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UNITED STATES OF AMERICA

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5090.3(a)
Ser 5SEN.MB/246
September 11, 2003

Mr. Daniel Cordero
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Enclosed is the Draft Removal Action Closeout Report for the Time-Critical Removal Action (TCRA), Installation Restoration Site 5 - Unit 2, Naval Air Station North Island, San Diego, California. The California Environmental Protection Agency ID Number for North Island is CA7170090016.

This TCRA was performed as an interim measure by the Navy for the protection of human health and the environment and in an effort to reduce long-term environmental management costs. The closeout report documents the major activities making-up the removal action effort. This includes descriptions of the fieldwork, chemical sampling efforts, laboratory test results and documentation on monitored natural attenuation (MNA) practicality.

Overall, the TCRA objective of significantly reducing risk was accomplished. An estimated two tons of VOCs were removed from the site during the TCRA. Site conditions indicate MNA will be an effective remedy for residual groundwater contamination. Recommended follow-up evaluations based on TCRA decision rules include performing a soil risk assessment, an inhalation risk assessment, and a groundwater MNA evaluation. These tasks are expected to occur either during a site Feasibility Study or other follow-up site evaluation.

The North Island Federal Facility Site Remediation Agreement review period for this document is 60 days. Please send written comments to the above address.

The point of contact at this command is Mark Bonsavage, Remedial Project Manager, South Bay Area Focus Team, at (619) 556-7315.

Sincerely,

William E. Collins

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Environmental Engineer
By direction of the Commander

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Ser 5SEN.MB/246
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5090.3(a)
Ser 5SEN.MB/246
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CERTIFICATION

I certify that the information contained in or accompanying this submittal is true, accurate, and complete. As to those portions of this submittal for which I cannot personally verify the accuracy, I certify that this submittal and all attachments were prepared at my direction in accordance with procedures designed to assure that qualified personnel properly gathered and evaluated the information submitted. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

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Document Title: Draft Removal Action Closeout Report
IR Site 5 - Unit 2
Naval Air Station North Island
San Diego, California

Date: 9/10/2003

DRAFT
REMOVAL ACTION CLOSEOUT REPORT
Time-Critical Removal Action
Installation Restoration Site 5 – Unit 2
Naval Air Station North Island
San Diego, California

Environmental Remedial Action
Contract No. N62474-98-D-2076
Contract Task Order No. 0027

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Table of Contents

***Table of Contents** (continued)*

Table of Contents (continued)

Table of Contents *(continued)*

List of Figures

List of Tables

List of Appendices

Acronyms and Abbreviations

µg/L	microgram(s) per liter
bgs	below ground surface
BNI	Bechtel National, Inc.
BTEX	benzene, toluene, ethylbenzene, xylenes
CAH	chlorinated aliphatic hydrocarbon
cis-1,2-DCE	*cis*-1,2-dichloroethene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	chemicals of potential concern
CPT	cone penetrometer testing
CTO	Contract Task Order
DCA	dichloroethane
DCE	dichloroethene
DGGE	denaturing gradient gel electrophoresis
DHE	*Dehalococcoides ethenogenes*
DNA	deoxyribonucleic acid
DOT	U.S. Department of Transportation
DSITMS	direct sampling ion trap mass spectrometer
DTSC	Department of Toxic Substances Control
EBSI	Environmental Business Solutions International, Inc.
EM	electromagnetic
EPA	U.S. Environmental Protection Agency
GC/MS	gas chromatograph/mass spectrometer
gpm	gallons per minute
HCl	hydrochloric acid
IR	Installation Restoration
ISCO	in situ chemical oxidation
IT	IT Corporation
$KMnO_4$	potassium permanganate
mg/kg	milligram(s) per kilogram
MIP	membrane interface probe
MNA	monitored natural attenuation
NAS	Naval Air Station
ORP	oxidation-reduction potential
OHM	OHM Remediation Services Corp.
Parsons	Parsons Engineering Science, Inc.
PAH	polynuclear aromatic hydrocarbon(s)
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
Pelorus	Pelorus EnBiotech, Inc.
PLFA	phospholipid fatty acid content

pmole	picomole
PPE	personal protective equipment
ppmv	parts per million by volume
PRG	Preliminary Remediation Goal
psi	pound(s) per square inch
PVC	polyvinyl chloride
PWC	Public Works Center
RAW	Removal Action Work Plan
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RI	Remedial Investigation
RNA	remediation by natural attenuation
RSK	R.S. Kerr
RWQCB	Regional Water Quality Control Board
SAM	Site Assessment and Mitigation
SCAPS	Site Characterization and Analysis Penetrometer System
SHSP	Site Health and Safety Plan
SiREM	SiREM Laboratory
SPLP	synthetic precipitation leaching procedure
SVOC	semivolatile organic compound
SWDIV	Naval Facilities Engineering Command – Southwest Division
TCE	trichloroethene
TCLP	toxicity characteristic leaching procedure
TCRA	Time-Critical Removal Action
trans-1,2-DCE	*trans*-1,2-dichloroethene
TIC	total ion count
TOC	total organic carbon
VC	vinyl chloride
VOC	volatile organic compound
WQO	water quality objective

1.0 Introduction

This removal action closeout report details Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) time-critical removal action (TCRA) activities completed for Installation Restoration (IR) Site 5 – Unit 2, Naval Air Station (NAS) North Island, San Diego County, California. TCRA measures were conducted by Shaw Environmental, Inc., under Contract Task Order (CTO) 0027 for the U.S. Department of the Navy, Engineering Field Activities – West (EFA-West) Environmental Remedial Action Contract Number N62474-98-D-2076.

1.1 Project Objective

The objective of the TCRA was to reduce the potential risk to human health and the environment posed by site contaminants, to reduce site contaminant mass, and to ensure that remediation by natural attenuation (RNA) is an effective remedy for residual chlorinated aliphatic hydrocarbons (CAHs) in groundwater following the TCRA. The selected method for the rapid reduction of groundwater CAHs, particularly vinyl chloride (VC), *cis*-1,2-dichloroethene (*cis*-1,2-DCE), *trans*-1,2-dichloroethene (*trans*-1,2-DCE), trichloroethene (TCE), and 1,1-dichloroethane (DCA) was via source area removal using *in situ* chemical oxidation (ISCO) (U.S. Department of the Navy, 1999)

1.2 Background

This section provides a concise description of the site, site background, site geology, and identified extent of site contaminants, which are detailed in previous reports (Bechtel National, Inc. [BNI], 1998; Parsons Engineering Science, Inc. [Parsons], 1999).

1.2.1 Site Description

IR Site 5 is located in the southeastern corner of NAS North Island in San Diego County, California. The site is subdivided into Units 1 and 2 to differentiate the former municipal landfill and a former liquid waste disposal area, respectively. Figure 1 shows the location, topography, and geographical features of IR Site 5 and the boundaries of Units 1 and 2.

Unit 2 of IR Site 5 is located approximately 250 feet south-southeast east of the intersection of Rogers and Sherman Roads and is about 1,800 feet from the western limit of the city of Coronado (Figure 1). The site is generally flat, covered mostly with loose sand, extends over approximately 3.4 acres, and is located predominately within the approach for NAS North Island Runway 29. The nearest natural (nonintrusive) pathway to potential environmental and human receptors is a slough (IR Site 1 – Outfall 16) that is located approximately 550 feet south of the identified source area.

1.2.2 Site Background

NAS North Island was enlarged in the 1930s and 1940s using dredged bay sediments to fill shallow inlets and extend the shoreline. Between 1943 and 1945, the shallow inlet between North Island and Coronado Island, known as the Spanish Bight, was backfilled. Shortly thereafter, a solid waste disposal facility began operation atop the newly created land at the southwest corner of the former Spanish Bight. The solid waste disposal facility, now known as IR Site 5 – Unit 1, was initially operated as a cut-and-cover sanitary landfill (BNI, 1998).

During the remedial investigation (RI)/Resource Conservation and Recovery Act (RCRA) facility investigation for IR Site 5, it was discovered that groundwater immediately southwest of the former solid waste disposal facility was impacted by volatile organic compounds (VOCs). Contaminant delineation activities determined that the VOC plume adjacent to the site did not originate from the solid waste disposal facility. The RI/RCRA Facility Investigation reported that the VOC source area was suspected to be two generally rectangular-shaped pits observed in a 1948 aerial photograph. The pits were identified as being located under or adjacent to Sherman Road near the upgradient extent of the delineated VOC plume (Figures 1 and 2). The exact nature and quantity of waste that was disposed of in the identified liquid waste disposal pits are unknown (BNI, 1998).

Waste disposal activities at IR Site 5 were ended between 1965 and 1968, after which the site was used until 1983 as a waste transfer station to dispose of Navy wastes off base (BNI, 1998).

1.2.3 Site Geology

Two discrete aquifers exist just below the subsurface at IR Site 5 – Unit 2. They consist of an upper shallow aquifer, which was created when the former Spanish Bight was filled with dredged sediment, and the underlying aquifer that is the upper extent of the Bay Point Formation.

The upper unconfined aquifer in which the VOC plume is located consists of an approximately 8- to 12-foot-thick layer of hydraulic fill that is predominantly poorly-graded fine to very fine-grained sand. Immediately below the hydraulic fill is a 3- to 5-foot-thick layer of bay floor mud, consisting of organic silts and clays that were deposited in quiet shallow water of the former Spanish Bight. Bay floor sediments of the former Spanish Bight (Spanish Bight sediment) are identified as extending under IR Site 5 – Unit 2, but are discontinuous along the western edge and plunge deeper south of the site (BNI, 1998; Parsons, 1999). The Spanish Bight sediment below the site is identified as a clayey silt that was described as a leaky confining/semiconfining layer by BNI (1998) and as a zone of low-permeability silt and clay by Parsons (1999).

Beneath the Spanish Bight sediment is the Bay Point Formation. The sediments of the Bay Point Formation at the site were observed in sample borings drilled by BNI (1998), and were described as medium dense to dense and composed of interbedded sand, silt, and clay layers.

The top of groundwater occurs in the surficial hydraulic fill layer at approximately 5.0 feet below ground surface (bgs). The base of this upper water-bearing zone occurs at the top of the underlying low-permeability Spanish Bight sediments, at a depth of approximately 8 to 12 feet. The flow direction of groundwater in the upper aquifer is predominantly to the southwest, within the main body of the VOC plume. A weighted average hydraulic gradient of 0.0036 feet per foot and an average hydraulic conductivity of 37.5 feet per day were provided by Parsons (1999) as hydraulic parameters for the upper aquifer at the site. Groundwater in the upper aquifer is nonsaline and is not affected by tidal fluctuations.

1.2.4 Groundwater Contaminant Delineation

Chemicals of potential concern (COPC) identified at IR Site 5 – Unit 2 in groundwater include chlorinated VOCs and petroleum hydrocarbons. RI/RFI sampling performed by BNI delineated VOC-impacted groundwater at IR Site 5 – Unit 2 as being located predominantly in the shallow 5- to 8-foot-thick upper aquifer, which is situated above the aquitard formed by Spanish Bight sediments. The distribution of VOCs in groundwater was identified as an inverted, "teardrop-shaped" plume that extends from the suspected source area to the south-southwest for a distance of about 400 feet. Detected COPCs in groundwater identified at concentrations exceeding risk-based standards and criteria for human health protection and the associated maximum measured concentrations were *cis*-1,2-DCE (19,000 micrograms per liter [µg/L]), 1,4-dichlorobenzene (21 µg/L), benzene (180 µg/L), methylene chloride (1,900 µg/L), tetrachloroethene (PCE) (1,200 µg/L), TCE (11,000 µg/L), VC (48,000 µg/L), 2,4-dimethylphenol (9,800 µg/L), acenaphthylene (200 µg/L), bis(2-chloroethyl)ether (3,000 µg/L), bis(2-ethylhexyl)phthalate (24 µg/L), fluorine (0.6 µg/L), phenanthrene (1 µg/L), arsenic (147 µg/L), barium (2,870 µg/L), beryllium (4.9 µg/L), mercury (3 µg/L), and thallium (5.3 µg/L) (BNI, 1998).

The monitored natural attenuation (MNA) assessment performed by Parsons following the RI/RFI included four quarters of groundwater monitoring to ascertain VOC concentrations, to delineate the distribution of impacted groundwater, and to assess whether MNA is an acceptable means to achieve site remediation. The contaminant plume identified by Parsons consisted of an inverted, "teardrop-shaped" main body of impacted groundwater surrounded by a generally oval-shaped zone of less impacted groundwater (Figures 1 and 2). VOCs detected by Parsons during quarterly sampling and identified in the RI/RFI as COPCs and the associated maximum measured concentrations were *cis*-1,2-DCE (550,000 µg/L), benzene (280 µg/L), methylene chloride (340 µg/L), TCE (180 µg/L), and VC (110,000 µg/L). The majority of the contaminants with elevated concentrations were detected in monitoring wells S5-MW-20 and S5-MW-21 (Figure 2).

1.2.5 Human Health and Ecological Risk

The RI/RFI provided a human health risk assessment for Unit 2 that identified a conservative total cancer risk estimate of 5.7×10^{-4} (to future residents), based largely on exposure to VC-contaminated soil at a depth of approximately 5 to 8 feet bgs. The ecological risk evaluation for Site 5 – Unit 2 recommended further evaluation of site conditions and indicated that remedial action for contaminated soil and groundwater could be required after a period of monitoring to assess plume migration and natural attenuation (BNI, 1998).

Additional assessment of the site by Parsons (1999) concluded that natural attenuation of chlorinated VOCs and petroleum hydrocarbons in groundwater is occurring. The Parsons report also identified that with source removal, VC would not reach potential downgradient receptors (i.e., the slough located south of the site), and that VOC concentrations should decrease to site cleanup goals within 60 to 78 years. Without source area removal, the maximum duration for long-term remediation via RNA of the VOC plume was estimated at 475 years. The Parsons report also recommended that a soil vapor risk assessment be performed prior to the initiation of long-term monitoring to assess the potential risk posed by the high concentrations of VC in groundwater at the site.

1.3 TCRA Remediation Activities

Given site conditions and the objectives of the TCRA, the primary TCRA remediation activities performed for IR Site 5 – Unit 2 included the following:

- Fenton’s reagent groundwater treatment pilot study
- Supplemental site assessment
- Vadose zone source area soil removal
- Exploratory trenching to locate potential secondary sources
- Full-scale ISCO groundwater treatment
- Microbial natural attenuation assessment

The following documents describe procedures followed for the implementation of the TCRA and present additional assessment data needed to perform remedial source area removal activities:

- OHM Remediation Services Corp. [OHM], 2001, *Remedial Action Work Plan, Time-Critical Removal Action, Installation Restoration Site 5, Unit 2, Naval Air Station North Island, California,* Delivery Order 0141, DCN SW6838, Revision 3, June 8.

- IT Corporation (IT), 2001, *Remedial Action Work Plan Addendum, Time-Critical Removal Action, Installation Restoration Site 5, Unit 2, Naval Air Station North Island, California*, CTO-0027, DCN 1441, Revision 1, November 19.
- SWDIV, 2002, *Summary Letter Describing the Planned Oxidant Change for IR Site 5–Unit 2, Time Critical Removal Action, Naval Air Station North Island, California*, December 4.

Activities described in the Remedial Action Work Plan (RAW) and RAW addendum are summarized herein to provide a complete report of TCRA activities. Four revisions of the RAW have been distributed. They include Revision 0 (the initial document); Revision 1 (created by placing page inserts into the initial document), which provided modified soil sampling procedures (U.S. Environmental Protection Agency [EPA] Method 5035 using Encore® samplers); Revision 2, which provided initial Department of Toxic Substances Control (DTSC) comments and related responses, pilot test data, and proposed technology for full-scale implementation; and Revision 3 (created by placing page inserts into the Revision 2 document), which provided the last RAW DTSC comments and related responses. There have been two revisions of the RAW addendum. They include Revision 0 (the initial document) and Revision 1 (created by placing page inserts into the initial document), which provided the health and safety plan addendum to detail procedures for source area excavation activities.

2.0 Fenton’s Reagent Groundwater Treatment Pilot Study

The Fenton’s reagent groundwater pilot study for IR Site 5 – Unit 2 was performed by ManTech, Inc., under subcontract to Shaw Environmental, Inc. The pilot test encompassed the following tasks:

- Bench testing
- Field preparation
- Baseline testing of site conditions
- Applications of Fenton’s reagent
- Posttest assessment of site conditions
- Data evaluation and conceptual treatment system design

Chemical oxidation by Fenton’s reagent is accomplished by injecting an oxidizer (e.g., hydrogen peroxide) and a ferrous catalyst (e.g., ferrous sulfate) into a contaminated aquifer that has a pH between 6 and 3 (either naturally occurring or through acidification). The catalyst converts the oxidizer to hydroxyl radicals, which, in turn, oxidize petroleum and/or CAH contaminants to harmless compounds. As shown below, in the process of creating hydroxyl radicals, the Fenton reaction converts ferrous iron in the catalyst to ferric iron and precipitates ferric compounds:

$$\mathbf{H_2O_2 + Fe^{+2} \rightarrow Fe^{+3} + OH\bullet + OH^-}$$

H_2O_2 = Hydrogen peroxide
Fe^{+2} = Ferrous iron (provided by the iron catalyst)
Fe^{+3} = Ferric iron (rust)
$OH\bullet$ = Hydroxyl free radical
OH^- = Hydroxyl ion

The hydroxyl free radical generated by Fenton’s reagent is a powerful, nonselective oxidant. Oxidation of organic compounds by Fenton’s reagent is a rapid and exothermic reaction (heat-producing), and 100 percent mineralization is generally complete in minutes. Intermediate compounds produced during the reaction are primarily carboxylic acids. The end products of oxidation are primarily carbon dioxide, water, and chloride ion. Hydrogen peroxide not consumed in the initial reaction will continue to oxidize groundwater contaminants or will naturally degrade to oxygen and water. The injected reagents should not adversely affect the aquifer, with the exception of the temporal effects of iron precipitation and lowered pH.

2.1 Pilot Study Bench Test

Bench test soil and groundwater samples for the pilot study were collected from the site by Shaw Environmental, Inc. on April 13, 2000. VOC-impacted soil samples were collected from just above and below the top of groundwater in soil borings S5-B-13 (subsequent number to the last BNI RI/RFI soil boring) through S5-B-15 using a direct-push drill rig (OHM, 2001). Groundwater samples were collected from monitoring well S5-MW-21 (Figure 2), where total VOCs historically have been the highest at the site (OHM, 2001).

Bench testing was initiated by ManTech, Inc. on April 18, 2000, to assess selected Fenton's reagent chemical oxidation processes and evaluate their effectiveness on site groundwater and soil. Bench test analytical results for site groundwater indicated that a greater than 99 percent reduction of VOCs could be achieved when compared against prebench and control sample results. Soil sample results showed contaminant reduction and indicated sample heterogeneity in contaminant distribution. Bench test results also indicated that the ManTech CleanOx® process could lower the pH in groundwater and saturated soil to the desired range of 3 to 5, which is necessary for a Fenton reagent reaction to work effectively (OHM, 2001).

2.2 Pilot Study Field Preparation

Field preparations performed prior to the pilot study included a geophysical survey to locate possible ignition sources and utilities and the installation of an injection well, monitoring wells, and soil-gas probes.

2.2.1 Geophysical Survey to Locate Utilities

Prior to the pilot study, a geophysical survey was performed on April 5, 2000, in an attempt to locate subsurface utilities, the two former liquid waste disposal pits, and other buried features within the central portion of the site. The intent of the survey was to clear the immediate vicinity of proposed drilling locations and to identify any possible ignition sources within the treatment area. No structures or devices constituting potential ignition sources were identified during the survey that could potentially ignite flammable soil vapor, which might be produced during ISCO groundwater treatment. Various subsurface metallic anomalies (representing buried metallic material) were identified throughout the site. One of the metallic anomalies found in the central portion of the VOC plume corresponded to an apparent backfilled excavation that was also identified by the geophysical survey. Utilities identified to the south of Sherman Road and east of Rogers Road are shown in Figure 2. The ignition source/utility geophysical survey report is provided in Appendix A (A-1).

2.2.2 Injection and Monitoring Well Installation

On May 8 and 9, 2000, pilot test injection well S5-VIW-01 and six monitoring wells (S5-MW-24 through S5-MW-29, sequentially numbered following the last Parsons monitoring well [Parsons, 1999]) were installed in the central portion of the VOC plume (Figure 2). Pilot study wells were installed in proximity to the apparent backfilled excavation identified during the ignition source geophysical survey (Section 2.2.1 and Appendix A-1). A seventh monitoring well (S5-MW-30) was installed on August 22, 2000. Boring logs for those monitoring wells were provided in the RAW (OHM, 2001). Monitoring wells were installed in a generally "T"-shaped pattern roughly parallel and perpendicular to the direction of groundwater flow at distances of 5, 10, 15, 20, 25, and 30 feet around the injection well, as shown in Figure 2. Location survey data for pilot study wells are provided in Appendix B.

Prior to installation of wells, continuous soil cores were collected for baseline soil and lithologic samples of the contaminated aquifer. Groundwater in the pilot study area was encountered at approximately 5 feet bgs, and the top of the underlying Spanish Bight sediments was encountered at approximately 10 feet bgs. A zone of apparent landfill debris was found in the subsurface within the pilot study area. The debris is situated at and above groundwater and contains broken glass, oxidized and welded metal, wood, charcoal, putty, paint, oil, and other industrial consumer-type materials. Debris density appeared to be greatest in the vicinity of injection well S5-VIW-01 and upgradient monitoring well S5-MW-27, with less debris apparent cross-gradient to the northwest and downgradient of the injection well.

2.2.3 Soil-Gas Probe Installation

Three soil-gas probes (S5-SG-01 through S5-SG-03) were installed close to the pilot study injection well (S5-VIW-01) on May 19, 2000. The stainless steel probes were located within 15 feet of the injection well and the screened intervals extend from 1.5 to 2 feet bgs. The locations of the soil-gas probes in conjunction with the pilot study injection well are shown in Figure 2.

2.3 Testing of Site Conditions to Assess Pilot Study

Soil, groundwater, and vapor sampling; aquifer conductivity testing; and general site monitoring activities were performed at the site to establish pretreatment site conditions and quantify changes resulting from chemical treatment. Testing was conducted prior to the pilot study (baseline), during the pilot study for selected parameters (interim), after the second pilot study injection event (rebaseline), and shortly after the study was completed (posttreatment).

2.3.1 Soil Sampling and Analysis

Baseline soil samples were collected from the borings into which injection well S5-VIW-01 and monitoring wells S5-MW-24 through S5-MW-29 were installed (Section 2.2.2) using a hollow-stem auger drill rig and standard splitspoon sampler. Sample intervals included the depth of groundwater (water table) at approximately 5 to 5.5 feet bgs and deeper selected intervals to a maximum of 10 feet bgs. Interim soil samples (soil borings S5-B-16 through S5-B-22), rebaseline soil samples (soil borings S5-B-23 through S5-B-30), and posttreatment soil samples (soil borings S5-B-31 through S5-B-38) were collected using a direct-push drill rig on August 12, 13, and 29, and September 20, 2000, respectively (OHM, 2001).

The soil samples were analyzed for VOCs using EPA Method 8260B. In addition, baseline and interim soil samples were analyzed for total iron using EPA Method 6010B and rebaseline and posttreatment soil samples were analyzed for total organic carbon (TOC) using EPA Method 9060. Analytical data tables and laboratory reports for pilot test soil samples are provided in the RAW (OHM, 2001).

2.3.2 Groundwater Sampling and Analysis

Baseline groundwater samples were collected from injection well S5-VIW-01 and pilot test monitoring wells S5-MW-24 through S5-MW-29 on May 15, 2000. Interim groundwater samples were also collected from the same wells on May 30, 2000; June 1, 3, 19, 21, and 23, 2000; and July 11, 2000. Rebaseline groundwater samples were collected from the previously sampled wells, monitoring well S5-MW-21, and the newly installed monitoring well S5-MW-30 on August 29, 2000. Post rebaseline interim groundwater samples were collected from monitoring wells S5-MW-24 through S5-MW-27 and S5-MW-30 on September 14, 2000, to evaluate the dilution effect of conditioner (hydrochloric acid [HCl] and ferrous iron catalyst) application. Posttreatment groundwater samples were collected from monitoring wells S5-MW-21 and S5-MW-24 through S5-MW-30 on September 20, 2000, and from injection well S5-VIW-01 on September 21, 2000. Groundwater samples were collected using low-flow sampling procedures.

Baseline, selected interim split samples, interim samples collected on July 11, 2000, rebaseline samples, post-rebaseline interim groundwater samples, and posttreatment groundwater samples were analyzed for VOCs using EPA Method 8260B. Remaining interim groundwater samples were analyzed for VOCs (EPA Method 8260B) using a portable Inficon Hapsite® gas chromatograph/mass spectrometer (GC/MS). In addition, baseline and July 11, 2000, interim groundwater samples from S5-MW-24 through S5-MW-26 were analyzed for Title 22 metals, excluding mercury, iron, magnesium, manganese, potassium, and sodium) using EPA Method 6010B; hexavalent chromium using EPA Method 7196A; and general chemistry using EPA Methods 300.0A, 310.1, and 160.1. Rebaseline and posttreatment groundwater samples were analyzed for selected metals (aluminum, calcium, total iron, magnesium, potassium, and sodium) using EPA Method 6010B and for general chemistry using EPA Methods 300.0A, 310.1, 340.2, 350.3, 120.1, and 160.1 and Standard Method 1030F. Analytical data tables and laboratory reports for pilot test groundwater samples are provided in the RAW (OHM, 2001).

2.3.3 Aquifer Conductivity Test

Pilot study aquifer testing was performed to evaluate how aquifer permeability is influenced by ferric iron precipitation (expected to result from the chemical reaction caused by oxidant injection). Baseline slug testing of the injection well was conducted on May 19 and 21, 2000. Posttreatment slug testing of the injection well was conducted on September 26 and 27, 2000. Slug test graphs and calculations are provided in the RAW (OHM, 2001).

2.3.4 Soil Vapor Sampling and Analysis

Baseline soil vapor samples were collected from soil-gas probes S5-SG-01 through S5-SG-03 on May 22, 2000. Interim soil vapor samples were collected from those probes while the first injection event was in progress on May 25, 2000, as part of rebaseline sampling on August 29 and 30, 2000, and while the third/final injection event was in progress on September 15, 2000. Posttreatment soil vapor samples were collected from the three site soil-gas probes on September 20, 2000. Soil vapor samples were analyzed for VOCs using a portable GC/MS in general conformance with EPA Method TO-14 (OHM, 2001).

2.4 Fenton’s Reagent Pilot Study Chemical Injections

The Fenton’s reagent pilot-scale field test was initiated in May 2000. The pilot test program was composed of three injection events, each entailing approximately 1 week of injecting chemicals into injection well S5-VIW-01 and concurrent groundwater monitoring. Chemical reagents that were added to the aquifer included HCl for pH adjustment, ferrous sulfate as catalyst, and hydrogen peroxide as the oxidizer. Chemical injection activities were conducted by ManTech, Inc.

2.4.1 First and Second Injection Events

The first two pilot test injection events began on May 22 and June 12, 2000, and lasted 4 and 3 days each, respectively. Based on bench test results and initial estimates to meet pilot test objectives, it was determined that 7,500 pounds of 35 percent hydrogen peroxide, 600 pounds of ferrous sulfate, and 60 gallons 34.1 percent HCl were needed to prepare reagent solutions for injection during these combined events. Total fluids produced and injected from the estimated quantity of chemicals during the first and second injection events included approximately 700 gallons of conditioning/catalyst solution composed of HCl and ferrous iron and approximately 1,600 gallons of oxidant solution at 8- to 20-percent hydrogen peroxide. Two-thirds of the total reagent volumes were injected during the first event and the remainder was injected during the second event. Conditioner/catalyst application was performed each day prior to oxidant application during these injection events. Conditioning/catalyst and oxidant solutions were applied at a rate of approximately 1 to 2 gallons per minute (gpm).

2.4.2 Third Injection Event

The third injection event began on September 11, 2000, and lasted 5 days. The objective of the third and final pilot test injection event was to address data gaps identified during the first two events. Specific objectives for the third event were to evaluate aquifer-buffering capacity to determine the economic feasibility of aquifer acidification, to estimate the design radius of influence for conditioning reagents, and to evaluate contaminant mass reduction versus mass movement through phase transport and migration.

Based on VOC mass calculations and previous injection event results, it was determined that 9,500 pounds of 35 percent hydrogen peroxide, 800 pounds of ferrous sulfate, and 260 gallons 34.1 percent HCl were needed to prepare reagent solutions for the third injection event. Total fluids produced and injected from the estimated quantity of chemicals included approximately 2,800 gallons of conditioning/catalyst solution and 1,950 gallons of oxidant solution at 8 to 20 percent hydrogen peroxide. The total volume of conditioning/catalyst solution was applied prior to oxidant application at a rate of approximately 6 to 7 gpm. The oxidant application rate ranged from 1 to 2 gpm.

2.5 Pilot Study Conclusions

Evaluation of the data collected during the pilot study indicated that full-scale ISCO by Fenton’s reagent should successfully achieve TCRA goals. The following pilot study results support this conclusion:

- Groundwater concentrations of total VOCs decreased an average of 60 percent within 25 feet of the injection well based upon baseline and posttreatment sample results.
- Soil concentrations decreased an average of 69 percent within a 15-foot radius of the injection well based on sample results collected before and after the third injection event.
- VOC mass calculations based on all sample media (vapor, soil, and groundwater) indicated that VOCs were destroyed rather than moved from one media to another.
- Mass calculations determined that approximately 76 pounds of VOCs were destroyed during the pilot test.
- Aquifer hydrogeologic characteristics are conducive to treating groundwater through chemical injection (the radius of influence is adequate, no adverse effects were observed, and aquifer geochemical and hydrologic changes appear to be temporary).
- Aquifer buffering capacity can be overcome through acidification sufficient to obtain pH levels conducive to Fenton’s reaction.

The following pilot study observations and conclusions were identified as necessary in understanding site conditions, designing the full-scale treatment system, and implementing full-scale treatment activities:

- Calculations indicate that approximately 95 percent of the VOC mass within the pilot study area is sorbed to soil at and below the water table (OHM, 2001).
- Increases (rebound) in groundwater contaminant concentrations following the application of conditioning solution and chemical treatment in selected groundwater samples suggest that sorbed-phase VOCs were released from saturated soil into groundwater.
- Total VOC soil vapor concentrations increased during chemical injection (from approximately 10 to 100 parts per million by volume [ppmv]), but were not detected during breathing zone air monitoring.
- Sample results indicated that most contaminant reduction occurred downgradient and cross-gradient from the injection well.

2.6 Conceptual Full-Scale Treatment System Design

Full-scale conceptual treatment system design provided in the RAW included well field design and chemical injection parameters. The following sections summarize recommended full-scale treatment system design.

2.6.1 Full-Scale Treatment Area Well Field Design

Pilot study results indicated a parabola-shaped treated area surrounding the injection well. Based on that finding, the estimated treatment area for each injection well, including treatment area overlap, would be a 30- by 45-foot rectangle (1,350 square feet) oriented parallel to groundwater flow. The injection well in each of the rectangle treatment areas would be located in the center upgradient third of the rectangle. For proper overlap, the injection wells of adjacent treatment areas should be aligned with the upgradient edge of the neighboring treatment area rectangle. Using the delineated aquifer source area of approximately 20,000 square feet and the estimated injection well treatment area of 1,350 square feet, it was calculated that approximately 15 injection wells would be needed for full-scale treatment of the highly impacted saturated soil and groundwater at the site.

In addition to the 15 source area injection wells, another 30 injection/monitoring wells were proposed to surround the source area. The additional wells would envelop the source area aquifer and the identified site groundwater plume that has total selected VOC concentrations of greater than 1,000 μg/L. The conceptual well field outside the identified aquifer source area covers approximately 40,000 square feet.

Initial treatment injections would be concentrated in the source area aquifer (as defined by pretreatment baseline groundwater sampling). Surrounding injection/monitoring wells would be monitored to assess treatment progress and potential outward migration of VOCs. Based on monitoring results, chemicals would be applied to injection wells outside the source area to meet TCRA objectives.

2.6.2 Chemical Injection

The volume, concentration, and injection rate of the chemicals required to achieve the remedial design goals were presented in the RAW and are summarized in the following sections. As discussed in the RAW, the actual volumes of chemicals that would be used to meet TCRA objectives would depend on contaminant distribution and geochemical conditions within the full-scale treatment area.

2.6.2.1 Oxidant Solution

Based on site conditions and pilot test results, it was estimated that approximately ¼ pound of 35 percent hydrogen peroxide solution would be needed to oxidize 1 gram of VOCs (OHM, 2001). Given the assumptions derived in the RAW, VOC mass within the source area aquifer was estimated at 3,638 pounds (combined in water-saturated soil and groundwater). The VOC mass for the area outside the source area aquifer was estimated at 308 pounds (groundwater only). The total estimated mass, if groundwater outside the aquifer source area was to be treated, was approximately 3,946 pounds. Therefore, the volume of 17 percent hydrogen peroxide solution (optimal proportion determined by the pilot study) identified as needed to oxidize the identified contaminant mass at the site was estimated to be approximately 75,000 gallons (OHM, 2001).

2.6.2.2 Conditioning and Catalyst Solution

The results of the third injection event of the pilot study identified that 1,800 to 2,000 gallons of conditioning and catalyst fluid containing 3.5 percent HCl and 500 pounds ferrous sulfate would be needed at each injection well to adequately condition the aquifer prior to oxidant application. From that volume, it is estimated that 80,000 to 90,000 gallons of conditioning/catalyst solution of that makeup would be required to condition the aquifer in and surrounding the source area at the site.

2.6.2.3 Chemical Injection

Optimum pumping pressure and flow rate for conditioning fluids identified during the pilot study were 5 to 15 pounds per square inch (psi), as needed to maintain a flow rate of 6 to 7 gpm. It was also determined that the oxidant solution should be allowed to infiltrate by gravity feed at an estimated flow rate of approximately 2 gpm.

2.7 Recommended Supplemental Site Assessment

The following additional site assessment activities supporting full-scale remediation planning were identified and recommended in the RAW (OHM, 2001):

- Additional assessment of the nature and extent of VOCs in soil and groundwater to delineate the aquifer source area in greater detail
- Verification of site geometry, including the depth to Spanish Bight sediments
- Delineation of vadose zone source area

The location of injection wells for full-scale groundwater treatment would then be selected based on the results of the supplemental study.

3.0 Supplemental Site Assessment

Beginning in February 2001, following the pilot study, additional site assessment activities were performed to characterize the nature and extent of the shallow aquifer and VOC contaminants at the site in greater detail. Supplemental site assessment activities included a geophysical survey, membrane interface probe (MIP)/direct sampling ion trap mass spectrometer (DSITMS) screening, delineation soil sampling, and groundwater well sampling. Data acquired during the site assessment were reported in the RAW addendum (IT, 2001) and are summarized in the following sections.

3.1 Geophysical Survey to Locate Utilities

A second geophysical survey was performed at the site on February 2, 2001, to locate subsurface utilities and other buried features within the southern extent of the site. The intent of the survey was to clear the immediate vicinity of the proposed Navy Site Characterization and Analysis Penetrometer System (SCAPS) boring locations and to supplement the pilot study geophysical survey by delineating buried metallic anomalies to the south of the initial survey.

Various subsurface metallic anomalies (representing buried metallic material) distributed throughout the southern portion of the site were identified during the second geophysical survey. The map provided in the second geophysical survey report incorporates geophysical data acquired from the initial pilot study survey and the second survey to provide a site geophysical map that depicts metallic anomalies and the three utilities within the surveyed portion of the site. Utilities identified to the south of Sherman Road and east of Rogers Road are shown in Figure 2. The second geophysical survey report is provided in Appendix A (A-2).

3.2 MIP/DSITMS Delineation

Site screening was conducted from February 6 through 11, 2001, to assess site soil type and delineate VOC distribution using the SCAPS combined direct-push cone penetrometer testing (CPT) technology and MIP, respectively. Screening was performed at 36 borings locations (S5-MIP-01 through S5-MIP-36) as shown in Figure 3. MIP samples, collected from 140 sample points, were analyzed using a DSITMS.

SCAPS CPT boring logs indicated that the fine-grained Spanish Bight sediments start at about 9 to 10 feet bgs have a minimal thickness of about 2.5 feet. A few fine-grained layers with limited thickness (0.25 to 1 foot) were also identified as being scattered through the upper aquifer from about 6 to 9 feet bgs. CPT boring logs also indicated that the Spanish Bight sediments thin and terminate below the western portion of the VOC plume. SCAPS CPT boring logs are presented in the RAW addendum (IT, 2001).

Compounds that were quantified using the DSITMS included TCE, *cis*-1,2-DCE, VC, and PCE. Identified contaminant concentrations at each of the 140 MIP sample locations represent a combined sorbed, dissolved, and volatile phase concentration for each compound. In many cases, the DSITMS values for total dichloroethene (DCE) and VC were masked by the presence of late eluting VOCs such as fuel hydrocarbons, which are known to be present at the site. Therefore, in addition to specific compound quantification, total ion counts (TICs) were collected to qualitatively assess total VOCs (in all phases) present in the subsurface at the site. Figures 2 and 3 show the MIP delineated extent of TICs exceeding 50,000 in conjunction with the estimated extent of selected VOCs in groundwater identified by Parsons (1999). The MIP boring with the greatest measured contaminant concentration was MIP-28, which is located approximately 28 feet upgradient from monitoring well S5-MW-21. Elevated contaminant concentrations were also identified adjacent to the southeast edge of the site in MIP-09 and MIP-11. SCAPS/MIP boring logs, DSITMS results, and location survey data for SCAPS borings are provided in the RAW addendum (IT, 2001).

3.3 Confirmation and Site Delineation Soil Sampling

Soil sampling was conducted to quantify and confirm selected MIP sample results, to further delineate site contaminants, and to attempt to locate potential vadose zone source areas. Preliminary soil samples (soil borings S5-B-39 to S5-B-48) and secondary soil samples (soil borings S5-B-49 to S5-B-61) were collected using a direct-push drill rig on February 22 and March 21, 2001, respectively (Figure 3). Soil samples were collected at depths ranging from 1.5 to 7.5 feet bgs, with the majority of the samples originating from the lower portion of the vadose zone at 3 to 4 feet bgs. Soil samples were analyzed for VOCs using EPA Method 8260B. Synthetic precipitation leaching procedure (SPLP) was performed on vadose zone soil samples using EPA Method 1312 to produce sample leachate that was analyzed for VOCs using EPA Method 8260B. SPLP/VOC analysis was performed to evaluate the potential impact that contaminated vadose zone soil could have on site groundwater. SCAPS confirmation and site delineation soil sample boring locations are shown in Figure 3. Boring logs, analytical data tables, and laboratory reports for delineation soil samples are provided in the RAW addendum (IT, 2001). Location survey data for delineation soil borings are provided in Appendix B.

The soil sample identified with the highest TCE concentration was collected from soil boring S5-B-41, which is located approximately 28 feet upgradient from MIP-28 (MIP boring with highest identified contaminant concentration). The TCE concentration reported for the soil sample from soil boring S5-B-41 (650 milligrams per kilogram [mg/kg]) was about seven times greater than the TCE concentration reported for the soil sample collected adjacent to MIP-28 in S5-B-46 (89 mg/kg). The TCE leachate concentration derived from the S5-B-41 soil sample was 4,400 µg/L. Analytical data tables and laboratory reports for soil samples are provided in the RAW addendum (IT, 2001).

Of the contaminants detected in the vadose zone soil, only PCE and TCE were consistently found in associated sample leachate. Of these contaminants, TCE concentrations in leachate represented the greater hazard to groundwater. It was established in the RAW addendum (IT, 2001) that a TCE concentration in soil greater than approximately 10 mg/kg corresponded to a potential TCE leachate concentration that could pose a possible impact to groundwater.

3.4 Supplemental Site Assessment Conclusions

Primary conclusions derived from supplemental site assessment data are as follows:

- Spanish Bight sediments thin out to the west and are not present below the western edge of the site VOC plume.
- Elevated contaminant concentrations/groundwater aquifer source area extended farther to the east than previously delineated (MIP TIC contour).
- Elevated VOC concentrations in vadose zone soil in the vicinity of soil boring S5-B-41 likely represented the location of the former eastern liquid waste disposal pit.
- VOC-impacted soil in the suspected eastern former disposal pit represented a potential ongoing contaminant source to groundwater.
- Impacted vadose zone soil with a TCE concentration of greater than 10 mg/kg appeared to have the greatest potential to impact or reimpact (after treatment) groundwater.

Because the identified eastern former disposal pit represented a potential ongoing contaminant source that could reimpact groundwater subsequent to TCRA groundwater treatment, the following actions were recommended in the RAW addendum (IT, 2001):

- Collect soil samples needed to identify the center of the vadose zone source area and to estimate the boundary of the former liquid waste disposal pit.
- Excavate the vadose zone VOC source area, targeting soil with TCE concentrations exceeding 10 mg/kg.

4.0 Vadose Zone Source Area Removal

Vadose source area removal was performed to eliminate an ongoing source of groundwater contamination that could reimpact groundwater following TCRA remediation activities. Removal of the vadose zone source area (suspected to be the former eastern liquid waste disposal pit) included source area delineation, field activity preparation, excavation of impacted soil, site restoration, characterization of excavated soil, and waste disposal.

4.1 Source Area Delineation

Prior to the excavation of the VOC source area, it was necessary to delineate the horizontal extent of impacted soil in the vadose zone. The following sections describe source area delineation soil sampling, sampling results, and the estimated extent of impacted soil that required excavation.

4.1.1 Source Area Delineation Soil Sampling

Preconstruction source area soil sampling was performed on September 6, 2001, to determine the center of the vadose zone source area and to attempt to determine the former boundary of the source area, which was suspected to be the former eastern liquid waste disposal pit. Soil samples were collected from direct-push delineation soil borings S5-B-01D through S5-B-09D (Figures 3 and 4). These borings were located surrounding S5-B-41 (S5-B-04D to S5-B-07D), just east-southeast of those borings (S5-B-02D and S5-B-03D), to the west-northwest of S5-B-40 (S5-B-08D and S5-B-09D), and to the southeast of S5-B-50 (S5-B-01D) as proposed in the RAW addendum (IT, 2001). A soil sample was collected from each of these borings in the lower portion of the vadose zone at approximately 3.8 feet bgs. Soil samples were analyzed for VOCs using EPA Method 8260B. Boring logs were not created for soil borings S5-B-01D through S5-B-09D because of their limited depth and the discrete collection of soil only from the sampled interval. Location survey data for vadose zone source area delineation soil borings is provided in Appendix B.

4.1.2 Source Area Delineation Soil Sampling Results

Elevated TCE concentrations were reported for the four soil samples collected from soil borings S5-B-04D (540 mg/kg), S5-B-05D (1,000/1,100 [duplicate] mg/kg), S5-B-06D (2,300 mg/kg), and S5-B-07D (1,100 mg/kg) that were drilled to encompass soil boring S5-B-41 (the supplemental site assessment boring with the highest reported TCE concentration). Moderate TCE concentrations were reported for the soil samples collected just to the south-southeast of S5-B-41 in soil borings S5-B-02D (150 mg/kg) and S5-B-03D (300 mg/kg). TCE concentrations reported for soil borings S5-B-01D (not detected), S5-B-08D (0.82 mg/kg), and S5-B-09D (1.1 mg/kg) were below the project TCE screening criteria of 10 mg/kg. Supplemental site assessment delineation soil sample results in the vicinity of the suspected source area are shown in Figure 4 and presented in Table 1. Laboratory analytical results for these samples are included in Appendix C.

4.1.3 Estimated Extent of Vadose Zone TCE-Impacted Soil

Elevated TCE concentrations reported for the four soil samples surrounding S5-B-41 suggest that soil boring S5-B-41 is situated in the central portion of the vadose zone TCE source area. The moderate TCE concentrations reported for the soil samples collected in soil borings S5-B-02D and S5-B-03D indicated that soil with contaminant concentrations exceeding the 10-mg/kg project screening criteria extends to the south-southeast from the source area to at least the location of those two borings. Soil boring locations that form the minimum delineated extent of TCE impacted vadose zone soil exceeding 10 mg/kg are S5-B-40, S5-B-46, S5-B-49, S5-B-50, S5-B-02D, S5-B-03D, S5-B-05D, and S5-B-07D (Figure 4). Most of the delineated vadose zone TCE-impacted soil is located beneath Sherman Road.

The estimated surface extent of the excavation to remove impacted soil of the vadose zone source area was identified in the RAW addendum as approximately 70 by 45 feet (IT, 2001), as shown in Figure 4. Based on additional data provided from delineation soil sampling, the planned extent of the proposed excavation would cover about the same surface area as proposed in the RAW addendum, but the location of the excavation was shifted to the northeast to center the dig around the most impacted portion of the delineated source area (Figure 4) and still encompass the area with TCE concentrations exceeding 10 mg/kg.

The final vertical limits of the excavation were to be determined by the presence of groundwater during excavation activities. The site water table occurs at approximately 5 feet (±1 foot) and impacted soil was believed to extend to at least that depth. Based on the estimated surface extent of the excavation and the depth to groundwater, it was estimated that approximately 600 cubic yards of soil would be excavated.

4.2 Excavation Field Activity Preparation

Multiple tasks were performed prior to initiation of site excavation activities. Tasks included acquiring Navy and DTSC site approval; drafting an addendum to the Site Health and Safety Plan (SHSP); acquiring necessary equipment, materials, and personnel; and preparation of the rolloff bin storage area.

Because of the proximity of the site to military and city of Coronado housing, the Navy requested that excavation activities be completed in the shortest time span possible and that the excavation be performed when it would cause the least impact to base operations and personnel. Therefore, it was decided that excavation activities would begin late Friday afternoon and would be completed by the following morning (approximately 16 hours). Because of the time constraint for the completion of the excavation, detailed preparatory excavation planning was necessary and all contingencies had to be considered and prepared for in order to ensure that the task was completed in the allotted time frame.

4.2.1 Site Approval and Public Notification

Prior to the initiation of site remediation activities, site approval was required from the Navy. Site approval by the Navy and the DTSC public notification ensured that base personnel and the public were notified about upcoming site activities, that site activities met DTSC requirements, and that activities would not impact base operations. DTSC (Negative Declaration) and Navy site approval were issued on October 12 and November 15, 2001, respectively. Methods used by the Navy to inform the public about site activities included conducting presentations at NAS North Island Restoration Advisory Board meetings, meetings with city of Coronado administrators and fire department, placing project work plans at the city of Coronado public library for review, running newspaper announcements, and mailing information packets to local residents. The two information packets that were distributed for the site are provided in Appendix D.

4.2.2 Site Health and Safety Plan Addendum

Because the excavation of VOC-impacted soil was a task that was added subsequent to the initiation of the TCRA, an SHSP addendum was drafted to modify the existing SHSP (OHM, 2001) to establish policies and procedures to protect workers and the public from potential hazards posed by the planned excavation. Only changes and/or additions to the original SHSP were presented in the SHSP addendum (IT, 2001). Activities detailed in the SHSP addendum included air monitoring within the worker breathing zone, around the site perimeter, and along the NAS North Island boundary using a portable GC/MS, flame-ionization detector, and detector tube monitoring devices for comparison with action levels. Other activities included monitoring of nuisance odors, traffic control, excavation utility clearance, establishing the excavation exclusion zone, identifying necessary personal protective equipment (PPE), means to reduce vapor emissions, storage container monitoring, site communications, spill response, and contingency planning for aircraft emergencies. The SHSP addendum was provided as an attachment to the RAW addendum (IT, 2001).

4.2.3 Equipment, Materials, and Personnel

Equipment mobilized to the site was selected and sized based on excavation requirements. Necessary equipment for excavation and restoration activities included a track-mounted excavator; rubber tire front-end loaders; gasket-sealing, closed-top, 20-yard soil storage rolloff bins; rolloff bin transfer trucks; a water truck; light towers; handheld air monitoring equipment; two field-portable GC/MS devices for air monitoring; self-contained breathing apparatuses; frequency modulated transceivers; decontamination equipment; and asphalt resurfacing equipment. Materials acquired to complete excavation activities included ¾-inch gravel and soil backfill; asphalt; geotextile; well screen and blank casing for horizontal wells; chemical detector tubes; and PPE specified in the RAW for Level D, Modified Level D, and Level B. Personnel required to complete excavation activities included heavy equipment operators, transfer and water truck drivers, air monitoring personnel, health and safety officer, project oversight personnel, quality control officer, sampling technicians, soil compaction testing technician, general laborers, and asphalt resurfacing personnel.

4.2.4 Rolloff Bin Storage Area

Empty rolloff bins were stored at the site in the immediate vicinity of the excavation to facilitate access during excavation activities. Once rolloff bins were filled with excavated soil, they were transferred to a secured area located approximately 1,000 feet northeast of the site, between Building 662 and the NAS North Island golf course driving range.

4.3 Excavation Activities

The following sections detail the excavation of impacted vadose zone source area soil, the extent of the excavation, and excavation air monitoring.

4.3.1 Soil Excavation

Vadose zone source removal was initiated on December 14, 2001, at 6:00 p.m. Impacted soil was excavated in 10-foot sections (reach of excavator) in a northwesterly direction from the eastern edges of the excavation (Figure 4). For each section, first a 10-foot section of asphalt was pulled up and placed in an open-top rolloff bin. Then the underlying soil without discernible staining was excavated in approximate 2-foot tiers until groundwater was encountered or stained soil was observed. Stained soil was partitioned from unstained soil and placed into separate rolloff bins to simplify waste characterization.

Excavated soil was placed by the track-mounted excavator directly into rolloff bins as it was extracted. Once a rolloff bin was filled with soil and sealed, it was loaded onto a bin transport truck and transported to the rolloff bin storage area for sampling and storage. Following the removal of each loaded bin, empty bins were placed within reach of the excavator using a front-end loader equipped with lifting forks.

During the process of removing the first section of soil from the excavation, very dark staining and odor were identified in the central western face of the excavation. The impacted soil was left in place to be excavated as part of the next section of extracted soil. Excavation of the first section continued in tiers until standing water was observed in the excavation at approximately 7.5 feet bgs. Prior to reaching that depth, highly impacted soil (very dark staining) was encountered at about 6.5 to 7 feet bgs extending across the base of the excavation.

Because subsurface conditions differed from what was expected (i.e., soil with a low hydraulic conductivity extending below the planned excavation depth), an assessment of the planned excavation extent was initiated. The reassessment was performed to ensure that excavation activities removed the maximum volume of impacted soil that could not be readily treated by chemical oxidation (i.e., vadose zone or low-permeability soil).

Based on the reassessment of site conditions, a field decision was made that the apparent low-permeability soil in the upper portion of the aquifer (below the vadose zone source area) should be excavated to promote site cleanup and to remove a potential ongoing groundwater contaminant source. Because of the time constraint for the completion of the excavation, only the volume of soil that was originally planned could be excavated from the site. Therefore, to account for the additional soil that would be excavated from below the water table, the southern and western extents of the planned excavation were reduced (Figure 4).

Excavation activities resumed with a target excavation depth of approximately 7 feet bgs. Soil excavation continued to the northwest until the whole of the vadose zone source area was removed.

During excavation of the delineated vadose zone source area, which is suspected to have been the location of the eastern liquid waste disposal pit, various kinds of debris were encountered. Objects encountered included 55-gallon metal drums; 5-gallon metal containers similar to those used to store oil, solvent, paint, etc.; rubber gloves; rags; and other debris. At least six 55-gallon metal drums were excavated coincident with impacted soil. All of the drums identified during the excavation of the former disposal pit were either already crushed or unintentionally crushed during excavation activities. Excavated drums were placed in rolloff bins with related excavated soil.

Three notches (Figure 4) were cut into the southern edge of the excavation to permit the installation of 30-foot-long horizontal infiltration well screens (Section 4.4). The excavated notches were equally spaced along the southern wall, about 4 feet wide, and 3 feet into the side of the excavation, and extended to the depth of the excavation.

Soil excavation and subsequent grooming of the excavation were completed on December 15, 2001, at 3:00 a.m. At completion of the excavation, approximately 3 to 4 inches of standing water was present in the bottom of the excavation, separated by the soil ridges produced by the teeth of the excavator bucket during final grooming. At the conclusion of excavation activities, a total of 51 closed-top rolloff bins and 2 open-top rolloff bins had been filled with excavated soil and asphalt, respectively.

4.3.2 Excavation Extent

Excavated soil removed from the site was derived predominantly from below Sherman Road (Figure 4). The finished dimensions of the excavation were approximately 66 feet long and 34 feet wide, with an average depth of approximately 7 feet bgs; an estimated total volume of 582 cubic yards of soil was excavated.

Because the planned western and southern excavation boundaries were moved inward to account for the additional soil excavated from below the source area water table, a quantity of TCE-impacted soil with concentrations exceeding the project screening level of 10 mg/kg was left in place at the site. TCE delineation sample concentrations for the soil that was not excavated are 11 mg/kg in S5-B-40 (4 feet bgs), 89 mg/kg in S5-B-46 (3 feet bgs), 160 and 100 mg/kg in S5-B-49 (1.5 and 3.5 feet bgs, respectively), and 12 mg/kg in S5-B-50 (4 feet bgs). The estimated volume of soil above the water table with TCE concentrations exceeding project screening criteria is approximately 128 cubic yards. Approximately half of the impacted soil remaining in place is located beneath the pavement of Sherman Road.

4.3.3 Excavation Air Monitoring

Air monitoring was performed to ensure that workers and off-site personnel were not affected by airborne contaminants resulting from excavation activities. Air monitoring was performed in the immediate vicinity of the excavation, at locations surrounding the excavation to a distance of approximately 300 feet, and at distant locations between the excavation and residential areas (near Navy base housing and the NAS North Island/city of Coronado fence line). Monitoring was performed using flame-ionization detectors and two field-portable GC/MSs. The GC/MSs were calibrated to monitor for benzene, 1,1-DCA, methylene chloride, PCE, TCE, toluene, and VC, with a detection limit of 0.2 ppmv for those compounds.

With the exception of a single very low TCE detection of 0.37 ppmv near Building 513 (approximately 600 feet southwest of site), airborne contaminants were not detected away from the excavation. Maximum airborne contaminant concentrations measured in the immediate vicinity of the excavation, as determined by the GC/MS, were TCE at 20 ppmv, 1,1-DCA at 3.0 ppmv, toluene at 1.6 ppmv, PCE at 0.89 ppmv, and methylene chloride at 0.25 ppmv. VC and benzene were not detected during excavation activities. All detected airborne contaminant concentrations were transitory and below project action levels. The excavation air monitoring report is provided in Appendix E (E-1).

4.4 Site Restoration

Site restoration included installing three horizontal wells across the bottom of the excavation; filling the excavation with approximately 4 feet of ¾-inch gravel from the base of the excavation to approximately 3 feet bgs; installing a nonwoven geotextile (Mirafi® 140N) atop the gravel;

placing and properly compacting sand from 3 feet to 4 inches bgs; and repaving Sherman Road with a pavement section consisting of 3 inches of asphaltic concrete over 4 inches of Caltrans Class II aggregate base (Figure 5). Road striping was painted on the replaced asphalt on January 17, 2002. The compaction test report is provided in Appendix E (E-2).

Horizontal wells S5-HIW-01 through -03 were installed at about 1 foot above the base of the excavation during the placement of the ¾-inch gravel. The wells were installed for the injection of chemical oxidants and consist of three 30-foot-long screen sections that were placed perpendicular to Sherman Road at roughly equal intervals along the length of the excavation (Figure 4). Well screens consist of 2-inch-diameter 0.01-inch slot Schedule 80 polyvinyl chloride (PVC) screen that is capped at the northern end and connected to the surface through blank PVC casing that extends upward in the notches that were cut in the southern side of the excavation (Figures 4 and 5). The horizontal injection wells are situated at a depth approximately 1 foot below the water table, immediately under the location of the former source area.

4.5 Excavated Soil Waste Characterization

Waste characterization soil samples were collected from each of the 51 rolloff bins that were filled during excavation activities. Soil samples were collected as grab samples using glass jars and Encore® samplers, as each bin arrived at the bin storage area. Waste characterization soil samples were analyzed by the Navy Public Works Center (PWC) laboratory for VOCs using EPA Method 8260B and the toxicity characteristic leaching procedure (TCLP) using EPA Method 1311/8260A. VOC and TCLP waste characterization soil sample results are provided in Tables 2 and 3, respectively.

Contaminant screening was performed on greater than 10 percent of the waste characterization samples collected, to ensure proper waste disposal and to assess whether other COPC were disposed of in the former liquid waste disposal pit. Soil screening analyses included pesticides by EPA Method 8081A, polychlorinated biphenyls (PCBs) by EPA Method 8082, semivolatile organic compounds (SVOCs) by EPA Method 8270C, and Title 22 metals by EPA Method 6010/7471A. Based on metals analytical data, TCLP for cadmium, chromium, and lead by EPA Method 1311/6010B was also performed on selected soil samples. Contaminants screening analytical results are listed in Tables 4 through 7, and TCLP data for cadmium, chromium, and lead are listed in Table 3. Laboratory analytical reports for waste characterization soil samples are provided in Appendix C.

Contaminants detected in the excavated source area soil included VOCs, PCBs, SVOCs, and metals. Pesticides were not detected. Aroclor-1260 was the only PCB detected, with a maximum reported concentration of 2.10 mg/kg. VOCs detected in excavation waste characterization soil samples are listed in Table 2. Detected SVOCs and maximum reported concentrations are as follows:

- 4-Methylphenol (313 mg/kg)
- 2-Methylnaphthalene (248 mg/kg)
- 2,4-Dimethylphenol (240 mg/kg)
- 2-Methylphenol (210 mg/kg)
- Naphthalene (199 mg/kg)
- Phenol (147 mg/kg)
- Fluorene (61.6 mg/kg)
- Phenanthrene (48.4 mg/kg)
- bis(2-ethylhexyl)phthalate (25.6 mg/kg)
- Acenaphthene (18 mg/kg)
- Dibenzofuran (14 mg/kg)
- 1,2-Dichlorobenzene (14 mg/kg)

Detected metals and maximum reported concentration are as follows:

- Lead (1,510 mg/kg)
- Zinc (693 mg/kg)
- Chromium (487 mg/kg)
- Copper (481 mg/kg)
- Barium (97 mg/kg)
- Cadmium (96 mg/kg)
- Antimony (89 mg/kg)
- Nickel (25 mg/kg)
- Vanadium (22 mg/kg)
- Molybdenum (6 mg/kg)
- Mercury (0.3 mg/kg)

Waste characterization of excavated soil identified that 34 of the 51 rolloff bins contained RCRA hazardous waste that required treatment by incineration prior to disposal. Of the remaining 17 rolloff bins filled with excavated soil, two contained RCRA hazardous waste that required stabilization prior to disposal, two contained RCRA hazardous waste for direct landfill disposal, and 13 contained California hazardous waste for direct landfill disposal. Significantly elevated concentrations of TCE, PCE, and lead were the primary drivers for waste disposal requirements (Tables 2, 3, and 7).

4.6 Disposal of Excavated Waste

A materials profile package was prepared by Shaw Environmental, Inc. for the transportation and disposal of RCRA and California hazardous waste in accordance with U.S. Department of

Transportation (DOT) and EPA regulations. Following the review and approval of the materials profile package by the NAS North Island PWC and the permitted waste disposal facility, hazardous waste manifests for the transportation and disposal of excavated wastes were issued by the PWC.

Excavated wastes were transported to designated waste disposal facilities by MP Environmental beginning on February 12, 2002. RCRA hazardous waste requiring incineration (500 tons) was transported to the Safety Kleen disposal facility located in Aragonite, Utah. RCRA hazardous waste requiring stabilization prior to interment (26.4 tons), RCRA hazardous waste for direct interment (28 tons), and non-RCRA hazardous waste/California hazardous waste (169.5 tons) were transported to the Safety Kleen disposal facility located in Buttonwillow, California. A total of 724 tons of contaminated soil was excavated and transported off site for treatment and/or disposal. The last load of hazardous waste departed NAS North Island on March 4, 2002. Hazardous waste disposal manifests for the soil excavated from the site are provided in Appendix E (E-3).

