MARINE CORPS AIR STATION EL TORO
EL TORO, CALIFORNIA
INSTALLATION RESTORATION PROGRAM
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
FINAL SOIL GAS SURVEY
TECHNICAL MEMORANDUM
SITES 24 AND 25

31 October 1994

Revision 0

PREPARED BY:
Southwest Division, Naval Facilities
Engineering Command
1220 Pacific Highway
San Diego, California 92132-5190

THROUGH:
CONTRACT #N68711-89-D-9296
CTO #145
DOCUMENT CONTROL NO:
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WITH:
Jacobs Engineering Group Inc.
3655 Nobel Drive, Suite 200
San Diego, California 92122

In association with:
International Technology Corporation
CH2M HILL

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John Dolegowski 28 Oct '94
Date

John Dolegowski
CLEAN Project Manager
CH2M HILL, Inc.

27 Oct '94
Date

Michael Bitner, R.G.
CLEAN Technical Reviewer
CH2M HILL, Inc.

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BECHTEL NATIONAL INC.

CLEAN II TRANSMITTAL/DELIVERABLE RECEIPT

Contract No. N-68711-92-D-4670 **Document Control No.:** CTO-0164/0243

File Code: 0216

TO: Contracting Officer
Naval Facilities Engineering Command
Southwest Division
Mr. Richard Selby, Code 02R1
1220 Pacific Highway
San Diego, CA 92132-5190

DATE: August 23, 2001
CTO #: 0164
LOCATION: MCAS El Toro, CA

FROM: Jane W. York for
Thurman L. Heironimus, Project Manager

DESCRIPTION: Transmittal of Documents to Administrative Record

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August 23, 2001

Contracting Officer
Naval Facilities Engineering Command
Southwest Division
Mr. Richard Selby, Code 02R1
1220 Pacific Highway
San Diego, CA 92132-5190

Subject: Transmittal of Documents to Administrative Record
MCAS El Toro, CA

Dear Mr. Selby:

Attached please find two copies each of the following documents:

- Marine Corps Air Station El Toro Installation Restoration Program Final Soil Gas Survey Technical Memorandum Sites 24 and 25. Revision 0. 31 October 1994.
- Letter from Gerard J. Thibeaut, RWQCB, to Dean Gould, BEC, "Waste Discharge Requirements, Order No. 96-18, NPDES No. CAG918001, Groundwater Cleanup Project, Former Marine Corps Air Station, El Toro, IRP Site 16 – Discharge Authorization No. 96-18-181. 21 February 2001.
- Letter from Dean Gould, BEC, to John Broderick, RWQCB Santa Ana Region. Agree to Disagree Compromise on CERCLA Permit Exclusion. 8 March 2001.
- Letter from John Broderick, RWQCB Santa Ana Region, to Dean Gould, BEC, "Proposal to Discharge Treated Groundwater from Former Marine Corps Air Station, El Toro, IRP Site 16, to Bee Canyon Wash." 26 January 2001.
- Letter from Dean Gould, BEC, to John Broderick, RWQCB Santa Ana Region. "Discharge Permitting at IRP Site 16, Marine Corps Air Station (MCAS) El Toro." 27 December 2000.

These documents are being transmitted to Ms. D. Silva for entry into the MCAS El Toro Administrative Record. Each document should be entered separately by the document date to facilitate retrieval.

Also enclosed are copies of sheets from the MCAS El Toro Administrative Record Index. These sheets have been marked up to show information that should be added to the Administrative Record database to allow a complete site-specific index to be printed for IRP Site 16.

BECHTEL NATIONAL, INC.

1230 Columbia Street, Suite 400
San Diego, CA 92101-8502 USA

If you have any questions or would like further information, please contact Jane Wilzbach at (619) 744-3029, or myself at (619) 744-3004.

Sincerely,

Jane Wilzbach for

Thurman L. Heironimus, R.G.
Project Manager

TLH/sp
Enclosure

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ACRONYMS AND ABBREVIATIONS

A&R	assembly and repair
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
BCT	BRAC Cleanup Team
bgs	below ground surface
BRAC	Base Realignment and Closure
BTEX	benzene, toluene, ethylbenzene, and xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CLEAN	Comprehensive Long-term Environmental Action Navy
CLP	Contract Laboratory Program
CRDL	contract required detection limit
CRQL	contract required quantitation limit
CTO	Contract Task Order
1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethylene
1,2-DCE	1,2-dichloroethylene
C-1,2-DCE	cis-1,2-dichloroethylene
t-1,2-DCE	trans-1,2-dichloroethylene
DOT	U.S. Department of Transportation
DQO	data quality objective
Cal-EPA, DTSC	California Environmental Protection Agency, Department of Toxic Substances Control
ECD	electron capture detector
EPA	U.S. Environmental Protection Agency
FBRs	fuel bladder revetments
FID	flame ionization detector
Freon 113	trichlorotrifluoroethane
FS	feasibility study

ACRONYMS AND ABBREVIATIONS (Continued)

GAC	granular activated carbon
GC	gas chromatograph
GIS	geographic information system
GPR	ground penetrating radar
HSP	health and safety plan
HWSA	hazardous waste storage area
IAS	initial assessment study
ICE	Industrial Contracting Engineers
IDW	investigation derived waste
IR	Installation Restoration
IT	International Technology Corporation
Jacobs	Jacobs Engineering Group Inc.
LDC	Laboratory Data Consultants, Inc.
MCAS	Marine Corps Air Station
MDL	method detection limit
mg/kg	milligrams per kilograms
ml	milliliter
MS	mass spectrometer
MS/MSD	matrix spike/matrix spike duplicate
mu	mass units
NPL	National Priorities List
OCWD	Orange County Water District
O.D.	outside diameter
OVA	organic vapor analyzer
OWS	oil/water separator
PAH	polycyclic aromatic hydrocarbon
PCE	tetrachloroethylene
PCB	polychlorinated biphenyl
PE	performance evaluation

ACRONYMS AND ABBREVIATIONS (Continued)

ppb	parts per billion
ppm	parts per million
PPE	personal protective equipment
psi	pounds per square inch
QAL	Quality Analytical Laboratory
QAPP	quality assurance project plan
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RFA	RCRA facility assessment
RI	remedial investigation
ROICC	resident officer in charge of construction
RRT	relative retention time
RSDs	relative standard deviations
SAP	sampling and analysis plan
SARA	Superfund Amendments and Reauthorization Act of 1986
SDG	sample delivery group
SIE	selected ion extraction
SIM	selected ion monitoring
SOPs	Standard Operating Procedures
SVOC	semivolatile organic compound
SWMU/AOC	solid waste management unit/area of concern
1,1,1-TCA	1,1,1-trichloroethane
1,1,2-TCA	1,1,2-trichloroethane
TCE	trichloroethylene
TCL	target compound list
TDGC	thermal desorption gas chromatograph
TDSP	thermal desorption sampling probe
TIC	tentatively identified compound
TM	technical memorandum

ACRONYMS AND ABBREVIATIONS (Continued)

TPH	total fuel hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
ug/kg	micrograms per kilogram
ug/L	micrograms per liter
ug/L-v	micrograms per liter-volume
USCS	unified soil classification system
UST	underground storage tank
VOA	volatile organic analysis
VOC	volatile organic compound
VPS	Ventura Petroleum Services
VSI	visual site inspection
WP	work plan

EXECUTIVE SUMMARY

The United States Navy has conducted a soil gas survey for Remedial Investigation (RI) Sites 24 and 25 for the Marine Corps Air Station (MCAS) El Toro (Station) under the Comprehensive Long-term Environmental Action Navy (CLEAN) Program. This Soil Gas Survey Technical Memorandum summarizes the results of the Sites 24 and 25 soil gas investigation completed by the Jacobs Engineering Group Inc. (Jacobs) Team. It is limited to the presentation and preliminary interpretation of data gathered during this field investigation.

In 1993, a Phase I RI was conducted at the Station. During that investigation, trichloroethylene (TCE) was detected at concentrations as high as 2,000 ug/L-v in groundwater beneath the southwest quadrant of the Station. Despite extensive soil sampling, relatively little soil contamination that can be considered the source of groundwater contamination was found.

The primary objective of the investigation was to locate potential shallow subsurface source(s) of volatile organic compound (VOC) groundwater contamination, a soil gas field investigation was performed in the southwest quadrant of the Station during June 1994. Other objectives of the investigation included:

- Collect soil gas and soil sample results to assist in identifying Phase II RI sample locations
- Collect soil data for use in risk assessments and feasibility studies
- Evaluate the effect of the air knife drilling method on soil gas sample concentrations
- Evaluate the use of a methanol preservation method for soil samples analyzed for VOCs

Potential VOC source areas investigated included RI sites, Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) sites, and other significant features identified through records searches and interviews. During the investigation, a total of 777 soil gas and 76 soil samples were collected from 465 sample locations; samples were collected from depths between 12 and 30 feet below ground surface (bgs). Soil gas samples were analyzed onsite for 19 VOCs and total petroleum hydrocarbons (TPH) using gas chromatographs with dual flame ionization detectors and electron capture detectors. Soil samples were analyzed at an offsite fixed laboratory for VOCs using U.S. Environmental Protection Agency Contract Laboratory Program methodology.

The highest concentrations of halogenated hydrocarbons in soil gas and soil were detected primarily at and around Buildings 296, 297, and 324. The refurbishing operations present on-Station during the 1940s were centered in these three buildings. The extent of this area is considered as the Main Soil Gas Source Area. Sample results indicated the possible presence of multiple source areas within the main source area; six subareas were identified within this main source area.

In addition to the six subareas in the Main Soil Gas Source Area, 12 other possible shallow halogenated hydrocarbon source areas have been identified. Aromatic hydrocarbons/TPH and low levels of halogenated hydrocarbons were detected at five other locations.

The most frequently detected VOCs in soil gas included TCE; tetrachloroethylene (PCE); 1,2-dichloroethylene (1,2-DCE); 1,1-dichloroethylene (1,1-DCE); trichlorotrifluoroethane (Freon 113); and carbon tetrachloride. TCE was the halogenated hydrocarbon with the highest concentration in soil gas (approximately 2,200 ug/L-v), located near the northeast corner of Building 297.

Concentrations of TCE in soil gas were generally observed to increase with depth, indicating that TCE in soil gas is present deeper in the vadose zone. The Main Soil Gas Source Area is generally situated above or upgradient of the highest concentrations of VOCs detected in groundwater in the southwest quadrant of the Station. This

information suggests that the Main Soil Gas Source Area is likely the primary source of TCE in groundwater in the southwest quadrant of the Station.

Fourteen of the 18 halogenated hydrocarbon source areas were recommended for further investigation to evaluate the extent of VOCs in soil gas or soil.

- At five areas, further investigation to evaluate both the vertical and horizontal extent of VOCs in soil gas and soil was recommended.

- At seven areas, further investigation to evaluate the vertical extent of VOCs in soil gas and soil was recommended.

- At two areas, further investigation to evaluate the horizontal extent of soil gas was recommended.

- No further investigation was recommended at the remaining four locations. However, the regulatory agencies recommended further investigation at these sites.

At four of the five aromatic hydrocarbon/TPH source areas, further investigation to evaluate the extent of contamination was recommended. Also, since these four areas have underground storage tanks (USTs) or an oil/water separator (OWS) system, which are possible sources, removal actions are recommended. One aromatic hydrocarbon/TPH source area was recommended for inclusion in the Main Soil Gas Source Area investigation. The fifth area was recommended for further investigation to assess the extent of contamination.

One subobjective of the soil gas survey was to evaluate the effects of the use of an air knife on VOC concentrations in soil gas. A series of four field tests were performed as part of this evaluation. The results of the tests suggested that the air knife exerted a net purging effect during the bottom 2 feet of air knife advancement (5 to 7 feet). Oxygen contents were generally not affected and soil gas concentrations that were affected re-

equilibrated in less than 1 hour. Based on these results, the Navy, regulatory agencies, and Jacobs Team agreed that the air knife would not affect soil gas results and that the air knife should be used for the soil gas survey.

A second subobjective of the soil gas survey was to evaluate the use of methanol preservation for soil samples. Methanol preservation of VOC soil samples was used in an effort to reduce the loss of VOCs prior to sample analysis. At 11 locations, one soil sample was prepared using methanol preservation and a second (duplicate) sample was prepared using the capped sleeve method to evaluate the methanol preservation method. In general, for samples with lower VOC concentrations, measurable concentrations were only reported for the capped sleeve samples because the detection limits for the methanol preservation method were too high to detect the lower levels. For one sample at which an elevated contaminant concentration was detected, the methanol-preserved sample was observed to have a higher concentration than the capped sleeve sample. Overall, however, it was concluded that an insufficient number of samples were collected to reach significant conclusions on the methanol sample preservation method.

1.0 INTRODUCTION

The United States Navy has conducted a soil gas survey for Remedial Investigation (RI) Sites 24 (Possible Volatile Organic Compound [VOC] Source Area) and 25 (Major Drainages) at the Marine Corps Air Station (MCAS) El Toro (Station) under the Comprehensive Long-term Environmental Action Navy (CLEAN) Program. Sites 24 and 25 are part of Operable Unit (OU)-2. OU-2 includes sites that are considered potential source areas for the regional VOC groundwater contamination. This work was performed under Contract Task Order (CTO) No. 145.

This Soil Gas Survey Technical Memorandum summarizes the results of the Sites 24 and 25 soil gas investigation. It is primarily limited to the presentation and preliminary interpretation of data gathered during this field investigation. Soil gas data are intended for qualitative screening use and do not necessarily reflect soil contamination. These data will be used to assist with the planning of the Phase II RI field work. The primary objective of the Phase II RI will be to adequately characterize the sites (determine nature and extent of contamination) to determine if remediation is required or if no further investigation is necessary.

The source(s) of the regional VOC groundwater plume is believed to be located in the southwestern quadrant of the Station, and therefore, the Soil Gas Survey focused on this portion of MCAS El Toro. Site 24 includes the majority of the southwestern quadrant of the Station and encompasses various possible VOC source areas. Site 24 was created, subsequent to the Phase I RI, to cover the VOCs detected in groundwater in the southwest quadrant because the established RI sites did not cover all of the potential source areas. The areas of investigation were selected for inclusion into Site 24 based on the results of the Phase I RI, the Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA), records searches, interviews with current and past Station employees, and meetings and discussions with the regulatory agencies. Also located in the southwest quadrant of the Station are unlined portions of Agua Chinon Wash and Bee Canyon Wash, which comprise part of Site 25 and may also be possible

VOC source areas. More detailed descriptions of the possible source areas at Sites 24 and 25 are provided in Section 3.0 of this report.

1.1 Investigation Objectives

The overall goal of this soil gas survey was to collect sufficient data to identify shallow (less than 30 feet below ground surface [bgs]) vadose zone source(s) of the regional VOC groundwater contamination that appears to originate from the southwest portion of MCAS El Toro. Specific objectives of the soil gas survey were as follows:

- Identify shallow vadose zone VOC contamination source areas in the southwest quadrant of MCAS El Toro
- Use soil gas and soil sample results to assist in identifying Phase II RI sample locations
- Collect soil data for use in the OUs-2 and -3 risk assessments and feasibility studies (FSs)

Additional objectives of the Soil Gas Survey included the following:

- Evaluate the effects of the air knife drilling method (used for utility clearances) on soil gas sample concentrations.
- Evaluate the use of a methanol preservation method for soil samples analyzed for VOCs. Phase I RI soil samples were not preserved with methanol. Soil gas survey soil sample results will be used to assess whether Phase II RI soil samples that are analyzed for VOCs should be preserved with methanol.

Section 2.0 of the Soil Gas Survey Work Plan provides additional details on the investigation objectives and includes discussions of the stratum concept, calculation of human and ecological risk, and data quality levels (Jacobs, 1994a).

1.2 Relationship of Soil Gas Survey to RI/FS Schedule

As discussed above, a specific objective of the investigation is to use soil gas and soil sample results to assist in locating Phase II RI sampling locations. The CLEAN II Team is presently revising the Phase II RI planning documents. To generate data for use by the CLEAN II Team, the Jacobs Team set an aggressive schedule for the completion of the Soil Gas Survey field work and this memorandum.

1.3 Report Organization

This technical memorandum is organized into the following five sections:

- Section 1.0 is the introduction
- Section 2.0 includes a description of investigation methods, including preliminary field activities, site characterization field methods, field and laboratory quality assurance/quality control (QA/QC), waste management data validation, and data evaluation methods. Changes made during the field investigation are also documented.
- Section 3.0 summarizes the results of the field investigation, including subsurface geology, air knife test results, soil gas analytical results, and soil analytical results. Soil, soil gas, and Phase I RI groundwater analytical data are also compared.
- Section 4.0 includes a summary of results and conclusions, as well as recommendations for further investigation.
- Section 5.0 is the list of references for this technical memorandum.

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2.0 INVESTIGATION METHODS

The Final Soil Gas Survey Work Plan (Jacobs, 1994a) for the MCAS El Toro RI was submitted on 16 May 1994. The Work Plan describes, in detail, the recommended sampling methodologies and rationale for the soil gas investigation.

This section provides an overview of the field activities and investigation methods conducted for the Soil Gas Survey. Included in this section are summaries of the preliminary field activities and sampling and analysis procedures, including QA/QC samples and data validation. In-field changes to and variances from the Work Plan are also discussed. In addition, a discussion of the management of investigation-derived waste (IDW) is presented.

For further details on the sampling and analysis procedures for the soil gas investigation, the Final Soil Gas Survey Work Plan should be consulted (refer to Section 3.0, Appendix A, Sampling and Analysis Plan [SAP], and Appendix B, Quality Assurance Project Plan [QAPP]) (Jacobs 1994a).

2.1 Preliminary Field Activities

Preliminary field activities consisted of those activities that were performed prior to the collection of soil and soil gas samples. The schedule of events for the soil gas survey is presented in Figure 2-1. Preliminary field activities included conducting acquisition of utility maps and marking sample locations in the field, geophysical utility clearance, concrete coring and cutting of Marsden aircraft matting, air knife nondestructive drilling utility clearance, and survey of sample locations.

2.1.1 Marking Sample Locations

Prior to the implementation of field work, electrical, gas, communication, water, and storm sewer utility maps for the southwest quadrant of the Station were

collected from the MCAS El Toro Environmental Department. These maps were used to avoid locating samples at areas with known underground utilities. The sample locations were marked by the Jacobs Team field coordinator by spray painting on paved surfaces or staking on unpaved surfaces.

The Round 1 sample locations were marked in the field based on the maps contained in the Soil Gas Work Plan (Jacobs 1994a). These locations were marked during April 1994. Round 2 sample location maps were developed during the field investigation, and the locations were marked between 20 and 28 June 1994.

2.1.2 Geophysical Utility Clearance

International Technology Corporation (IT) performed the geophysical utility clearance of the sample locations. At each location, a Metrotech Model 810 electromagnetic (EM) line tracer and a Fisher TW-6 metal detector were used. At locations with dense underground utilities, an extra clearance step was taken using a ground penetrating radar (GPR) unit (GSSI Sr System 3). GPR provides an extra level of geophysical evaluation in areas of dense utilities.

In summary, the utility clearance procedures were as follows:

1. The base utility maps were reviewed. The locations of nearby utilities were noted.

2. All known utilities were traced with the EM line tracer.

3. The sample point was cleared to a 20-foot radius with the line tracer by holding a transmitter over the point and circling with a receiver. Any utilities encountered were traced. The locations of the utilities were spray painted on the ground.

4. Two perpendicular GPR profiles were performed over the sampling point for areas with dense underground utilities. Subsurface anomalies found were noted.

Round 1 sample locations were cleared during May 1994. Round 2 sample locations were cleared between 21 and 29 June 1994.

2.1.3 Concrete Coring and Cutting of Aircraft Matting

Sample locations on the concrete parking apron were cored with a diamond-tipped coring device by Industrial Contracting Engineers, Inc. (ICE). Locations were cored subsequent to geophysical utility clearance and prior to air knife nondestructive drilling. The concrete cores ranged from 3 to 10 inches in diameter and from 6 to 14 inches thick.

A hard asphalt layer was encountered beneath the concrete at RI Site 10. The asphalt layer could not be penetrated by hand auger or air knife nondestructive drilling. At these nine locations, a 10-inch-diameter core was drilled through the concrete. ICE used a 6-inch-diameter power auger mounted on a small Bobcat brand backhoe to penetrate the approximately 1-foot-thick hard asphalt layer. Each hole was then backfilled and the concrete core was placed back in the hole until the air knife drilling was conducted.

Sample locations on Marsden metal aircraft matting were cut with a special saw by ICE. ICE cut a hole approximately 6 inches in diameter into the matting to provide access to the underlying dirt for subsequent sampling activities. The inner piece of cut metal matting was disposed of in regular trash bins.

2.1.4 Air Knife Nondestructive Drilling Utility Clearance

Prior to driving the soil gas probe, a hole was bored to a depth of 7 feet bgs as a final utility clearance, in accordance with Jacobs Engineering Group Inc. (Jacobs) standard operating procedure (SOP) 7.7. This was accomplished using an air knife, a nondestructive drilling method. An air knife is a 3-inch-diameter dual-tube apparatus that is pushed into the ground with soil being displaced by air injected under pressure through an inner tube. The soil is then removed by suction through an outer tube. A more detailed description of the operation of the air knife is provided in Appendix D (Air Knife Fact Sheet) of the Soil Gas Work Plan (Jacobs, 1994a).

The air knife drilled quickly in dry, loosely consolidated sands and silts; it drilled more slowly in gravels and moist clays. Clays easily stick to the air knife discharge tube. Boreholes were partially or fully hand augered where clays or coarse gravels were encountered.

The final utility check using an air knife was performed 2 to 3 weeks before the Round 1 soil gas samples were collected. Approximately 300 Round 1 sample locations were air knifed during May 1994. The air-knifed holes were backfilled immediately after being drilled.

As stated earlier, the air knife was driven to a depth of 7 feet bgs. The shallowest soil gas sample collected during the soil gas survey was 12 feet bgs. Thus, a vertical buffer zone of about 5 feet existed at the sample locations.

To evaluate possible effects of the air knife on soil gas concentrations collected at 12 feet bgs, a test was conducted during the first week of the soil gas survey. Air knife test data, including a general description of the test, results (pressure, oxygen, and soil gas concentrations), QA/QC, and conclusions, are presented in Subsection 3.2.

Based on the air knife test results presented at a 13 June 1994 soil gas meeting, the Jacobs Team and agencies agreed that a minimum of 2 days should be maintained between air knife utility clearance and collection of Round 2 soil gas samples (Jacobs 1994d). The air knife test results are discussed in Subsection 3.2.6. A total of 165 Round 2 locations were air knifed between 20 and 28 June 1994. To the extent possible, the order of the Round 2 soil gas sample collection schedule paralleled the air knife utility check order to maximize the time between the air knife utility check and the soil gas sampling.

2.1.5 Survey of Sample Locations

After the utility clearance was completed and prior to collection of samples, a Jacobs Team registered surveyor performed surveys of the sample station locations and elevations to an accuracy of 0.1 feet. Second round locations were surveyed concurrently with the utility clearance tasks.

2.2 Field Methods for Site Characterization

This section summarizes the field methods used for site characterization, including procedures for borehole logging, soil and soil gas sampling, and soil and soil gas analysis.

2.2.1 Boring Logs

The 465 borings drilled by the air knife were geologically logged by Jacobs Team geologists to a depth of 7 feet bgs. The borings were also logged at a maximum depth of 30 feet bgs at the 40 locations where soil samples were collected. The soil borings were logged using the CH2M HILL Standard Procedures for Logging of Soil Borings (January 1990), which is included in the Soil Gas Work Plan (Jacobs 1994a).

2.2.2 Sampling and Analysis Procedures

This subsection briefly summarizes soil and soil gas sampling and analysis procedures used during the soil gas investigation at MCAS El Toro. For a further detailed description of soil gas and soil sampling and analysis procedures, refer to Subsection 3.3 and Appendix A (SAP) of the Soil Gas Survey Work Plan (Jacobs, 1994a). Soil analysis procedures are also discussed in the Phase II RI QAPP (Jacobs, 1993a). Deviations from the original Soil Gas Work Plan are documented in Subsection 2.5.

A total of 777 soil gas samples from 465 locations within the southwest quadrant of the Station were collected during the soil gas survey. The soil gas samples were collected in two consecutive rounds: 296 locations were sampled during Round 1; and 169 locations were sampled during Round 2 (see Figure 2-2). During the second round of soil gas sampling, 76 shallow (less than 30 feet bgs) soil samples were also collected from 39 locations (see Figure 2-3).

During Round 1, 560 soil gas samples (505 original samples, 55 duplicate samples) were collected from 296 locations. Round 1 sample locations were selected in potential VOC source areas (see Table 3-4). Based on the results of the first round, a second round of 217 soil gas samples (199 original samples, 18 duplicate samples) were collected from 169 locations to further define the extent of the higher concentration locations.

Round 1 soil gas sample depths were either 12 and 20 or 15 feet bgs. Soil gas samples were not collected shallower than 12 feet bgs to minimize losses to the atmosphere and to maintain a 5-foot buffer between the bottom of the air knife utility clearance hole (7 feet bgs) and the first sample. For Round 2, soil gas and soil sample depths were modified by the Jacobs Team and the regulators, as discussed in Subsection 2.5. At locations where only soil gas samples were collected, samples were either collected at 15 feet bgs only or at

both 15 and 30 feet bgs. At locations where both soil gas and soil samples were collected, soil gas samples were collected at 15 and 27 feet bgs, and soil samples were collected at 12 and 29 feet bgs.

Soil gas samples were analyzed for 14 halogenated VOCs, total petroleum hydrocarbons (TPH), and benzene, toluene, ethylbenzene, and xylene (BTEX) compounds, using a gas chromatograph (GC) equipped with a flame ionization detector (FID) and an electron capture detector (ECD), as shown in Table 2-1. Soil samples were analyzed for VOCs at an offsite fixed location analytical laboratory.

A total of 76 shallow soil samples (68 original samples, 8 duplicate samples) were collected from 39 locations during the second round of the soil gas investigation. The locations and depths of soil samples were determined based on Round I soil gas results and field measurements made with organic vapor analyzer (OVA) or HNu detectors in the field. Soil samples were generally collected in areas of elevated VOC soil gas concentrations to determine if VOCs were also present in soil. Soil samples were collected at depths of 12 and 29 feet bgs.

Sampling Procedures. This subsection summarizes the field procedures for probe installation, soil gas sampling, and subsurface soil sampling. A more detailed description of these field procedures is presented in the Soil Gas Survey Work Plan in Subsection 3.3.1 and the SAP (Appendix A) (Jacobs, 1994a).

To collect soil gas samples, soil gas probes were driven with a truck-mounted hydraulic probe (approximately 1-inch outside diameter [OD]) to the desired depths. Then, the soil gas probe was removed and a 1-inch OD sampling core was driven 1 foot. The steel soil gas probe points were left in the ground after the samples were collected.

The remaining hole was filled with fine-grade bentonite pellets and hydrated with the manufacturer-suggested amount of potable water. Then, the surfaces were appropriately patched. Concrete and tarmac surfaces were patched with concrete epoxy, asphalt surfaces were filled with asphalt patch, and soil surfaces were filled with soil from the hole.

Soil gas samples were extracted immediately after the sample depth was penetrated by the probe. Samples of soil gas were extracted using an active sampling technique. The portable sampling system consists of a stainless steel probe that is connected to a stainless steel sampling box by TFE Teflon tubing of inert material. After reaching the desired sample depth, the annulus between the tubing and casing was sealed by a packer to isolate the probe from the atmosphere. A syringe in the sampling box was used to pull a volume of in-situ soil gas vapor from the ground through the probe and tubing. Three hundred milliliters (ml) (15 purge volumes) of gas was extracted to purge the air from the sampling system and then vented to the atmosphere. A second sample was then extracted and drawn into a 30 ml pre-evacuated, self-sealing, U.S. Environmental Protection Agency (EPA)-clean glass vial where it was encapsulated at two atmospheres pressure. The system was then closed from the probe tip to the glass vial to prevent the possible loss of VOCs. Following the sample extraction, the sample vials were packaged in an airtight bag, labeled, and logged in a field notebook and chain-of-custody form. The bag is then transported to a field laboratory for analysis.

OVA/HNu measurements were taken in the field by attaching the instrument probe tip to the exhaust port on the sampling system. These measurements were recorded in the field notebook.

Subsurface soil samples were collected in the same holes as the soil gas samples by advancing a hydraulically driven 1-inch hollow-stem rod using a truck-mounted rig to the desired sample depth. Three 4-inch-long decontaminated stainless-steel liners were inserted into the 1-foot sampling

core at the base of the drive rod at each sample location. Prior to collecting the soil, an open tip was exposed and a soil core was collected by driving the core through the desired soil layer. After the drive rod was removed from the soil, the stainless-steel liners containing the soil were separated from the drive rod. Soil from the middle liner was used for the VOC analysis.

The sample collection procedure for collecting two soil gas (onsite analysis) and two soil (offsite analysis) samples at a single location was as follows:

1. The soil sample core was pushed to a depth of 12 feet bgs. The soil sampler was driven from 12 to 13 feet to collect a sample. The soil sample core was then withdrawn.

2. A soil gas probe tip was placed at the end of the drive rod. The soil gas tip was pushed to 15 feet bgs and a soil gas sample was collected.

3. The soil gas probe was then pushed to 27 feet bgs and the soil gas sample was collected.

4. The push rods were removed from the hole.

5. The soil sample core was pushed to a depth of 29 feet bgs. The soil sample core was driven from 29 to 30 feet bgs. The soil sample core was withdrawn.

Sixty-three of the 76 soil samples were preserved with methanol. Approximately 25 grams of soil from the liner was removed and placed into a preweighed 60 ml volatile organic analysis (VOA) vial filled with 25 ml of purge-and-trap grade methanol. The weights of the vial and methanol were recorded in the field notebook and reported to the laboratory so that the weight of the

soil could be calculated. Additional samples were also placed in a jar without methanol for analysis of soil moisture content.