The estimated mass of VOCs removed from the site through excavation of the vadose zone source area and off-site disposal were calculated using the average mass of total VOCs detected in each bin (waste characterization sampling) and the measured mass of soil in each bin. Mass removal calculations identified that approximately 3,050 pounds of VOCs were disposed of as RCRA hazardous waste requiring incineration (2,987 pounds), non-RCRA hazardous waste/California hazardous waste (56 pounds), and RCRA hazardous waste for direct interment and requiring stabilization prior to interment (7 pounds).

4.7 Western Liquid Waste Disposal Pit Location

The approximate locations of the eastern and western liquid waste disposal pits were identified in the RI/RFI based on the correlation of two apparent pit-type structures seen in a 1948 aerial photograph and the estimated location of Sherman Road (BNI, 1998). Because nearby fixed structures (i.e., Sherman and Rogers Roads, etc.) were not present when the aerial photograph was taken, only a general location for the former disposal pits was provided. During excavation activities, it was confirmed that the eastern liquid waste disposal pit was located under the center of Sherman Road (Figure 4) and provided an additional reference point to correlate site structures with disposal pits seen in the 1948 aerial photograph (BNI, 1998). Therefore, the position of the former western liquid waste disposal pit was refined (Figure 6).

5.0 Exploratory Trenching to Locate Secondary Sources

Following the discovery of 55-gallon metal drums and 5-gallon metal containers in the excavated source area, a supplemental investigation was performed to assess subsurface electromagnetic (EM) anomalies, which were suspected to be landfill debris. This task was performed to determine whether other subsurface metallic objects identified during previous geophysical surveys contained solvents and/or petroleum hydrocarbons that could be ongoing contaminant sources. Tasks related to the investigation of potential secondary sources associated with metallic debris included a geophysical survey to delineate large metallic objects, exploratory trenching to assess identified metallic objects, and disposal of excavated waste.

5.1 Geophysical Survey to Locate Secondary Sources

A geophysical survey was performed at the site on June 5, 2002, to identify and mark locations where relatively large (about one-quarter the size of a 55-gallon metal drum or larger) subsurface metal objects were present. The geophysical survey extended south of Sherman Road and east of Rogers Road for approximately 300 and 360 feet, respectively. Metallic objects were located using a Geonics EM-61 high-sensitivity metal detector and EM utility-locating equipment. EM-61 readings were recorded at 5-foot intervals along a grid established for the geophysical survey. EM utility-locating methods were used following the EM-61 survey in an attempt to delineate the source of identified anomalies. The geophysical survey report to locate potential secondary sources is provided in Appendix A (A-3).

The secondary source geophysical survey identified and marked 34 locations where large metallic objects were present in the subsurface. Identified locations were marked using a wood stake to locate the center of the anomaly and a circle was painted around the stake that corresponded to the apparent size of the object. Plate 1 of the secondary source geophysical survey report in Appendix A (A-3) depicts site features and the locations of identified anomalies.

5.2 Exploratory Trenching

Initial exploratory trenching to quantify secondary sources at the site was performed on June 6 and June 7, 2002, using a backhoe. Locations, pinpointed and marked during the geophysical survey, were excavated until a large metallic object was uncovered and extracted, groundwater was encountered (ranging from 3.5 to 5 feet bgs), or screening indicated the presence of hydrocarbons. Screening of excavated soil and metallic objects for hydrocarbons was performed using a photoionization detector and visual observation.

Excavation of the 34 EM anomaly locations revealed 4 locations where hydrocarbon-related materials were discovered (including rusted and crushed drum fragments, rags, gloves, and a complete drum without lid). At locations where hydrocarbon-related material was discovered, the extracted impacted material was placed in polyethylene drum overpack containers, and the excavation was backfilled to be reassessed at a later date.

Re-excavation of the four possible secondary source locations (Anomalies A, T, X, and Y [Appendix A-3 – Plate 1]) was conducted on June 10 and 11, 2002. Anomalies X and Y were reexcavated on June 10, 2002, and anomalies A and T were re-excavated the following day. No further indications of hydrocarbons were identified during re-excavation of anomalies A and T. Soil and the capillary fringe were not impacted below the hydrocarbon-impacted material (rags, gloves, and dark stained soil within the crushed drum that had a solvent-type odor at about 2.5 feet bgs) that had been found at the Anomaly A location. Soil below the impacted waste and above the capillary fringe at Anomaly T was not impacted below the crushed drum and related soil with solvent-type odor (at about 1.5 to 2 feet bgs) that was removed from the Anomaly T location.

Re-excavation of anomalies X and Y yielded additional drum fragments, rags, impacted soil, and an intact drum without a lid. The locations of Anomalies X and Y are separated horizontally by about 22 feet (Appendix A-3 – Plate 1). Hydrocarbon-related materials found at Anomalies X and Y included impacted soil, drum fragments, and rags with a solvent-type odor extending from 2 feet bgs to the capillary fringe. The lidless intact drum found at Anomaly Y was filled with soil and was situated horizontally within the capillary fringe at the top of the water table, at approximately 3.5 feet bgs. Capillary fringe soil at Anomalies X and Y was stained black and had a solvent-type odor. Soil within the intact drum was disposed of with the drum. Remaining impacted soil at the capillary fringe at Anomalies X and Y was left in place.

Non-hydrocarbon-related materials encountered during exploratory trenching activities included various large metallic objects and landfill debris. With the exception of Anomaly BB, all EM anomaly locations produced a large metallic object or metallic debris. Anomaly BB is situated immediately adjacent to monitoring well S5-MW-26 and the metallic surface completion for that monitoring well may have resulted in a false EM signal. Other material encountered during excavation activities included a very large framed metal object that was left in place at Anomaly GG; a 6.5-foot-diameter concrete ring with suspected iron reinforcement extends from 2.5 feet bgs to greater than 4.5 feet bgs (Anomaly C); general landfill debris, including metal objects, bottles, and rubber (Anomalies DD and CC); and possible incinerated waste that included rusted/corroded metal, glass, and apparent ash (Anomalies FF, V, EE, and T). Excavated material to the south of the runway lights (which bisect the site) consisted of dispersed large metallic objects (large pipes, gears, sheet metal, etc.) but without the generic landfill type debris such as was found to the north of the runway lights.

5.3 Exploratory Trenching Waste Disposal

Impacted soil, related waste (rags, gloves, etc.), drum fragments, and the single intact soil-filled drum uncovered during exploratory trenching were placed directly into polyethylene drum overpack containers for containment and temporary storage. Excavated hydrocarbon-related wastes were then transferred to the NAS North Island PWC Industrial Waste Treatment Plant for characterization and disposal. Inert metallic debris was transported and disposed of at the Miramar Class III landfill.

5.4 Summary of Exploratory Trenching

Exploratory trenching identified that 4 of 34 identified EM anomalies south of Sherman Road and east of Rogers Road contained material related to hydrocarbon waste. Of the four locations identified as containing hydrocarbon waste, only two locations (Anomalies X and Y) were identified as possible secondary sources that may have contributed to the impacted groundwater at Site 5.

6.0 Chemical Oxidation Groundwater Treatment

Full-scale groundwater treatment was performed by Environmental Business Solutions International, Inc. (EBSI), under the oversight of Shaw Environmental, Inc. Groundwater treatment activities included injection well installation, full-scale bench testing, chemical injection, and posttreatment groundwater sampling. Treatment activities were performed with the intended goal of achieving 90 percent VOC concentration reduction of the groundwater plume source area. The following sections detail groundwater treatment activities and results.

6.1 Groundwater Treatment Well Field Design

Additional monitoring well locations were selected based on the identified groundwater plume (Figure 2) to complement existing monitoring wells, to measure whether contaminants were pushed outward from the plume during groundwater treatment (boundary monitoring wells), and to assess VOC reduction within the treatment area (treatment area monitoring wells). Treatment area monitoring well locations were selected such that monitoring wells were situated centrally between planned injection point locations to ensure that ISCO occurred throughout the treatment area. Multiple derivations of well field design were performed to achieve the final well field layout shown in Figures 6 and 7.

Injection well placement was based on the type of injection well selected for use at the site, existing monitoring well locations, the location of the horizontal injection wells within the former source area excavation, and optimal treatment overlap. Because injection wells were installed following the installation and sampling of boundary and treatment area monitoring wells (Section 6.3), injection well placement was based on a more complete understanding of the source area groundwater plume.

6.2 Monitoring Well Installation

Ten additional monitoring wells (S5-MW-31 through S5-MW-40) were installed at the site to monitor groundwater treatment. Monitoring wells were installed on May 1 through 3, 2002, and were developed the following week on May 7 and 8, 2002. Additional monitoring wells were constructed, completed, and developed in accordance with procedures specified in the RAW (OHM, 2001) and in general accordance with the San Diego County Department of Environmental Health *Site Assessment and Mitigation (SAM) Manual* (2003). Soil was collected from selected monitoring well borings (S5-MW-37, S5-MW-38, S5-MW-40) during monitoring well installation for full-scale bench testing. Monitoring well boring locations are shown in Figure 6 and boring logs are provided in Appendix F. Location survey data for full-scale monitoring wells are provided in Appendix B.

6.3 Baseline Groundwater Sampling

Baseline groundwater samples were collected May 14 through 22, 2002, from monitoring wells S5-MW-10, S5-MW-20, S5-MW-21, S5-MW-25, S5-MW-26, S5-MW-28, and S5-MW-30 through S5-MW-40. Groundwater samples were analyzed for VOCs using EPA Method 8260B. Groundwater samples from selected wells (S5-MW-10, S5-MW-21, S5-MW-30, S5-MW-36, and S5-MW-37) were analyzed for general chemistry, including TOC (EPA Method 415.0); sulfide (EPA Method 376.0); hardness (Standard Method 2340B); chloride, nitrate, and sulfate (EPA Method 300.0); and ethane, ethene, and methane (R.S. Kerr [RSK] 175M). General chemistry results were used to gauge the effects of ISCO on the subsequent natural attenuation of residual VOCs. Additional groundwater was collected during baseline sampling from monitoring wells S5-MW-30 and S5-MW-37 for full-scale bench testing.

Groundwater samples were collected by micro-purge sampling using a low-flow bladder pump that was located in the central portion of the aquifer in each monitoring well at approximately 8 feet bgs.

6.3.1 Pre-ISCO Baseline Groundwater Analytical Results

VOCs detected during baseline groundwater sampling (per the EPA Method 8260B analyte list) and their maximum reported concentrations at 10 µg/L or greater are listed below to categorize site groundwater contaminants and their detected upper limit.

- *cis*-1,2-DCE (61,000 µg/L)
- VC (51,000 µg/L)
- Toluene (1,600 µg/L)
- *trans*-1,2-DCE (960 µg/L)
- Naphthalene (570 µg/L)
- m/p-Xylene (240 µg/L)
- o-Xylene (190 µg/L)
- 1,2,4-Trimethylbenzene (140 µg/L)
- Benzene (120 µg/L)
- Ethylbenzene (120 µg/L)
- p-Isoproyplytoluene (120 µg/L)
- 1,2-Dichlorobenzene (100 µg/L)
- TCE (76 µg/L)
- 1,3,5-Trimethylbenzene (70 µg/L)
- 1,4-Dichlorobenzene (58 µg/L)
- Acetone (17 µg/L)
- n-Propylbenzene (17 µg/L)
- Isopropylbenzene (13 µg/L)
- n-Butylbenzene (13 µg/L)

The primary compounds that form the majority of the site contaminant mass in groundwater are VC and *cis*-1,2-DCE. Combined VC and *cis*-1,2-DCE concentrations represent 96 percent of the total VOC concentrations reported for treatment area baseline groundwater samples. Of those, only two treatment area baseline groundwater samples contained TCE, with the highest reported treatment area concentration at 69 µg/L (S5-MW-39). PCE was only detected in one baseline groundwater sample at below the laboratory detection limit (0.4 µg/L in S5-MW-39).

Groundwater laboratory data were used to develop figures of baseline total VOCs (Figure 8); VC and *cis*-1,2-DCE (Figure 9); and toluene and naphthalene (Figure 10) distribution within and surrounding the saturated source area. These figures indicate that the primary groundwater plume extends to the southwest from the excavated source area in a teardrop-shaped configuration (Figure 8).

Baseline total VOC, toluene, and naphthalene contours suggest that at least one (Figures 8 and 10) and possibly two (Figure 10) secondary VOC sources could exist at the site, as indicated by elevated groundwater contaminant concentrations that appear to be unrelated to the main source area plume. The unrelated elevated groundwater concentrations/outlying concentric contours correlate with the location of the western liquid disposal pit (Section 4.7) and are downgradient from identified potential secondary sources EM Anomalies X and Y (Section 5.4) and elevated MIP TICs reported for MIP-09 and MIP-11 (Section 3.2). Baseline groundwater VOC and general chemistry analytical results are presented in Tables 8, 9, and 10.

6.4 Injection Well Installation

The majority of the injection wells installed at the site consist of a steel conveyance pipe that was driven to just above the base of the aquifer and a horizontal sand disk that extends outward from the bottom of the conveyance pipe (Figure 11). These injection wells, identified as propagation wells because of their sand propagation, provide an innovative approach for the introduction of chemicals into the aquifer. The injection of chemicals along the base of the aquifer (where denser than water VOCs tend to reside) and the larger delivery area provided by the propagation permits better distribution of injected chemicals. Because chemicals are distributed through the circular sand lens of the propagation, the resultant radial distribution pattern is larger than the parabolic-shaped treatment area provided by vertical injection wells. Figure 7 displays the estimated chemical distribution area for site injection wells (propagation, vertical, and horizontal) and the resulting treatment area.

Construction of propagation injection wells S5-PIW-01 through S5-PIW-19 included the installation of conveyance pipes, temporary traffic boxes, and sand propagations. Conveyance pipes consist of a 10-foot, 2-inch-diameter, Schedule 40 steel pipe with an end-cap drive point that was pushed to a depth of approximately 10 feet bgs using a direct-push drill rig. The installation of sand propagations involved pushing the drive point downward from the end of steel conveyance pipe, cutting a small horizontal notch using a directional pressure washer bit that was lowered into the void below the conveyance pipe, and injecting sand through the conveyance pipe. Injected sand propagations consisted of Number 12/20 sand and a hydrated guar (a biodegradable food-grade starch) that provided the matrix to carry the injected sand into the subsurface. Conveyance pipes and temporary traffic boxes were installed on June 12 and 13, 2002. The sand propagations were installed from June 21 through June 23, 2002. Propagation injection well locations and well construction details are shown in Figures 6 and 11, respectively. Location survey data for propagation injection wells are provided in Appendix B.

In addition to the 19 propagation injection wells, four vertical injection wells (S5-VIW-02 through S5-VIW-05) were installed at the site on June 14, 2002, using a direct-push drill rig. The four additional vertical injection wells were installed within the downgradient end of the source area groundwater VOC plume. Vertical injection well locations are shown in Figure 6, and well construction diagrams are provided in the EBSI summary report (Appendix G [G-3]). Location survey data for vertical injection wells is provided in Appendix B.

6.5 Pre-ISCO Baseline Soil Sampling

Baseline soil samples were collected on June 27, 2002, from six soil borings (S5-B-01B through S5-B-06B) within the boundary of the VOC groundwater source area (Figure 12). These samples were collected and analyzed for later correlation with posttreatment soil samples. Baseline soil samples were collected from approximately the vertical center of the aquifer at about 7.5 feet bgs in each boring. Additional samples were collected from soil boring S5-B-02B at 4.4 and 11.6 feet bgs at the capillary fringe and the underlying confining layer, respectively. Soil samples were collected using a direct-push drill rig and were analyzed for VOCs by EPA Method 8260B. Baseline soil analytical results are presented in Table 11 and are listed in Figure 12. Location survey data, analytical reports, and boring logs for baseline soil samples are provided in Appendices B, C, and F, respectively.

6.6 Fenton's Reagent Bench Testing

A bench test was performed by Pelorus EnBiotech Inc. (Pelorus) for EBSI to determine appropriate chemicals for the ISCO treatment of the site groundwater plume using a Fenton's-type reaction. The following sections detail bench test methods and results.

6.6.1 Fenton's Reagent Bench Test Methods

Full-scale bench testing for the site was finalized on June 28, 2002. Testing was performed using a slurry of site VOC-contaminated soil and groundwater, which consisted of 30 percent solids by weight. The resulting mixture was placed in separate test vessels for treatment by selected chemicals and as a control sample that was not treated. Oxidant mixtures that were evaluated included hydrogen peroxide; hydrogen peroxide with a mixture of complex organic acids; and hydrogen peroxide with a mixture of complex organic acids and ferrous iron. Oxidant mixtures used a 10 percent hydrogen peroxide solution. Fenton's reagent bench testing activities are detailed in the Pelorus (June 28, 2002) chemical oxidation bench test report provided in Appendix G (G-1).

6.6.2 Fenton's Reagent Bench Test Results

VC and DCE were effectively removed from the treated bench test slurries after two oxidant treatments. The hydrogen peroxide, hydrogen peroxide with a mixture of complex organic acids, and hydrogen peroxide with a mixture of complex organic acids and ferrous iron treatments resulted in a combined VC and DCE reduction of 94.2, 94.0 and 95.9 percent, respectively. A 1.3 percent reduction of combined VC and DCE concentrations was observed in the untreated control sample. Graphs and tables presenting VC and DCE bench text results are provided in the Pelorus Fenton's reagent bench test report provided in Appendix G (G-1).

6.6.3 Fenton's Reagent Bench Test Discussion

Considering the relatively small difference in removal efficiency between the three evaluated treatments, the simplest treatment method was recommended by Pelorus as the preferred groundwater treatment approach for the site. This consists of the use of hydrogen peroxide without aquifer acidification or the addition of ferrous iron. Bench testing indicated that, at least initially, there appeared to be enough naturally occurring iron at the site to support a Fenton's reagent chemical reaction. Furthermore, bench testing indicated that a Fenton's-type chemical reaction occurred without acidification and resulted in a VC and DCE reduction comparable to that produced by the Fenton's reagent reaction.

6.7 Fenton's-Type Reaction Groundwater Treatment

Groundwater treatment was performed at the site in a sequential manner consisting of chemical injection, a rebound period, then groundwater sampling and analysis to assess each treatment cycle. The following sections describe the two Fenton's-type reaction groundwater treatment cycles that were preformed at the site.

6.7.1 First Groundwater Treatment

The first groundwater treatment cycle at the site began on July 15, 2002, and consisted of two injection events. For each event, approximately 4,400 gallons of 17 percent hydrogen peroxide solution was injected into the VOC source area portion of the aquifer, for a total injected volume of 8,800 gallons.

Because naturally occurring ferrous iron was present in site groundwater during the first half of the first treatment cycle, ferrous iron catalyst was not injected. During the second half of the first treatment cycle, ferrous chloride solution was injected prior to the delivery of the hydrogen peroxide solution.

6.7.1.1 First Interim Groundwater Sampling

Posttreatment groundwater sampling for the first treatment cycle was performed from August 12 through August 14, 2002. Groundwater samples were collected from 7 boundary monitoring wells (S5-MW-10, -20, -31, -33, -36, -39, and –40) and from 10 treatment area monitoring wells (S5-MW-21, -25, -26, -28, -30, -32, -34, -35, -37, and -38) (Figure 7). Interim groundwater sampling was initiated 16 days after the completion of the first chemical treatment cycle. Groundwater samples were collected using the same sample collection procedures as used during baseline groundwater sampling. Interim groundwater samples were analyzed for VOCs using EPA Method 8260B.

6.7.1.2 First Interim Groundwater Sampling Results

A comparison of treatment area baseline and first interim groundwater analytical results indicated that a 47.9 percent reduction of total VOCs was achieved in the treatment area as a result of the initial Fenton's-type reaction chemical treatment cycle. Baseline and first interim posttreatment treatment area VOC groundwater sample results are listed in Table 8 and are shown in Figure 13. Laboratory analytical results are provided in Appendix C.

A comparison of boundary well baseline and first interim groundwater results (Table 9 and Figure 14) indicated that the first groundwater treatment resulted in a 28.4 percent reduction of total boundary well VOC concentrations, even though groundwater was not directly treated in the vicinity of the boundary wells (Figure 7). The decrease in groundwater VOC concentrations in boundary wells demonstrated that chemical injection in the treatment area is not resulting in the migration of VOC impacted groundwater from the VOC source area.

6.7.2 Second Groundwater Treatment

The second groundwater treatment cycle at the site was conducted from September 16 through September 22, 2002. A total of approximately 4,400 gallons of a 17 percent hydrogen peroxide solution was injected throughout the treatment area during the second cycle. The majority of the injected chemical was delivered along the center length of the plume where the greatest mass of VOCs continued to persist, as determined from first interim groundwater sampling data. Prior to the injection of hydrogen peroxide, ferrous chloride solution was injected at each injection point to provide catalyst for the Fenton's-type reaction.

6.7.2.1 Second Interim Groundwater Sampling

Posttreatment groundwater sampling for the second treatment cycle was performed October 23 and October 24, 2002. Groundwater samples were collected from monitoring wells S5-MW-21, -25, -26, -28, -30, -32, -34, -35, -37, and -38 (Figure 7). Interim groundwater sampling was initiated 30 days after the completion of the second chemical treatment cycle. Groundwater samples were collected using the same sample collection procedures as used during baseline groundwater sampling. Interim groundwater samples were analyzed for VOCs using EPA Method 8260B.

6.7.2.2 Second Interim Groundwater Sampling Results

A comparison of baseline and second interim treatment area groundwater analytical results indicated that a 48.1 percent reduction of total VOCs was achieved in the treatment area following the second Fenton's-type reaction chemical treatment cycle. The calculated VOC reduction for the second interim treatment event represents an additional 0.2 percent VOC reduction compared with the calculated result (47.9 percent) for the first interim posttreatment sampling event. Baseline and interim posttreatment treatment area VOC groundwater sample results are listed in Table 8 and are shown in Figure 13. Laboratory analytical results are provided in Appendix C.

6.7.2.3 Discussion of Second Interim Groundwater Sampling Results

Likely causes for the apparent lack of continued reduction in groundwater VOC concentrations following the second groundwater treatment event include the following:

- Continued release of sorbed contaminants (from water-saturated and vadose zone soil)
- Diffusion from dead-end pores
- A longer rebound period prior to the collection of the second posttreatment samples (4 weeks for the second period compared with 2 weeks for the first)
- The distance between monitoring wells and injection wells (small percent of total injected chemical/catalyst gets to monitoring points)
- The lack of ferrous iron/catalyst to initiate the Fenton's-type reaction
- The presence of subsurface calcium carbonate that could be acting as a hydroxyl radical scavenger.

Similar results, where subsequent Fenton's-type treatments did not appear to produce significant VOC reduction, were observed by EBSI (Adams, 2002) and Tetra Tech NUS, Inc. (Henn, 2002), at a site located on NAS Dallas. At that site, multiple-treatments using the Fenton's approach were performed but resulted in only limited contaminant reduction. Therefore, to improve the effectiveness of the *in-situ* treatment, the oxidant at that site was changed to potassium permanganate ($KMnO_4$). After two $KMnO_4$ treatments, the NAS Dallas project achieved a reduction in VOC concentrations of more than 95 percent.

6.8 $KMnO_4$ Groundwater Treatment

Because second interim posttreatment groundwater sample results indicated that the Fenton's-type treatment had stalled at the site, the use of $KMnO_4$ was considered for continuing groundwater treatment. The primary characteristics that differentiate chemical oxidation by $KMnO_4$ and Fenton's reaction are that $KMnO_4$ has a slower reaction rate (e.g., weeks compared to minutes) and does not require a catalyst. A slower reaction rate and lack of catalyst permits unreacted oxidants to disperse throughout the aquifer, oxidizing VOCs over a larger area and in finer-grained materials. In addition, the longer persistence of permanganate will allow it to oxidize contaminants that slowly desorb from the sediments. Based on these characteristics and the successful completion of a $KMnO_4$ bench test, it was decided that an aqueous solution of $KMnO_4$ would be used for remaining site groundwater treatments to promote the continued reduction of CAH contaminants into harmless compounds. The following formula shows the breakdown of VC:

$$\mathbf{C_2H_3Cl + 2KMnO_4 + H_2O \rightarrow 2CO_2 + 2MnO_2 + KCl + KOH + 2H_2}$$

Where:

C_2H_3Cl = Vinyl chloride
$KMnO_4$ = Potassium permanganate
H_2O = Water
CO_2 = Carbon dioxide
MnO_2 = Manganese dioxide
KCl = Potassium chloride
KOH = Potassium hydroxide
H_2 = Hydrogen

A telephone meeting was held on November 26, 2002, between the DTSC, Navy, Shaw Environmental, Inc., and EBSI to discuss the planned oxidant change. A field modification notification letter detailing the oxidant switch from Fenton's to $KMnO_4$ was provided to the DTSC on December 6, 2002 (SWDIV, 2002).

6.8.1 $KMnO_4$ Bench Test

A bench test was performed by Pelorus for EBSI to evaluate the efficiency of $KMnO_4$ in reducing site groundwater VOC concentrations through chemical oxidation. The following sections detail bench test methods and results.

6.8.1.1 $KMnO_4$ Bench Test Methods

The $KMnO_4$ bench testing for the site was finalized on November 21, 2002. Bench testing was performed by creating a slurry of VOC-contaminated soil (collected from S5-MW-37 for the initial site bench test) and groundwater (collected from S5-MW-21 on November 11, 2002) that consisted of approximately 40 percent solids by weight. The resulting mixture was then placed in separate test vessels for treatment by selected chemicals and as a control sample that was not treated. Four $KMnO_4$ bench test treatments were performed. A 1 percent $KMnO_4$ solution was applied for the first two treatments, and a 0.25 percent solution was applied for the last two treatments. $KMnO_4$ bench testing activities are detailed in the Pelorus (November 21, 2002) chemical oxidation bench test report provided in Appendix G (G-2).

6.8.1.2 $KMnO_4$ Bench Test Results

$KMnO_4$ bench test results relative to the control sample indicated a 96 and 94 percent reduction of VC and DCE, respectively. Consumption of $KMnO_4$ in the bench test was significantly higher then the theoretical requirements for complete oxidation.

Elevated $KMnO_4$ consumption suggests that the natural oxidant demand of site soil will likely reduce the effectiveness of injected chemicals. Graphs and tables presenting VC and DCE bench text results are provided in the Pelorus $KMnO_4$ bench test report provided in Appendix G (G-2).

6.8.2 Third Groundwater Treatment

The third groundwater treatment cycle at the site was conducted from December 9 through December 19, 2002. The first half of the third treatment cycle consisted of the injection of 1,540 pounds of $KMnO_4$, throughout the treatment area, for a total injected volume of approximately 4,300 gallons of a 4 percent $KMnO_4$ solution. Because the desired distribution of $KMnO_4$ was not observed in site monitoring wells following the first $KMnO_4$ injection, a groundwater treatment pilot study targeting monitoring well S5-MW-21 was performed.

The pilot study, performed on December 18 and 19, 2002, consisted of treating groundwater surrounding monitoring well S5-MW-21 using 660 pounds of $KMnO_4$ (injected through propagation injection wells S5-PIW-04, -07, and -09), while at the same time extracting groundwater from S5-MW-21 a low flow rate (approximately 1 gpm) to distribute chemicals from the injection points to the monitoring point. Groundwater extracted from S5-MW-21 was treated with $KMnO_4$ and then injected, as allowed under RCRA Section 3020 (EPA, 2000), into the two adjacent upgradient propagations (S5-PIW-04 and -07) as part of the pilot study. A total of approximately 1,600 gallons of a 4 percent $KMnO_4$ solution was injected during the pilot study. Of that volume, approximately one-third was groundwater (approximately 580 gallons) that was extracted from S5-MW-21, treated, and returned to the aquifer. $KMnO_4$ was not identified in monitoring well S5-MW-21 either during or after the pilot study.

A total of approximately 5,900 gallons of a 4 percent $KMnO_4$ solution was injected into the site aquifer during the third groundwater treatment cycle. That volume of liquid delivered 2,200 pounds of $KMnO_4$ for the continued reduction of source area groundwater VOCs.

6.8.2.1 Third Interim Groundwater Sampling

The third interim posttreatment groundwater sampling was performed on January 7, 2003. Because the third groundwater treatment cycle did not result in the evidence of $KMnO_4$ migrating from injection points to site monitoring wells, only three treatment area monitoring wells were sampled to assess results of the third treatment cycle. The samples were collected from site monitoring wells S5-MW-21, -26, and -34 (Figure 7), which continued to indicate elevated site VOC concentrations compared with other treatment area monitoring wells. Interim groundwater sampling was initiated 18 days after the completion of the third chemical treatment cycle. Groundwater samples were collected using the same sample collection procedures as used during baseline groundwater sampling. Interim groundwater samples were analyzed for VOCs using EPA Method 8260B by the NAS North Island PWC laboratory.

6.8.2.2 Third Interim Groundwater Sampling Results

A comparison of the results for the third and second interim posttreatment groundwater samples indicated a total VOC concentration increase of 25, 118, and 210 percent in monitoring wells S5-MW-21, -26, and -34, respectively. Baseline and interim posttreatment treatment area VOC groundwater sample results are listed in Table 8 and are shown in Figure 13. Laboratory analytical results are provided in Appendix C.

6.8.2.3 Discussion of Third Interim Groundwater Sampling Results

$KMnO_4$ was not observed in S5-MW-21 during or following the mini-groundwater treatment pilot study, suggesting that the chemical was consumed before reaching the well. Mini-pilot study results indicated that the quantity of $KMnO_4$ needed to treat impacted groundwater at the site is much greater than the initial estimated field quantities calculated by EBSI.

6.8.3 Additional Vertical Injection Well Installation

Six additional vertical injection wells (S5-VIW-06 through -11) were installed at the site on January 29, 2003, using a hollow-stem auger drill rig. Additional vertical injection wells were installed to permit a more focused treatment of the VOC source area groundwater plume where elevated contaminant concentrations continued to persist (demarcated by monitoring wells S5-MW-21, -26, and -34 [Figure 13]). Additional vertical injection well locations are shown in Figure 6, and well construction diagrams are provided in the EBSI report (Appendix G [G-3]). Location survey data for the additional vertical injection wells are provided in Appendix B.

6.8.4 Fourth Groundwater Treatment

The fourth and final groundwater treatment cycle began on January 30 and was completed February 19, 2003. The fourth treatment cycle consisted of the injection of 13,228 pounds of $KMnO_4$ throughout the VOC source area groundwater plume where elevated contaminant concentrations continued to persist, for a total injected volume of approximately 34,900 gallons of a 4 percent $KMnO_4$ solution.

Of the approximately 34,900 gallons of 4 percent $KMnO_4$ solution that was injected into the site aquifer during the fourth treatment cycle, approximately 295 gallons was groundwater extracted from monitoring wells S5-MW-21, -24, -27, -28, and -30. Groundwater extracted from these wells was treated with $KMnO_4$ and then injected into adjacent vertical injection wells.

6.9 Initial Posttreatment Groundwater Sampling

Initial posttreatment groundwater sampling of treatment area monitoring wells was conducted to quantify VOC reduction resulting from the multiple chemical oxidation groundwater treatments 30 and 48-days subsequent to the last site chemical injection. Groundwater testing was also performed following treatment activities to assess groundwater VOC concentrations in boundary and perimeter monitoring wells. The following sections summarize initial posttreatment groundwater sampling activities and results.

6.9.1 Initial Posttreatment Groundwater Sampling Activities

The 30-day posttreatment groundwater samples were collected March 24 through 26, 2003, from treatment area monitoring wells S5-MW-21, -25, -26, -28, -30, -32, -34, -35, -37, and -38. Confirmation 48-day posttreatment groundwater samples were collected from the same monitoring wells, excluding S5-MW-26, -34, and -37 on April 8 and 9, 2003. Initial posttreatment groundwater samples were collected from boundary and perimeter monitoring wells S5-MW-10 through -20, -22, -23, -31, -33, -36, -39, and -40 from April 23 through April 25, 2003.

Initial posttreatment groundwater samples were analyzed for VOCs using EPA Method 8260B, and selected wells (S5-MW-10, -21, -30, -36, and -37) were analyzed for TOC (EPA Method 415.0); sulfide (EPA Method 376.0); hardness (Standard Method 2340B); chloride, nitrate, and sulfate (EPA Method 300.0); and ethane, ethene, and methane (RSK 175M) to evaluate the effects of the full-scale ISCO treatment on the natural attenuation of the residual VOCs. Groundwater samples were collected using the same sample collection procedures used during baseline groundwater sampling and subsequent interim sampling events.

6.9.2 Initial Posttreatment Groundwater Sampling Results

A comparison of analytical results from the baseline and 30-day posttreatment treatment area samples indicated that an 83.4 percent concentration increase of total VOCs in groundwater had occurred relative to baseline data. The significant increase in groundwater VOC concentrations was found to occur predominantly in monitoring wells S5-MW-25, -28, and -32 (Figure 13). Total VOC concentrations for S5-MW-25 increased from the second interim posttreatment sample concentration of 2,486 μg/L to a concentration of 210,800 μg/L, almost twice the highest site baseline groundwater concentration (114,460 μg/L detected in source area monitoring well S5-MW-21).

Because of the elevated posttreatment treatment area VOC groundwater results, confirmation samples were collected from treatment area monitoring wells, except for monitoring wells S5-MW-26, -34, and -37. Samples were not collected from S5-MW-37, since the posttreatment total VOC result for that upgradient monitoring well was very low. Samples were not collected from S5-MW-26 and -34 because visible evidence indicated that $KMnO_4$ was still present in groundwater (i.e., purple color resulting from dissolved unreacted $KMnO_4$). The continued presence of $KMnO_4$ in groundwater indicates that the injected oxidant is available to oxidize existing organic compounds including dissolved phase and sorbed phase contaminants.

The 48-day confirmation sample results indicated that a 57.1 percent concentration increase of total VOCs in groundwater had occurred with respect to baseline data (Figure 13); representing an approximate 26.3 percent decrease in total groundwater VOC concentrations relative to 30-day posttreatment sample results (verifying the expected continuation of oxidation of desorbed contaminants in the aqueous phase). Although the 48-day posttreatment analytical results suggest that groundwater VOC concentrations are decreasing, significant VOC concentration increases (43,510 to 149,200 μg/L) were observed for the source area monitoring well S5-MW-21. These concentrations exceeded the baseline concentration for that monitoring well (Figure 13), indicating that desorption of sorbed contaminants was still occurring at the time of sampling.

A comparison of boundary well baseline and initial posttreatment groundwater results (Table 9 and Figure 14) indicated that total VOC concentrations in boundary wells have decreased by 26.6 percent since ISCO treatments were initiated. Groundwater concentrations in boundary wells have predominantly displayed a decreasing VOC concentration and have remained below baseline levels, with the exception of monitoring well S5-MW-20, where initial posttreatment results were observed to increase to just above detected baseline groundwater concentrations.

Treatment area and boundary pretreatment and posttreatment VOC groundwater sample results are listed in Tables 8 and 9, and are shown in Figures 8 through 10, 13, and 14. Perimeter monitoring well VOC data are listed in Table 12. Laboratory analytical results are provided in Appendix C.

6.9.3 Discussion of Initial Posttreatment Groundwater Sampling Results

The analytical results for 30-day posttreatment groundwater samples indicated that chemical oxidation via $KMnO_4$ had reduced aqueous-phase VOC concentrations in portions of the source area plume where the focused treatment had occurred, as illustrated by the decrease in VOC concentrations observed for S5-MW-21 and the continued presence of dissolved $KMnO_4$ in S5-MW-26 and -34. In contrast, the remaining 30-day analytical results for other treatment area monitoring wells showed an increase in aqueous-phase VOC concentrations, indicating that the $KMnO_4$, in addition to oxidizing aqueous phase contaminants, had fostered the release of a significant quantity of sorbed contaminants from the aquifer matrix.

The analytical results for 48-day posttreatment groundwater samples showed that within the 18-day period between the first and second posttreatment sampling events, groundwater VOC concentrations were beginning to decrease, significantly in monitoring wells S5-MW-25 and -32, suggesting that oxidation of aqueous-phase contaminants was continuing. The results from the second 48-day posttreatment samples also indicated that groundwater concentrations in source area monitoring well S5-MW-21 had rebounded to concentrations exceeding baseline concentrations, further suggesting that the $KMnO_4$ treatment of the source area released sorbed contaminants from aquifer matrices to the aqueous phase for continued oxidation. Increases in aqueous phase *cis*-1,2-DCE and VC were most predominant; other compounds exhibiting increased concentrations in the aqueous phase posttreatment samples include 1,2,3-trichloropropane, acetone, and toluene.

The continued decreasing concentration trend in boundary well groundwater data demonstrates that ISCO treatment of the source area is not mobilizing site contaminants outward from the source area plume. The observed groundwater VOC concentration increase in boundary monitoring well S5-MW-20 is believed to be unrelated to ISCO activities because of the location of that well and the correlation that groundwater concentrations in S5-MW-20 appear to be related to a former secondary VOC source location (Sections 5.4 and 6.3.1 and Figure 10) that is unrelated to the primary VOC source.

6.10 Posttreatment Soil Sampling

On March 27, 2003, posttreatment soil samples were collected from six soil borings (S5-B-01P through -06P) within the boundary of the VOC groundwater source area (Figure 12) using the same procedures as baseline soil sampling. Posttreatment soil samples were collected from locations approximately 1 foot from baseline soil samples and at approximately the same depth as baseline soil samples (samples were collected from the vertical center of the aquifer at about 7.5 feet bgs in each boring, with an additional sample collected at 4.4 [capillary fringe] and 11.6 feet bgs [confining layer below the aquifer] in soil boring S5-B-02P). Soil samples were collected using a direct-push drill rig and were analyzed for VOCs by EPA Method 8260B.

6.10.1 Posttreatment Soil Sampling Results

Posttreatment soil analytical data showed similar or increased VOC concentrations relative to baseline soil sample results in four (S5-B-02 through -05) of the six samples that were collected from the center of the site aquifer. Decreasing and increasing trends for the capillary fringe and confining layer samples, respectively, were observed for those samples collected in soil boring S5-B-02 (Figure 15). Primary contaminants that contributed to the increase in VOC concentrations in posttreatment soil samples were 1,2,3-trichloropropane, *cis*-1,2-DCE, toluene, TCE, and xylenes. Baseline and posttreatment soil analytical results are presented in Table 11 and are shown in Figures 12 and 15. Analytical reports for posttreatment soil samples are provided in Appendix C.

6.10.2 Discussion of Posttreatment Soil Sampling Results

A decreasing trend in soil VOC concentrations is expected in areas where groundwater is being treated by ISCO, although that trend was not observed within the limited sample set collected at the site. Of the six posttreatment soil samples collected, VOC concentration decreases were only observed in the two soil samples that were collected upgradient and lateral to the excavated source area. The greatest VOC concentration increases were reported for soil samples that were collected downgradient and laterally downgradient of the former source area. The apparent contaminant concentration increases observed may be the result of soil and contaminant heterogeneities, the limited number of soil samples collected may not be representative of the site, and/or possibly due to the influx of impacted groundwater resulting from contaminant desorption following the last $KMnO_4$ treatment.

6.11 Groundwater Level Measurements

Groundwater levels were measured in site monitoring wells on April 21, 2003. Contoured groundwater levels are shown in Figure 16 and indicate that groundwater flow through the center of the site VOC plume it to the southwest. Posttreatment groundwater contours and flow direction correlate well with the groundwater contours and flow direction identified for the site on April 16, 1998, by Parsons (1999).

6.12 Injection Well and Vapor Monitoring Point Abandonment

Twenty-nine injection wells (S5-PIW-01 to -19 and S5-VIW-02 to -11) and three pilot study vapor monitoring points (S5-SG-01 to -03) were abandoned during the period of June 10 through June 13, 2003. Abandonment was performed to remove temporary vertical injection wells from the site and to ensure that subsurface voids produced by chemical injections were properly closed. Pilot study vapor monitoring points were abandoned because they were no longer needed.

Well abandonment consisted of removing the surface completion, extracting the well casing/propagation conduit, filling the resultant void to above the level of groundwater with #2/16 well sand, excavating the immediate vicinity of the well using a backhoe to just above the level of groundwater and outward to the extent of any voids, backfilling the excavation to 4 feet below grade with the excavator providing compaction of soil using excavator bucket, and backfilling the excavation from 4 feet to surface using the excavator and a hand-operated compactor to compact excavated soil to a consistency denser than the surrounding soil. Abandonment was performed in this fashion to ensure that the aquifer is maintained as a continuous body (using #2/16 sand), to prevent the formation of sinkholes, and to ensure that manmade conduits to the subsurface do not exist.

Surface completions for the three site horizontal wells S5-HIW-01 to -03 were removed to ensure that they did not present a trip hazard and to protect the wells from vehicular traffic. Horizontal well conduit pipes were cut off at approximately 1.5 to 2 feet below ground surface and secured with a locking well cap. The ends of the cut-off piping extend approximately 3.5 feet from the edge of Sherman Road asphalt, and can be located using survey data for each well location (Appendix B). Horizontal injection wells were left in place for potential future source area treatment activities. If it is decided that the horizontal injection wells are no longer needed they should be abandoned in place.

6.13 Final Posttreatment Groundwater Sampling

Final posttreatment groundwater sampling of treatment area and boundary monitoring wells was conducted to quantify groundwater VOC reduction following a limited aquifer stabilization period of approximately 4 months. The following sections summarize final posttreatment groundwater sampling activities and results.

6.13.1 Final Posttreatment Groundwater Sampling Activities

Final posttreatment groundwater sampling consisted of an initial screening sampling event of four treatment area wells followed by a final posttreatment sampling event of treatment area and boundary monitoring wells. Screening 106-day posttreatment groundwater samples were collected from treatment area monitoring wells S5-MW-21, -25, -28, and -30 on June 5, 2003.

Final 138-day posttreatment groundwater samples were collected on July 7 through 9, 2003, from treatment area monitoring wells S5-MW-21, -25, -28, -30, -32, -35, -37, and -38 and boundary monitoring wells S5-MW-10, -20, -31, -33, -36, and -40. Groundwater samples were not collected from treatment area monitoring wells S5-MW-26 and -34 because visible evidence indicated that $KMnO_4$ was still present in groundwater (i.e., purple color resulting from dissolved unreacted $KMnO_4$), suggesting that VOCs are no longer present at those locations. Monitoring well S5-MW-39 was not sampled due to golf course construction activities that prevented access to that monitoring well.

Screening final posttreatment and final posttreatment groundwater samples were analyzed for VOCs using EPA Method 8260B, and selected wells (S5-MW-10, -21, -30, -36, and -37) were analyzed for TOC (EPA Method 415.0); sulfide (EPA Method 376.0); hardness (Standard Method 2340B); chloride, nitrate, and sulfate (EPA Method 300.0); and ethane, ethene, and methane (RSK 175M). Groundwater samples were collected using the same sample collection procedures used during baseline groundwater sampling and subsequent sampling events.

6.13.2 Final Posttreatment Groundwater Sampling Results

A comparison of analytical results for baseline and 138-day final posttreatment treatment area samples indicated that an approximate 8.6 percent concentration decrease of total VOCs in groundwater has occurred relative to baseline data (Figure 17). Identified total VOC reduction relative to 30-day and 40-day sample data is predominantly related to decreasing groundwater contaminant concentrations observed for monitoring wells S5-MW-25, -28, -32, and -35 (Figure 13). Groundwater VOC concentrations in S5-MW-21 have oscillated from significantly below baseline (30-day), to above baseline (48-day), to just below baseline (106-day), to again above baseline concentrations at approximately 125,200 μg/L. Groundwater concentrations in monitoring well S5-MW-30 have displayed an increasing trend since initial posttreatment sampling began. Baseline and final posttreatment treatment area VOC groundwater sample results are listed in Table 8 and are displayed in Figures 8, 13, and 17. Baseline and final posttreatment analytical results for *cis*-1,2-DCE and VC and for toluene and naphthalene are shown in Figures 9 and 10, respectively. Laboratory analytical results are provided in Appendix C.

An assessment of final posttreatment groundwater sample analytical results indicates that the majority of the remaining site contaminant mass in treatment area groundwater at the site continues to be VC and *cis*-1,2-DCE (Table 8). Combined VC and *cis*-1,2-DCE concentrations represent approximately 96.5 percent of the total VOC concentrations that were reported for final posttreatment treatment area groundwater samples.

A comparison of baseline and final posttreatment groundwater results for boundary wells (Table 9 and Figure 14) indicated that a 45.8 percent reduction of total VOCs occurred in the groundwater surrounding the source area plume since groundwater chemical treatment was initiated, although groundwater was not directly treated in the vicinity of the boundary wells (Figure 7).

6.13.3 Discussion of Final Posttreatment Groundwater Sampling Results

Groundwater analytical results suggest that contaminant concentrations have generally stabilized in six (S5-MW-25, -26, -28, -32, -34, and -35) of the 10 treatment area monitoring wells (Figure 13). The four remaining treatment area monitoring wells (S5-MW-21, -30, -37, and -38) display either an oscillating VOC concentration (S5-MW-21), an elevated increasing trend (S5-MW-30), or a slight increasing trend (S5-MW-37 and -38). The elevated increasing concentration observed in S5-MW-30 is believed to be related to its proximity to $KMnO_4$-saturated groundwater present in and surrounding S5-MW-26. Based upon treatment area monitoring well data (Figure 17), the majority of the contaminant mass remaining in the saturated zone at the site is localized in the vicinity of S5-MW-21 (adjacent to source area) and S5-MW-30. The continued presence of $KMnO_4$-saturated groundwater in the vicinity of S5-MW-25 and -34 after approximately 4.5 months strongly suggests that both dissolved and adsorbed contaminants no longer exist within the aquifer at those two locations.

The approximately 50 percent decrease in total VOC concentrations in boundary monitoring wells clearly demonstrates that ISCO activities have not resulted in outward migration of VOC-impacted groundwater and that the site VOC plume is shrinking as a result of the TCRA. The reduction of VC and *cis*-1,2-DCE groundwater concentrations in the majority of treatment area monitoring wells, as shown in Figures 8, 9, and 17, demonstrates that the plume and contaminant concentrations within the plume have been reduced. Concentrations of toluene and naphthalene, which are beneficial to microbial degradation of contaminants, remain relatively unchanged compared to pretreatment groundwater concentrations (Figure 10).

6.14 Groundwater Water Quality Objectives

The effectiveness assessment of ISCO treatment for the TCRA is based upon regulatory water-quality objectives (WQOs) for groundwater and a calculated residual source area VC groundwater concentration that is protective of the nearest natural (nonintrusive) pathway to potential ecological and human receptors.

6.14.1 TCRA WQOs

The WQOs used for site groundwater data evaluation include RWQCB interim cleanup goals for sites located within 1,000 feet of a marine surface water for BTEX and PAHs (RWQCB, 1996) and California Ocean Plan numerical water quality values (Human Health [30-day Average] aquatic organism consumption only) that were supplemented by Acute Saltwater Aquatic Life Protection values (RWQCB, 2000). Table 13 presents site WQOs for the EPA Method 8260B VOC analyte list.

Final posttreatment VOC analytical results indicate that VC and 1,4-dichlorobenzene are the only detected site groundwater contaminants that exceed the project VOC WQOs listed in Table 13. Elevated VC concentrations, ranging from 75 µg/L to 30,000 µg/L, were detected in seven of the ten treatment area monitoring wells (Table 8) at concentrations that exceed the 36 µg/L Ocean Plan WQO for VC. A single 1,4-dichlorobenzene detection in S5-MW-39 at 22 µg/L was reported, which exceeded the 18 µg/L Ocean Plan WQO for this compound (Tables 9 and 14).

6.14.2 Upper VC Contaminant Limit

TCRA decision rules provided to guide the full-scale ISCO groundwater treatment process require that a maximum allowable residual source area groundwater (target) concentration be derived using the EPA developed BIOCHLOR model. The model-derived target concentration would be used to assess source-area groundwater concentrations in the event that ISCO does not achieve WQOs in the source-area. BIOCHLOR modeling was performed for VC (primary site contaminant of concern), assuming baseline site conditions, and monitoring well S5-MW-13 (adjacent to slough [the nearest nonintrusive receptor pathway]) as the point of compliance location where groundwater concentrations should not exceed the WQO for VC.

BIOCHLOR modeling, based on site-specific biotransformation rates, determined that VC concentrations at the point of compliance will exceed the VC WQO only if the source area VC concentration is greater than 5,000,000 µg/L. Because that concentration exceeds the solubility limit of VC, the lower solubility limit for VC of 1,100,000 µg/L is selected as the target VC groundwater concentration for the source area that would be protective of the nearest nonintrusive receptor.

6.15 ISCO Groundwater Contaminant Mass Reduction

Contaminant mass reduction estimates for the site were calculated using the total mass of injected oxidants and site soil and groundwater oxidant demand ratios derived for each oxidant during bench testing. Bench testing identified that an estimated 15 pounds of $KMnO_4$ and 712 pounds of 15 percent hydrogen peroxide solution were required to destroy 1 pound of VOCs. Therefore, the VOC mass reduction resulting from the injection of 13,200 gallons (110,088 pounds) of 15 percent hydrogen peroxide and 15,428 pounds of $KMnO_4$ would be approximately 155 pounds and 1,028 pounds, respectively. Because $KMnO_4$ still persists in groundwater in the vicinity of monitoring wells S5-MW-26 and -34, a 30 percent adjustment was applied to the $KMnO_4$ VOC reduction estimate (1,028 pounds) to account for the unreacted oxidant; producing an estimated VOC reduction of 720 pounds for $KMnO_4$ injected at the site. Based upon these calculations, it is estimated that approximately 875 pounds of VOCs were removed from the site through ISCO. This estimate is considered an upper bound because bench tests are performed under ideal conditions and have less variability than field conditions.

Estimating contaminant mass reduction through the lessening of VOC groundwater concentrations resulting from ISCO was the planned method to gauge the effectiveness of groundwater treatments at the site. Because of continued contaminant desorption that resulted following ISCO (Figure 13), it was found that depending solely on groundwater results to gauge the effectiveness of site groundwater treatments was not effective. The limited pre- and posttreatment soil data collected at the site also was found to be an ineffective method to gauge ISCO mass reduction. Of the six soil samples collected from the center of the aquifer (about 7.5 feet bgs), four displayed net increases in VOC concentrations (Section 6.10.2 and Figure 15) instead of the expected reductions. However, heterogeneities in the distribution of VOCs may lead to large sample-to-sample variability and prevent accurate estimates of VOC mass reduction by re-sampling soil over time, unless a large number of samples are obtained.

Based upon project analytical results, an accurate method to gauge site contaminant mass reduction is not available due to the desorption of adsorbed contaminants, the localized mobilization of contaminants, and the heterogeneities (contaminant concentration and lithology) of the site. Large scale baseline and posttreatment soil sampling following a sufficient aquifer stabilization period in conjunction with groundwater sampling is likely to be the most accurate method available to directly account for contaminant mass reduction at ISCO sites.

7.0 Monitored Natural Attenuation Assessment

Groundwater sampling and analysis were performed at the site to assess and document baseline site conditions and to gauge the effect of ISCO on the natural attenuation of residual VOCs. Monitoring included conducting pretreatment and posttreatment microbial sampling and evaluating posttreatment groundwater monitoring data.

7.1 Baseline Microbial Characterization

Baseline microbial sampling and analysis were performed to identify and quantify whether dehalorespiring bacteria are present in site groundwater. Microbial assessment activities were performed as a joint effort by BNI and Shaw Environmental, Inc. The following sections detail microbial sampling activities and results.

7.1.1 Baseline Microbial Sampling Activities

Pretreatment microbial groundwater sampling was performed on July 11, 2002, three days prior to the initiation of full-scale groundwater treatment. Groundwater samples were collected from monitoring wells S5-MW-20, -21, -30, -36, and -38 (Figure 7) by Shaw Environmental, Inc., using low-flow groundwater sampling procedures. BNI processed, packaged, and transported the extracted groundwater samples to Microbial Insights, Inc., and SiREM Laboratory (SiREM) for analyses. Analyses performed included phospholipid fatty acid content (PLFA) and deoxyribonucleic acid (DNA) at the Microbial Insights laboratory and denaturing gradient gel electrophoresis (DGGE) and Gene-Trac analyses at the SiREM laboratory.

7.1.2 Baseline Microbial Sampling Results

Baseline microbial sampling and analysis determined that *Dehalococcoides ethenogenes* (DHE), the only isolated microorganism capable of the complete dechlorination of toxic chlorinated hydrocarbons (e.g., PCE, TCE, and VC) into harmless ethene (SiREM, 2002), is present in site groundwater. DNA testing identified DHE in each of the five groundwater samples collected and established that DHE levels at Site 5 are relatively high compared with other sites. Baseline DHE intensity or relative abundance was high for monitoring wells S5-MW-20, -21, -30, and -38, and low for S5-MW-36 (upgradient well).

The highest detected microbe biomass level (total concentration of PLFA) was detected in the sample collected from monitoring well S5-MW-30, which is located within the downgradient portion of the source area plume (Figure 8). Moderate biomass levels were detected in source area monitoring well S5-MW-21 and outside the primary source area plume within an adjacent suspected secondary source plume (Section 6.3.1) in monitoring well S5-MW-20. Low and very low biomass levels were reported for cross-gradient well S5-MW-38 and upgradient well S5-MW-36, respectively.

PLFA profiles reveal a moderately diverse microbe community in groundwater samples collected from monitoring wells S5-MW-20, -21, and -30. Identified microbes in those samples and other site groundwater samples mainly consist of Gram-negative bacteria, which have the ability to use a wide range of carbon sources and adapt quickly to changing environmental conditions. Baseline microbial laboratory analytical reports are provided as Appendix H (H-1 and H-2).

7.2 Posttreatment Microbial Assessment

Posttreatment microbial sampling and analysis were performed to assess the fate of treatment area microbes following groundwater treatment activities. The following sections detail posttreatment microbial sampling activities and results.

7.2.1 Posttreatment Microbial Sampling Activities

Posttreatment microbial groundwater sampling was conducted on April 2, April 30, June 5, and July 9, 2003. During the four sampling events, groundwater samples were collected from monitoring wells S5-MW-21 and -30 (Figure 7) using low-flow groundwater sampling procedures. Microbial sample analyses were performed by Microbial Insights, Inc., and included PLFA and DNA testing.

7.2.2 Posttreatment Microbial Sampling Results

Posttreatment DHE intensity or relative abundance for monitoring well S5-MW-21 was not detected in groundwater during the first posttreatment microbial sampling; it was detected at moderate levels during the second and third sampling event, and was detected at high intensity similar to baseline during the fourth and final sampling event. Posttreatment DHE intensity for monitoring well S5-MW-30 was detected in groundwater during the first posttreatment microbial sampling at high levels, was not detected during the second sampling event, was detected at low levels during the third sampling event, and was detected at high intensity similar to baseline during the last microbial sampling event (Appendix H [H1 and H-3]).

Posttreatment microbe biomass levels (total concentration of PLFA) relative to baseline increased in both monitoring wells S5-MW-21 and S5-MW-30. PLFA levels detected in S5-MW-21 during microbial sampling varied from approximately 8 picomoles (pmoles), to 1,680 pmoles, to 275 pmoles, to 342 pmoles, to 2,740 pmoles for baseline and first, second, third, and fourth posttreatment sampling events, respectively. PLFA levels detected in S5-MW-30 during microbial sampling varied from approximately 31 pmoles (averaged with duplicate sample), to 137 pmoles, to 192 pmoles, to 93 pmoles, to 127 pmoles for baseline and first, second, third, and fourth posttreatment sampling events, respectively. The baseline and posttreatment summary microbial laboratory analytical reports are provided in Appendix H (H-1 and H-3).

7.2.3 Discussion of Posttreatment Microbial Sampling Results

Microbial sampling performed subsequent to groundwater treatment indicates that the site microbial population was only minimally affected by the resultant changes due to chemical oxidation. Microbe biomass levels indicated that a microbial bloom occurred in the heavily treated vicinity of the source area monitoring well (S5-MW-21) subsequent to the completion of ISCO (first posttreatment sampling), while at the same time DHE was not observed at that location. Subsequent sampling at S5-MW-21 indicated that DHE returned at a moderate intensity and then increased to high intensity. A second elevated microbial bloom was observed for groundwater samples from S5-MW-21. The initial lack of detectable DHE during initial posttreatment sampling followed by increasing DHE levels and the observed microbial blooms indicated that the microbe population in S5-MW-21 was impacted as a result of ISCO, and site conditions are still in the process returning to normal after about 3 months of recovery. Microbial blooms are believed to be related to the continued desorption of adsorbed VOC contaminants as contaminants in saturated soil and groundwater progress towards equilibrium. In addition, partial oxidation of some fraction of the naturally occurring organic carbon, which resulted in increased TOC concentrations after treatment, may have acted to stimulate the microbes.

Microbe biomass levels in monitoring well S5-MW-30 have generally increased and remained above baseline levels since the completion of ISCO. The presence of DHE for the initial posttreatment sample and then its lack of presence followed by increasing DHE levels indicate that the aquifer in the immediate vicinity of S5-MW-30 was affected only after the completion of ISCO and only for a brief period. This observed phenomenon is associated with the continued presence of $KMnO_4$ in the adjacent upgradient monitoring well S5-MW-26. It is suspected that the $KMnO_4$-saturated groundwater observed in S5-MW-26 extends to the immediate vicinity of monitoring well S5-MW-30 and that the continued presence of the $KMnO_4$ in groundwater at that location is producing increased levels of microbe biomass through desorption of VOCs and had temporarily removed DHE from that location.

7.3 Posttreatment Evaluation of Groundwater Monitoring Data

An evaluation was performed for the site that focused on determining if aquifer conditions are favorable for continued microbial degradation of CAH and predicting the effectiveness of the remedial treatments that have been performed. The evaluation, presented as Appendix I, considers direct evidence based on observations of the changes in contaminant concentrations, and indirect evidence based on natural attenuation parameters.

7.3.1 Natural Attenuation Parameters Assessment

An assessment of site natural attenuation parameters in selected monitoring wells concluded that the oxidation-reduction potential (ORP) as well as concentrations of methane and TOC have returned to baseline values, and that VC/DCE ratios indicate that reductive dechlorination is continuing (Appendix I). Evidence supporting dechlorination includes the increasing ethene concentrations and a general upward trend in the VC/DCE ratios. Indications that reducing anaerobic conditions also exist at the site include the return of ORP to pretreatment levels, the presence of detectable sulfide, and the presence of methane at concentrations that are similar to baseline concentrations. Total organic carbon concentrations as a result of ISCO treatments have increased to above pretreatment concentrations, which were already in excess of the 20 milligrams per liter necessary to drive reductive dechlorination reactions (EPA, 1998). General chemistry laboratory analytical reports are provided in Appendix C.

7.3.2 MNA Assessment

The time remaining until VC concentrations decrease to below the project WQO of 36 µg/L was estimated for two treatment area monitoring wells (S5-MW-25 and -28) in which contaminant concentration appear to have stabilized. The estimate was performed using previously determined VC degradation rates (Parsons, 1999) that were applied to final posttreatment VC groundwater sample concentrations. Based upon the high and low degradation rates calculated by Parsons (1999), concentrations of VC at S5-MW-25 are predicted to reach the regulatory limit between 43 and 212 days, and concentrations of VC at S5-MW-28 are predicted to reach the regulatory limit between 83 and 405 days (Appendix I).

The time required for attenuation of VC for the site cannot be estimated because contaminant concentrations have not stabilized in site monitoring wells with the highest posttreatment contaminant concentrations (S5-MW-21 and -30). It is recommended that these estimates be calculated for the site once site groundwater VOC concentrations have stabilized. Application of the Parsons 1999 degradation rates to posttreatment site concentrations is valid only if conditions have completely stabilized and current chemical and microbiological conditions are similar to the pre-treatment conditions that existed when the degradation rates were developed.

8.0 TCRA Decision Rules and Objectives

The following sections detail decision rules and removal action objectives for the TCRA.

8.1 TCRA Decision Rules

Decision rules for the TCRA were provided in the RAW (IT, 2001) to guide/evaluate full-scale groundwater ISCO activities and to evaluate site conditions. The following sections discuss the decision rules followed for full-scale ISCO treatment and detail the site evaluation for site soil, vapor, and posttreatment groundwater as directed using decision rules.