At 11 sample depths, duplicate samples were collected and preserved using the standard EPA preservation method. For this preservation method, the stainless-steel sample sleeve ends were covered with teflon and capped with plastic caps. The caps were taped on with electrical tape and then sealed with a custody seal. The sleeves were then placed in a sealed plastic bag and placed in an ice-filled cooler. A comparison of the analytical results for the methanol preservation and standard capped sleeve preservation methods is discussed in Subsection 3.4.

Sample Analysis. Soil gas sample methods, SOPs, analyses, and QC procedures are detailed in the Soil Gas Survey Work Plan in Subsection 3.3.3 and Appendix B (Phase II RI QAPP Addendum) (Jacobs, 1994a). Fixed laboratory soil sample methods and analyses are covered in the Phase II RI QAPP (Jacobs, 1993a). Section 3.0 also includes descriptions of the compounds that were analyzed for each medium, data uses, and data users. The information in these sections is briefly summarized below.

Soil gas samples were analyzed in an onsite mobile laboratory equipped with two GCs using auto samplers to provide 24-hour-per-day operations. Soil gas analytes and detection limits are listed in Table 2-1.

Freon 113 was added as a soil gas analyte during the investigation. During the Phase I RI, Freon 113 was analyzed in soil and groundwater on a gas chromatograph/mass spectrometer (GC/MS) using EPA Contract Laboratory Program (CLP) methodology. Freon 113 was not a standard analyte, but was reported as a tentatively identified compound (TIC) at an estimated value.

Soil samples were submitted to a certified offsite commercial analytical laboratory (Quality Analytical Laboratory [QAL]) for analysis. The samples were

analyzed for VOCs by EPA CLP methodology (modified EPA method 8010/ 8020). Detection limits, with the exception of those samples preserved with methanol, met EPA contract required detection limits (CRDLs) (see Appendix B, Soil Gas Survey Work Plan (Jacobs, 1994a). The soil samples were collected in areas of high soil gas concentrations (onsite analysis) to assess if VOCs also occur in soil.

2.3 Field QA/QC Activities

Field QA/QC procedures are described in Subsection 3.5 and in the SAP (Appendix A) of the Soil Gas Work Plan (Jacobs, 1994a).

2.3.1 Sample Identification

Sample numbering is discussed in Subsection 3.3.2 of the Soil Gas Work Plan (Jacobs, 1994a). For Round 1, the station identification numbers are 24_SG_001 through 24_SG_300. For Round 2, the station identification numbers will be 24_SG_301 through 24_SG_475. Soil and soil gas samples were numbered as summarized in Table 2-2. Waste soil sample numbers are summarized in Subsection 2.6.

2.3.2 Handling and Shipping

Detailed sample collection and handling procedures are described in the SAP and Subsection 3.3.2 of the Soil Gas Work Plan (Jacobs, 1994a). Soil gas and soil samples were collected as described in Subsection 2.2.2. Sample collection and analyses requested were documented on a chain-of-custody form.

2.3.3 Field QA/QC Samples

Soil gas field QA/QC samples are summarized in Table 2-3. Soil field QA/QC samples are summarized in Table 2-4.

2.3.4 Field Audits

Jacobs conducted a field QA audit on 24 June 1994. A memorandum was then prepared that included observations and corrective action recommendations. The only field work corrective action required, which was implemented on 25 June 1994, was to place plastic sheeting under the drill rig at sample locations on dirt. A Corrective Action Plan that addressed the concerns detailed in the Jacobs QA Audit was issued on 28 July 1994 by the CH2M HILL technical manager (Jacobs, 1994c).

Field laboratory audits are summarized in Subsection 2.4.2.

2.4 Laboratory QA/QC and Data Validation

Soil and soil gas laboratory QA/QC information is provided in three documents:

- Subsection 3.5, QA/QC Procedures in the Soil Gas Work Plan (Jacobs, 1994a)
- Appendix B, Phase II RI QAPP Addendum of the Soil Gas Work Plan (Jacobs, 1994a)
- The Phase II RI QAPP (soil QA/QC only) (Jacobs, 1993a)

2.4.1 Laboratory QA/QC

Offsite laboratory soil analyses were carried out per EPA CLP protocols; for parameters not covered under the CLP, an equivalent level of effort was

maintained. The soil QA/QC is detailed in the Phase I and Phase II RI QAPPs (Jacobs, 1991 and 1993a).

Onsite laboratory QA/QC for soil gas included internal, as well as external, QC checks. Internal QC checks were the following:

- Daily continuing calibration
- Daily laboratory control standard
- Duplicate runs after every tenth sample
- Blank runs after every tenth sample

External checks included performance evaluation samples and audits described below.

2.4.2 Laboratory Audits

CH2M HILL performed an audit of the mobile laboratory during the first week of the investigation (31 May to 03 June 1994). CH2M HILL prepared a project note that included observations and recommendations to improve analytical chemistry and QA/QC (Jacobs, 1994h). Target, the mobile laboratory, was asked to:

- Supplement their analytical chemistry and standard operating procedure documentation
- Establish current detection limits for the GCs
- Provide records of origin and composition of standards
- Run TCE; PCE; and 1,1-DCE standards for the FID detector in addition to those run for the ECD detector

- Calculate relative standard deviations (RSDs) rather than coefficient of variations for calibration runs
- Visually review chromatograms each day for retention time
- Tabulate and review precision measurements daily
- Run laboratory control samples at the end of each day

Target implemented corrective actions during the investigation.

A field laboratory audit was performed by Jacobs on 24 June 1994. The scope of the audit included QA/QC protocol, SOPs, documentation, and calibration. Target implemented corrective actions during the investigation and completed a corrective action plan on 28 July 1994 (Target, 1994a). The audit was a follow up to a previous audit of Target's Maryland Laboratory. Jacobs prepared an addendum to the earlier audit (Jacobs, 1994c).

The EPA Region IX laboratory provided 3 soil gas performance evaluation standard samples for analysis by the onsite laboratory. The samples were shipped from the EPA laboratory to the Department of Toxic Substances Control (DTSC) in Long Beach, California. DTSC brought the samples from Long Beach to Target's field trailer at MCAS El Toro. The soil gas samples were analyzed onsite and the results were given to DTSC. Soil gas performance evaluation sample results are presented in Subsection 3.3.6.

2.4.3 Data Validation

Fixed laboratory soil data are currently being validated by Laboratory Data Consultants, Inc. (LDC). Ninety percent of the samples will receive partial validation and 10 percent will receive full validation. The data validation results

for soil samples will be included in the final version of this technical memorandum.

2.5 Data Collection Field Changes

Field data collection procedures were established in the Soil Gas Survey Work Plan and SAP (Jacobs, 1994a). Changes to the data collection procedures were made by the team (Jacobs Team, Navy, regulatory agencies) during two meetings held during the investigation (13 and 20 June 1994) (Jacobs 1994d,e). The meeting minutes were issued as project notes on 21 June and 28 July 1994 for the 13 and 20 June meetings, respectively. The data collection changes were summarized in the meeting notes and are summarized in this subsection.

2.5.1 Regulatory Agency Meetings to Provide Technical Direction

Regulatory agency meetings were held prior to the investigation (01 March 1994), during the investigation (13 and 20 June 1994), and subsequent to the field investigation (07 July 1994) (Jacobs 1994f). The 01 March 1994 meeting was a soil gas technical exchange meeting that addressed the field work schedule, suspected source areas to be investigated, grid spacing, sample depths, and placement of Round 1 soil gas sample locations. The two meetings, which took place during the investigation, included discussion of Round 1 soil gas results, sample depths, GC identification of Freon 113 and 11-DCE, soil sampling, and Round 2 sample locations. The meeting subsequent to the investigation was used to present preliminary soil gas results from both rounds of sampling.

2.5.2 Sample Depths

Changes to sample depths were made during the two team meetings held during the investigation. Originally, Round 1 soil gas samples were to be collected at depths of 12 and 20 feet bgs at each location. At the 13 June

1994 meeting, during the middle of Round 1, the team decided to collect subsequent Round 1 samples at a depth of 15 feet bgs only because soil gas concentrations at 12 and 20 feet bgs were similar. At the same meeting, the team also decided to collect 15-foot bgs and 27- or 30-foot bgs soil gas samples in areas of high VOC concentrations. If soil samples were also collected, the deeper soil gas sample was collected at 27 instead of 30 feet bgs. During the 20 June 1994 meeting, the team also decided to collect several 12- and 30-foot bgs soil samples. The total number of Round 2 soil gas samples proposed at depths of 15 and 30 feet bgs were 175 and 25, respectively. The total number of Round 2 soil samples proposed at depths of 12 and 30 feet bgs were 40 and 20, respectively.

Samples were not collected below 30 feet bgs for two reasons. One, the scope of this investigation was limited to a screening level survey of the shallow vadose zone. An investigation of the deeper vadose zone will take place during the Phase II RI field work. Secondly, Target's direct push rigs were not able to effectively collect samples below 30 feet bgs; at some locations where the direct push rigs encountered gravel, the rigs could not reach 30 feet bgs.

2.5.3 Soil Gas Analytical Methods

Dual analyses were conducted on all of the soil gas samples. Both analyses were done on a GC using direct injection. One analysis was conducted according to EPA Method 8010 (modified) using an ECD and the other analysis was conducted according to EPA Method 8020 (modified) with an FID. Specific analytes for each analysis are summarized in Table 2-1. Note that the total xylene concentrations reported are the sum of the meta-, para-, and ortho-xylene isomers. The chlorinated hydrocarbons in this suite were selected because 1) they were detected in soil or groundwater during the Phase I RI, 2) their suspected usage at MCAS El Toro, and/or 3) they degrade from commonly used industrial solvents.

During the investigation, relatively high levels of TCE, PCE, and 1,1-DCE in some soil gas samples exceeded the linear calibration range of an ECD; therefore, the values of these analytes were quantified with an FID. If concentrations were within the linear calibration range, the ECD value was used.

The laboratory analyses of the soil gas samples were reported in micrograms per liter-volume (ug/L-v). Method detection limits were determined for the target analytes found on site using EPA protocols and are summarized in the project files.

Although not listed as a target compound prior to the investigation, Freon 113, or trichlorotrifluoroethane, was later identified as a potential compound during investigation. Because Freon 113 elutes very closely to 1,1-DCE under the chromatographic conditions used for this program, misidentification of these two compounds is possible, especially on the ECD due to the instrument's high response and low recovery time. Indeed, this problem occurred prior to 22 June 1994, during which high values of 1,1-DCE were reported.

It was learned that Freon 113 had been used previously on-Station. The chromatograms from the previous analyses were re-examined to determine whether the reported 1,1-DCE results might represent Freon 113. The chromatograms from the ECD were not helpful in this differentiation; however, the chromatograms from the FID did enable the individual identification of 1,1-DCE and Freon 113. To verify the FID chromatograms, a number of archived samples were reanalyzed on a photoionization detector (PID), which responds to only 1 of the 2 compounds. These analyses confirmed the FID results. Subsequent to 22 June 1994, the PID was used onsite as a confirmation detector to test a large number of the samples (Target, 1994b).

For the period after 22 June 1994, quantitation of Freon 113 was done from the FID chromatograms by preparing and analyzing a Freon 113 standard. For all

data collected, quantitation of the analyses was performed by applying the average response factor for the Freon 113 standard analyses obtained from the latter part of the program.

The Jacobs Team also requested that Target check the sample chromatograms for the presence of Freon 11 and Freon 12. Freon 11 and Freon 12 standards were prepared during the final week of the investigation and analyzed. Retention times were determined and the earlier chromatograms examined for peaks matching the retention times. No matching peaks were found, therefore indicating a lack of both Freon 11 and Freon 12.

2.5.4 Soil Sampling

Several changes were made to the soil sampling portion of the Soil Gas Survey Work Plan during the 13 and 20 June 1994 Soil Gas Survey meetings. The changes and rationale for changes are summarized in the meeting minutes (Jacobs, 1994d,e). A summary of the changes are listed below:

- Onsite analysis of Round 2 soil samples for VOCs, semivolatile organic compounds (SVOCs), and pesticides/polychlorinated biphenyls (PCBs) was eliminated.

- Offsite, fixed laboratory analysis of SVOCs and pesticides/PCBs was eliminated.

- Surface soil samples were eliminated.

- Thirty additional offsite, fixed laboratory VOC analyses were added; 40 analyses had been proposed originally. Six more VOC analyses were added during the field investigation for a total of 76 samples (40 original, 30 added at meeting, and 6 added in the field). Sixty-

three of the samples were preserved using the methanol preservation method and 13 samples were preserved using the standard EPA capped sleeve preservation method.

- The methanol preservation method was revised. Twenty-five ml of methanol was added to each sample vial prior to adding the 25 grams of soil. Previously, 25 grams of soil were collected first, the vial was reweighed, the weight of the soil calculated, and an equivalent volume of methanol was added to the vial.

2.6 Waste Management

This subsection summarizes the handling and sampling of wastes from the soil gas survey. This memorandum includes a summary of the waste generated, sampling procedures, analytes, sample numbers, waste criteria, and waste disposal.

The waste soil cuttings were placed in 55-gallon drums and labeled with the following information:

- Drum number
- Boring numbers from which the cuttings were derived
- Dates cuttings were collected
- Description of cuttings

2.6.1 Preliminary Classification and Quantities of Generated Wastes

A total of 17 drums of waste were generated and segregated into the following five groups:

1. Ten drums contained soil cuttings from borings that did not have detectable concentrations of organic vapors in the headspace. Organic vapors were measured with an organic vapor monitor (OVM).

2. One drum contained soil cuttings collected from borings that had detectable concentrations of organic vapors in the headspace.

3. Two drums contained asphalt and concrete.

4. One drum contained personal protective equipment (PPE) waste.

5. One drum contained decontamination water.

2.6.2 Waste Sampling Procedures

One soil sample was collected from each of the 11 drums from the first two categories above (drums with soil cuttings) on 13 and 14 July 1994. The soil sampling was directed by the County of Orange Integrated Waste Management Department. The samples were collected by hand augering into each drum and placing the soil into glass jars. Custody seals were then placed by County of Orange personnel on the plastic bags that were used to seal the samples. The concentrations detected in waste soil samples are presented in Appendix E.

Waste soil QA/QC samples included a trip blank, a duplicate, a matrix spike/matrix spike duplicate (MS/MSD), and an equipment blank. The hand auger was decontaminated between each drum according to procedures outlined in the SAP (Appendix A) in the Soil Gas Work Plan (Jacobs, 1994a).

The decontamination water was pumped from the 55-gallon drums through the three granular activated carbon (GAC) units that were plumbed in series. One sample was collected at the end of the three GAC units. A VOC blank and MS sample for all analytes were collected, along with the single water sample.

The waste asphalt and gravel were not sampled. An attempt is being made to recycle the asphalt and gravel. The PPE drum(s) will be disposed of at a landfill.

2.6.3 Waste Analytes

Analyses for the following parameters were performed on waste samples:

- VOCs
- SVOCs
- Pesticides/PCBs
- TPH-gasoline/TPH-diesel
- Total recoverable petroleum hydrocarbons (TRPH) (EPA Method 418.1)
- Herbicides
- Metals

2.6.4 Sample Numbers

The waste soil sample numbers are S1459351 through S1459399. The wastewater sample numbers are S1458151 through S1458199.

2.6.5 Waste Disposal Criteria

The IDWs have not yet been disposed. The Orange County Integrated Waste Management Department is the agency that oversees waste disposal in Orange County landfills. Waste acceptance criteria are listed in Table 2-5.

2.7 Data Evaluation Methods

This subsection summarizes the data evaluation tools and methods used to manage and display soil and soil gas data.

2.7.1 Data Management

During the soil gas investigation, soil gas data were delivered by Target personnel to the database manager in both electronic (Excel spreadsheet) and hard copy formats. The database manager transferred the data into database software called Paradox.™ During the investigation, data were updated and queried for use in the field.

Soil data were analyzed by Quality Analytical Laboratory. The data were provided to the database manager in both hard copy and electronic formats.

2.7.2 Geographical Information System

Soil gas and soil data were transferred from the Paradox™ database to the Informix database for Geographical Information System (GIS) use. The GIS system was used to generate map view plots of soil gas and soil VOC concentrations.

Table 2-1
Analytes for Soil Gas Analysis
MCAS El Toro Soil Gas Survey Technical Memorandum

Analytes	Modified EPA Method	Detection Limit Goal[a] (ug/L-v)
1,2-dichloroethylene (1,2-DCE)	8010	1.0
Trichloroethylene (TCE)	8010	1.0
Tetrachloroethylene (PCE)	8010	1.0
1,1,1-trichloroethane (1,1,1-TCA)	8010	1.0
1,1,2-trichloroethane (1,1,2-TCA)	8010	1.0
1,1-dichloroethane (1,1-DCA)	8010	1.0
Methylene Chloride (dichloromethane)	8010	1.0
1,1-dichloroethylene (1,1-DCE)	8010	1.0
carbon tetrachloride (CT)	8010	1.0
Chloroform (CF)	8010	1.0
1,2-dichloroethane (1,2-DCA)	8010	1.0
1,2-dichloropropane	8010	1.0
Vinyl chloride	8020	1.0
Freon 113	8020	1.0
Benzene	8020	1.0
Ethylbenzene	8020	1.0
Toluene	8020	1.0
Meta- and para-xylene	8020	1.0
Ortho-xylene	8020	1.0
Total Petroleum Hydrocarbons (TPH) - Diesel/Gasoline	GC/FID	Qualitative Fingerprint

[a]Actual detection limits may be different depending on sample size, instrument performance, and matrix effects.

Table 2-2
Soil Gas Survey Sample Numbers
MCAS El Toro Soil Gas Survey Technical Memorandum

	Soil Gas Data				Soil Data	
	12' or 15'	20' or 30'	Additional	QA/QC	Fixed Lab	QA/QC
Round 1	S145G1001-S14561300	S145G1301-S145G1600	S145G2001-S145G2999	S145G3001-S145G3999	NA	NA
Round 2	S145G1601-S145G1800	S145G1801-S145G2000	S145G2001-S145G2999*	S145G3001-S145G3999	S1457600-S1457699	S1457700-S1457799

Notes:
QA/QC = Quality Assurance/Quality Control
NA = Not Applicable (no soil samples were collected during Round 1)
* Numbers were continued from Round 1 Additional Soil Gas Samples.

Table 2-3
Field Soil Gas Quality Control Samples
Soil Gas Investigation
MCAS El Toro Soil Gas Survey Technical Memorandum

Soil Gas Sample	Frequency of Collection			
	Field Control Blanks	Sample Container Blanks	Sample Probe Blanks	Field Replicates
Soil Gas Samples	5 percent	One per bottle lot	1[a]	10 percent

Notes:
[a]One sample probe blank was collected to demonstrate that the tubing used in the sampling system was inert.

Table 2-4
Field Soil Quality Control Samples
MCAS El Toro Soil Gas Survey Technical Memorandum

Soil Sample Type	MS/MSD	Field Duplicates	Equipment Blanks	Methanol Method/ Trip Blanks
Field Screening Soil Samples	10 percent	10 percent	10 percent	1/day

Notes:

MS/MSD = Matrix spike/matrix spike duplicate
Note: A trip blank accompanied each cooler for shipment to the fixed laboratory containing samples for VOC analysis. The trip blanks were analyzed for VOCs by EPA Method 8010/8020.

Table 2-5
Waste Acceptance Criteria for Orange County Landfills
MCAS El Toro Soil Gas Survey Technical Memorandum

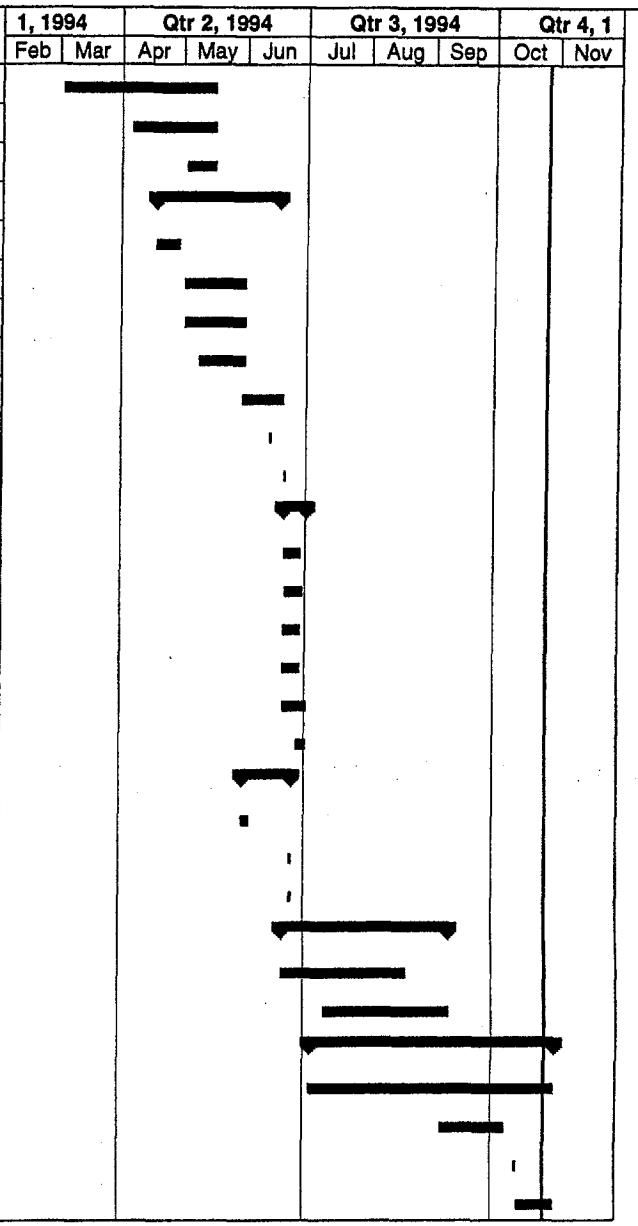
Volatile Organic Compounds	Criteria (ug/kg)
TCE	50
Benzene	70
Toluene	100
Total xylenes	620
Ethylbenzene	100
1,1,1-TCA	200
1,2-DCA	60
Methylene chloride	50
Waste Oil or TRPH (EPA Method 418.1) probably 10,000 mg/kg	
TPH diesel and gasoline (modified EPA Method 8015) TPH diesel probably 1,000 or 10,000 mg/kg TPH gasoline probably 100 or 1,000 mg/kg	
Pesticides (Method 8270)	Consult with the County of Orange
Water content less than 50 percent	

Notes:

ug/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
1,2 DCA	1,2 Dichloroethene (total)
1,1,1-TCA	1,1,1-Trichloroethane
TCE	Trichloroethylene
TPH	total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons

FIGURE 2-1
SOIL GAS SURVEY SCHEDULE
MCAS EL TORO SOIL GAS SURVEY TECHNICAL MEMORANDUM

Task	Dur	Start	End
1. PREPARE WORK PLAN	53d	3/3/94	5/16/94
2. PROCURE SUBCONTRACTORS	29d	4/6/94	5/16/94
3. ACQUIRE UTILITY MAPS	10d	5/3/94	5/16/94
4. ROUND 1 FIELD WORK	45d	4/18/94	6/17/94
a. Mark Locations	10d	4/18/94	4/29/94
b. Geophysical Utility Clearance	22d	5/2/94	5/31/94
c. Concrete Coring	22d	5/2/94	5/31/94
d. Air Knife Utility Clearance	17d	5/9/94	5/31/94
e. Soil Gas Sampling	15d	5/30/94	6/19/94
f. 13 June Field Meeting	1d	6/13/94	6/13/94
g. 20 June Field Meeting	1d	6/20/94	6/20/94
5. ROUND 2 FIELD WORK	10d	6/20/94	7/1/94
a. Mark Locations	7d	6/20/94	6/28/94
b. Geophysical Utility Clearance	7d	6/21/94	6/29/94
c. Concrete Coring	7d	6/20/94	6/28/94
d. Air Knife Utility Clearance	7d	6/20/94	6/28/94
e. Soil Gas/Soil Sampling	10d	6/20/94	7/1/94
f. Concrete Patching	5d	6/27/94	7/1/94
6. FIELD AUDITS	19d	5/31/94	6/24/94
a. CH2M HILL Laboratory Audit	4d	5/31/94	6/3/94
b. Jacobs Laboratory Audit	1d	6/24/94	6/24/94
c. Jacobs Field Audit	1d	6/24/94	6/24/94
7. SUBCONTRACT SUPPORT	60d	6/20/94	9/9/94
a. CLP Laboratory	45d	6/20/94	8/19/94
b. Data Validation	45d	7/11/94	9/9/94
8. REPORT PREPARATION	86d	7/4/94	10/31/94
a. Data Analysis and Write Report	86d	7/4/94	10/31/94
b. Navy/Agency Review	24d	9/6/94	10/7/94
c. Comment Resolution Meeting	1d	10/13/94	10/13/94
d. Incorporate Comments	12d	10/14/94	10/31/94



Project: El Toro
Date: 10/26/94

Progress **Summary**

FEATURES:

- MCAS EL TORO BOUNDARY
- WASH OR STREAM
- ROUND 1 SOIL GAS TEST LOCATION
- ROUND 2 SOIL GAS TEST LOCATION

SEE PLATE 1 FOR
STATION IDENTIFICATIONS

N

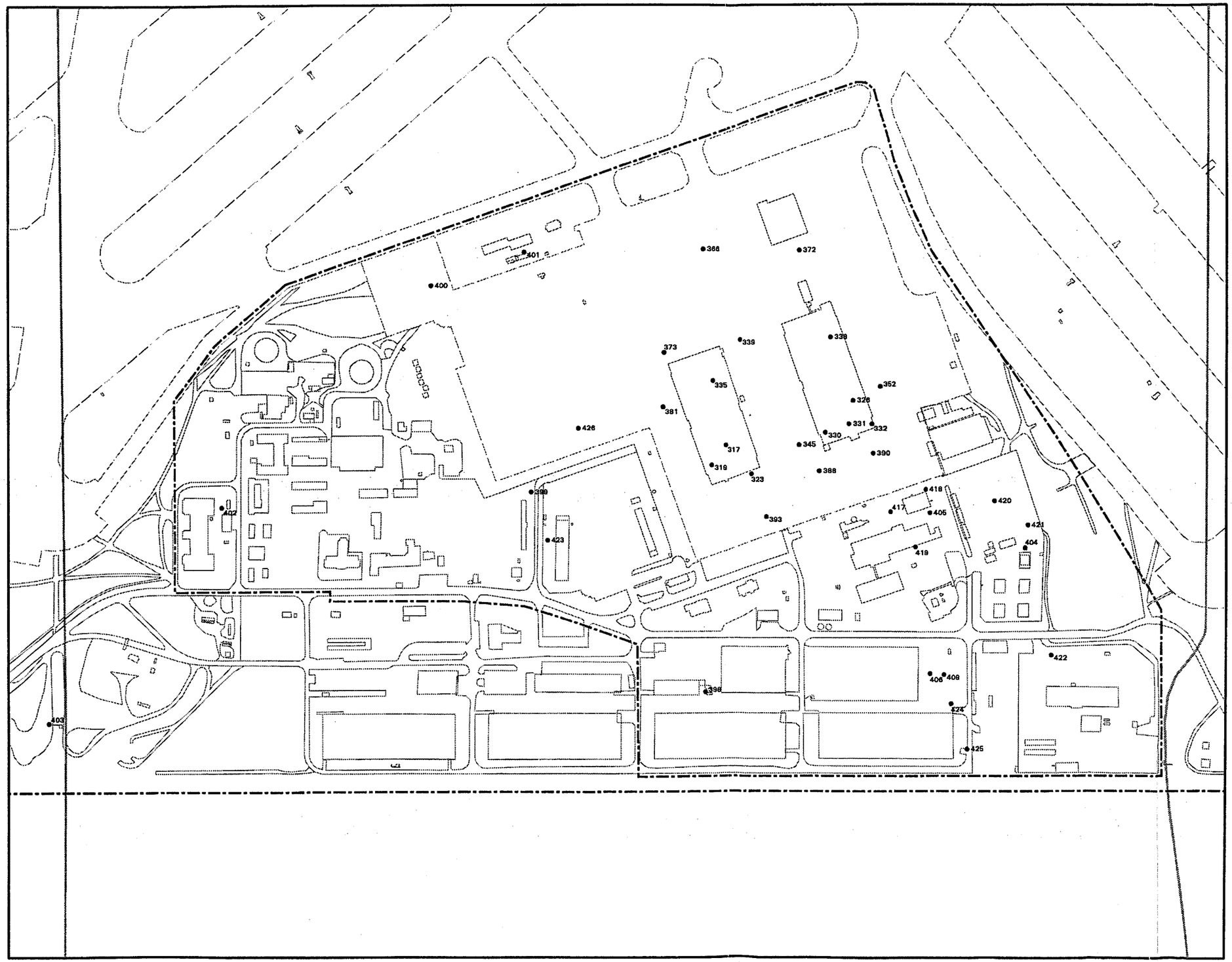
0 225 450 900
SCALE IN FEET

FIGURE 2-2

**ROUND 1 AND ROUND 2
SAMPLE LOCATIONS**

**MCAS EL TORO
SOIL GAS SURVEY**

Plot date: 16 Aug 94 12:32:55 Monday /gic2/eltoro/plots/soilgas/emplmd.aml &arge comb 1040 ledger



FEATURES:

- MCAS EL TORO BOUNDARY
- WASH OR STREAM
- SOIL STATION

0 225 450 900

SCALE IN FEET

FIGURE 2-3

SOIL SAMPLE LOCATIONS

MCAS EL TORO
SOIL GAS SURVEY

Plot date: 31 Aug 94 23:20:46 Wednesday /gis2/eltoro/plots/soilgas/soilsmploc.aml &args 1 1040 ledger

3.0 SUMMARY OF FIELD RESULTS

This section provides a summary of field results for the Soil Gas Survey. Included in this section are discussions of subsurface geology, air knife test results, soil gas analytical results, and soil analytical results. A comparison of soil gas, soil, and Round II RI groundwater results is also presented.

3.1 Subsurface Geology (boring logs)

Air knife holes and soil boring lithologies were logged on CH2M HILL standard soil boring log forms. Copies of the air knife boring logs (465 borings), logged to approximately 7 feet bgs, are in the CH2M HILL project files. Soil boring logs for the deepest borings (39 borings), logged to a maximum of 30 feet bgs, are presented in Appendix A.

Soil samples were generally collected at depths of 12 and 27 feet bgs in borings. Soil samples generally coarsened from silts and clays to silty sands and clays with depth. Samples collected from 12 feet bgs were primarily sandy silt or clay or, to a lesser extent, silty sand or sand. Samples collected at 27 feet bgs were primarily sand or silty sand, or to a lesser extent, sandy silt or clay.

3.2 Air Knife Test Results

As described in Subsection 2.1.4, an air knife was used for utility clearance prior to the soil gas investigation. A test was designed to evaluate the potential impact that the air knife may have on soil gas sample results.

A detailed description of the air knife test, including objectives, test configuration, rationale, test procedures, QA/QC, and data evaluation, is presented in Subsection 3.4 of the Soil Gas Survey Work Plan (Jacobs, 1994a). This information is briefly

summarized in this section. A description of the air knife drilling method is summarized in the Air Knife Fact Sheet, dated 23 March 1994 (Appendix D) (Jacobs, 1994a).

The main objective of the air knife field test was to evaluate the effect of the air knife on soil gas VOC concentrations in the 12-foot bgs samples. If soil gas concentrations were affected by the air knife, then an additional objective was to assess how quickly the soil gas concentration would re-equilibrate; this was used to assess a "safe" equilibration period between air knife utility clearance and collection of the 12-foot soil gas sample.

3.2.1 Summary of Air Knife Test Configuration, Procedures, and Rationale

Four locations were selected for air knife tests based on lithologic homogeneity, relative coarseness of the soil, and probability of encountering VOC and/or BTEX contamination. Location 1 includes Station ID 24_SG308, 309, and 276 along the west side of the Agua Chinon Wash. Location 2 is located at Solid Waste Management Unit/Area of Concern (SWMU/AOC) 095 (Station IDs 24_SG200, 241 and 214). Location 3 is located along the Bee Canyon Wash (Station IDs 24_SF034, 37, 98, 139, 141, and 143). Location 4 is located at SWMU/AOC 198 (Station IDs 24_SG153, 154, and 155).

Each air knife test consisted of three sample locations:

- A distal location used as a control point
- The air-knifed hole
- A proximal hole within 2 feet of the air knifed hole

This three-hole test configuration was conducted in four locations (three sets of three borings each and one set of six borings) that were identified as likely to have VOC or BTEX contamination based on previous investigations. The location with six borings contained duplicate borings for QA/QC purposes; the

rationale is described in detail in Subsection 3.4.4 of the Soil Gas Survey Work Plan (Jacobs, 1994a) and is briefly described below in Subsection 3.2.4.

The distal and proximal locations were hand-augered to 7 feet bgs. Dedicated soil gas sample probes were placed in the distal and air knifed locations to monitor soil gas concentrations and percent oxygen with time. The configuration of the holes and drilling methods (air knife or hand auger) are depicted in Figure 3-1.

Analyses included VOCs and percent oxygen in soil gas at all three sample locations. Pressure was monitored in the proximal hole as the air knife was advanced. Oxygen in soil gas was monitored to evaluate if the higher oxygen concentrations from the air knife affected the percent oxygen at the 12-feet bgs sample depth.

The test procedure process involved several steps. First, in order to establish background conditions and to have a control point that could not be significantly affected by the air knife, a distal location (at least 100 feet from the air knifed location) with a dedicated sampling probe was installed. The distal location was first hand augered to 7 feet bgs to complete the utility clearance and then backfilled. A dedicated sampling probe was then installed at a depth of 12 feet bgs with a direct push rig. To establish background VOC concentrations and percent oxygen in soil gas prior to air knife advancement, the dedicated probe was sampled.

Next, the proximal hole adjacent to the air knife location was installed. As with the distal location, the hole was hand augered to 7 feet bgs and backfilled. A temporary probe was pushed to 12 feet bgs. In order to establish percent oxygen and VOC soil gas concentrations prior to air knife advancement, a soil gas sample was collected and analyzed in the onsite laboratory. The drill rods and the temporary sampling probe were then left in the ground in the proximal hole to monitor pressure as the adjacent air knife hole was advanced.

The air knife hole was then drilled with the air knife to a depth of 7 feet bgs and backfilled. As noted above, pressure was monitored in the proximal hole during air knife advancement to evaluate if the air knife was affecting the pressure (injecting or vacuuming air) at a depth of 12 feet bgs. A dedicated sampling probe was then installed at the air knife location at a depth of 12 feet bgs with a direct push rig. In order to evaluate soil gas and percent oxygen shortly after air knife advancement, a soil gas sample was collected.

The temporary soil gas probe and drill rods were then removed from the proximal location and the hole was abandoned with cement grout.

Time-series soil gas samples were collected from both the distal and air knife dedicated sampling probes approximately 1 hour, 4 hours, 1 day, and 4 days after air knifing. As before, soil gas samples were analyzed for VOCs and percent oxygen. If soil gas concentrations in the air knife hole were changed subsequent to air knife drilling, the time-series samples were used to evaluate how quickly the soil gas concentrations re-equilibrated. Time-series samples in the distal holes were used for evaluating changes in soil gas concentrations not related to the effects of the air knife test (i.e. barometric pressure changes).

The air knife test results are summarized in Table 3-1. For each of the four tests, pressure during air knife advancement, time series soil gas concentrations, and the time-series percent oxygen are presented. The results are discussed in the following three subsections.

3.2.2 Pressure Results

As discussed above, pressure was monitored at a depth of 12 feet bgs in an adjacent (proximal) hole as the air knife drilled to a depth of 7 feet bgs. The pressure measurement was used to assess subsurface air communication between the air knife and 12 feet bgs. The air knife extracts a net volume of approximately 50 cubic feet per minute (cfm). Therefore, as the air knife is

advanced, it was expected that a vacuum would be measured at 12 feet bgs as air is drawn up toward the air knife.

The objectives of pressure monitoring were to answer the following air knife questions related to use of the air knife:

- Is there a pressure effect at 12 feet bgs (soil gas sample depth) as the air knife is advanced to a depth of 7 feet bgs?

- If there is a pressure effect:

  - Is there a positive pressure (air introduced into the subsurface) or is there a vacuuming effect (purging effect)?

  - At what air knife advancement depth are these effects first seen?

  - What is the maximum pressure or vacuum measured?

  - How long does it take for pressure to re-equilibrate?

Table 3-2 includes a summary of pressure monitoring for the air knife tests and addresses the questions above.

As expected, a vacuum rather than positive pressure was measured during air knife advancement for three of the four air knife tests; there was no effect on one test. Air knife tests 2 and 4 yielded similar pressure effects: pressure effects were not recorded until the air knife was below 5 feet bgs (5 feet bgs for test 2 and 6.5 feet bgs for test 4) and the maximum recorded vacuum was 0.75 inches of water (0.68 inches for test 2 and 0.75 for test 4). Figure 3-2 displays the pressure (in inches of water) and air knife drilling depth (in feet

bgs) versus time for air knife test Number 2. Air knife tests 1 and 3 yielded different results. There was no pressure effect on air knife test 1. For air knife test 3, vacuum effects were observed when the air knife was at a depth of 2 feet bgs and the vacuum went as high as 2 inches of water. For all tests where a vacuum effect was measured, the pressure returned to zero almost immediately after the air knife stopped drilling. The pressure and drilling depth versus drilling time graphs for air knife tests 1, 3, and 4 are presented in Appendix B.

There does not appear to be a clear relationship between pressure effects and lithology. Based on air knife boring logs (kept in the project files), the predominant lithology from 0 to 7 feet for each air knife test is:

- Test 1 - silty sand
- Test 2 - clay
- Test 3 - silty sand
- Test 4 - clay and silty sand

It might be expected that pressure effects would be higher in sands and lower in clays relative to one another. This effect was observed for air knife test 3, which had the strongest pressure effect and was completed in silty sand. However, no pressure effects were measured for air knife test 1, which was also completed in silty sand. A minimal pressure effect was measured for air knife tests 2 and 4, which were completed in clay and in clay and silty sand, respectively.

3.2.3 Percent Oxygen Results

Oxygen percentages in the soil gas were measured to assess the potential influence of the air knife on the concentration of oxygen in the 12-foot bgs soil gas sample. The difference between percent oxygen in the atmosphere (21 percent oxygen) and in vadose zone soil gas (12 to 19 percent oxygen)

was used to assess the effects of the air knife. If the percent oxygen increased subsequent to air knife drilling, the air knife may have introduced higher percent oxygen down to the sampling interval. The higher percent oxygen could either be injected by the air knife or drawn down from the surface or other areas with higher oxygen content. Lower percent oxygen could result if the air knife pulled in soil gas with a lower oxygen content. Note that there is likely a measurement error of 1 percent.

Oxygen was measured prior to air knife advancement in the distal and proximal sample locations for each test. Time-series oxygen percentages were measured in the distal and air knife dedicated probes approximately 1 hour, 4 hours, 1 day, and 4 days after air knife advancement. Results and percent oxygen values are summarized in Tables 3-1 and 3-3, respectively.

For air knife tests 2 and 4, there did not appear to be any changes in oxygen concentration from before air knifing (proximal hand augered holes) to immediately after air knifing (air knife dedicated probe). The percent oxygen versus time since air knife drilling for air knife test 2 is presented in Figure 3-3. Note that percent oxygen does not vary by more than 1 percent.

Air knife test number 3, displayed in Figure 3-4, is the only test where a drop in percent oxygen related to the air knife seems to have occurred. The proximal hand-auger location collected before air knifing, as well as the distal control point, ranged from 16.5 to 18 percent oxygen. The percent oxygen at the air knife probe location ranged from 14 to 15 percent. Therefore, the air knife may have dropped the oxygen content by a few percent. The lower oxygen content likely came from an adjacent area in the vadose zone. Also note that the difference in percent oxygen between the air knife probe (Station ID 24_SG139) and the distal control point (Station ID 24_SG141) was still 3 percent after 4 days.

The drop in oxygen concentration for air knife test 3 may have been related to the vacuum observed during air knife drilling. Of the four tests, test 3 had more than double the vacuum pressure (2 inches of water) measured during the other tests. Also, pressure effects were observed over the entire drilling depth (0 to 7 feet bgs).

The percent oxygen versus time plots for the remaining air knife tests 1 and 4 are presented in Appendix B. For air knife test 1, although there appeared to be a drop in percent oxygen in the air knife probe, the distal control location also displayed a similar drop. This suggests that the drop in percent oxygen for air knife test 1 was not likely related to the effects of the air knife.

3.2.4 Soil Gas Concentrations

Soil gas samples were collected before air knife drilling in the proximal and distal locations (both hand augered). Immediately after air knife drilling, soil gas samples were collected in the air-knifed hole and the distal location. If the soil gas concentration in the proximal hole before air knifing were approximately the same as the sample from the air-knifed hole after air knifing, then it may be concluded that the air knife has no apparent effect on soil gas concentrations at that location.

However, if soil gas concentrations in the air-knifed hole change subsequent to air knife drilling, the air knife may have an effect on soil gas concentrations. If soil gas concentrations were affected by the air knife, time series samples were collected at the air knife location to evaluate how quickly the soil gas concentrations re-equilibrate to the pre-air knife concentrations. Time-series samples in the distal holes were used as a control for evaluating changes in soil gas concentrations not related to the effects of the air knife test.

Table 3-1 summarizes the effects that the air knife had on soil gas concentrations. Table 3-3 summarizes time series air knife test results,

including 1,1-DCE, PCE, TCE, and Freon 113 soil gas concentrations and percent oxygen. There are too few compounds detected in soil gas for air knife tests 1 and 3 to make any evaluations.

For air knife test 2, PCE was detected in the proximal hole (Station ID 24_SG200) prior to air knife drilling at concentrations between 2 and 5 ug/L-v, as shown in Figure 3-5. Immediately after air knife drilling, PCE was detected in the air-knifed hole (Station ID 24_SG241) at a concentration of 3.5 ug/L-v. The sample collected from this location 1 hour later had a concentration of 4.8 ug/L-v. The concentrations of PCE in soil gas were similar before and after air knife drilling. The air knife did not seem to affect PCE concentrations in soil gas.

The air knife may have affected Freon 113 soil gas concentrations for air knife test 2. Freon 113 was detected at concentrations between 2.5 and 3.8 ug/L-v at the proximal location (Station ID 24_SG200) prior to air knife drilling and at a concentration of 1.7 ug/L-v at the air knife hole (Station ID 24_SG241) immediately after air knifing, as shown in Figure 3-6. After 1 hour, the Freon 113 concentration at the air-knifed hole (Station ID 24_SG241) increased to 2.6 ug/L-v. The Freon 113 soil gas concentrations may have dropped slightly after air knife drilling and returned to pre-air knife concentrations after 1 hour.

For air knife test 4, PCE was detected both before air knife drilling at the proximal hole (Station ID 24_SG155) and after air knife drilling at the air knife location (Station ID 24_SG153), as shown in Figure 3-7. PCE concentrations did not significantly change from before air knife drilling (8.3 ug/L-v at Station ID 24_SG155) to after air knife drilling (Station ID 8.6 ug/L-v at 24_SG 153). Therefore, the air knife did not appear to affect the soil gas concentration at air knife test 4.

3.2.5 Air Knife Test QA/QC

QA/QC specific to the air knife test included paired sample locations (air knife QA/QC test at location 3) and duplicate samples (test 1). Table 3-3 includes QA/QC data for the air knife tests, including oxygen content and soil gas concentrations. For air knife test number 3, the air knife, proximal, and distal holes were paired to obtain data on small scale spatial variability. For air knife test number 1, duplicates were collected for all samples collected. All QA/QC samples were collected at a depth of 12 feet bgs.

Air Knife QA/QC Test. As stated above, air knife test 3 was selected as the QA/QC site where each of the three sample locations had a paired adjacent location. Samples were only collected from the paired hole prior to air knife drilling. The duplicate holes for the air knife test are listed below:

- Proximal Location: Station IDs 24_SG037 and 24_SG098
- Air Knife Location: Station IDs 24_SG034 and 24_SG139
- Distal Location: Station IDs 24_SG141 and 24_SG143

Between the two proximal locations, the oxygen content differed by 1.5 percent; 16.5 percent oxygen at Station ID 24_SG037 and 18 percent oxygen at Station ID 24_SG098. At Station ID 24_SG037, four analytes were detected in soil gas, including 1,1-DCE (1.3 ug/L-v), vinyl chloride (5.8 ug/L-v), toluene (5.5 ug/L-v), and total petroleum hydrocarbons (110 ug/L-v) (Table 3-6). No compounds were detected in soil gas at the paired location (Station ID 24_SG098).

Between the two air knife locations, the oxygen content was the same (14 percent). Also, for the samples collected before air knife drilling, no analytes were detected in soil gas for either air knife location.

At the distal locations, the oxygen content was 17.5 percent at Station ID 24_SG141 and 17 percent at Station ID 24_SG143, a difference of 0.5 percent. At Station ID 24_SG143, total xylenes were detected in soil gas at a concentration of 5.9 ug/L-v. No compounds were detected in soil gas at the paired location.

In summary, some degree of spatial variability was exhibited between the duplicate locations. Oxygen contents were similar but differed from 0 to 1.5 percent. In general, the correlation of soil gas concentrations between duplicate locations was poor. At the two stations that had detectable concentrations of analytes in soil gas, the duplicate locations had nondetects.

Duplicate Air Knife Samples. For air knife test number 1, duplicate samples were collected for all time-series samples. For the proximal location (Station ID 24_SG076), no analytes were detected in soil gas.

For the air knife sample location (Station ID 24_SG308), there were 5 time series samples that were duplicated (10 total samples). Trans-1,2-Dichloroethylene (t-1,2-DCE) was detected in all of the samples and cis-1,2-Dichloroethylene (c-1,2-DCE) was detected during two of the time series samples (Table 3-3). All of the 1,2-DCE concentrations were in general agreement. Toluene was detected at 1.3 and 1.7 ug/L-v for duplicate sample numbers S145G2003 and S145G3006, respectively. Only one sample (S145G2004) had detectable concentrations of soil gas analytes (toluene at 6.1 ug/L-v and TPH at 14.3 ug/L-v) that were not detected in the duplicate sample (S145G3007).

For the distal sample location (Station ID 24_SG309), c-1,2-DCE and t-1,2-DCE were detected at 1 ug/L-v for sample number S145G1809. No analytes were detected in soil gas for the duplicate sample (S145G3003). However, because the detection limit for the 1,2-DCE compounds was only 1 ug/L-v, the duplicate

samples are generally the same. No other analytes were detected for any of the time series samples.

Duplicate results for the air knife test were good. Only one sample (S145G2004) had significant concentrations of analytes that were not detected in the duplicate sample.

3.2.6 Discussion of Air Knife Results and Conclusions

The purpose of the air knife tests were to evaluate the effect of the air knife on soil gas concentrations. To aid in the evaluation, pressure and percent oxygen were also measured. This discussion presents the general air knife test results and conclusions.

During air knife advancement from 0 to 7 feet bgs, the pressure was monitored at a depth of 12 feet bgs. For one of the four air knife tests (test 1), there were no pressure effects. For two of the remaining three air knife tests (tests 2 and 4), no pressure effects were measured as the air knife drilled from 0 to 5 feet bgs and a net vacuuming effect of less than 1 inch of water was measured as the air knife drilled from 5 to 7 feet bgs. For air knife test number 3, a vacuum of as high as 2 inches of water was measured during advancement. For all of the tests where a vacuum effect was measured, the pressure returned to zero almost immediately after the air knife stopped drilling (Table 3-2).

The percent oxygen was measured before air knife drilling, immediately after air knife drilling, and time series readings were subsequently measured. The oxygen content was the same before and after air knife drilling for two of the four air knife tests (tests 2 and 4). For air knife tests 1 and 3, the oxygen content may have been affected by the air knife. Although the percent oxygen decreased for air knife test 1, because the control point also exhibited a decrease, it is not conclusive that the air knife affected the oxygen content. For air knife test 3, the oxygen content seemed to be reduced by the air knife.

Soil gas compounds were detected at significant enough concentrations to measure air knife effects at 2 of the air knife tests (2 and 4). For air knife test 4, PCE concentrations did not appear to be affected by air knife drilling. For air knife test 2, PCE soil gas concentrations did not appear to be affected by air knife drilling. Freon 113 soil gas concentrations may have dropped slightly after air knife drilling but returned to pre-air knife drilling concentrations after 1 hour.

In summary, for air knife test number 1, there were no measurable pressure effects, it was not conclusive if the percent oxygen was affected, and no soil gas analytes were measured. For air knife test number 2, there were minor pressure effects, no effect on the percent oxygen, and soil gas concentrations may have been affected by air knife drilling. For air knife test number 3, there were pressure and percent oxygen effects but VOCs were not detected in soil gas at high enough concentrations to be able to effectively evaluate the effect of the air knife. For air knife test number 4, there were minor pressure effects, no oxygen effects, and VOCs in soil gas were not detected at high enough concentrations to make evaluations.

From these results, the Jacobs Team and the regulatory agencies decided at the 13 June 1994 soil gas meeting to leave a 2-day buffer between air knife drilling and collection of soil gas samples (Jacobs, 1994d). Although soil gas concentrations affected by the air knife returned to preair knife drilling concentrations in less than 1 hour, the meeting attendees decided to leave an additional safety margin of time.

3.3 Soil Gas Analytical Results

3.3.1 Possible VOC Source Areas Investigated

VOCs were detected in groundwater above regulatory standards in the southwest quadrant of MCAS El Toro during the Phase I RI field investigation

(Jacobs, 1993c). However, only minor concentrations of VOCs were detected in soil during the Phase I RI and the RFA (Jacobs, 1993b) field investigations. Thus, the goal of the soil gas survey was to locate shallow (less than 30 feet bgs) vadose zone contamination in the southwest quadrant of the Station that may be contributing to VOC contamination in groundwater.

A new site, Site 24 (Possible VOC Source Area), was defined during preparation of the Draft Phase II RI Work Plan (Jacobs, 1993c) to address the possible sources of VOCs in the southwest quadrant of MCAS El Toro. Site 24 consists of the majority of the southwest quadrant of the Station and encompasses existing RI Sites 7, 8, 9, 10, 11, and 22 and SWMUs/AOCs investigated in the RFA where VOCs were detected. The area also has a variety of other significant features, including the former refurbishing operations area. These source areas were selected for investigation in the soil gas survey based on the results of the Phase I RI, the RFA, records searches, interviews with current and past Station employees, and meetings and discussions with the regulatory agencies. Table 3-4 lists the possible source areas located within Site 24 and provides a general description of the soil gas survey investigation at each source area. The locations of these features and the current boundaries of Site 24 are shown on Plate 2.

In addition to Site 24, unlined portions of the Agua Chinon and Bee Canyon Washes, part of Site 25, are also located in the southwestern quadrant of the Station and were included in the Soil Gas Survey. Site 25 addresses the major drainages at MCAS El Toro, including Agua Chinon Wash, Bee Canyon Wash, Borrego Canyon Wash, and Marshburn Channel. Agua Chinon Wash and Bee Canyon Wash pass adjacent to the southeast and northwest sides of Site 24, respectively. Both washes were investigated during the Phase I RI and RFA field investigations. Descriptions of these two washes, and the soil gas survey investigation at each wash, are included in Table 3-4. The locations of the washes relative to Site 24 are shown on Plate 2.

The Soil Gas Survey Work Plan provides additional detailed descriptions of the possible source areas investigated in the soil gas survey (refer to Subsection 3.2 of the Soil Gas Survey Work Plan) (Jacobs, 1994a). In addition, sampling results for the RI and RFA sites listed in Table 3-4 are provided in the RI Technical Memorandum (Jacobs, 1993d) and Final RFA Report (Jacobs, 1993b), respectively.

3.3.2 Halogenated Hydrocarbons

This section describes the halogenated hydrocarbons detected in soil gas. Soil gas analytes and their optimal detection limits are presented in Table 2-1. Table 3-4 includes a description of each source area. Table 3-5 summarizes the VOC analytes and their maximum concentrations in soil gas. This table includes the number of samples analyzed (777); the number of times each analyte was detected; the number of sample locations (465); and the station identification, sample number, and depth of the maximum detected concentration. Table 3-6 provides a summary of the concentrations of VOCs and TPH detected in soil gas. Appendix C-1 provides a complete summary of the results of all soil gas analyses. The sample station identifications and possible VOC source areas investigated are presented on Plates 1 and 2, respectively. The soil gas concentration maps presented in Subsection 3.3 are based on the maximum concentration at each sample location. Soil gas concentration contour maps are included in this section and color-coded maps showing concentrations at individual sample locations are included in Appendix C-2.

Of the halogenated hydrocarbons (all analytes except TPH and BTEX), the most commonly detected analytes were TCE; PCE; 1,1-DCE; and Freon 113. Each was detected more than 100 times. No other analyte was detected more than 63 times.

The halogenated hydrocarbon with the highest concentration detected was TCE at a concentration of 2,199.3 ug/L-v. The analytes with the next highest concentrations were 1,1-DCE at a concentration of 175.4 ug/L-v, PCE at a concentration of 103.4 ug/L-v, and Freon 113 at a concentration of 47.5 J ug/L-v. No other halogenated hydrocarbons were detected at concentrations above 20 ug/L-v.

TCE. Figure 3-8 is a TCE soil gas concentration contour map based on the highest concentration at each sample location. A discussion of the comparison between shallow and deep soil gas concentrations is provided in Subsection 3.3.4. TCE was detected over a large area in and around Buildings 296 and 297 (the large aircraft hangars). TCE was detected above a concentration of 1,000 ug/L-v in two subareas: outside the east corner of Building 297 (former assembly and repair shop) and the south corner of Building 296 (paint and dope shops). Other subareas with TCE concentrations above 500 ug/L-v include inside Building 297 (Station IDs 24_SG318 and 24_SG335) and outside the south corner of Building 296 (Station IDs 24_SG354 and 24_SG355). Although the four areas described above include detected TCE soil gas concentrations above 500 ug/L-v, the soil gas concentrations are primarily between 50 and 500 ug/L-v over most of the subareas.

TCE was detected above 50 ug/L-v in four other areas:

- Southeast end of Site 8
- The downstream (southwest) end of Agua Chinon Wash
- Station ID 24_SG245 (southeastern portion of Site 24)
- Station ID 24_SG294 (south of Site 8)

TCE was detected above 5 ug/L-v in three other areas:

- Between Site 9 and Building 435 (north end of Site 24)

- Station ID 24_SG061 (northeast of Building 307) adjacent to abandoned well number 4

- Buildings 324 and 326 (south of Buildings 296 and 297)

All other locations with TCE in soil gas were detected at concentrations below 5 ug/L-v.

PCE. PCE was detected in 136 of the soil gas samples at concentrations ranging from 1 to 103.4 ug/L-v. The area with the highest PCE soil gas concentrations (greater than 50 ug/L-v) was north of Building 635 (Figure 3-9). A potential source of the PCE is the vehicle wash rack (SWMU/AOC 198) at the north end of Building 655. Also, in a 1970 aerial photograph, a channelized drainage ran southwestward from the edge the concrete tarmac along the road just west of Building 655 (Jacobs, 1992). Solvents may have drained off the tarmac and flowed along the channelized drainage.

PCE was detected above 5 ug/L-v in three other areas:

- At Building 297
- The area between the east ends of Buildings 324 and 326
- Station ID 24_SG445 (east of Building 326)

All other locations with PCE in soil gas were detected at concentrations below 5 ug/L-v.

C-1,2-DCE and t-1,2-DCE. C-1,2-DCE and t-1,2-DCE, which are degradation products of TCE, were detected in 50 and 15 of the soil gas samples, respectively. The highest c-1,2-DCE and t-1,2-DCE concentrations detected in soil gas are 16 and 3.4 ug/L-v, respectively (Table 3-5). Figure 3-10 is a soil gas contour map based on the higher soil gas concentration of the two 1,2-DCE isomers at each location.

The area with the highest 1,2-DCE soil gas concentration (greater than 5 ug/L-v) is located around the east corner of Building 297 (former assembly and repair shop). 1,2-DCE was detected above 5 ug/L-v at three other individual Station IDs:

- Station ID 24_SG354 near the south corner of Building 296 (6.6 ug/L-v)
- Station ID 24_SG206 south of Buildings 296 and 297 (14.2 ug/L-v)
- Station ID 24_SG010 between RI Site 9 and Building 435 (Crash Crew Building) (6.1 ug/L-v)

All other locations with 1,2-DCE in soil gas had concentrations below 5 ug/L-v.

1,1-DCE. 1,1-DCE, which is a degradation product of TCE, was detected in 148 soil gas samples with a maximum detected concentration of 175.4 ug/L-v (Figure 3-11). 1,1-DCE was detected above 50 ug/L-v in four areas:

- An area east of Building 297 and north of Building 296
- A crescent-shaped area west of Building 297
- At Station ID 24_SG331 located at the southwest end of Building 296 (68.1 ug/l at a depth of 27 feet bgs)
- At Station IDs 24_SG175 (43.8 ug/L-v at 12 feet bgs) and 24_SG323 (123.7 ug/L-v at 15 ft bgs and 175.4 ug/L-v at 27 feet bgs) located just outside the south corner of Building 297.

Seven isolated Station IDs had 1,1-DCE soil gas concentrations above or at 20 ug/L-v:

- Station ID 24_SG372 located south of Building 295 (33.7 ug/L-v 1,1-DCE at 15 feet bgs)

- Station IDs 24_SG338 and 24_SG331 located in Building 296 (37 ug/L-v at 27 feet bgs and 68.1 ug/L-v at 27 feet bgs, respectively)

- Station ID 24_SG204 located near the south end of Site 24 (20 ug/L-v at 15 feet bgs)

- Station ID 24_SG258 located north of Site 8 (45 ug/L-v at 15 feet bgs)

- Station ID 24_SG335 located in Building 297 (25.5 ug/L-v at 15 feet bgs and 21 ug/L-v at 27 feet bgs)

- Station ID 24_SG459 located east of Building 655 (46.1 ug/L-v at 15 feet bgs)

The other three small areas had 1,1-DCE concentrations below 20 ug/L-v.

Freon 113. Freon 113 was detected in 133 soil gas samples at a maximum concentration of 47.5 J ug/L-v. Freon 113 was primarily detected in one large area centered around the southwest end of Building 296 (Figure 3-12). Three arms of Freon 113 in soil gas radiate away from the southwest end of Building 296. The southwest end of Building 296 is the location of the former paint and dope shops, which housed a degreaser. Freon 113 was detected at concentrations above 40 ug/L-v at the southwest end of Building 296 and generally less than 10 ug/L-v within the three arms. The three arms of Freon 113 in soil gas include:

- One arm extends northeastward along the edge of Building 296.

- Another arm extends northwestward and includes the south corner of Building 297. The area between Buildings 296 and 297 is generally greater than 10 ug/L-v.

- The third arm extends to the south and includes Buildings 324 and 326. Between Buildings 234 and 326, Freon 113 was detected above 10 ug/L-v.

Freon 113 was detected in four additional small areas. At only one of these areas was Freon 113 detected greater than 10 ug/L-v. At Station ID 24_SG219, Freon 113 was detected at 17.5 ug/L-v. Station ID 24_SG219 is located along the abandoned industrial sewer line, north of Building 359 (preservation building).

Carbon Tetrachloride. Carbon tetrachloride was detected in 63 soil gas samples at a maximum concentration of 4.8 ug/L-v. Carbon tetrachloride was detected above 2 ug/L-v in three areas as described below (Figure 3-13).

- One area is south of Building 296 and east of Building 326. The former paint and dope shops were located at the south corner of Building 296.

- A second area is located along the east edge of Building 297. Potential sources in this area include the former plating and anodizing shop at the southwest end of Building 297, the oil/water separator (OWS) (SWMU/AOC 76) east of Building 297, and the former assembly and repair shops at the northeast end of Building 297.