8.1.1 Full-Scale ISCO Process

Decision rules provided to guide the full-scale ISCO groundwater treatment process were based on the project groundwater WQO for VC and the target concentration derived from BIOCHLOR modeling. The following describes the sequence of events based on TCRA decision rules that occurred to fulfill full-scale ISCO.

- *Start:* Complete two ISCO treatments and determine if VOC groundwater concentrations are below WQOs, between WQOs and the target concentration, or greater than target concentrations in all site monitoring wells.
- *Result:* VOC concentrations are between WQOs and target concentrations in the majority of treatment area monitoring wells.
- *Evaluation rule:* If VOC concentrations are greater than WQOs but below target concentrations, determine economic and technical feasibility of continuing treatment.
- *Decision:* Continue ISCO treatment because it is economically feasible, but switch the oxidant to $KMnO_4$ because the technical assessment determined that the Fenton's-type treatment had stalled at the site.

Two additional ISCO treatments were performed at the site following the above decision rule process for each treatment. Based on the assessment performed after the first $KMnO_4$ treatment, it was determined that it was still economically feasible to continue but additional injection points were required. Additional injection wells were installed and a second $KMnO_4$ treatment was performed. After the second $KMnO_4$ treatment, it was determined that it was still technically feasible to continue ISCO groundwater treatment but no longer economically feasible due to contract limitations.

8.1.2 Evaluation of Site Soil

Decision rules provided for the evaluation of posttreatment soil data were based on soil concentrations being either below Residential EPA Region 9 primary remediation goals (PRGs), below Industrial PRGs, or above Industrial PRGs. Residential (0.053 mg/kg) and Industrial (0.11 mg/kg) TCE PRGs were used to evaluate soil risk at the site (EPA, 2002). Evaluating site soil risk using source area delineation soil sample data (Figure 4) indicate that soil concentrations in the vadose soil surrounding the location of the source-area excavation are above Industrial PRGs. South of the former excavation two delineated locations exist with elevated TCE concentrations (S5-B-49 [160 mg/kg at 1.5 feet] and S5-B-46 [89 mg/kg at 3 feet]) that exceed Industrial PRGs. Samples from the majority of remaining soil borings that surround the excavation also contained TCE above Industrial PRGs (ranging from 0.11 to 11 mg/kg). Based on these finding, as directed by TCRA decision rules, it is recommended that a soil risk assessment be conducted with respect to current site uses.

8.1.3 Evaluation of Site Vapor

Decision rules provided for the evaluation of site inhalation risk with respect to soil and groundwater were based on excess cancer risk levels of less than 10^{-6}, levels between 10^{-4} and 10^{-6}, and levels above 10^{-4}. Modeling performed to assess inhalation risk was performed using the San Diego County Department of Environmental Health (2003) Vapor Risk 2000 Excel 97 Spreadsheet Model. A Level 1 assessment was performed using the conservative default values of the model and an attenuation factor of 1.0 (dirt floor) to represent current site conditions. Contaminant concentration inputs included both soil (TCE at 160 mg/kg [S5-B-49]) and groundwater (VC at 14,000 μg/L [S5-MW-21]) with resultant inhalation risk values of 6.95×10^{-3} and 7.07×10^{-2}, respectively. Based on these findings, as directed by TCRA decision rules, it is recommended that a focused inhalation risk assessment be conducted for the site.

Although vapor modeling indicates an elevated inhalation risk, this result is not representative of the actual risk posed by current site conditions. The model is based on an exposure duration at the test location of 12 hours a day, for 250 days per year, for 25 years. This scenario is unimaginable under current site conditions.

8.1.4 Evaluation of Site Groundwater

Decision rules provided for the evaluation of site groundwater data were based on groundwater concentrations that are below the WQO for VC (36 μg/L), between the WQO and the site target concentration for VC (1,100,000 μg/L), or above the target VC concentration. The highest posttreatment VC concentration detected at the site is 14,000 μg/L (S5-MW-21), which is greater than the WQO and less than the site target concentration for that compound. Based on this finding, as directed by TCRA decision rules, it is recommended that groundwater MNA be performed at the site to assess plume variation.

8.2 TCRA Project Objectives Assessment

The primary project objectives of the TCRA were to achieve significant reduction of source area CAHs, to reduce the risk to human health and the environment, and to expedite site cleanup. Other supporting TCRA activities performed to achieve project objectives included assessing the feasibility of ISCO, remediation system design and construction, aquifer contaminant reduction through ISCO (dissolved and adsorbed), and removal action reporting. The TCRA proceeded dynamically, in that remedial activities were adjusted to address unforeseen site conditions to ensure that removal action goals were achieved.

Additional project objectives that were incorporated into the TCRA to ensure removal action goals were realized included performing a supplemental site assessment to delineate the nature and extent of VOC contaminants, vadose zone source area soil removal (to prevent recontamination of site groundwater following ISCO), exploratory trenching and removal of secondary sources related to metallic objects, and an assessment of the site microbial population (to document population and to assess the effects of ISCO).

TCRA project objectives are listed and detailed in Table 14. Project objectives for the site were either completely realized or the predominant component of each objective was achieved. The final outcome of the TCRA cannot be fully quantified until site conditions have reached steady state (adsorbed and dissolved contaminants reach equilibrium, degradation rates stabilize, remaining $KMnO_4$ is consumed, and microbial population returns to normal levels), and an MNA assessment is performed using steady state values.

9.0 Summary and Cost

The following sections provide a summary of the TCRA, detail the total cost of the removal action, and provide recommendations for subsequent remedial activities.

9.1 TCRA Summary

The following sections summarize site contaminant delineation, the extensive effort put forth to reduce site VOC contaminant mass, natural attenuation assessment results, and future plans for the site.

9.1.1 Site Contaminant Delineation

Assessment activities included the completion of 93 soil borings (MIP and soil sample) and the installation of an additional 17 monitoring wells at the site. Resultant data from those borings demonstrated that groundwater contaminants at the site originated from impacted vadose zone soil located beneath Sherman Road that was likely acting as an ongoing source. The delineated source area is identified as the former eastern liquid waste disposal pit that once existed at the site.

Waste characterization samples collected to characterize excavated source area soil provided a means to catalog contaminants that were disposed of in the former eastern liquid waste disposal pit. Identified site contaminants in the excavated vadose zone source area soil include VOCs, PCB, SVOCs, and metals. Pesticides were not detected. Aroclor-1260 was the only PCB detected, with a maximum reported concentration of 2.10 mg/kg.

Because drums were discovered during the excavation of the vadose zone source area, a site assessment was performed to determine if other EM anomalies present at the site were related to the disposal of hydrocarbons that might pose a risk to site groundwater. Exploratory trenching was used to identify that 4 of 34 EM anomalies south of Sherman Road and east of Rogers Road contained material (including rusted and crushed drum fragments, rags, gloves, and a complete drum without lid) related to hydrocarbon waste. Of those four locations, only two locations (Anomalies X and Y) were identified as possible secondary sources that may have contributed to impacting groundwater.

Groundwater at the site is predominantly impacted by *cis*-1,2-DCE and VC, with only a very limited quantity of parent compounds (TCE and PCE) present. Other VOC compounds detected in groundwater with concentrations at or greater than 100 μg/L include toluene, *trans*-1,2-DCE, naphthalene, total xylenes, 1,2,4-trimethylbenzene, benzene, ethylbenzene, p-isopropyltoluene, and 1,2-dichlorobenzene. The only detected groundwater contaminants that exceed site WQOs (Table 13) are VC and 1,4-dichlorobenzene with TCRA WQOs of 36 μg/L and 18 μg/L, respectively. Posttreatment VC concentrations detected in seven of the ten treatment area monitoring wells range from 75 µg/L to 30,000 µg/L. 1,4-dichlorobenzene was detected during posttreatment sampling in a single monitoring well (S5-MW-39) at 22 µg/L.

Contouring of groundwater toluene and naphthalene concentrations shows that two other minor secondary sources may have existed at the site, and that both appear to be unrelated to the primary VOC plume source. The two delineated potential secondary groundwater plumes are situated within the main VOC plume (Figure 10) and are located just northwest and to the south-southwest of the former eastern disposal pit. The secondary groundwater plumes are believed to be related to the former western liquid waste disposal pit and a buried drum that was uncovered during exploratory trenching (Anomaly Y), respectively. Groundwater contaminant concentrations of the two secondary groundwater plumes are insignificant relative to the main plume.

9.1.2 Site Contaminant Mass Reduction

A significant effort was put forth to reduce contaminant mass at the site. Site contaminant mass removal included pilot study testing, vadose zone source removal, and ISCO groundwater treatment. The estimated VOC masses removed for each of these activities are 76 pounds, 3,050 pounds, and 875 pounds, respectively, for an estimated total VOC mass removed from the site of approximately 4,000 pounds or 2 tons.

Vadose zone source removal included the excavation of the primary site contaminant source (former eastern liquid waste disposal pit) and exploratory trenching of four potential secondary vadose zone sources (metallic debris locations). Full-scale ISCO groundwater treatment made use of approximately 13,200 gallons of 15 percent hydrogen peroxide and 15,428 pounds of $KMnO_4$ to reduce VOCs to harmless compounds.

Groundwater containing residual $KMnO_4$ is still present in two portions of the site (near S5-MW-26 and -34), suggesting that dissolved and adsorbed VOCs no longer exist within the source area groundwater plume at those locations. The presence of $KMnO_4$ at those locations will continue to reduce site VOCs as desorption and groundwater migration occurs and reactions between contaminant and oxidants proceed toward equilibrium.

First interim, initial posttreatment, and final posttreatment sample results indicated that total VOC concentrations in boundary monitoring wells relative to baseline concentrations had decreased by 28.4 percent, 26.6 percent, and 45.8, respectively. The almost 50 percent decrease in total VOC concentrations in boundary monitoring wells demonstrates that ISCO activities have not resulted in the outward migration of VOC-impacted groundwater and, in fact, clearly demonstrates that the site VOC groundwater plume has begun to shrink.

9.1.3 Natural Attenuation Assessment

Assessment of the microbial community at the site indicates that the site microbe population:

- Is moderately diverse
- Consists mainly of gram-negative bacteria that have the ability to use a wide range of carbon sources
- Can adapt quickly to changing environmental conditions
- Includes DHE, the only documented microorganisms possessing necessary enzymes for the complete dechlorination of toxic chlorinated hydrocarbons into harmless ethene, at relatively high levels
- Appears to have been stimulated by $KMnO_4$ ISCO, through desorption of adsorbed VOCs and partial oxidation of some fraction of TOC, likely resulting in increased contaminant reduction
- Is in the process of re-establishing itself (evidenced by posttreatment microbial sample results) and that DHE was only temporarily impacted by the ISCO treatment

Based on the results of the natural attenuation parameters evaluation, it was determined that aquifer conditions are favorable for continued microbial degradation of CAHs and that reductive dechlorination is continuing at the site. It has also been determined that total organic carbon concentrations at the site exceed the desired greater than 20 milligrams per liter necessary to drive reductive dechlorination reactions.

The time remaining until VC concentrations decrease to below the project WQO of 36 µg/L was estimated for two portions of the treatment area (S5-MW-25 and -28), where contaminant concentrations appear to have stabilized. The estimates suggest that VC at S5-MW-25 should reach the regulatory limit between 43 and 212 days and at S5-MW-28 should require between 83 and 405 days. Contaminant concentrations have not stabilized in site monitoring wells with the highest posttreatment contaminant concentrations (S5-MW-21 and -30) and, therefore, time estimates to reach WQOs cannot be calculated. It is recommended that time remaining MNA estimates be calculated once site groundwater VOC concentrations have stabilized.

9.2 Cost of TCRA

The costs required to perform TCRA activities are summarized below.

Chemical Oxidation Pilot Test

Preconstruction Submittals		
• Action Memo	$	30,400.
• Removal Action Work Plan	$	19,800.
• Fact Sheet and Communication Plan	$	4,500
Chemical Oxidation Bench and Pilot Test	$	199,900.
Pre-Treatment Investigation	$	129,900.
Project Management	$	79,100.
Subtotal:	**$**	**463,600**.

Full-Scale Treatment

Preconstruction Submittals		
• Technical Memo (Pre-treatment Investigation)	$	4,800.
• Removal Action Work Plan Addendum	$	75,800.
Excavation of Former Hazardous Waste Pit	$	530,500.
In Situ Chemical Oxidation Treatment	$	594,500.
Data Analysis and Closeout Report	$	52,000.
Project Management	$	313,500.
Subtotal:	**$**	**1,571,100**.
Total Cost:	**$**	**2,034,700**.

9.3 Site Recommendations

Based on TCRA decision rules, the following recommendations are put forth:

- A soil risk assessment should be conducted at the site with respect to current site uses (Section 8.1.2).

- A focused inhalation risk assessment with respect to impacted soil and groundwater should be conducted for the site (Section 8.1.3).

- A groundwater MNA study should be performed at the site to monitor and assess variations of the site VOC groundwater plume (Section 8.1.4).

Additional recommendations for the site include the following:

- Horizontal injection wells S5-MW-01 through S5-MW-03 should be abandoned if they are no longer required for potential future treatment activities (i.e., injection wells may be lost if not tracked properly).
- If site land uses change, the potential human health risks associated with exposure to site contaminants should be reevaluated.
- This TCRA closeout report provides useful information pertinent to future site activities and, as such, this document should be provided to those who will perform the Feasibility Study or other follow-on evaluations.

10.0 TCRA Conclusions

The TCRA objective of reducing the potential risk to public health and the environment posed by site contaminants was accomplished at the site through contaminant mass reduction including vadose source removal of shallow contaminated soil and ISCO groundwater treatment. An estimated 2 tons of VOCs were removed from the site during the TCRA.

Site conditions indicate RNA will be an effective remedy for residual groundwater CAHs. The identification and verification that DHE are present in site groundwater and these microbes were not adversely affected by ISCO will ensure that RNA will effectively reduce the remaining aquifer VOC contaminants.

Recommended follow-up evaluations based on TCRA decision rules include performing a soil risk assessment, an inhalation risk assessment, and a groundwater MNA evaluation. These tasks are expected to occur either during a site Feasibility Study or other follow-up site evaluation.

This TCRA was performed as an interim measure by the Navy for the protection of human health and the environment and in an effort to reduce long-term environmental management costs. Based on the quantity of mass removed and identified posttreatment site conditions, this goal has been achieved.

11.0 References

Adams, Ron, 2002, personal communication, November.

Bechtel National, Inc, 1998, *Final Remedial Investigation/RCRA Facility Investigation Report, Site 5 -Golf Course Garbage Disposal Area*, *Naval Air Station*, *North Island, Coronado, California*, April.

California Regional Water Quality Control Board, Central Valley Region, 2000, *A Compilation of Water Quality Goals*, August.

California Regional Water Quality Control Board, San Diego Region, 1996, *Revised Table 1 to San Diego Regional Water Quality Control Board "Interim Guidance on Required Cleanup at Low-Risk Fuel Contaminated Sites*," July 24.

EPA, see U.S. Environmental Protection Agency

Henn, Keith, 2002, personal communication, November.

IT Corporation, 2001, *Remedial Action Work Plan Addendum, Time-Critical Removal Action, Installation Restoration Site 5, Unit 2, Naval Air Station North Island, California*, CTO-0027, DCN 1441, Revision 1, November 19.

OHM Remediation Services Corp., 2001, *Remedial Action Work Plan, Time-Critical Removal Action, Installation Restoration Site 5, Unit 2, Naval Air Station North Island, San Diego, California,* Delivery Order No. 0141, DCN SW6838, Revision 3, June 8.

Parsons Engineering Science, Inc., 1999, *Evaluation of Monitored Natural Attenuation for Groundwater at Site 5 (Area of VOC Contamination) Golf Course Disposal Area, Naval Air Station North Island, California,* May.

RWQCB, see California Regional Water Quality Control Board.

San Diego County Department of Environmental Health, 2003, *Site Assessment and Mitigation (SAM) Manual*.

SiREM, 2002, *Test Results for Gene-Trac™ Dehalococcoides Assay for IR Site 5 – Unit 2, Time Critical Removal Action, Naval Air Station North Island, California*, July 26.

Southwest Division Naval Facilities Engineering Command, 2002, *Summary Letter Describing the Planned Oxidant Change for IR Site 5 – Unit 2, Time Critical Removal Action, Naval Air Station North Island, California*, December 4.

SWDIV, see Southwest Division, Naval Facilities Engineering Command.

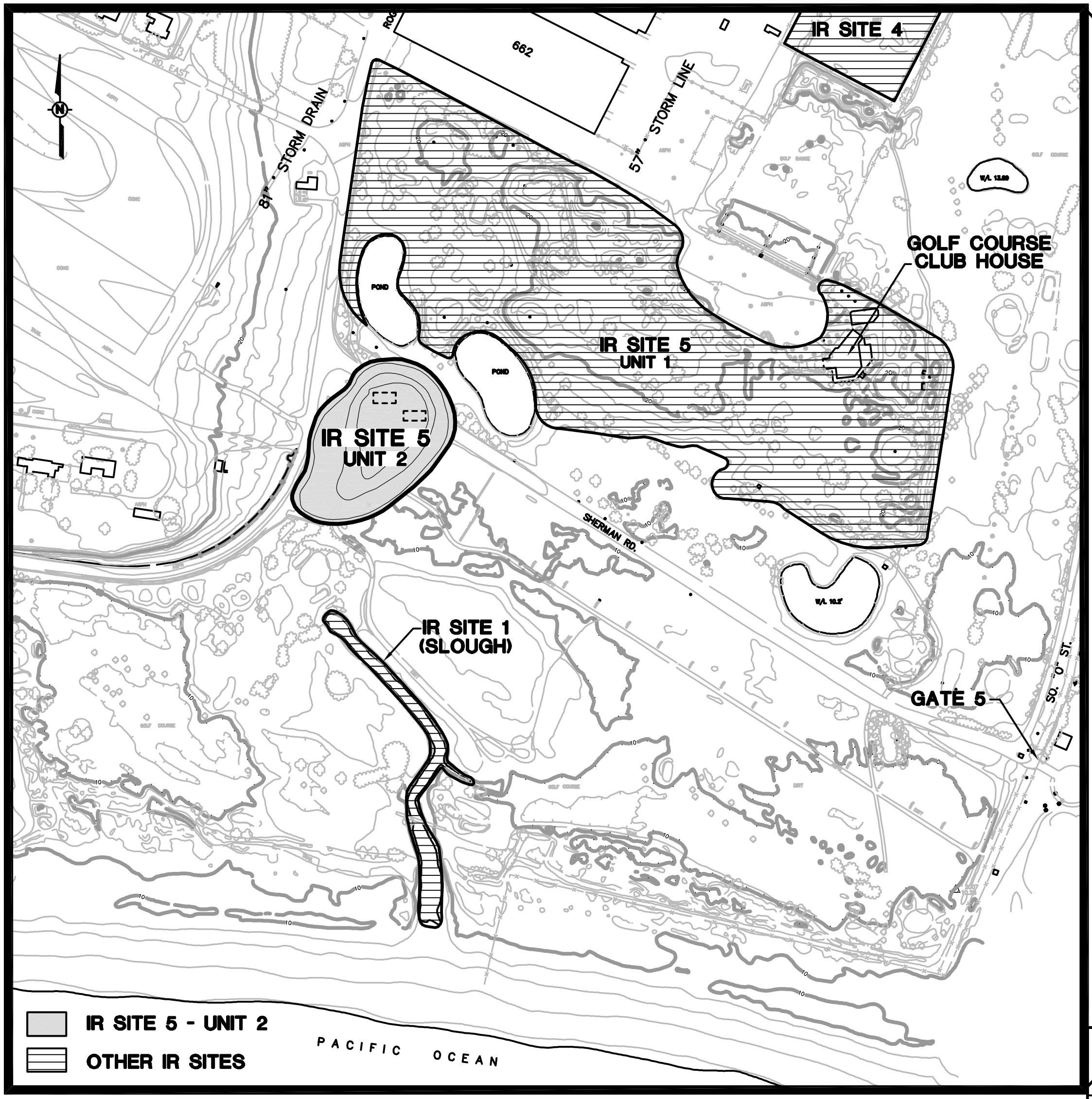
U.S. Department of the Navy, 1999, *Action Memorandum, Time-Critical Removal Action for Installation Restoration Site 5 – Unit 2, Naval Air Station North Island, San Diego County, California*, December 9.

U.S. Environmental Protection Agency, 1998, *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water*, United States Environmental Protection Agency, Office of Research and Development, Washington, DC 20460, EPA/600/R-98/128, September.

U.S. Environmental Protection Agency, 2000, *Memorandum: Applicability of RCRA Section 3020 to In-Situ Treatment of Ground Water*, United States Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC 20460, December 27.

U.S. Environmental Protection Agency, 2002, *EPA Region 9: Preliminary Remediation Goals (PRGs) Summary Tables*, http://www.epa.gov/region09/waste/sfund/prg/index.htm, accessed September 2.

Figures



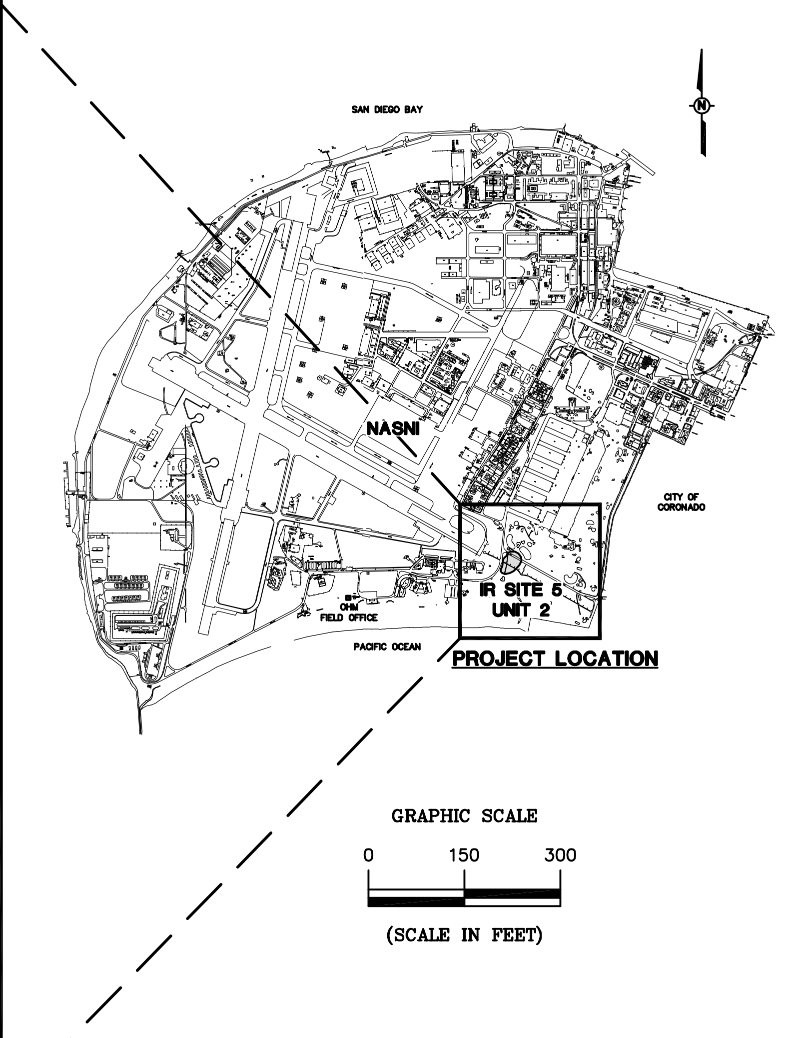
SITE VICINITY MAP

GRAPHIC SCALE

0 500 1000

(SCALE IN FEET)

Reference:
Rick Engineering, 1994
Bechtel National, Inc. 1996
Parsons Engineering Science, Inc, 1995



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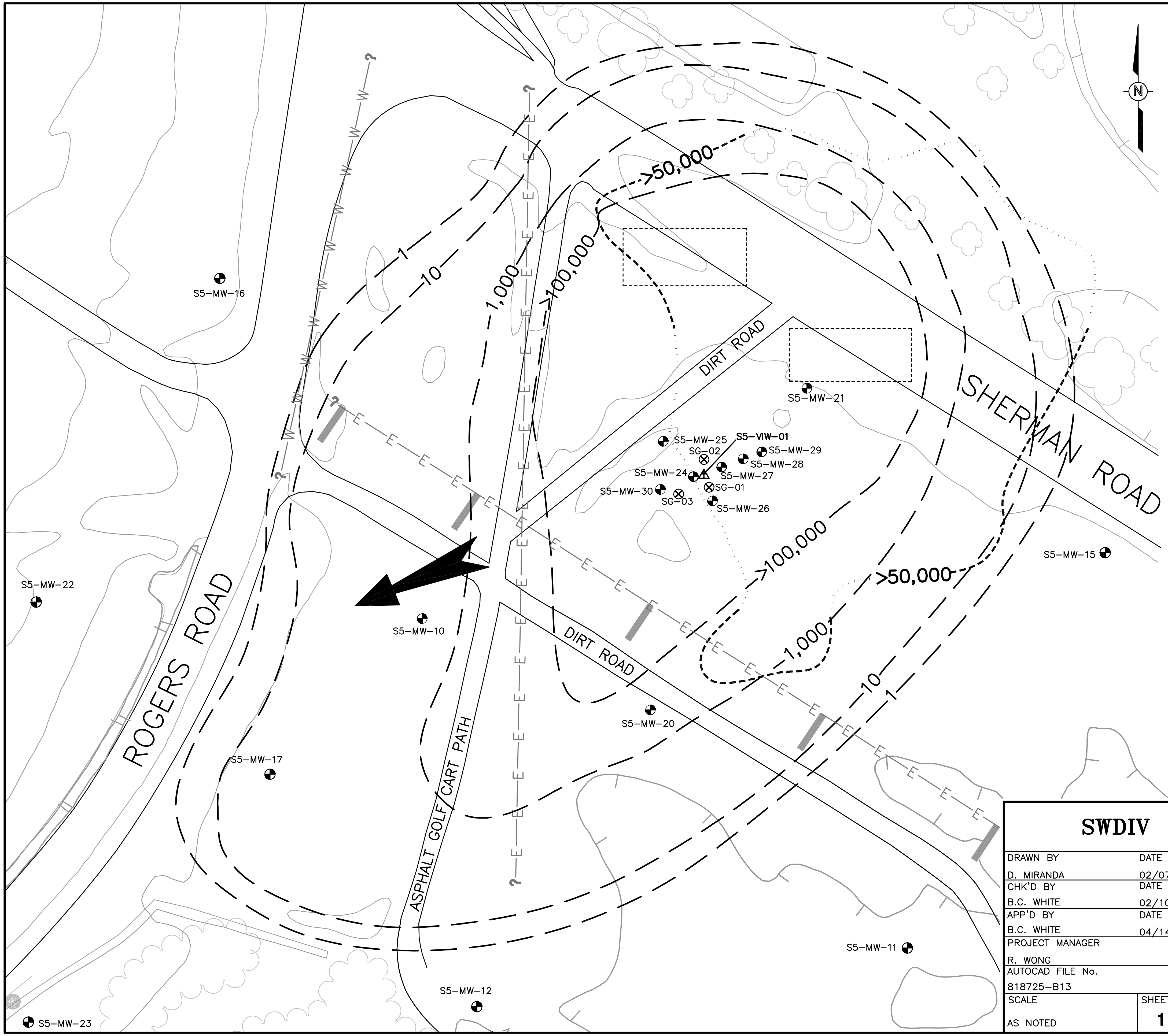
APP'D BY B.C. WHITE	DATE 4/14/03
PROJECT MANAGER R. WONG	
AUTOCAD FILE No. 818725-A2	

FIGURE 1

PROJECT LOCATION AND SITE VICINITY MAP

IR SITE 5 - UNIT 2
NAVAL AIR STATION, NORTH ISLAND
SAN DIEGO, CALIFORNIA

SCALE	SHEET	OF	SHAW PROJECT No.	DOCUMENT CONTROL No.	REVISION
AS NOTED	1	1	818725	5399	0



LEGEND:

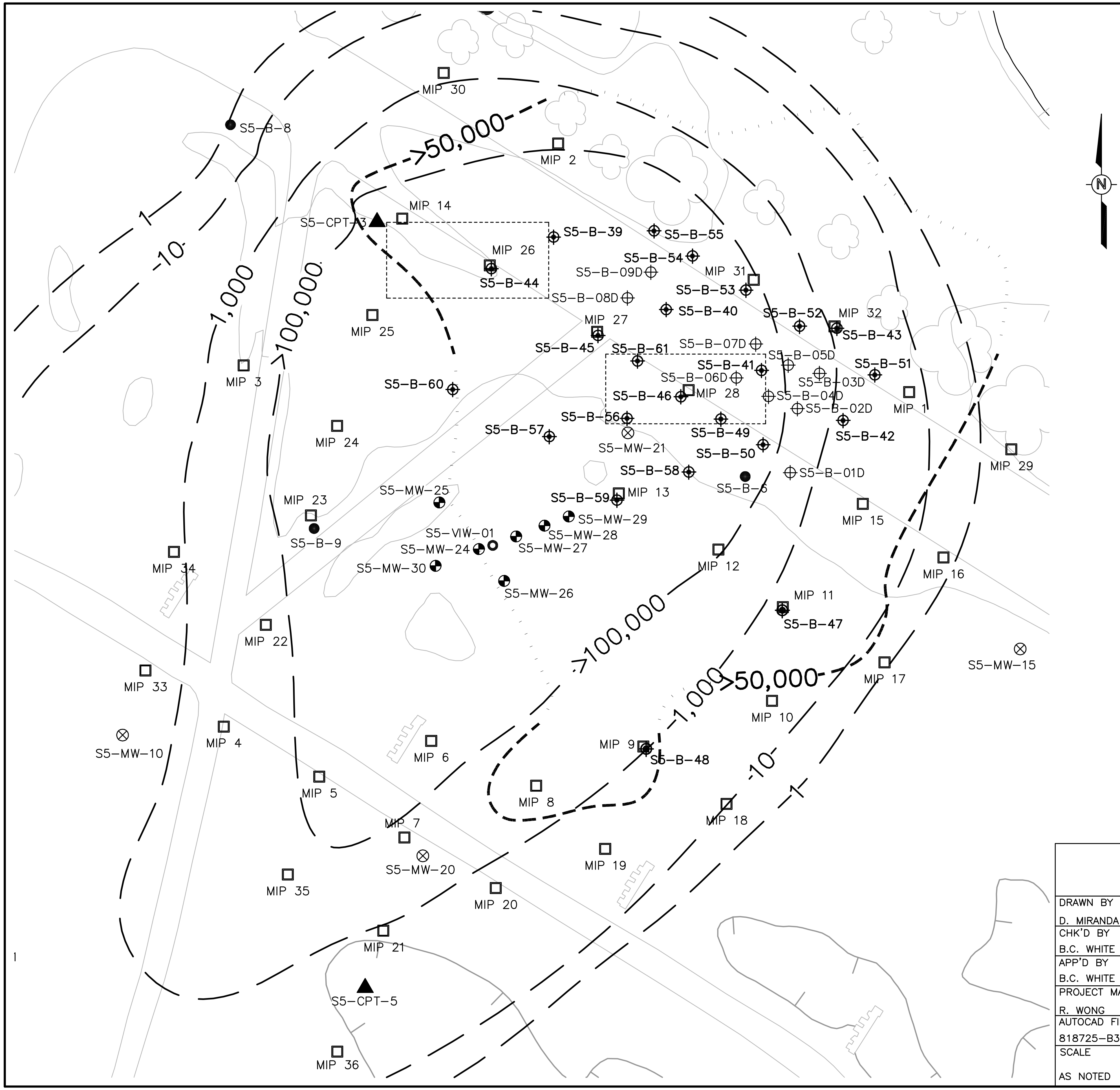
▭	SUSPECTED FORMER DISPOSAL PITS
➤	GROUNDWATER FLOW DIRECTION
- - -	MIP TOTAL ION COUNTS EXCEEDING 50,000 – DASHED WHERE ESTIMATED, DOTTED WHERE SURMIZED
—10—	ESTIMATED EXTENT OF TOTAL SELECTED VOCs IN $\mu g/L$
S5-MW-30 ◐	MONITORING WELL
SG-01 ⊗	SOIL VAPOR PROVE (2' BGS)
S5-VIW-01 ⚠	VERTICAL INJECTION WELL
▬	RUNWAY LIGHTS
—E—	ELECTRICAL LINE
—W—	WATER LINE

NOTE:

1. SELECTED VOC CONTOURS DERIVED FROM PARSONS (1999).
2. SELECTED VOCs INCLUDE CHLORINATED ETHENES, CHLORINATED ETHANES, AND BTEX.
3. GOLF COURSE UTILITIES (NORTH OF SHERMAN ROAD) HAVE NOT BEEN DELINEATED.

SCALE
0 50 100 FEET

SWDIV		Shaw™ Shaw Environmental, Inc.		
DRAWN BY D. MIRANDA	DATE 02/07/03	**FIGURE 2** **PRETREATMENT SITE CONDITIONS AND SITE UTILITIES** **IR SITE 5 - UNIT 2** **NAVAL AIR STATION, NORTH ISLAND** **SAN DIEGO, CALIFORNIA**		
CHK'D BY B.C. WHITE	DATE 02/10/03			
APP'D BY B.C. WHITE	DATE 04/14/03			
PROJECT MANAGER R. WONG				
AUTOCAD FILE No. 818725-B13				
SCALE AS NOTED	SHEET 1 OF 1	SHAW PROJECT No. 818725	DOCUMENT CONTROL No. 5399	REVISION 0

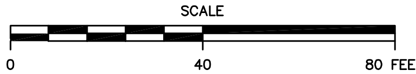


LEGEND:

—10—	ELEVATION IN FEET, DATUM MLLW
- - — —	MIP TOTAL ION COUNTS EXCEEDING 50,000 – DASHED WHERE ESTIMATED, DOTTED WHERE SURMIZED
┌┄┐	SUSPECTED FORMER DISPOSAL PITS
—10—	ESTIMATED EXTENT OF TOTAL SELECTED VOCs IN μg/L
☐ MIP 1	PRETREATMENT SCAPS/MIP BORING (FEBRUARY 2001)
⊕ S5-B-43	SITE DELINEATION SOIL BORING LOCATION (FEBRUARY & MARCH 2001)
⊕ S5-B-01D	SOURCE AREA DELINEATION (D) SOIL BORING LOCATION (SEPTEMBER 2001)
○ VIW-01	PILOT TEST INJECTION WELL
◑ MW-30	PILOT TEST MONITORING WELL
● S5-B-6	PRE-TCRA SOIL BORING LOCATION
▲ S5-CPT-3	PRE-TCRA CONE PENETROMETER BORING LOCATIONS
⊗ S5-MW-21	MONITORING WELL INSTALLED PRIOR TO TCRA

NOTE:

1. SELECTED VOC CONTOURS DERIVED FROM PARSONS (1999).
2. SELECTED VOCs INCLUDE CHLORINATED ETHENES, CHLORINATED ETHANES, AND BTEX.



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AUTOCAD FILE No. 818725-B3
SCALE AS NOTED
SHEET 1 OF 1

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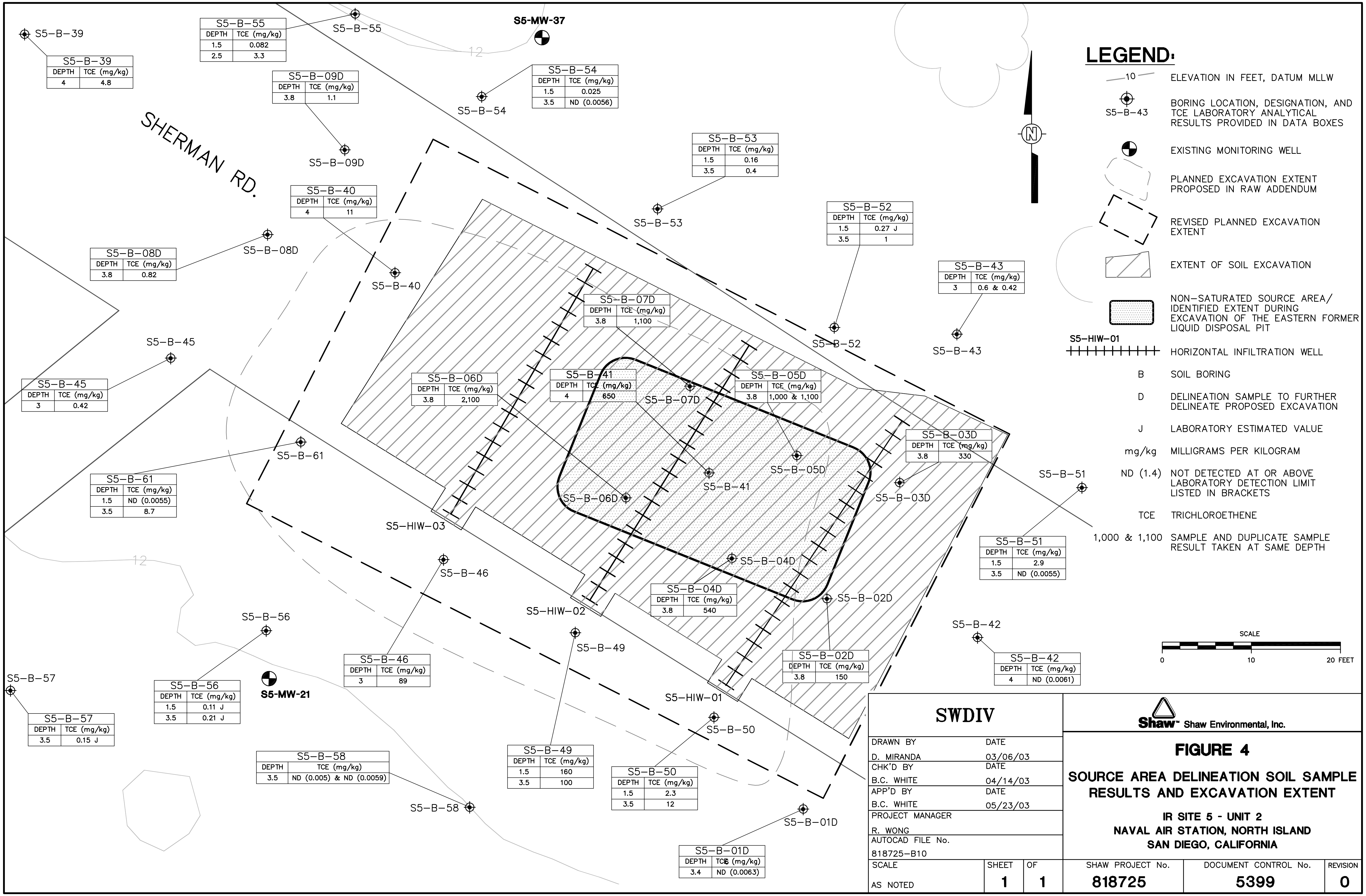
FIGURE 3

DELINEATION SOIL BORING LOCATIONS

IR SITE 5 - UNIT 2
NAVAL AIR STATION, NORTH ISLAND
SAN DIEGO, CALIFORNIA

SHAW PROJECT No. 818725
COCUMENT CONTROL No. 5399
REVISION 0



LEGEND:

10	ELEVATION IN FEET, DATUM MLLW
S5-B-43	BORING LOCATION, DESIGNATION, AND TCE LABORATORY ANALYTICAL RESULTS PROVIDED IN DATA BOXES
●	EXISTING MONITORING WELL
	PLANNED EXCAVATION EXTENT PROPOSED IN RAW ADDENDUM
	REVISED PLANNED EXCAVATION EXTENT
▨	EXTENT OF SOIL EXCAVATION
	NON-SATURATED SOURCE AREA/ IDENTIFIED EXTENT DURING EXCAVATION OF THE EASTERN FORMER LIQUID DISPOSAL PIT
S5-HIW-01	HORIZONTAL INFILTRATION WELL
B	SOIL BORING
D	DELINEATION SAMPLE TO FURTHER DELINEATE PROPOSED EXCAVATION
J	LABORATORY ESTIMATED VALUE
mg/kg	MILLIGRAMS PER KILOGRAM
ND (1.4)	NOT DETECTED AT OR ABOVE LABORATORY DETECTION LIMIT LISTED IN BRACKETS
TCE	TRICHLOROETHENE
1,000 & 1,100	SAMPLE AND DUPLICATE SAMPLE RESULT TAKEN AT SAME DEPTH

S5-B-55

DEPTH	TCE (mg/kg)
1.5	0.082
2.5	3.3

S5-B-39

DEPTH	TCE (mg/kg)
4	4.8

S5-B-09D

DEPTH	TCE (mg/kg)
3.8	1.1

S5-B-54

DEPTH	TCE (mg/kg)
1.5	0.025
3.5	ND (0.0056)

S5-B-53

DEPTH	TCE (mg/kg)
1.5	0.16
3.5	0.4

S5-B-40

DEPTH	TCE (mg/kg)
4	11

S5-B-08D

DEPTH	TCE (mg/kg)
3.8	0.82

S5-B-52

DEPTH	TCE (mg/kg)
1.5	0.27 J
3.5	1

S5-B-43

DEPTH	TCE (mg/kg)
3	0.6 & 0.42

S5-B-07D

DEPTH	TCE (mg/kg)
3.8	1,100

S5-B-45

DEPTH	TCE (mg/kg)
3	0.42

S5-B-06D

DEPTH	TCE (mg/kg)
3.8	2,100

S5-B-41

DEPTH	TCE (mg/kg)
4	650

S5-B-05D

DEPTH	TCE (mg/kg)
3.8	1,000 & 1,100

S5-B-03D

DEPTH	TCE (mg/kg)
3.8	330

S5-B-61

DEPTH	TCE (mg/kg)
1.5	ND (0.0055)
3.5	8.7

S5-B-51

DEPTH	TCE (mg/kg)
1.5	2.9
3.5	ND (0.0055)

S5-B-04D

DEPTH	TCE (mg/kg)
3.8	540

S5-B-46

DEPTH	TCE (mg/kg)
3	89

S5-B-02D

DEPTH	TCE (mg/kg)
3.8	150

S5-B-42

DEPTH	TCE (mg/kg)
4	ND (0.0061)

S5-B-56

DEPTH	TCE (mg/kg)
1.5	0.11 J
3.5	0.21 J

S5-B-57

DEPTH	TCE (mg/kg)
3.5	0.15 J

S5-B-58

DEPTH	TCE (mg/kg)
3.5	ND (0.005) & ND (0.0059)

S5-B-49

DEPTH	TCE (mg/kg)
1.5	160
3.5	100

S5-B-50

DEPTH	TCE (mg/kg)
1.5	2.3
3.5	12

S5-B-01D

DEPTH	TCE (mg/kg)
3.4	ND (0.0063)

SWDIV

DRAWN BY D. MIRANDA	DATE 03/06/03
CHK'D BY B.C. WHITE	DATE 04/14/03
APP'D BY B.C. WHITE	DATE 05/23/03
PROJECT MANAGER R. WONG	
AUTOCAD FILE No. 818725-B10	

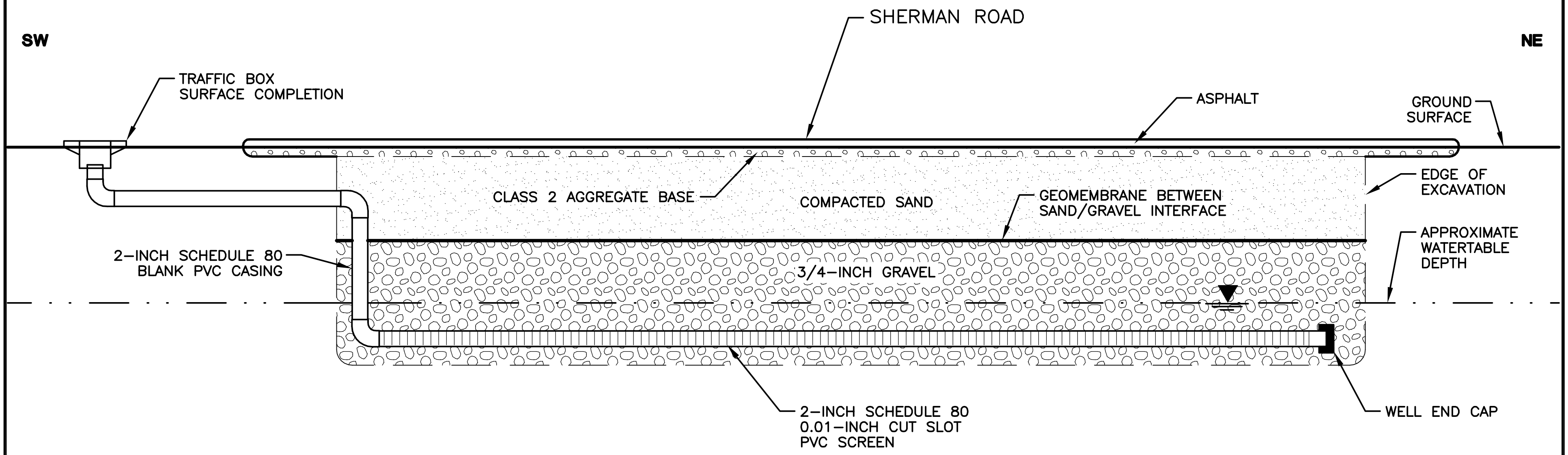
Shaw™ Shaw Environmental, Inc.

FIGURE 4

SOURCE AREA DELINEATION SOIL SAMPLE RESULTS AND EXCAVATION EXTENT

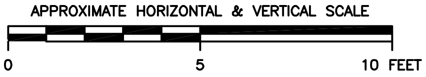
IR SITE 5 - UNIT 2
NAVAL AIR STATION, NORTH ISLAND
SAN DIEGO, CALIFORNIA

SCALE	SHEET	OF	SHAW PROJECT No.	DOCUMENT CONTROL No.	REVISION
AS NOTED	1	1	818725	5399	0



NOTE:

1. PIPE DIAMETER NOT TO SCALE
2. CROSS-SECTION VIEW DIRECTION IS TO THE NORTHWEST



SWDIV

DRAWN BY D. MIRANDA	DATE 03/20/03
CHK'D BY B.C. WHITE	DATE 04/10/03
APP'D BY B.C. WHITE	DATE 05/23/03
PROJECT MANAGER R. WONG	
AUTOCAD FILE No. 818725-A3	

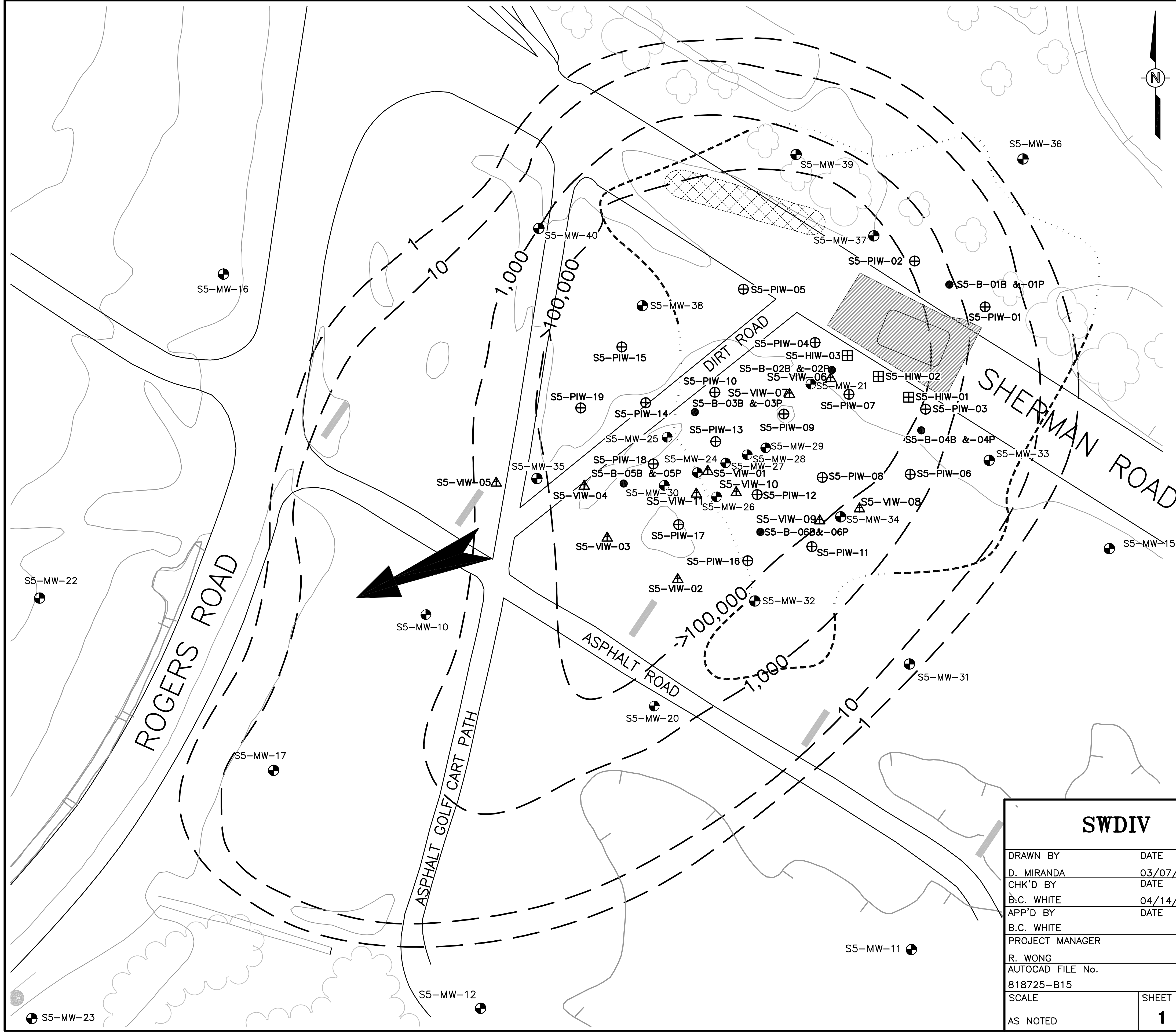
Shaw™ Shaw Environmental, Inc.

FIGURE 5

IDEALIZED EXCAVATION CROSS-SECTION

IR SITE 5 - UNIT 2
NAVAL AIR STATION, NORTH ISLAND
SAN DIEGO, CALIFORNIA

SCALE	SHEET	OF	SHAW PROJECT No.	DOCUMENT CONTROL No.	REVISION
AS NOTED	1	1	818725	5399	0



LEGEND:

▨	ESTIMATED LOCATION OF SUSPECTED WESTERN FORMER DISPOSAL POND
▨	EXTENT OF SOIL EXCAVATION
▭	SOURCE AREA/IDENTIFIED EXTENT OF EASTERN FORMER LIQUID DISPOSAL PIT
◀	GROUNDWATER FLOW DIRECTION
- - -	MIP TOTAL ION COUNTS EXCEEDING 50,000 – DASHED WHERE ESTIMATED, DOTTED WHERE SURMIZED
—10—	ESTIMATED EXTENT OF TOTAL SELECTED VOCs IN μg/L
S5-MW-30 ◐	MONITORING WELL
S5-PIW-10 ⊕	PROPAGATION INJECTION WELL
S5-HIW-03 ⊞	HORIZONTAL INJECTION WELL
S5-VIW-05 △	VERTICAL INJECTION WELL
S5-B-01B&-01P ●	TREATMENT ASSESSMENT SOIL BORING
▬	RUNWAY LIGHTS

NOTE:

1. SELECTED VOC CONTOURS DERIVED FROM PARSONS (1999).
2. SELECTED VOCs INCLUDE CHLORINATED ETHENES, CHLORINATED ETHANES, AND BTEX.

SCALE
0 50 100 FEET

SWDIV

Shaw™ Shaw Environmental, Inc.

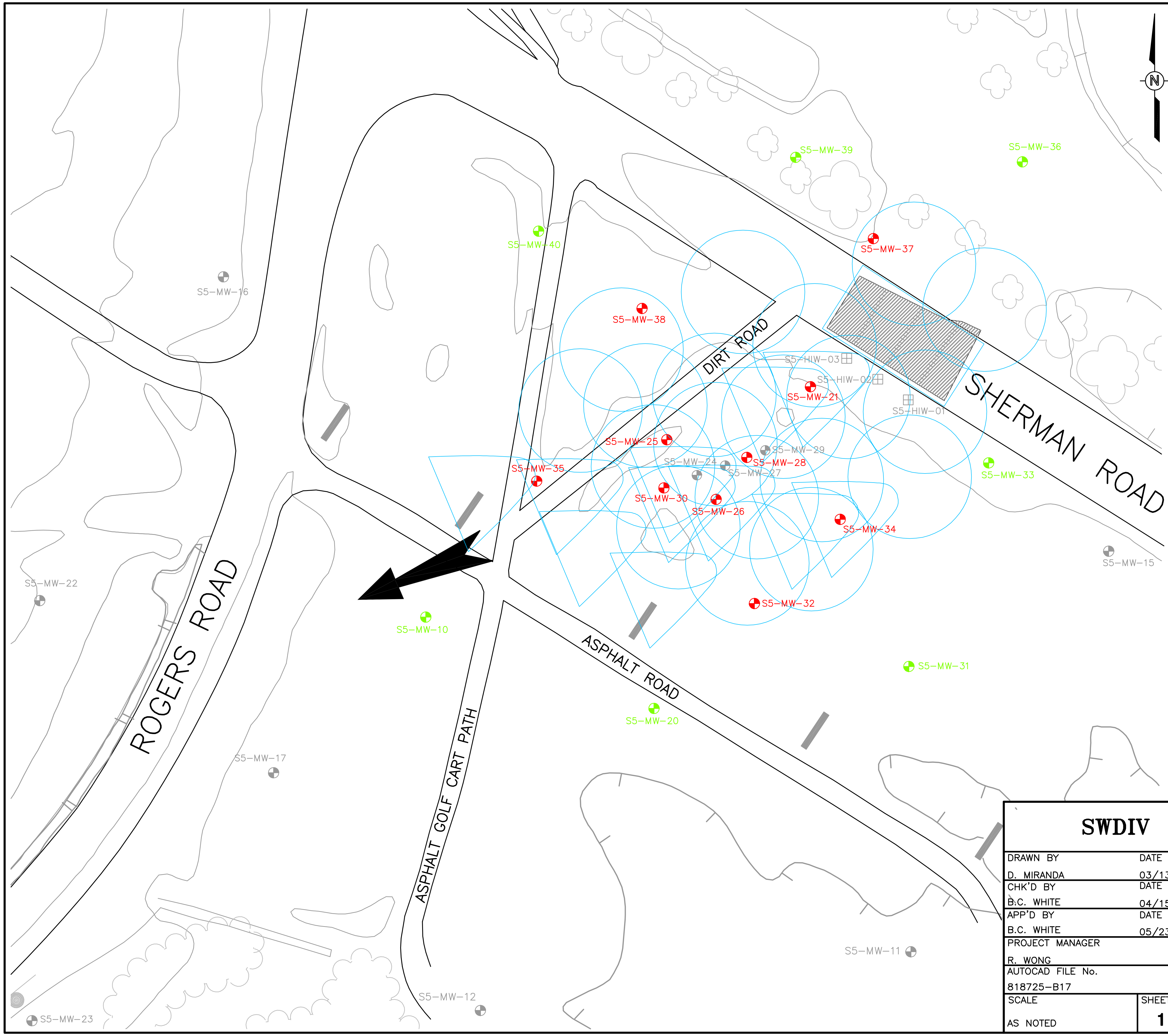
DRAWN BY	DATE		
D. MIRANDA	03/07/03		
CHK'D BY	DATE		
B.C. WHITE	04/14/03		
APP'D BY	DATE		
B.C. WHITE			
PROJECT MANAGER			
R. WONG			
AUTOCAD FILE No.			
818725-B15			
SCALE	SHEET	OF	
AS NOTED	1	1	

FIGURE 6

TREATMENT MONITORING WELL, INJECTION WELL, AND TREATMENT ASSESSMENT SOIL BORING LOCATIONS

IR SITE 5 - UNIT 2
NAVAL AIR STATION, NORTH ISLAND
SAN DIEGO, CALIFORNIA

SHAW PROJECT No.	DOCUMENT CONTROL No.	REVISION
818725	5399	0



LEGEND:

○	APPROXIMATE AREA OF PROPAGATION TREATMENT (60 FOOT DIAMETER)
▽	APPROXIMATE TREATMENT AREA OF VERTICAL WELLS
▭	APPROXIMATE TREATMENT AREA OF HORIZONTAL WELLS
▨	EXTENT OF SOIL EXCAVATION
←	GROUNDWATER FLOW DIRECTION
S5–MW–30 ●	MONITORING WELL
S5–HIW–03 ⊞	HORIZONTAL INJECTION WELL
⋰	SCREENED INTERVAL OF HORIZONTAL INJECTION WELL
▬	RUNWAY LIGHTS

NOTE:

1. RED WELLS ARE TREATMENT AREA MONITORING WELLS.
2. GREEN WELLS ARE BOUNDARY MONITORING WELLS.

SCALE
0 50 100 FEET

SWDIV

DRAWN BY D. MIRANDA	DATE 03/13/03
CHK'D BY B.C. WHITE	DATE 04/15/03
APP'D BY B.C. WHITE	DATE 05/23/03
PROJECT MANAGER R. WONG	
AUTOCAD FILE No. 818725–B17	

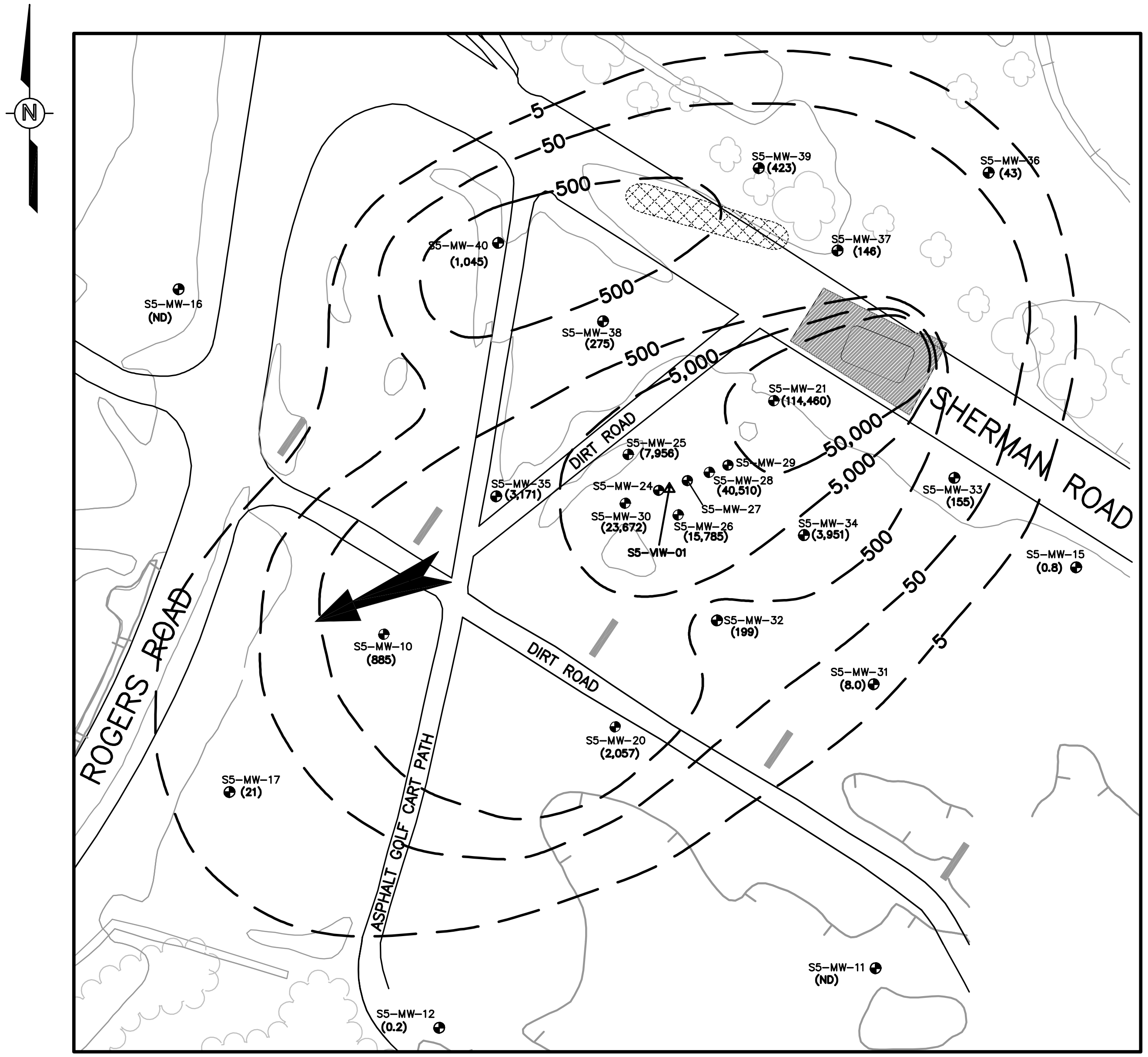
Shaw™ Shaw Environmental, Inc.