- The third area is located at the southeast end of RI Site 8, which is the Defense Reutilization and Marketing Office (DRMO) storage yard.

Other Halogenated Hydrocarbons. Other halogenated hydrocarbons that were detected in soil gas, but not described above, include 1,1,1-trichloroethane (1,1,1-TCA); 1,1,2-trichloroethane (1,1,2-TCA); chloroform; and vinyl chloride. Chloroform was detected in 23 soil gas samples; 1,1,1-TCA in 18 soil gas samples; 1,1-DCA and vinyl chloride in 9 soil gas samples; and 1,1,2-TCA in two soil gas samples (Tables 3-5 and 3-6).

1,1,1-TCA; 1,1,2-TCA; and chloroform were not detected above 10 ug/L-v in soil gas. The maximum concentration of 1,1-DCA detected in soil gas was 11.3 ug/L-v at Station ID 24_SG112 at a depth of 20 feet bgs. Station ID 24_SG112 is located at the east corner of Building 297 near the location of the former assembly and repair shop.

The maximum concentration of vinyl chloride detected in soil gas was 9.4 ug/L-v at Station ID 24_SG472 at 15 feet bgs. Station ID 24_SG472 is located east of Building 307 near a UST.

3.3.3 Aromatic Hydrocarbons and Total Petroleum Hydrocarbons

This section describes the extent of aromatic hydrocarbons and TPH detected in soil gas samples. Aromatic hydrocarbons include BTEX compounds. A summary of the optimal detection limits for these analytes is presented in Table 2-1.

Aromatic hydrocarbons and TPH were detected in 60 of the 777 soil gas samples (44 of the 465 sample stations). Table 3-5 summarizes maximum concentrations of aromatic hydrocarbons TPH detected in the soil gas samples. A list of the soil gas samples with aromatic hydrocarbons and/or TPH detected is provided in Table 3-6. The sample station locations are shown on Plate 1. Plate 2 shows the locations of the possible VOC source areas investigated in the Soil Gas Survey.

The following subsections provide a summary of the locations and concentrations of aromatic hydrocarbons and TPH identified in the soil gas samples.

Total Petroleum Hydrocarbons. TPH was detected in 34 of the soil gas samples at concentrations ranging from 10.2 to 12,300 ug/L-v. The highest TPH concentrations were found in borings located near an OWS and a UST that were investigated during the RFA (SWMU/AOC Nos. 175 and 176, respectively) and found to have elevated levels of TPH in soil (Figure 3-14).

The maximum TPH concentration (12,300 ug/L-v) was detected adjacent to SWMUs/AOCs 175/176 at Station ID 24_SG404 at a depth of 15 feet below bgs. The deeper sample in this boring (21 feet bgs) had a TPH concentration of 6,600 ug/L-v. At the other borings located near these SWMUs/AOCs, TPH concentrations in soil gas included 10,500 (15 feet bgs) at Station ID 24_SG404, and 10,000 and 8,900 ug/L-v in duplicate samples (15 feet bgs) at Station ID 24_SG265. BTEX was also detected in soil gas samples at this location.

TPH were also detected at concentrations greater than 100 ug/L-v at the following locations:

- Agua Chinon Wash
- Bee Canyon Wash
- Tarmac area at east corner of Building 297
- Tarmac area south and southwest of Buildings 296 and 297
- South side of Building 435 (Crash Crew Building)
- SWMU/AOC 145 (located in the west portion of Site 24)

Benzene. Benzene was detected in eight of the soil gas samples at concentrations ranging from 1.8 to 163 ug/L-v. Six of the eight samples with benzene detected were collected adjacent to SWMUs/AOCs 175/176

(described above) (Figure 3-15). The maximum benzene concentration (163 ug/L-v) was detected in the 15-foot sample at Station ID 24_SG474. Other elevated benzene levels detected in the soil gas at SWMUs/AOCs 175/176 include 145 (15 feet bgs) and 68 ug/L-v (21 feet bgs) at Station ID 24_SG404 and, 121 and 112 ug/L-v in duplicate samples (15 feet bgs) at Station ID 24_SG265. Benzene was also detected at a concentration of 2 ug/L-v in the 6-foot sample at Station ID 24_SG475.

Benzene was detected in soil gas at low levels (near the detection limit) at two other locations in Site 24. At Station ID 24_SG448, benzene was detected in the 15-foot sample at 1.8 ug/L-v. This boring is located about 100 feet west of SWMUs/AOCs 175/176. At Station ID 24_SG072, located on the tarmac near the east corner of Building 297, benzene was detected in the 20-foot sample at a concentration of 2 ug/L-v. No other aromatic hydrocarbons were detected in this sample.

Toluene. Toluene was detected in 27 soil gas samples at concentrations ranging from 1 to 108 ug/L-v. The highest toluene concentration was detected in the 15-foot sample at Station ID 24_SG206, located southwest of Buildings 296 and 297 (Figure 3-16).

Higher concentrations of toluene were also detected in the samples collected at SWMUs/AOCs 175/176. At Station ID 24_SG404, toluene was detected at concentrations of 71 (15 feet bgs) and 30 ug/L-v (21 feet bgs), and at concentrations of 71 and 80 ug/L-v in duplicate samples (15 feet bgs) collected at Station ID 24_SG265.

Toluene was also detected at lower levels (below 10 ug/L-v) at various locations in the southwest quadrant of the Station, including:

- Agua Chinon Wash
- Bee Canyon Wash

- Near the northwest corner of Building 655 (Station ID 24_SG153)
- South side of Building 435 (Crash Crew Building)
- Tarmac area north of Building 297 (Station ID 24_SG375)
- Tarmac area south and southwest of Building 297 (except Station ID 24_SG206 where toluene=108 ug/L-v)

Ethylbenzene. Ethylbenzene was detected in 18 soil gas samples at concentrations ranging from 1 to 216 ug/L-v. The maximum ethylbenzene concentration (216 ug/L-v) was detected in the 15-foot sample at Station ID 24_SG404; ethylbenzene was detected at a concentration of 113 ug/L-v in the 21-foot sample in this boring (Figure 3-17). This boring is located adjacent to SWMUs/AOCs 175/176. Other elevated ethylbenzene levels detected in the soil gas at SWMUs/AOCs 175/176 include 157 and 180 ug/L-v in duplicate samples (15 feet bgs) at Station ID 24_SG265, and 171 ug/L-v in the 15-foot sample at Station ID 24_SG474.

Ethylbenzene was also detected at lower levels (below 5 ug/L-v) at various locations in the southwest quadrant of the Station, including:

- East side of Building 324
- South side of Building 435 (Crash Crew Building)
- SWMU/AOC 145 (located in the west portion of Site 24)
- Tarmac area at east corner of Building 297 (Station ID 24_SG375)
- Tarmac area south and southwest of Buildings 296 and 297

Total Xylenes. Total xylenes were detected in 44 of the soil gas samples. The total xylene concentrations ranged from 1 to 565 ug/L-v, with the highest concentrations detected at SWMUs/AOCs 175/176 (Figure 3-18). The maximum total xylenes concentration in soil gas (565 ug/L-v) was detected in the 15-foot sample at Station ID 24_SG404; the 21-foot sample in this boring had a xylene concentration of 286 ug/L-v. Other elevated total xylene concentrations in soil gas at SWMUs/AOCs 175/176 include 375 and 448

ug/L-v in duplicate samples (15 feet bgs) at Station ID 24_SG265, and 415 ug/L-v in the 15-foot sample at Station ID 24_SG474.

Total xylenes were also detected at lower levels (below 15 ug/L-v) at various locations in the southwest quadrant of the Station, including:

- Agua Chinon Wash
- Bee Canyon Wash
- Between RI Site 9 and Building 435 (Station IDs 24_SG413 and 24_SG414)
- East side of Building 324
- Inside Building 297
- Site 8 - East Storage Yard (Station ID 24_SG274)
- South side of Building 435 (Crash Crew Building)
- SWMU/AOC 145 (located in the west portion of Site 24)
- Tarmac area at east corner of Building 297 (Station IDs 24_SG374 and 24_SG375)
- Tarmac area south and southwest of Buildings 296 and 297

3.3.4 Soil Gas Depth Trends

Concentrations of TCE in soil gas were observed to generally increase with depth. Table 3-7 provides a comparison of TCE soil gas concentrations for

stations where samples were collected at multiple depths. Sample depths were 12 and 20 feet bgs (Round 1) or 15 and 27 or 30 feet bgs (Round 2). The concentration of the shallow sample was subtracted from the concentration of the deeper sample and tabulated in the last column of Table 3-7; these values were plotted on Figure 3-19 and contoured to evaluate TCE concentration depth trends. Positive numbers indicate increasing concentrations of TCE with depth.

In general, an increase in soil gas concentration with depth may suggest the following:

- o More permeable soils are near the surface.
- o Deeper samples (i.e. below the deepest sample collected) may yield higher soil gas concentrations.
- o The soil gas is from an older source that has subsequently migrated downward.
- o The presence of a deeper source to begin with (i.e. subgrade pits or leaky buried utility lines).

A decrease in soil gas concentration with depth may suggest:

- o The highest concentrations may be closer to the surface (i.e. above the shallowest sample).
- o More clays and silts are near the surface.
- o A source was released at the surface.

Areas that have differences of more than 10 ug/L-v of TCE between the shallow and deep samples are summarized below. The following areas exhibit increasing TCE concentrations with depth:

- Between Buildings 296 and 297
- The area between RI Site 9 and Building 435
- Two small areas within Building 297
- The southeast portion of Site 8
- The southwest half of Building 296

Two areas in or near Building 297 have concentrations of TCE in soil gas that decrease by more than 10 ug/L-v with depth. One area is near the east corner and the other is outside the south corner. Station ID 24_SG331 is the only other Station that exhibits a TCE decrease of more than 10 ug/L-v. TCE in soil gas is likely highest near the surface in these areas.

3.3.5 Soil Gas QA/QC

Onsite laboratory soil gas QA/QC is described in Section 2.0 and results are presented in the Target draft soil gas report (Target, 1994).

Soil gas field QA/QC included lot blanks, equipment blanks, and duplicates. Duplicates were collected once every 10 soil gas samples. One lot blank was collected from each lot of soil gas sample vials. Equipment blanks, which were collected at least at the beginning and end of each day, were used to ensure that the soil gas sampling equipment was properly purged between soil gas samples.

The total number of field QA/QC samples collected includes 6 lot blanks, 124 equipment blanks, and 73 duplicates. Compounds were detected in soil gas in zero lot blanks and four equipment blanks.

Table 3-8 summarizes all compounds detected in soil gas equipment blank samples. One equipment blank, collected at Station ID 24_SG174, contained most of the contamination detected. Compounds detected in soil gas for this sample, with concentration in parentheses, include 1,1-DCE (3.1 ug/L-v), PCE (2.3 ug/L-v), and TCE (17.7ug/L-v). TCE was also detected in two other equipment blanks at 1.2 and 1.3 ug/L-v. Total xylenes were detected in one equipment blank sample at 2 ug/L-v.

There was good general agreement between soil gas concentrations in the original samples and the duplicates. Sixty-seven of the 73 duplicates were within an order of magnitude difference of the duplicated original sample.

3.3.6 Soil Gas Performance Evaluation Sample Results

As stated in Subsection 2.4.2, the EPA provided three soil gas performance evaluation samples to the onsite laboratory for analysis. Table 3-9 provides a summary of soil gas performance evaluation (PE) sample concentrations and the corresponding concentrations detected by the onsite laboratory. The table includes onsite laboratory data for one or two GCs (left and right) and the average concentration (if both GCs were used). Also included are the differences between the EPA concentrations and the onsite laboratory concentrations.

EPA PE samples 1 and 2 included 12 analytes and PE sample 3 included 13 analytes. For PE samples 1 and 2, 9 of the 12 analytes were part of the investigation analyte list and for cylinder 3, 5 of the 13 analytes were on the investigation analyte list (Table 3-9).

In general, there were no significant differences between the EPA PE sample concentrations and the onsite laboratory concentrations. Of those analytes on the investigation analyte list, the onsite laboratory detected all nine analytes for PE sample 1, eight of nine analytes for PE sample 2, and all five analytes for

PE sample 3. The onsite laboratory was capable of detecting PE sample analytes at concentrations required for the screening level objectives of the soil gas survey.

3.3.7 Discussion of Soil Gas Results and Conclusions

This section summarizes VOC compounds that were detected at Site 24 during the soil gas investigation. Included are discussions of source areas for both halogenated hydrocarbons and for aromatic hydrocarbons and TPH.

TCE was detected in soil gas over a large area that includes Buildings 296, 297, 324, and 326. This area is considered the Main Soil Gas Source Area; six subareas have been identified within this area. Except for one area near the east corner of Building 297, concentrations of TCE in soil gas were generally observed to increase with depth. There are two areas where TCE was detected at concentrations greater than 1,000 ug/L-v:

- **The east corner of Building 297.** The northeast end of Building 297 is the site of former assembly and repair shops. The highest concentrations of 1,1-DCE in soil gas (greater than 40 ug/L-v) were also detected in this area. 1,2-DCE, which along with 1,1-DCE is a degradation product of TCE, was also detected in this area at concentrations greater than 5 ug/L-v. In addition, TPH and BTEX were detected in this area.

- **The south end of Building 296.** This is the former location of paint and dope shops and a degreaser. Although few TCE degradation products were detected here (e.g. 1,1-DCE and 1,2-DCE), the highest concentrations (greater than 40 ug/L-v) of Freon 113 were detected in this area.

In two other subareas within the Main Soil Gas Plume Area, TCE was detected in soil gas at concentrations above 500 ug/L-v:

- **Inside Building 297 (aircraft hangar).** TCE and PCE were detected in soil gas over the majority of the aircraft hangar. Carbon tetrachloride was detected in soil gas over the southeastern half of Building 297. 1,1-DCE was detected in soil gas in an area that begins in the central portion of the building and extends away from the building to the northwest. Total xylenes were also detected in the north-central portion of Building 297.

- **The area on the concrete tarmac south of Building 296.** Stains have been noted in this area on aerial photographs from 1965, 1970, and 1980 (Jacobs, 1992). Compounds detected in soil gas include TCE, PCE, carbon tetrachloride, Freon-113, and total xylenes.

The remaining two subareas in the Main Soil Gas Area are described below. Although these two areas had concentrations of TCE in soil gas greater than 5 ug/L-v, most of the subareas are less than 5 ug/L-v.

- **Around Buildings 324 and 326.** Building 324 is the former engine overhaul building which included cleaning tanks, a degreaser, a plating room, and a painting room. There are also two RFA sites between the two buildings: SWMU/AOC 283, a UST site and SWMU/AOC 95, a hazardous waste storage area (HWSA). Compounds detected in soil gas include TCE, PCE, Freon 113, ethylbenzene, and total xylenes.

- **Area in northeast portion of Building 296.** Former assembly and repair shops were located in the north corner of the building, which included a propeller shop, a paint/spray booth, stripping and

anodizing tanks, and plating tanks. Compounds detected in soil gas include TCE and 1,1-DCE.

There are 10 additional areas where TCE was the prominent compound detected in soil gas that are not within the Main Soil Gas Source Area:

- **At the east end of RI Site 8, the DRMO storage yard.** TCE and carbon tetrachloride were detected in soil gas.

- **The drainage channel southeast of Building 296.** TCE was detected in soil gas.

- **The south reach of the Agua Chinon Wash.** TCE; PCE; 1,1-DCE; c-1,2-DCE; t-1,2-DCE; TPH; toluene; and total xylenes were detected in soil gas.

- **Southwest of Site 8 at the southwest border of the Station.** TCE and PCE were detected in soil gas.

- **The north end of the motor pool (northeast of Building 800 near the south end of Site 24).** TCE was detected in soil gas.

- **Along the abandoned metal plating sewer lines west of Building 312.** TCE, PCE, Freon 113, and carbon tetrachloride were detected in soil gas.

- **Abandoned well number 4 located in the west portion of Site 24.** TCE was detected in soil gas.

- **Tarmac area northwest of Building 295.** TCE; 1,1-DCE; and total xylenes detected in soil gas.

- **East end of Building 359, adjacent to a former TCE degreaser.** TCE was detected in soil gas.

- **The area between RI Site 9 (Crash Crew Pit) and Building 435 (the Crash Crew Building).** TCE, 1,2-DCE, and total xylenes were detected in soil gas in this area.

Two other halogenated hydrocarbon source areas were identified:

- **Area northwest of Building 655.** The highest concentrations of PCE in soil gas (greater than 10 ug/L-v) were detected west of Building 655. Contamination may be related to a former surface drainage identified in a 1970 aerial photograph. The drainage ran southwestward from the concrete tarmac along the road just northwest of Building 655. 1,2-DCE, possibly a degradation product of PCE, was also detected in soil gas at this location.

- **Tarmac area southwest of Building 295.** 1,1-DCE was detected in soil gas at the tarmac area southwest of Building 295.

The highest concentrations of aromatic hydrocarbons and TPH were detected in two locations:

- **SWMUs/AOCs 175 and 176.** An OWS (SWMU/AOC 175) and UST (SWMU/AOC 176) are located in the eastern portion of Site 24. The highest concentrations of TPH, benzene, ethylbenzene, and total xylenes were detected in this area. No chlorinated VOCs were detected at this location.

- **SWMU/AOC 145.** Located in the western portion of Site 24, this UST location had elevated levels of TPH, toluene, ethylbenzene, and total xylenes. PCE was also detected at this location.

In addition to the two SWMU/AOC locations described above, aromatic hydrocarbons and TPH were the primary compounds detected in soil gas at three other areas:

- Tarmac area located south and southwest of Buildings 296 and 297
- Near the OWS system at Bee Canyon Wash
- South of Building 435

3.4 Soil Analytical Results

This subsection provides a summary of the analytical results for the soil samples collected during the soil gas survey. Included is a discussion of QA/QC sample results. A complete tabulation of the analytical results for soil samples is provided in Appendix D. A summary table of the compounds detected in the soil samples is included in the following subsections.

A total of 76 soil samples were collected during the Soil Gas Survey. This total includes 68 original samples and 8 duplicate samples. Sample collection and preservation methodologies are discussed in Subsection 2.2. The locations of the soil samples were determined by the results of the Round 1 soil gas survey; soil samples were generally collected at the locations of the highest observed soil gas concentrations. Sample analyses were performed by Quality Analytical Laboratory (QAL) located in Redding, California. The soil samples were analyzed for VOCs (CLP Methodology) only. Freon 113 was not included in the analyses.

3.4.1 Halogenated Hydrocarbons

Halogenated hydrocarbons were detected in 9 of the 76 soil samples collected. TCE and PCE were the only halogenated hydrocarbons detected in soil. A summary of TCE and PCE detected in soil is provided in Table 3-11. Figure 3-20 shows the locations where TCE and PCE were detected in soil samples. This figure also includes the compounds detected, concentrations,

and sample depths. Summaries of the TCE and PCE levels detected in soil samples are provided below.

TCE. TCE was detected in seven soil samples during the soil gas survey. Six of these samples were collected within or adjacent to the south corner of Building 296. The TCE concentrations in these six samples ranged from 11 J to 400 ug/kg. The highest TCE concentration (400 ug/kg) was detected in the bottom sample (28 feet bgs) of a boring located inside the south corner of Building 296 (Station ID 24_SG331).

TCE was detected in one sample collected within the northeast portion of Building 297 (located adjacent to Building 296). TCE was detected at a concentration of 81 J ug/kg in the top sample (12 feet bgs) at Station ID 24_SG335. TCE was not detected in the bottom sample (28 feet bgs) at this location.

PCE. PCE was detected at only one sample location during the soil gas survey. At Station ID 24_SG402, PCE was detected at concentrations of 8 J (12 feet bgs) and 120 J ug/kg (28 feet bgs). This boring is located near SWMU/AOC 145 (UST). Soil samples collected during the RFA at this location indicated low levels of PCE (i.e., 4 J ug/kg at 10 feet bgs) (Jacobs, 1993b).

3.4.2 Aromatic Hydrocarbons

Aromatic hydrocarbons (e.g., BTEX) were detected in 7 of the 76 soil samples collected. A summary of the aromatic hydrocarbons detected in soil is provided in Table 3-11. Figure 3-20 shows the locations where aromatic hydrocarbons were detected in soil samples during the soil gas survey. This figure also includes the compounds detected, concentrations, and sample depths.

Aromatic hydrocarbons were detected in soil at three general areas within Site 24. A brief summary of the BTEX concentrations detected in soil samples at these locations is provided below.

SWMUs/AOCs 175 and 176. The maximum BTEX concentrations were observed at Station ID 24_SG404 located adjacent to the northeast side of Building 672 in the central eastern portion of Site 24. Benzene (220 and 530 ug/kg), toluene (43 J and 210 J ug/kg), ethylbenzene (650 and 2,300 ug/kg), and total xylenes (2,300 and 10,000 ug/kg) were detected in the original and duplicate samples collected at 12 feet bgs in this boring; no soil samples below the 12-foot sample were collected. This boring is located near an OWS and UST that were investigated during the RFA (SWMU/AOC Nos. 175 and 176, respectively) and found to have elevated levels of petroleum hydrocarbons, including BTEX, in soil. No halogenated hydrocarbons were detected in the RFA or soil gas survey soil samples collected at this location.

SWMU/AOC 145. Toluene, ethylbenzene, and total xylenes were detected at Station ID 24_SG402 located adjacent to Building 529 in the western portion of Site 24. Toluene was detected at a concentration of 2 J ug/kg in the upper sample (12 feet bgs) only. Ethylbenzene and xylene (total) were detected at concentrations of 920 and 1,400 ug/kg, respectively, in the lower sample (28 feet bgs) only. Benzene was not detected at either depth. PCE was also detected in this boring (refer to Subsection 3.4.1). In the RFA, this location was found to have high levels of total petroleum hydrocarbons, including BTEX, and PCE in soil around the UST.

Inside Building 296. Toluene was the only petroleum hydrocarbon detected in soil samples collected from within Building 296. Toluene was detected at Station IDs 24_SG338 (located in the northeast portion of Building 296) and 24_SG326 (located in the south portion of Building 296). At Station ID 24_SG338, toluene was detected at concentrations of 150 (12 feet bgs) and 18 ug/kg (28 feet bgs). At Station ID 24_SG326, toluene was detected at a

concentration of 10 J ug/kg in the bottom sample (28 feet bgs); toluene was not detected in the duplicate sample at this depth.

3.4.3 Moisture Content

Moisture content was measured for all of the soil samples that were preserved with methanol. Moisture content was measured from an extra soil sample volume that was collected in a glass sample jar. For the 76 soil samples collected, the moisture content ranged from 3 to 24 percent, with an average of 13.6 percent. For soil samples with VOCs detected, the moisture content ranged from 12 to 22 percent.

3.4.4 Comparison of Soil Sample Preservation Methodologies

For soil samples collected during the Soil Gas Survey, the standard preservation method used was methanol preservation. This method was employed to reduce the loss of soil contaminants prior to sample analysis. The standard EPA method for preservation for cored soil samples consists of capping the sample sleeves. To evaluate the methanol preservation method, double soil volumes were collected for 11 samples. At these locations, one soil sample was prepared using methanol preservation and a second (duplicate) sample was prepared using the capped sleeve method. Table 3-11 lists the 11 sample pairs for which both preservation methods were used, along with the analytical results for the samples. In some cases, three samples are listed for a sample pairing because a duplicate sample for a preservation methodology was also collected with the original sample pair.

As shown in Table 3-11, 9 of the 11 sample pairs had at least one analytical parameter detected. A summary of the correlation of analytical results for the two preservation methods is provided below:

- For four of the sample pairs (Station IDs 24_SG326, 338 [12 and 28 feet bgs], and 402), petroleum hydrocarbons (benzene, toluene, ethylbenzene, and/or xylene) were detected at low concentrations in the capped sleeve samples, but were not detected in the methanol-preserved samples. The lower concentrations were not detected in the methanol-preserved samples due to higher detection limits associated with this sample preservation method (refer to Table 3-11).

- For one of the sample pairs (Station ID 24_SG404), elevated BTEX levels were detected in both samples. However, the concentrations were substantially greater in the methanol-preserved sample. Although limited to one sample pair, this result may indicate that less contaminant loss occurred with the methanol-preserved sample.

- Only one sample pair had chlorinated hydrocarbons detected. At Station ID 24_SG326, TCE was detected at 11 J ug/kg in the capped sleeve sample only. A detection limit of 12 ug/kg was reported for the methanol-preserved sample. The TCE concentrations present in the soil sample appear to have been too low to be detected due to the higher detection limits associated with the methanol preservation method.

- For four of the sample pairs, acetone was the only compound detected. Generally, acetone was detected at low concentrations in all of the capped samples (and in laboratory blanks as indicated by the "B" qualifier flag) and was not detected in all of the methanol-preserved samples. Because acetone appeared in the laboratory blanks and the soil samples, variations in analytical results for the soil samples appear to be more a function of the laboratory conditions than sample preservation method.

In summary, various differences were observed in the comparison of results for the two types of soil sample preservation methods used in the Soil Gas Survey. It should be noted, however, that these differences observed are based on a relatively small number of comparison samples, and the trends could be significantly different if a greater number of samples were to be evaluated.

In general, for the sample with elevated contaminant concentrations detected, the methanol-preserved sample was observed to have higher concentrations than the capped sleeve sample. Also, due to higher detection limits associated with the methanol preservation method, low contaminant concentrations reported for the capped sleeve samples were not reported for the methanol-preserved samples.

3.4.5 Soil QA/QC

Field duplicates, equipment rinsate blanks, field/trip blanks, and laboratory QC samples (MS/MSDs) for soil samples were collected during the Soil Gas Survey to assess QC. QC samples were collected in accordance with the frequency specified in the *Soil Gas Survey Work Plan* (Jacobs, 1994a) (refer to Subsections 2.3 and 2.4 of this report). The results for the equipment rinsate blanks and trip/field blanks are discussed below. Laboratory blanks prepared and analyzed by the laboratory are also discussed in this subsection. The results of the field duplicate samples are included with the soil sampling results presented in Subsections 3.4.1 and 3.4.2.

Field Duplicate Samples. Field duplicates were collected and analyzed on a minimum of 10 percent of the soil samples. A total of seven duplicate soil samples were collected during the field investigation. In addition, duplicate samples were collected to compare the sample preservation methods used for soil samples. The results of these duplicate samples are discussed in Subsection 3.4.4.

Equipment Blank Samples. Equipment blank (rinsate) samples were collected on a minimum of 5 percent of the number of soil samples collected. A total of seven equipment rinsate samples were collected as part of the soil sampling effort. No VOCs were detected above their respective detection limits.

Methanol Blank Samples (Field/Trip Blank Samples). A total of nine field/trip blank samples were collected as part of the soil sampling activities. As described in Section 2.0, the samples served as field samples and trip blank samples. A field/trip blank sample consisted of a glass sample jar filled with methanol in the field trailer that was exposed to field conditions during sampling (field sample). Upon completion of sampling, the sample was sealed and shipped along with the soil samples to the laboratory (trip blank sample).

Of the nine field/trip blank samples collected, VOCs were detected in only two samples. For Station ID 24_SG339, acetone was detected at 700 B ug/L and chloroform was detected at 49 JB ug/kg. Acetone and chloroform were also detected in the laboratory blank sample associated with this sample, as indicated by the "B" flag. Therefore, the acetone and chloroform reported are possibly attributable to contamination introduced in the laboratory and not to field or shipping conditions.

The second field/trip blank with VOCs detected was Station ID 24_SG373. Acetone was detected in this sample at a concentration of 530 ug/kg. Acetone was not reported in the laboratory blank sample associated with this sample.

Laboratory QC Samples (MS/MSDs). MS/MSD samples were collected on a minimum of 5 percent of the samples (including duplicates and blanks) to assess the precision and accuracy of the analytical procedures on varying soil conditions. MS/MSDs require an extra soil volume and were collected in the same manner as duplicate samples. The analytical results for these samples will be evaluated during data validation (the results of data validation were not available at the time this report was prepared).

Laboratory QC Samples (Laboratory Blanks). Laboratory blanks were prepared and analyzed by the laboratory for QC purposes. At a minimum, one laboratory blank was analyzed per 20 soil samples analyzed. A summary of the compounds detected in laboratory blanks, along with their associated soil samples, is shown in Table 3-10. Acetone, chloroform, and methylene chloride were detected in at least one laboratory blank (methylene chloride was not detected in soil samples and, therefore, does not appear in Table 3-10). These three compounds are common laboratory contaminants and the concentrations found in the soil samples can generally be attributed to contamination introduced during the sample analysis process. Although acetone was detected in the laboratory blanks at elevated concentrations (up to 530 ug/L), it was also found in soil samples at concentrations of up to 900 ug/kg.

In addition to the compounds reported in the laboratory blanks, the laboratory reported that carbon disulfide has been sporadically detected at low concentrations in some of the laboratory blanks. The laboratory has not identified the source of the compound. As shown in Table 3-10, carbon disulfide was reported in Sample ID S1457522 at a concentration of 8 J ug/kg. According to laboratory staff, this level of carbon disulfide is likely attributable to laboratory contamination and was not present in the soil sample.

3.4.6 Discussion of Soil Results and Conclusions

A total of 76 soil samples were collected during the Soil Gas Survey. These samples were analyzed for VOCs at a fixed offsite laboratory. After screening the sample results for field- or laboratory-introduced contamination (as indicated by the QC samples), detected VOCs were limited to two halogenated hydrocarbons (TCE and PCE) and BTEX.

TCE in soil samples was limited to the area within and around the southern corner of Building 296, and within the northeast portion of Building 297. Refurbishing operations conducted at the Station during the 1940s, which

included the use of solvents, were centered in these two buildings; no TCE was detected at the other primary building involved in the refurbishing operations (Building 324). With the exception of one low concentration of toluene in one sample collected within the southern portion of Building 296, no other VOCs, including PCE, were detected in the samples with TCE.

The highest BTEX concentrations were present in soil samples collected at two RFA SWMUs/AOCs. Soil samples collected during the RFA at these locations indicated the presence of elevated levels of aromatic hydrocarbons, and low levels of PCE at one of the locations (SWMU/AOC 145) (Jacobs, 1993b). The RFA recommended further investigation of the extent of subsurface contamination at these SWMUs/AOCs. The soil samples collected during the Soil Gas Survey confirmed the presence of petroleum hydrocarbons in subsurface soil at these SWMUs/AOCs; however, because the soil gas borings only reached a depth of 30 feet bgs, no additional information regarding the vertical extent of subsurface contamination at these locations was obtained.

3.5 Comparison of Soil Gas, Soil, and Groundwater Results

3.5.1 Comparison of Soil Gas and Soil Concentrations

This subsection presents a discussion of the comparison of VOCs detected in soil gas and soil. Soil gas concentration contour maps are presented and described in Subsections 3.3.1 and 3.3.2. The results of soil sampling are presented and discussed in Subsection 3.4.

A total of 777 soil gas samples were collected during the Soil Gas Survey. Seventy-six soil samples (approximately 10 percent of the number of soil gas samples) were collected at the soil gas sampling locations to assess VOC concentrations in soil. Soil samples were generally collected in the areas of highest concentrations detected in soil gas samples. A comparison of the soil gas and soil results is provided below.

TCE. The highest concentrations of TCE in soil gas and soil samples were detected at the south corner of Building 296 and within the northern portion of Building 297. TCE was also detected in soil gas at various other locations within Site 24, but was not detected in soil samples in these locations.

PCE. PCE was detected in 136 soil gas samples but only in one soil sample. The PCE in soil was detected in a boring located adjacent to a UST (SWMU/AOC 145) in the western portion of Site 24. PCE was also detected in soil gas at this location. The area of highest PCE concentrations in soil gas is at the north end of Building 635. No soil samples were collected in this area during the soil gas investigation. The possible sources of PCE in this area are a wash rack (SWMU/AOC 198) and a former drainage channel. Soil samples (2 and 5 feet bgs) were collected during the RFA at SWMU/AOC 198 and PCE was detected at low concentrations (1 J to 16 ug/kg) in eight of the nine samples (Jacobs, 1993b).

Other Halogenated Hydrocarbons. Various halogenated hydrocarbons in addition to TCE and PCE were detected in soil gas. In soil samples, however, TCE and PCE were the only halogenated hydrocarbons detected.

Aromatic Hydrocarbons. Aromatic hydrocarbons were detected at several locations in both soil gas and soil. The maximum aromatic hydrocarbon concentrations in both soil gas and soil were located at an OWS and UST (SWMUs/AOCs 175 and 176, respectively) located in the eastern portion of Site 24. No halogenated hydrocarbons were detected in this area. Elevated levels of aromatic hydrocarbons were also detected in both soil gas and soil at a UST (SWMU/AOC 145) located in the western portion of Site 24. The soil and soil gas results at both of these locations generally confirmed the elevated levels of aromatic hydrocarbons identified during the RFA (Jacobs, 1993b).

3.5.2 Comparison of Soil Gas and Groundwater Plumes

This subsection provides a comparison of TCE detected in soil gas and groundwater. Soil gas concentration contour maps were presented and described in Subsections 3.3.1 and 3.3.2. Groundwater at Site 24 was investigated during the Phase I RI and during a subsequent round of groundwater sampling. Recent groundwater concentration contour maps were created in the Draft OU-1 (groundwater operable unit) RI Report (Jacobs, 1994g).

TCE. Figure 3-21 includes the extent of TCE detected in soil gas and shallow groundwater during the second round of groundwater sampling (June 1993 to December 1993). The concentration contour lines on the figure are labelled. Concentrations within a polygon are greater than the outer line and less than the inner line. TCE soil gas concentration contours are 1, 5, 50, and 500 ug/L-v of soil gas. TCE groundwater concentration contours are 0.5, 5, 50, and 500 ug/L-v of water.

Note that TCE was detected in soil gas above 50 ug/L-v in five locations:

- The Main Soil Gas Source Area in and around Buildings 296, 297, and 324
- The south reach of the Agua Chinon Wash
- The east end of RI Site 8
- At Station ID 24_SG245 (drainage channel southeast of Building 296 near the southeast portion of Site 24)
- Southwest of RI Site 8 at the southwest border of the Station

Groundwater generally flows to the northwest in the southwest quadrant of the Station. Note that all of these areas of high TCE soil gas concentrations are just upgradient or within the areas of highest TCE concentrations in groundwater (TCE greater than 50 ug/L-v). The four TCE source areas identified in the soil gas investigation are potential contributors to groundwater contamination.

PCE. Figure 3-22 includes the extent of PCE detected in soil gas and in groundwater during the second round of groundwater sampling. PCE soil gas concentration contours are 1, 5, and 50 ug/L-v of air. TCE groundwater concentration contours are 0.5 and 5 ug/L-v of water.

The three largest areas of PCE detected in soil gas are:

- In and around Building 297
- Around and north of Building 655
- South of Building 296 and including portions of Buildings 324 and 326

These three areas of high PCE concentrations in soil gas are within or upgradient of the areas of detectable concentrations of PCE in groundwater. The highest PCE concentrations in groundwater (greater than 5 ug/L-v) are located around RI Site 9 (north end of Site 24) and around RI Site 8 (south end of Site 24). The three areas of highest PCE soil gas concentrations are upgradient of RI Site 9 but not upgradient of RI Site 8. Hence, a source area of PCE contamination in soil gas was not identified for the PCE contamination in groundwater at RI Site 8.

Carbon Tetrachloride. Figure 3-23 includes the extent of carbon tetrachloride detected in soil gas and groundwater during the second round of groundwater sampling (June to December 1993). During the second round of groundwater sampling, carbon tetratchloride was detected in groundwater across the south half of Site 24 and around RI Site 9 (Jacobs, 1994g). Carbon tetrachloride was

detected in soil gas around Building 297, south of Building 296, and at the southeast end of RI Site 8; these three areas are upgradient of groundwater contamination and are potential shallow vadose zone sources of groundwater contamination.

Other Hydrocarbons. During the second round of groundwater monitoring, 1,1-DCE was detected in two wells at RI Site 8 (DRMO Storage Yard) and one well at RI Site 22 (Tactical Air Fuel Dispensing System [TAFDS]) at concentrations below 5 ug/L-v. Most of the 1,1-DCE detected in soil gas is in and around Building 297. Building 297 is upgradient, and a possible shallow vadose zone source, of 1,1-DCE detected in groundwater at RI Site 22.

During the second round of groundwater monitoring, Freon 113 was detected in three wells in the southwest quadrant (09_DBMW45 at 30J ug/L-v, 18_PS2 at 10 J ug/L-v, and 21_DBMW56 at 3J ug/L-v. During the Phase I RI, Freon 113 was detected in 17 soil samples at RI Sites 7 (2 samples in well 07_DGMW91), 8 (11 samples), and 12 (1 sample). Freon 113 concentrations in RI soil samples ranged from 9 J to 200 J ug/L-v. Freon 113 detected in soil gas was centered around the southwest end of Building 296 which may be upgradient of the Freon 113 detected in groundwater.

1,2-DCE was not detected in groundwater at Site 24 during the second round of groundwater monitoring. The aromatic hydrocarbons (BTEX) were also not detected in groundwater during either groundwater sampling round.

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Table 3-1
Summary of Air Knife Test Results
MCAS El Toro Soil Gas Survey Technical Memorandum

Air Knife Test No.	Pressure			Oxygen			Soil Gas Concentrations			
	Effects?	Drilling Depth of 1st Effect (ft bgs)	If Effects, Maximum Vacuum (in water)	Effects?	If Effects, Did O2 re-equilibrate?	How Soon did O2 re-equilibrate? (hours or days)	Effects?	If Effects, Did Conc. re-equilibrate?	How Soon did Conc. re-equilibrate? (hours)	Compounds Detected
1	N	-	-	Y	NC	NC	N	-	-	none
2	Y	5	0.68	N	-	<1 hour	Y	Y	<1	PCE,TCE,F113
3	Y	2	2	Y	N	>4 days	N	-	-	11-DCE
4	Y	6.5	0.75	N	-	-	N	-	-	PCE,TCE

Notes:
Y Yes
N No
- Not applicable
NC Data not conclusive

Table 3-2
Air Knife Test Pressure Data
MCAS El Toro Soil Gas Survey Technical Memorandum

Agua Chinon Wash
Air Knife Test 1:
Location 308 (AK) and 276 (HA)
Begin Test: 17:50 AM 6/2/94

Elapsed Time (min)	Vacuum (inches of water) (a)	Depth (ft)
0	0	0
0.42	0	1
2.67	0	2
4.17	0	3
4.83	0	4
6.58	0	5
7.33	0	5.5
7.83	0	6
8.58	0	6.5
8.98	0	7

Near BLDG 236
Air Knife Test 2:
Location 241 (AK) and 200 (HA)
Begin Test: 14:50 6/1/94

Elapsed Time (min)	Vacuum (inches of water) (a)	Depth (ft)
0	0	0
1	0	1
2	0	3
5	0.03	3.5
5.33	0.05	4
9	0.05	5.5
10	0.1	6
10.67	0.25	6.3
11	0.55	6.8
11.1	0.68	7

Bee Canyon Wash
Air Knife Test 3a:
Location 139 (AK) and 37 (HA)
Begin Test: 11:00 6/2/94

Elapsed Time (min)	Vacuum (inches of water) (a)	Depth (ft)
0	0	0
1	0.1	2.5
1.25	0.25	3.25
1.75	0.1	3.5
2	0.05	3.5
2.75	0.75	4.5
3.25	1.5	5.5
3.5	2	6
4	1.5	6.25
4.25	1	6.5
4.5	0	7

Bee Canyon Wash
Air Knife Test 3b:
Location 34 (AK) and 37 (HA)
Begin Test: 11:12 6/2/94

Elapsed Time (min)	Vacuum (inches of water) (a)	Depth (ft)
0	0	0
0.5	0	0.4
1	0	0.5
2	0	1
2.75	0.5	2
3.25	0	2.5
3.3	0.25	3
3.5	0.15	3.5
4.25	0.15	4
4.5	0.5	4.5
4.75	0.75	5
5.25	1.25	5.5
5.75	1.5	6
6.25	1	6.5
7	0	6.5
7.05	2	6.75
7.15	1.75	6.8
7.5	0.25	7

Table 3-2
Air Knife Test Pressure Data
MCAS El Toro Soil Gas Survey Technical Memorandum

Near BLDG 635
Air Knife Test 4:
Probes 153 (AK) and 155 (HA)
Begin Test: 15:12:30 6/2/94

Elapsed Time (min)	Vacuum (inches of water) (a)	Depth (ft)
0	0	0
1.5	0	1
2.25	0	1
2.75	0	2
4	0	2.5
5.85	0	2.8
6.35	0	3
7.85	0	4
9.85	0	5
11.35	0	5.5
12.6	0.49	6.5
12.85	0.75	7

Notes:
AK Air Knife hole
HA Hand auger (proximal) hole
(a) The pressure returned to 0 almost immediately after the air knife stopped drilling.

Table 3-3
Soil Gas Concentrations and Percent Oxygen for Air Knife Tests
MCAS El Toro Soil Gas Survey Technical Memorandum

Station ID	Proximal or Distal	Dedicated or Temp.	Hand Auger or Air Knife	Sample Number S145G xxxx	Date	Clock Time	Time Elapsed after AK (hours)	Percent Oxygen	Soil Gas Concentrations (ug/L)			
									11DCE	PCE	TCE	F113
Air Knife Test Number 1												
276	Proximal	Temporary	Hand Auger	1276	6/2/94	17:47	-1.07	19.5				
276	Proximal	Temporary	Hand Auger	3001	6/2/94	17:48	-1.05	19.5				
276	Proximal	Temporary	Hand Auger	1576	6/2/94	19:35	0.73	8				
308	Proximal	Dedicated	Air Knife	3002	6/2/94	18:51	0.00	17.8				
308	Proximal	Dedicated	Air Knife	1808	6/2/94	18:52	0.02	17.8				
308	Proximal	Dedicated	Air Knife	3004	6/2/94	19:43	0.87	14.5				
308	Proximal	Dedicated	Air Knife	2001	6/2/94	19:44	0.88	14.5				
308	Proximal	Dedicated	Air Knife	2002	6/2/94	23:17	4.43	12.5				
308	Proximal	Dedicated	Air Knife	3005	6/2/94	23:18	4.45	12.5				
308	Proximal	Dedicated	Air Knife	2003	6/3/94	15:43	20.87	11				
308	Proximal	Dedicated	Air Knife	3006	6/3/94	15:44	20.88	11				
308	Proximal	Dedicated	Air Knife	2004	6/6/94	17:10	94.32	10				
308	Proximal	Dedicated	Air Knife	3007	6/6/94	17:11	94.33	10				
309	Distal	Dedicated	Hand Auger	3003	6/2/94	19:19	0.47	15				
309	Distal	Dedicated	Hand Auger	1809	6/2/94	19:20	0.48	15				
309	Distal	Dedicated	Hand Auger	3008	6/2/94	20:08	1.28	13				
309	Distal	Dedicated	Hand Auger	2005	6/2/94	20:09	1.30	13				
309	Distal	Dedicated	Hand Auger	2006	6/2/94	23:20	4.48	13.5				
309	Distal	Dedicated	Hand Auger	3009	6/2/94	23:21	4.50	13.5				
309	Distal	Dedicated	Hand Auger	3007	6/2/94	23:21	4.50	13.5				
309	Distal	Dedicated	Hand Auger	2007	6/3/94	15:48	20.95	12.8				
309	Distal	Dedicated	Hand Auger	3010	6/3/94	15:49	20.97	12.8				
309	Distal	Dedicated	Hand Auger	2008	6/6/94	17:15	94.40	10.8				
309	Distal	Dedicated	Hand Auger	3001	6/6/94	17:15	94.40	10.8				
309	Distal	Dedicated	Hand Auger	3011	6/6/94	17:16	94.41	10.8				

Table 3-3
Soil Gas Concentrations and Percent Oxygen for Air Knife Tests
MCAS El Toro Soil Gas Survey Technical Memorandum

Station ID	Proximal or Distal	Dedicated or Temp.	Hand Auger or Air Knife	Sample Number S145G xxxx	Date	Clock Time	Time Elapsed after AK (hours)	Percent Oxygen	Soil Gas Concentrations (ug/L)			
									11DCE	PCE	TCE	F113
Air Knife Test Number 2												
200	Proximal	Temporary	Hand Auger	1200	6/1/94	14:25	-2.61			2		2.5
200	Proximal	Temporary	Hand Auger	2041	6/1/94	15:15	-1.78	19.5		5	4.1	2.5
200	Proximal	Temporary	Hand Auger	1500	6/1/94	16:10	-0.86			3		3.8
214	Distal	Dedicated	Hand Auger	1214	6/1/94	14:30	-2.53			2.6		10.2
214	Distal	Dedicated	Hand Auger	2013	6/1/94	17:00	-0.03	19.2		2.4	3.9	10.3
214	Distal	Dedicated	Hand Auger	2014	6/1/94	20:05	3.05	19.5		2.7	4	10.6
214	Distal	Dedicated	Hand Auger	2015	6/2/94	14:08	21.10	19.9		5	3.5	4.2
214	Distal	Dedicated	Hand Auger	2016	6/4/94	16:40	71.64	19		2.6	1.5	9.7
241	Proximal	Dedicated	Air Knife	1241	6/1/94	15:50	-1.20			3.5		1.7
241	Proximal	Dedicated	Air Knife	2009	6/1/94	17:02	0.00	19.2		4.8		2.6
241	Proximal	Dedicated	Air Knife	2010	6/1/94	20:13	3.19	19.6		4.8		2.6
241	Proximal	Dedicated	Air Knife	2011	6/2/94	12:45	19.72	19.7		4.1		1.1
241	Proximal	Dedicated	Air Knife	2012	6/4/94	16:45	71.72	18.7		2.1		2.9

Table 3-3
Soil Gas Concentrations and Percent Oxygen for Air Knife Tests
MCAS El Toro Soil Gas Survey Technical Memorandum

Station ID	Proximal or Distal	Dedicated or Temp.	Hand Auger or Air Knife	Sample Number S145G xxxx	Date	Clock Time	Time Elapsed after AK (hours)	Percent Oxygen	Soil Gas Concentrations (ug/L)			
									11DCE	PCE	TCE	F113
Air Knife Test Number 3 - QA/QC Test												
34	Proximal	Temporary	Air Knife	1034	6/2/94	11:40	0.00	14				
34	Proximal	Temporary	Air Knife	1037	6/2/94	11:40	0.00	14				
37	Proximal	Temporary	Hand Auger	1037	6/2/94	10:10	-1.50	16.5	1.3			
98	Proximal	Temporary	Hand Auger	1098	6/2/94	10:15	-1.42	18				
98	Proximal	Temporary	Hand Auger	1398	6/2/94	10:25	-1.25	18				
139	Proximal	Dedicated	Air Knife	3102	6/2/94	9:00	-2.67					
139	Proximal	Dedicated	Air Knife	1139	6/2/94	12:20	0.66	14	2.5			
139	Proximal	Dedicated	Air Knife	2017	6/2/94	12:40	1.00	14				
139	Proximal	Dedicated	Air Knife	2018	6/2/94	16:51	5.18	14				
139	Proximal	Dedicated	Air Knife	2019	6/3/94	11:55	24.25	14.5	2.6			
139	Proximal	Dedicated	Air Knife	2020	6/6/94	16:40	101.00	15				
141	Distal	Dedicated	Hand Auger	1141	6/2/94	9:55	-1.75	17.5				
141	Distal	Dedicated	Hand Auger	2025	6/2/94	12:28	0.80	17.8				
141	Distal	Dedicated	Hand Auger	2026	6/2/94	17:01	5.35	17.5				
141	Distal	Dedicated	Hand Auger	2027	6/3/94	11:58	24.30	17				
141	Distal	Dedicated	Hand Auger	2028	6/6/94	16:45	101.08	18				
143	Distal	Temporary	Hand Auger	1143	6/2/94	10:53	-0.79	17				
143	Distal	Temporary	Hand Auger	1443	6/2/94	11:00	-0.67	17				

Table 3-3
Soil Gas Concentrations and Percent Oxygen for Air Knife Tests
MCAS El Toro Soil Gas Survey Technical Memorandum

Station ID	Proximal or Distal	Dedicated or Temp.	Hand Auger or Air Knife	Sample Number S145G xxxx	Date	Clock Time	Time Elapsed after AK (hours)	Percent Oxygen	Soil Gas Concentrations (ug/L)			
									11DCE	PCE	TCE	F113
Air Knife Test Number 4												
153	Proximal	Dedicated	Air Knife	1153	6/2/94	15:05	0.00	13.9		5		
153	Proximal	Dedicated	Air Knife	2033	6/2/94	16:45	1.67	13.5		5.2		
153	Proximal	Dedicated	Air Knife	3106	6/3/94	10:00	18.92	17.8				
153	Proximal	Dedicated	Air Knife	2034	6/3/94	10:05	19.00	17.8		5.9		
153	Proximal	Dedicated	Air Knife	2039	6/3/94	15:33	24.47	12.5			2.1	
153	Proximal	Dedicated	Air Knife	2036	6/6/94	17:00	97.92	11		4.9	1	
154	Distal	Dedicated	Hand Auger	1154	6/2/94	14:05	-1.00	0.5				
154	Distal	Dedicated	Hand Auger	2037	6/2/94	16:07	1.04	0.5				
154	Distal	Dedicated	Hand Auger	2038	6/3/94	10:10	19.09					
154	Distal	Dedicated	Hand Auger	2035	6/3/94	15:27	24.37	1		5.8	1.3	
154	Distal	Dedicated	Hand Auger	2040	6/6/94	17:05	98.00	0.5				
155	Proximal	Temporary	Hand Auger	1155	6/2/94	14:22	-0.71	14		4.6		
155	Proximal	Temporary	Hand Auger	1455	6/2/94	16:25	1.34			5.1		

Table 3-4
Possible Source Areas at Sites 24 and 25
MCAS El Toro Soil Gas Survey Technical Memorandum

Possible Source Area	Source Area Description (a)	Soil Gas Sampling Description
SITE 24 (POSSIBLE VOC SOURCE AREA)		
RI Site 7 (Drop Tank Storage Area)	Located north and east of Buildings 295 and 296. Received releases of JP-5 and applications of lubricants (for dust control). The site has five areas of concern: o Edge of pavement, north of Bldg 295, where drop tanks were drained and washed (fuel residuals drained onto adjacent unpaved area) o Former edge of pavement where drop tanks were drained (identified for no further action based on Phase I results) o Current edge of pavement, east of Bldgs. 295 and 296 o Drainage ditch, east of pavement (received drainage) o Open and (since 1991) partially paved area south of Bldg. 296	Collected soil gas samples at Current Edge of Pavement (north edge) (200-foot spacing), Current Edge of Pavement (east edge) (200-foot spacing), along Drainage Ditch (east of pavement), and in Open Space and Partially Paved Area south of Bldg. 296. No soil gas samples were collected at the Former Edge of Pavement.
Site 8 (Defense Reutilization and Marketing Organization [DRMO] Storage Yard)	Active storage area for containerized liquids of unknown origin and various scrap materials (e.g., mechanical and electrical components). The storage area is a fenced, unpaved lot located north of Bldg. 360. The site has two areas of concern, including the Old Salvage Yard (eastern portion) and the Current Storage Yard (western portion). The Old Salvage Yard has apparently been paved over and is currently an elevated, gravel-topped parking lot. In 1984, several gallons of PCB oil were spilled at the Current Storage Yard. Refuse piles and staining are evident at this site in aerial photographs taken since 1952.	Collected soil gas samples within the two storage yards (200-foot spacing).

Table 3-4
Possible Source Areas at Sites 24 and 25
MCAS El Toro Soil Gas Survey Technical Memorandum

Possible Source Area	Source Area Description (a)	Soil Gas Sampling Description
Site 9 (Crash Crew Pit No. 1)	Located in the northern portion of Site 24, east of Bldg. 306, this site consists of two pits (east and west), both formerly used during fire-fighting training. The pits are currently filled with dirt; the east pit is partly covered with aircraft matting. The west pit is estimated to have been about 150 feet long (east-west), 25-50 feet wide (north-south), and 3-4 feet deep. For training, the pit was filled with water and layered with JP-5 fuel, aviation gasoline, and other wastes, and then ignited. Operational information on the east pit is not available. From aerial photographs, the pit appears to measure about 90 feet (east-west) by 60 feet (north-south); its depth is uncertain.	Collected soil gas samples within each pit and surrounding the pits.
Site 10 (Petroleum Disposal Area)	Located south of Bldg. 435 and east of Bldg. 369, this site comprises an area of about 1,200 by 800 feet. From 1952-1970, waste crankcase oil, antifreeze, hydraulic and transmission fluids, motor oils, and solvents were applied to this area for dust control. Historical aerial photos indicate that nearly the entire area was discolored by heavy staining. Since 1970, the sprayed areas have been excavated (2-foot depth) and concreted, or built upon. The site is currently covered with Marsdon metal aircraft matting (north portion) and a concrete apron (south portion).	Collected soil gas samples within Aircraft Matting Area and Concrete Apron Area (200-foot spacing) and surrounding the edges of these areas (150-foot spacing).

Table 3-4
Possible Source Areas at Sites 24 and 25
MCAS El Toro Soil Gas Survey Technical Memorandum

Possible Source Area	Source Area Description (a)	Soil Gas Sampling Description
Site 11 (Transformer Storage Area)	Site consists of a 30-square-foot concrete pad located northeast of Bldg. 369, where approximately 50-75 transformers were stored (1968-1983). Reportedly, five transformers leaked and one spilled an estimated 60 gallons of PCB oil that may have leaked onto the concrete pad. In 1983, the transformers were removed and disposed of off-Station.	Collected soil gas samples at edge of storage pad pavement to detect oil that may have run off the concrete and seeped into soil.
Site 22 (Tactical Air Fuel Dispensing System [TAFDS])	Located both within and west of Site 10, this site has an undocumented history of fuel spills and leaks from routine operations. Aerial photographs (1965-1970) show that the TAFDS was originally located in the east part of Site 10, and was relocated to the west of Site 10 (aerial photos for 1980 and 1986). Several fuel bladder revetments (FBRs), each containing a fuel bladder, were located at the TAFDs. Heavy staining was reportedly observed at both TAFDS locations.	Collected soil gas samples at both the Western Area and Eastern Area (addressed by soil gas probes at Site 10)
RFA SWMU/AOC 76 (Oil/Water Separator [OWS])	100-gallon, steel walled tank (Tank 297B) located on east side of Bldg. 297. Installed in 1972 and is currently active; receives wastewater from Bldg. 297.	Collected soil gas samples at OWS.
RFA SWMU/AOC 84 (OWS)	Located south of Bldg. 298 and north of South Marine Way.	Collected soil gas samples along abandoned industrial sewer line (located across South Marine Way).
RFA SWMU/AOC 95 (Engine Test Cell)	Former test cell (Bldg. 324). RFA identified a potential former hazardous waste storage area (HWSA) near southeast corner of Bldg. 324.	Collected soil gas samples within the boundaries of the possible former HWSA.

Table 3-4
Possible Source Areas at Sites 24 and 25
MCAS El Toro Soil Gas Survey Technical Memorandum

Possible Source Area	Source Area Description (a)	Soil Gas Sampling Description
RFA SWMU/AOC 98 (Vehicle Wash Rack)	Located on southeast side of Bldg. 359.	Collected soil gas samples within wash rack boundaries.
RFA SWMU/AOC 99 (Drum Storage Area [DSA])	Former DSA located south of Bldg. 359.	Collected soil gas samples within estimated DSA boundaries.
RFA SWMU/AOC 100 (TCE Degreaser)	Former TCE degreaser located in south corner of Bldg. 359 (inside structure)	Collected soil gas samples adjacent to south wall of Bldg. 359.
RFA SWMU/AOC 101 (OWS)	OWS located near south side of Bldg. 359.	Addressed with soil gas investigation for SWMU/AOC 100.
RFA SWMU/AOC 303 Underground Storage Tank (UST)	UST located beneath concrete floor in Bldg. 359.	Collected soil gas samples immediately outside Bldg. 359 adjacent to UST.
RFA SWMU/AOC 110 (Vehicle Wash Rack)	Inactive 3,200-square foot concrete wash rack located at the northwest side of Bldg. 386. Drain leads to OWS 386-B.	Collected soil gas samples within wash rack area.
RFA SWMU/AOC 145 (UST)	Waste oil tank (Tank 529) located at northeast side of Bldg. 529. Installed 25,000-gallon concrete UST in 1944; currently active.	Collected soil gas samples adjacent to UST.
RFA SWMU/AOC 173 (OWS)	OWS located north of Site 8 and abandoned Well 29.	Collected soil gas samples adjacent to OWS.
RFA SWMU/AOCs 175, 176	USTs north of Building 672/OWS	Collected a soil and soil gas samples adjacent to UST and OWS.
RFA SWMU/AOC 188 (UST)	UST located along south reach of Agua Chinon Wash. UST collects waste oil from OWS associated with skimmer at wash.	Collected soil gas samples adjacent to UST.

Table 3-4
Possible Source Areas at Sites 24 and 25
MCAS El Toro Soil Gas Survey Technical Memorandum

Possible Source Area	Source Area Description (a)	Soil Gas Sampling Description
RFA SWMU/AOC 198 (Vehicle Wash Rack)	Concrete wash rack (15 feet by 60 feet) located adjacent to northeast side of Bldg. 655. Drains lead to an OWS (SWMU/AOC 199).	Collected soil gas samples within wash rack area.
RFA SWMU/AOC 199 (OWS)	Located west of the wash rack (SWMU/AOC 198) at the north end of Bldg. 655	Collected soil gas samples adjacent to OWS.
RFA SWMU/AOC 229 (HWSA)	Concrete HWSA (10 feet by 20 feet) located east of Bldg. 800, adjacent to the southeastern Station boundary fence. Wastes stored include waste oil, antifreeze, used batteries, hydraulic fluid, and waste grease.	Collected soil gas samples within HWSA area.
RFA SWMU/AOC 231 (UST)	Located adjacent to north side of Bldg. 800.	Collected soil gas samples adjacent to UST.
RFA SWMU/AOC 250 (UST)	Waste Oil UST located at eastern corner of Bldg. 655. Size, construction materials, and installation date are unknown.	Collected soil gas samples adjacent to UST.
RFA SWMU/AOC 283 (UST)	Steel JP-5 fuel tank located adjacent to Bldg. 326. Size and installation date are unknown.	Collected soil gas samples adjacent to UST.
Refurbishing Operations	During the 1940s, these operations were performed in the southwest quadrant, and were centered in Bldgs. 296, 297, and 324. Operations consisted of cleaning and plating activities that may have included solvents (types not known). Wastewater from these buildings was discharged to the abandoned industrial wastewater sewer lines (SWMU/AOC 265). According to former Station employees, these operations lasted only 3 to 6 months.	Collected soil gas samples in the vicinity of Building 296 and 297 (150-foot spacing), and Building 324 (100-foot spacing).

Table 3-4
Possible Source Areas at Sites 24 and 25
MCAS El Toro Soil Gas Survey Technical Memorandum

Possible Source Area	Source Area Description (a)	Soil Gas Sampling Description
Abandoned Industrial Sewer Lines (SWMU/AOC 265)	Vitrified clay sewer lines installed in about 1945 that received wastewater discharges from refurbishing operations described above (also received wastes from Bldgs. 359 and 312 [photo lab]). Wastes may have included solvents and metal plating wastes.	Collected soil gas samples along the industrial wastewater sewer lines (200-foot spacing)
Former Bldg. 1589	Vehicle maintenance facility located west of Sites 10 and 22. Past features included two 500-gallon aboveground tanks for mixing oil and solvents, a degreaser, and a waterwall curtain paint booth. Structure was joined with Bldg. 386 in 1977 to form current Bldg. 386.	Collected soil gas samples around Bldg. 386 (100-foot spacing)
Abandoned Water Wells (6)	Well No. 1 - Located 300 feet east of Site 10. Drilled 1943; no demolition information available. Well No. 2 - Located in northern portion of Site 10. Drilled 1943; demolished 1971. Well No. 3 - Located west of Site 10 at the south side of Bldg. 369. No construction or demolition information available. Well No. 4 - Located west of Bldg. 370 near west border of Site 24. No construction or demolition information available. Well No. 5 - Located about 250 feet west of Site 9. Drilled in 1944; demolished in 1963. Well No. 6 - Located in the western corner of Site 10. Drilled in 1944; no demolition information available.	Collected soil gas samples adjacent to each of the abandoned wells.