FIGURE 7

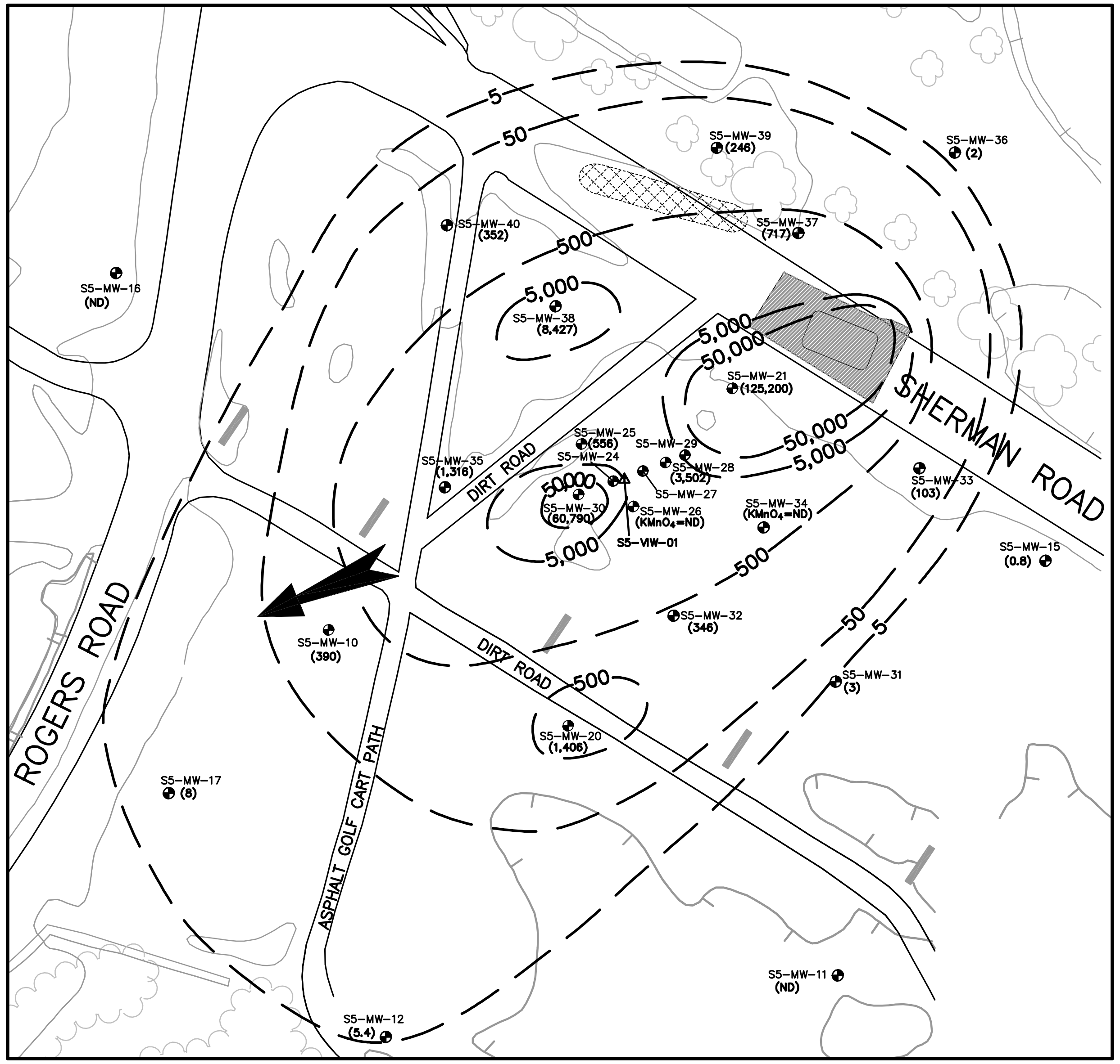
CHEMICAL TREATMENT AREA AND MONITORING WELL LOCATIONS

IR SITE 5 - UNIT 2
NAVAL AIR STATION, NORTH ISLAND
SAN DIEGO, CALIFORNIA

SCALE	SHEET	OF	SHAW PROJECT No.	DOCUMENT CONTROL No.	REVISION
AS NOTED	1	1	818725	5399	0



BASELINE TOTAL VOC CONTOURS (MAY 2002)



FINAL POSTTREATMENT TOTAL VOC CONTOURS (JULY 2003)

SCALE

0 80 160 FEET

LEGEND:

- ▨ ESTIMATED LOCATION OF SUSPECTED WESTERN FORMER DISPOSAL PIT
- ▨ EXTENT OF SOIL EXCAVATION
- ☐ SOURCE AREA/IDENTIFIED EXTENT OF EASTERN FORMER LIQUID DISPOSAL PIT
- ← GROUNDWATER FLOW DIRECTION
- —50— ESTIMATED EXTENT OF SELECTED VOC(s) IN µg/L
- S5-MW-30 ● (100) MONITORING WELL WITH DETECTED VOC(s) CONCENTRATION IN µg/L PROVIDED IN BRACKETS
- (ND) NOT DETECTED
- S5-VIW-01 △ VERTICAL INJECTION WELL
- ▬ RUNWAY LIGHTS

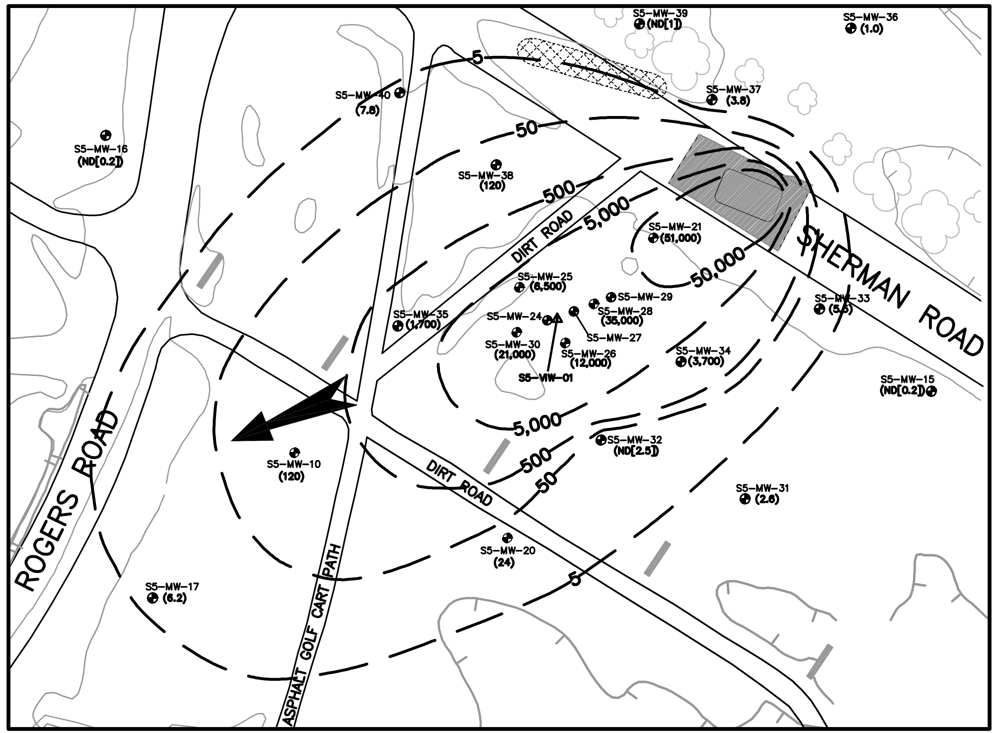
NOTE:

1. BASELINE GROUNDWATER DATA FOR PERIMETER WELLS S5-MW-11, -12, -16, -17, -18, -22, AND -23 FROM PARSONS (1999) JULY 1998 GROUNDWATER SAMPLING.
2. AVERAGE CONCENTRATION OF SAMPLES IS USED FOR CONTOURS WHEN DUPLICATE SAMPLE WAS COLLECTED.
3. APRIL 2003 DATA FOR S5-MW-39 IS USED IN POSTTREATMENT CONTOURS BECAUSE THAT WELL COULD NOT BE SAMPLED IN JULY 2003.

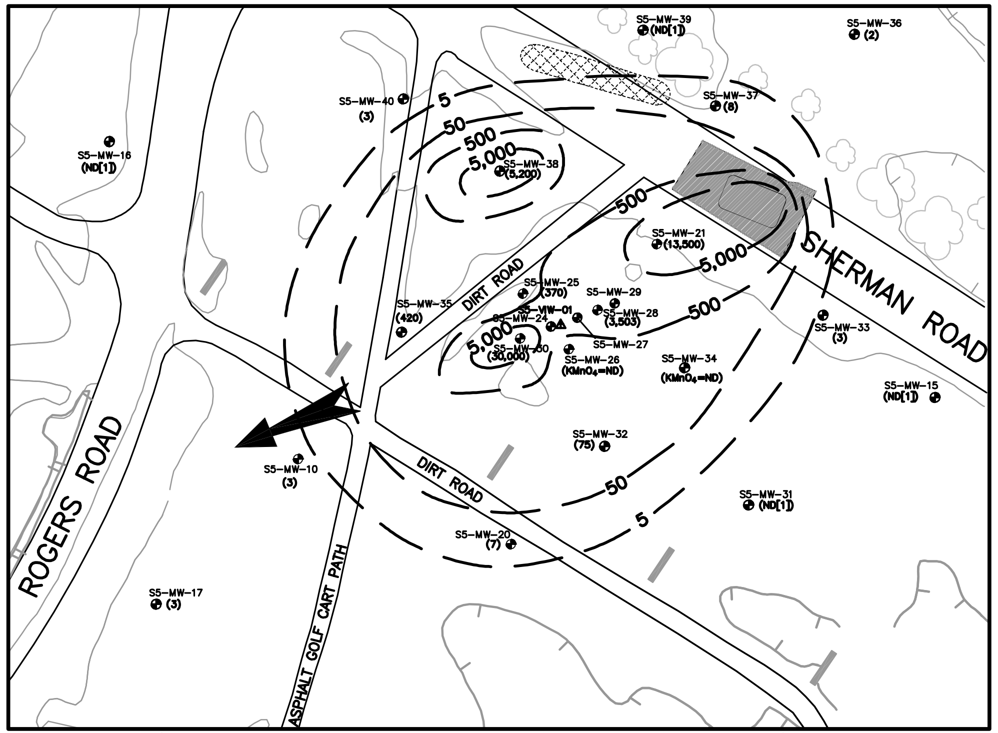
SWDIV			Shaw™ Shaw Environmental, Inc.
DRAWN BY D. MIRANDA	DATE 03/20/03		FIGURE 8 BASELINE AND FINAL POSTTREATMENT TOTAL VOC CONTOURS IR SITE 5 - UNIT 2 NAVAL AIR STATION, NORTH ISLAND SAN DIEGO, CALIFORNIA
CHK'D BY B.C. WHITE	DATE 06/03/03		
APP'D BY B.C. WHITE	DATE 06/03/03		
PROJECT MANAGER R. WONG			
AUTOCAD FILE No. 818725-B24			
SCALE AS NOTED	SHEET 1	OF 1	SHAW PROJECT No. 818725

DOCUMENT CONTROL No.	REVISION
5399	0

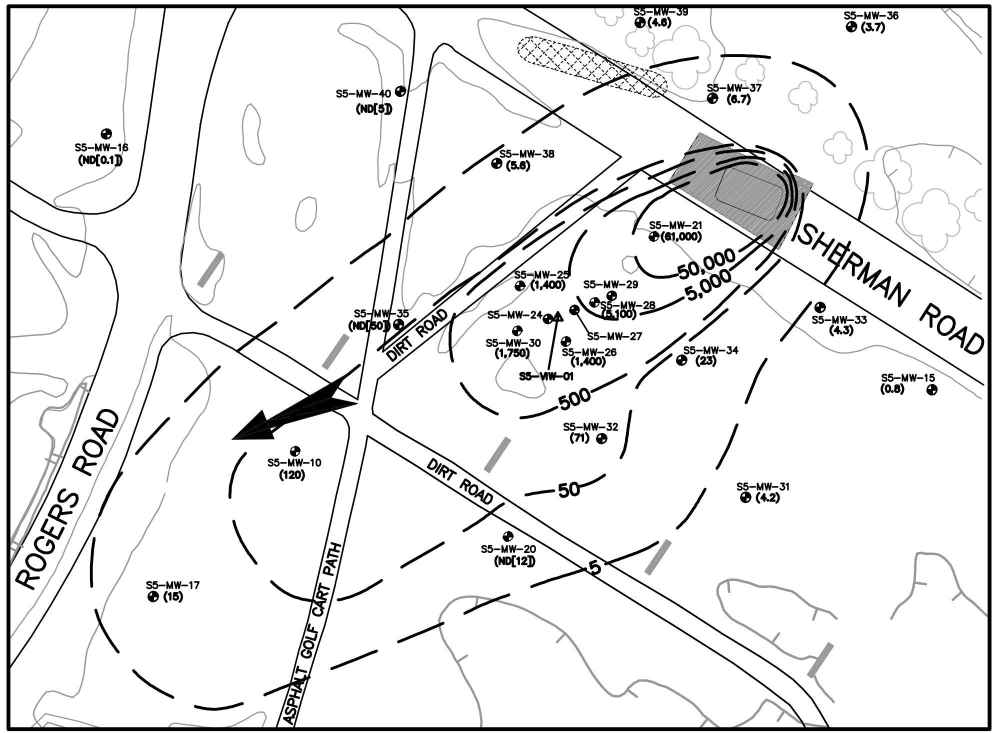
N



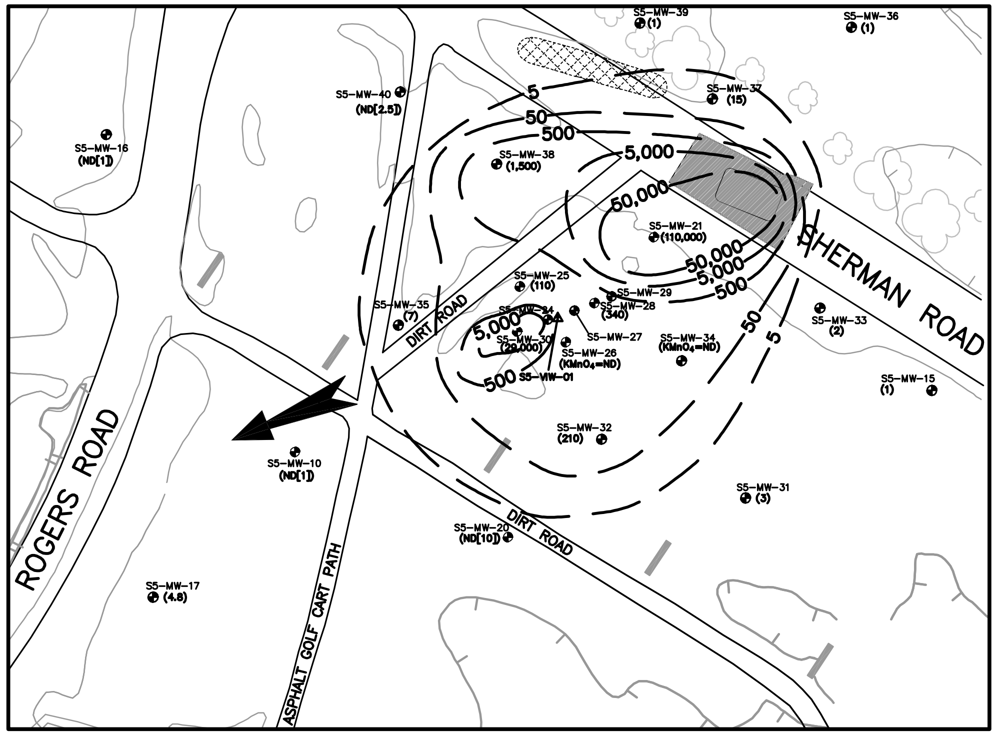
BASELINE VINYL CHLORIDE CONTOURS (MAY 2002)



FINAL POSTTREATMENT VINYL CHLORIDE CONTOURS (JULY 2003)



BASELINE CIS-1,2-DICHLOROETHENE CONTOURS (MAY 2002)



FINAL POSTTREATMENT CIS-1,2-DICHLOROETHENE CONTOURS (JULY 2003)

LEGEND:

▨	ESTIMATED LOCATION OF SUSPECTED WESTERN FORMER DISPOSAL PIT
▨	EXTENT OF SOIL EXCAVATION
▭	SOURCE AREA/IDENTIFIED EXTENT OF EASTERN FORMER LIQUID DISPOSAL PIT
←	GROUNDWATER FLOW DIRECTION
—50—	ESTIMATED EXTENT OF SELECTED VOC(s) IN μg/L
S5-MW-30 ⊕ (100)	MONITORING WELL WITH DETECTED VOC(s) CONCENTRATION IN μg/L PROVIDED IN BRACKETS
(ND[0.2])	NOT DETECTED ABOVE OR EQUAL TO LABORATORY REPORTING LIMIT IN BRACKETS
S5-VIW-01 △	VERTICAL INJECTION WELL
▬	RUNWAY LIGHTS

NOTE:

1. BASELINE GROUNDWATER DATA FOR PERIMETER WELLS S5-MW-11, -12, -16, -17, -18, -22, AND -23 FROM PARSONS (1999) JULY 1998 GROUNDWATER SAMPLING.
2. AVERAGE CONCENTRATION OF SAMPLES IS USED FOR CONTOURS WHEN DUPLICATE SAMPLE WAS COLLECTED.
3. APRIL 2003 DATA FOR S5-MW-39 IS USED IN POSTTREATMENT CONTOURS BECAUSE THAT WELL COULD NOT BE SAMPLED IN JULY 2003.

SCALE

0 100 200 FEET

SWDIV

DRAWN BY D. MIRANDA	DATE 03/20/03
CHK'D BY B.C. WHITE	DATE 06/03/03
APP'D BY B.C. WHITE	DATE 06/03/03
PROJECT MANAGER R. WONG	
AUTOCAD FILE No. 818725-B25	

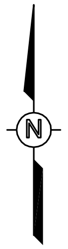
Shaw™ Shaw Environmental, Inc.

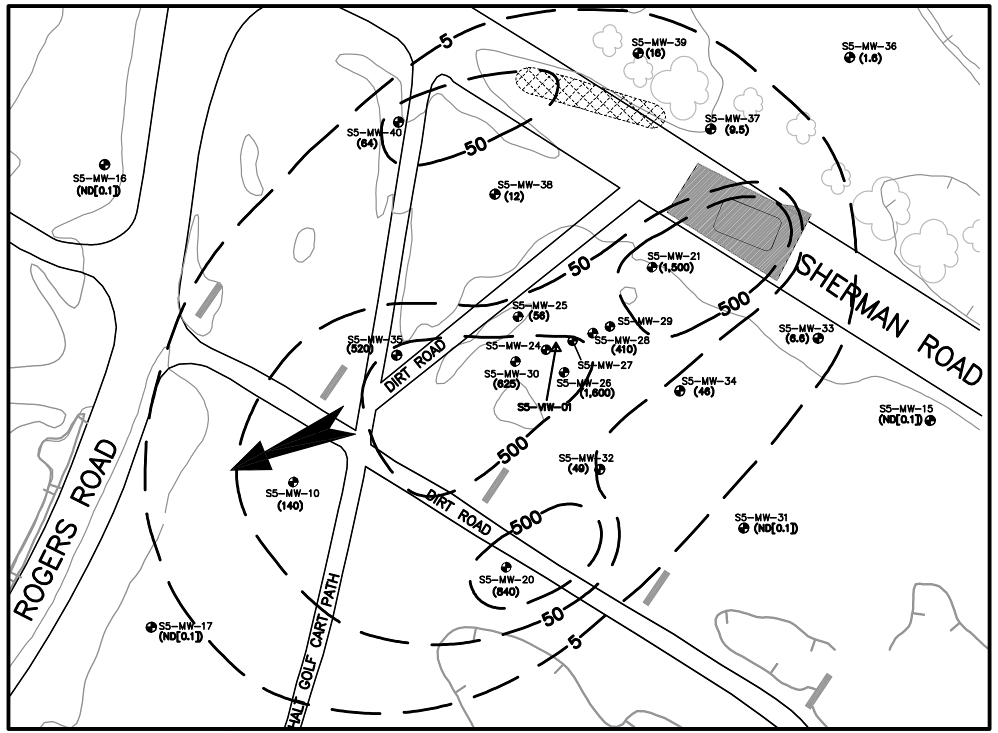
FIGURE 9

BASELINE AND FINAL POSTTREATMENT VINYL CHLORIDE AND CIS-1,2-DICHLOROETHENE CONTOURS

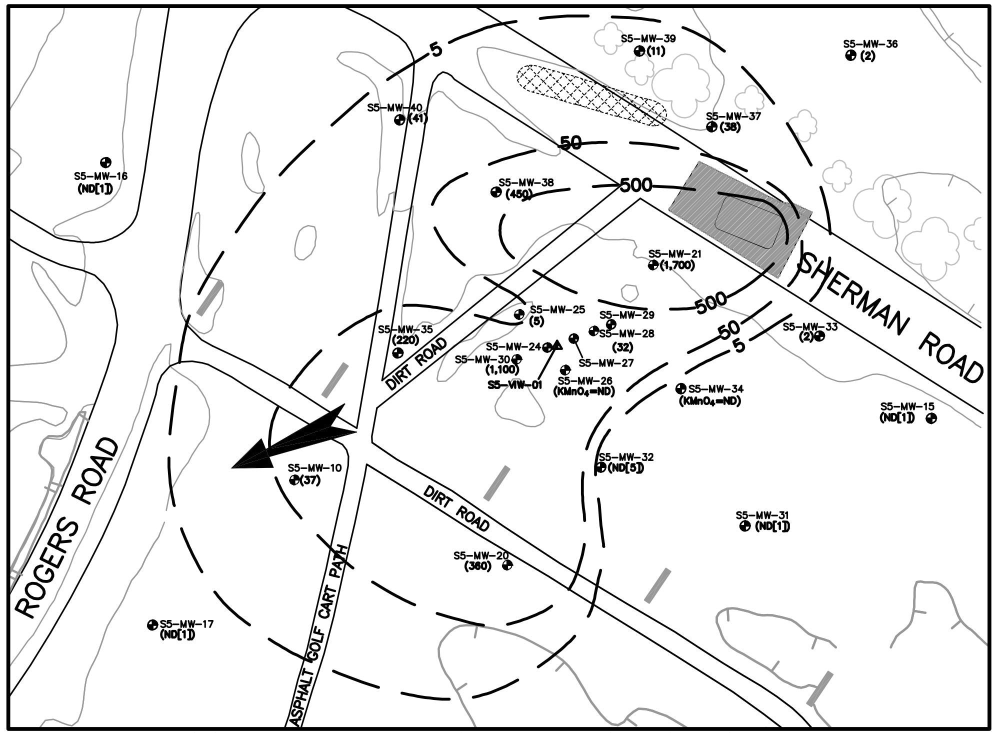
IR SITE 5 - UNIT 2
NAVAL AIR STATION, NORTH ISLAND
SAN DIEGO, CALIFORNIA

SCALE	SHEET	OF	SHAW PROJECT No.	DOCUMENT CONTROL No.	REVISION
AS NOTED	1	1	818725	5399	0

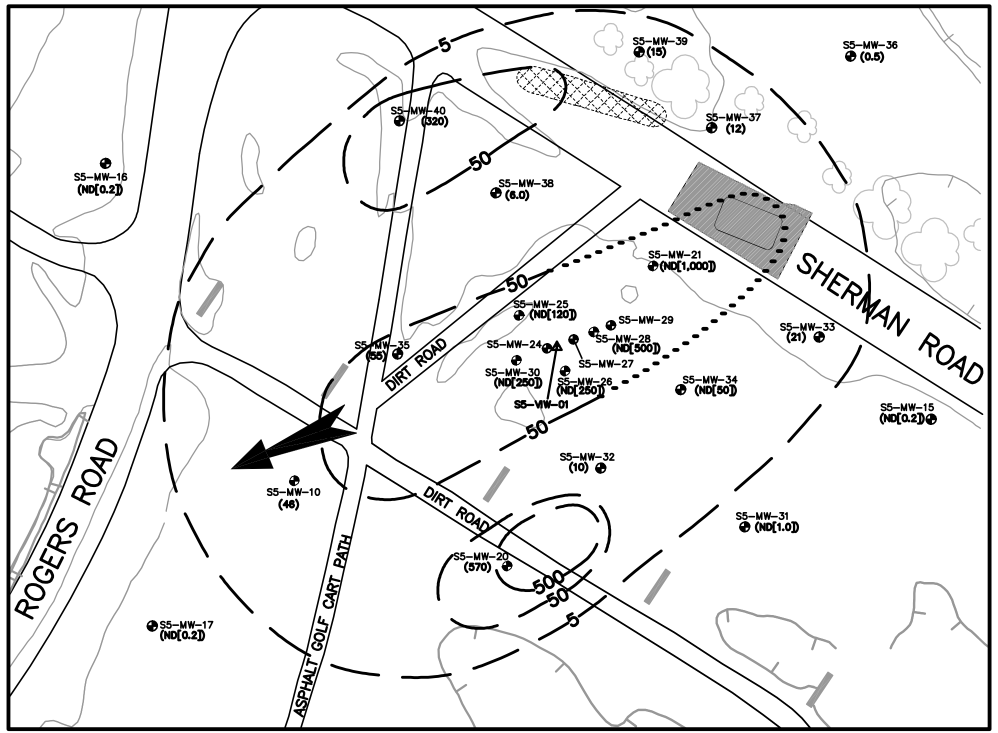




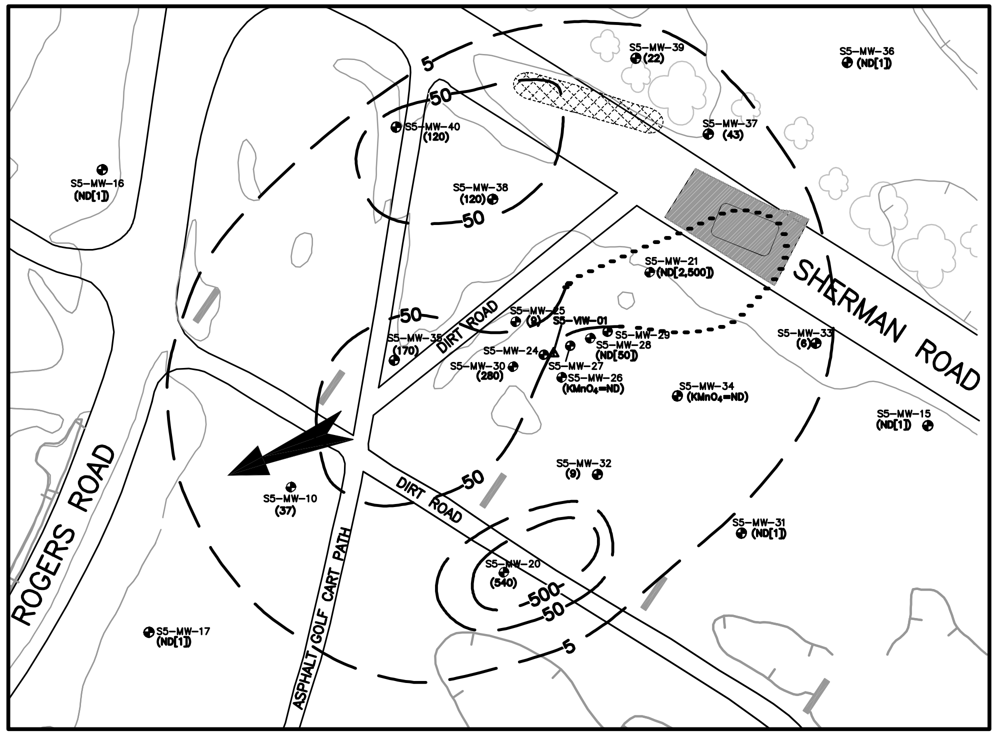
BASELINE TOLUENE CONTOURS (MAY 2002)



FINAL POSTTREATMENT TOLUENE CONTOURS (JULY 2003)



BASELINE NAPHTHALENE CONTOURS (MAY 2002)



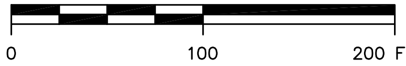
FINAL POSTTREATMENT NAPHTHALENE CONTOURS (JULY 2003)

LEGEND:

▨	ESTIMATED LOCATION OF SUSPECTED WESTERN FORMER DISPOSAL PIT
▨	EXTENT OF SOIL EXCAVATION
▭	SOURCE AREA/IDENTIFIED EXTENT OF EASTERN FORMER LIQUID DISPOSAL PIT
←	GROUNDWATER FLOW DIRECTION
—50—	ESTIMATED EXTENT OF SELECTED VOC(s) IN µg/L
S5-MW-30 ⊕ (100)	MONITORING WELL WITH DETECTED VOC(s) CONCENTRATION IN µg/L PROVIDED IN BRACKETS
(ND[0.2])	NOT DETECTED ABOVE OR EQUAL TO LABORATORY REPORTING LIMIT IN BRACKETS
S5-VIW-01 △	VERTICAL INJECTION WELL
▬	RUNWAY LIGHTS

NOTE:

1. BASELINE GROUNDWATER DATA FOR PERIMETER WELLS S5-MW-11, -12, -16, -17, -18, -22, AND -23 FROM PARSONS (1999) JULY 1998 GROUNDWATER SAMPLING.
2. AVERAGE CONCENTRATION OF SAMPLES IS USED FOR CONTOURS WHEN DUPLICATE SAMPLE WAS COLLECTED.
3. APRIL 2003 DATA FOR S5-MW-39 IS USED IN POSTTREATMENT CONTOURS BECAUSE THAT WELL COULD NOT BE SAMPLED IN JULY 2003.



SWDIV

DRAWN BY D. MIRANDA	DATE 04/11/03
CHK'D BY B.C. WHITE	DATE 06/03/03
APP'D BY B.C. WHITE	DATE 06/03/03
PROJECT MANAGER R. WONG	
AUTOCAD FILE No. 818725-B26	

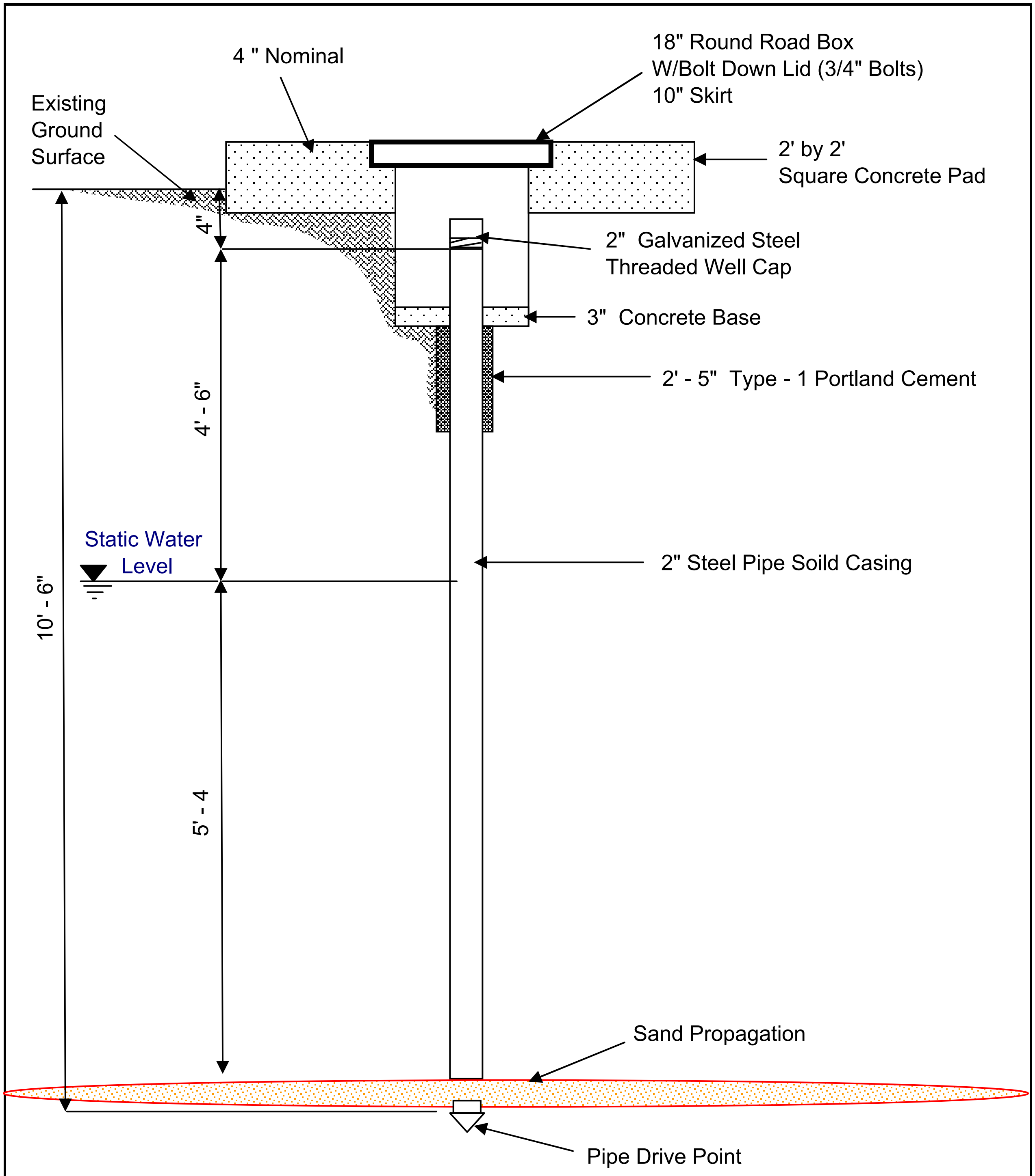
Shaw™ Shaw Environmental, Inc.

FIGURE 10

BASELINE AND FINAL POSTTREATMENT TOLUENE AND NAPHTHALENE CONTOURS

IR SITE 5 - UNIT 2
NAVAL AIR STATION, NORTH ISLAND
SAN DIEGO, CALIFORNIA

SCALE	SHEET	OF	SHAW PROJECT No.	DOCUMENT CONTROL No.	REVISION
AS NOTED	1	1	818725	5399	0



ENVIRONMENTAL BUSINESS SOLUTIONS INTERNATIONAL, INC.

INJECTION WELL ID
S5-PIW-01 through -19

DRAWN BY
R. RESSEGUIE

DATE
6/14/02

GEOPROBE COMPANY
VIRONEX

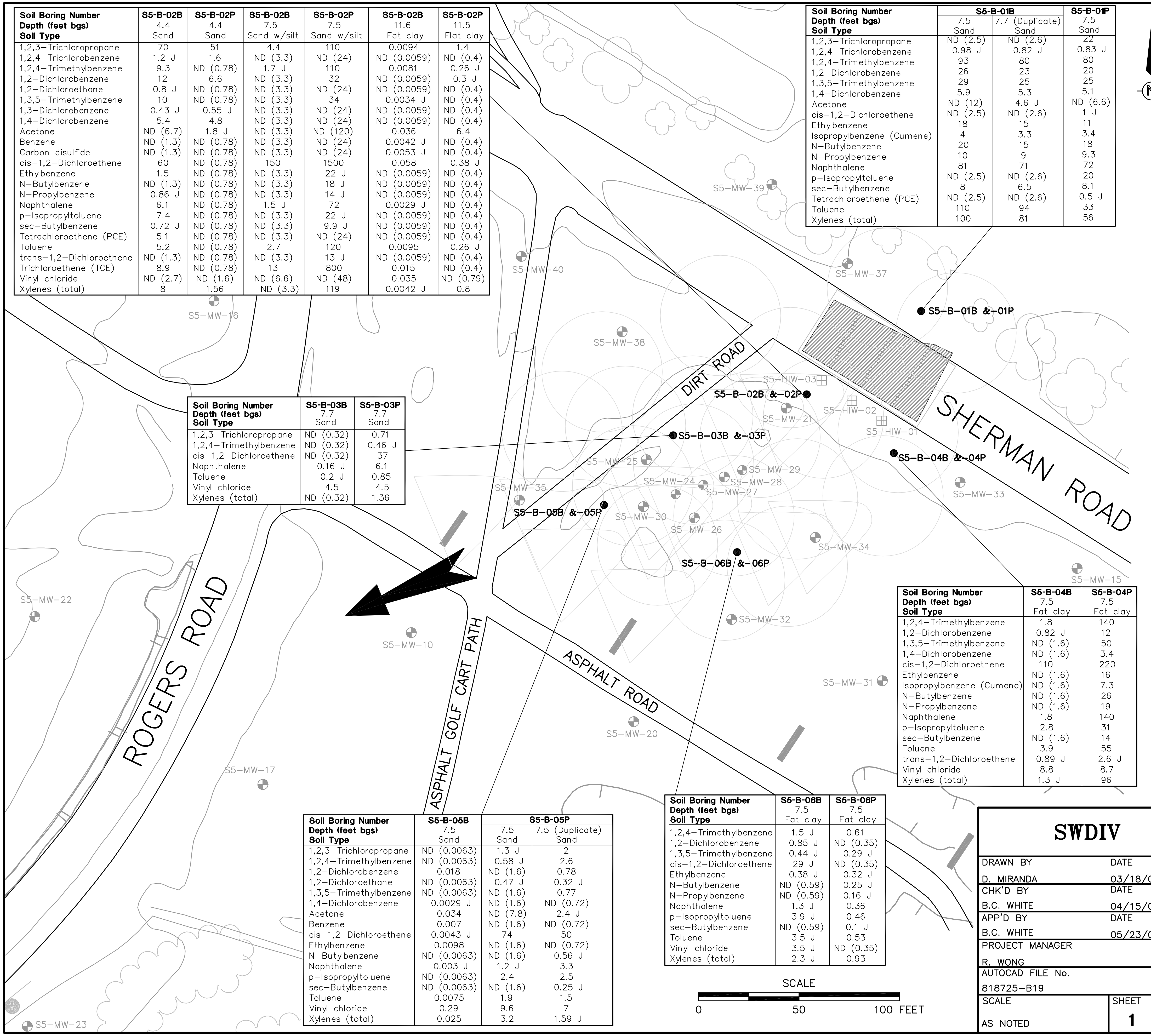
SCALE
NOT TO SCALE

INSTALLED BY
R. RESSEGUIE

FIGURE 11
PROPAGATION INJECTION
WELL DESIGN
IR SITE 5. UNIT 2
NAS NORTH ISLAND
SAN DIEGO COUNTY, CALIFORNIA

Soil Boring Number Depth (feet bgs) Soil Type	S5-B-02B 4.4 Sand	S5-B-02P 4.4 Sand	S5-B-02B 7.5 Sand w/silt	S5-B-02P 7.5 Sand w/silt	S5-B-02B 11.6 Fat clay	S5-B-02P 11.5 Flat clay
1,2,3–Trichloropropane	70	51	4.4	110	0.0094	1.4
1,2,4–Trichlorobenzene	1.2 J	1.6	ND (3.3)	ND (24)	ND (0.0059)	ND (0.4)
1,2,4–Trimethylbenzene	9.3	ND (0.78)	1.7 J	110	0.0081	0.26 J
1,2–Dichlorobenzene	12	6.6	ND (3.3)	32	ND (0.0059)	0.3 J
1,2–Dichloroethane	0.8 J	ND (0.78)	ND (3.3)	ND (24)	ND (0.0059)	ND (0.4)
1,3,5–Trimethylbenzene	10	ND (0.78)	ND (3.3)	34	0.0034 J	ND (0.4)
1,3–Dichlorobenzene	0.43 J	0.55 J	ND (3.3)	ND (24)	ND (0.0059)	ND (0.4)
1,4–Dichlorobenzene	5.4	4.8	ND (3.3)	ND (24)	ND (0.0059)	ND (0.4)
Acetone	ND (6.7)	1.8 J	ND (3.3)	ND (120)	0.036	6.4
Benzene	ND (1.3)	ND (0.78)	ND (3.3)	ND (24)	0.0042 J	ND (0.4)
Carbon disulfide	ND (1.3)	ND (0.78)	ND (3.3)	ND (24)	0.0053 J	ND (0.4)
cis–1,2–Dichloroethene	60	ND (0.78)	150	1500	0.058	0.38 J
Ethylbenzene	1.5	ND (0.78)	ND (3.3)	22 J	ND (0.0059)	ND (0.4)
N–Butylbenzene	ND (1.3)	ND (0.78)	ND (3.3)	18 J	ND (0.0059)	ND (0.4)
N–Propylbenzene	0.86 J	ND (0.78)	ND (3.3)	14 J	ND (0.0059)	ND (0.4)
Naphthalene	6.1	ND (0.78)	1.5 J	72	0.0029 J	ND (0.4)
p–Isopropyltoluene	7.4	ND (0.78)	ND (3.3)	22 J	ND (0.0059)	ND (0.4)
sec–Butylbenzene	0.72 J	ND (0.78)	ND (3.3)	9.9 J	ND (0.0059)	ND (0.4)
Tetrachloroethene (PCE)	5.1	ND (0.78)	ND (3.3)	ND (24)	ND (0.0059)	ND (0.4)
Toluene	5.2	ND (0.78)	2.7	120	0.0095	0.26 J
trans–1,2–Dichloroethene	ND (1.3)	ND (0.78)	ND (3.3)	13 J	ND (0.0059)	ND (0.4)
Trichloroethene (TCE)	8.9	ND (0.78)	13	800	0.015	ND (0.4)
Vinyl chloride	ND (2.7)	ND (1.6)	ND (6.6)	ND (48)	0.035	ND (0.79)
Xylenes (total)	8	1.56	ND (3.3)	119	0.0042 J	0.8

Soil Boring Number	S5-B-01B		S5-B-01P
Depth (feet bgs)	7.5	7.7 (Duplicate)	7.5
Soil Type	Sand	Sand	Sand
1,2,3–Trichloropropane	ND (2.5)	ND (2.6)	22
1,2,4–Trichlorobenzene	0.98 J	0.82 J	0.83 J
1,2,4–Trimethylbenzene	93	80	80
1,2–Dichlorobenzene	26	23	20
1,3,5–Trimethylbenzene	29	25	25
1,4–Dichlorobenzene	5.9	5.3	5.1
Acetone	ND (12)	4.6 J	ND (6.6)
cis–1,2–Dichloroethene	ND (2.5)	ND (2.6)	1 J
Ethylbenzene	18	15	11
Isopropylbenzene (Cumene)	4	3.3	3.4
N–Butylbenzene	20	15	18
N–Propylbenzene	10	9	9.3
Naphthalene	81	71	72
p–Isopropyltoluene	ND (2.5)	ND (2.6)	20
sec–Butylbenzene	8	6.5	8.1
Tetrachloroethene (PCE)	ND (2.5)	ND (2.6)	0.5 J
Toluene	110	94	33
Xylenes (total)	100	81	56



Soil Boring Number Depth (feet bgs) Soil Type	S5-B-03B 7.7 Sand	S5-B-03P 7.7 Sand
1,2,3–Trichloropropane	ND (0.32)	0.71
1,2,4–Trimethylbenzene	ND (0.32)	0.46 J
cis–1,2–Dichloroethene	ND (0.32)	37
Naphthalene	0.16 J	6.1
Toluene	0.2 J	0.85
Vinyl chloride	4.5	4.5
Xylenes (total)	ND (0.32)	1.36

Soil Boring Number Depth (feet bgs) Soil Type	S5-B-04B 7.5 Fat clay	S5-B-04P 7.5 Fat clay
1,2,4–Trimethylbenzene	1.8	140
1,2–Dichlorobenzene	0.82 J	12
1,3,5–Trimethylbenzene	ND (1.6)	50
1,4–Dichlorobenzene	ND (1.6)	3.4
cis–1,2–Dichloroethene	110	220
Ethylbenzene	ND (1.6)	16
Isopropylbenzene (Cumene)	ND (1.6)	7.3
N–Butylbenzene	ND (1.6)	26
N–Propylbenzene	ND (1.6)	19
Naphthalene	1.8	140
p–Isopropyltoluene	2.8	31
sec–Butylbenzene	ND (1.6)	14
Toluene	3.9	55
trans–1,2–Dichloroethene	0.89 J	2.6 J
Vinyl chloride	8.8	8.7
Xylenes (total)	1.3 J	96

Soil Boring Number Depth (feet bgs) Soil Type	S5-B-06B 7.5 Fat clay	S5-B-06P 7.5 Fat clay
1,2,4–Trimethylbenzene	1.5 J	0.61
1,2–Dichlorobenzene	0.85 J	ND (0.35)
1,3,5–Trimethylbenzene	0.44 J	0.29 J
cis–1,2–Dichloroethene	29 J	ND (0.35)
Ethylbenzene	0.38 J	0.32 J
N–Butylbenzene	ND (0.59)	0.25 J
N–Propylbenzene	ND (0.59)	0.16 J
Naphthalene	1.3 J	0.36
p–Isopropyltoluene	3.9 J	0.46
sec–Butylbenzene	ND (0.59)	0.1 J
Toluene	3.5 J	0.53
Vinyl chloride	3.5 J	ND (0.35)
Xylenes (total)	2.3 J	0.93

Soil Boring Number	S5-B-05B	S5-B-05P	
Depth (feet bgs)	7.5	7.5	7.5 (Duplicate)
Soil Type	Sand	Sand	Sand
1,2,3–Trichloropropane	ND (0.0063)	1.3 J	2
1,2,4–Trimethylbenzene	ND (0.0063)	0.58 J	2.6
1,2–Dichlorobenzene	0.018	ND (1.6)	0.78
1,2–Dichloroethane	ND (0.0063)	0.47 J	0.32 J
1,3,5–Trimethylbenzene	ND (0.0063)	ND (1.6)	0.77
1,4–Dichlorobenzene	0.0029 J	ND (1.6)	ND (0.72)
Acetone	0.034	ND (7.8)	2.4 J
Benzene	0.007	ND (1.6)	ND (0.72)
cis–1,2–Dichloroethene	0.0043 J	74	50
Ethylbenzene	0.0098	ND (1.6)	ND (0.72)
N–Butylbenzene	ND (0.0063)	ND (1.6)	0.56 J
Naphthalene	0.003 J	1.2 J	3.3
p–Isopropyltoluene	ND (0.0063)	2.4	2.5
sec–Butylbenzene	ND (0.0063)	ND (1.6)	0.25 J
Toluene	0.0075	1.9	1.5
Vinyl chloride	0.29	9.6	7
Xylenes (total)	0.025	3.2	1.59 J

LEGEND:

N

○	APPROXIMATE AREA OF PROPAGATION TREATMENT (60 FOOT DIAMETER)
△	APPROXIMATE TREATMENT AREA OF VERTICAL WELLS
▭	APPROXIMATE TREATMENT AREA OF HORIZONTAL WELLS
▨	EXTENT OF SOIL EXCAVATION
←	GROUNDWATER FLOW DIRECTION
S5–MW–30 ⊕	MONITORING WELL
S5–HIW–03 ⊞	HORIZONTAL INJECTION WELL
S5–B–01B ●	SOIL BORING LOCATION FOR BASELINE (B) AND POST–TREATMENT (P) SOIL SAMPLES COLLECTED ON JUNE 27, 2002 AND MARCH 27, 2003, RESPECTIVELY
J –	DATE QUALIFIER INDICATING ESTIMATED CONCENTRATION
ND (2,000) –	COMPOUND NOT DETECTED AT/ABOVE THE MEAN DETECTION LIMIT, REPORTING LIMIT IS PROVIDED IN BRACKETS
B –	BACKGROUND, ALSO IDENTIFIED IN LABORATORY BLANK
bgs –	BELOW GROUND SURFACE
⁄⁄⁄	SCREENED INTERVAL OF HORIZONTAL INJECTION WELL
▬	RUNWAY LIGHTS

NOTE:

1. ALL CONCENTRATIONS ARE MILLIGRAMS PER KILOGRAM (mg/kg).
2. POST–TREATMENT SOIL BORINGS WERE LOCATED APPROXIMATELY 1–FOOT FROM THE SURVEYED BASELINE SOIL BORING LOCATIONS.

SWDIV

Shaw™ Shaw Environmental, Inc.

DRAWN BY D. MIRANDA	DATE 03/18/03
CHK'D BY B.C. WHITE	DATE 04/15/03
APP'D BY B.C. WHITE	DATE 05/23/03
PROJECT MANAGER R. WONG	
AUTOCAD FILE No. 818725–B19	

FIGURE 12

DETECTED VOCs IN BASELINE AND POSTTREATMENT SOIL SAMPLES

IR SITE 5 - UNIT 2
NAVAL AIR STATION, NORTH ISLAND
SAN DIEGO, CALIFORNIA

SCALE	SHEET	OF	SHAW PROJECT No.	DOCUMENT CONTROL No.	REVISION
AS NOTED	1	1	818725	5399	0

Figure 13

Treatment Area Total Detected VOC Analytical Results

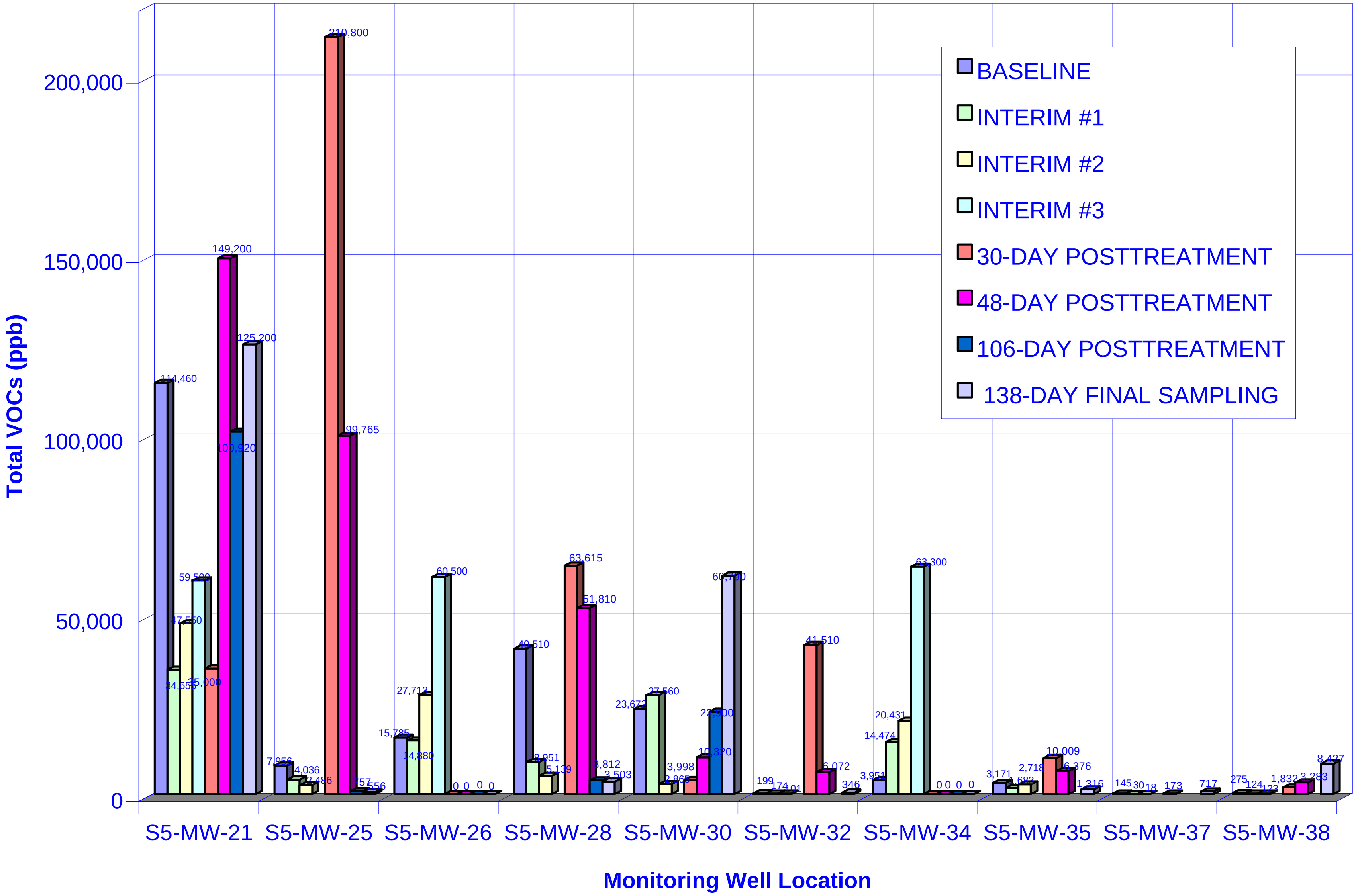


Figure 14

Boundary Well Total Detected VOC Analytical Results

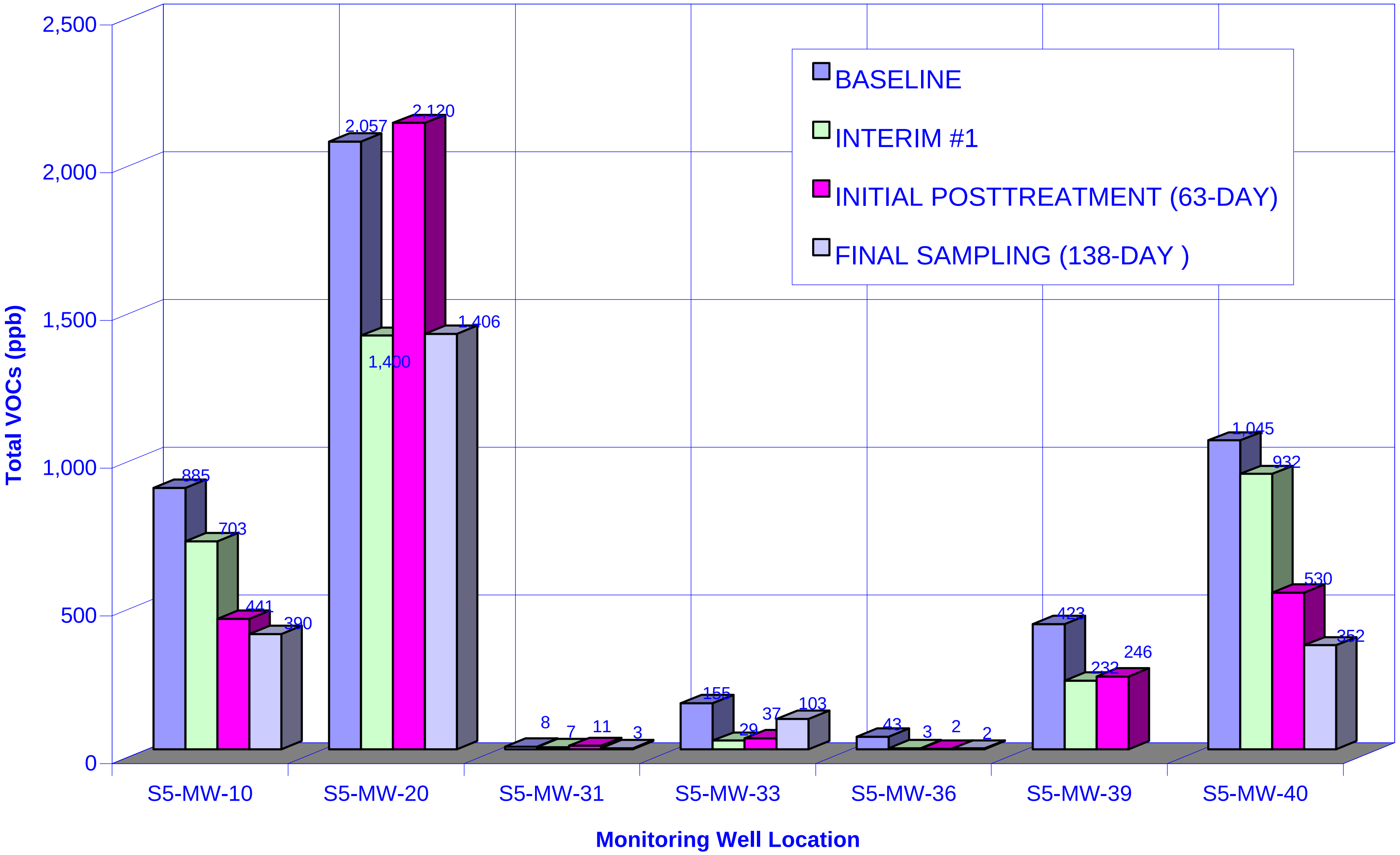
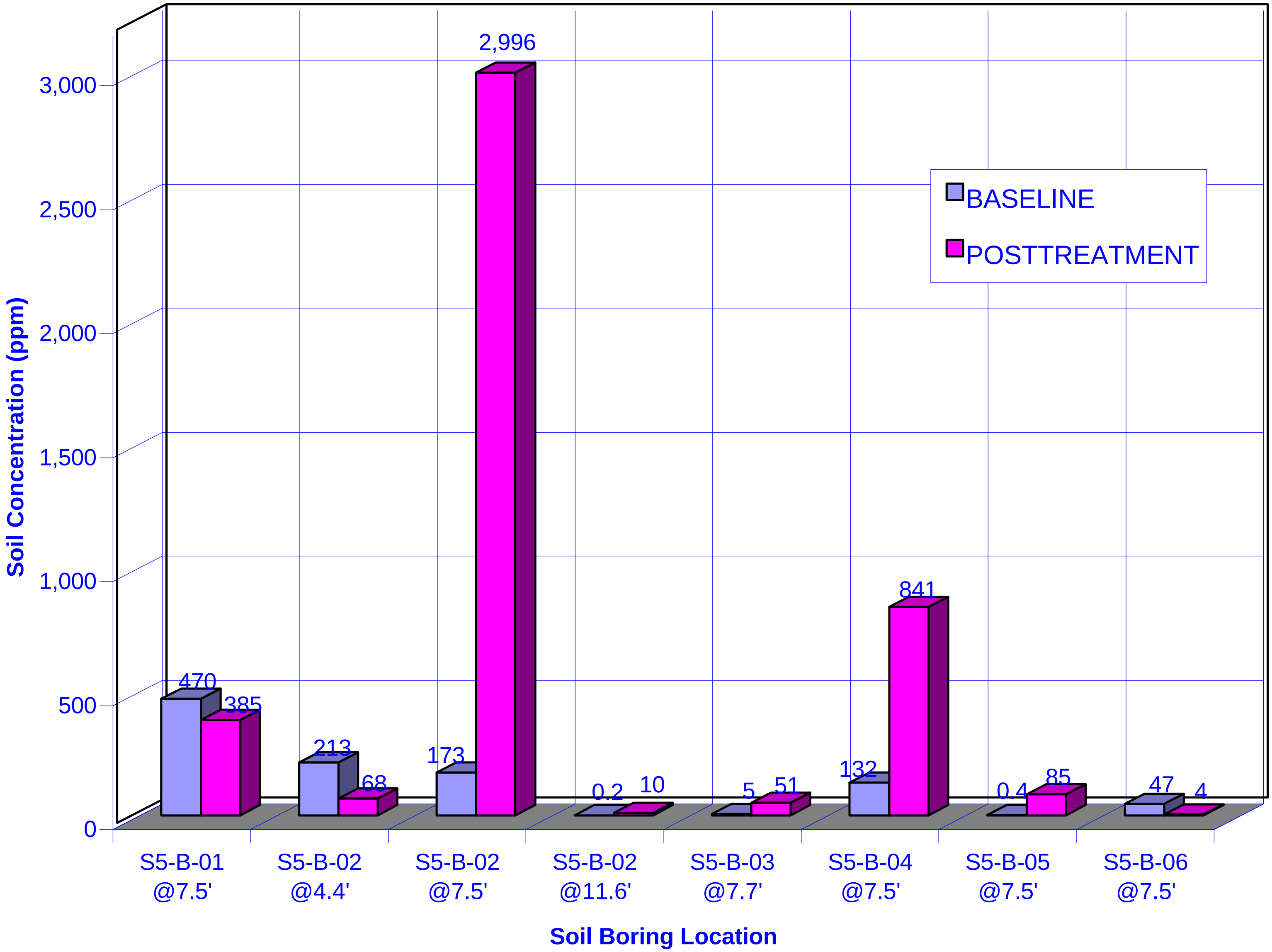
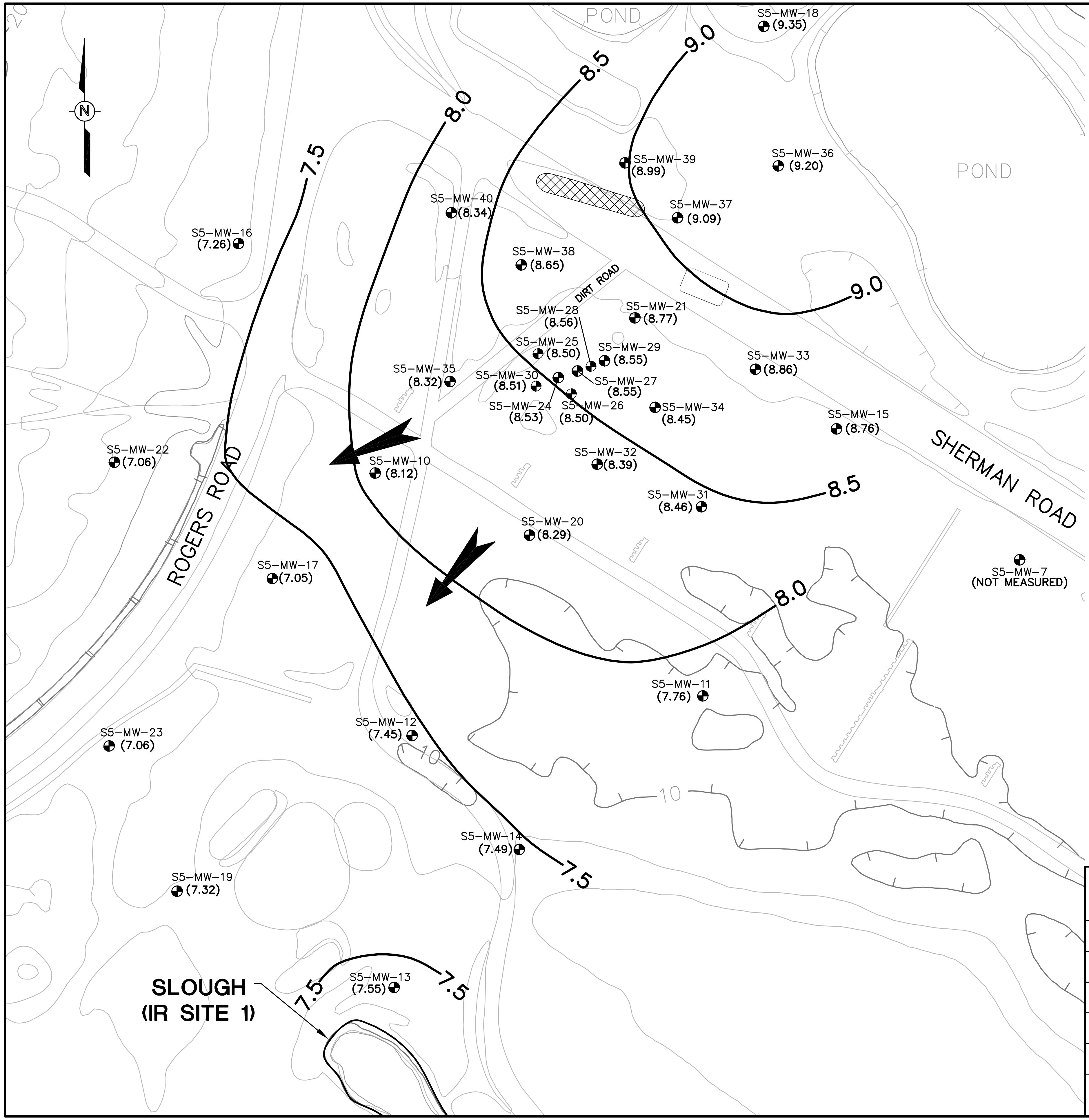


Figure 15

Baseline and Posttreatment Total VOC Soil Sample Analytical Results





LEGEND:

—10— SURFACE ELEVATION IN FEET, DATUM MLLW

▨ ESTIMATED LOCATION OF SUSPECTED WESTERN FORMER DISPOSAL POND

◀ GROUNDWATER FLOW DIRECTION

▭ SOURCE AREA/IDENTIFIED EXTENT OF EASTERN FORMER LIQUID DISPOSAL POND

—8.0— GROUNDWATER ELEVATION IN FEET, DATUM MLLW

S5-MW-30 (8.51) ● MONITORING WELL WITH GROUNDWATER ELEVATION IN FEET IN BRACKETS

RUNWAY LIGHTS

NOTES:

1. S5-MW-34 DATA EXCLUDED.

SCALE
0 80 160 FEET

SWDIV

Shaw™ Shaw Environmental, Inc.