Table 3-4
Possible Source Areas at Sites 24 and 25
MCAS El Toro Soil Gas Survey Technical Memorandum

Possible Source Area	Source Area Description (a)	Soil Gas Sampling Description
SITE 25 (STATION WASHES)		
Agua Chinon Wash	This channel traverses the east-central portion of the Station, entering at Site 3/4 on the northeast edge. The wash is culverted across the entire Station, except for a short reach adjacent to Site 19. The unlined portion of the wash near the southwestern boundary of the Station is being realigned and lined with concrete. This portion of the wash, which passes along the south side of Site 24, is addressed in the soil gas survey.	o Ten soil gas probes located along the unlined portion (southern reach) adjacent to Site 24 (150-foot spacing)
Bee Canyon Wash	This channel traverses the west-central portion of the Station. It enters at a culvert from the north, and is culverted across the Station, re-emerging for about 100 yards at the southwest boundary of the Station. This unculverted portion of the wash, which passes along the west side of Site 24, is addressed in the soil gas survey.	o Ten soil gas probes located along the unlined portion (southern reach) adjacent to Site 24 (150-foot spacing)

Notes:

(a) Source of information is the Soil Gas Survey Work Plan (Jacobs, 1994a)
DSA - drum storage area
HWSA - hazardous waste storage area
UST - underground storage tank
OWS - oil/water separator
SWMU/AOC - solid waste management unit/area of concern

Table 3-5
Summary of VOC Analytes and Their Maximum Concentrations Detected in Soil Gas
MCAS El Toro Soil Gas Survey Technical Memorandum

Concentration in ug/L

Analyte	Number of Samples	Number of Times Detected	Number of Sampling Locations	Maximum Detected Concen.	Flag 1	Flag 2 [a]	Station ID with Maximum Detected Concen.	Sample Number	Sampling Depth (ft)
Tetrachloroethylene	777	136	465	103.4		FI	24_SG094	S145G1094	15
Trichloroethylene	777	285	465	2199.3		FI	24_SG375	S145G1675	15
CIS-1,2-Dichloroethylene	777	50	465	16			24_SG112	S145G1412	20
Trans-1,2-Dichloroethene	777	15	465	3.4			24_SG308	S145G3004	12
1,1-Dichloroethane	777	11	465	11.3			24_SG112	S145G1412	20
1,1-Dichloroethylene	777	148	465	175.4		FI	24_SG323	S145G1823	27
Vinyl Chloride	777	9	465	9.4		FI	24_SG472	S145G1772	15
1,1,1-Trichloroethane	777	18	465	8.6			24_SG318	S145G1618	15
1,1,2-Trichloroethane	777	2	465	3.3			24_SG112	S145G1412	20
TCTFA(FREON 113)	777	133	465	47.5	J	FI	24_SG185	S145G1485	20
Carbon Tetrachloride	777	63	465	4.8			24_SG172	S145G3114	20
	777	63	465	4.8			24_SG270	S145G3069	20
	777	63	465	4.8			24_SG172	S145G1472	20
Chloroform	777	23	465	7.5			24_SG012	S145G1312	20
Total Petroleum Hydrocarbons	777	34	465	12300		FI	24_SG404	S145G1704	15
Benzene	777	8	465	163		FI	24_SG474	S145G1774	15
Toluene	777	27	465	108		FI	24_SG206	S145G1206	15
Ethylbenzene	777	18	465	216		FI	24_SG404	S145G1704	15
Total Xylenes	777	47	465	565		FI	24_SG404	S145G1704	15

Key:
J estimated value
(a) FI - Flame Ionization Detector
No Flag - Electron Capture Detector

Table 3-6
Concentrations Detected in Soil Gas
MCAS El Toro Soil Gas Survey Technical Memorandum

Concentration in ug/L

(1) Key to Full Parameter names in Legend.

Station_ID	Depth	Sample_ID	PCE	TCE	C12DCE	T12DCE	11DCA	11DCE	VC	111TCA	112TCA	TCTFA	CT	CHCL3	TPH	Benzene	Toluene	Ethylbenzene	Total Xylenes
24_SG002	20	S145G1302			1.1	1.5													
24_SG008	12	S145G1008			1														
24_SG010	12	S145G1010			6.1	3.3													1.1
24_SG010	20	S145G1310			1.1		1.6												
24_SG011	20	S145G1311		9.5 FI															
24_SG012	20	S145G1312		10.7 FI										7.5					
24_SG015	12	S145G1015													53.4		3.6	2.7	2
24_SG015	20	S145G1315													115.2		9.2	5.7	6.5
24_SG018	20	S145G1318			1.1														
24_SG022	20	S145G1322			1.5														
24_SG027	12	S145G1027			1.5	1													
24_SG032	12	S145G1032												1.9					
24_SG032	20	S145G1332												1.3					
24_SG033	20	S145G1333			1.3														
24_SG036	20	S145G1336			1														
24_SG037	12	S145G1037						1.3 FI							110		5.5		
24_SG042	12	S145G1042					1.5												
24_SG047	12	S145G1047		3.4				4.4 FI											
24_SG047	20	S145G3038						12.5											
24_SG048	20	S145G1348						15.1 FI											
24_SG049	12	S145G1049						54.4											
24_SG051	20	S145G1351										1.1 J							
24_SG053	20	S145G1353			2														
24_SG054	12	S145G1054			1.3														
24_SG054	20	S145G1354			1.4														
24_SG056	12	S145G1056			1.2														
24_SG057	12	S145G1057						3.5											
24_SG058	20	S145G1358											1						
24_SG061	20	S145G1361		5.5															
24_SG062	20	S145G1362	1.1												120			3	5
24_SG068	12	S145G1068												1.1					
24_SG068	20	S145G1368												1.1					
24_SG070	20	S145G1370					1.2												
24_SG071	12	S145G1071		3.3	3.1			1.1 FI											
24_SG071	20	S145G1371			2			6.1 FI											
24_SG072	12	S145G1072		42.6 FI	6			11.9 FI											
24_SG072	20	S145G1372		185 FI	9.9		1.6	50.7 FI						1		2			

Table 3-6
Concentrations Detected in Soil Gas
MCAS El Toro Soil Gas Survey Technical Memorandum

Concentration in ug/L

(1) Key to Full Parameter names in Legend.

Station_ID	Depth	Sample_ID	PCE	TCE	C12DCE	T12DCE	11DCA	11DCE	VC	111TCA	112TCA	TCTFA	CT	CHCL3	TPH	Benzene	Toluene	Ethylbenzene	Total Xylenes
24_SG073	12	S145G1073			1.2														
24_SG073	20	S145G1373		20.6 FI				25.6 FI											
24_SG074	12	S145G1074		2.5	1.6														
24_SG074	20	S145G1374		2.6				3.5 FI											
24_SG075	12	S145G1075		2.7															
24_SG075	20	S145G1375		1									1.1						
24_SG075	20	S145G3027											1.4						
24_SG076	12	S145G1076						1.4											
24_SG077	12	S145G1077		1.6															
24_SG077	20	S145G1377		1.3 FI															
24_SG082	12	S145G1082											2.3						
24_SG091	15	S145G1091	2.9																
24_SG092	15	S145G1092	3																
24_SG093	12	S145G1093	1.3																
24_SG094	15	S145G1094	103.4 FI																
24_SG095	15	S145G3141	2.4																
24_SG097	15	S145G1097						1.7											
24_SG099	20	S145G1399						6.9											
24_SG100	15	S145G1100		3.9				19 FI					1.3						
24_SG102	15	S145G1102	1.1	6.8 FI				3.6 FI											
24_SG103	12	S145G1103	1	5 FI				2.8 FI											
24_SG103	20	S145G1403	1.2	6.1 FI				3.8 FI											
24_SG104	12	S145G1104		2.4															
24_SG104	20	S145G1404		5.3				1.6 FI											
24_SG105	12	S145G1105		5.4				1.4 FI											
24_SG105	20	S145G1405	1.3	15 FI				4.8 FI						1.8					
24_SG106	12	S145G1106	2.8	91.2 FI	15			7.1 FI					1.9						
24_SG106	20	S145G1406		13.9 FI	4.3			2.7 FI											
24_SG107	12	S145G1107		12.3	1.5														
24_SG107	20	S145G1407	2.3	21.5 FI	1.4			1.6 FI											
24_SG108	12	S145G1108	2.6 FI	67 FI				4.5 FI						4.9					1.6
24_SG108	20	S145G1408	3.8 FI	113.8 FI				9.1 FI			1.3		1.3	6.7					
24_SG109	12	S145G1109	4.1	51.4 FI				3.7 FI					1.1						
24_SG109	20	S145G1409		5.8	2.1														
24_SG110	12	S145G1110	1	122.6 FI	6.6		2.6	10.7 FI											
24_SG110	20	S145G1410		18 FI	1.7			1 FI											
24_SG111	12	S145G1111	1.7	31.3 FI				1.4 FI						2.2					

Table 3-6
Concentrations Detected in Soil Gas
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Concentration in ug/L

(1) Key to Full Parameter names in Legend.

Station_ID	Depth	Sample_ID	PCE	TCE	C12DCE	T12DCE	11DCA	11DCE	VC	111TCA	112TCA	TCTFA	CT	CHCL3	TPH	Benzene	Toluene	Ethylbenzene	Total Xylenes
24_SG111	20	S145G1411	1.5 FI	49 FI				1.7 FI											
24_SG112	12	S145G1112	1.2	195.8 FI	6.4		5	13.6 FI		1.6									
24_SG112	20	S145G1412	3.9	610.2 FI	16		11.3	44.6 FI		2.1	3.3		1.7	2.1					
24_SG113	12	S145G1113	3	160.4 FI	5.5		3.7	15.5 FI					1.5						
24_SG113	20	S145G1413	3.6 FI	174 FI				22.9 FI					4.1						
24_SG113	20	S145G3108	3.6 FI	175.6 FI	1.4			22.9 FI					4.2						
24_SG114	12	S145G1114		3.4															
24_SG114	12	S145G3111		8.5															
24_SG114	20	S145G1414	3.6 FI	92.1 FI				6.1 FI					3.1						
24_SG115	12	S145G1115		20.4 FI				19.5 FI											
24_SG115	20	S145G1415		35.2 FI				26.6 FI					1.1						
24_SG116	12	S145G1116		4.2	2														
24_SG116	20	S145G1416	4.5	13 FI				1 FI					2.5						
24_SG117	12	S145G1117		3.8				2.1 FI											
24_SG117	20	S145G1417		9.1				7.4 FI											
24_SG118	12	S145G1118		1.5															
24_SG119	12	S145G1119		7.4															
24_SG119	20	S145G1419		8.4															
24_SG120	12	S145G1120		4.3															
24_SG120	20	S145G1420		8.3				8.1 FI											
24_SG120	20	S145G3018		10.6				10.7 FI											
24_SG121	12	S145G1121		5.6				1.1 FI											
24_SG121	20	S145G1421		4 FI				7.9 FI											
24_SG122	12	S145G1122		4.3															
24_SG122	20	S145G1422		8.6															
24_SG123	20	S145G1423		1.5				1.5 FI		1.1									
24_SG124	20	S145G1424		1.3															
24_SG125	20	S145G1425		2.5															
24_SG126	20	S145G1426		3.1															
24_SG127	12	S145G1127		2.5															
24_SG127	20	S145G1427		4.5															
24_SG128	12	S145G1128		7															
24_SG128	20	S145G1428		5.4 FI															
24_SG129	12	S145G1129		9.5															
24_SG129	20	S145G1429		4.3 FI															
24_SG130	12	S145G1130		4.2															
24_SG130	20	S145G1430		9.4															

Table 3-6
Concentrations Detected in Soil Gas
MCAS El Toro Soil Gas Survey Technical Memorandum

Concentration in ug/L

(1) Key to Full Parameter names in Legend.

Station_ID	Depth	Sample_ID	PCE	TCE	C12DCE	T12DCE	11DCA	11DCE	VC	111TCA	112TCA	TCTFA	CT	CHCL3	TPH	Benzene	Toluene	Ethylbenzene	Total Xylenes
24_SG131	12	S145G1131		7.8 FI															
24_SG131	20	S145G1431		12.5 FI															
24_SG131	20	S145G3034		14.4 FI															
24_SG139	12	S145G1139				1		2.5 FI	5.2						160		7.9		2.2
24_SG139	12	S145G2017															1.7		
24_SG139	12	S145G2018															2.7		
24_SG139	12	S145G2019						2.6											
24_SG139	12	S145G2020													10.2		3.6		
24_SG143	12	S145G1143																	5.9
24_SG151	15	S145G1151	1.8 FI																
24_SG153	12	S145G1153	5 FI														4.3		
24_SG153	12	S145G2033	5.2 FI																
24_SG153	12	S145G2034	5.9 FI												18		2.6		
24_SG153	12	S145G2036	4.9	1													2.3		
24_SG153	12	S145G2039		2.1	2.4														
24_SG154	12	S145G2035	5.8 FI	1.3															
24_SG154	12	S145G2038			3.4														
24_SG155	12	S145G1155	4.6 FI																
24_SG155	20	S145G1455	5.1 FI																
24_SG156	15	S145G1156	1.1		2.7	1													
24_SG157	15	S145G1157						2.2 FI											
24_SG157	15	S145G3145						2.6 FI											
24_SG160	12	S145G1160	1.5	27.9 FI				10.6 FI											
24_SG160	20	S145G1460	2.2	63.9 FI			1.8	24.3 FI											
24_SG161	12	S145G1161	1.7 FI	37.7 FI				12.1 FI						3.9					
24_SG161	20	S145G1461	2 FI	45.8 FI				14.6 FI						4.1					
24_SG162	12	S145G1162		4.6															
24_SG162	20	S145G1462		1.8	1.1														
24_SG162	20	S145G3049		2.4	1.3														
24_SG163	12	S145G1163	2.9 FI	73.6 FI				5 FI						5.7					
24_SG163	20	S145G1463	2.4 FI	68.1 FI				4.4 FI											
24_SG166	12	S145G1166		5.7															
24_SG166	20	S145G1466		7.6 FI				1.1 FI											
24_SG167	12	S145G1167		3.2															
24_SG167	20	S145G1467		1.2															
24_SG168	12	S145G1168	4.3	101.9 FI				3.1 FI		1.6			1.5						
24_SG168	20	S145G1468	4.6 FI	117.8 FI				3.8 FI		1.6			2.1						

Table 3-6
Concentrations Detected in Soil Gas
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Concentration in ug/L

(1) Key to Full Parameter names in Legend.

Station_ID	Depth	Sample_ID	PCE	TCE	C12DCE	T12DCE	11DCA	11DCE	VC	111TCA	112TCA	TCTFA	CT	CHCL3	TPH	Benzene	Toluene	Ethylbenzene	Total Xylenes
24_SG168	20	S145G3113	5.2 FI	127.1 FI				4 FI		1.7			2.3						
24_SG169	12	S145G1169	2.4 FI	47.9 FI				2.2 FI		1			1.5	3.2					
24_SG169	20	S145G1469	4.4 FI	96.4 FI				4.7 FI		1.5			3.8	4.8					
24_SG170	12	S145G1170		5.9 FI										1.3					
24_SG170	20	S145G1470	1.6 FI	21.1 FI				1.3 FI				1.1 J	3.6	1.3					
24_SG172	12	S145G1172	2.7 FI	29 FI								4.6 J	4	1.4					
24_SG172	20	S145G1472	3.6 FI	43.2 FI								6.2 J	4.8	1.8					
24_SG172	20	S145G3114	3.6 FI	43.7 FI								6.2 J	4.8	1.8					
24_SG173	20	S145G1473	3.3 FI	84.1 FI				2 FI					2.3						
24_SG174	12	S145G1174	2.1	39.6 FI	2.2								1.4						
24_SG174	20	S145G1474		12.3 FI															
24_SG174	20	S145G3043	1.2	19.5 FI															
24_SG175	12	S145G1175	2.1	24.4 FI				43.8 FI					2						
24_SG175	20	S145G1475	1.3	14.1 FI								1.1 J	1.1						
24_SG176	12	S145G1176		3.9								3.4 J							
24_SG176	20	S145G1476		4.9								4.5 J							
24_SG177	12	S145G1177	4.4	12.2 FI	2.6							1.2 J	2.6						
24_SG177	12	S145G3040	2.1 FI	16.5 FI	2.4							1.5 J	3.3						
24_SG177	20	S145G1477	1.9 FI	17.1 FI								1.5 J							
24_SG178	12	S145G1178		3.8								12.9 J							
24_SG178	20	S145G1478		1.7								4.5 J							
24_SG179	12	S145G1179		6.1 FI															
24_SG179	20	S145G1479		10.2 FI															
24_SG180	12	S145G1180		8.8						1.6		1.7 J							
24_SG180	12	S145G3022		9.9						1.9		2 J							
24_SG180	20	S145G1480		9.9						1.5		1.8 J							
24_SG182	12	S145G1182		4.6 FI															
24_SG182	20	S145G1482		15 FI															
24_SG183	12	S145G1183		37 FI					6.3			22 J							
24_SG183	20	S145G1483		48 FI					6.9			27.1 J							
24_SG184	12	S145G1184		128.8 FI								21.4 J							
24_SG184	20	S145G1484		152.3 FI								23.8 J							
24_SG185	12	S145G1185		33.8 FI								19.4 J							
24_SG185	20	S145G1485		87.8 FI				1.2 FI				47.5 J							
24_SG186	12	S145G1186		12.5 FI															
24_SG186	20	S145G1486		19.6 FI															
24_SG187	12	S145G1187		169.8 FI								26.9 J							

Table 3-6
Concentrations Detected in Soil Gas
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Concentration in ug/L

(1) Key to Full Parameter names in Legend.

Station_ID	Depth	Sample_ID	PCE	TCE	C12DCE	T12DCE	11DCA	11DCE	VC	111TCA	112TCA	TCTFA	CT	CHCL3	TPH	Benzene	Toluene	Ethylbenzene	Total Xylenes
24_SG187	20	S145G1487		205.3 FI								30.8 J							
24_SG188	12	S145G1188		111.1 FI								8.7 J							
24_SG188	20	S145G1488		199.9 FI								15.8 J							
24_SG188	20	S145G3031		146.2 FI								11.4 J							
24_SG189	12	S145G1189		66.5 FI								2.3 J							
24_SG189	20	S145G1489		102.8 FI								3.6 J	1.2						
24_SG190	12	S145G1190										1.3 J							
24_SG190	12	S145G3025		17.8 FI								2.2 J							
24_SG190	20	S145G1490	1.3	257.8 FI				1.1				24.4 J	2.5						
24_SG191	12	S145G1191		90.1 FI								15.8 J	1						
24_SG191	20	S145G1491	1.3	179.6 FI				1.3 FI				32.7 J	2.1						
24_SG192	12	S145G1192												2.3					
24_SG195	15	S145G1195			1.3														
24_SG197	15	S145G1197	1																
24_SG199	15	S145G1199	1																
24_SG200	12	S145G1200	2 FI						2.2			2.5 J							
24_SG200	12	S145G2041	5	4.1								2.5 J							
24_SG200	20	S145G1500	3 FI									3.8 J							
24_SG203	12	S145G1203										1.4 J							
24_SG203	20	S145G1503						6.3 FI											
24_SG203	20	S145G3047										1.7 J							
24_SG206	15	S145G1206		2.1	14.2							4.9 J			990		108	2.9	10.6
24_SG207	12	S145G1207	1.2																
24_SG207	20	S145G1507	1.5 FI																
24_SG208	20	S145G1508	1.1	1.4															
24_SG209	12	S145G1209	1.4	17.4 FI								17.8 J							
24_SG209	20	S145G1509		19 FI								14.6 J							
24_SG210	12	S145G1210		13.3 FI								1.4 J							
24_SG210	20	S145G1510		24.4 FI								2.4 J							
24_SG210	20	S145G3129		18.9 FI								1.9 J							
24_SG211	12	S145G1211	1.1 FI	6.8 FI								2.2 J							
24_SG211	20	S145G1511	1.5 FI	15.4 FI								3.6 J							
24_SG212	20	S145G1512	3.6 FI	7.2								14.3 J							
24_SG213	12	S145G1213	1 FI	2.1								7.7 J							
24_SG214	12	S145G1214	2.6 FI									10.2 J							
24_SG214	12	S145G2013	2.4 FI	3.9								10.3 J							
24_SG214	12	S145G2014	2.7 FI	4								10.6 J							

Table 3-6
Concentrations Detected in Soil Gas
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Concentration in ug/L

(1) Key to Full Parameter names in Legend.

Station_ID	Depth	Sample_ID	PCE	TCE	C12DCE	T12DCE	11DCA	11DCE	VC	111TCA	112TCA	TCTFA	CT	CHCL3	TPH	Benzene	Toluene	Ethylbenzene	Total Xylenes
24_SG214	12	S145G2015	5	3.5								4.2 J							
24_SG214	12	S145G2016	2.6 FI	1.5 FI								9.7 J							
24_SG215	12	S145G1215	1					1.8 FI				4.3 J	1						
24_SG215	20	S145G1515	1.2					2.6 FI				5.8 J	1.5						
24_SG218	15	S145G3079						5.2											
24_SG219	20	S145G1519	1.8 FI	4.3								17.5 J	1.7						
24_SG226	15	S145G1226						15.6											
24_SG231	20	S145G1531										1.2 J							
24_SG234	20	S145G1534										1 J							
24_SG235	12	S145G1235										1.1 J							
24_SG236	12	S145G1236		1.5															
24_SG236	20	S145G1536		5.3								3 J							
24_SG237	12	S145G1237										1 J							
24_SG237	20	S145G1537		1.6								1.5 J							
24_SG238	12	S145G1238		2.5								1.1 J							
24_SG238	20	S145G1538		6.4								1.9 J							
24_SG239	12	S145G1239										1.8 J							
24_SG239	20	S145G1539		2.9								2.2 J							
24_SG240	12	S145G1240	1.6 FI									1.4 J							
24_SG240	20	S145G1540	1.8 FI	2.1								1.8 J							
24_SG241	12	S145G1241	3.5									1.7 J			35			3	13.4
24_SG241	12	S145G2009	4.8									2.6 J			33			1.1	5
24_SG241	12	S145G2010	4.8									2.6 J							1.8
24_SG241	12	S145G2011	4.1									1.1 J							
24_SG241	12	S145G2012	2.1 FI									2.9 J							
24_SG242	15	S145G1242						1.4 FI	8.7						17				
24_SG243	12	S145G1243	2.9 FI	2								3.9 J							
24_SG243	20	S145G1543	2.2 FI	2								2.6 J							
24_SG243	20	S145G3133	2.4 FI	2.1								2.6 J							
24_SG244	12	S145G1244	2.7 FI									2.6 J							
24_SG244	12	S145G3128	1.3 FI									1.4 J							
24_SG244	20	S145G1544	2.7 FI									3.2 J							
24_SG245	15	S145G1245		79.1 FI															
24_SG251	15	S145G1251		1.1															
24_SG252	15	S145G1252		1															
24_SG253	15	S145G1253		1															
24_SG254	15	S145G1254		1															

Table 3-6
Concentrations Detected in Soil Gas
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Concentration in ug/L

(1) Key to Full Parameter names in Legend.

Station_ID	Depth	Sample_ID	PCE	TCE	C12DCE	T12DCE	11DCA	11DCE	VC	111TCA	112TCA	TCTFA	CT	CHCL3	TPH	Benzene	Toluene	Ethylbenzene	Total Xylenes
24_SG258	15	S145G1258						45											
24_SG260	12	S145G1260										1 J							
24_SG262	20	S145G1562			1.1														
24_SG263	20	S145G1563			1.1														
24_SG265	15	S145G1265						10							10000	121	80	180	448
24_SG265	15	S145G3084													8900	112	71	157	375
24_SG267	12	S145G1267						1.9 FI											
24_SG268	20	S145G1568											1.1						
24_SG269	12	S145G1269						1.3 FI											
24_SG269	20	S145G1569						1.7 FI					1.2						
24_SG270	12	S145G1270											4.3						
24_SG270	20	S145G1570											4.4						
24_SG270	20	S145G3069		1.4				1.1 FI					4.8						
24_SG271	12	S145G1271											2.5						
24_SG271	20	S145G1571					1												
24_SG272	12	S145G1272		4.8															
24_SG272	20	S145G1572		3.8															
24_SG273	20	S145G1573	1	9.5 FI									4.7						
24_SG274	15	S145G1274																	4.2
24_SG274	15	S145G3088																1	4.6
24_SG276	20	S145G1576			1.7														
24_SG279	15	S145G3087		32 FI															
24_SG280	15	S145G1280		1.1															
24_SG292	12	S145G1292		1.8															
24_SG292	12	S145G3070		1.9															
24_SG292	20	S145G1592		3															
24_SG294	15	S145G1294	1	63 FI															
24_SG302	15	S145G1802		3.2															
24_SG308	12	S145G1808			1.1	1.8													
24_SG308	12	S145G2001			1	2.6													
24_SG308	12	S145G2002				1.6													
24_SG308	12	S145G2003				3											1.3		
24_SG308	12	S145G2004													14.3		6.1		
24_SG308	12	S145G3002				1.4													
24_SG308	12	S145G3004			1.1	3.4											1		
24_SG308	12	S145G3005				2													
24_SG308	12	S145G3006				3											1.7		

Table 3-6
Concentrations Detected in Soil Gas
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Station_ID	Depth	Sample_ID	PCE	TCE	C12DCE	T12DCE	11DCA	11DCE	VC	111TCA	112TCA	TCTFA	CT	CHCL3	TPH	Benzene	Toluene	Ethylbenzene	Total Xylenes
24_SG309	12	S145G1809			1	1													
24_SG311	15	S145G1611	1.6	53.1 FI															1.5
24_SG312	15	S145G1612						4.6							434		1.3		8
24_SG315	15	S145G1615	15 FI	345.1 FI				25.6 FI											
24_SG316	15	S145G1616	1.4	92.6 FI				4.4 FI											
24_SG316	15	S145G3504	1.7	115.1 FI				5.4 FI											
24_SG317	15	S145G1617	1.7	138.8 FI				4.2 FI											
24_SG317	15	S145G3163	2.5	216.4 FI				6.3 FI		1.2									
24_SG317	27	S145G1817	16.9 FI	385.1 FI				10.2 FI		1.5			1.4						
24_SG318	15	S145G1618	31.9 FI	636.9 FI				9.2 FI		8.6			2.5						
24_SG320	15	S145G1620		35.7 FI															
24_SG321	15	S145G1621		4.3				4.1 FI											1
24_SG322	15	S145G1622	13.6 FI	183.3 FI				1.6 FI				1.3 J	2.5						
24_SG323	15	S145G1623	2.7	102.6 FI				123.7 FI					3.5						
24_SG323	27	S145G1823	14.1 FI	152.4 FI				175.4 FI					4.5						
24_SG324	15	S145G1624		63.2 FI								3.2 J							
24_SG325	15	S145G1625		174.1 FI								4.4 J							
24_SG326	15	S145G1626		493.7 FI								5.6 J							
24_SG326	27	S145G1826		655 FI								7.8 J							
24_SG327	15	S145G1627		100.1 FI								8.3 J							
24_SG328	15	S145G1628		285.3 FI								7.3 J							
24_SG329	15	S145G1629		443.4 FI								6.9 J							
24_SG330	15	S145G1630		75.5 FI						1		17.8 J							
24_SG330	27	S145G1830		171.9 FI						1.7		37.9 J							
24_SG331	15	S145G1631		970.8 FI				2.5 FI				34.8 J							
24_SG331	27	S145G1831		96.9 FI				68.1 FI											
24_SG332	15	S145G1632		459.1 FI								9.4 J							
24_SG332	27	S145G1832		1550 FI				4 FI				42.3 J	2.1						
24_SG333	15	S145G1633		308.3 FI								16.6 J							
24_SG334	15	S145G1634	1.6	57 FI				3.7 FI											
24_SG335	15	S145G1635	22.9 FI	678.8 FI				25.5 FI					1.5						
24_SG335	27	S145G1835	16.8 FI	374.3 FI				21 FI											
24_SG336	15	S145G1636		6.1															
24_SG337	15	S145G1637		1.3															
24_SG338	15	S145G1638		1.8															
24_SG338	27	S145G1838						1 FI											
24_SG338	27	S145G3166		1.2				37											

Table 3-6
Concentrations Detected in Soil Gas
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Concentration in ug/L

(1) Key to Full Parameter names in Legend.

Station_ID	Depth	Sample_ID	PCE	TCE	C12DCE	T12DCE	11DCA	11DCE	VC	111TCA	112TCA	TCTFA	CT	CHCL3	TPH	Benzene	Toluene	Ethylbenzene	Total Xylenes
24_SG339	15	S145G1639		133.3 FI				54.8 FI											
24_SG339	22	S145G1839		240.8 FI				80.2 FI											
24_SG340	15	S145G1640		50.9 FI				29.6											
24_SG340	15	S145G3160	1	100 FI				23.1 FI											
24_SG341	15	S145G1641		65.5 FI				39.7 FI											
24_SG342	15	S145G1642		1.6															
24_SG343	15	S145G1643		1															
24_SG344	15	S145G1644	1.4	7.3								15.6 J	1.8						
24_SG345	15	S145G1645	1.1									18.9 J							
24_SG346	15	S145G1646		5.8								1.5 J	1						
24_SG347	15	S145G1647		4.2								1.4 J							
24_SG348	15	S145G1648		9.5								2.5 J							
24_SG349	15	S145G1649		72.3 FI								3 J							
24_SG350	15	S145G1650		5.4						3.3		2.4 J							
24_SG351	15	S145G1651		115.9 FI								1.6 J							
24_SG351	15	S145G3501		134.6 FI								1.8 J							
24_SG352	15	S145G1652		233 FI								2.8 J							
24_SG353	15	S145G1653		22.6 FI															
24_SG354	15	S145G1654	1.4	844 FI	6.6							26 J	1.9		20				3.3
24_SG355	15	S145G1655	2	531.2 FI				8.2 FI				9 J	2.8						
24_SG356	15	S145G1656						5.3 FI											
24_SG356	15	S145G3507						5 FI											1
24_SG357	15	S145G1657		130.2 FI								4.5 J	1						
24_SG360	15	S145G3169						2											
24_SG361	15	S145G1661																	2
24_SG363	15	S145G1663										2.8 J							
24_SG364	15	S145G1664										1.8 J							
24_SG366	15	S145G1666						11.2											1
24_SG367	15	S145G1667		1.3															2
24_SG367	30	S145G1867						18.9 FI											
24_SG368	15	S145G1668						1.7 FI											
24_SG370	15	S145G1670		43.4 FI				34.9 FI											
24_SG372	15	S145G1672						33.7 FI											
24_SG373	15	S145G1673		85.3 FI				22.6 FI				2 J			32				
24_SG373	27	S145G1873		117.1 FI				28.3 FI											
24_SG374	15	S145G1674		563.6 FI	5.7			66.6 FI				1.3 J			295				3.7
24_SG375	15	S145G1675		2199.3 FI			2	131.4 FI						1.2	640		3.2	4.2	6.8

Table 3-6
Concentrations Detected in Soil Gas
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Concentration in ug/L

(1) Key to Full Parameter names in Legend.

Station_ID	Depth	Sample_ID	PCE	TCE	C12DCE	T12DCE	11DCA	11DCE	VC	111TCA	112TCA	TCTFA	CT	CHCL3	TPH	Benzene	Toluene	Ethylbenzene	Total Xylenes
24_SG376	15	S145G1676		218 FI				67.8 FI											
24_SG377	15	S145G1677		50 FI				31.4 FI											
24_SG378	15	S145G1678		2.6				19.2 FI											
24_SG379	15	S145G1679		1.1															
24_SG380	15	S145G1680		3.1				1.7 FI											
24_SG381	15	S145G1681		1.6															
24_SG382	15	S145G1682		2.6				2.7 FI											
24_SG383	15	S145G1683	2.8	134.4 FI				47.1 FI											
24_SG383	15	S145G3097	11.7 FI	152 FI				52.8 FI											
24_SG385	15	S145G1685													120		6.2		4.6
24_SG386	15	S145G1686		1.4								7.1 J			81		3.4		2.3
24_SG387	15	S145G1687										7.7 J							
24_SG388	15	S145G1688		2								17 J							
24_SG389	15	S145G1689		58.9 FI								13.9 J							
24_SG390	15	S145G1690		76 FI								7.9 J							3.3
24_SG391	15	S145G1691	2.1	496.6 FI				15.4 FI				27.7 J	2.8						1
24_SG392	15	S145G1692													62		4.4		2.4
24_SG394	15	S145G1694										3.1 J							
24_SG395	15	S145G1695		32.1 FI								15.2 J							
24_SG396	15	S145G1696	2.2	94.4 FI				18.8 FI				15.9 J	1.1		29				1
24_SG397	15	S145G1697	1.7	7.5						1.3			1.1						3.1
24_SG399	15	S145G1699	2																
24_SG399	27	S145G1899	30.4 FI																
24_SG400	15	S145G1700		33.3 FI															
24_SG400	27	S145G1900		49 FI															
24_SG401	15	S145G1701	1.2																
24_SG402	15	S145G1702													350			3.3	2.4
24_SG402	27	S145G1902													575			12.3	7
24_SG404	15	S145G1704						20							12300	145	71	216	565
24_SG404	21	S145G1904						11							6600	68	30	113	286
24_SG405	15	S145G1705	9.4 FI	1.9								15.1 J							
24_SG405	27	S145G1905	2.5	1								6.2 J							
24_SG406	27	S145G1906						1.9 FI	8.2										
24_SG407	15	S145G1707		5															
24_SG407	30	S145G1907	1.2	61.4 FI				2.4 FI					1.2						
24_SG407	30	S145G3181	1	55.8 FI				2.2 FI					1.1						
24_SG408	15	S145G1708		1															

Table 3-6
Concentrations Detected in Soil Gas
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Station_ID	Depth	Sample_ID	PCE	TCE	C12DCE	T12DCE	11DCA	11DCE	VC	111TCA	112TCA	TCTFA	CT	CHCL3	TPH	Benzene	Toluene	Ethylbenzene	Total Xylenes
24_SG408	30	S145G1908		28.6 FI				3.3 FI					2.4						
24_SG409	15	S145G1709		2.7		1.3		1 FI	5.1										
24_SG412	15	S145G1712		2.8															
24_SG412	15	S145G3178		2.5															
24_SG412	30	S145G1912		4.4															
24_SG413	15	S145G1713		6.2															2
24_SG413	30	S145G1913		9.9															
24_SG414	30	S145G1914		3.3															2.1
24_SG416	30	S145G1916							5.4										
24_SG417	15	S145G1717		1															
24_SG418	16	S145G1718										3.5 J							
24_SG419	15	S145G1719		1.6								1.8 J							
24_SG421	15	S145G1721																	1.1
24_SG421	15	S145G3513																	1.3
24_SG422	15	S145G1722						3.1											1.2
24_SG423	15	S145G1723	2.5																
24_SG425	15	S145G1725		8															
24_SG431	15	S145G1731						2 FI											
24_SG432	15	S145G1732																	1
24_SG433	15	S145G1733		1.7															
24_SG436	15	S145G1736		1.8															
24_SG437	15	S145G1737		1.4															
24_SG439	15	S145G1739		1.1															
24_SG442	15	S145G1742										4.3 J							
24_SG443	15	S145G1743		59.6 FI											21.8				
24_SG444	15	S145G1744										12 J							
24_SG445	15	S145G1745	7 FI										2.2						
24_SG447	15	S145G1747										3.1 J							
24_SG447	15	S145G3519										3.1 J							
24_SG448	15	S145G1748						15.8							150	1.8	1	3.3	13
24_SG453	15	S145G1753	1.2																
24_SG453	15	S145G3184	1																
24_SG454	15	S145G1754	18.3 FI																
24_SG455	15	S145G1755	34.9 FI																
24_SG456	15	S145G1756						8.2 FI											
24_SG457	15	S145G1757						20.5 FI											
24_SG458	15	S145G1758	10.5 FI																

Table 3-6
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Concentration in ug/L

(1) Key to Full Parameter names in Legend.

Station_ID	Depth	Sample_ID	PCE	TCE	C12DCE	T12DCE	11DCA	11DCE	VC	111TCA	112TCA	TCTFA	CT	CHCL3	TPH	Benzene	Toluene	Ethylbenzene	Total Xylenes
24_SG459	15	S145G1759						46.1											
24_SG460	15	S145G1760						1.3 FI											
24_SG463	15	S145G1763						8.5											
24_SG466	15	S145G1766	1.8																
24_SG468	15	S145G1768	1.8									3.1 J			107				3
24_SG470	15	S145G1770		1.4								2.3 J							
24_SG470	15	S145G3510		1.6								2.6 J							
24_SG471	15	S145G1771	1.3	5.2				11.7 FI				10.3 J			85				
24_SG472	15	S145G1772						1.7 FI	9.4						725		1.1	22.6	24.5
24_SG474	15	S145G1774						19.2							10500	163		171	415
24_SG475	6	S145G1775						6.2 FI							207	2	1.3	3.9	10.5

(1) Legend:

111TCA - 1,1,1-Trichloroethane
112TCA - 1,1,2-Trichloroethane
11DCA - 1,1-Dichloroethane
11DCE - 1,1-Dichloroethylene
12DCP - 1,2-Dichloropropane
C12DCE - CIS-1,2-Dichloroethylene
CHCL3 - Chloroform
CT - Carbon Tetrachloride
MeCL2 - Methylene Chloride
PCE - Tetrachloroethylene
T12DCE - Trans-1,2-Dichloroethene
TCE - Trichloroethylene
TCTFA - TCTFA (Freon 113)
TPH - Total Petroleum Hydrocarbons
VC - Vinyl Chloride

J estimated value

(2) GC detector flag for TCE, PCE, and 1,1-DCE. FI is Flame Ionization Detector. No flag is Electron Capture Detector.

Table 3-7
Soil Gas TCE Concentration Depth Trends
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	Depth (ft.)		Concentration (ug/L)		Concentration Trend with Depth
Station_ID	Shallow	Deep	Shallow	Deep	(Deep-Shallow)
24_SG001	12	20	1 U	1 U	0
24_SG002	12	20	1 U	1 U	0
24_SG003	12	20	1 U	1 U	0
24_SG004	12	20	1 U	1 U	0
24_SG005	12	20	1 U	1 U	0
24_SG006	12	20	1 U	1 U	0
24_SG007	12	20	1 U	1 U	0
24_SG008	12	20	1 U	1 U	0
24_SG009	12	20	1 U	1 U	0
24_SG010	12	20	1 U	1 U	0
24_SG011	12	20	1 U	9.5	8.5
24_SG012	12	20	1 U	10.7	9.7
24_SG013	12	20	1 U	1 U	0
24_SG014	12	20	1 U	1 U	0
24_SG015	12	20	1 U	1 U	0
24_SG016	12	20	1 U	1 U	0
24_SG017	12	20	1 U	1 U	0
24_SG018	12	20	1 U	1 U	0
24_SG019	12	20	1 U	1 U	0
24_SG020	12	20	1 U	1 U	0
24_SG021	12	20	1 U	1 U	0
24_SG022	12	20	1 U	1 U	0
24_SG023	12	18	1 U	1 U	0
24_SG024	12	20	1 U	1 U	0
24_SG025	12	20	1 U	1 U	0
24_SG026	12	20	1 U	1 U	0
24_SG027	12	20	1 U	1 U	0
24_SG028	12	20	1 U	1 U	0
24_SG030	12	20	1 U	1 U	0
24_SG031	12	20	1 U	1 U	0
24_SG032	12	20	1 U	1 U	0
24_SG033	12	20	1 U	1 U	0
24_SG035	12	20	1 U	1 U	0
24_SG036	12	20	1 U	1 U	0
24_SG038	12	20	1 U	1 U	0
24_SG039	12	20	1 U	1 U	0
24_SG040	12	20	1 U	1 U	0
24_SG041	12	20	1 U	1 U	0
24_SG042	12	20	1 U	1 U	0
24_SG043	12	20	1 U	1 U	0
24_SG044	12	20	1 U	1 U	0
24_SG045	12	20	1 U	1 U	0
24_SG046	12	20	1 U	1 U	0
24_SG047	12	20	3.4	1 U	-2.4
24_SG048	12	20	1 U	1 U	0

Table 3-7
Soil Gas TCE Concentration Depth Trends
MCAS El Toro Soil Gas Survey Technical Memorandum

	Depth (ft.)		Concentration (ug/L)		Concentration Trend with Depth (Deep-Shallow)
Station_ID	Shallow	Deep	Shallow	Deep	
24_SG049	12	20	1 U	1 U	0
24_SG050	12	20	1 U	1 U	0
24_SG051	12	20	1 U	1 U	0
24_SG052	12	20	1 U	1 U	0
24_SG053	12	20	1 U	1 U	0
24_SG054	12	20	1 U	1 U	0
24_SG055	12	20	1 U	1 U	0
24_SG056	12	18	1 U	1 U	0
24_SG057	12	20	1 U	1 U	0
24_SG058	12	20	1 U	1 U	0
24_SG061	12	20	1 U	5.5	4.5
24_SG062	12	20	1 U	1 U	0
24_SG068	12	20	1 U	1 U	0
24_SG069	12	20	1 U	1 U	0
24_SG070	12	20	1 U	1 U	0
24_SG071	12	20	3.3	1 U	-2.3
24_SG072	12	20	42.6	185	142.4
24_SG073	12	20	1 U	20.6	19.6
24_SG074	12	20	2.5	2.6	0.1
24_SG075	12	20	2.7	1	-1.7
24_SG077	12	20	1.6	1.3	-0.3
24_SG078	12	20	1 U	1 U	0
24_SG082	12	20	1 U	1 U	0
24_SG093	12	20	1 U	1 U	0
24_SG096	12	20	1 U	1 U	0
24_SG098	12	20	1 U	1 U	0
24_SG099	12	20	1 U	1 U	0
24_SG101	12	20	1 U	1 U	0
24_SG103	12	20	5	6.1	1.1
24_SG104	12	20	2.4	5.3	2.9
24_SG105	12	20	5.4	15	9.6
24_SG106	12	20	91.2	13.9	-77.3
24_SG107	12	20	12.3	21.5	9.2
24_SG108	12	20	67	113.8	46.8
24_SG109	12	20	51.4	5.8	-45.6
24_SG110	12	20	122.6	18	-104.6
24_SG111	12	20	31.3	49	17.7
24_SG112	12	20	195.8	610.2	414.4
24_SG113	12	20	160.4	175.6	15.2
24_SG114	12	20	8.5	92.1	83.6
24_SG115	12	20	20.4	35.2	14.8
24_SG116	12	20	4.2	13	8.8
24_SG117	12	20	3.8	9.1	5.3
24_SG118	12	20	1.5	1 U	-0.5
24_SG119	12	20	7.4	8.4	1

Table 3-7
Soil Gas TCE Concentration Depth Trends
MCAS El Toro Soil Gas Survey Technical Memorandum

Station_ID	Depth (ft.)		Concentration (ug/L)		Concentration Trend with Depth (Deep-Shallow)
	Shallow	Deep	Shallow	Deep	
24_SG120	12	20	4.3	10.6	6.3
24_SG121	12	20	5.6	4	-1.6
24_SG122	12	20	4.3	8.6	4.3
24_SG123	12	20	1 U	1.5	0.5
24_SG124	12	20	1 U	1.3	0.3
24_SG125	12	20	1 U	2.5	1.5
24_SG126	12	20	1 U	3.1	2.1
24_SG127	12	20	2.5	4.5	2
24_SG128	12	20	7	5.4	-1.6
24_SG129	12	20	9.5	4.3	-5.2
24_SG130	12	20	4.2	9.4	5.2
24_SG131	12	20	7.8	14.4	6.6
24_SG132	12	20	1 U	1 U	0
24_SG134	12	20	1 U	1 U	0
24_SG136	12	20	1 U	1 U	0
24_SG143	12	20	1 U	1 U	0
24_SG155	12	20	1 U	1 U	0
24_SG160	12	20	27.9	63.9	36
24_SG161	12	20	37.7	45.8	8.1
24_SG162	12	20	4.6	2.4	-2.2
24_SG163	12	20	73.6	68.1	-5.5
24_SG166	12	20	5.7	7.6	1.9
24_SG167	12	20	3.2	1.2	-2
24_SG168	12	20	101.9	127.1	25.2
24_SG169	12	20	47.9	96.4	48.5
24_SG170	12	20	5.9	21.1	15.2
24_SG172	12	20	29	43.7	14.7
24_SG173	12	20	1 U	84.1	83.1
24_SG174	12	20	39.6	19.5	-20.1
24_SG175	12	20	24.4	14.1	-10.3
24_SG176	12	20	3.9	4.9	1
24_SG177	12	20	16.5	17.1	0.6
24_SG178	12	20	3.8	1.7	-2.1
24_SG179	12	20	6.1	10.2	4.1
24_SG180	12	20	9.9	9.9	0
24_SG181	12	20	1 U	1 U	0
24_SG182	12	20	4.6	15	10.4
24_SG183	12	20	37	48	11
24_SG184	12	20	128.8	152.3	23.5
24_SG185	12	20	33.8	87.8	54
24_SG186	12	20	12.5	19.6	7.1
24_SG187	12	20	169.8	205.3	35.5
24_SG188	12	20	111.1	199.9	88.8
24_SG189	12	20	66.5	102.8	36.3
24_SG190	12	20	17.8	257.8	240

Table 3-7
Soil Gas TCE Concentration Depth Trends
MCAS El Toro Soil Gas Survey Technical Memorandum

	Depth (ft.)		Concentration (ug/L)		Concentration Trend with Depth
Station_ID	Shallow	Deep	Shallow	Deep	(Deep-Shallow)
24_SG191	12	20	90.1	179.6	89.5
24_SG192	12	20	1 U	1 U	0
24_SG193	12	20	1 U	1 U	0
24_SG200	12	20	4.1	1 U	-3.1
24_SG203	12	20	1 U	1 U	0
24_SG207	12	20	1 U	1 U	0
24_SG208	12	20	1 U	1.4	0.4
24_SG209	12	20	17.4	19	1.6
24_SG210	12	20	13.3	24.4	11.1
24_SG211	12	20	6.8	15.4	8.6
24_SG215	12	20	1 U	1 U	0
24_SG216	12	20	1 U	1 U	0
24_SG219	15	20	1 U	4.3	3.3
24_SG231	12	20	1 U	1 U	0
24_SG232	12	20	1 U	1 U	0
24_SG233	12	20	1 U	1 U	0
24_SG234	12	20	1 U	1 U	0
24_SG235	12	20	1 U	1 U	0
24_SG236	12	20	1.5	5.3	3.8
24_SG237	12	20	1 U	1.6	0.6
24_SG238	12	20	2.5	6.4	3.9
24_SG239	12	20	1 U	2.9	1.9
24_SG240	12	20	1 U	2.1	1.1
24_SG243	12	20	2	2.1	0.1
24_SG244	12	20	1 U	1 U	0
24_SG257	12	20	1 U	1 U	0
24_SG260	12	20	1 U	1 U	0
24_SG262	12	20	1 U	1 U	0
24_SG263	12	20	1 U	1 U	0
24_SG267	12	20	1 U	1 U	0
24_SG268	12	20	1 U	1 U	0
24_SG269	12	20	1 U	1 U	0
24_SG270	12	20	1 U	1.4	0.4
24_SG271	12	20	1 U	1 U	0
24_SG272	12	20	4.8	3.8	-1
24_SG273	12	20	1 U	9.5	8.5
24_SG276	12	20	1 U	1 U	0
24_SG282	15	20	1 U	1 U	0
24_SG288	12	18	1 U	1 U	0
24_SG292	12	20	1.9	3	1.1
24_SG317	15	27	216.4	385.1	168.7
24_SG323	15	27	102.6	152.4	49.8
24_SG326	15	27	493.7	655	161.3
24_SG330	15	27	75.5	171.9	96.4
24_SG331	15	27	970.8	96.9	-873.9

Table 3-7
Soil Gas TCE Concentration Depth Trends
MCAS El Toro Soil Gas Survey Technical Memorandum

Station_ID	Depth (ft.)		Concentration (ug/L)		Concentration Trend with Depth (Deep-Shallow)
	Shallow	Deep	Shallow	Deep	
24_SG332	15	27	459.1	1550	1090.9
24_SG335	15	27	678.8	374.3	-304.5
24_SG338	15	27	1.8	1.2	-0.6
24_SG339	15	22	133.3	240.8	107.5
24_SG359	15	22	1 U	1 U	0
24_SG367	15	30	1.3	1 U	-0.3
24_SG373	15	27	85.3	117.1	31.8
24_SG393	15	27	1 U	1 U	0
24_SG398	15	27	1 U	1 U	0
24_SG399	15	27	1 U	1 U	0
24_SG400	15	27	33.3	49	15.7
24_SG401	15	27	1 U	1 U	0
24_SG402	15	27	1 U	1 U	0
24_SG403	15	27	1 U	1 U	0
24_SG404	15	21	1 U	1 U	0
24_SG405	15	27	1.9	1	-0.9
24_SG406	15	27	1 U	1 U	0
24_SG407	15	30	5	61.4	56.4
24_SG408	15	30	1	28.6	27.6
24_SG411	15	30	1 U	1 U	0
24_SG412	15	30	2.8	4.4	1.6
24_SG413	15	30	6.2	9.9	3.7
24_SG414	15	30	1 U	3.3	2.3
24_SG415	15	30	1 U	1 U	0
24_SG416	15	30	1 U	1 U	0

Key:
U nondetect, value is detection limit

Table 3-8
Concentrations Detected in Soil Gas Equipment Blank Samples
MCAS El Toro Soil Gas Survey Technical Memorandum

Concentration in ug/L

STA_ID	SMPL_ID	PCE	TCE	1,1DCE	Total Xylenes
24_EB025	S145G3144		1.3		
24_EB174	S145G3044	2.3	79.7 FI	3.1 FI	
24_EB187	S145G3033		1.2		
24_EB323	S145G3162			3.1	
24_EB448	S145G3173				2
BASE	S145G3164			1.5	

Legend:

1,1DCE - 1,1-Dichloroethylene
TCE - Trichloroethylene
PCE - Tetrachloroethylene
FI flame ionization detector flag; no flag indicates electron capture detector.

Table 3-9
Soil Gas Performance Evaluation Sample Data
MCAS El Toro Soil Gas Survey Technical Memorandum

Sample	Analyte	Study Analyte?	EPA Lab Value (ug/L-v)	Onsite Lab Concentration (ug/L-v)					EPA Minus Onsite Lab Value (ug/L)
				Left Machine		Right Machine			
				ECD	FID	ECD	FID	Average	
Cylinder 1	vinyl chloride	Y	11.15				52.48	52.48	-41.33
Cylinder 1	1,2-dichloropane	Y	20.15			29.11		29.11	-8.96
Cylinder 1	methylene chloride	Y	15.18			22.42		22.42	-7.24
Cylinder 1	toluene	Y	16.45				21.7	21.7	-5.25
Cylinder 1	benzene	Y	13.64				17.95	17.95	-4.31
Cylinder 1	tetrachloroethylene	Y	29.59			30.65		30.65	-1.06
Cylinder 1	chloroform	Y	21.3			21.16		21.16	0.14
Cylinder 1	trichloroethylene	Y	23.45			23.23		23.23	0.22
Cylinder 1	1,1-dichloroethane	Y	17.66			17.31		17.31	0.35
Cylinder 1	1,1,1-trichloroethylene	Y	NA			1.32		1.32	NA
Cylinder 1	1,3-butadiene	N	9.65					NA	NA
Cylinder 1	1,2-dibromoethane	N	33.53					NA	NA
Cylinder 1	chlorobenzene	N	20.09					NA	NA
Cylinder 2	vinyl chloride	Y	11.15		26		19.5	22.75	-11.60
Cylinder 2	benzene	Y	13.94		15.6		12.9	14.25	-0.31
Cylinder 2	toluene	Y	16.45		17.3		14.4	15.85	0.60
Cylinder 2	1,1-dichloroethane	Y	17.66	13.5		15.3		14.4	3.26
Cylinder 2	methylene chloride	Y	15.16	9.2		9.6		9.4	5.76
Cylinder 2	trichlroroethylene	Y	23.45	9.1	41.2	10.5	36	17.48	5.98
Cylinder 2	tetrachloroethylene	Y	29.69	5	60.4	5.3	63.4	18.93	10.77
Cylinder 2	chloroform	Y	21.30	9.6		11		10.3	11.00
Cylinder 2	1,2-dichlroropropane	Y	20.10					NA	NA
Cylinder 2	1,3-butadiene	N	9.65					NA	NA
Cylinder 2	1,2-dibromoethane	N	33.53					NA	NA
Cylinder 2	chlorobenzene	N	20.09					NA	NA
Cylinder 3	trans-1,2-dichloroethene	Y	17.3	20		34.2		27.1	-9.80
Cylinder 3	1,1-dichloroethene	Y	17.3	18.6		19.5		19.05	-1.75
Cylinder 3	cis-1,2 dichloroethene	Y	17.3	15.2		16		15.6	1.70
Cylinder 3	1,1,2-trichloroethane	Y	23.81	9.9		10.5		10.2	13.61
Cylinder 3	carbon tetrachloride	Y	27.45	9.1		8.5		8.8	18.65
Cylinder 3	methylene chloride	Y	NA	19.6		22.5		21.05	NA
Cylinder 3	total xylenes	Y	NA		2.4		2	2.2	NA
Cylinder 3	propylene	N	7.51					NA	NA
Cylinder 3	chloroethane	N	11.51					NA	NA
Cylinder 3	trichlorofluoromethane	N	11.51					NA	NA
Cylinder 3	n-pentane	N	12.88					NA	NA
Cylinder 3	3-chloro-1-propene	N	13.66					NA	NA
Cylinder 3	hexane	N	15.38					NA	NA
Cylinder 3	heptane	N	17.88					NA	NA
Cylinder 3	1,1,2,2-tetrachloroethane	N	29.95					NA	NA

Notes:

NA	Not applicable	ECD	Electron Capture Detector
Y	Yes	FID	Flame Ionization Detector
N	No	ug/L-v	micrograms per liter-volume

Table 3-10
Summary of VOC Analytes and Their Maximum Concentrations Detected in Soil
MCAS El Toro Soil Gas Survey Technical Memorandum

Concentrations in ug/kg

Analyte	Number of Samples	Number of Times Detected	Number of Sampling Locations	Maximum Detected Concentration	Flag[(a)]	Station_ID with Maximum Detected Concentration	Sample Number	Sampling Depth (feet)	
								Top	Bottom
Tetrachloroethylene	76	2	38	120	J	24_SG402	S1457523	28	29
Trichloroethylene	76	7	38	400		24_SG331	S1457501	28	29
Benzene	76	2	38	530		24_SG404	S1457404	12	13
Toluene	76	6	38	210	J	24_SG404	S1457404	12	13
Ethylbenzene	76	3	38	2,300		24_SG404	S1457404	12	13
Total Xylenes	76	3	38	10,000		24_SG404	S1457404	12	13
2-Butanone	76	1	38	3	J	24_SG338	S1457511	28	29
Acetone	76	6	38	900	B	24_SG406	S1457518	28	29
Carbon Disulfide	76	1	38	8	J	24_SG402	S1457522	12	13

Notes:
(a) J - estimated value
B - compound also detected in blank

Table 3-11
Concentrations Detected in Soil
MCAS El Toro Soil Gas Survey Technical Memorandum

SOIL SAMPLE RESULTS
(concentrations in ug/kg)

Station_ID	Depth (feet)	Sample_ID	PCE	TCE	Benzene	Toluene	Ethyl-benzene	Total Xylenes	2-Butanone	Acetone	Carbon Disulfide
24_SG326	28	S1457500		11 J		10 J					
24_SG331	12	S1457331		83 J							
24_SG331	12	S1457704		59 J							
24_SG331	28	S1457501		400							
24_SG332	12	S1457332		110 J							
24_SG335	12	S1457335		81 J							
24_SG338	12	S1457509				150					
24_SG338	28	S1457511				18			3 J		
24_SG352	12	S1457352		110 J							
24_SG398	12	S1457512								4 J	
24_SG402	12	S1457522	8 J			2 J					8 J
24_SG402	28	S1457523	120 J				920	1,400			
24_SG404	12	S1457404			530	210 J	2,300	10,000			
24_SG404	12	S1457515			220	43 J	650	2,300		54 J	
24_SG405	12	S1457516								58	
24_SG406	28	S1457518								900	
24_SG425	11	S1457557								15	
24_SG426	11	S1457561								6 J	

Notes:
J - estimated value
B - compound also detected in blank

TCE - trichloroethylene
PCE - tetrachloroethylene

Table 3-12
Comparison of Preservation Methods for Soil Samples
MCAS El Toro Soil Gas Survey Technical Memorandum

Concentrations in ug/kg

Station_ID	Depth (bgs)	Sample_ID	Preservation Method	PCE	TCE	Benzene	Toluene	Ethyl-benzene	Total Xylenes	2-Butanone	Acetone	Carbon Disulfide
24_SG326	28	S1457313	Methanol		12 U		12 U					
	28	S1457500	Capped		11 J		10 J					
24_SG338	12	S1457338	Methanol				490 U					
	12	S1457508	Methanol				520 U					
	12	S1457509	Capped				150					
24_SG338	28	S1457510	Methonol				810 U			810 U		
	28	S1457511	Capped				18			3 J		
24_SG373	28	S1457505	Methanol									
	28	S1457506	Capped									
	28	S1457705	Methanol									
24_SG390	11	S1457390	Methanol									
	11	S1457554	Capped									
24_SG398	12	S1457398	Methanol								1600 U	
	12	S1457512	Capped								4 J	
24_SG402	12	S1457402	Methanol	450 U			450 U					450 U
	12	S1457522	Capped	8 J			2 J					8 J
24_SG404	12	S1457404	Methanol			530	210 J	2,300	10,000		290 U	
	12	S1457515	Capped			220	43 J	650	2,300		54 J	
	12	S1457520	Capped			13 U	13 U	13 U	13 U		13 U	
24_SG405	12	S1457405	Methanol								480 U	
	12	S1457516	Capped								58	
	12	S1457710	Methanol								490 U	
24_SG425	11	S1457425	Methanol								440 U	
	11	S1457557	Capped								15	
24_SG426	11	S1457426	Methanol								440 U	
	11	S1457561	Capped								6 J	

Notes:

J - estimated value
U - not detected (detection limit concentration shown)
Capped - Sample was preserved in a stainless-steel sleeve with plastic endcaps.
Methanol - Sample was preserved in a 500-ml jar with methanol.