DRAWN BY D. MIRANDA	DATE 05/28/03
CHECKED BY B.C. WHITE	DATE 06/03/03
APP'D BY B.C. WHITE	DATE 06/03/03
PROJECT MANAGER R. WONG	
AUTOCAD FILE No. 818725-B14	

FIGURE 16

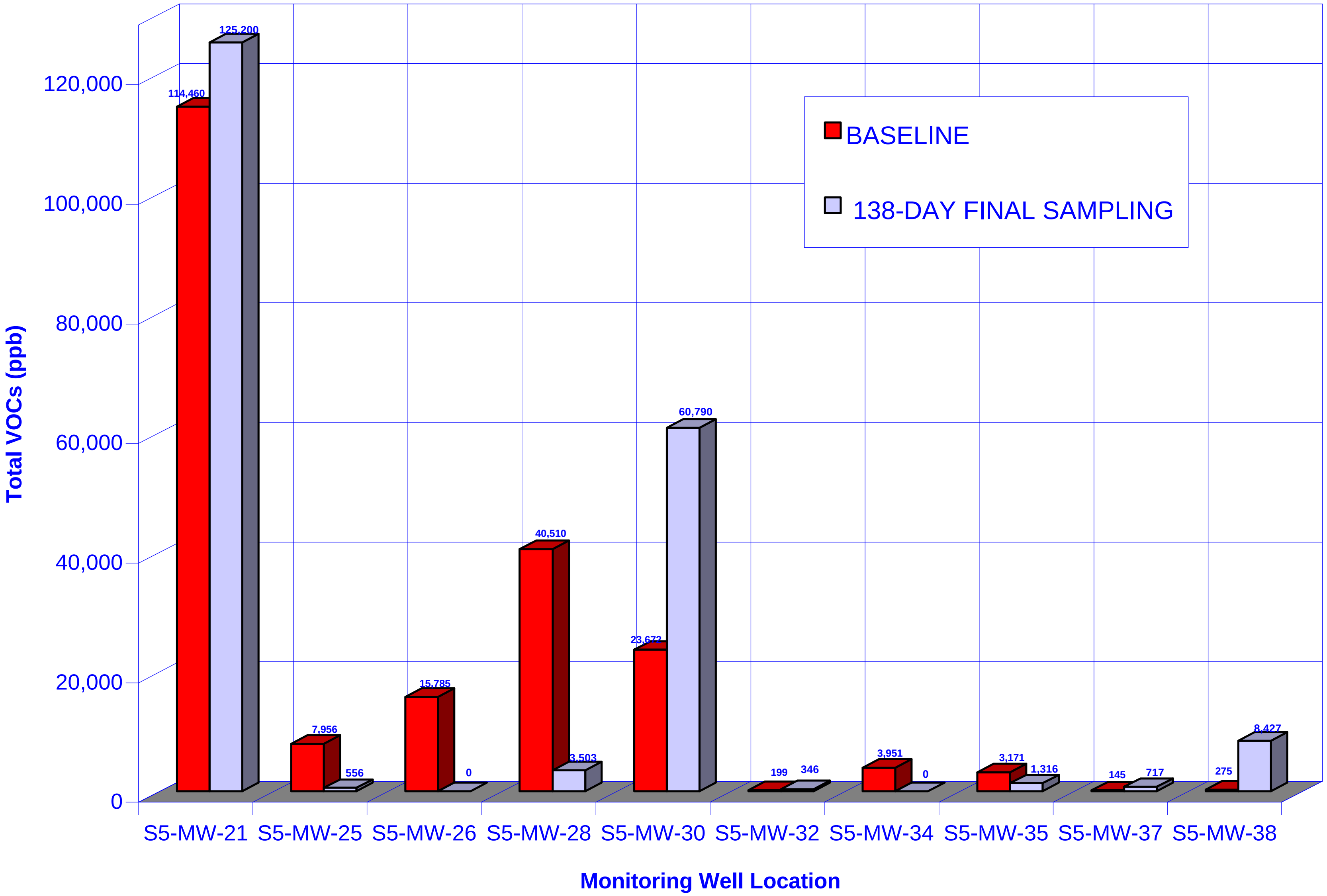
GROUNDWATER CONTOURS
APRIL 21, 2003

IR SITE 5 - UNIT 2
NAVAL AIR STATION, NORTH ISLAND
SAN DIEGO, CALIFORNIA

SCALE	SHEET	OF	SHAW PROJECT No.	DOCUMENT CONTROL No.	REVISION
AS NOTED	1	1	818725	5399	0

Figure 17

Treatment Area Total Detected VOC Analytical Results



Tables

Table 1
Source Area Delineation Soil Sample Analytical Results

Sample Identification		818725-013	818725-008	818725-007	818725-009	818725-005	818725-006 (Dup)	818725-010	818725-004	818725-002	818725-003
Location Code		S5-B-01D	S5-B-02D	S5-B-03D	S5-B-04D	S5-B-05D	S5-B-05D	S5-B-06D	S5-B-07D	S5-B-08D	S5-B-09D
Date Sampled		09/06/01	09/06/01	09/06/01	09/06/01	09/06/01	09/06/01	09/06/01	09/06/01	09/06/01	09/06/01
Depth (feet below ground surface)		3.4	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
	Unit										
SW8260B											
1,1,1,2-Tetrachloroethane	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
1,1,1-Trichloroethane	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
1,1,2,2-Tetrachloroethane	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
1,1,2-Trichloro-1,2,2-trifluoroethane	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
1,1,2-Trichloroethane	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
1,1-Dichloroethane	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
1,1-Dichloroethene	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
1,1-Dichloropropene	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
1,2,3-Trichlorobenzene	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
1,2,3-Trichloropropane	mg/kg	**0.12**	**40**	**5.7**	**72**	**220**	**210**	**210**	**21**	**17**	**16**
1,2,4-Trichlorobenzene	mg/kg	0.0058 U	2.5 U	**2.4 J**	6.2 U	53 U	55 U	31 U	21 U	**1.6**	**2.1**
1,2,4-Trimethylbenzene	mg/kg	0.0058 U	**3.5**	**62**	**13**	**42 J**	**48 J**	**160**	**71**	0.58 U	0.63 U
1,2-Dibromo-3-chloropropane (DBCP)	mg/kg	0.012 U	5 U	11 U	12 U	110 U	110 U	62 U	42 U	1.2 U	1.3 U
1,2-Dibromoethane (EDB)	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
1,2-Dichlorobenzene	mg/kg	0.0058 U	**8.4**	**52**	**14**	**30 J**	**28 J**	**43**	**28**	**22**	**16**
1,2-Dichloroethane	mg/kg	0.0058 U	2.5 U	**16**	**4.1 J**	**19 J**	**18 J**	**36**	**29**	0.58 U	0.63 U
1,2-Dichloropropane	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
1,3,5-Trimethylbenzene	mg/kg	0.0058 U	**1.6 J**	**19**	**4.9 J**	53 U	55 U	**47**	**21**	0.58 U	0.63 U
1,3-Dichlorobenzene	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
1,3-Dichloropropane	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
1,4-Dichlorobenzene	mg/kg	0.0058 U	**3.1**	**12**	**4.2 J**	53 U	55 U	31 U	21 U	**4.8**	**5.3**
1-Bromo-2-Chloroethane	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
2,2-Dichloropropane	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
2-Butanone (MEK)	mg/kg	0.029 U	13 U	29 U	31 U	270 U	270 U	160 U	110 U	2.9 U	3.1 U
2-Chlorotoluene	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
2-Hexanone	mg/kg	0.029 U	13 U	29 U	31 U	270 U	270 U	160 U	110 U	2.9 U	3.1 U
4-Chlorotoluene	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
4-Methyl-2-pentanone (MIBK)	mg/kg	0.029 U	13 U	29 U	31 U	270 U	270 U	160 U	110 U	2.9 U	3.1 U
Acetone	mg/kg	0.029 U	13 U	29 U	31 U	270 U	270 U	160 U	110 U	2.9 U	3.1 U
Benzene	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
Bromobenzene	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
Bromochloromethane	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
Bromodichloromethane	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
Bromoform	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
Bromomethane	mg/kg	0.012 U	5 U	11 U	12 U	110 U	110 U	62 U	42 U	1.2 U	1.3 U
Carbon disulfide	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
Carbon tetrachloride	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
Chlorobenzene	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
Chloroethane	mg/kg	0.012 U	5 U	11 U	12 U	110 U	110 U	62 U	42 U	1.2 U	1.3 U
Chloroform	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
Chloromethane	mg/kg	0.012 U	5 U	11 U	12 U	110 U	110 U	62 U	42 U	1.2 U	1.3 U
cis-1,2-Dichloroethene	mg/kg	0.0058 U	**17**	**340**	**47**	**54**	**53 J**	**130**	**330**	**1.5**	**1.2**
cis-1,3-Dichloropropene	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
Dibromochloromethane	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
Dibromomethane	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
Dichlorodifluoromethane	mg/kg	0.012 U	5 U	11 U	12 U	110 U	110 U	62 U	42 U	1.2 U	1.3 U
Ethylbenzene	mg/kg	0.0058 U	2.5 U	**12**	**3.5 J**	53 U	55 U	**24 J**	**15 J**	0.58 U	0.63 U
Hexachlorobutadiene	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
Isopropylbenzene (Cumene)	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
m/p-Xylene	mg/kg	0.0058 U	2.5 U	**49**	**8.4**	**37 J**	55 U	**97**	**56**	0.58 U	0.63 U
Methyl tert-butyl ether (MTBE)	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
Methylene chloride	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	**4.6 J**	0.58 U	0.63 U
N-Butylbenzene	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
N-Propylbenzene	mg/kg	0.0058 U	2.5 U	**5.6 J**	**3 J**	53 U	55 U	**17 J**	21 U	0.58 U	0.63 U
Naphthalene	mg/kg	0.0058 U	**1.3 J**	**87**	**7.5**	**60**	**57**	**120**	**120**	**0.69**	0.63 U
o-Xylene	mg/kg	0.0058 U	2.5 U	**22**	**4.6 J**	53 U	55 U	**43**	**24**	0.58 U	0.63 U
p-Isopropyltoluene	mg/kg	0.0058 U	**1.6 J**	5.7 U	**6.2**	53 U	55 U	31 U	**21**	**0.44 J**	0.63 U
sec-Butylbenzene	mg/kg	0.0058 U	2.5 U	**5.3 J**	**3.4 J**	53 U	55 U	**13 J**	**7.2 J**	0.58 U	0.63 U
Styrene	mg/kg	0.012 U	5 U	11 U	12 U	110 U	110 U	62 U	42 U	1.2 U	1.3 U
tert-Butylbenzene	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
Tetrachloroethene (PCE)	mg/kg	0.0058 U	**47**	**4.5 J**	**160**	**3,700**	**4,200**	**320**	21 U	**0.43 J**	**0.59 J**
Toluene	mg/kg	0.0058 U	**1.3 J**	**65**	**15**	**63**	**66**	**130**	**86**	0.58 U	0.63 U
trans-1,2-Dichloroethene	mg/kg	0.0058 U	2.5 U	**4.4 J**	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
trans-1,3-Dichloropropene	mg/kg	0.0058 U	2.5 U	5.7 U	6.2 U	53 U	55 U	31 U	21 U	0.58 U	0.63 U
Trichloroethene (TCE)	mg/kg	0.0058 U	**130**	**310**	**490**	**910**	**1,000**	**2,100**	**990**	**0.75**	**0.97**
Vinyl chloride	mg/kg	0.012 U	5 U	11 U	12 U	110 U	110 U	62 U	42 U	1.2 U	1.3 U

Explanation:
J - estimated value
U - not detected at or above the stated reporting limit
mg/kg - miligrams per kilogram

Table 2
Excavated Soil VOC Waste Characterization Analytical Results

Sample Identification		818725-015	818725-016	818725-017	818725-018	818725-019	818725-020	818725-021	818725-022	818725-023	818725-024	818725-025	818725-026	818725-027	818725-028
Location Code		Bin 4873	Bin 4961	Bin 4938	Bin 5060	Bin 5001	Bin 89360	Bin 5326	Bin 5320	Bin 5325	Bin 5324	Bin 5303	Bin 5321	Bin 89304	Bin 5328
Date Sampled		12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01
	Unit														
EPA 8260B															
1,1,1,2-Tetrachloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,1-Trichloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloropropene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,3-Trichlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,3-Trichloropropane	mg/kg	5 U	**9**	**10**	5 U	5 U	5 U	**17**	5 U	**22**	**56**	**44**	5 U	**45**	**57**
1,2,4-Trichlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trimethylbenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**11**	**23**	**19**	**99**	**38**	**26**
1,2-Dibromo-3-chloropropane (DBCP)	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane (EDB)	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**8**	**12**	**18**	**31**	**15**	**19**
1,2-Dichloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**15**	5 U	5 U	**6**	5 U
1,2-Dichloropropane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3,5-Trimethylbenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**6**	**11**	**26**	**11**	**9**
1,3-Dichlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichloropropane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**8**	**10**	5 U	**7**
2,2-Dichloropropane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone (MEK)	mg/kg	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U
2-Chlorotoluene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	mg/kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone (MIBK)	mg/kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	mg/kg	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Benzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromochloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromodichloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	mg/kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon disulfide	mg/kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon tetrachloride	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	**16**	5 U	**17**	**29**	**36**	5 U	**114**	**11**
cis-1,3-Dichloropropene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromomethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**14**	**6**	5 U
Hexachlorobutadiene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Isopropylbenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
m/p-Xylene	mg/kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**17**	10 U	**54**	**24**	**16**
Methylene chloride	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
N-Butylbenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**6**	**9**
N-Propylbenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**10**	5 U	5 U
Naphthalene	mg/kg	15 U	15 U	15 U	15 U	15 U	15 U	15 U	15 U	15 U	**39**	15 U	**99**	**39**	**19**
o-Xylene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**7**	**6**	**28**	**11**	**8**
p-Isopropyltoluene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**10**	5 U	**8**	5 U
sec-Butylbenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**10**	5 U	5 U
Styrene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
tert-Butylbenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene (PCE)	mg/kg	5 U	**6**	**6**	5 U	**24**	5 U	**8**	**5**	**18**	**41**	**27**	5 U	**57**	**147**
Toluene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**7**	**32**	**8**	**27**	**37**	**21**
trans-1,2-Dichloroethene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene (TCE)	mg/kg	5 U	**12**	**19**	5 U	**14**	5 U	**22**	**22**	**124**	**441**	**79**	**9**	**690**	**209**
Trichlorofluoromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U

Table 2

Excavated Soil VOC Waste Characterization Analytical Results, Site 5 - Unit 2, NAS North Island

Sample Identification		818725-029	818725-030	818725-031	818725-032	818725-033	818725-034	818725-035	818725-036	818725-037	818725-038	818725-039	818725-040	818725-041	818725-042
Location Code		Bin 5329	Bin 89303	Bin 89298	Bin 89300	Bin 89302	Bin 89301	Bin 3165	Bin 3167	Bin 3164	Bin 3166	Bin 3162	Bin 5331	Bin 89364	Bin 89306
Date Sampled		12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01
	Unit														
EPA 8260B															
1,1,1,2-Tetrachloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,1-Trichloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloropropene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,3-Trichlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,3-Trichloropropane	mg/kg	**453**	**62**	**48**	5 U	**31**	5 U	**139**	**81**	**39**	**94**	**16**	**14**	**5**	**36**
1,2,4-Trichlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trimethylbenzene	mg/kg	**149**	**29**	**10**	5 U	**24**	5 U	**78**	**73**	**28**	**67**	**18**	**14**	5 U	**34**
1,2-Dibromo-3-chloropropane (DBCP)	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane (EDB)	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	mg/kg	**60**	**14**	**11**	5 U	**6**	5 U	**32**	**25**	**10**	**22**	**7**	5 U	5 U	**12**
1,2-Dichloroethane	mg/kg	**107**	5 U	6 U	5 U	6 U	5 U	**25**	**6**	**10**	**17**	**7**	5 U	5 U	**6**
1,2-Dichloropropane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3,5-Trimethylbenzene	mg/kg	**44**	**9**	5 U	5 U	**6.5**	5 U	**23**	**24**	**8**	**21**	5 U	5 U	5 U	**10**
1,3-Dichlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichloropropane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	mg/kg	**15**	5 U	5 U	5 U	5 U	5 U	**7**	**7**	5 U	5 U	5 U	5 U	5 U	5 U
2,2-Dichloropropane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone (MEK)	mg/kg	25 U	25 U	25 U	25 U	25 U	25 U	**132**	25 U	25 U	25 U	25 U	25 U	25 U	25 U
2-Chlorotoluene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	mg/kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone (MIBK)	mg/kg	**18**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	mg/kg	**87**	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Benzene	mg/kg	**8**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromochloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromodichloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	mg/kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon disulfide	mg/kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon tetrachloride	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	mg/kg	**132**	**14**	**25**	5 U	**13**	5 U	**23**	**17**	**16**	**9**	**6**	**9**	5 U	**21**
cis-1,3-Dichloropropene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromomethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	mg/kg	**39**	5 U	5 U	5 U	5 U	5 U	**21**	**11**	**5**	**11**	5 U	5 U	5 U	5 U
Hexachlorobutadiene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Isopropylbenzene	mg/kg	**8**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
m/p-Xylene	mg/kg	**127**	**16**	10 U	10 U	**17**	10 U	**71**	**42**	**21**	**46**	**12**	**12**	10 U	**19**
Methylene chloride	mg/kg	**130**	5 U	5 U	5 U	5 U	5 U	**42**	5 U	5 U	5 U	5 U	5 U	5 U	5 U
N-Butylbenzene	mg/kg	**25**	**9**	5 U	5 U	5 U	5 U	**10**	**22**	**5**	**16**	5 U	5 U	5 U	**11**
N-Propylbenzene	mg/kg	**18**	5 U	5 U	5 U	5 U	5 U	**9**	**8**	5 U	**7**	5 U	5 U	5 U	5 U
Naphthalene	mg/kg	**157**	**29**	15 U	**15**	**20**	15 U	**82**	**82**	**38**	**81**	**25**	**18**	15 U	**64**
o-Xylene	mg/kg	**56**	**9**	5 U	5 U	**7**	5 U	**31**	**20**	**9**	**20**	**5**	**5**	5 U	**8**
p-Isopropyltoluene	mg/kg	**30**	5 U	5 U	5 U	**6**	5 U	**17**	5 U	**6**	5 U	5 U	5 U	5 U	5 U
sec-Butylbenzene	mg/kg	**15**	5 U	5 U	5 U	5 U	5 U	**7**	**8**	5 U	**6**	5 U	5 U	5 U	5 U
Styrene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
tert-Butylbenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene (PCE)	mg/kg	**6427**	**246**	**237**	**21**	**36**	**16**	**1230**	**179 D**	**533**	**140**	**11**	**6**	5 U	**41**
Toluene	mg/kg	**472**	**24**	**13**	5 U	**22**	5 U	**285**	5 U	**38**	**71**	**16**	**11**	5 U	**21**
trans-1,2-Dichloroethene	mg/kg	**14**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene (TCE)	mg/kg	NA	**434**	**384**	**11**	**125**	**10**	**1160**	**505 D**	**517**	**504**	**140**	**45**	**5**	**128**
Trichlorofluoromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U

Table 2
Excavated Soil VOC Waste Characterization Analytical Results, Site 5 - Unit 2, NAS North Island

Sample Identification		818725-043	818725-044	818725-045	818725-046	818725-047	818725-048	818725-049	818725-050	818725-051	818725-052	818725-053	818725-054	818725-055	818725-056
Location Code		Bin 89363	Bin 5074	Bin 89305	Bin 5042	Bin 3163	Bin 3140	Bin 5037	Bin 5034	Bin 3168	Bin R1808ML	Bin R1882ML	Bin R1949ML	Bin 4996	Bin 4604
Date Sampled		12/14/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01
	Unit														
EPA 8260B															
1,1,1,2-Tetrachloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,1-Trichloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**7**	5 U
1,1-Dichloroethene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloropropene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,3-Trichlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,3-Trichloropropane	mg/kg	**72**	**8**	**129**	**189**	**396**	**62**	**60**	**43**	**22**	**44**	**49**	**195**	**367**	**65**
1,2,4-Trichlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trimethylbenzene	mg/kg	**74**	**21**	**75**	**98**	**376**	**10**	**45**	5 U	**6**	5 U	**70**	**113**	**328**	**52**
1,2-Dibromo-3-chloropropane (DBCP)	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane (EDB)	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	mg/kg	**20**	**8**	**30**	**45**	**76**	**10**	**28**	**16**	**23**	**15**	**27**	**49**	**101**	**20**
1,2-Dichloroethane	mg/kg	**7**	5 U	**37**	**50**	**51**	5 U	5 U	5 U	5 U	5 U	5 U	**22**	**108**	5 U
1,2-Dichloropropane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3,5-Trimethylbenzene	mg/kg	**22**	**6**	**22**	**33**	**70**	5 U	**14**	5 U	5 U	5 U	**23**	**40**	**80**	**17**
1,3-Dichlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichloropropane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	mg/kg	**5**	5 U	**7**	**9**	**20**	5 U	**8**	**6**	**8**	**5**	**7**	**11**	**28**	5 U
2,2-Dichloropropane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone (MEK)	mg/kg	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U
2-Chlorotoluene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	mg/kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone (MIBK)	mg/kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**11**	10 U
Acetone	mg/kg	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Benzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**15**	5 U
Bromobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromochloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromodichloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	mg/kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon disulfide	mg/kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon tetrachloride	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	mg/kg	**20**	**10**	**29**	**64**	**700**	**24**	**28**	5 U	**11**	**8**	**37**	**370**	**909**	**33**
cis-1,3-Dichloropropene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromomethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	mg/kg	**11**	5 U	**14**	**22**	**47**	5 U	**8**	5 U	5 U	5 U	**11**	**24**	**63**	**9**
Hexachlorobutadiene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Isopropylbenzene	mg/kg	5 U	5 U	5 U	5 U	**12**	5 U	5 U	5 U	5 U	5 U	5 U	**6**	**14**	5 U
m/p-Xylene	mg/kg	**46**	**14**	**56**	**83**	**162**	10 U	**29**	10 U	10 U	10 U	**41**	**92**	**217**	**36**
Methylene chloride	mg/kg	5 U	5 U	**6**	**10**	**7**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**49**	5 U
N-Butylbenzene	mg/kg	**11**	**6**	**12**	5 U	**25**	5 U	**7**	5 U	5 U	5 U	**15**	**24**	**40**	**12**
N-Propylbenzene	mg/kg	**7**	5 U	**8**	**11**	**29**	5 U	5 U	5 U	5 U	5 U	**7**	**14**	**33**	**5**
Naphthalene	mg/kg	**60**	**43**	**119**	**158**	**246**	15 U	**45**	15 U	15 U	15 U	**76**	**167**	**271**	**52**
o-Xylene	mg/kg	**21**	**6**	**24**	**38**	**70**	5 U	**15**	5 U	5 U	5 U	**19**	**43**	**88**	**17**
p-Isopropyltoluene	mg/kg	**17**	5 U	**15**	5 U	**42**	5 U	**10**	5 U	5 U	5 U	**14**	5 U	**51**	5 U
sec-Butylbenzene	mg/kg	**7**	5 U	**7**	**10**	**20**	5 U	5 U	5 U	5 U	5 U	**6**	**10**	**24**	5 U
Styrene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
tert-Butylbenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**86**
Tetrachloroethene (PCE)	mg/kg	**123**	5 U	**130**	**105**	**378**	**45**	**34**	**36**	**10**	**24**	**23**	**103**	**2027**	5 U
Toluene	mg/kg	**51**	**15**	**88**	**144**	**449**	**14**	**30**	5 U	5 U	5 U	**45**	158 U	**613**	52 U
trans-1,2-Dichloroethene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**18**	5 U
trans-1,3-Dichloropropene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene (TCE)	mg/kg	**445**	**107**	**1570**	**2050 E**	**6170**	**220**	**151**	**110**	**26**	**63**	**500**	**1474**	**8664**	**361**
Trichlorofluoromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U

Table 2

Excavated Soil VOC Waste Characterization Analytical Results, Site 5 - Unit 2, NAS North Island

Sample Identification		818725-057	818725-058	818725-059	818725-060	818725-061	818725-062	818725-063	818725-064	818725-065	818725-066	818725-067	818725-068	818725-069	818725-070
Location Code		Bin 5256	Bin R1939ML	Bin 4636	Bin 3149	Bin R1914ML	Bin 274787	Bin 89362	Bin R18291ML	Bin 5187	Bin 5042	Bin 3140	Bin 5034	Bin R1808ML	Bin R1949ML
Date Sampled		12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	01/04/02	01/04/02	01/04/02	01/04/02	01/04/02
	Unit														
EPA 8260B															
1,1,1,2-Tetrachloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,1-Trichloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloropropene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,3-Trichlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,3-Trichloropropane	mg/kg	**102**	**128**	**77**	**106**	**140**	27	109	88	71	317	102	11	**26**	**141**
1,2,4-Trichlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trimethylbenzene	mg/kg	**83**	**105**	**76**	**111**	**125**	13	70	24	62	125	110	5 U	**22**	**220**
1,2-Dibromo-3-chloropropane (DBCP)	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane (EDB)	mg/kg	5 U	5 U	**8**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	mg/kg	**28**	**34**	**28**	**31**	**42**	7	24	18	25	65	45	6	**11**	**56**
1,2-Dichloroethane	mg/kg	**12**	**16**	5 U	**6**	**9**	5 U	18	5 U	5 U	6	5 U	5 U	5 U	5 U
1,2-Dichloropropane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3,5-Trimethylbenzene	mg/kg	**26**	**37**	**24**	**35**	**37**	5 U	22	8	20	34	31	5 U	**7**	**48**
1,3-Dichlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichloropropane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	mg/kg	**7**	**9**	**7**	**9**	**11**	5 U	6	6	6	12	10	5 U	**5**	**13**
2,2-Dichloropropane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone (MEK)	mg/kg	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U
2-Chlorotoluene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	mg/kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone (MIBK)	mg/kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	mg/kg	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Benzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromochloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromodichloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	mg/kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon disulfide	mg/kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon tetrachloride	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	mg/kg	**116**	**1523**	**52**	**152**	**100** J	5 U	**84**	**82**	**41**	**6**	**5**	5 U	5 U	**50**
cis-1,3-Dichloropropene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromomethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	mg/kg	**16**	**20**	**14**	**16**	**19**	5 U	**13**	5 U	**12**	**11**	**10**	5 U	5 U	**19**
Hexachlorobutadiene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Isopropylbenzene	mg/kg	5 U	**5**	5 U	5 U	**5**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**6**
m/p-Xylene	mg/kg	**57**	**78**	**51**	**58**	**69**	10 U	**49**	10 U	**46**	**46**	**44**	10 U	10 U	**77**
Methylene chloride	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
N-Butylbenzene	mg/kg	**12**	**27**	**12**	**25**	**20**	5 U	**10**	**6**	**10**	**20**	**19**	5 U	5 U	**24**
N-Propylbenzene	mg/kg	**10**	**13**	**8**	**12**	**12**	5 U	**7**	5 U	**6**	**11**	**11**	5 U	5 U	**18**
Naphthalene	mg/kg	**78**	**116**	**69**	**80**	**121**	15 U	**94**	**18**	**65**	**330**	**141**	15 U	**19**	**196**
o-Xylene	mg/kg	**25**	**37**	**23**	**29**	**33**	5 U	**22**	**6**	**21**	**25**	**21**	5 U	**5**	**37**
p-Isopropyltoluene	mg/kg	**17**	5 U	**16**	**23**	**30**	5 U	5 U	**9**	**5**	**30**	**25**	5 U	5 U	**35**
sec-Butylbenzene	mg/kg	**8**	**10**	**7**	**10**	**12**	5 U	**6**	5 U	**6**	**13**	**11**	5 U	5 U	**15**
Styrene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
tert-Butylbenzene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene (PCE)	mg/kg	**146**	**3697**	**143**	**1848**	**151 J**	**38**	**320**	**88**	**89**	**47**	**39**	**5**	**8**	**58**
Toluene	mg/kg	**93**	**137**	**73**	**86**	**104**	**7**	**78**	**15**	**40**	**34**	**32**	5 U	**8**	**86**
trans-1,2-Dichloroethene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene (TCE)	mg/kg	**1166**	**15585**	**649**	**11500**	**833**	**81**	**1690**	**98**	**478**	**362**	**240**	**9**	**52**	**668**
Trichlorofluoromethane	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U

Table 2
Excavated Soil VOC Waste Characterization Analytical Results, Site 5 - Unit 2, NAS North Island

Sample Identification		818725-071	818725-072	818725-073	818725-074	818725-075
Location Code		Bin 4604	Bin R1939ML	Bin 3149	Bin 274787	Bin R18291ML
Date Sampled		01/04/02	01/04/02	01/04/02	01/04/02	01/04/02
	Unit					
EPA 8260B						
1,1,1,2-Tetrachloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U
1,1,1-Trichloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	mg/kg	5 U	5 U	5 U	5 U	5 U
1,1-Dichloropropene	mg/kg	5 U	5 U	5 U	5 U	5 U
1,2,3-Trichlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U
1,2,3-Trichloropropane	mg/kg	**25**	**79**	**109**	**34**	**33**
1,2,4-Trichlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U
1,2,4-Trimethylbenzene	mg/kg	**42**	**83**	**80**	**25**	**13**
1,2-Dibromo-3-chloropropane (DBCP)	mg/kg	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane (EDB)	mg/kg	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	mg/kg	**15**	**26**	**29**	**9**	**9**
1,2-Dichloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U
1,2-Dichloropropane	mg/kg	5 U	5 U	5 U	5 U	5 U
1,3,5-Trimethylbenzene	mg/kg	**11**	5 U	**25**	**8**	5 U
1,3-Dichlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U
1,3-Dichloropropane	mg/kg	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	mg/kg	5 U	**6**	**8**	5 U	5 U
2,2-Dichloropropane	mg/kg	5 U	5 U	5 U	5 U	5 U
2-Butanone (MEK)	mg/kg	25 U	25 U	25 U	25 U	25 U
2-Chlorotoluene	mg/kg	5 U	5 U	5 U	5 U	5 U
2-Hexanone	mg/kg	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	mg/kg	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone (MIBK)	mg/kg	10 U	10 U	10 U	10 U	10 U
Acetone	mg/kg	25 U	25 U	25 U	25 U	25 U
Benzene	mg/kg	5 U	5 U	5 U	5 U	5 U
Bromobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U
Bromochloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U
Bromodichloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U
Bromoform	mg/kg	5 U	5 U	5 U	5 U	5 U
Bromomethane	mg/kg	10 U	10 U	10 U	10 U	10 U
Carbon disulfide	mg/kg	10 U	10 U	10 U	10 U	10 U
Carbon tetrachloride	mg/kg	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	mg/kg	5 U	5 U	5 U	5 U	5 U
Chloroethane	mg/kg	5 U	5 U	5 U	5 U	5 U
Chloroform	mg/kg	5 U	5 U	5 U	5 U	5 U
Chloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	mg/kg	5 U	**8**	**9**	5 U	5 U
cis-1,3-Dichloropropene	mg/kg	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	mg/kg	5 U	5 U	5 U	5 U	5 U
Dibromomethane	mg/kg	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane	mg/kg	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	mg/kg	5 U	**9**	**9**	5 U	5 U
Hexachlorobutadiene	mg/kg	5 U	5 U	5 U	5 U	5 U
Isopropylbenzene	mg/kg	5 U	5 U	5 U	5 U	5 U
m/p-Xylene	mg/kg	**10**	**38**	**38**	10 U	10 U
Methylene chloride	mg/kg	5 U	5 U	5 U	5 U	5 U
N-Butylbenzene	mg/kg	**8**	**15**	**10**	5 U	5 U
N-Propylbenzene	mg/kg	5 U	**9**	**8**	5 U	5 U
Naphthalene	mg/kg	**77**	**77**	**67**	**27**	**19**
o-Xylene	mg/kg	5 U	**18**	**18**	5 U	5 U
p-Isopropyltoluene	mg/kg	**11**	**20**	**18**	**6**	**6**
sec-Butylbenzene	mg/kg	5 U	**8**	**7**	5 U	5 U
Styrene	mg/kg	5 U	5 U	5 U	5 U	5 U
tert-Butylbenzene	mg/kg	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene (PCE)	mg/kg	**29**	**151**	**109**	**33**	**22**
Toluene	mg/kg	**7**	**33**	**43**	**8**	5 U
trans-1,2-Dichloroethene	mg/kg	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	mg/kg	5 U	5 U	5 U	5 U	5 U
Trichloroethene (TCE)	mg/kg	**63**	**270**	**284**	**77**	**15**
Trichlorofluoromethane	mg/kg	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	mg/kg	5 U	5 U	5 U	5 U	5 U

***Explanation*:**
D - dilution
E - estimated value over calibration range
EPA - United States Environmental Protection Agency
J - estimated value
mg/kg - milligrams per kilogram
U - not detected at or above the stated reporting limit
VOC - volatile organic compound

***Notes*:**
1. Because 10 of the initial waste characterization samples were not analyzed for TCLP within their analysis holding time (even sample numbers 818725-46 through -64), related roll-off bins were resampled and analyzed again for VOCs and TCLP (sample numbers 818725-066 through -075).

Table 3
Excavated Soil TCLP Waste Characterization Analytical Results

Sample Identification		818725-015	818725-016	818725-017	818725-018	818725-019	818725-020	818725-021	818725-022	818725-023
Location Code		Bin 4873	Bin 4961	Bin 4938	Bin 5060	Bin 5001	Bin 89360	Bin 5326	Bin 5320	Bin 5325
Date Sampled		12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01
	Unit									
EPA 1311/6010B										
Cadmium	mg/L	**0.2**	**0.5**	**0.4**	**0.6**	**0.5**	**0.1**	**2.7**	**0.8**	**4.8**
Chromium	mg/L	0.1 U	**0.1**	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Lead	mg/L	**1.1**	**0.3**	**0.2**	**0.2**	**0.6**	0.1 U	**6.0**	**4.6**	**72.7**
EPA 1311/8260A										
1,1-Dichloroethene	µg/L	NA	5 U	5 U	NA	5 U	NA	5 U	500 U	25 U
1,2-Dichloroethane	µg/L	NA	**2 J**	5 U	NA	5 U	NA	**0.9 J**	**41 J**	25 U
1,4-Dichlorobenzene	µg/L	NA	**14**	**8**	NA	**3 J**	NA	**7**	**56 J**	**12 J**
2-Butanone (MEK)	µg/L	NA	100 U	100 U	NA	100 U	NA	100 U	10000 U	500 U
Benzene	µg/L	NA	5 U	5 U	NA	5 U	NA	5 U	500 U	25 U
Carbon tetrachloride	µg/L	NA	5 U	5 U	NA	5 U	NA	5 U	500 U	25 U
Chlorobenzene	µg/L	NA	5 U	5 U	NA	5 U	NA	5 U	500 U	25 U
Chloroform	µg/L	NA	5 U	5 U	NA	5 U	NA	5 U	500 U	25 U
Tetrachloroethene (PCE)	µg/L	NA	**105**	**37**	NA	**85**	NA	**56**	**360 J**	**130**
Trichloroethene (TCE)	µg/L	NA	**259**	**36**	NA	**10**	NA	**88**	**4600**	**110**
Vinyl chloride	µg/L	NA	10 U	10 U	NA	10 U	NA	10 U	1000 U	50 U

Sample Identification		818725-024	818725-025	818725-026	818725-027	818725-028	818725-029	818725-030	818725-031	818725-032
Location Code		Bin 5324	Bin 5303	Bin 5321	Bin 89304	Bin 5328	Bin 5329	Bin 89303	Bin 89298	Bin 89300
Date Sampled		12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01
	Unit									
EPA 1311/6010B										
Cadmium	mg/L	NA	**0.1**	**0.2**	NA	NA	NA	NA	NA	0.1 U
Chromium	mg/L	NA	0.1 U	0.1 U	NA	NA	NA	NA	NA	0.1 U
Lead	mg/L	NA	**7.4**	**4.5**	NA	NA	NA	NA	NA	0.1 U
EPA 1311/8260A										
1,1-Dichloroethene	µg/L	500 U	130 U	NA	130 U	50 U	130 U	500 U	130 U	5 U
1,2-Dichloroethane	µg/L	**1600**	130 U	NA	**200**	50 U	**900**	**39 J**	**82 J**	**2 J**
1,4-Dichlorobenzene	µg/L	**41 J**	**56 J**	NA	**68 J**	**34 J**	**77 J**	**48 J**	**57 J**	**17**
2-Butanone (MEK)	µg/L	10000 U	2500 U	NA	2500 U	1000 U	**2200 J**	10000 U	**64 J**	100 U
Benzene	µg/L	500 U	130 U	NA	130 U	50 U	**84 J**	500 U	130 U	5 U
Carbon tetrachloride	µg/L	500 U	130 U	NA	130 U	50 U	130 U	500 U	130 U	5 U
Chlorobenzene	µg/L	500 U	130 U	NA	130 U	50 U	130 U	500 U	130 U	5 U
Chloroform	µg/L	500 U	130 U	NA	130 U	50 U	130 U	500 U	130 U	5 U
Tetrachloroethene (PCE)	µg/L	**430 J**	**200**	NA	**1200**	**1100**	**7100**	**4100**	**3880**	**70**
Trichloroethene (TCE)	µg/L	**31400**	**480**	NA	**15900**	**1290**	**18100**	**8900**	**7210**	**6**
Vinyl chloride	µg/L	1000 U	250 U	NA	250 U	100 U	250 U	1000 U	250 U	10 U

Table 3

Excavated Soil TCLP Waste Characterization Analytical Results, Site 5 - Unit 2, NAS North Island

Sample Identification		818725-033	818725-034	818725-035	818725-036	818725-037	818725-038	818725-039	818725-040	818725-041
Location Code		Bin 89302	Bin 89301	Bin 3165	Bin 3167	Bin 3164	Bin 3166	Bin 3162	Bin 5331	Bin 89364
Date Sampled		12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01	12/14/01
	Unit									
EPA 1311/6010B										
Cadmium	mg/L	NA	**0.8**	NA	NA	NA	NA	NA	**1.1**	**0.3**
Chromium	mg/L	NA	0.1 U	NA	NA	NA	NA	NA	0.1 U	0.1 U
Lead	mg/L	NA	**0.5**	NA	NA	NA	NA	NA	**2.6**	**0.6**
EPA 1311/8260A										
1,1-Dichloroethene	µg/L	250 U	50 U	130 U	500 U	130 U	500 U	130 U	50 U	NA
1,2-Dichloroethane	µg/L	**120 J**	50 U	**2640**	**160 J**	**290**	**800**	**630**	**41 J**	NA
1,4-Dichlorobenzene	µg/L	250 U	**10 J**	**38 J**	**65 J**	**27 J**	**41 J**	**40 J**	**10 J**	NA
2-Butanone (MEK)	µg/L	**230 J**	**47 J**	**11000**	10000 U	**670 J**	**670 J**	**540 J**	**140 J**	NA
Benzene	µg/L	250 U	50 U	**85 J**	500 U	**15 J**	500 U	**13 J**	50 U	NA
Carbon tetrachloride	µg/L	250 U	50 U	130 U	500 U	130 U	500 U	130 U	50 U	NA
Chlorobenzene	µg/L	250 U	50 U	130 U	500 U	130 U	500 U	130 U	50 U	NA
Chloroform	µg/L	250 U	50 U	130 U	500 U	130 U	500 U	130 U	50 U	NA
Tetrachloroethene (PCE)	µg/L	**510**	**730**	**12200**	**3000**	**5290**	**4200**	**680**	**100**	NA
Trichloroethene (TCE)	µg/L	**3500**	**240**	**30300**	**14800**	**9090**	**21600**	**11200**	**690**	NA
Vinyl chloride	µg/L	500 U	100 U	250 U	1000 U	250 U	1000 U	250 U	100 U	NA

Sample Identification		818725-042	818725-043	818725-044	818725-045	818725-046	818725-047	818725-048	818725-049	818725-050
Location Code		Bin 89306	Bin 89363	Bin 5074	Bin 89305	Bin 5042	Bin 3163	Bin 3140	Bin 5037	Bin 5034
Date Sampled		12/14/01	12/14/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01
	Unit									
EPA 1311/6010B										
Cadmium	mg/L	NA	**0.4**	NA	NA	NA	NA	NA	NA	**0.3**
Chromium	mg/L	NA	0.1 U	NA	NA	NA	NA	NA	NA	0.1 U
Lead	mg/L	NA	**1.8**	NA	NA	NA	NA	NA	NA	**1.9**
EPA 1311/8260A										
1,1-Dichloroethene	µg/L	500 U	130 U	500 U	130 U	RS	500 U	RS	130 U	RS
1,2-Dichloroethane	µg/L	**1500**	130 U	**210 J**	**560**	RS	**1300**	RS	**64 J**	RS
1,4-Dichlorobenzene	µg/L	**54 J**	**31 J**	**31 J**	**41 J**	RS	**65 J**	RS	**76 J**	RS
2-Butanone (MEK)	µg/L	10000 U	2500 U	10000 U	220 J	RS	10000 U	RS	2500 U	RS
Benzene	µg/L	500 U	130 U	500 U	130 U	RS	500 U	RS	130 U	RS
Carbon tetrachloride	µg/L	500 U	130 U	500 U	130 U	RS	500 U	RS	130 U	RS
Chlorobenzene	µg/L	500 U	130 U	500 U	130 U	RS	500 U	RS	130 U	RS
Chloroform	µg/L	500 U	130 U	500 U	130 U	RS	500 U	RS	130 U	RS
Tetrachloroethene (PCE)	µg/L	**1000**	**310**	**64 J**	**1100**	RS	**1300**	RS	**350**	RS
Trichloroethene (TCE)	µg/L	**27900**	**200**	**3500**	**23700**	RS	**69300**	RS	**3830**	RS
Vinyl chloride	µg/L	1000 U	250 U	1000 U	250 U	RS	1000 U	RS	250 U	RS

Table 3
Excavated Soil TCLP Waste Characterization Analytical Results, Site 5 - Unit 2, NAS North Island

Sample Identification		818725-051	818725-052	818725-053	818725-054	818725-055	818725-056	818725-057	818725-058	818725-059
Location Code		Bin 3168	Bin R1808ML	Bin R1882ML	Bin R1949ML	Bin 4996	Bin 4604	Bin 5256	Bin R1939ML	Bin 4636
Date Sampled		12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01
	Unit									
EPA 1311/6010B										
Cadmium	mg/L	0.1 U	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	mg/L	0.1 U	NA	NA	NA	NA	NA	NA	NA	NA
Lead	mg/L	**4.7**	NA	NA	NA	NA	NA	NA	NA	NA
EPA 1311/8260A										
1,1-Dichloroethene	µg/L	130 U	RS	130 U	RS	2500 U	RS	2500 U	RS	1300 U
1,2-Dichloroethane	µg/L	130 U	RS	130 U	RS	**740 J**	RS	**1300 J**	RS	**250 J**
1,4-Dichlorobenzene	µg/L	**95 J**	RS	**61 J**	RS	2500 U	RS	2500 U	RS	1300 U
2-Butanone (MEK)	µg/L	2500 U	RS	2500 U	RS	50000 U	RS	50000 U	RS	25000 U
Benzene	µg/L	130 U	RS	130 U	RS	2500 U	RS	2500 U	RS	1300 U
Carbon tetrachloride	µg/L	130 U	RS	130 U	RS	2500 U	RS	2500 U	RS	1300 U
Chlorobenzene	µg/L	130 U	RS	130 U	RS	2500 U	RS	2500 U	RS	1300 U
Chloroform	µg/L	130 U	RS	130 U	RS	2500 U	RS	2500 U	RS	1300 U
Tetrachloroethene (PCE)	µg/L	**100 J**	RS	**200**	RS	**5000**	RS	2500 J	RS	**3400**
Trichloroethene (TCE)	µg/L	**200**	RS	**1800**	RS	**47000**	RS	**65700**	RS	**23000**
Vinyl chloride	µg/L	250 U	RS	250 U	RS	5000 U	RS	5000 U	RS	2500 U

Sample Identification		818725-060	818725-061	818725-062	818725-063	818725-064	818725-065	818725-066	818725-067	818725-068
Location Code		Bin 3149	Bin R1914ML	Bin 274787	Bin 89362	Bin R18291ML	Bin 5187	Bin 5042	Bin 3140	Bin 5034
Date Sampled		12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	12/15/01	01/04/02	01/04/02	01/04/02
	Unit									
EPA 1311/6010B										
Cadmium	mg/L	NA	NA	NA	NA	**0.3**	NA	NA	NA	NA
Chromium	mg/L	NA	NA	NA	NA	0.1 U	NA	NA	NA	NA
Lead	mg/L	NA	NA	NA	NA	**2.2**	NA	NA	NA	NA
EPA 1311/8260A										
1,1-Dichloroethene	µg/L	RS	500 U	RS	1300 U	RS	1000 U	500 U	500 U	25 U
1,2-Dichloroethane	µg/L	RS	**53 J**	RS	**250 J**	RS	**150 J**	**240 J**	500 U	25 U
1,4-Dichlorobenzene	µg/L	RS	**77 J**	RS	**210 J**	RS	1000 U	**50 J**	**57 J**	**30**
2-Butanone (MEK)	µg/L	RS	10000 U	RS	25000 U	RS	20000 U	10000 U	10000 U	500 U
Benzene	µg/L	RS	500 U	RS	1300 U	RS	1000 U	500 U	500 U	25 U
Carbon tetrachloride	µg/L	RS	500 U	RS	1300 U	RS	1000 U	500 U	500 U	25 U
Chlorobenzene	µg/L	RS	500 U	RS	1300 U	RS	1000 U	500 U	500 U	25 U
Chloroform	µg/L	RS	500 U	RS	1300 U	RS	1000 U	500 U	500 U	25 U
Tetrachloroethene (PCE)	µg/L	RS	**1400**	RS	**9000**	RS	**1000**	**300 J**	**220 J**	**63**
Trichloroethene (TCE)	µg/L	RS	**7000**	RS	**32400**	RS	**17000**	**7100**	**4800**	**120**
Vinyl chloride	µg/L	RS	1000 U	RS	2500 U	RS	2000 U	1000 U	1000 U	50 U

Table 3
Excavated Soil TCLP Waste Characterization Analytical Results

Sample Identification		818725-069	818725-070	818725-071	818725-072	818725-073	818725-074	818725-075
Location Code		Bin R1808ML	Bin R1949ML	Bin 4604	Bin R1939	Bin 3149	Bin 274787	Bin R18291ML
Date Sampled		01/04/02	01/04/02	01/04/02	01/04/02	01/04/02	01/04/02	01/04/02
	Unit							
EPA 1311/6010B								
Cadmium	mg/L	NA	NA	NA	NA	NA	NA	NA
Chromium	mg/L	NA	NA	NA	NA	NA	NA	NA
Lead	mg/L	NA	NA	NA	NA	NA	NA	NA
EPA 1311/8260A								
1,1-Dichloroethene	µg/L	100 U	500 U	500 U	500 U	500 U	50 U	100 U
1,2-Dichloroethane	µg/L	**26 J**	**160 J**	500 U	500 U	500 U	**11 J**	100 U
1,4-Dichlorobenzene	µg/L	**55 J**	**83 J**	**98 J**	**76 J**	**120 J**	**26 J**	**40 J**
2-Butanone (MEK)	µg/L	2000 U	10000 U	10000 U	10000 U	10000 U	1000 U	2000 U
Benzene	µg/L	100 U	500 U	500 U	500 U	500 U	50 U	100 U
Carbon tetrachloride	µg/L	100 U	500 U	500 U	500 U	500 U	50 U	100 U
Chlorobenzene	µg/L	100 U	500 U	500 U	500 U	500 U	50 U	100 U
Chloroform	µg/L	100 U	500 U	500 U	500 U	500 U	50 U	100 U
Tetrachloroethene (PCE)	µg/L	**210**	**440 J**	**1300**	**1800**	**1300**	**410**	**270**
Trichloroethene (TCE)	µg/L	**3000**	**9900**	**5200**	**9600**	**6500**	**1490**	**430**
Vinyl chloride	µg/L	200 U	1000 U	1000 U	1000 U	1000 U	100 U	200 U

***Explanation*:**

EPA - United States Environmental Protection Agency
J - estimated value
mg/L - milligrams per liter
NA - not analyzed
RS - resampled because laboratory holding time exceeded
TCLP - toxicity characteristic leaching procedure
U - not detected at or above the stated reporting limit
µg/L - micrograms per liter

***Notes*:**

1. Because 10 of the initial waste characterization samples were not analyzed for TCLP within their analysis holding time (even sample numbers 818725-46 through -64), related roll-off bins were resampled and analyzed again for VOCs and TCLP (sample numbers 818725-066 through -075).