TCE - trichloroethylene
PCE - tetrachloroethylene

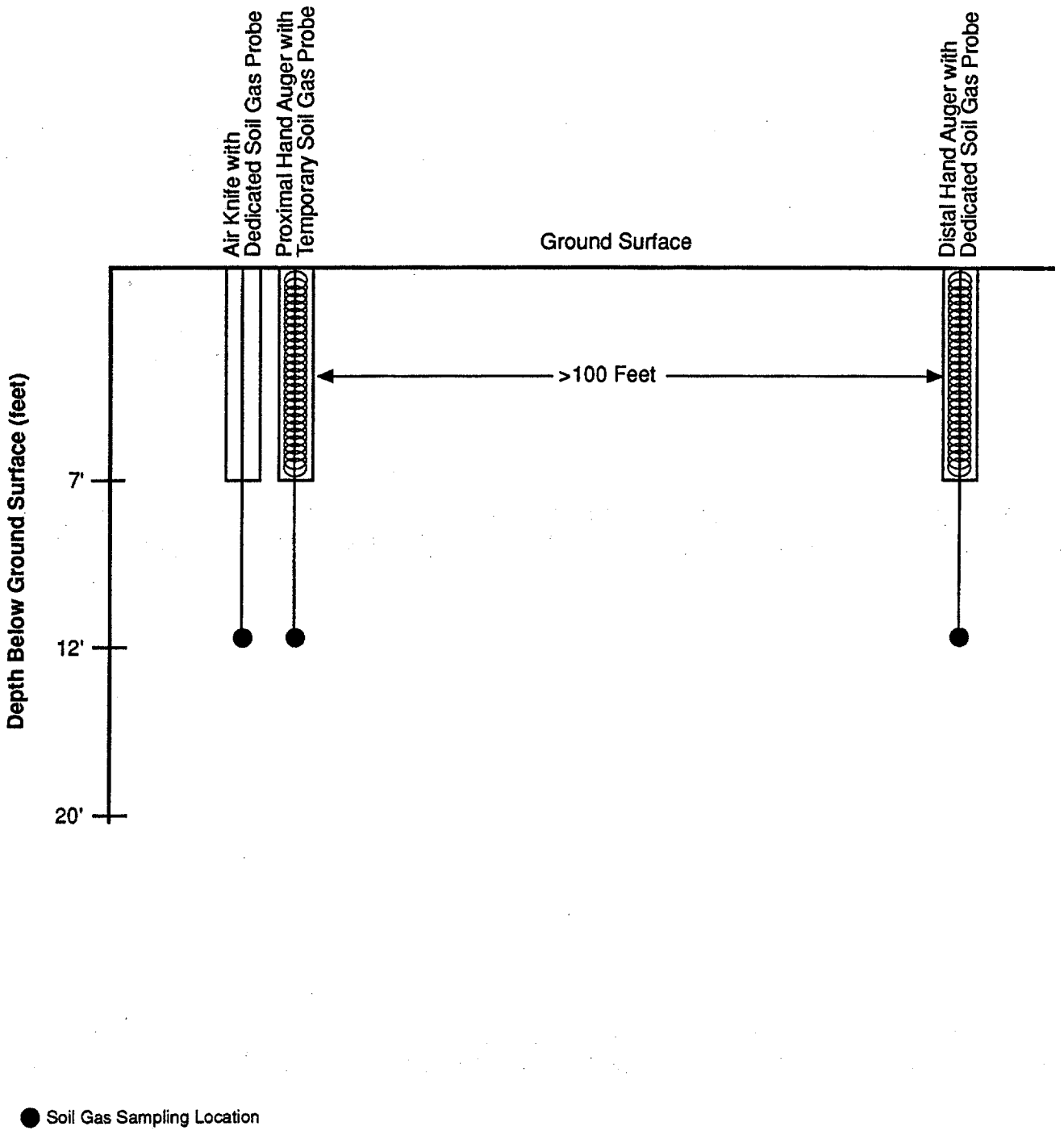

Figure 3-1
Test Configuration for Effects of Air Knife on 12 Foot Soil Gas Sample
MCAS El Toro Soil Gas Survey Technical Memorandum

Figure 3-2
Pressure and Drilling Depth vs. Time
Air Knife Test Number 2
MCAS El Toro Soil Gas Survey Technical Memorandum

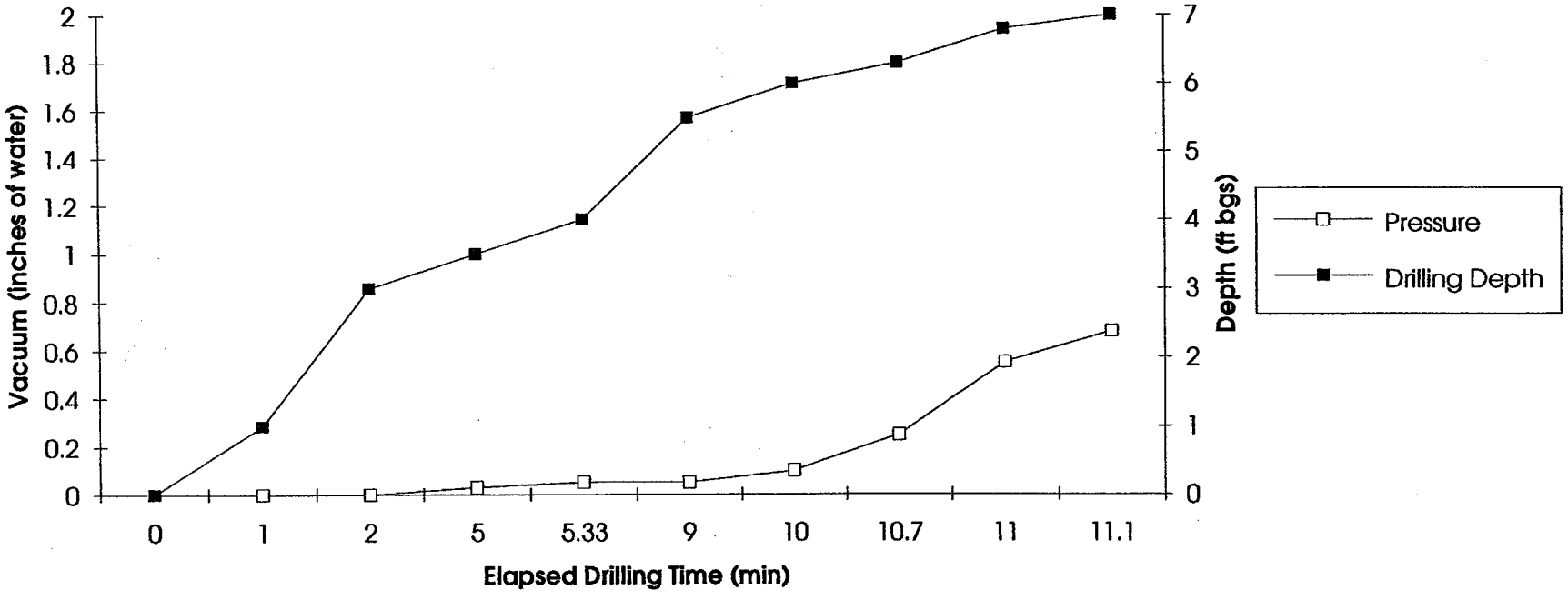

Figure 3-3
Percent Oxygen vs. Time
Air Knife Test Number 2
MCAS El Toro Soil Gas Survey Technical Memorandum

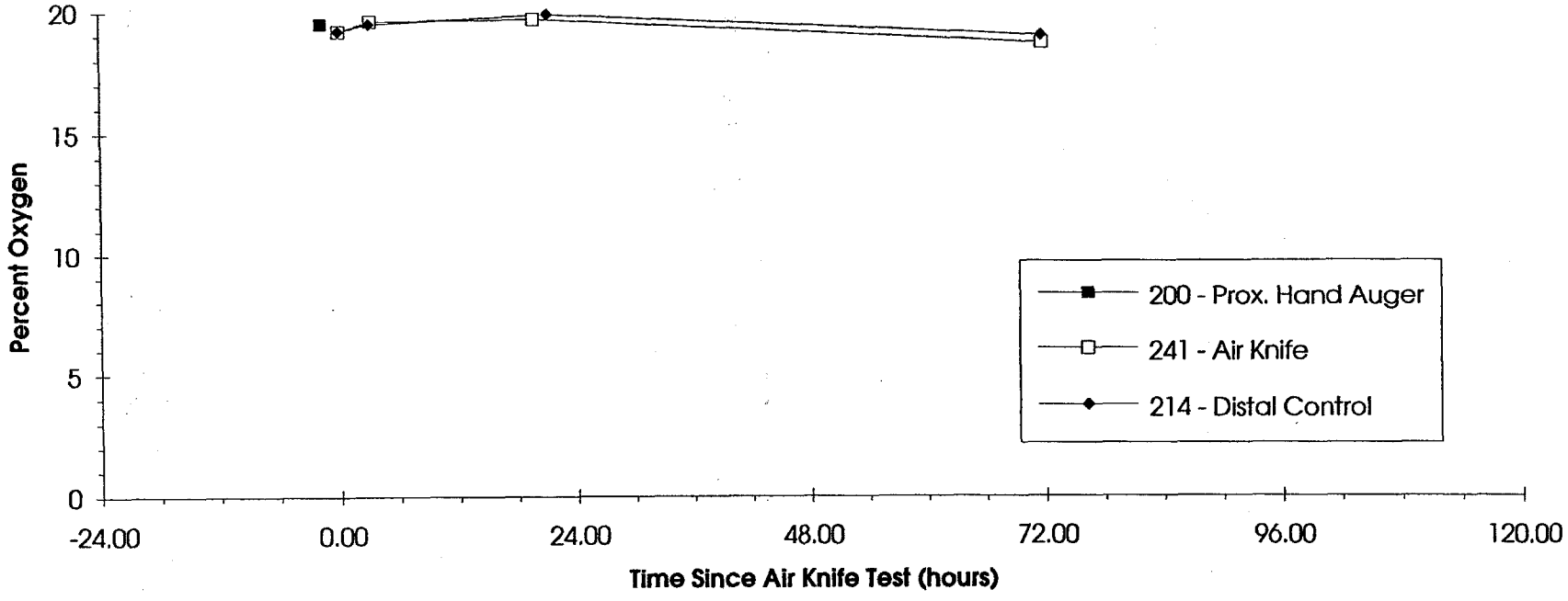

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Figure 3-4
Percent Oxygen vs. Time
Air Knife Test Number 3
MCAS El Toro Soil Gas Survey Technical Memorandum

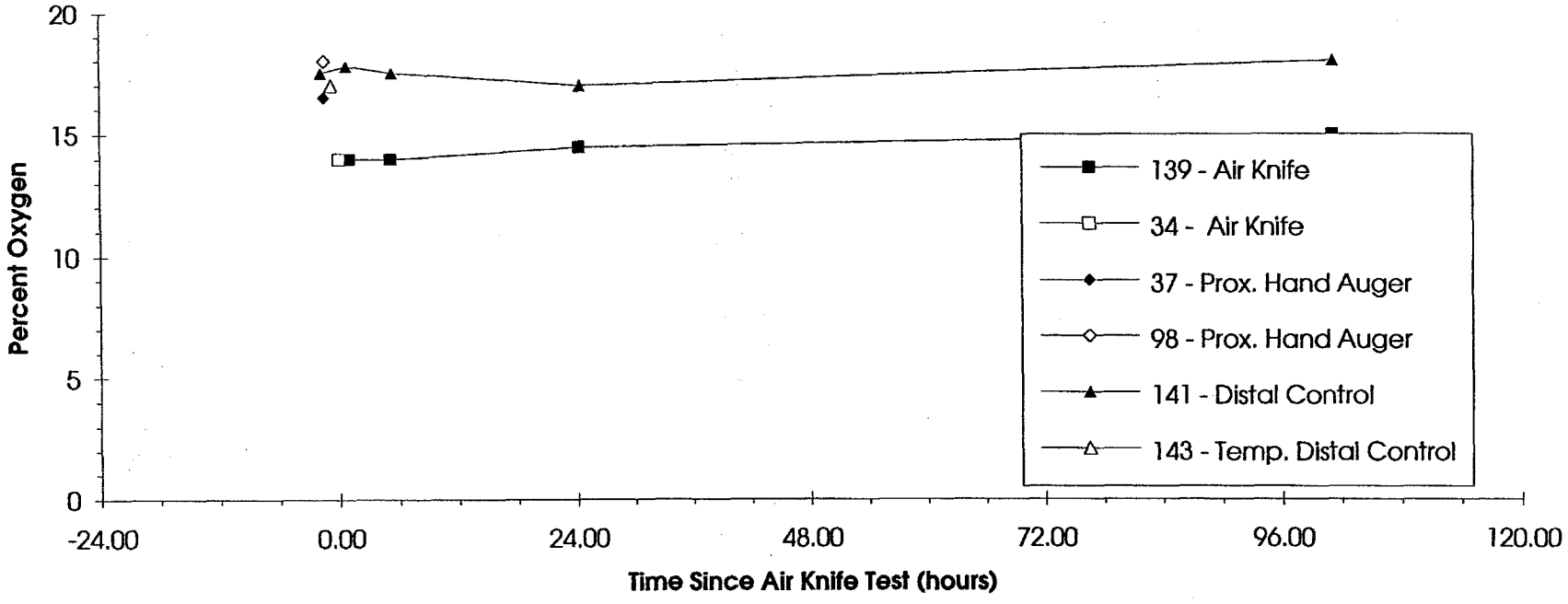

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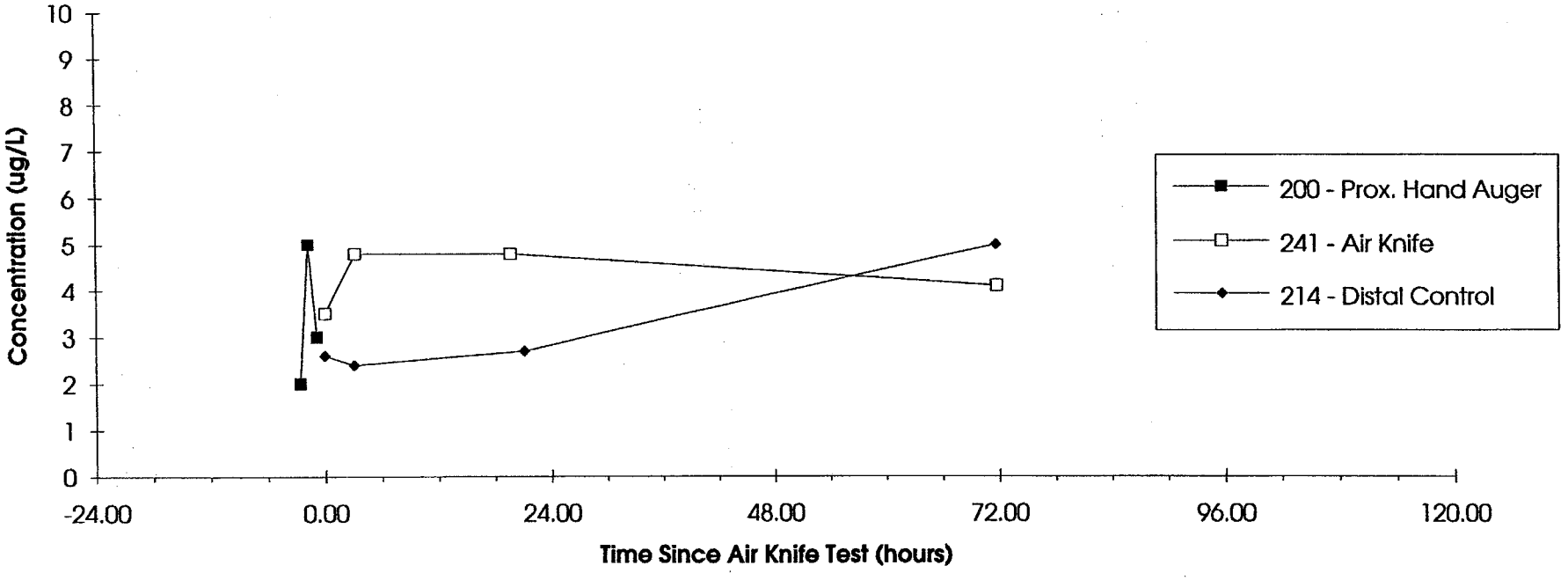
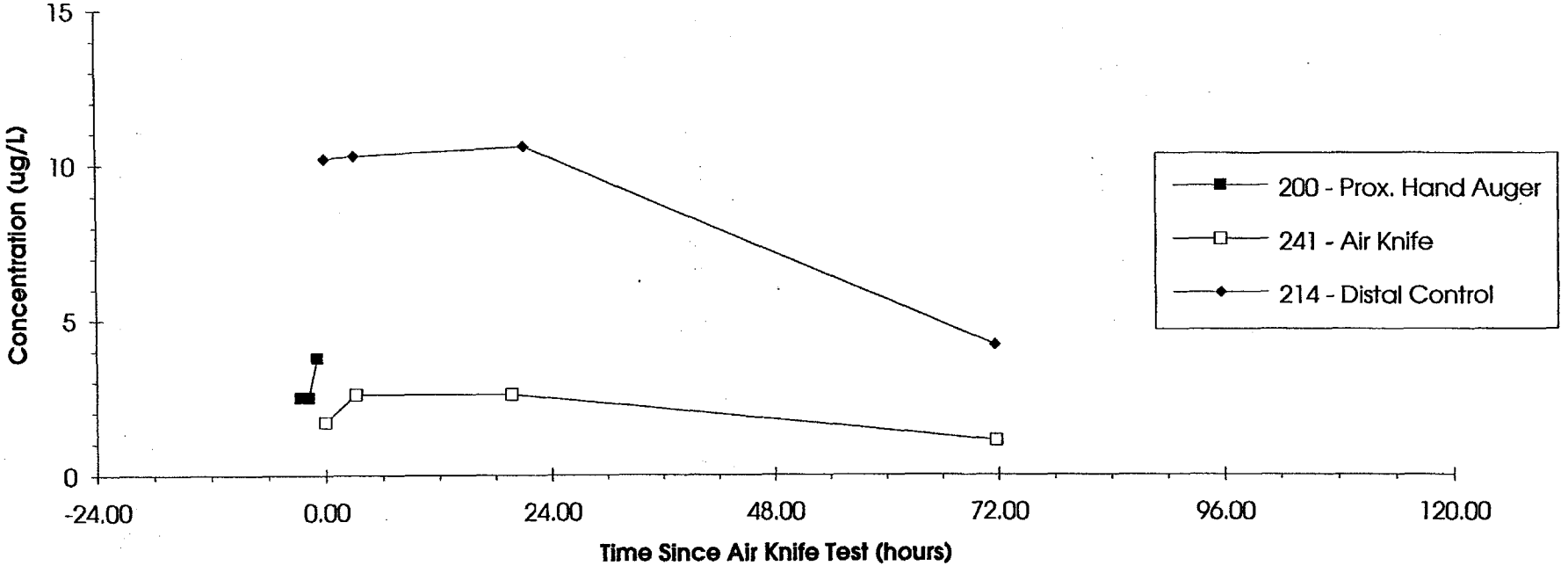
Figure 3-5
PCE Soil Gas Concentrations vs. Time
Air Knife Test Number 2
MCAS El Toro Soil Gas Survey Technical Memorandum



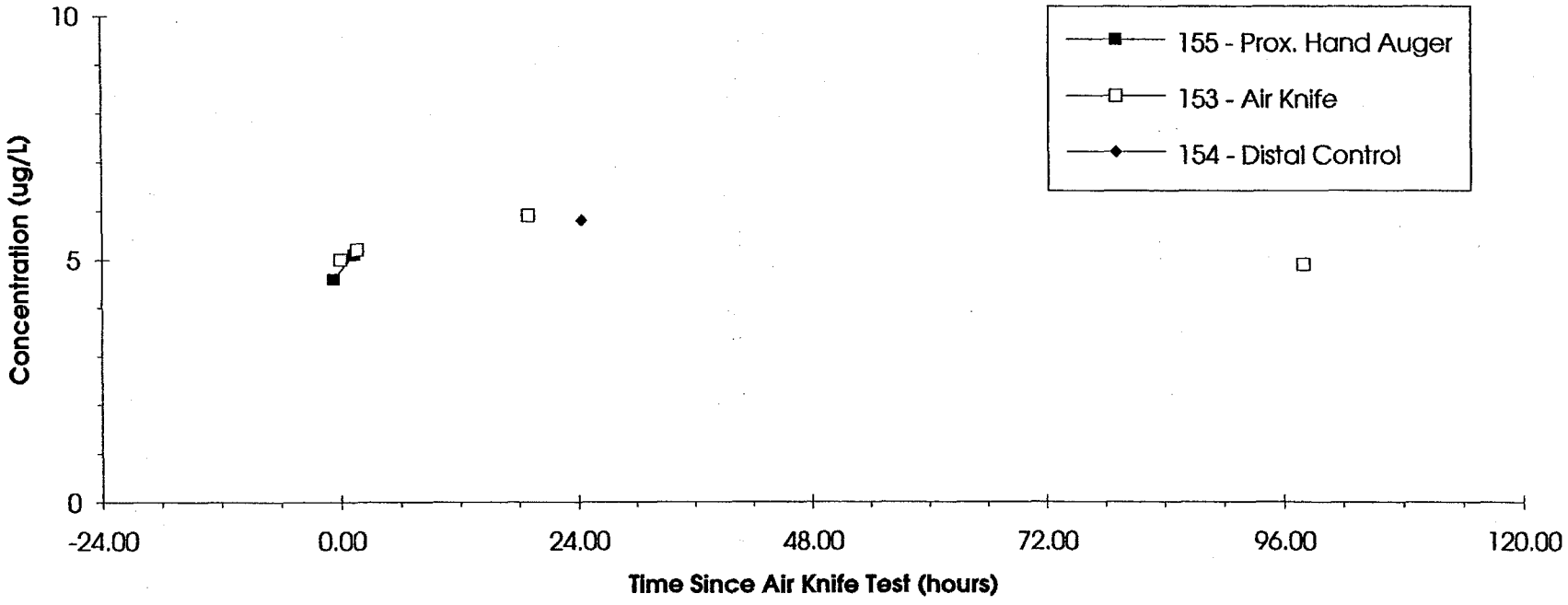
PCE_AK2X.XLC 9/1/94 10:35 AM

Figure 3-6
FREON 113 Soil Gas Concentrations vs. Time
Air Knife Test Number 2
MCAS El Toro Soil Gas Survey Technical Memorandum



FRE_AK2.XLC 9/1/94 10:35 AM

Figure 3-7
PCE Soil Gas Concentrations vs. Time
Air Knife Test Number 4
MCAS El Toro Soil Gas Survey Technical Memorandum



FEATURES:

- 1.0 TO 5.0 ug/l TCE
- 5.0 TO 50.0 ug/l TCE
- 50.0 TO 500.0 ug/l TCE
- GREATER THAN 500.0 ug/l TCE
- MCAS EL TORO BOUNDARY
- WASH OR STREAM
- SITE 24 BOUNDARY
- SOIL GAS MONITORING LOCATION

CONTOUR LINES ARE
DASHED WHERE INFERRED

0 225 450 900
SCALE IN FEET

FIGURE 3-8

MAXIMUM TRICHLOROETHYLENE (TCE) SOIL GAS CONCENTRATIONS AT EACH SAMPLE LOCATION

SOIL GAS MONITORING MAY-JULY 1994
MCAS EL TORO
SOIL GAS SURVEY

Plot date: 30 Aug 94 18:18:48 Tuesday /gis2/eltoro/plots/soilgas/round2plm.GIS &args tce comb 1040 ledger

FEATURES:

- 1.0 TO 5.0 ug/l PCE
- 5.0 TO 50.0 ug/l PCE
- GREATER THAN 50.0 ug/l PCE
- MCAS EL TORO BOUNDARY
- WASH OR STREAM
- SITE 24 BOUNDARY
- SOIL GAS MONITORING LOCATION

CONTOUR LINES ARE
DASHED WHERE INFERRED

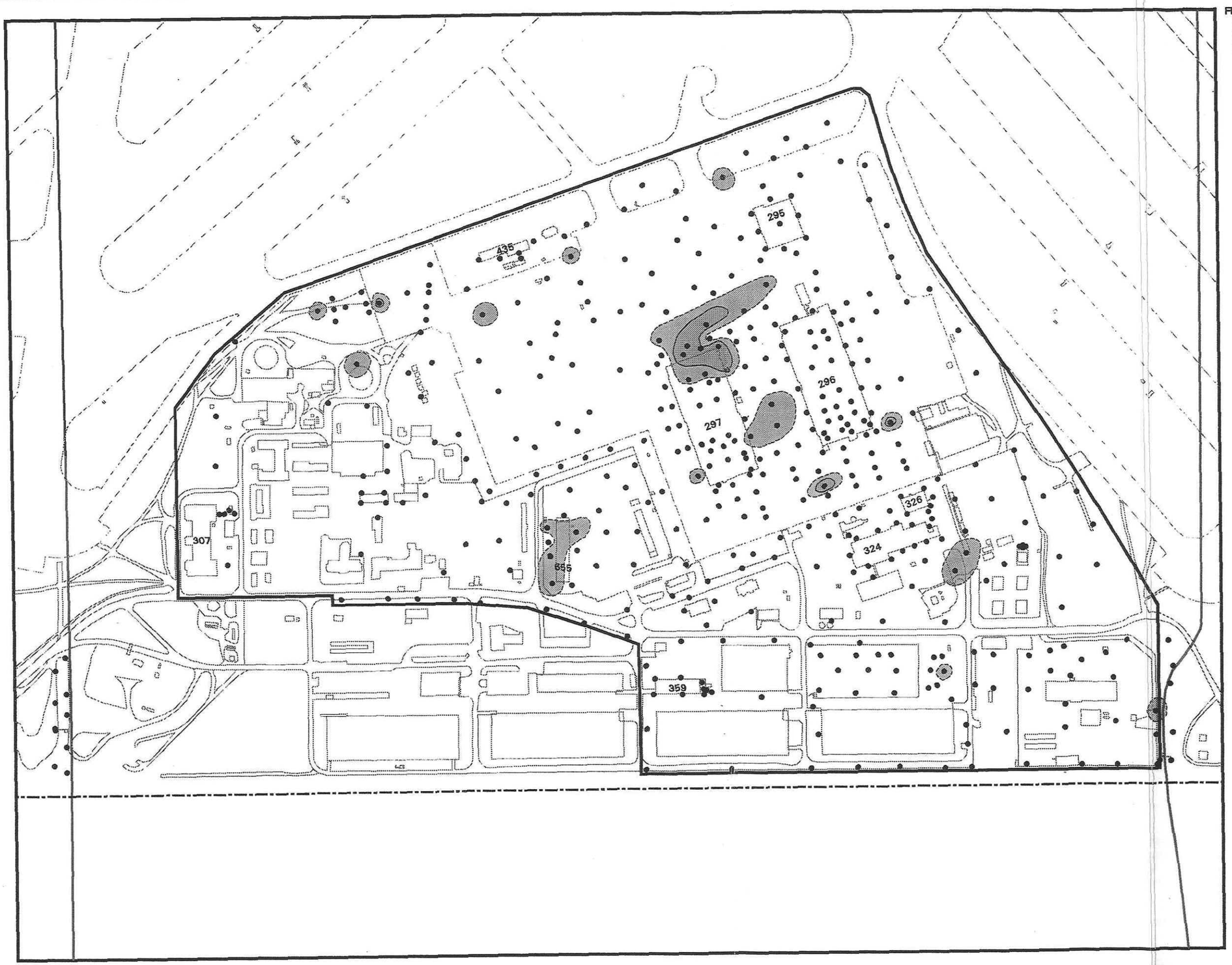
0 225 450 900
SCALE IN FEET

FIGURE 3-9

MAXIMUM TETRACHLOROETHYLENE (PCE) SOIL GAS CONCENTRATIONS AT EACH SAMPLE LOCATION

SOIL GAS MONITORING MAY-JULY 1994
MCAS EL TORO
SOIL GAS SURVEY

Plot date: 06 Oct 94 07:43:52 Wednesday /gis2/eltoro/plots/soilgas/round2plm.GIS &args pce comb 1040 ladger



FEATURES:

- 1.0 TO 5.0 ug/L 1,2-DCE
- GREATER THAN 5.0 ug/L 1,2-DCE
- MCAS EL TORO BOUNDARY
- WASH OR STREAM
- SITE 24 BOUNDARY
- SOIL GAS MONITORING LOCATION

CONTOUR LINES ARE DASHED WHERE INFERRED

0 225 450 900

SCALE IN FEET

FIGURE 3-10

MAXIMUM 1,2-DICHLOROETHYLENE SOIL GAS CONCENTRATIONS AT EACH SAMPLE LOCATION

SOIL GAS MONITORING MAY-JULY 1994

MCAS EL TORO SOIL GAS SURVEY

Plot date: 05 Oct 94 10:21:05 Wednesday /gis2/eltoro/plots/soilgas/round2plm.GIS &args 12dce comb 1040 ledger

FEATURES:

- 1.0 TO 5.0 ug/l 1,1 DCE
- 5.0 TO 50.0 ug/l 1,1 DCE
- 50.0 TO 500.0 ug/l 1,1 DCE
- MCAS EL TORO BOUNDARY
- WASH OR STREAM
- SITE 24 BOUNDARY
- SOIL GAS MONITORING LOCATION

CONTOUR LINES ARE
DASHED WHERE INFERRED

0 225 450 900

SCALE IN FEET

FIGURE 3-11

**MAXIMUM
1,1 DICHLOROETHYLENE
SOIL GAS CONCENTRATIONS
AT EACH SAMPLE LOCATION**

**SOIL GAS MONITORING
MAY-JULY 1994**

**MCAS EL TORO
SOIL GAS SURVEY**

FEATURES:

- 1.0 TO 5.0 ug/l TCTFA (FREON-113)
- 5.0 TO 50.0 ug/l TCTFA (FREON-113)
- MCAS EL TORO BOUNDARY
- WASH OR STREAM
- SITE 24 BOUNDARY
- SOIL GAS MONITORING LOCATION

CONTOUR LINES ARE DASHED WHERE INFERRED

N

0 225 450 900

SCALE IN FEET

FIGURE 3-12

MAXIMUM TRICHLOROTRI-FLUOROETHANE (FREON-113) SOIL GAS CONCENTRATIONS AT EACH SAMPLE LOCATION

SOIL GAS MONITORING MAY-JULY 1994
MCAS EL TORO
SOIL GAS SURVEY

Plot date: 08 Oct 94 11:24:11 Thursday /gis2/eltoro/plots/soilgas/round2plm.GIS &args tcfa comb 1040 ledger