Table 4
Excavated Soil Pesticides Screening Analytical Results

Sample Identification **Location Code** **Date Sampled**		818725-015 Bin 4873 12/14/01	818725-025 Bin 5303 12/14/01	818725-035 Bin 3165 12/14/01	818725-043 Bin 89363 12/14/01	818725-047 Bin 3163 12/15/01	818725-053 Bin R1882ML 12/15/01	818725-055 Bin 4996 12/15/01	818725-061 Bin R1914ML 12/15/01	818725-072 Bin R1939 01/04/02
	Unit									
EPA 8081										
4,4'-DDD	µg/kg	30 U	300 U	30 U	30 U	30 U	30 U	30 U	30 U	300 U
4,4'-DDE	µg/kg	30 U	300 U	30 U	30 U	30 U	30 U	30 U	30 U	300 U
4,4'-DDT	µg/kg	30 U	300 U	30 U	30 U	30 U	30 U	30 U	30 U	300 U
Aldrin	µg/kg	17 U	170 U	17 U	17 U	17 U	17 U	17 U	17 U	170 U
alpha-BHC	µg/kg	17 U	170 U	17 U	17 U	17 U	17 U	17 U	17 U	170 U
alpha-Chlordane	µg/kg	10 U	100 U	10 U	10 U	10 U	10 U	10 U	10 U	100 U
Beta-BHC	µg/kg	17 U	170 U	17 U	17 U	17 U	17 U	17 U	17 U	170 U
Delta-BHC	µg/kg	17 U	170 U	17 U	17 U	17 U	17 U	17 U	17 U	170 U
Dieldrin	µg/kg	30 U	300 U	30 U	30 U	30 U	30 U	30 U	30 U	300 U
Endosulfan I	µg/kg	17 U	170 U	17 U	17 U	17 U	17 U	17 U	17 U	170 U
Endosulfan II	µg/kg	30 U	300 U	30 U	30 U	30 U	30 U	30 U	30 U	300 U
Endosulfan sulfate	µg/kg	50 U	500 U	50 U	50 U	50 U	50 U	50 U	50 U	500 U
Endrin	µg/kg	30 U	300 U	30 U	30 U	30 U	30 U	30 U	30 U	300 U
Endrin aldehyde	µg/kg	30 U	300 U	30 U	30 U	30 U	30 U	30 U	30 U	300 U
Endrin ketone	µg/kg	20 U	200 U	20 U	20 U	20 U	20 U	20 U	20 U	200 U
gamma-BHC	µg/kg	17 U	170 U	17 U	17 U	17 U	17 U	17 U	17 U	170 U
gamma-Chlordane	µg/kg	10 U	100 U	10 U	10 U	10 U	10 U	10 U	10 U	100 U
Heptachlor	µg/kg	17 U	170 U	17 U	17 U	17 U	17 U	17 U	17 U	170 U
Heptachlor epoxide	µg/kg	17 U	170 U	17 U	17 U	17 U	17 U	17 U	17 U	170 U
Methoxychlor	µg/kg	100 U	1000 U	100 U	100 U	100 U	100 U	100 U	100 U	1000 U
Toxaphene	µg/kg	1000 U	10000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	10000 U

***Explanation*:**
EPA - United States Environmental Protection Agency
U - not detected at or above the stated reporting limit
µg/kg - micrograms per kilogram

Table 5
Excavated Soil PCB Screening Analytical Results

Sample Identification		818725-015	818725-025	818725-035	818725-043	818725-047	818725-053	818725-055	818725-061	818725-072
Location Code		Bin 4873	Bin 5303	Bin 3165	Bin 89363	Bin 3163	Bin R1882ML	Bin 4996	Bin R1914ML	Bin R1939
Date Sampled		12/14/01	12/14/01	12/14/01	12/14/01	12/15/01	12/15/01	12/15/01	12/15/01	01/04/02
	Unit									
EPA 8082										
Aroclor-1016	mg/kg	0.033 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	3.3 U
Aroclor-1221	mg/kg	0.066 U	0.66 U	0.66 U	0.66 U	0.66 U	0.66 U	0.66 U	0.66 U	6.6 U
Aroclor-1232	mg/kg	0.033 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	3.3 U
Aroclor-1242	mg/kg	0.033 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	3.3 U
Aroclor-1248	mg/kg	0.033 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	3.3 U
Aroclor-1254	mg/kg	0.033 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	3.3 U
Aroclor-1260	mg/kg	**0.067**	**0.85**	**1.7**	**0.8**	**0.2 J**	**0.59**	**0.41**	**0.95**	**2.1 J**

***Explanation*:**

EPA - United States Environmental Protection Agency
J - estimated value
PCB - polychlorinated biphenyl
U - not detected at or above the stated reporting limit
µg/kg - micrograms per kilogram

Table 6
Excavated Soil SVOC Screening Analytical Results

Sample Identification **Location Code** **Date Sampled**		818725-015 Bin 4873 12/14/01	818725-025 Bin 5303 12/14/01	818725-035 Bin 3165 12/14/01	818725-043 Bin 89363 12/14/01	818725-047 Bin 3163 12/15/01	818725-049 Bin 5037 12/15/01	818725-053 Bin R1882ML 12/15/01
	Unit							
EPA 8270								
1,2,4-Trichlorobenzene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
1,2-Dichlorobenzene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
1,3-Dichlorobenzene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
1,4-Dichlorobenzene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
2,4,5-Trichlorophenol	mg/kg	4.5 U	45 U	90 U	45 U	49.95 U	49.95 U	45 U
2,4,6-Trichlorophenol	mg/kg	4.5 U	45 U	90 U	45 U	49.95 U	49.95 U	45 U
2,4-Dichlorophenol	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
2,4-Dimethylphenol	mg/kg	4.5 U	45 U	**240**	45 U	**158**	**130**	45 U
2,4-Dinitrophenol	mg/kg	4.5 U	45 U	90 U	45 U	49.95 U	49.95 U	45 U
2,4-Dinitrotoluene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
2,6-Dinitrotoluene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
2-Chloronaphthalene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
2-Chlorophenol	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
2-Methylnaphthalene	mg/kg	4.5 U	**128**	**240**	**87**	**248**	**234**	**74**
2-Methylphenol	mg/kg	4.5 U	45 U	**210**	**58**	**207**	**170**	45 U
2-Nitroaniline	mg/kg	4.5 U	45 U	90 U	45 U	49.95 U	49.95 U	45 U
2-Nitrophenol	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
3,3'-Dichlorobenzidine	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
3-Nitroaniline	mg/kg	4.5 U	45 U	90 U	45 U	49.95 U	49.95 U	45 U
4,6-Dinitro-2-Methylphenol	mg/kg	4.5 U	45 U	90 U	45 U	49.95 U	49.95 U	45 U
4-Bromophenyl phenyl ether	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
4-Chloro-3-Methylphenol	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
4-Chloroaniline	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
4-Chlorophenyl phenyl ether	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
4-Methylphenol	mg/kg	4.5 U	45 U	**120**	45 U	**313**	**272**	45 U
4-Nitroaniline	mg/kg	4.5 U	45 U	90 U	45 U	49.95 U	49.95 U	45 U
4-Nitrophenol	mg/kg	4.5 U	45 U	90 U	45 U	49.95 U	49.95 U	45 U
Acenaphthene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Acenaphthylene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Aniline	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Anthracene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Benzidine	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Benzo[a]anthracene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Benzo[a]pyrene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Benzo[b]fluoranthene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Benzo[ghi]perylene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Benzo[k]fluoranthene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Benzoic acid	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Benzyl alcohol	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Bis (2-chloroethoxy)methane	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Bis (2-chloroethyl)ether	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Bis (2-chloroisopropyl)ether	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Bis (2-ethylhexyl)phthalate	mg/kg	4.5 U	45 U	90 U	45 U	**25.6**	9.99 U	45 U
Butyl benzyl phthalate	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Chrysene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Di-n-butyl phthalate	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Di-n-octyl phthalate	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Dibenz[a,h]anthracene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Dibenzofuran	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Diethyl phthalate	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Dimethyl phthalate	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Fluoranthene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Fluorene	mg/kg	4.5 U	45 U	90 U	45 U	**61.6**	**40.4**	45 U
Hexachlorobenzene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Hexachlorobutadiene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Hexachlorocyclopentadiene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Hexachloroethane	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Indeno[1,2,3-cd]pyrene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Isophorone	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
N-Nitrosodi-n-propylamine	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
N-Nitrosodimethylamine	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
N-Nitrosodiphenylamine	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Naphthalene	mg/kg	4.5 U	**58**	90 U	45 U	**197**	**199**	**80**
Nitrobenzene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Pentachlorophenol	mg/kg	4.5 U	45 U	90 U	45 U	49.95 U	49.95 U	45 U
Phenanthrene	mg/kg	4.5 U	45 U	90 U	45 U	**48.4**	**25.6**	45 U
Phenol	mg/kg	4.5 U	45 U	**147**	45 U	**67.2**	**132**	45 U
Pyrene	mg/kg	4.5 U	45 U	90 U	45 U	9.99 U	9.99 U	45 U
Pyridine	mg/kg	30 U	300 U	600 U	300 U	9.99 U	9.99 U	300 U

Table 6
Excavated Soil SVOC Screening Analytical Results

Sample Identification		818725-061	818725-072
Location Code		Bin R1914ML	Bin R1939
Date Sampled		12/15/01	01/04/02
	Unit		
EPA 8270			
1,2,4-Trichlorobenzene	mg/kg	45 U	5 U
1,2-Dichlorobenzene	mg/kg	45 U	**14**
1,3-Dichlorobenzene	mg/kg	45 U	5 U
1,4-Dichlorobenzene	mg/kg	45 U	5 U
2,4,5-Trichlorophenol	mg/kg	45 U	5 U
2,4,6-Trichlorophenol	mg/kg	45 U	5 U
2,4-Dichlorophenol	mg/kg	45 U	5 U
2,4-Dimethylphenol	mg/kg	45 U	5 U
2,4-Dinitrophenol	mg/kg	45 U	5 U
2,4-Dinitrotoluene	mg/kg	45 U	5 U
2,6-Dinitrotoluene	mg/kg	45 U	5 U
2-Chloronaphthalene	mg/kg	45 U	5 U
2-Chlorophenol	mg/kg	45 U	5 U
2-Methylnaphthalene	mg/kg	**59**	**112**
2-Methylphenol	mg/kg	45 U	**18**
2-Nitroaniline	mg/kg	45 U	5 U
2-Nitrophenol	mg/kg	45 U	5 U
3,3'-Dichlorobenzidine	mg/kg	45 U	5 U
3-Nitroaniline	mg/kg	45 U	5 U
4,6-Dinitro-2-Methylphenol	mg/kg	45 U	5 U
4-Bromophenyl phenyl ether	mg/kg	45 U	5 U
4-Chloro-3-Methylphenol	mg/kg	45 U	5 U
4-Chloroaniline	mg/kg	45 U	5 U
4-Chlorophenyl phenyl ether	mg/kg	45 U	5 U
4-Methylphenol	mg/kg	45 U	**19**
4-Nitroaniline	mg/kg	45 U	5 U
4-Nitrophenol	mg/kg	45 U	5 U
Acenaphthene	mg/kg	45 U	**18**
Acenaphthylene	mg/kg	45 U	5 U
Aniline	mg/kg	45 U	5 U
Anthracene	mg/kg	45 U	5 U
Benzidine	mg/kg	45 U	5 U
Benzo[a]anthracene	mg/kg	45 U	5 U
Benzo[a]pyrene	mg/kg	45 U	5 U
Benzo[b]fluoranthene	mg/kg	45 U	5 U
Benzo[ghi]perylene	mg/kg	45 U	5 U
Benzo[k]fluoranthene	mg/kg	45 U	5 U
Benzoic acid	mg/kg	45 U	5 U
Benzyl alcohol	mg/kg	45 U	5 U
Bis (2-chloroethoxy)methane	mg/kg	45 U	5 U
Bis (2-chloroethyl)ether	mg/kg	45 U	5 U
Bis (2-chloroisopropyl)ether	mg/kg	45 U	5 U
Bis (2-ethylhexyl)phthalate	mg/kg	45 U	5 U
Butyl benzyl phthalate	mg/kg	45 U	5 U
Chrysene	mg/kg	45 U	5 U
Di-n-butyl phthalate	mg/kg	45 U	10 U
Di-n-octyl phthalate	mg/kg	45 U	5 U
Dibenz[a,h]anthracene	mg/kg	45 U	5 U
Dibenzofuran	mg/kg	45 U	**14**
Diethyl phthalate	mg/kg	45 U	5 U
Dimethyl phthalate	mg/kg	45 U	5 U
Fluoranthene	mg/kg	45 U	5 U
Fluorene	mg/kg	45 U	**8**
Hexachlorobenzene	mg/kg	45 U	5 U
Hexachlorobutadiene	mg/kg	45 U	5 U
Hexachlorocyclopentadiene	mg/kg	45 U	5 U
Hexachloroethane	mg/kg	45 U	5 U
Indeno[1,2,3-cd]pyrene	mg/kg	45 U	5 U
Isophorone	mg/kg	45 U	5 U
N-Nitrosodi-n-propylamine	mg/kg	45 U	5 U
N-Nitrosodimethylamine	mg/kg	45 U	5 U
N-Nitrosodiphenylamine	mg/kg	45 U	5 U
Naphthalene	mg/kg	45 U	**45**
Nitrobenzene	mg/kg	45 U	5 U
Pentachlorophenol	mg/kg	45 U	5 U
Phenanthrene	mg/kg	45 U	**5**
Phenol	mg/kg	45 U	**10**
Pyrene	mg/kg	45 U	5 U
Pyridine	mg/kg	300 U	20 U

***Explanation*:**

EPA - United States Environmental Protection Agency
mg/kg - milligrams per kilogram
SVOC - semivolatile organic compound
U - not detected at or above the stated reporting limit

Table 7
Exacavated Soil Metals Screening Analytical Results

Sample Identification		818725-015	818725-025	818725-035	818725-043	818725-047	818725-053	818725-055	818725-061	818725-072
Location Code		Bin 4873	Bin 5303	Bin 3165	Bin 89363	Bin 3163	Bin R1882ML	Bin 4996	Bin R1914ML	Bin R1939
Date Sampled		12/14/01	12/14/01	12/14/01	12/14/01	12/15/01	12/15/01	12/15/01	12/15/01	01/04/02
	Unit									
EPA 6010										
Antimony	mg/kg	5 U	5 U	5 U	5 U	**89**	5 U	5 U	5 U	5 U
Arsenic	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Barium	mg/kg	**90**	**24**	**49**	**18**	**97**	**41**	**52**	**25**	**28**
Beryllium	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Cadmium	mg/kg	**8**	5 U	**96**	**12**	**77**	**21**	**56**	**15**	**22**
Chromium	mg/kg	**27**	**21**	**172**	**25**	**487**	**177**	**229**	**38**	**72**
Cobalt	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Copper	mg/kg	**98**	**39**	**163**	**32**	**272**	**143**	**481**	**33**	**49**
Lead	mg/kg	**178**	**284**	**862**	**129**	**1510**	**632**	**662**	**198**	**272**
Molybdenum	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	**6**	5 U	5 U
Nickel	mg/kg	**16**	5 U	**21**	5 U	**25**	**14**	**14**	**6**	**8**
Selenium	mg/kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Silver	mg/kg	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Thallium	mg/kg	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Vanadium	mg/kg	**22**	**11**	**12**	**10**	**11**	**11**	**15**	**12**	**12**
Zinc	mg/kg	**264**	**36**	**483**	**66**	**693**	**221**	**587**	**125**	**156**
EPA 7471A										
Mercury	mg/kg	**0.1**	0.1 U	**0.1**	0.1 U	**0.3**	0.1 U	0.1 U	**0.1**	**0.3**

***Explanation*:**
EPA - United States Environmental Protection Agency
mg/kg - milligrams per kilogram
U - not detected at or above the stated reporting limit

Table 8
Groundwater VOC Analytical Results for Treatment Area Monitoring Wells

Sample Event		**Baseline**	**Interim #1**		**Interim #2**	**Interim #3**	**30-Day Post**		**48-Day Post**	**MNA Post #3**	**Final**		**Baseline**	**Interim #1**	**Interim #2**	**Interim #3**
Sample Identification		818725-96	818725-129	818725-130 (Dup)	818725-154	818725-157	818725-171	818725-172 (Dup)	818725-196	818725-223	818725-242	818725-243 (Dup)	818725-80	818725-139	818725-148	
Location Code		S5-MW-21	S5-MW-21	S5-MW-21	S5-MW-21	S5-MW-21	S5-MW-21	S5-MW-21	S5-MW-21	S5-MW-21	S5-MW-21	S5-MW-21	S5-MW-25	S5-MW-25	S5-MW-25	S5-MW-25
Date Sampled		05/20/02	08/13/02	08/13/02	10/24/02	01/07/03	03/26/03	03/26/03	04/09/03	06/05/03	07/09/03	07/09/03	05/14/02	08/14/02	10/23/02	
	Unit															
SW8260B																
1,1,1,2-Tetrachloroethane	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
1,1,1-Trichloroethane	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
1,1,2,2-Tetrachloroethane	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/L	1,000 U	500 U	500 U	500 U	NA	1,000 U	500 UJ	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
1,1,2-Trichloroethane	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
1,1-Dichloroethane	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
1,1-Dichloroethene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
1,1-Dichloropropene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
1,2,3-Trichlorobenzene	µg/L	1,000 U	500 U	500 U	500 U	20,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
1,2,3-Trichloropropane	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	**3,300**	**2,200**	**5,900**	**1,900 J**	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
1,2,4-Trichlorobenzene	µg/L	1,000 U	500 U	500 U	500 U	20,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
1,2,4-Trimethylbenzene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
1,2-Dibromo-3-chloropropane (DBCP)	µg/L	2,000 U	1,000 U	1,000 U	1,000 U	20,000 U	2,000 U	1,000 U	5,000 U	5,000 U	5,000 U	5,000 U	250 U	200 U	50 U	NS[1]
1,2-Dibromoethane (EDB)	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
1,2-Dichlorobenzene	µg/L	1,000 U	500 U	**170 J**	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	**19 J**	NS[1]
1,2-Dichloroethane	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
1,2-Dichloropropane	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
1,3,5-Trimethylbenzene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
1,3-Dichlorobenzene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
1,3-Dichloropropane	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
1,4-Dichlorobenzene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
2,2-Dichloropropane	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
2-Butanone (MEK)	µg/L	5,000 R	2,500 U	2,500 U	2,500 U	200,000 U	5,000 U	2,500 UJ	12,000 U	12,000 U	12,000 U	12,000 U	620 R	500 U	120 U	NS[1]
2-Chlorotoluene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
2-Hexanone	µg/L	5,000 U	2,500 U	2,500 U	2,500 U	20,000 U	5,000 U	2,500 U	12,000 U	12,000 U	12,000 U	12,000 U	620 U	500 U	120 U	NS[1]
4-Chlorotoluene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
4-Methyl-2-pentanone (MIBK)	µg/L	5,000 U	2,500 U	2,500 U	2,500 U	20,000 U	5,000 U	2,500 U	12,000 U	12,000 U	12,000 U	12,000 U	620 U	500 U	120 U	NS[1]
Acetone	µg/L	10,000 R	5,000 U	5,000 U	5,000 U	200,000 U	**15,000**	**9,000 J**	**31,000**	**9,600 J**	25,000 U	25,000 U	1,200 R	1,000 U	250 U	NS[1]
Benzene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Bromobenzene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Bromochloromethane	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Bromodichloromethane	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Bromoform	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Bromomethane	µg/L	2,000 UJ	1,000 U	1,000 U	1,000 U	20,000 U	2,000 U	1,000 U	5,000 U	5,000 U	5,000 U	5,000 U	250 UJ	200 U	50 U	NS[1]
Carbon disulfide	µg/L	1,000 U	500 U	500 U	500 U	20,000 U	1,000 U	500 UJ	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Carbon tetrachloride	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Chlorobenzene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Chloroethane	µg/L	2,000 U	1,000 U	1,000 U	1,000 U	10,000 U	2,000 U	1,000 U	5,000 U	5,000 U	5,000 U	5,000 U	250 U	200 U	50 U	NS[1]
Chloroform	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Chloromethane	µg/L	2,000 UJ	1,000 U	1,000 U	1,000 U	10,000 U	2,000 U	1,000 U	5,000 U	5,000 U	5,000 U	5,000 U	250 UJ	200 U	50 U	NS[1]
cis-1,2-Dichloroethene	µg/L	**61,000**	**12,000**	**13,000**	**27,000**	**27,300**	**23,000**	**14,000**	**110,000**	**82,000**	**110,000**	**110,000**	**1,400**	**350**	**67**	NS[1]
cis-1,3-Dichloropropene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Dibromochloromethane	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Dibromomethane	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Dichlorodifluoromethane	µg/L	2,000 U	1,000 U	1,000 U	1,000 U	10,000 U	2,000 U	1,000 UJ	5,000 U	5,000 U	5,000 U	5,000 U	250 U	200 U	50 U	NS[1]
Ethylbenzene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Hexachlorobutadiene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Isopropylbenzene (Cumene)	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
m/p-Xylene	µg/L	1,000 U	500 U	500 U	500 U	20,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Methyl tert-butyl ether (MTBE)	µg/L	1,000 U	500 U	500 U	500 U	NA	1,000 U	500 UJ	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Methylene chloride	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
N-Butylbenzene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
N-Propylbenzene	µg/L	1,000 U	500 U	500 U	500 U	20,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Naphthalene	µg/L	1,000 U	**410 J**	500 U	**250 J**	30,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	**150**	25 U	NS[1]
o-Xylene	µg/L	1,000 U	**100 J**	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
p-Isopropyltoluene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
sec-Butylbenzene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Styrene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
tert-Butylbenzene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Tetrachloroethene (PCE)	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Toluene	µg/L	**1,500**	**730**	**740**	**1,100**	10,000 U	**600 J**	**330 J**	2,500 U	**920 J**	**1,600 J**	**1,800 J**	**56 J**	**36 J**	25 U	NS[1]
trans-1,2-Dichloroethene	µg/L	**960 J**	500 U	**160 J**	**200 J**	10,000 U	**510 J**	**300 J**	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
trans-1,3-Dichloropropene	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Trichloroethene (TCE)	µg/L	1,000 U	500 U	500 U	500 U	10,000 U	1,000 U	500 U	2,500 U	2,500 U	2,500 U	2,500 U	120 U	100 U	25 U	NS[1]
Trichlorofluoromethane	µg/L	2,000 U	1,000 U	1,000 U	1,000 U	10,000 U	2,000 U	1,000 U	5,000 U	5,000 U	5,000 U	5,000 U	250 U	200 U	50 U	NS[1]
Vinyl chloride	µg/L	**51,000**	**20,000**	**22,000**	**19,000**	**32,200**	**1,100**	**660**	**2,300 J**	**6,500**	**13,000**	**14,000**	**6,500**	**3,500**	**2,400**	NS[1]
Total Detected VOCs		**114,460**	**33,240**	**36,070**	**47,550**	**59,500**	**43,510**	**26,490**	**149,200**	**100,920**	**124,600**	**125,800**	**7,956**	**4,036**	**2,486**	N/A

Table 8
Groundwater VOC Analytical Results for Treatment Area Monitoring Wells, Site 5 - Unit 2, NAS North Island

Sample Event		**30-Day Post**	**48-Day Post**		**MNA Post #3**	**Final**	**Baseline**	**Interim #1**	**Interim #2**	**Interim #3**	**30-Day Post**	**48-Day Post**	**Final**	**Baseline**	**Interim #1**	
Sample Identification		818725-170	818725-194	818725-195 (Dup)	818725-221	818725-237	818725-78	818725-135	818725-143	818725-156	818725-169			818725-79	818725-136	818725-137 (Dup)
Location Code		S5-MW-25	S5-MW-25	S5-MW-25	S5-MW-25	S5-MW-25	S5-MW-26	S5-MW-26	S5-MW-26	S5-MW-26	S5-MW-26	S5-MW-26	S5-MW-26	S5-MW-28	S5-MW-28	S5-MW-28
Date Sampled		03/26/03	04/09/03	04/09/03	06/05/03	07/08/03	05/14/02	08/14/02	10/23/02	01/07/03	03/25/03			05/14/02	08/14/02	08/14/02
	Unit															
SW8260B																
1,1,1,2-Tetrachloroethane	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
1,1,1-Trichloroethane	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
1,1,2,2-Tetrachloroethane	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	NA	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
1,1,2-Trichloroethane	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
1,1-Dichloroethane	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
1,1-Dichloroethene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
1,1-Dichloropropene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
1,2,3-Trichlorobenzene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	20,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
1,2,3-Trichloropropane	µg/L	**1,000 J**	**930 J**	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
1,2,4-Trichlorobenzene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	20,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
1,2,4-Trimethylbenzene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	**90 J**	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
1,2-Dibromo-3-chloropropane (DBCP)	µg/L	5,000 U	2,500 U	2,500 R	25 U	12 U	500 U	1,000 U	500 U	20,000 U	3,000 µg/kg U G	NS^2	NS^2	1,000 U	500 U	500 U
1,2-Dibromoethane (EDB)	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
1,2-Dichlorobenzene	µg/L	2,500 U	1,200 U	1,200 U	**15**	**10**	250 U	500 U	**93 J**	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
1,2-Dichloroethane	µg/L	2,500 U	1,200 U	1,200 UJ	12 U	**2.7 J**	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
1,2-Dichloropropane	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
1,3,5-Trimethylbenzene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	**56 J**	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
1,3-Dichlorobenzene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
1,3-Dichloropropane	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
1,4-Dichlorobenzene	µg/L	2,500 U	1,200 U	1,200 U	12 U	**1.9 J**	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
2,2-Dichloropropane	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
2-Butanone (MEK)	µg/L	12,000 U	6,200 U	6,200 R	62 U	31 U	1,200 R	2,500 U	1,200 U	200,000 U	7,500 µg/kg U G	NS^2	NS^2	2,500 R	1,200 U	1,200 U
2-Chlorotoluene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
2-Hexanone	µg/L	12,000 U	6,200 U	6,200 U	62 U	31 U	1,200 U	2,500 U	1,200 U	20,000 U	7,500 µg/kg U G	NS^2	NS^2	2,500 U	1,200 U	1,200 U
4-Chlorotoluene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
4-Methyl-2-pentanone (MIBK)	µg/L	12,000 U	6,200 U	6,200 UJ	62 U	31 U	1,200 U	2,500 U	1,200 U	20,000 U	7,500 µg/kg U G	NS^2	NS^2	2,500 U	1,200 U	1,200 U
Acetone	µg/L	25,000 U	12,000 U	12,000 R	120 U	62 U	2,500 R	5,000 U	2,500 U	200,000 U	**8,100 µg/kg B** G P	NS^2	NS^2	5,000 R	2,500 U	2,500 U
Benzene	µg/L	2,500 U	1,200 U	1,200 U	**4.5 J**	**4 J**	**120 J**	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Bromobenzene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Bromochloromethane	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Bromodichloromethane	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Bromoform	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Bromomethane	µg/L	5,000 U	2,500 U	2,500 U	25 U	12 U	500 U	1,000 U	500 U	20,000 U	3,000 µg/kg U G	NS^2	NS^2	1,000 UJ	500 U	500 U
Carbon disulfide	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	20,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Carbon tetrachloride	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Chlorobenzene	µg/L	2,500 U	1,200 U	1,200 U	12 U	**1.9 J**	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Chloroethane	µg/L	5,000 U	2,500 U	2,500 U	**18 J**	**27**	500 U	1,000 U	500 U	10,000 U	3,000 µg/kg U G	NS^2	NS^2	1,000 U	500 U	500 U
Chloroform	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Chloromethane	µg/L	5,000 U	2,500 U	2,500 U	25 U	**3.7 J**	500 U	1,000 U	500 U	10,000 U	3,000 µg/kg U G	NS^2	NS^2	1,000 UJ	500 U	500 U
cis-1,2-Dichloroethene	µg/L	**130,000**	**58,000**	**62,000**	**250**	**110**	**1,400**	**980**	**2,200**	10,000 U	1,500 µg/kg U G	NS^2	NS^2	**5,100**	**1,000**	**710**
cis-1,3-Dichloropropene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Dibromochloromethane	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Dibromomethane	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Dichlorodifluoromethane	µg/L	5,000 U	2,500 U	2,500 UJ	25 U	12 U	500 U	1,000 U	500 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	1,000 U	500 U	500 U
Ethylbenzene	µg/L	2,500 U	1,200 U	1,200 U	12 U	**1.2 J**	**99 J**	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Hexachlorobutadiene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Isopropylbenzene (Cumene)	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
m/p-Xylene	µg/L	2,500 U	1,200 U	1,200 U	12 U	**3.2 J**	**240 J**	500 U	**160 J**	20,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Methyl tert-butyl ether (MTBE)	µg/L	2,500 U	1,200 U	1,200 UJ	12 U	6.2 U	250 U	500 U	250 U	NA	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Methylene chloride	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
N-Butylbenzene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
N-Propylbenzene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	20,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Naphthalene	µg/L	**1,300 J**	1,200 U	1,200 U	12 U	**8.5**	250 U	500 U	250 U	30,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
o-Xylene	µg/L	2,500 U	1,200 U	1,200 U	**3.1 J**	**2.9 J**	**180 J**	500 U	**160 J**	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
p-Isopropyltoluene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
sec-Butylbenzene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Styrene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
tert-Butylbenzene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Tetrachloroethene (PCE)	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Toluene	µg/L	**1,500 J**	**1,700**	**1,900**	**6.8 J**	**5.1 J**	**1,600**	**900**	**1,100**	10,000 U	1,500 µg/kg U G	NS^2	NS^2	**410 J**	**92 J**	250 U
trans-1,2-Dichloroethene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
trans-1,3-Dichloropropene	µg/L	2,500 U	1,200 U	1,200 U	12 U	6.2 U	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Trichloroethene (TCE)	µg/L	2,500 U	1,200 U	1,200 U	12 U	**4.3 J**	250 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	500 U	250 U	250 U
Trichlorofluoromethane	µg/L	5,000 U	2,500 U	2,500 U	25 U	12 U	500 U	1,000 U	500 U	10,000 U	1,500 µg/kg U G	NS^2	NS^2	1,000 U	500 U	500 U
Vinyl chloride	µg/L	**77,000**	**36,000**	**39,000**	**460**	**370**	**12,000**	**13,000**	**24,000**	**60,500**	3,000 µg/kg U G	NS^2	NS^2	**35,000**	**9,400**	**6,700**
Total Detected VOCs		**210,800**	**96,630**	**102,900**	**757**	**556.4**	**15,785**	**14,880**	**27,713**	**60,500**	8,100 µg/kg **B**	N/A	N/A	**40,510**	**10,492**	**7,410**

Table 8

Groundwater VOC Analytical Results for Treatment Area Monitoring Wells, Site 5 - Unit 2, NAS North Island

Sample Event		**Interim #2**	**Interim #3**	**30-Day Post**		**48-Day Post**	**MNA Post #3**	**Final**		**Baseline**		**Interim #1**	**Interim #2**	**Interim #3**	**30-Day Post**	**48-Day Post**
Sample Identification		818725-144		818725-165	818725-166 (Dup)	818725-192	818725-222	818725-239	818725-240 (Dup)	818725-97	818725-98 (Dup)	818725-138	818725-147		818725-168	818725-189
Location Code		S5-MW-28	S5-MW-28	S5-MW-28	S5-MW-28	S5-MW-28	S5-MW-28	S5-MW-28	S5-MW-28	S5-MW-30	S5-MW-30	S5-MW-30	S5-MW-30	S5-MW-30	S5-MW-30	S5-MW-30
Date Sampled		10/23/02		03/25/03	03/25/03	04/08/03	06/05/03	07/09/03	07/09/03	05/20/02	05/20/02	08/14/02	10/23/02		03/25/03	04/08/03
	Unit															
SW8260B																
1,1,1,2-Tetrachloroethane	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
1,1,1-Trichloroethane	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
1,1,2,2-Tetrachloroethane	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/L	50 U	NS[1]	1,200 U	1,200 UJ	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
1,1,2-Trichloroethane	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
1,1-Dichloroethane	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
1,1-Dichloroethene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
1,1-Dichloropropene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
1,2,3-Trichlorobenzene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
1,2,3-Trichloropropane	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	**110**	250 U
1,2,4-Trichlorobenzene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
1,2,4-Trimethylbenzene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
1,2-Dibromo-3-chloropropane (DBCP)	µg/L	100 U	NS[1]	2,500 U	2,500 U	2,000 U	250 U	100 U	100 U	500 U	500 U	1,000 U	100 U	NS[1]	100 U	500 U
1,2-Dibromoethane (EDB)	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
1,2-Dichlorobenzene	µg/L	**33 J**	NS[1]	1,200 U	1,200 U	1,000 U	120 U	**30 J**	**31 J**	**91 J**	**100 J**	500 U	50 U	NS[1]	50 U	250 U
1,2-Dichloroethane	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	**29 J**	250 U
1,2-Dichloropropane	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
1,3,5-Trimethylbenzene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
1,3-Dichlorobenzene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
1,3-Dichloropropane	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
1,4-Dichlorobenzene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
2,2-Dichloropropane	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
2-Butanone (MEK)	µg/L	250 U	NS[1]	6,200 U	6,200 UJ	5,000 U	620 U	250 U	250 U	1,200 R	1,200 R	2,500 U	250 U	NS[1]	250 U	1,200 U
2-Chlorotoluene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
2-Hexanone	µg/L	250 U	NS[1]	6,200 U	6,200 U	5,000 U	620 U	250 U	250 U	1,200 U	1,200 U	2,500 U	250 U	NS[1]	250 U	1,200 U
4-Chlorotoluene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
4-Methyl-2-pentanone (MIBK)	µg/L	250 U	NS[1]	6,200 U	6,200 U	5,000 U	620 U	250 U	250 U	1,200 U	1,200 U	2,500 U	250 U	NS[1]	250 U	1,200 U
Acetone	µg/L	500 U	NS[1]	12,000 U	12,000 UJ	10,000 U	1,200 U	500 U	500 U	2,500 R	2,500 R	5,000 U	500 U	NS[1]	**150 J**	2,500 U
Benzene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	**19 J**	250 U
Bromobenzene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
Bromochloromethane	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
Bromodichloromethane	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
Bromoform	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
Bromomethane	µg/L	100 U	NS[1]	2,500 U	2,500 U	2,000 U	250 U	100 U	100 U	500 UJ	500 UJ	1,000 U	100 U	NS[1]	100 U	500 U
Carbon disulfide	µg/L	50 U	NS[1]	1,200 U	1,200 UJ	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
Carbon tetrachloride	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
Chlorobenzene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
Chloroethane	µg/L	100 U	NS[1]	2,500 U	2,500 U	2,000 U	250 U	100 U	100 U	500 U	500 U	1,000 U	100 U	NS[1]	100 U	500 U
Chloroform	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
Chloromethane	µg/L	100 U	NS[1]	2,500 U	2,500 U	2,000 U	250 U	100 U	100 U	500 UJ	500 UJ	1,000 U	100 U	NS[1]	100 U	500 U
cis-1,2-Dichloroethene	µg/L	**180**	NS[1]	**36,000**	**24,000**	**27,000**	**370**	**320**	**360**	**1,800**	**1,700**	**3,700**	**480**	NS[1]	**1,500**	**3,400**
cis-1,3-Dichloropropene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
Dibromochloromethane	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
Dibromomethane	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
Dichlorodifluoromethane	µg/L	100 U	NS[1]	2,500 U	2,500 UJ	2,000 U	250 U	100 U	100 U	500 U	500 U	1,000 U	100 U	NS[1]	100 U	500 U
Ethylbenzene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	**73 J**	**89 J**	500 U	50 U	NS[1]	50 U	250 U
Hexachlorobutadiene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
Isopropylbenzene (Cumene)	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
m/p-Xylene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	**51**	250 U
Methyl tert-butyl ether (MTBE)	µg/L	50 U	NS[1]	1,200 U	1,200 UJ	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
Methylene chloride	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
N-Butylbenzene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
N-Propylbenzene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
Naphthalene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	**70**	**140 J**
o-Xylene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	**120 J**	**120 J**	**100 J**	**13 J**	NS[1]	**36 J**	**70 J**
p-Isopropyltoluene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
sec-Butylbenzene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
Styrene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
tert-Butylbenzene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
Tetrachloroethene (PCE)	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
Toluene	µg/L	**26 J**	NS[1]	**1,100 J**	**730 J**	**810 J**	**42 J**	**29 J**	**35 J**	**620**	**630**	**760**	**72**	NS[1]	**300**	**410**
trans-1,2-Dichloroethene	µg/L	50 U	NS[1]	**400 J**	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	**33 J**	250 U
trans-1,3-Dichloropropene	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
Trichloroethene (TCE)	µg/L	50 U	NS[1]	1,200 U	1,200 U	1,000 U	120 U	50 U	50 U	250 U	250 U	500 U	50 U	NS[1]	50 U	250 U
Trichlorofluoromethane	µg/L	100 U	NS[1]	2,500 U	2,500 U	2,000 U	250 U	100 U	100 U	500 U	500 U	1,000 U	100 U	NS[1]	100 U	500 U
Vinyl chloride	µg/L	**4,900**	NS[1]	**36,000**	**29,000**	**24,000**	**3,400**	**3,000**	**3,200**	**21,000**	**21,000**	**23,000**	**2,300**	NS[1]	**1,700**	**6,300**
Total Detected VOCs		**5,139**	N/A	**73,500**	**53,730**	**51,810**	**3,812**	**3,379**	**3,626**	**23,704**	**23,639**	**27,560**	**2,865**	N/A	**3,998**	**10,320**

Table 8
Groundwater VOC Analytical Results for Treatment Area Monitoring Wells, Site 5 - Unit 2, NAS North Island

Sample Event		**MNA Post #3**	**Final**	**Baseline**	**Interim #1**	**Interim #2**	**Interim #3**	**30-Day Post**	**48-Day Post**	**Final**	**Baseline**	**Interim #1**	**Interim #2**	**Interim #3**	**30-Day Post**	**48-Day Post**
Sample Identification		818725-224	818725-241	818725-81	818725-121	818725-146		818725-162	818725-191	818725-233	818725-84	818725-134	818725-145	818725-155	818725-164	
Location Code		S5-MW-30	S5-MW-30	S5-MW-32	S5-MW-32	S5-MW-32	S5-MW-32	S5-MW-32	S5-MW-32	S5-MW-32	S5-MW-34	S5-MW-34	S5-MW-34	S5-MW-34	S5-MW-34	S5-MW-34
Date Sampled		06/05/03	07/09/03	05/14/02	08/12/02	10/23/02		03/25/03	04/08/03	07/08/03	05/15/02	08/14/02	10/23/02	01/07/03	03/25/03	
	Unit															
SW8260B																
1,1,1,2-Tetrachloroethane	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
1,1,1-Trichloroethane	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
1,1,2,2-Tetrachloroethane	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	NA	1,500 µg/kg U G	NS[2]
1,1,2-Trichloroethane	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
1,1-Dichloroethane	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
1,1-Dichloroethene	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
1,1-Dichloropropene	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
1,2,3-Trichlorobenzene	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	20,000 U	1,500 µg/kg U G	NS[2]
1,2,3-Trichloropropane	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	**3,300**	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
1,2,4-Trichlorobenzene	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	20,000 U	1,500 µg/kg U G	NS[2]
1,2,4-Trimethylbenzene	µg/L	500 U	500 U	**4**	**2**	**2**	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
1,2-Dibromo-3-chloropropane (DBCP)	µg/L	1,000 U	1,000 U	5 U	2 U	2 U	NS[1]	1,000 U	250 U	10 U	100 U	500 U	250 U	20,000 U	3,000 µg/kg U G	NS[2]
1,2-Dibromoethane (EDB)	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
1,2-Dichlorobenzene	µg/L	500 U	500 U	**5**	**6**	**5**	NS[1]	500 U	120 U	**6.7**	**56**	250 U	**73 J**	10,000 U	1,500 µg/kg U G	NS[2]
1,2-Dichloroethane	µg/L	500 U	500 U	3 U	**2**	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
1,2-Dichloropropane	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
1,3,5-Trimethylbenzene	µg/L	500 U	500 U	**2 J**	**2**	**2**	NS[1]	500 U	120 U	**1.0 J**	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
1,3-Dichlorobenzene	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
1,3-Dichloropropane	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
1,4-Dichlorobenzene	µg/L	500 U	500 U	3 U	**1 J**	**0.5 J**	NS[1]	500 U	120 U	5.0 U	**48 J**	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
2,2-Dichloropropane	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
2-Butanone (MEK)	µg/L	2,500 U	2,500 U	12 R	5 U	5 U	NS[1]	2,500 U	620 U	25 U	250 R	1,200 U	620 U	200,000 U	7,500 µg/kg U G	NS[2]
2-Chlorotoluene	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
2-Hexanone	µg/L	2,500 U	2,500 U	12 U	5 U	5 U	NS[1]	2,500 U	620 U	25 U	250 U	1,200 U	620 U	20,000 U	7,500 µg/kg U G	NS[2]
4-Chlorotoluene	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
4-Methyl-2-pentanone (MIBK)	µg/L	2,500 U	2,500 U	12 U	5 U	5 U	NS[1]	2,500 U	620 U	25 U	250 U	1,200 U	620 U	20,000 U	7,500 µg/kg U G	NS[2]
Acetone	µg/L	5,000 U	5,000 U	25 R	**6 J**	10 U	NS[1]	**15,000**	1,200 U	50 U	500 R	2,500 U	1,200 U	200,000 U	**5,900 µg/kg** J **B** G	NS[2]
Benzene	µg/L	500 U	500 U	**18**	**17**	**15**	NS[1]	500 U	120 U	**15**	**24 J**	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
Bromobenzene	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
Bromochloromethane	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
Bromodichloromethane	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
Bromoform	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
Bromomethane	µg/L	1,000 U	1,000 U	5 UJ	2 U	2 U	NS[1]	1,000 U	250 U	10 U	100 U	500 U	250 U	20,000 U	3,000 µg/kg U G	NS[2]
Carbon disulfide	µg/L	500 U	500 U	3 U	**0.4 J**	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	20,000 U	1,500 µg/kg U G	NS[2]
Carbon tetrachloride	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
Chlorobenzene	µg/L	500 U	500 U	**2 J**	**3**	**3**	NS[1]	500 U	120 U	**3.0 J**	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
Chloroethane	µg/L	1,000 U	1,000 U	5 U	2 U	2 U	NS[1]	1,000 U	250 U	10 U	100 U	500 U	250 U	10,000 U	3,000 µg/kg U G	NS[2]
Chloroform	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
Chloromethane	µg/L	1,000 U	1,000 U	5 UJ	2 U	2 U	NS[1]	1,000 U	250 U	10 U	100 U	500 U	250 U	10,000 U	3,000 µg/kg U G	NS[2]
cis-1,2-Dichloroethene	µg/L	**5,100**	**29,000**	**71**	**17**	**5**	NS[1]	**21,000**	**3,800**	**210**	**23 J**	**3,900**	**7,500**	**11,500**	1,500 µg/kg U G	NS[2]
cis-1,3-Dichloropropene	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
Dibromochloromethane	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
Dibromomethane	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
Dichlorodifluoromethane	µg/L	1,000 U	1,000 U	5 U	2 U	2 U	NS[1]	1,000 U	250 U	10 U	100 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS[2]
Ethylbenzene	µg/L	500 U	500 U	**8**	**9**	**7**	NS[1]	500 U	120 U	**6.8**	**27 J**	250 U	**39 J**	10,000 U	1,500 µg/kg U G	NS[2]
Hexachlorobutadiene	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
Isopropylbenzene (Cumene)	µg/L	500 U	500 U	**2 J**	**2**	**2**	NS[1]	500 U	120 U	**2.1 J**	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
m/p-Xylene	µg/L	500 U	500 U	**11**	**8**	**6**	NS[1]	500 U	120 U	**4.4 J**	50 U	250 U	**75 J**	20,000 U	1,500 µg/kg U G	NS[2]
Methyl tert-butyl ether (MTBE)	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	NA	1,500 µg/kg U G	NS[2]
Methylene chloride	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
N-Butylbenzene	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
N-Propylbenzene	µg/L	500 U	500 U	**1 J**	**1**	**1**	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	20,000 U	1,500 µg/kg U G	NS[2]
Naphthalene	µg/L	5,000 U	**280 J**	**10**	**11**	**8**	NS[1]	500 U	**62 J**	**9.1**	50 U	250 U	120 U	**35,400 B**	1,500 µg/kg U G	NS[2]
o-Xylene	µg/L	**120 J**	**170 J**	**13**	**13**	**11**	NS[1]	500 U	120 U	**7.5**	**27 J**	**54 J**	**68 J**	10,000 U	1,500 µg/kg U G	NS[2]
p-Isopropyltoluene	µg/L	500 U	500 U	3 U	0 J	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
sec-Butylbenzene	µg/L	500 U	500 U	3 U	0 J	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
Styrene	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
tert-Butylbenzene	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
Tetrachloroethene (PCE)	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
Toluene	µg/L	**680 J**	**1,100**	**49**	**36**	**11**	NS[1]	**590**	**110 J**	5.0 U	**46 J**	**520**	**620**	10,000 U	1,500 µg/kg U G	NS[2]
trans-1,2-Dichloroethene	µg/L	500 U	240 J	**2 J**	**1 J**	1 U	NS[1]	**620**	120 U	**5.6**	50 U	250 U	**56 J**	10,000 U	1,500 µg/kg U G	NS[2]
trans-1,3-Dichloropropene	µg/L	500 U	500 U	3 U	1 U	1 U	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
Trichloroethene (TCE)	µg/L	500 U	500 U	3 U	1 U	**0.3 J**	NS[1]	500 U	120 U	5.0 U	50 U	250 U	120 U	10,000 U	1,500 µg/kg U G	NS[2]
Trichlorofluoromethane	µg/L	1,000 U	1,000 U	5 U	2 U	2 U	NS[1]	1,000 U	250 U	10 U	100 U	500 U	250 U	10,000 U	1,500 µg/kg U G	NS[2]
Vinyl chloride	µg/L	**17,000**	**30,000**	3 U	**37**	**22**	NS[1]	**1,000**	**2,100**	**75**	**3,700**	**10,000**	**12,000**	**16,400**	3,000 µg/kg U G	NS[2]
Total Detected VOCs		**22,900**	**60,790**	**199**	**174**	**101**	N/A	**41,510**	**6,072**	**346.2**	**3,951**	**14,474**	**20,431**	**63,300**	5,900 µg/kg **J B**	N/A

Table 8
Groundwater VOC Analytical Results for Treatment Area Monitoring Wells, Site 5 - Unit 2, NAS North Island

Sample Event		**Final**	**Baseline**	**Interim #1**	**Interim #2**	**Interim #3**	**30-Day Post**	**48-Day Post**	**Final**	**Baseline**		**Interim #1**	**Interim #2**	**Interim #3**	**30-Day Post**	**48-Day Post**
Sample Identification			818725-90	818725-140	818725-150		818725-160	818725-190	818725-228	818725-94	818725-95 (Dup)	818725-125	818725-152		818725-159	
Location Code		S5-MW-34	S5-MW-35	S5-MW-35	S5-MW-35	S5-MW-35	S5-MW-35	S5-MW-35	S5-MW-35	S5-MW-37	S5-MW-37	S5-MW-37	S5-MW-37	S5-MW-37	S5-MW-37	S5-MW-37
Date Sampled			05/16/02	08/14/02	10/24/02		03/24/03	04/08/03	07/07/03	05/20/02	05/20/02	08/13/02	10/24/02		03/24/03	
	Unit															
SW8260B																
1,1,1,2-Tetrachloroethane	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
1,1,1-Trichloroethane	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
1,1,2,2-Tetrachloroethane	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
1,1,2-Trichloroethane	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
1,1-Dichloroethane	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
1,1-Dichloroethene	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	**1 J**	NS[3]
1,1-Dichloropropene	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
1,2,3-Trichlorobenzene	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
1,2,3-Trichloropropane	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	**86**	NS[3]
1,2,4-Trichlorobenzene	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	**1 J**	**0.61 J**	1 U	1 U	NS[1]	3 U	NS[3]
1,2,4-Trimethylbenzene	µg/L	NS[2]	**120**	**120**	**280**	NS[1]	**130 J**	**130 J**	**100**	**27**	**27**	**0.4 J**	1 U	NS[1]	3 U	NS[3]
1,2-Dibromo-3-chloropropane (DBCP)	µg/L	NS[2]	100 U	50 U	20 U	NS[1]	500 U	500 U	12 U	2 U	2 U	2 U	2 U	NS[1]	5 U	NS[3]
1,2-Dibromoethane (EDB)	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
1,2-Dichlorobenzene	µg/L	NS[2]	**69**	**80**	**82**	NS[1]	250 U	250 U	**41**	**8**	**8.3**	**4**	**3**	NS[1]	**6**	NS[3]
1,2-Dichloroethane	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	**2**	**2.1**	**2**	**1**	NS[1]	3 U	NS[3]
1,2-Dichloropropane	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	**0.4 J**	1 U	NS[1]	3 U	NS[3]
1,3,5-Trimethylbenzene	µg/L	NS[2]	**70**	**64**	**92**	NS[1]	250 U	250 U	**33**	**11**	**11**	1 U	1 U	NS[1]	3 U	NS[3]
1,3-Dichlorobenzene	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	**0.45 J**	1 U	1 U	NS[1]	3 U	NS[3]
1,3-Dichloropropane	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
1,4-Dichlorobenzene	µg/L	NS[2]	**58**	**10 J**	10 U	NS[1]	250 U	250 U	**7.2**	**4**	**4**	**2**	**2**	NS[1]	**2 J**	NS[3]
2,2-Dichloropropane	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
2-Butanone (MEK)	µg/L	NS[2]	250 R	120 U	50 U	NS[1]	1,200 U	1,200 U	31 U	5 R	5 R	5 U	5 U	NS[1]	12 U	NS[3]
2-Chlorotoluene	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
2-Hexanone	µg/L	NS[2]	250 U	120 U	50 U	NS[1]	1,200 U	1,200 U	31 U	5 U	5 U	5 U	5 U	NS[1]	12 U	NS[3]
4-Chlorotoluene	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
4-Methyl-2-pentanone (MIBK)	µg/L	NS[2]	250 U	120 U	50 U	NS[1]	1,200 U	1,200 U	31 U	5 U	5 U	5 U	5 U	NS[1]	12 U	NS[3]
Acetone	µg/L	NS[2]	500 R	250 U	100 U	NS[1]	2,500 U	2,500 U	**32 J**	10 R	10 R	**5 J**	10 U	NS[1]	**36**	NS[3]
Benzene	µg/L	NS[2]	**28 J**	**27**	**34**	NS[1]	250 U	250 U	**23**	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
Bromobenzene	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
Bromochloromethane	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
Bromodichloromethane	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
Bromoform	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
Bromomethane	µg/L	NS[2]	100 U	50 U	20 U	NS[1]	500 U	500 U	12 U	2 UJ	2 UJ	2 U	2 U	NS[1]	5 U	NS[3]
Carbon disulfide	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	**1**	1 U	NS[1]	3 U	NS[3]
Carbon tetrachloride	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
Chlorobenzene	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	**9**	**8.8**	**5**	**2**	NS[1]	**1 J**	NS[3]
Chloroethane	µg/L	NS[2]	100 U	50 U	20 U	NS[1]	500 U	500 U	**57**	2 U	2 U	2 U	2 U	NS[1]	5 U	NS[3]
Chloroform	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
Chloromethane	µg/L	NS[2]	100 U	50 U	20 U	NS[1]	500 U	500 U	12 U	2 UJ	2 UJ	2 U	2 U	NS[1]	5 U	NS[3]
cis-1,2-Dichloroethene	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	**200 J**	250 U	**7.4**	**7**	**6.4**	**4**	**5**	NS[1]	**19**	NS[3]
cis-1,3-Dichloropropene	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
Dibromochloromethane	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
Dibromomethane	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
Dichlorodifluoromethane	µg/L	NS[2]	100 U	50 U	20 U	NS[1]	500 U	500 U	12 U	2 U	2 U	2 U	2 U	NS[1]	5 U	NS[3]
Ethylbenzene	µg/L	NS[2]	**61**	**58**	**87**	NS[1]	250 U	250 U	**42**	**3**	**2.4**	**0.4 J**	1 U	NS[1]	**1 J**	NS[3]
Hexachlorobutadiene	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
Isopropylbenzene (Cumene)	µg/L	NS[2]	50 U	25 U	**16**	NS[1]	250 U	250 U	**8.3**	**1**	**1**	1 U	1 U	NS[1]	3 U	NS[3]
m/p-Xylene	µg/L	NS[2]	**180**	**190**	**260**	NS[1]	250 U	250 U	**34**	**7**	**6.4**	1 U	1 U	NS[1]	3 U	NS[3]
Methyl tert-butyl ether (MTBE)	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
Methylene chloride	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
N-Butylbenzene	µg/L	NS[2]	50 U	25 U	**12**	NS[1]	250 U	250 U	**6.3**	**13**	**13**	**1 J**	**0.4 J**	NS[1]	3 U	NS[3]
N-Propylbenzene	µg/L	NS[2]	50 U	25 U	**18**	NS[1]	250 U	250 U	**6 J**	**3**	**2.9**	1 U	1 U	NS[1]	3 U	NS[3]
Naphthalene	µg/L	NS[2]	**55**	**110**	**200**	NS[1]	**180 J**	**190 J**	**170**	**12**	**12**	**1**	1 U	NS[1]	**3**	NS[3]
o-Xylene	µg/L	NS[2]	**190**	**250**	**170**	NS[1]	**99 J**	**76 J**	**90**	**4**	**3.8**	**0.2 J**	1 U	NS[1]	**1 J**	NS[3]
p-Isopropyltoluene	µg/L	NS[2]	**120**	**110**	**210**	NS[1]	**250 U**	250 U	**9.5**	**16**	**14**	1 U	1 U	NS[1]	3 U	NS[3]
sec-Butylbenzene	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	**5.1 J**	**5**	**5.7**	**1**	**1 J**	NS[1]	3 U	NS[3]
Styrene	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
tert-Butylbenzene	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	0 J	1 U	NS[1]	3 U	NS[3]
Tetrachloroethene (PCE)	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
Toluene	µg/L	NS[2]	**520**	**630**	**570**	NS[1]	**500**	**380**	**220**	**10**	**9**	1 U	1 U	NS[1]	**1 J**	NS[3]
trans-1,2-Dichloroethene	µg/L	NS[2]	50 U	25 U	**7 J**	NS[1]	250 U	250 U	**4.6 J**	**1 J**	**0.94 J**	**1 J**	**1 J**	NS[1]	**2 J**	NS[3]
trans-1,3-Dichloropropene	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	1 U	1 U	1 U	1 U	NS[1]	3 U	NS[3]
Trichloroethene (TCE)	µg/L	NS[2]	50 U	25 U	10 U	NS[1]	250 U	250 U	6.2 U	**1 J**	**0.64 J**	1 U	**1 J**	NS[1]	3 U	NS[3]
Trichlorofluoromethane	µg/L	NS[2]	100 U	50 U	20 U	NS[1]	500 U	500 U	12 U	2 U	2 U	2 U	2 U	NS[1]	5 U	NS[3]
Vinyl chloride	µg/L	NS[2]	**1,700**	**34**	**680**	NS[1]	**8,900**	**5,600**	**420**	**4**	**3.5**	**2**	**3**	NS[1]	**14**	NS[3]
Total Detected VOCs		N/A	**3,171**	**1,683**	**2,718**	N/A	**10,009**	**6,376**	**1,316.4**	**147**	**143.94**	**30**	**18**	N/A	**173**	N/A

Table 8
Groundwater VOC Analytical Results for Treatment Area Monitoring Wells, Site 5 - Unit 2, NAS North Island

Sample Event		**Final**	**Baseline**	**Interim #1**	**Interim #2**	**Interim #3**	**30-Day Post**	**48-Day Post**	**Final**
Sample Identification		818725-232	818725-89	818725-122	818725-151		818725-163	818725-188	818725-226
Location Code		S5-MW-37	S5-MW-38	S5-MW-38	S5-MW-38	S5-MW-38	S5-MW-38	S5-MW-38	S5-MW-38
Date Sampled		07/08/03	05/16/02	08/12/02	10/24/02		03/25/03	04/08/03	07/07/03
	Unit								
SW8260B									
1,1,1,2-Tetrachloroethane	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
1,1,1-Trichloroethane	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
1,1,2,2-Tetrachloroethane	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
1,1,2-Trichloroethane	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
1,1-Dichloroethane	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
1,1-Dichloroethene	µg/L	3.7 J	**1 J**	2 U	1 U	NS^1	25 U	50 U	100 U
1,1-Dichloropropene	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
1,2,3-Trichlorobenzene	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
1,2,3-Trichloropropane	µg/L	**490**	3 U	2 U	**3**	NS^1	**45**	**51**	**340**
1,2,4-Trichlorobenzene	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
1,2,4-Trimethylbenzene	µg/L	**24**	**4**	**1 J**	**1**	NS^1	**95**	**110**	**210**
1,2-Dibromo-3-chloropropane (DBCP)	µg/L	12 U	5 U	4 U	2 U	NS^1	50 U	100 U	200 U
1,2-Dibromoethane (EDB)	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
1,2-Dichlorobenzene	µg/L	**19**	**13**	**15**	18	NS^1	**76**	**90**	**140**
1,2-Dichloroethane	µg/L	6.2 U	**3**	**2**	1 U	NS^1	**21 J**	**42 J**	**74 J**
1,2-Dichloropropane	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
1,3,5-Trimethylbenzene	µg/L	6.2 U	**1 J**	**0.5 J**	**0.5 J**	NS^1	**23 J**	**25 J**	**59 J**
1,3-Dichlorobenzene	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
1,3-Dichloropropane	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
1,4-Dichlorobenzene	µg/L	**10**	**5**	**5**	**5**	NS^1	**16 J**	**20 J**	100 U
2,2-Dichloropropane	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
2-Butanone (MEK)	µg/L	31 U	12 R	10 U	5 U	NS^1	120 U	250 U	500 U
2-Chlorotoluene	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
2-Hexanone	µg/L	31 U	12 U	10 U	5 U	NS^1	120 U	250 U	500 U
4-Chlorotoluene	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
4-Methyl-2-pentanone (MIBK)	µg/L	31 U	12 U	10 U	5 U	NS^1	120 U	250 U	500 U
Acetone	µg/L	**20 J**	25 R	**7 J**	10 U	NS^1	250 U	500 U	1,000 U
Benzene	µg/L	6.2 U	**15**	**17**	**16**	NS^1	**54**	**67**	**110**
Bromobenzene	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
Bromochloromethane	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
Bromodichloromethane	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
Bromoform	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
Bromomethane	µg/L	12 U	5 U	4 U	2 U	NS^1	50 U	100 U	200 U
Carbon disulfide	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
Carbon tetrachloride	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
Chlorobenzene	µg/L	6.2 U	**8**	**5**	**5**	NS^1	25 U	50 U	100 U
Chloroethane	µg/L	12 U	5 U	4 U	2 U	NS^1	50 U	100 U	200 U
Chloroform	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
Chloromethane	µg/L	12 U	5 U	4 U	2 U	NS^1	50 U	100 U	200 U
cis-1,2-Dichloroethene	µg/L	**15**	**6**	**2 J**	**1**	NS^1	**340**	**660**	**1,500**
cis-1,3-Dichloropropene	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
Dibromochloromethane	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
Dibromomethane	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
Dichlorodifluoromethane	µg/L	12 U	5 U	4 U	2 U	NS^1	50 U	100 U	200 U
Ethylbenzene	µg/L	**11**	**2 J**	**0.5 J**	**1 J**	NS^1	**29**	**34 J**	**74 J**
Hexachlorobutadiene	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
Isopropylbenzene (Cumene)	µg/L	6.2 U	3 U	2 U	**0.4 J**	NS^1	25 U	50 U	100 U
m/p-Xylene	µg/L	**8.5**	**5**	**1 J**	**2**	NS^1	**21 J**	50 U	100 U
Methyl tert-butyl ether (MTBE)	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
Methylene chloride	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
N-Butylbenzene	µg/L	6.2 U	3 U	2 U	1 J	NS^1	25 U	50 U	100 U
N-Propylbenzene	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
Naphthalene	µg/L	**43**	**6**	**2**	**2**	NS^1	**73**	**82**	**120**
o-Xylene	µg/L	**22**	**3**	**1 J**	**1**	NS^1	**60**	**62**	**150**
p-Isopropyltoluene	µg/L	**2.2 J**	3 U	2 U	1 U	NS^1	**9 J**	50 U	100 U
sec-Butylbenzene	µg/L	6.2 U	**1 J**	**1 J**	**1**	NS^1	25 U	50 U	100 U
Styrene	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
tert-Butylbenzene	µg/L	6.2 U	3 U	2 U	0 J	NS^1	25 U	50 U	100 U
Tetrachloroethene (PCE)	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
Toluene	µg/L	**38**	**12**	**4**	**6**	NS^1	**170**	**240**	**450**
trans-1,2-Dichloroethene	µg/L	**2.9 J**	**1 J**	2 U	**1 J**	NS^1	25 U	50 U	100 U
trans-1,3-Dichloropropene	µg/L	6.2 U	3 U	2 U	1 U	NS^1	25 U	50 U	100 U
Trichloroethene (TCE)	µg/L	6.2 U	**69**	2 U	1 U	NS^1	25 U	50 U	100 U
Trichlorofluoromethane	µg/L	12 U	5 U	4 U	2 U	NS^1	50 U	100 U	200 U
Vinyl chloride	µg/L	**7.5**	**120**	**60**	**58**	NS^1	**800**	**1,800**	**5,200**
Total Detected VOCs		**716.8**	**275**	**124**	**123**	N/A	**1,832**	**3,283**	**8,427**

Explanation:

G - elevated reporting limit due to matrix interference related to potassium permanganate
J - estimated value
N/A - not applicable
NS^1 - not sampled as part of third interim groundwater sceening event
NS^2 - not sampled due to continued presence of potassium permanganate in groundwater
NS^3 - not sampled due to low 30-day post-treatment groundwater sample VOC concentations
R - rejected data
U - not detected at or above the stated reporting limit
UJ - not detected at or above the stated estimated reporting limit
µg/L - micrograms per liter
30-Day Post - posttreatment sample collected 30-days after the last chemical groundwater treatment
48-Day Post - posttreatment confirmation samples collected 48-days after the last chemical groundwater treatment

Notes:

1. Total Detected VOCs include all detected concentrations to include estimated values (J).

Table 9
Groundwater VOC Analytical Results for Boundary Monitoring Wells

Sample Event		**Baseline**	**Interim**	**Posttreatment**	**Final**	**Baseline**	**Interim**	**Posttreatment**	**Final**	**Baseline**	**Interim**	**Posttreatment**	**Final**	**Baseline**	**Interim**	**Posttreatment**	**Final**
Sample Identification		818725-99	818725-131	818725-210	818725-236	818725-91	818725-132	818725-213	818725-235	818725-83	818725-119	818725-203	818725-234	818725-85	818725-120	818725-201	818725-229
Location Code		S5-MW-10	S5-MW-10	S5-MW-10	S5-MW-10	S5-MW-20	S5-MW-20	S5-MW-20	S5-MW-20	S5-MW-31	S5-MW-31	S5-MW-31	S5-MW-31	S5-MW-33	S5-MW-33	S5-MW-33	S5-MW-33
Date Sampled		05/22/02	08/13/02	04/25/03	07/08/03	05/16/02	08/13/02	04/25/03	07/08/03	05/15/02	08/12/02	04/24/03	07/08/03	05/15/02	08/12/02	04/24/03	07/07/03
	Unit																
SW8260B																	
1,1,1,2-Tetrachloroethane	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
1,1,1-Trichloroethane	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
1,1,2,2-Tetrachloroethane	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
1,1,2-Trichloroethane	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
1,1-Dichloroethane	µg/L	**1.6 J**	**1.7 J**	**2.5**	**2.3**	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
1,1-Dichloroethene	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
1,1-Dichloropropene	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
1,2,3-Trichlorobenzene	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
1,2,3-Trichloropropane	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
1,2,4-Trichlorobenzene	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	**0.72 J**	1 U	**0.3 J**	1.0 U
1,2,4-Trimethylbenzene	µg/L	**30**	**33**	**25**	**8.3**	**140**	**100**	**170**	**110**	1 U	1 U	**0.47 J**	1.0 U	**20**	**0.31 J**	1 U	**0.57 J**
1,2-Dibromo-3-chloropropane (DBCP)	µg/L	4 U	10 U	5 U	2.0 U	25 U	20 U	25 U	20 U	2 U	2 U	2 U	2.0 U	2 U	2 U	2 U	2.0 U
1,2-Dibromoethane (EDB)	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
1,2-Dichlorobenzene	µg/L	**24**	**30**	**26**	**30**	12 U	10 U	**7.5 J**	10 U	1 U	1 U	1 U	1.0 U	**35**	**7.9**	**19**	**42**
1,2-Dichloroethane	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	**0.45 J**	1 U	1 U	1.0 U	**1.3**	**0.92 J**	1 U	**0.42 J**
1,2-Dichloropropane	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	**0.53 J**	1 U	1.0 U
1,3,5-Trimethylbenzene	µg/L	**12**	**13**	**10**	**5.0**	**47**	**27**	**51**	**34**	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	**0.56 J**
1,3-Dichlorobenzene	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	**0.62 J**	1 U	**0.41 J**	**0.81 J**
1,3-Dichloropropane	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
1,4-Dichlorobenzene	µg/L	2 U	**2 J**	**2.5**	**2.2**	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	**11**	**2.5**	**6**	**12**
2,2-Dichloropropane	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
2-Butanone (MEK)	µg/L	10 R	25 U	12 U	5.0 U	62 R	50 U	62 U	50 U	5 R	5 U	5 U	5.0 U	5 R	5 U	5 U	5.0 U
2-Chlorotoluene	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
2-Hexanone	µg/L	10 U	25 U	12 U	5.0 U	62 U	50 U	62 U	50 U	5 U	5 U	5 U	5.0 U	5 U	5 U	5 U	5.0 U
4-Chlorotoluene	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
4-Methyl-2-pentanone (MIBK)	µg/L	10 U	25 U	12 U	5.0 U	62 U	50 U	62 U	50 U	5 U	5 U	5 U	5.0 U	5 U	5 U	5 U	5.0 U
Acetone	µg/L	**17 J**	50 U	25 U	**16**	120 R	100 U	120 U	100 U	10 R	**3.3 J**	10 U	10 U	10 R	**5.2 J**	10 U	**13**
Benzene	µg/L	**61**	**67**	**42**	**51**	**62**	**60**	**44**	**60**	1 U	1 U	1 U	1.0 U	**0.44 J**	1 U	**0.34 J**	**0.45 J**
Bromobenzene	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
Bromochloromethane	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
Bromodichloromethane	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
Bromoform	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
Bromomethane	µg/L	4 UJ	10 U	5 U	2.0 U	25 U	20 U	25 U	20 U	2 U	2 U	2 U	2.0 U	2 U	2 U	2 U	2.0 U
Carbon disulfide	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
Carbon tetrachloride	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
Chlorobenzene	µg/L	2 U	5 U	2.5 U	**0.5 J**	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	**1.2**	**1.2**	**0.58 J**	**0.96 J**
Chloroethane	µg/L	**8.7**	**7.8 J**	**3.7 J**	**13**	25 U	20 U	25 U	**5.9 J**	2 U	2 U	2 U	2.0 U	2 U	2 U	2 U	2.0 U
Chloroform	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
Chloromethane	µg/L	4 UJ	10 U	5 U	2.0 U	25 U	20 U	25 U	20 U	2 U	2 U	2 U	2.0 U	2 U	2 U	2 U	2.0 U
cis-1,2-Dichloroethene	µg/L	**120**	5 U	2.5 U	1.0 U	12 U	**3.6 J**	12 U	10 U	**4.2**	**3.1**	**3**	**2.8**	**4.3**	**3.1**	**1.3**	**2.2**
cis-1,3-Dichloropropene	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
Dibromochloromethane	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
Dibromomethane	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
Dichlorodifluoromethane	µg/L	4 U	10 U	5 U	2.0 U	25 U	20 U	25 U	20 U	2 U	2 U	2 U	2.0 U	2 U	2 U	2 U	2.0 U
Ethylbenzene	µg/L	**61**	**83**	**54**	**67**	**43**	**32**	**71**	**46**	1 U	1 U	**0.59 J**	1.0 U	**8**	**0.24 J**	**2.1**	**7.8**
Hexachlorobutadiene	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
Isopropylbenzene (Cumene)	µg/L	**3.7**	**4.4 J**	**3.6**	**4.8**	**9.1 J**	**5.7 J**	**11 J**	**8.1 J**	1 U	1 U	1 U	1.0 U	**0.82 J**	1 U	1 U	**0.9 J**
m/p-Xylene	µg/L	**89**	**99**	**47**	**30**	**150**	**110**	**150**	**130**	1 U	1 U	1 U	1.0 U	**6.2**	1 U	1 U	**1.5**
Methyl tert-butyl ether (MTBE)	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
Methylene chloride	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
N-Butylbenzene	µg/L	2 U	5 U	2.5 U	**0.5 J**	**3.8 J**	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	**0.9 J**	1 U	1 U	**0.44 J**
N-Propylbenzene	µg/L	**2.9**	**4.2 J**	**3.5**	**2.6**	**11 J**	**6.5 J**	**13**	**9.2 J**	1 U	1 U	1 U	1.0 U	**1**	1 U	1 U	**0.6 J**
Naphthalene	µg/L	**46**	**62**	**44**	**37**	**570**	**500**	**910**	**540**	1 U	1 U	**6.5**	1.0 U	**21**	**1.9**	**1.3**	**6.0**
o-Xylene	µg/L	**120**	**160**	**98**	**78**	**92**	**75**	**150**	**96**	1 U	1 U	**0.55 J**	1.0 U	**25**	**0.77 J**	**3.2**	**6.1**
p-Isopropyltoluene	µg/L	2 U	**2.5 J**	2.5 U	1.0 U	**51**	**10**	**46**	10 U	1 U	1 U	1 U	1.0 U	**4.3**	1 U	1 U	1.0 U
sec-Butylbenzene	µg/L	2 U	5 U	2.5 U	**0.7 J**	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	**0.77 J**	1 U	1 U	**0.72 J**
Styrene	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
tert-Butylbenzene	µg/L	2 U	5 U	**2.8**	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	**0.36 J**
Tetrachloroethene (PCE)	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
Toluene	µg/L	**140**	**130**	**53**	**37**	**840**	**460**	**490**	**360**	1 U	1 U	1 U	1.0 U	**6.6**	**0.39 J**	**0.85 J**	**2.3**
trans-1,2-Dichloroethene	µg/L	**5.6**	**1.5 J**	2.5 U	**1.1**	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
trans-1,3-Dichloropropene	µg/L	2 U	5 U	2.5 U	1.0 U	12 U	10 U	12 U	10 U	1 U	1 U	1 U	1.0 U	1 U	1 U	1 U	1.0 U
Trichloroethene (TCE)	µg/L	**22**	5 U	2.5 U	1.0 U	**14**	10 U	12 U	10 U	**0.93 J**	1 U	1 U	1.0 U	**0.76 J**	1 U	1 U	**0.3 J**
Trichlorofluoromethane	µg/L	4 U	10 U	5 U	2.0 U	25 U	20 U	25 U	20 U	2 U	2 U	2 U	2.0 U	2 U	2 U	2 U	2.0 U
Vinyl chloride	µg/L	**120**	**2.2 J**	**23**	**2.9**	**24**	**10**	**6.6 J**	**6.6 J**	**2.6**	**0.65 J**	1 U	1.0 U	**5.5**	**3.8**	**1.7**	**2.6**
Total Detected VOCs		**884.5**	**703.3**	**440.6**	**389.9**	**2056.9**	**1399.8**	**2120.1**	**1405.8**	**8.2**	**7.1**	**11.1**	**2.8**	**155.4**	**28.8**	**37.1**	**102.6**

Table 9
Groundwater VOC Analytical Results for Boundary Monitoring Wells, Site 5 - Unit 2, NAS North Island

Sample Event		**Baseline**	**Interim**	**Posttreatment**	**Final**	**Baseline**	**Interim**	**Posttreatment**	**Final**	**Baseline**	**Interim**	**Posttreatment**	**Final**
Sample Identification		818725-93	818725-124	818725-207	818725-231	818725-88	818725-126	818725-205		818725-86	818725-127	818725-204	818725-227
Location Code		S5-MW-36	S5-MW-36	S5-MW-36	S5-MW-36	S5-MW-39	S5-MW-39	S5-MW-39	S5-MW-39	S5-MW-40	S5-MW-40	S5-MW-40	S5-MW-40
Date Sampled		05/20/02	08/13/02	04/24/03	07/08/03	05/16/02	08/13/02	04/24/03		05/15/02	08/13/02	04/24/03	07/07/03
	Unit												
SW8260B													
1,1,1,2-Tetrachloroethane	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
1,1,1-Trichloroethane	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
1,1,2,2-Tetrachloroethane	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
1,1,2-Trichloroethane	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
1,1-Dichloroethane	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
1,1-Dichloroethene	µg/L	**0.39 J**	1 U	1 U	1.0 U	**1.3**	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
1,1-Dichloropropene	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
1,2,3-Trichlorobenzene	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
1,2,3-Trichloropropane	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	**12**	NS[1]	5 U	10 U	2 U	2.5 U
1,2,4-Trichlorobenzene	µg/L	1 U	1 U	1 U	1.0 U	**1.3**	**1.2 J**	**1.3**	NS[1]	5 U	10 U	2 U	2.5 U
1,2,4-Trimethylbenzene	µg/L	1 U	1 U	1 U	1.0 U	**70**	**36**	**35**	NS[1]	**95**	**86**	**48**	**25**
1,2-Dibromo-3-chloropropane (DBCP)	µg/L	2 U	2 U	2 U	2.0 U	2 U	4 U	2 U	NS[1]	10 U	20 U	4 U	5 U
1,2-Dibromoethane (EDB)	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
1,2-Dichlorobenzene	µg/L	1 U	1 U	1 U	1.0 U	**97**	**79**	**85**	NS[1]	**48**	**40**	**26**	**19**
1,2-Dichloroethane	µg/L	1 U	1 U	1 U	1.0 U	**0.66 J**	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
1,2-Dichloropropane	µg/L	**0.37 J**	**0.36 J**	**1**	**0.76 J**	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
1,3,5-Trimethylbenzene	µg/L	1 U	1 U	1 U	1.0 U	**3.4**	**0.48 J**	**0.51 J**	NS[1]	**26**	**18**	**13**	**4.6**
1,3-Dichlorobenzene	µg/L	1 U	1 U	1 U	1.0 U	**1**	**0.94 J**	**1**	NS[1]	5 U	10 U	2 U	2.5 U
1,3-Dichloropropane	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
1,4-Dichlorobenzene	µg/L	1 U	1 U	1 U	1.0 U	**25**	**21**	**22**	NS[1]	**14**	**12**	**8.6**	**6.3**
2,2-Dichloropropane	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
2-Butanone (MEK)	µg/L	5 R	5 U	5 U	5.0 U	5 R	10 U	5 U	NS[1]	25 R	50 U	10 U	12 U
2-Chlorotoluene	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
2-Hexanone	µg/L	5 U	5 U	5 U	5.0 U	5 U	10 U	5 U	NS[1]	25 U	50 U	10 U	12 U
4-Chlorotoluene	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
4-Methyl-2-pentanone (MIBK)	µg/L	5 U	5 U	5 U	5.0 U	5 U	10 U	5 U	NS[1]	25 U	50 U	10 U	12 U
Acetone	µg/L	10 R	10 U	10 U	10 U	10 R	**15 J**	10 U	NS[1]	50 R	100 U	20 U	25 U
Benzene	µg/L	1 U	1 U	1 U	1.0 U	**0.43 J**	2 U	1 U	NS[1]	**2.4 J**	10 U	**1.4 J**	2.5 U
Bromobenzene	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
Bromochloromethane	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
Bromodichloromethane	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
Bromoform	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
Bromomethane	µg/L	2 UJ	2 U	2 U	2.0 U	2 U	4 U	2 U	NS[1]	10 U	20 U	4 U	5 U
Carbon disulfide	µg/L	1 U	1 U	1 U	1.0 U	**0.92 J**	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
Carbon tetrachloride	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
Chlorobenzene	µg/L	1 U	1 U	1 U	1.0 U	**1**	**0.75 J**	**0.83 J**	NS[1]	5 U	10 U	2 U	2.5 U
Chloroethane	µg/L	2 U	2 U	2 U	2.0 U	2 U	4 U	2 U	NS[1]	10 U	20 U	4 U	5 U
Chloroform	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
Chloromethane	µg/L	2 UJ	2 U	2 U	2.0 U	2 U	4 U	2 U	NS[1]	10 U	20 U	4 U	5 U
cis-1,2-Dichloroethene	µg/L	**3.7**	**2**	**1**	**1.3**	**4.6**	**1.6 J**	**1**	NS[1]	5 U	10 U	2 U	2.5 U
cis-1,3-Dichloropropene	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
Dibromochloromethane	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
Dibromomethane	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
Dichlorodifluoromethane	µg/L	2 U	2 U	2 U	2.0 U	2 U	4 U	2 U	NS[1]	10 U	20 U	4 U	5 U
Ethylbenzene	µg/L	**0.24 J**	1 U	1 U	1.0 U	**50**	**21**	**20**	NS[1]	**120**	**84**	**42**	**32**
Hexachlorobutadiene	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
Isopropylbenzene (Cumene)	µg/L	1 U	1 U	1 U	1.0 U	**4.7**	**2.3**	**1.9**	NS[1]	**13**	**7.7 J**	**4.2**	**3.1**
m/p-Xylene	µg/L	1 U	1 U	1 U	1.0 U	**16**	**6.5**	**8.3**	NS[1]	**220**	**200**	**76**	**43**
Methyl tert-butyl ether (MTBE)	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
Methylene chloride	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
N-Butylbenzene	µg/L	1 U	1 U	1 U	1.0 U	**3.8**	**1.6 J**	**1.1**	NS[1]	**9.2**	**7.9 J**	**3.6**	**2.1 J**
N-Propylbenzene	µg/L	1 U	1 U	1 U	1.0 U	**7.6**	**3.7**	**3**	NS[1]	**17**	**11**	**5.9**	**4.3**
Naphthalene	µg/L	**0.52 J**	1 U	1 U	1.0 U	**15**	**15**	**22**	NS[1]	**320**	**330**	**180**	**120**
o-Xylene	µg/L	**0.34 J**	1 U	1 U	1.0 U	**17**	**13**	**14**	NS[1]	**71**	**67**	**61**	**46**
p-Isopropyltoluene	µg/L	1 U	1 U	1 U	1.0 U	**4.3**	2 U	**0.82 J**	NS[1]	**10**	**7.4 J**	**8.7**	2.5 U
sec-Butylbenzene	µg/L	1 U	1 U	1 U	1.0 U	**4.9**	**1.7 J**	**1.5**	NS[1]	**7.8**	**5.8 J**	**3**	**2.3 J**
Styrene	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
tert-Butylbenzene	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
Tetrachloroethene (PCE)	µg/L	1 U	1 U	1 U	1.0 U	**0.4 J**	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
Toluene	µg/L	**1.6**	1 U	1 U	1.0 U	**16**	**8.9**	**11**	NS[1]	**64**	**47**	**49**	**41**
trans-1,2-Dichloroethene	µg/L	**0.54 J**	**0.34 J**	1 U	1.0 U	**0.64 J**	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
trans-1,3-Dichloropropene	µg/L	1 U	1 U	1 U	1.0 U	1 U	2 U	1 U	NS[1]	5 U	10 U	2 U	2.5 U
Trichloroethene (TCE)	µg/L	**34**	1 U	1 U	1.0 U	**76**	**0.81 J**	**3.8**	NS[1]	5 U	10 U	2 U	2.5 U
Trichlorofluoromethane	µg/L	2 U	2 U	2 U	2.0 U	2 U	4 U	2 U	NS[1]	10 U	20 U	4 U	5 U
Vinyl chloride	µg/L	**0.96 J**	1 U	1 U	1.0 U	1 U	**1.8 J**	1 U	NS[1]	**7.8**	**7.7 J**	2 U	**2.8**
Total Detected VOCs		**42.7**	**2.7**	**2.0**	**2.1**	**423.0**	**232.3**	**246.1**	NS[1]	**1045.2**	**931.5**	**530.4**	**351.5**

Explanation:

J - estimated value

NS[1] - not sampled because monitoring well could not be accessed due to golf course pond construction activities

R - rejected data

U - not detected at or above the stated reporting limit

UJ - not detected at or above the stated estimated reporting limit

µg/L - micrograms per liter

Table 10
Groundwater General Chemistry Analytical Results

Sample Event		**Baseline**	**Posttreat/MNA #1**	**Final**	**Baseline**	**Posttreat/MNA #1**		**MNA #2**	**MNA #3**	**Final**	
Sample Identification		818725-99	818725-210	818725-236	818725-96	818725-171	818725-172 (Dup)	818725-218	818725-223	818725-242	818725-243 (Dup)
Location Code		S5-MW-10	S5-MW-10	S5-MW-10	S5-MW-21	S5-MW-21	S5-MW-21	S5-MW-21	S5-MW-21	S5-MW-21	S5-MW-21
Date Sampled		05/22/02	04/25/03	07/08/03	05/20/02	03/26/03	03/26/03	04/30/03	06/05/03	07/09/03	07/09/03
	Unit										
ASTM D 2340B											
Hardness as CaCO3	mg/L	823	1080	1180 J	687	351	332	257	287	184 J	183 J
EPA 300											
Chloride	mg/L	1,930 J	2280	1470 J	780	459	507	260	414	731	745
Nitrate as Nitrogen (NO^3)	mg/L	0.5 G U	0.10 U	0.10 U	0.1 U	0.51	0.051 J	0.10 U	0.26 B G	0.10 U	0.10 U
Sulfate	mg/L	1 U	24.8	27.7	37.4	630	682	623	883	445	458
EPA 376											
Sulfide	mg/L	0.1 U	0.10 U	0.29	0.1 U	0.087 J	0.09 J	0.62	0.36	0.54	0.54
EPA 415											
Total Organic Carbon (TOC)	mg/L	60.8	68.1	75.4	118	748	756	1420	1780	434	446
RSKSOP-175M											
Ethane	mg/L	0.0091	0.034	0.031	0.002 U	0.0013 J	0.0013 J	0.0015 J	0.00070 J	0.0027	0.0031
Ethene	mg/L	9.3	13	7.7	6.5	0.039	0.039	0.14	0.18	1.3	1.3
Methane	mg/L	6 B	8.5 B	8.5	4.3 B	3	2.9	2.9	2.1	3.6	3.6

Sample Event		**Baseline**		**Posttreat/MNA #1**	**MNA #2**	**MNA #3**	**Final**	**Baseline**	**Posttreat/MNA #1**	**Final**
Sample Identification		818725-97	818725-98 (Dup)	818725-168	818725-219	818725-224	818725-241	818725-93	818725-207	818725-231
Location Code		S5-MW-30	S5-MW-30	S5-MW-30	S5-MW-30	S5-MW-30	S5-MW-30	S5-MW-36	S5-MW-36	S5-MW-36
Date Sampled		05/20/02	05/20/02	03/25/03	04/30/03	06/05/03	07/09/03	05/20/02	04/24/03	07/08/03
	Unit									
ASTM D 2340B										
Hardness as CaCO3	mg/L	1110	1100	109	213	325	626 J	527	970	799 J
EPA 300										
Chloride	mg/L	2,950	2,910	1,280	1340	1360	1490	297	401	406 J
Nitrate as Nitrogen (NO^3)	mg/L	2 G U	2 G U	0.1 U	0.053 B	0.50 G U	0.10 U	0.1 U	0.10 U	0.10 U
Sulfate	mg/L	369	289	773	585	623	501	299	638	504
EPA 376										
Sulfide	mg/L	0.1 U	0.1 U	0.1 U	0.10 U	0.10 U	0.10 U	0.1 U	0.10 U	0.10 U
EPA 415										
Total Organic Carbon (TOC)	mg/L	30	28.2	405	158	155	94.4	15.5	17.3	17.8
RSKSOP-175M										
Ethane	mg/L	0.012	0.012	0.031	0.050	0.037	0.037	0.002 U	0.0020 U	0.0020 U
Ethene	mg/L	9.8	19	0.3	1.8	5.0	3.7	0.002	0.0010 U	0.0010 U
Methane	mg/L	5.3 B	5.3 B	0.74	1.7	2.6	4.8	2.2 B	1.5 B	0.055

Sample Event		**Baseline**		**Posttreat/MNA #1**	**Final**
Sample Identification		818725-94	818725-95 (Dup)	818725-159	818725-232
Location Code		S5-MW-37	S5-MW-37	S5-MW-37	S5-MW-37
Date Sampled		05/20/02	05/20/02	03/24/03	07/08/03
	Unit				
ASTM D 2340B					
Hardness as CaCO3	mg/L	610	624	669	733 J
EPA 300					
Chloride	mg/L	780	795	312	384 J
Nitrate as Nitrogen (NO^3)	mg/L	0.1 U	0.1 U	0.45 J	0.10 U
Sulfate	mg/L	339	351	91.7 J	289
EPA 376					
Sulfide	mg/L	0.1 U	0.1 U	23.8	12.4
EPA 415					
Total Organic Carbon (TOC)	mg/L	22.1	21.8	68.2	162
RSKSOP-175M					
Ethane	mg/L	0.062	0.065	0.00067 J	0.0020 U
Ethene	mg/L	0.019	0.019	0.00093 J	0.00060 J
Methane	mg/L	6.9 B	7.4 B	6.2	8.9

Explanation:

B - analyte was also detected in the associated blank
EPA - U.S. Environmental Protection Agency
G - reporting limit is elevated due to matrix interference
J - estimated value
mg/L - milligrams per liter
MNA - monitoring natural attenuation sampling
U - not detected at or above the stated reporting limit

Table 11
Pretreatment and Posttreatment Soil Analytical Results

Sample Identification		818725-109	818725-110 (Dup)	818725-174	818725-111	818725-178	818725-112	818725-179	818725-113	818725-180	818725-108	818725-181	818725-105	818725-175	818725-107	818725-176	818725-177 (Dup)	818725-106	818725-182
Location Code		S5-B-01B	S5-B-01B	S5-B-01P	S5-B-02B	S5-B-02P	S5-B-02B	S5-B-02P	S5-B-02B	S5-B-02P	S5-B-03B	S5-B-03P	S5-B-04B	S5-B-04P	S5-B-05B	S5-B-05P	S5-B-05P	S5-B-06B	S5-B-06P
Date Sampled		06/27/02	06/27/02	03/27/03	06/27/02	03/27/03	06/27/02	03/27/03	06/27/02	03/27/03	06/27/02	03/27/03	06/27/02	03/27/03	06/27/02	03/27/03	03/27/03	06/27/02	03/27/03
Depth (feet below ground surface)		7.5	7.7	7.5	4.4	4.4	7.5	7.5	11.6	11.5	7.7	7.7	7.5	7.5	7.5	7.5	7.5	7.5	7.5
	Unit																		
D2216																			
Percent Moisture	Percent	24.4	22.3	21.3	8.7	20.8	28.3	22.9	25	33.3	25.7	25.4	25.3	24.7	24.6	25.5	25.5	46.4	27.4
Soil Type		Sand	Sand	Sand	Sand	Sand	Sand w/silt	Sand w/silt	Fat clay	Flat clay	Sand	Sand	Fat clay	Fat clay	Sand	Sand	Sand	Fat clay	Fat clay
SW8260B																			
1,1,1,2-Tetrachloroethane	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
1,1,1-Trichloroethane	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
1,1,2,2-Tetrachloroethane	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
1,1,2-Trichloro-1,2,2-trifluoroethane	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
1,1,2-Trichloroethane	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
1,1-Dichloroethane	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
1,1-Dichloroethene	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
1,1-Dichloropropene	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
1,2,3-Trichlorobenzene	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
1,2,3-Trichloropropane	mg/kg	2.5 U	2.6 U	**22**	**70**	**51**	**4.4**	**110**	**0.0094**	**1.4**	0.32 U	**0.71**	1.6 U	3.1 U	0.0063 U	**1.3 J**	**2**	0.59 UJ	0.35 U
1,2,4-Trichlorobenzene	mg/kg	**0.98 J**	**0.82 J**	**0.83 J**	**1.2 J**	**1.6**	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
1,2,4-Trimethylbenzene	mg/kg	**93**	**80**	**80**	**9.3**	0.78 U	**1.7 J**	**110**	**0.0081**	**0.26 J**	0.32 U	**0.46 J**	**1.8**	**140**	0.0063 U	**0.58 J**	**2.6**	**1.5 J**	**0.61**
1,2-Dibromo-3-chloropropane (DBCP)	mg/kg	5 U	5.1 U	2.6 U	2.7 U	1.6 U	6.6 U	48 U	0.012 U	0.79 U	0.64 U	1.4 U	3.2 U	6.2 U	0.013 U	3.1 U	1.4 U	1.2 UJ	0.7 U
1,2-Dibromoethane (EDB)	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
1,2-Dichlorobenzene	mg/kg	**26**	**23**	**20**	**12**	**6.6**	3.3 U	**32**	0.0059 U	**0.3 J**	0.32 U	0.68 U	**0.82 J**	**12**	**0.018**	1.6 U	**0.78**	**0.85 J**	0.35 U
1,2-Dichloroethane	mg/kg	2.5 U	2.6 U	1.3 U	**0.8 J**	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	**0.47 J**	**0.32 J**	0.59 UJ	0.35 U
1,2-Dichloropropane	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
1,3,5-Trimethylbenzene	mg/kg	**29**	**25**	**25**	**10**	0.78 U	3.3 U	**34**	**0.0034 J**	0.4 U	0.32 U	0.68 U	1.6 U	**50**	0.0063 U	1.6 U	**0.77**	**0.44 J**	**0.29** J
1,3-Dichlorobenzene	mg/kg	2.5 U	2.6 U	1.3 U	**0.43 J**	**0.55 J**	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
1,3-Dichloropropane	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
1,4-Dichlorobenzene	mg/kg	**5.9**	**5.3**	**5.1**	**5.4**	**4.8**	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	**3.4**	**0.0029 J**	1.6 U	0.72 U	0.59 UJ	0.35 U
2,2-Dichloropropane	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
2-Butanone (MEK)	mg/kg	12 R	13 R	6.6 U	6.7 R	3.9 U	16 R	120 U	0.03 R	2 U	1.6 R	3.4 U	8 R	15 U	0.032 R	7.8 U	3.6 U	2.9 R	1.7 U
2-Chlorotoluene	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
2-Hexanone	mg/kg	12 U	13 U	6.6 U	6.7 U	3.9 U	16 U	120 U	0.03 U	2 U	1.6 U	3.4 U	8 U	15 U	0.032 U	7.8 U	3.6 U	2.9 UJ	1.7 U
4-Chlorotoluene	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
4-Methyl-2-pentanone (MIBK)	mg/kg	12 U	13 U	6.6 U	6.7 U	3.9 U	16 U	120 U	0.03 U	2 U	1.6 U	3.4 U	8 U	15 U	0.032 U	7.8 U	3.6 U	2.9 UJ	1.7 U
Acetone	mg/kg	12 U	**4.6 J**	6.6 U	6.7 U	**1.8 J**	16 U	120 U	**0.036**	**6.4**	1.6 U	3.4 U	8 U	15 U	**0.034**	7.8 U	**2.4 J**	2.9 UJ	1.7 U
Benzene	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	**0.0042 J**	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	**0.007**	1.6 U	0.72 U	0.59 UJ	0.35 U
Bromobenzene	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
Bromochloromethane	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
Bromodichloromethane	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
Bromoform	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
Bromomethane	mg/kg	5 R	5.1 R	2.6 U	2.7 R	1.6 U	6.6 R	48 U	0.012 U	0.79 U	0.64 R	1.4 U	3.2 R	6.2 U	0.013 U	3.1 U	1.4 U	1.2 R	0.7 U
Carbon disulfide	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	**0.0053 J**	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
Carbon tetrachloride	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
Chlorobenzene	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
Chloroethane	mg/kg	5 U	5.1 U	2.6 U	2.7 U	1.6 U	6.6 U	48 U	0.012 U	0.79 U	0.64 U	1.4 U	3.2 U	6.2 U	0.013 U	3.1 U	1.4 U	1.2 UJ	0.7 U
Chloroform	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
Chloromethane	mg/kg	5 U	5.1 U	2.6 U	2.7 U	1.6 U	6.6 U	48 U	0.012 U	0.79 U	0.64 U	1.4 U	3.2 U	6.2 U	0.013 U	3.1 U	1.4 U	1.2 UJ	0.7 U
cis-1,2-Dichloroethene	mg/kg	2.5 U	2.6 U	**1 J**	**60**	0.78 U	**150**	**1500**	**0.058**	**0.38 J**	0.32 U	**37**	**110**	**220**	**0.0043 J**	**74**	**50**	**29 J**	0.35 U
cis-1,3-Dichloropropene	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
Dibromochloromethane	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
Dibromomethane	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
Dichlorodifluoromethane	mg/kg	5 U	5.1 U	2.6 U	2.7 U	1.6 U	6.6 U	48 U	0.012 U	0.79 U	0.64 U	1.4 U	3.2 U	6.2 U	0.013 U	3.1 U	1.4 U	1.2 UJ	0.7 U
Ethylbenzene	mg/kg	**18**	**15**	**11**	**1.5**	0.78 U	3.3 U	**22 J**	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	**16**	**0.0098**	1.6 U	0.72 U	**0.38 J**	**0.32 J**
Hexachlorobutadiene	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
Isopropylbenzene (Cumene)	mg/kg	**4**	**3.3**	**3.4**	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	**7.3**	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
Methyl tert-butyl ether (MTBE)	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
Methylene chloride	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
N-Butylbenzene	mg/kg	**20**	**15**	**18**	1.3 U	0.78 U	3.3 U	**18 J**	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	**26**	0.0063 U	1.6 U	**0.56 J**	0.59 UJ	**0.25 J**
N-Propylbenzene	mg/kg	**10**	**9**	**9.3**	**0.86 J**	0.78 U	3.3 U	**14 J**	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	**19**	0.0063 U	1.6 U	0.72 U	0.59 UJ	**0.16 J**
Naphthalene	mg/kg	**81**	**71**	**72**	**6.1**	0.78 U	**1.5 J**	**72**	**0.0029 J**	0.4 U	**0.16 J**	**6.1**	**1.8**	**140**	**0.003 J**	**1.2 J**	**3.3**	**1.3 J**	**0.36**
p-Isopropyltoluene	mg/kg	2.5 U	2.6 U	**20**	**7.4**	0.78 U	3.3 U	**22 J**	0.0059 U	0.4 U	0.32 U	0.68 U	**2.8**	**31**	0.0063 U	**2.4**	**2.5**	**3.9 J**	**0.46**
sec-Butylbenzene	mg/kg	**8**	**6.5**	**8.1**	**0.72 J**	0.78 U	3.3 U	**9.9 J**	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	**14**	0.0063 U	1.6 U	**0.25 J**	0.59 UJ	**0.1 J**
Styrene	mg/kg	5 U	5.1 U	2.6 U	2.7 U	1.6 U	6.6 U	48 U	0.012 U	0.79 U	0.64 U	1.4 U	3.2 U	6.2 U	0.013 U	3.1 U	1.4 U	1.2 UJ	0.7 U
tert-Butylbenzene	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 UJ	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 UJ	1.6 U	0.72 U	0.59 UJ	0.35 U
Tetrachloroethene (PCE)	mg/kg	2.5 U	2.6 U	**0.5 J**	**5.1**	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
Toluene	mg/kg	**110**	**94**	**33**	**5.2**	0.78 U	**2.7 J**	**120**	**0.0095**	**0.26 J**	**0.2 J**	**0.85**	**3.9**	**55**	**0.0075**	**1.9**	**1.5**	**3.5 J**	**0.53**
trans-1,2-Dichloroethene	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	**13 J**	0.0059 U	0.4 U	0.32 U	0.68 U	**0.89 J**	**2.6 J**	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
trans-1,3-Dichloropropene	mg/kg	2.5 U	2.6 U	1.3 U	1.3 U	0.78 U	3.3 U	24 U	0.0059 U	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
Trichloroethene (TCE)	mg/kg	2.5 U	2.6 U	1.3 U	**8.9**	0.78 U	**13**	**800**	**0.015**	0.4 U	0.32 U	0.68 U	1.6 U	3.1 U	0.0063 U	1.6 U	0.72 U	0.59 UJ	0.35 U
Trichlorofluoromethane	mg/kg	5 U	5.1 U	2.6 U	2.7 U	1.6 U	6.6 U	48 U	0.012 U	0.79 U	0.64 U	1.4 U	3.2 U	6.2 U	0.013 U	3.1 U	1.4 U	1.2 UJ	0.7 U
Vinyl chloride	mg/kg	5 U	5.1 U	2.6 U	2.7 U	1.6 U	6.6 U	48 U	**0.035**	0.79 U	**4.5**	**4.5**	**8.8**	**8.7**	**0.29**	**9.6**	**7**	**3.5 J**	0.7 U
Xylenes (total)	mg/kg	**100**	**81**	**56**	**8**	**1.56**	3.3 U	**119**	**0.0042 J**	**0.8**	0.32 U	**1.36**	**1.3 J**	**96**	**0.025**	**3.2**	**1.59 J**	**2.3 J**	**0.93**
Total Detected VOCs		**505.9**	**433.5**	**385.2**	**212.9**	**67.9**	**173.3**	**2,995.9**	**0.2**	**9.8**	**4.9**	**51.0**	**132.1**	**841.0**	**0.4**	**94.7**	**75.6**	**46.7**	**4.0**

***Explanation*:**
J - estimated value
mg/kg - milligrams per kilogram
R - rejected data
U - not detected at or above the stated reporting limit

Table 12
Groundwater VOC Analytical Results for Perimeter Monitoring Wells

Sample Event		**Posttreatment**	**Posttreatment**	**Posttreatment**	**Posttreatment**	**Posttreatment**	**Posttreatment**	**Posttreatment**	**Posttreatment**	**Posttreatment**	**Posttreatment**	**Posttreatment**
Sample Identification		818725-215	818725-200	818725-197	818725-199	818725-202	818725-217	818725-209	818725-206	818725-211	818725-216	818725-212
Location Code		S5-MW-11	S5-MW-12	S5-MW-13	S5-MW-14	S5-MW-15	S5-MW-16	S5-MW-17	S5-MW-18	S5-MW-19	S5-MW-22	S5-MW-23
Date Sampled		04/25/03	04/23/03	04/23/03	04/23/03	04/24/03	04/25/03	04/25/03	04/24/03	04/25/03	04/25/03	04/25/03
	Unit											
SW8260B												
1,1,1,2-Tetrachloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloropropene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-Trichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-Trichloropropane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trimethylbenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane (DBCP)	µg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dibromoethane (EDB)	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**0.42 J**	1 U	1 U	1 U
1,2-Dichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**0.97 J**	1 U	1 U	1 U
1,3,5-Trimethylbenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichloropropane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2,2-Dichloropropane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Chlorotoluene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Hexanone	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Chlorotoluene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone (MIBK)	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromochloromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**1**
Bromoform	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	µg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Carbon disulfide	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	**0.51 J**	1 U	1 U	1 U	**0.75 J**
Carbon tetrachloride	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	µg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Chloroform	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**1.4**
Chloromethane	µg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
cis-1,2-Dichloroethene	µg/L	1 U	**4.7**	1 U	1 U	**0.84 J**	1 U	**4.8**	**0.39 J**	1 U	1 U	1 U
cis-1,3-Dichloropropene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromomethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	µg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Ethylbenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Hexachlorobutadiene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene (Cumene)	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m/p-Xylene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl ether (MTBE)	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene chloride	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
N-Butylbenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
N-Propylbenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Naphthalene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
p-Isopropyltoluene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
sec-Butylbenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Butylbenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene (PCE)	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene (TCE)	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	µg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vinyl chloride	µg/L	1 U	**0.67 J**	1 U	1 U	1 U	1 U	**2.6**	1 U	1 U	1 U	1 U
Total Detected VOCs		ND	**5.37**	ND	ND	**0.84**	ND	**7.91**	**1.78**	ND	ND	**3.15**

***Explanation*:**
J - estimated value
ND - not detected at or above laboratory detection limits
U - not detected at or above the stated reporting limit
µg/L - micrograms per liter

Table 13
Groundwater Water Quality Objectives

SW8260B List of Analytes	WQOs (m g/L)
1,1,1,2-Tetrachloroethane	-
1,1,1-Trichloroethane	540,000
1,1,2,2-Tetrachloroethane	1,200
1,1,2-Trichloro-1,2,2-trifluoroethane	-
1,1,2-Trichloroethane	43,000
1,1-Dichloroethane	7,100
1,1-Dichloroethene	-
1,1-Dichloropropene	-
1,2,3-Trichlorobenzene	-
1,2,3-Trichloropropane	-
1,2,4-Trichlorobenzene	160**
1,2,4-Trimethylbenzene	-
1,2-Dibromo-3-chloropropane	-
1,2-Dibromoethane (EDB)	-
1,2-Dichlorobenzene	5,100
1,2-Dichloroethane	130
1,2-Dichloropropane	10,300**
1,3,5-Trimethylbenzene	-
1,3-Dichlorobenzene	5,100
1,3-Dichloropropane	-
1,4-Dichlorobenzene	18
2,2-Dichloropropane	-
2-Butanone (MEK)	-
2-Chlorotoluene	-
2-Hexanone	-
4-Chlorotoluene	-
4-Methyl-2-pentanone (MIBK)	-
Acetone	-
Benzene	400*
Bromobenzene	-
Bromochloromethane	12,000**
Bromodichloromethane	130
Bromoform	130
Bromomethane	130
Carbon disulfide	-
Carbon tetrachloride	0.90
Chlorobenzene	570
Chloroethane	-
Chloroform	130
Chloromethane	130
cis-1,2-Dichloroethene	224,000**
cis-1,3-Dichloropropene	-
Dibromochloromethane	130
Dibromomethane	-
Dichlorodifluoromethane	12,000**
Ethylbenzene	430*
Hexachlorobutadiene	14
Isopropylbenzene (Cumene)	-
m/p-Xylene	-
Methyl tert-butyl ether (MTBE)	-
Methylene chloride	450
N-Butylbenzene	-
N-Propylbenzene	-
Naphthalene	2,350*
o-Xylene	-
p-Isopropyltoluene	-
sec-Butylbenzene	-
Styrene	-
tert-Butylbenzene	-
Tetrachloroethene (PCE)	99
Toluene	3,700*
trans-1,2-Dichloroethene	224,000**
trans-1,3-Dichloropropene	-
Trichloroethene (TCE)	27
Trichlorofluoromethane	12,000**
Vinyl chloride	36
Xylenes (total)	10,000*

Notes:

1. WQO are California Ocean Plan (RWQCB, 2000) Numberical Water Quality Objectives - Human Health (30-day Average) aquatic organism consumption only values unless otherwise noted.

Explanation:

* California Regional Water Quality Control Board interim cleanup goals (1996) for sites located within 1,000 feet of a marine surface water.

** United States Environmental Protection Agency National Recommended Ambient Water Quality Criteria for Saltwater Aquatic Life Protection values for Acute Toxicity (RWQCB, 2000).

WQO - water quality objective

\- WQO not provided

Table 14
Project Objectives Assessment

	Project Objective	Was Objective Achieved?	Comments
1	Remove a sufficient volume of VOCs from the soil and groundwater at the site such that MNA coupled with long term monitoring will be sufficient to document that potential receptors will not be adversely affected.	Majority Achieved, with Final Outcome Pending Further Testing	• The TCRA was intended as an interim measure for the protection of human health and the environment and to expedite site cleanup. • A significant effort was put forth to reduce site contaminant mass. Site contaminant mass removal included pilot study testing (76 pounds), vadose zone source removal (3,050 pounds), and ISCO groundwater treatment (875 pounds). The total estimated VOC mass removed from the site as a result of TCRA activities is approximately 4,000 pounds or 2 tons. • The site contaminant plume has reduced in size as a result of ISCO. • VOC contaminant concentrations in the source area monitoring well (S5-MW-21) has rebounded to above pretreatment concentrations. • MNA assessment data, including microbial assessment and an evaluation of natural attenuation parameters, indicate that site is returning to pretreatment conditions and that ISCO has not negatively impacted the elevated natural degradation ability of the site. • Estimates of the remaining time required to achieve site WQOs cannot be calculated until site groundwater VOC concentrations have stabilized.
2	Feasibility assessment of ISCO	Yes	• Feasibility assessment of ISCO (including a pilot study bench testing, a pilot study, and full-scale bench testing of Fenton's reagent and $KMnO_4$) showed that ISCO is a viable option for the site.

Table 14 (Continued)
Project Objectives Assessment

	Project Objective	Was Objective Achieved?	Comments
3	Remove vadose source area(s)	Yes	• Vadose zone source removal included the excavation of the primary site contaminant source (former eastern liquid waste disposal pit) and exploratory trenching and removal of four potential secondary sources associated with buried metallic objects.
4	Remove vadose zone soil with TCE concentration greater than 10 mg/kg	Majority Achieved	• The former eastern liquid waste disposal pit and associated soil with elevated concentrations of TCE were excavated and disposed of off site. • Periphery TCE impacted soil at concentrations greater than 10 mg/kg was left in place to permit the excavation of highly impacted low permeability soil found beneath the former eastern liquid waste disposal pit.
5	Vadose zone soil contaminant delineation	Majority Achieved	• The former eastern liquid waste disposal pit source, which caused site groundwater contamination was fully delineated and assessed. • Exploratory trenching identified that 4 of 34 identified electromagnetic anomalies contained material related to hydrocarbon waste. • Vadose zone soil of the former western liquid waste disposal pit has not been assessed.

Table 14 (Continued)
Project Objectives Assessment

	Project Objective	Was Objective Achieved?	Comments
6	Aquifer contaminant delineation	Majority Achieved	• The site VOC plume nature and extent has been determined. • The majority of the remaining VOC contaminant mass in groundwater at the site is cis-1,2-dichloroethene and vinyl chloride. • Vinyl chloride is the only detected relevant contaminant that is greater than site VOC WQOs. • The presence of polychlorinated biphenyls, semivolatile organic compounds, and metals in excavated source area soil suggests that these contaminants may be present in site groundwater. • Site contaminant groundwater contours show that two secondary groundwater VOC plumes may be located within the main site contaminant groundwater plume. Secondary plumes, with contaminant concentrations at insignificant levels relative to the main plume, are associated with the suspected location of the former western liquid waste disposal pit and electromagnetic Anomalies X and Y.
7	Closure of ISCO treatment apparatus	Majority Achieved	• All injection wells installed at the site were abandoned with the exception of S5-VIW-01 and S5-HIW-01 through S5-HIW-03. These wells require abandonment for complete closure of the treatment apparatus. • Horizontal wells were cut off below surface, capped, and surface completions removed for pedestrian safety and to protect the well casings.

Table 14 (Continued)
Project Objectives Assessment

	Project Objective	Was Objective Achieved?	Comments
8	Site microbial population assessment	Yes	• The assessment of the site microbial community indicates that it is moderately diverse, it consists mainly of gram-negative bacteria that have the ability to use a wide range of carbon sources, and it can adapt quickly to changing environmental conditions. • The microbe community includes DHE (the only documented microorganisms possessing necessary enzymes for the complete dechlorination of toxic chlorinated hydrocarbons into harmless ethene) at relatively high levels. • Monitoring results confirmed that DHE were only temporarily impacted as a result of ISCO. • Microbe activity appears to have been stimulated by $KMnO_4$ ISCO (through desorption of adsorbed VOCs and partial oxidation of some fraction of total organic carbon), which likely resulted in increased contaminant reduction.
9	TCRA site closeout report	Yes	• Relevant data have been provided in this report.

Explanation:

DHE - *Dehalococcoides ethenogenes*
ISCO - in situ chemical oxidation
mg/kg - milligrams per kilogram
MNA - monitored natural attenuation
KMnO4 - potassium permanganate
TCRA - time-critical removal action
TCE - trichloroethene
VOCs - volatile organic compounds
WQOs - water quality objectives

Appendix A
Geophysical Reports

(1) Geophysical Survey to Locate Utilities (April 24, 2000)
(2) Geophysical Survey to Locate Utilities (February 20, 2001)
(3) Geophysical Survey to Locate Secondary Sources (June 5, 2002)

A-1

Geophysical Survey to Locate Utilities (April 24, 2000)

Sub Surface Surveys
215 So. Highway 101, Suite 203 P.O. Box 1152 Solana Beach, CA 92075
Telephone: (858) 481-8949 Facsimile: (858) 481-8998 E mail: geop@subsurfacesurveys.com

April 24, 2000

OHM Remediation Services
Naval Air Station North Island
100 yards west of Bldg. 710
San Diego, CA 92135

Project Number: 00-091

Attn: **Judy Shiple**

Re: **Geophysical Investigation at the Naval Air Station North Island, Coronado, CA.**

This brief letter report is to present the findings of our geophysical surveys conducted at the North Island Naval Air Station former disposal pit sites at the south corner of Rodgers Road and Sherman Road in Coronado, California (Fig. 1) on April 5, 2000. Purpose of the surveys was to locate and identify, insofar as possible, two former disposal pits, piping, conduit, and other buried features that may exist on the site with particular emphasis in the immediate vicinity of proposed drill sites. A combination of ground penetrating radar, (GPR), magnetometer, magnetic gradiometer, and electromagnetic induction, (EM) were applied to the search.

Multiple methods were utilized because each instrument senses different material properties of the ground and buried objects. At any given site, the situation, geologic and cultural, may be such that one or two of the instruments may record excessive "noise", the ground may not provide sufficient contrasts with installations or discards, or there may be overlapping anomalies, and those instruments may not be definitive. Generally, however, the interpretation is based on the best reconciliation of the several data sets acquired.

Survey Design - The area to be searched was predetermined by the client and included a 280 foot section of Sherman Road and the adjacent grass lot just north of the flight line (Figs. 2 and 3). One formal rectilinear grid measuring 160X280 feet was established to guide data acquisition over the site. Enough of the grid is painted on the ground for recovery, if needs be, in follow up work. EM61 and EM31 data was collected at stations every 5 feet along southeast-to-northwest oriented survey lines spaced five feet apart and monitored continuously. The magnetic gradiometer and M-scope were traversed along the same survey lines and monitored continuously. Radar traverses were also referenced to these grids. GPR traversing was conducted every ten feet over the survey grid and in two orthogonal directions for detailing and confirmation when anomalous conditions were found.

Sub
Surface
Surveys

SITE LOCATION MAP

FIGURE 1

Sub Surface Surveys

SITE MAP

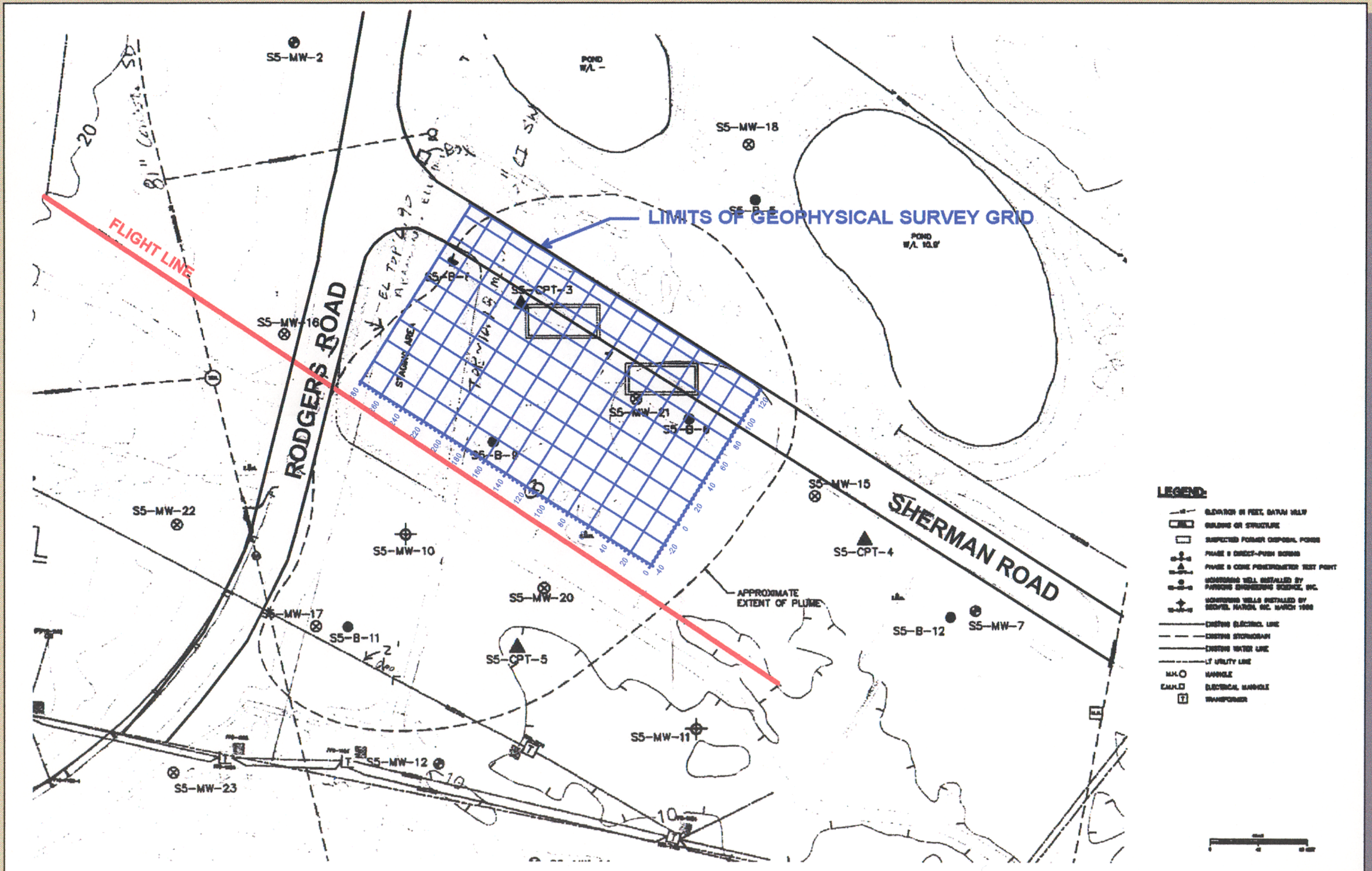


FIGURE 2

SITE PHOTOGRAPHS

FIGURE 3

Additionally, A total of 10 proposed boring locations were investigated with the geophysical instrumentation. To the extent that access permitted, the planned boring locations were to be cleared by traversing with geophysical instruments along the eight lines of the standard search pattern (Fig. A), wherein, there are two sets of three parallel lines, mutually orthogonal, and two diagonals, all centered on and extending in a 40 foot radius around the central drill location. Other traverses were taken, access permitting, for detailing and confirmation where anomalous conditions were found.

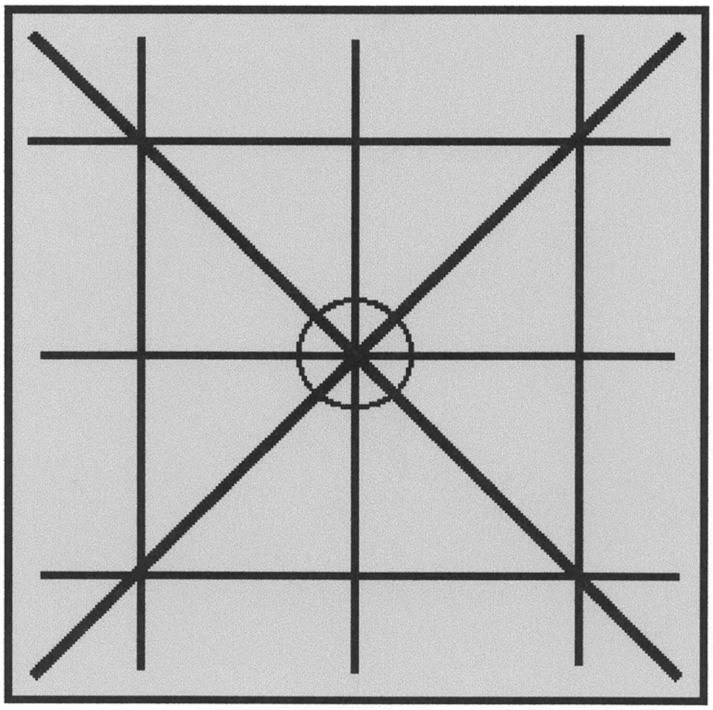


Figure A: Standard search pattern around borehole

Hard copy of the Mscope and magnetic gradient data was not acquired, that is, discrete readings on the nodes of a grid were not recorded. Rather, the instrument's meter was monitored continuously during traverses to detect excursions of the readouts that might have meaning in terms of buried objects. The lack of hard copy for these data sets does not degrade the quality of the survey in any way. The GPR output, of course, is in hard copy form, and position and direction of traverses were noted on the records as they were produced.

Geonics models EM-31 and EM-61 instruments were used for the EM sampling. A Sensors & Software Noggin Ground Penetrating Radar unit produced the radar images, the magnetic gradiometer was a Schonstedt, model GA-52C, and the line tracer used was a Metrotech 9860.

<u>Brief Description of the Geophysical Methods Applied</u> - The EM-31 and M-scope TW-6 devices

energize the ground by producing an alternating primary magnetic field with ac current in the transmitting coil. If conducting materials are within the area of influence of the primary field, ac eddy currents are induced to flow in the conductors. A receiving coil senses the secondary magnetic field produced by these eddy currents, and outputs the response to a meter in the form of ground conductivity values in the case of the EM-31. The strength of the secondary field is a function of the conductivity of the object; say a pipe, tank or cluster of drums, its size, and its depth and position relative to the instrument's two coils. Conductive objects, to a depth of approximately 18 feet for the EM31 and 10 feet for the M-scope, are sensed. Also the devices are somewhat focused, that is, they are more sensitive to conductors below (and above) the instrument, than to conductors off to the side.

The EM-61 instrument is a high resolution, time-domain device for detecting buried conductive objects. It consists of a powerful transmitter that generates a pulsed primary magnetic field when its coils are energized, which induces eddy currents in nearby conductive objects. The decay of the eddy currents, following the input pulse, is measured by the coils, which in turn serve as receiver coils. The decay rate is measured for two coils, mounted concentrically, one above the other. By making the measurements at a relatively long time interval (measured in milliseconds) after termination of the primary pulse, the response is nearly independent of the electrical conductivity of the ground. Thus, the instrument is a super-sensitive metal detector. Due to its unique coil arrangement, the response curve is a single well-defined positive peak directly over a buried conductive object. This facilitates quick and accurate location of targets. Conductive objects, to a depth of approximately 11 feet can be detected.

The magnetic gradiometer has two fluxgate magnetic fixed sensors that are passed closely to and over the ground. When not in close proximity to a magnetic object, that is, only in the earth's field, the instrument emits a sound signal at a low frequency. When the instrument passes over a buried iron or steel object, so that the field is significantly different at the two sensors, and locally magnetic gradient, the frequency of the emitted sound increases. Frequency is a function of the gradient between the two sensors.

Where risers are present, the utility locator transmitter can be connected to the object, and a current with a sharp frequency, 82 kHz in this instance, is impressed on the conductor, pipe conduit, etc. The receiver unit is tuned to this same frequency, and it is used to trace the pipe's surface projection away from the riser.

The GPR instrument beams energy into the ground from its transducer/antenna, in the form of electromagnetic waves. A portion of this energy is reflected back to the antenna at any boundary in the subsurface across which there is an electrical contrast. The recorder continuously makes a record of the reflected energy as the antenna is traversed across the ground surface. The greater the electrical contrast, the higher the amplitude of the returned energy. The EM wave travels at a velocity unique to the material properties of the ground being investigated, and when these velocities are known, or closely estimated from ground conductivity values and other information, two-way travel times can be converted to depth.

Penetration into the ground and resolution of the GPR images produced are a function of ground electrical conductivity and dielectric constant. Images tend to be graphic, even at considerable depth, in sandy soils, but penetration and resolution may be limited in drastically more conductive clayey moist ground.

Interpretation - The interpretation took place in real time as the survey progressed, and accordingly, the findings of our investigation were marked on the ground, reported to the client's representative at the completion of the field survey, and detailed on an Interpretation Map (Fig. 4). The EM61 and EM31 data were transferred to a computer in the field and are presented in contoured map format in figures 5 and 6. The intent of this document is to demonstrate the procedure, and report the findings of the work.

EM61 data collected at the site indicates a number of anomalies, which represent buried metallic material centered at [(X -5,Y 100), (X 40,Y 0 to 75), and (X 120,Y 40)]. Of these anomalies, the two centered at (X 40,Y 0 to 75), and (X 120,Y 40), appear to be the effect of abandoned pipes or utilities. The anomaly centered at (X -5,Y 100) appears to be the effect of buried metallic debris and corresponds to a topographic high (a berm of beach sand) and one sinkhole.

EM31 data collected at the site indicates one anomalous zone extending from the southeast end of the grid and tapering of at (Y 140). This anomalous region represents an area of higher soil conductivity, which may be the effect of buried metallic debris, soil contaminants, and seawater. The northwest end of the grid appears to be much less conductive and has one large linear anomaly, which represents an electric line transecting the grid.

Each of the geophysical instruments utilized were effective at detecting and delineating structures/objects constructed of metallic materials. GPR was useful in that it is the only instrument applied that is capable of producing high definition/resolution profile images of the shallow subsurface. According to theory, radar penetration is a function of soil conductivity and dielectric constant. At this site local conditions were reasonably favorable due to the sandy beach sediment type soil. Resulting in radar penetration down to between 4 and 5 feet.

Radar traverses for the area appear to have produced images, which suggest one backfilled excavation type image associated with the EM61 anomaly at (X -5,Y 100) (Figs. 7 and 8). Additionally, the electric line transecting the site was imaged, and appears to be at a depth of approximately one foot (Fig. 9).

In searching the area, utilities and anomalies detected were marked on the ground surface with paint and pin flags. Figures 10, 11, and 12 are presented to illustrate the EM61, EM31, and ground penetrating radar in use at the site.

Conclusions - Geophysical data acquired over the site appears to indicate a number of anomalies located in the southeastern half of the grid and one electric line crossing the northwestern half of the grid. EM61 data indicates a number of anomalies, two apparently associated with abandoned pipes or utilities, and one that appears to be some buried metallic debris at (X -5,Y 100) that has a corresponding topographic high and radar anomaly. EM31 data indicates a conductivity increase in the southeastern half of the grid possibly caused by buried metallic debris, conductive contaminants or the effect of seawater.

Sub Surface Surveys

SITE INTERPRETATION MAP

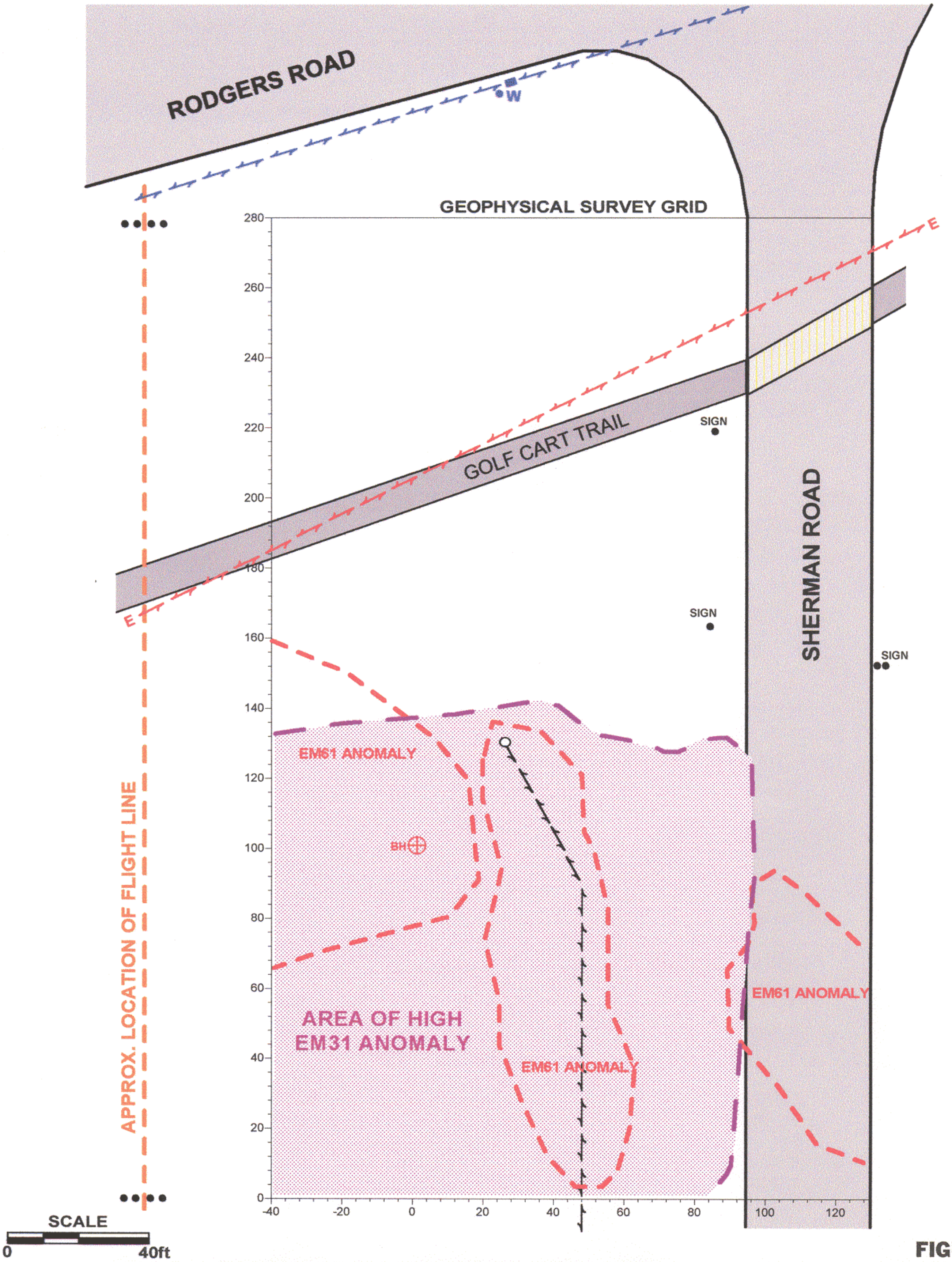


FIGURE 4

Sub Surface Surveys

EM61 DATA MAP

CI = 50mVolts

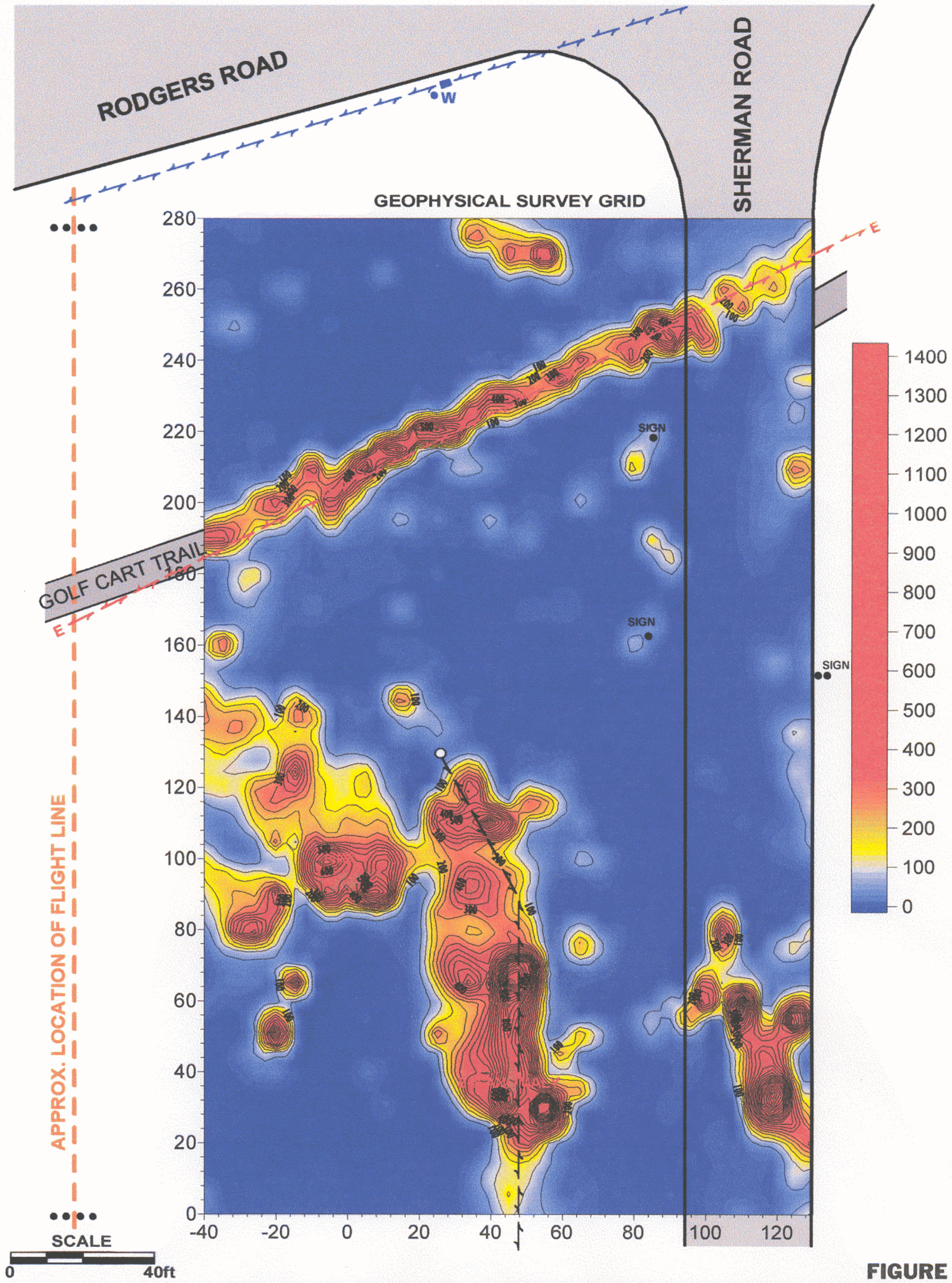


FIGURE 5

Sub Surface Surveys

EM31 DATA MAP

CI = 10mMohs/m

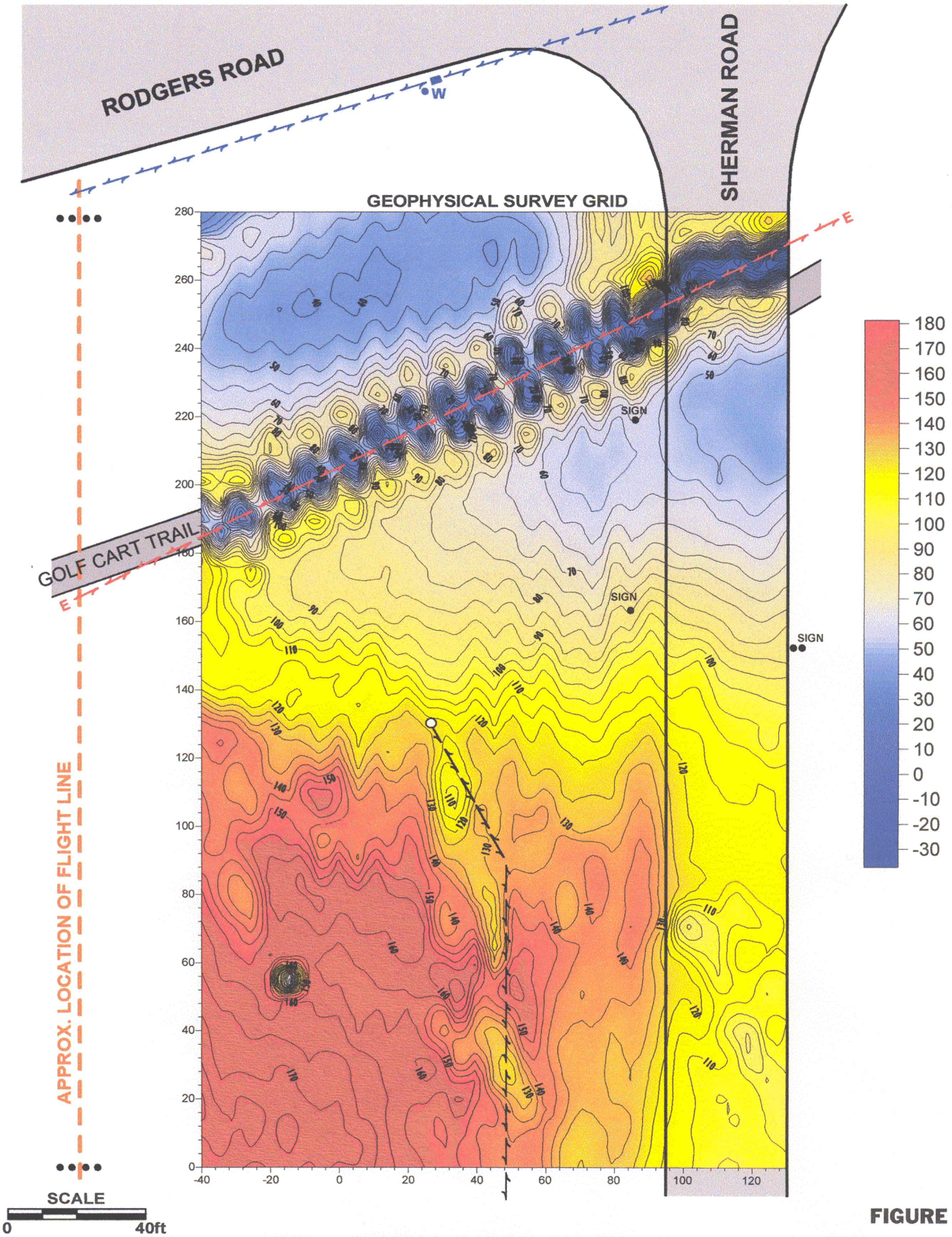


FIGURE 6

Sub
Surface
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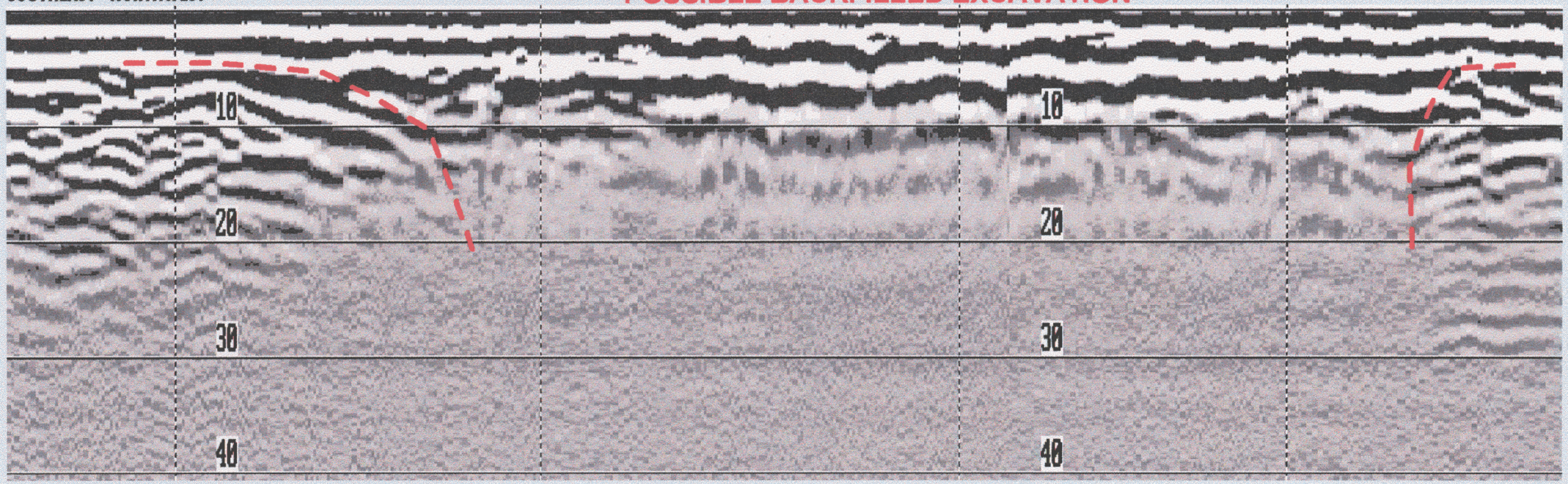
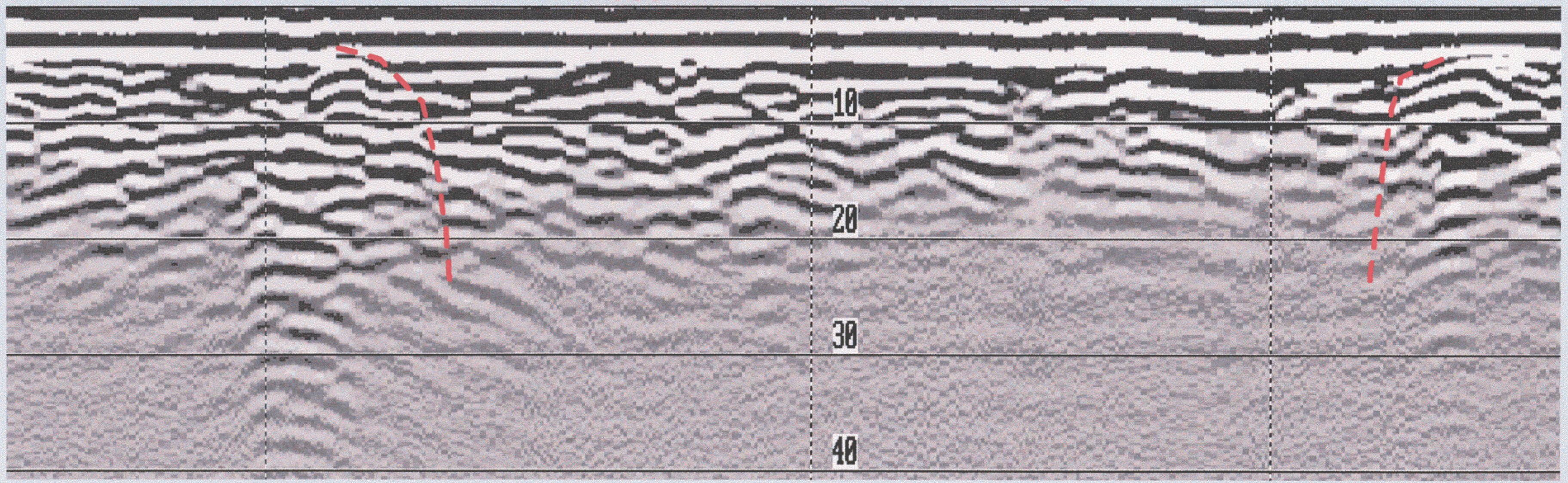
RADAR RECORDS



SOUTHEAST - NORTHWEST

POSSIBLE BACKFILLED EXCAVATION

FIGURE 7



SOUTHEAST - NORTHWEST

POSSIBLE BACKFILLED EXCAVATION

FIGURE 8

RADAR INTERPRETATION

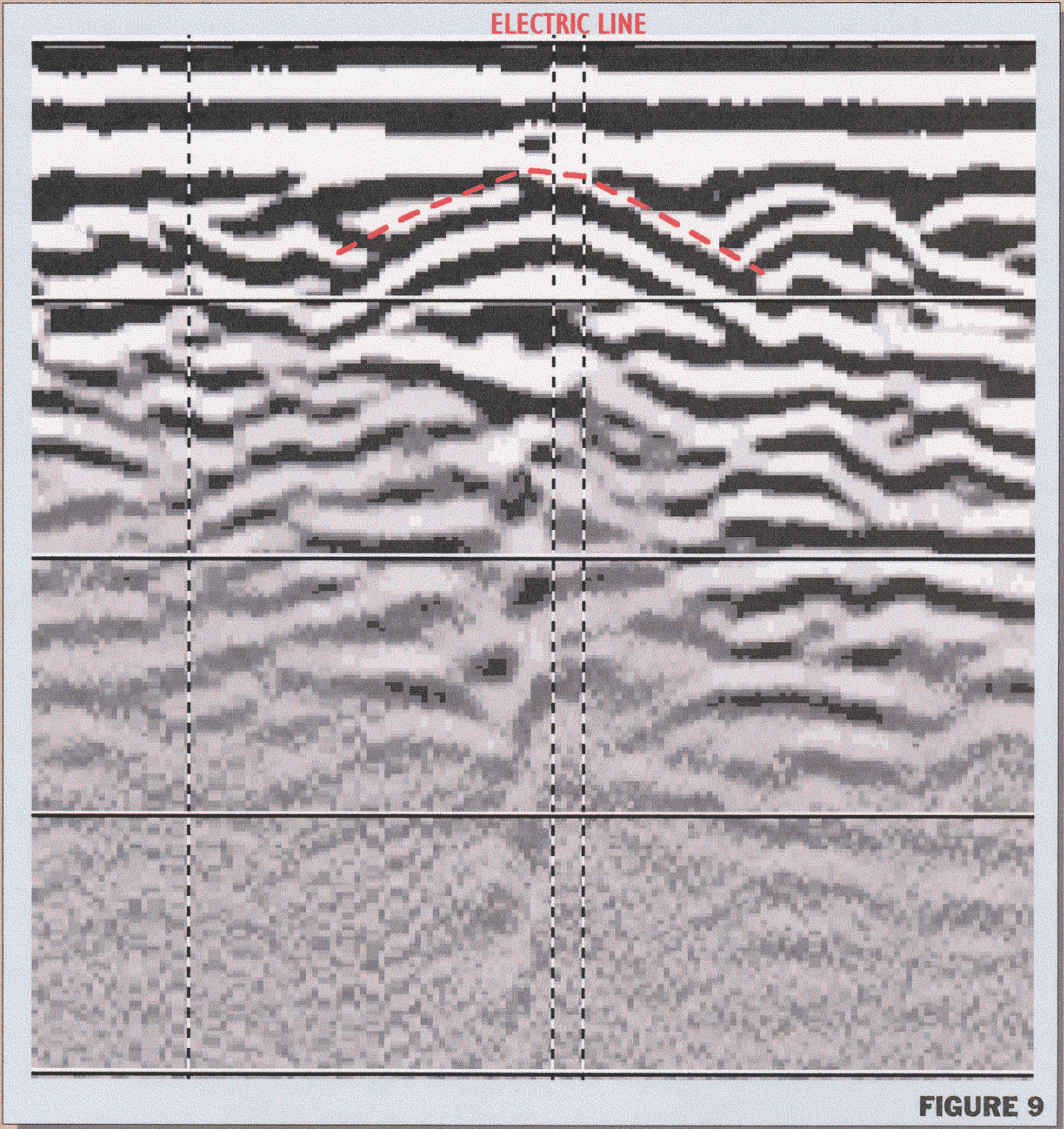


FIGURE 9

Sub
Surface
Surveys

SITE PHOTOGRAPHS

FIGURE 10

FIGURE 11

FIGURE 12

Based on the findings of the geophysical surveys, definitive responses indicating the position of the former disposal ponds were not acquired, however, it appears as though the anomalies expressed may be associated with the ponds targeted.

All data generated on this project are in confidential file in this office, and are available for review by authorized persons at any time. The opportunity to participate in this investigation is very much appreciated. Please call, if there are questions.

Patrick Lehmann
Patrick F. Lehrmann
Staff Geol/Geophysicist

Lawrence J. Favilla
Lawrence J. Favilla, GP969
Senior Geophysicist

A-2

Geophysical Survey to Locate Utilities (February 20, 2001)

Sub Surface Surveys

215 So. Highway 101, Suite 203 P.O. Box 1152 Solana Beach, CA 92075
Telephone: (858) 481-8949 Facsimile: (858) 481-8998 E mail: geop@subsurfacesurveys.com

February 20th, 2001

OHM Remediation Services
1230 Columbia Street, Suite 1200
San Diego, CA 92101

Project Number: 01-049

Attn: **Judy Shiple**

Re: **Geophysical Investigation at the Naval Air Station North Island, Coronado, CA.**

This brief letter report is to present the findings of our geophysical surveys conducted at the North Island Naval Air Station former disposal pit sites at the south corner of Rodgers Road and Sherman Road in Coronado, California (Fig. 1) on February 2nd, 2001. Purpose of the surveys was to locate and identify, insofar as possible, piping, conduit, and other buried features that may exist on the site with particular emphasis in the immediate vicinity of proposed drill sites.

A combination of electromagnetic induction, EM, magnetometry, and ground penetrating radar, GPR, were applied to the search. A utility locator with line tracing capabilities was also brought to the field and used where risers existed onto which a signal could be impressed and traced. Figure 2 is presented to illustrate the line tracer and the radar in use at the site. Multiple methods were utilized because each instrument senses different material properties of the ground and buried objects. At any given site the situation, geologic and cultural, may be such that one or two of the instruments may record excessive "noise", the ground may not provide sufficient contrasts, or there may be overlapping anomalies, for a given instrument to be effective. Generally, however, the interpretation is based on the best reconciliation of the several data sets.

Survey Design - Seventeen borehole locations were pre-selected and marked by the client. One formal rectilinear grid measuring 160X180 feet was established to encompass these boreholes and to guide data acquisition over the area (Fig. 3). Enough of the grid is painted on the ground for recovery, if needs be, in follow up work. EM-61 data were collected at stations every 0.6-foot along north-south oriented survey lines spaced five feet apart. The magnetic gradiometer and M-scope were traversed along the same survey lines and monitored continuously. Radar traverses were also referenced to these grids. GPR traversing was conducted for detailing and confirmation when anomalous conditions were found. Site Photographs area included as figure 4.

A Geonics model EM61 instrument, and a Fischer M-Scope, was used for the EM sampling. A GSSI SIR-2 Ground Penetrating Radar unit produced the radar images. The magnetic gradiometer was a Schonstedt GA-52, and a Metrotech 9890 utility locator rounded out the tools applied.

Sub Surface Surveys

SITE LOCATION MAP

FIGURE 1

Sub
Surface
Surveys

SITE PHOTOGRAPHS

EM-61

Metrotech

FIGURE 2

Sub
Surface
Surveys

SITE MAP

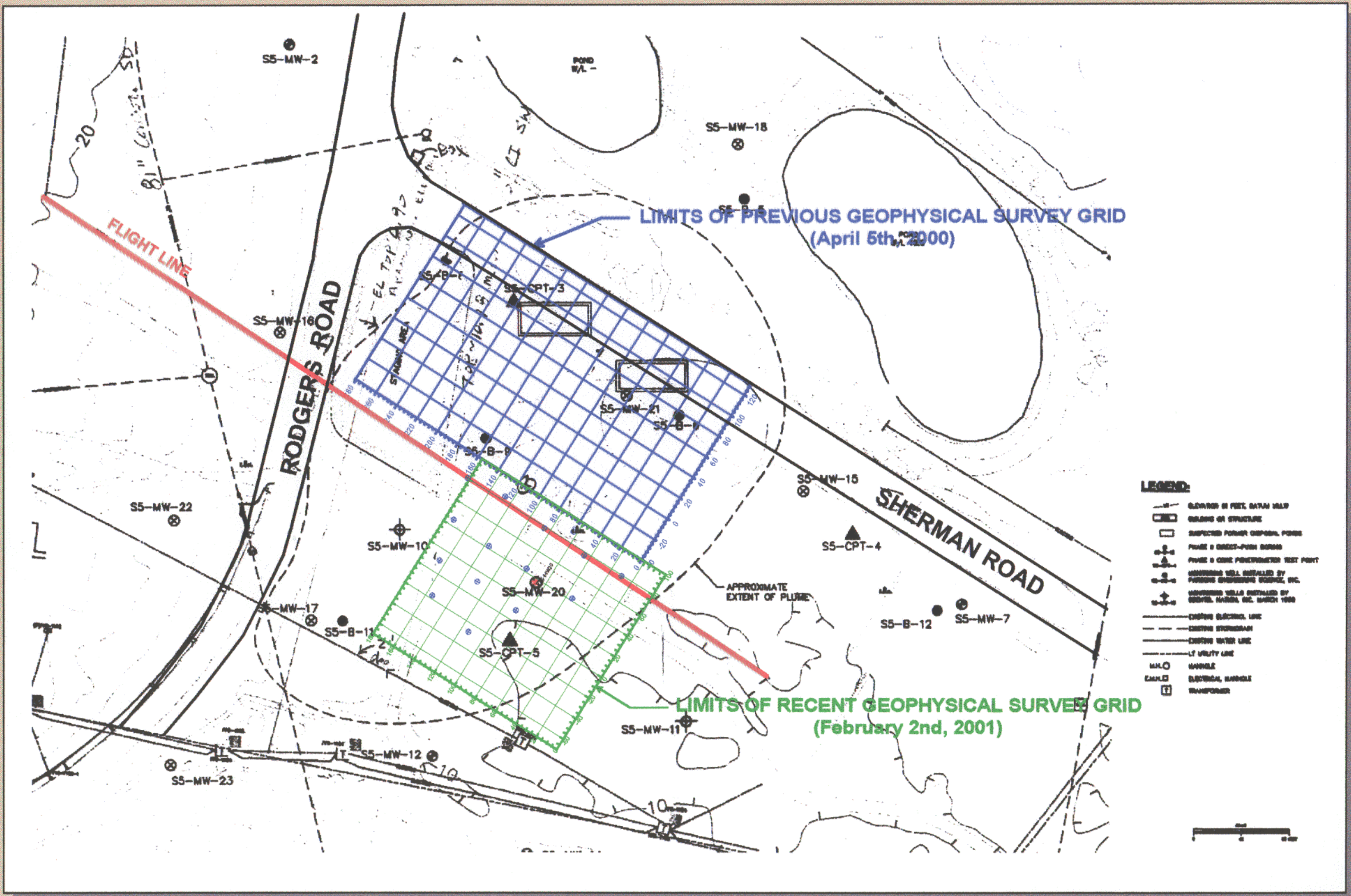


FIGURE 3

SITE PHOTOGRAPHS

FIGURE 4

Brief Description of the Geophysical Methods Applied - The EM-31 and the M-scope TW-6 devices energize the ground by producing an alternating primary magnetic field with ac current in the transmitting coil. If conducting materials are within the area of influence of the primary field, ac eddy currents are induced to flow in the conductors. A receiving coil senses the secondary magnetic field produced by these eddy currents, and outputs the response to a meter in the form of ground conductivity values in the case of the EM-31. The strength of the secondary field is a function of the conductivity of the object, say a pipe, tank or cluster of drums, its size, and its depth and position relative to the instrument's two coils. Conductive objects, to a depth of approximately 18 feet for the EM31 and 10 feet for the M-scope, are sensed. Also the devices are somewhat focused, that is, they are more sensitive to conductors below (and above) the instrument, than to conductors off to the side.

The EM61 instrument is a high resolution, time-domain device for detecting buried conductive objects. It consists of a powerful transmitter that generates a pulsed primary magnetic field when its coils are energized, which induces eddy currents in nearby conductive objects. The decay of the eddy currents, following the input pulse, is measured by the coils, which in turn serve as receiver coils. The decay rate is measured for two coils, mounted concentrically, one above the other. By making the measurements at a relatively long time interval (measured in milliseconds) after termination of the primary pulse, the response is nearly independent of the electrical conductivity of the ground. Thus, the instrument is a super-sensitive metal detector. Due to its unique coil arrangement, the response curve is a single well-defined positive peak directly over a buried conductive object. This facilitates quick and accurate location of targets. Conductive objects, to a depth of approximately 11 feet can be detected.

The magnetic gradiometer has two flux gate magnetic fixed sensors that are passed closely to and over the ground. When not in close proximity to a magnetic object, that is, only in the earth's field, the instrument emits a sound signal at a low frequency. When the instrument passes over a buried iron or steel object, so that locally there is a high magnetic gradient, the frequency of the emitted sound increases. The frequency is a function of the gradient between the two sensors.

The line locator is used to passively detect energized high voltage electric lines and electrical conduit (50-60 Hz), VLF signals (14-22 kHz), as well as to actively trace other utilities. Where risers are present, the utility locator transmitter can be connected directly to the object, and a signal (9.8-82 kHz) is sent traveling along the conductor, pipe, conduit, etc. In the absence of a riser, the transmitter can be used to impress an input signal on the utility by induction. In either case, the receiver unit is tuned to the input signal, and is used to actively trace the signal along the pipe's surface projection.

The GPR instrument beams energy into the ground from its transducer/antenna, in the form of electromagnetic waves. A portion of this energy is reflected back to the antenna at a boundary in the subsurface across which there is an electrical contrast. The instrument produces a continuous record of the reflected energy as the antenna is traversed across the ground surface. The greater the electrical contrast, the higher the amplitude of the returned energy. The radar wave travels at a velocity unique to the material properties of the ground being investigated, and when these velocities are known, the two-way travel times can be converted to depth. The depth of penetration and image resolution produced are a function of ground electrical conductivity and dielectric constant.

Interpretation - The interpretation took place in real time as the survey progressed, and accordingly, the findings of our investigation were marked on the ground and reported to the client's representative at the completion of the field survey. The EM61 data collected on February 2nd, 2001 was combined with the EM61 data that was collected on April 5th, 2000 and are presented in contoured map format with interpretation (Fig. 5). The intent of this document is to demonstrate the procedure, and report the findings of the work.

The EM61 data collected on February 2nd, 2001 indicates a number of anomalies, which represent buried metallic material centered at [(X 45,Y 110), (X 80,Y 120), and (X 95,Y 15)]. These anomalies appear to be the effect of buried metallic debris. There was also one long linear anomaly transecting the grid trending northeast southwest, which represents a piping/utility line. In addition, an electric line was detected with the line tracer that connects the flight-line light standards. In essence, the EM-61 data map delineates the effect of metal either on the surface or buried in the shallow subsurface. Therefore, the data in contour format can be used as a map indicating the position of all the metal buried beneath the site.

Each of the geophysical instruments utilized were effective at detecting and delineating structures/objects constructed of metallic materials. GPR was useful in that it is the only instrument applied that is capable of producing high definition/resolution profile images of the shallow subsurface. According to theory, radar penetration is a function of soil conductivity and dielectric constant. At this site local conditions were reasonably favorable due to the sandy beach sediment type soil. Resulting in radar penetration down to between 4 and 5 feet.

In searching the area, utilities and anomalies detected were marked on the ground surface with paint and pin flags.

Conclusions - Geophysical data acquired over the site appears to indicate a number of anomalies located within the grid, one piping/utility line transecting the grid, and an electric line that connects the flight-line light standards. Seventeen planned drill sites were investigated and appear to be free of piping/utilities as marked by the client, or they were moved a short distance by Subsurface Surveys to areas that appeared clear.

All data generated on this project are in confidential file in this office, and are available for review by authorized persons at any time. The opportunity to participate in this investigation is very much appreciated. Please call, if there are questions.

George E. Herman IV
Staff geophysicist/geologist

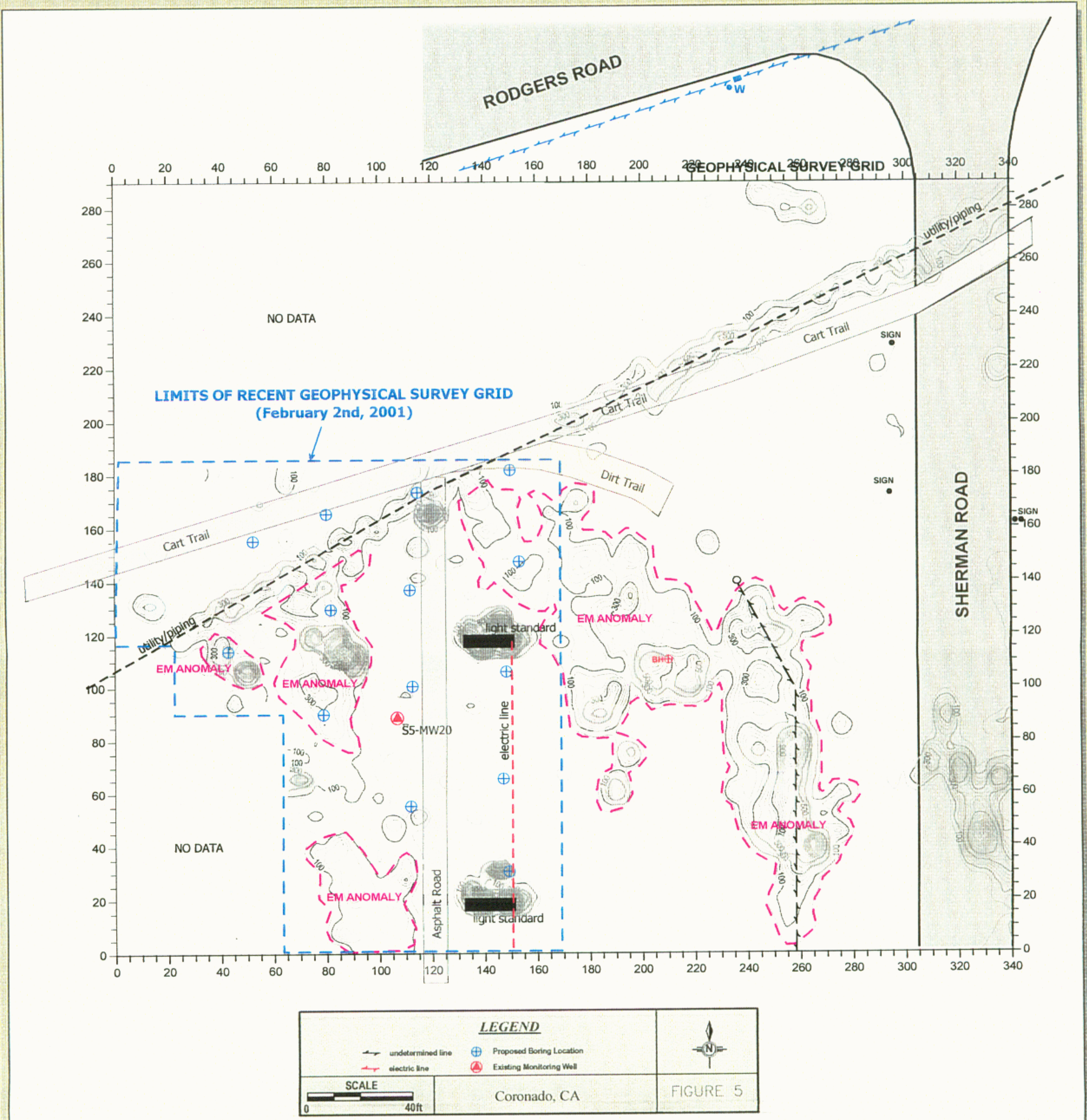
Lawrence J. Favilla, GP 969
Senior Geophysicist

Sub Surface Surveys

SITE INTERPRETATION MAP

EM61 DATA

Contour Interval = 50 mVolts



A-3

Geophysical Survey to Locate Secondary Sources (June 5, 2002)

SPECTRUM

GEOPHYSICS

1220 Destree Rd.
Escondido, CA 92027
760-738-8561
www.spectrum-geophysics.com

Los Angeles-Irvine-San Diego

Results of Geophysical Investigation

IR Site 5 - Unit 2
Naval Air Station, North Island
San Diego, California

Prepared for: **Shaw Environmental**
San Diego, California

Date of Investigation: June 5, 2002

Prepared by:

Jim Pfoser

Jim Pfoser
Project Manager
Spectrum Geophysics
1220 Destree Road
Escondido, CA 92027

Warranty:

Spectrum Geophysics was retained to conduct a geophysical investigation of the above facility to characterize the shallow subsurface. Our findings are subject to certain limitations due to site conditions and the instruments employed. We conducted this investigation in a manner consistent with our profession using similar methods. No other warranty as to the performance or deliverables is expressed or implied.

Contents:

Results of Geophysical Investigation
IR Site 5 - Unit 2
Naval Air Station, North Island
San Diego, California

Introduction

On June 5, 2002 Spectrum Geophysics conducted a geophysical investigation on a portion of IR Site 5 - Unit 2 at North Island Naval Air Station in San Diego, California. The purpose was to delineate the surface trace of detectable buried drums and other metallic subsurface features in an area approximately 300 by 360 feet in size.

Methods

The equipment used in this investigation consisted of a Geonics EM-61 high-sensitivity metal detector and electromagnetic (EM) utility-locating equipment.

The EM-61 was used in an effort to delineate areas where large metallic objects (such as steel drums) may be buried. The EM-61 transmitter generates short pulses of electromagnetic energy which travel downward and outward and have a primary field associated with them. This energy becomes "trapped" in conductive materials and causes a secondary magnetic field to be generated in these materials. The receiver measures the voltage of the decay curve of this secondary magnetic field, which is proportional to the conductivity of the subsurface materials. EM-61 voltage readings were taken, recorded and stored in a digital polycorder at 5-foot intervals along north-south lines spaced 5 feet apart within a grid established by the geophysics crew. These data were processed in the field and used to generate contour maps to assist in identifying anomalous areas that may represent drums.

EM utility-locating methods were used in the areas of interest to investigate EM-61 anomalies in an effort to determine their source.

Results and Conclusions

A site map with geophysical interpretation is presented in Plate 1 and a contour map of the EM-61 top coil data is presented in Plate 2.

Thirty-four anomalies, referred to in this report as Anomalies A-Z and AA-HH, were identified which could not be explained by above-ground cultural features (see Plate 1 and Table 1). A shallow-focus terrain conductivity meter indicated these anomalies are most likely caused by near-surface metallic debris although the exact sources of these anomalies are unknown. It is recommended that they be further investigated through excavation.

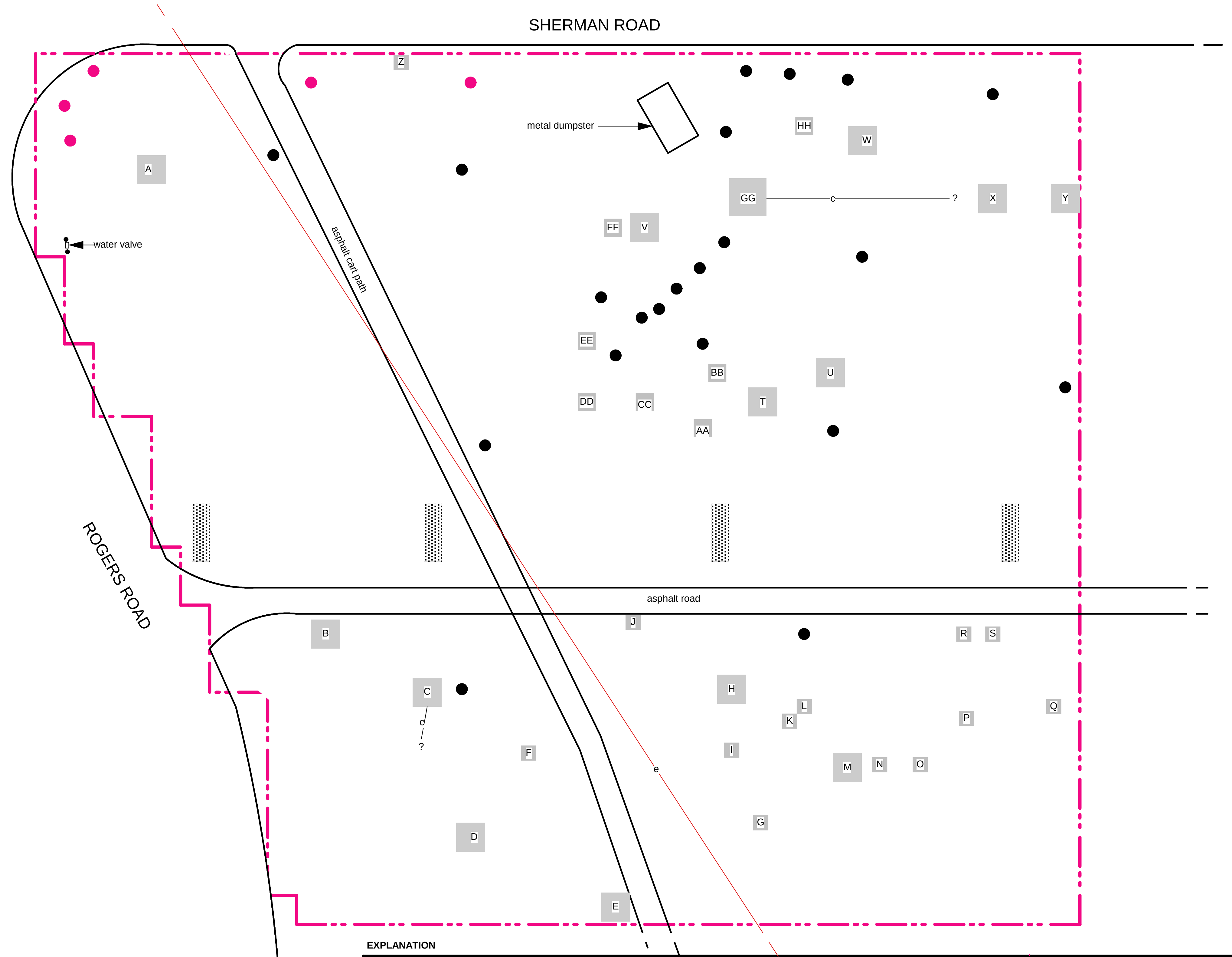
Thirty-four anomalies, referred to in this report as Anomalies A-Z and AA-HH, were identified which could not be explained by above-ground cultural features (see Plate 1 and Table 1). A shallow-focus terrain conductivity meter indicated these anomalies are most likely caused by near-surface metallic debris although the exact sources of these anomalies are unknown. It is recommended that they be further investigated through excavation.

Table 1 Anomalies Identified in the EM-61 Data

Anomaly	Location	Magnitude	Anomaly	Location	Magnitude
A	Line 40, Station 260	360 millivolts	AA	Line 230, Station 170	180 millivolts
B	Line 100, Station 100	360 millivolts	BB	Line 235, Station 190	360 millivolts
C	Line 135, Station 80	600 millivolts	CC	Line 210, Station 180	300 millivolts
D	Line 150, Station 30	600 millivolts	DD	Line 190, Station 180	180 millivolts
E	Line 200, Station 10	300 millivolts	EE	Line 190, Station 200	240 millivolts
F	Line 170, Station 60	120 millivolts	FF	Line 200, Station 240	480 millivolts
G	Line 250, Station 35	720 millivolts	GG	Line 245, Station 250	900 millivolts
H	Line 240, Station 80	900 millivolts	HH	Line 265, Station 275	360 millivolts
I	Line 240, Station 60	360 millivolts			
J	Line 205, Station 105	240 millivolts			
K	Line 260, Station 70	120 millivolts			
L	Line 270, Station 75	120 millivolts			
M	Line 275, Station 60	120 millivolts			
N	Line 290, Station 55	180 millivolts			
O	Line 305, Station 55	120 millivolts			
P	Line 320, Station 70	180 millivolts			
Q	Line 350, Station 70	180 millivolts			
R	Line 320, Station 100	120 millivolts			
S	Line 330, Station 100	120 millivolts			
T	Line 250, Station 180	600 millivolts			
U	Line 275, Station 190	720 millivolts			
V	Line 210, Station 240	600 millivolts			
W	Line 285, Station 270	900 millivolts			
X	Line 330, Station 250	300 millivolts			
Y	Line 355, Station 250	360 millivolts			
Z	Line 125, Station 295	240 millivolts			

PLATE 1
AREA OF GEOPHYSICAL INVESTIGATION
IR SITE 5 - UNIT 2
NAVAL AIR STATION, NORTH ISLAND
SAN DIEGO, CALIFORNIA

SPECTRUM
GEOPHYSICS
Revealing The Subsurface



EXPLANATION

▭	Area of EM-61 investigation	●	Metal signs	**Conduits**	
A	EM-61 anomaly with letter	—— ——	Trend continues	——c——	Conduit
●	Existing monitoring well			——e——	Electric
▨	Landing signal lights			—— ?	Continued trend not determined

N

0 20 40

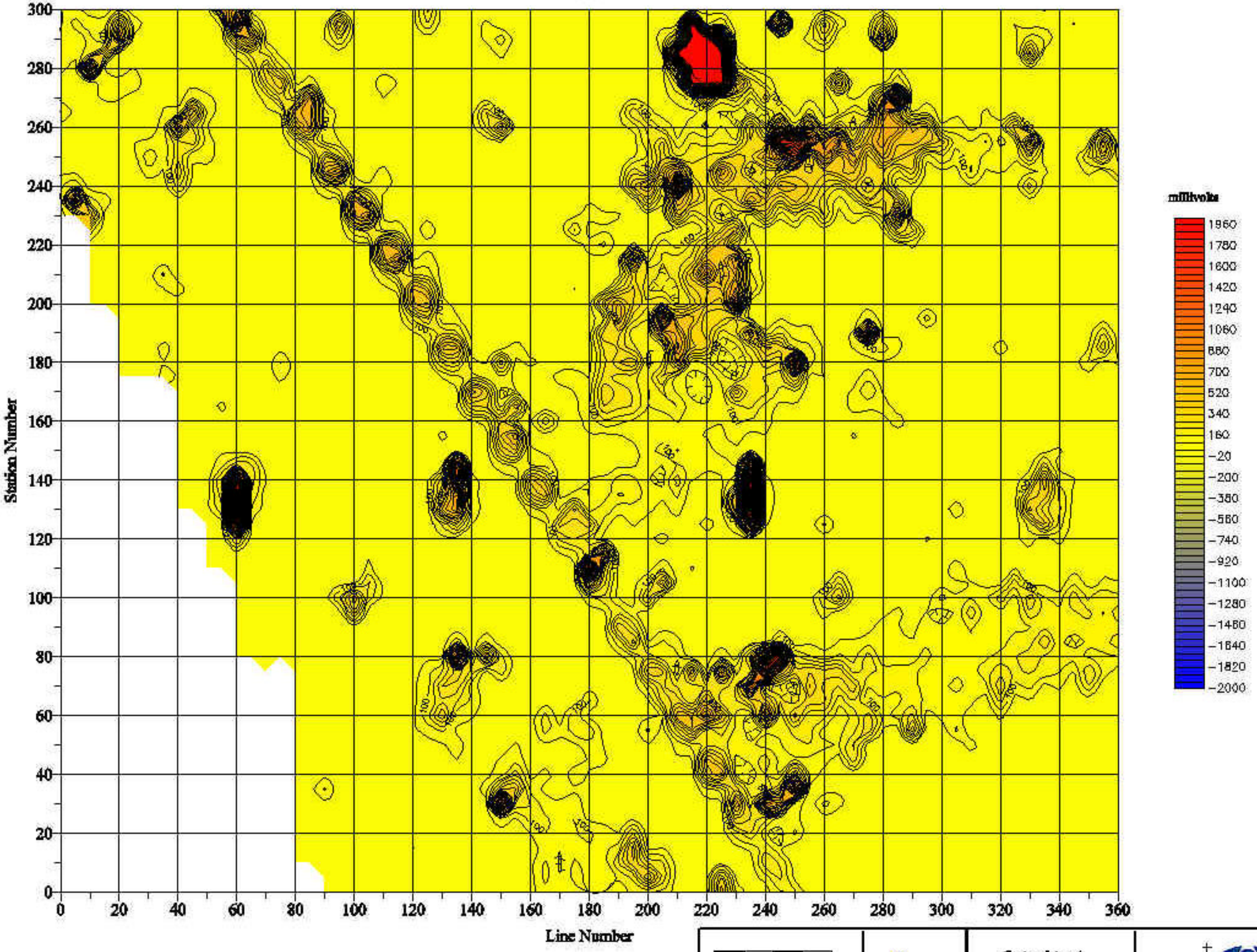
One inch equals approximately 40 feet

Project Number: 0206051F
Date of Investigation:
June 5, 2002

Not all below ground facilities may be represented on this map

Plate 2: Contour Map of EM-61 Top Coil Data

IR Site 5 - Unit 2
Naval Air Station, North Island
San Diego, California



0 10 20 30 40

Scale: One inch equals approximately 40 feet

Contour Interval:
60 millivolts

Project Number: 0206051F
Date of Investigation
June 5, 2002

SPECTRUM
GEOPHYSICS
Revealing The Subsurface

Appendix B
Location Survey Data

Soil Boring, Injection Well, and Monitoring Well Survey Data
IR Site 5 - Unit 2 Time Critical Removal Action

SOIL BORINGS

North	East	MSL Elev.	MLLW Elev.	Location Description
1832372.22	6269806.90	7.69	10.58	S5-B-14
1832366.11	6269855.96	7.32	10.21	S5-B-15
1832380.41	6269839.47	8.58	11.47	S5-B-23
1832381.65	6269830.02	8.50	11.39	S5-B-24
1832375.57	6269827.58	8.64	11.53	S5-B-25
1832373.96	6269817.86	8.64	11.53	S5-B-26
1832364.65	6269818.15	8.54	11.43	S5-B-27
1832364.74	6269829.68	8.58	11.47	S5-B-28
1832360.95	6269838.61	8.45	11.34	S5-B-29
1832369.81	6269835.65	8.37	11.26	S5-B-30
1832361.74	6269838.99	8.22	11.11	S5-B-31
1832369.11	6269836.21	8.33	11.22	S5-B-32
1832380.52	6269837.86	8.60	11.49	S5-B-33
1832382.43	6269829.51	8.46	11.35	S5-B-34
1832376.51	6269826.56	8.41	11.30	S5-B-35
1832373.25	6269818.90	8.50	11.39	S5-B-36
1832364.03	6269817.13	8.31	11.20	S5-B-37
1832364.60	6269828.78	8.40	11.29	S5-B-38
1832486.60	6269853.49	10.00	12.89	S5-B-39
1832459.87	6269894.81	10.35	13.24	S5-B-40
1832437.39	6269930.05	10.54	13.43	S5-B-41
1832418.92	6269960.18	10.74	13.63	S5-B-42
1832452.97	6269957.86	9.86	12.75	S5-B-43
1832474.95	6269830.24	9.37	12.26	S5-B-44
1832450.29	6269869.65	9.58	12.47	S5-B-45
1832427.66	6269900.25	9.53	12.42	S5-B-46
1832348.79	6269937.71	8.57	11.46	S5-B-47
1832297.60	6269887.43	8.15	11.04	S5-B-48
1832419.45	6269915.03	9.60	12.49	S5-B-49
1832409.96	6269930.61	9.82	12.71	S5-B-50
1832435.75	6269971.89	9.86	12.75	S5-B-51
1832453.73	6269944.11	9.85	12.74	S5-B-52
1832467.05	6269924.27	9.78	12.67	S5-B-53
1832479.65	6269904.54	9.51	12.40	S5-B-54
1832488.93	6269890.34	9.37	12.26	S5-B-55
1832419.69	6269880.36	8.34	11.23	S5-B-56
1832412.97	6269851.66	9.09	11.98	S5-B-57
1832399.86	6269903.19	9.24	12.13	S5-B-58
1832389.47	6269876.63	8.49	11.38	S5-B-59
1832430.33	6269815.98	9.53	12.42	S5-B-60
1832440.87	6269884.24	9.52	12.41	S5-B-61
1832399.65	6269940.62	9.75	12.64	S5-B-01D
1832423.27	6269943.28	10.73	13.62	S5-B-02D
1832436.30	6269951.44	10.54	13.43	S5-B-03D
1832427.80	6269932.61	10.64	13.53	S5-B-04D
1832439.35	6269939.90	10.52	13.41	S5-B-05D
1832434.60	6269920.72	10.52	13.41	S5-B-06D
1832447.13	6269927.91	10.45	13.34	S5-B-07D
1832464.16	6269880.52	10.28	13.17	S5-B-08D
1832473.68	6269889.17	10.24	13.13	S5-B-09D
1832462.61	6269947.92	9.64	12.53	S5-B-01B
1832421.15	6269890.94	9.15	12.04	S5-B-02B
1832400.75	6269824.43	8.67	11.56	S5-B-03B
1832391.88	6269934.31	9.79	12.68	S5-B-04B
1832366.08	6269789.93	8.32	11.21	S5-B-05B
1832342.56	6269856.28	8.16	11.05	S5-B-06B

MONITORING WELLS

North	East	MSL Elev.	MLLW Elev.	Location Description
1832708.01	6269606.17	12.58	15.47	S5-MW-02
1831967.93	6270579.34	10.01	12.90	S5-MW-06
1832240.32	6270157.38	10.84	13.73	S5-MW-07
1832302.41	6269694.15	10.13	13.02	S5-MW-10
1832142.22	6269929.53	9.91	12.80	S5-MW-11
1832114.07	6269720.51	9.61	12.50	S5-MW-12
1831932.90	6269707.79	11.47	14.36	S5-MW-13
1832032.21	6269797.74	11.41	14.30	S5-MW-14
1832334.45	6270025.68	11.35	14.24	S5-MW-15
1832467.94	6269595.89	11.69	14.58	S5-MW-16
1832227.01	6269620.34	11.66	14.55	S5-MW-17
1832623.86	6269973.22	14.08	16.97	S5-MW-18
1832002.10	6269551.56	9.84	12.73	S5-MW-19
1832258.14	6269804.82	10.00	12.89*	S5-MW-20
1832414.35	6269880.77	11.66	14.55*	S5-MW-21
1832310.35	6269506.90	12.46	15.35	S5-MW-22
1832106.33	6269502.88	10.64	13.53	S5-MW-23
1832371.40	6269825.65	11.19	14.08	S5-MW-24
1832388.59	6269811.01	11.40	14.29	S5-MW-25
1832359.43	6269835.12	11.20	14.09	S5-MW-26
1832376.03	6269839.39	11.42	14.31	S5-MW-27
1832380.02	6269849.88	11.30	14.19	S5-MW-28
1832383.44	6269858.85	11.64	14.53	S5-MW-29
1832365.21	6269809.63	10.62	13.51	S5-MW-30
1832278.51	6269928.57	10.21	13.10	S5-MW-31
1832309.09	6269853.57	10.23	13.12	S5-MW-32
1832377.35	6269967.29	11.86	14.75	S5-MW-33
1832349.95	6269895.22	10.29	13.18	S5-MW-34
1832368.50	6269747.85	10.93	13.82	S5-MW-35
1832523.54	6269983.66	9.85	12.74	S5-MW-36
1832486.27	6269911.30	9.13	12.02	S5-MW-37
1832452.35	6269799.01	11.97	14.86	S5-MW-38
1832525.74	6269873.60	8.66	11.55	S5-MW-39
1832489.88	6269748.78	11.29	14.18	S5-MW-40

PROPAGATION INJECTION WELLS

North	East	MSL Elev.	MLLW Elev.	Location Description
1832451.79	6269965.27	10.23	13.12	S5-PIW-01
1832474.03	6269931.08	9.77	12.66	S5-PIW-02
1832402.17	6269936.41	10.22	13.11	S5-PIW-03
1832434.48	6269882.79	9.55	12.44	S5-PIW-04
1832460.39	6269848.02	9.66	12.55	S5-PIW-05
1832370.60	6269928.95	9.20	12.09	S5-PIW-06
1832409.37	6269899.24	9.65	12.54	S5-PIW-07
1832369.08	6269886.31	8.78	11.67	S5-PIW-08
1832399.81	6269867.65	8.89	11.78	S5-PIW-09
1832410.38	6269834.15	9.18	12.07	S5-PIW-10
1832335.49	6269881.25	8.07	10.96	S5-PIW-11
1832360.73	6269854.69	8.64	11.53	S5-PIW-12
1832386.43	6269834.60	9.08	11.97	S5-PIW-13
1832405.25	6269800.66	9.41	12.30	S5-PIW-14
1832432.36	6269789.05	10.07	12.96	S5-PIW-15
1832328.59	6269850.12	8.50	11.39	S5-PIW-16
1832346.16	6269816.60	8.91	11.80	S5-PIW-17
1832375.60	6269804.30	8.97	11.86	S5-PIW-18
1832402.75	6269769.12	9.64	12.53	S5-PIW-19

HORIZONTAL INJECTION WELLS

North	East	MSL Elev.	MLLW Elev.	Location Description
1832407.98	6269928.25	10.18	13.07	S5-HIW-01
1832417.99	6269913.44	10.00	12.89	S5-HIW-02
1832428.13	6269898.40	9.98	12.87	S5-HIW-03

VERTICAL INJECTION WELLS

North	East	MSL Elev.	MLLW Elev.	Location Description
1832372.78	6269830.77	11.05	13.94	S5-VIW-01
1832320.21	6269816.17	9.05	11.94	S5-VIW-02
1832340.36	6269781.91	9.42	12.31	S5-VIW-03
1832365.52	6269770.79	9.44	12.33	S5-VIW-04
1832366.99	6269728.11	8.74	11.63	S5-VIW-05
1832417.66	6269890.43	9.74	12.63	S5-VIW-06
1832410.01	6269870.43	9.35	12.24	S5-VIW-07
1832354.47	6269904.37	8.57	11.46	S5-VIW-08
1832348.70	6269885.10	8.36	11.25	S5-VIW-09
1832362.42	6269844.55	8.86	11.75	S5-VIW-10
1832361.68	6269825.18	9.08	11.97	S5-VIW-11

Explanation:

-B- - soil boring
HIW - horizontal injection well
IR - Installation Restoration
MLLW Elev. - mean lower low water per station 9410169 North Island Navy Wharf North San Diego Bay (2.89 feet below mean sea level)
MSL Elev. - mean sea level elevation (United States Geological Survey, 1955)
MW - monitoring well
PIW - propagation injection well
S5 - Site 5
VIW - vertical injection well
-__B - baseline soil sample boring
-__D - delineation soil sample boring

Notes:

1. Land survey activities were performed by Advanced Survey Technologies, Inc., Alpine, Califorina

2. Survey activities were performed by a State of California registered land surveyor using Third-order Class I accuracy. Horizontal control points were tied to the State Plane Coordinate System based on the North American Datum of 1983 (NAD 83) and vertical control points were based on the NAD 83 Geodetic Reference System of 1980. Horizontal and vertical accuracy was surveyed to at least 0.01 foot.
3. Soil boring elevations are top center of ground surface.
4. Monitoring well elevations are top of well casing measuring point.
5. Injection well elevations are top center of traffic box cover.

Appendix D
Site 5 – Unit 2 Public Fact Sheet and Communication Plan

(1) August 2001 Fact Sheet

(2) December 2001 Communication Plan

D-1
August 2001 Fact Sheet

NAVAL AIR STATION
NORTH ISLAND

Fact Sheet No. 13 August 2001

Removal Action at Site 5, Unit 2

This fact sheet will tell you about . . .

- *removal of volatile organic compounds (VOCs) from the soil and groundwater at Site 5, Unit 2,*
- *how you can review the Removal Action Work Plan (RAW) and RAW Addendum for this removal, and*
- *how to obtain more information.*

Introduction

This fact sheet updates the status of the cleanup program and environmental restoration ongoing at NAS North Island (Figure 1). Since 1917, Naval Air Station (NAS) North Island has supported aviation activities of the Naval operating forces. During the operation and maintenance of aircraft at NAS North Island, hazardous substances have been generated. These include paint, used oil, scrap metal, solvents, and contaminated rinsewater. Past disposal practices, although acceptable at the time, often resulted in contamination of soil and groundwater at various locations on NAS North Island.

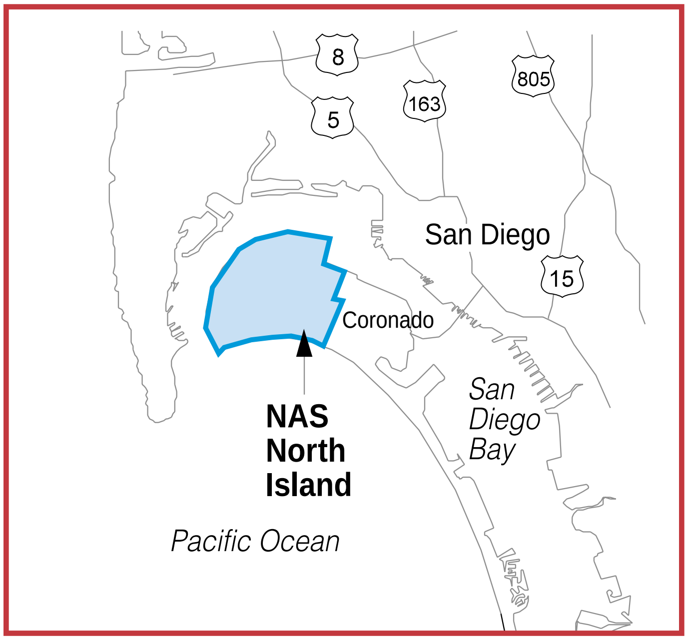


Figure 1 — Vicinity Map

BACKGROUND

The Navy is inviting the public to review and comment on a Removal Action Work Plan (RAW) and a RAW Addendum about a proposed removal action at Installation Restoration Site 5, Unit 2 at Naval Air Station (NAS) North Island. This removal action is being taken under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. The objective of this removal action is to reduce the risk associated with volatile organic compound (VOC)-impacted soil and groundwater to comply with contaminant levels mandated by the U.S. Environmental Protection Agency and the state of California. VOCs are chemicals (many of which are carcinogenic) that readily evaporate at room temperature. This action will substantially eliminate the potential for exposure to VOCs. The removal action is expected to take place from September through December 2001. The public review and comment period is August 13 to September 12, 2001 (see page 3, Public Comment Period).

Site 5, Unit 2

Site 5, Unit 2 is located in the southeast portion of NAS North Island, south of Site 5, Unit 1 (Figure 2). Site 5, Unit 1 is a former landfill that has been converted into a golf course. The golf course borders Site 5, Unit 2 to the north and south, and golf cart paths are located adjacent to the site. The nearest residential area is approximately 1,800 feet east of the site, in the city of Coronado.

During operation of the former landfill, two small disposal pits were located at Site 5, Unit 2 (Figure 2). Disposed waste included VOCs and petroleum hydrocarbons, which have impacted soil and groundwater at Site 5, Unit 2.

The VOC-impacted groundwater (the Site 5, Unit 2 groundwater plume) is shown on Figure 2 as the site outline. The southern end of the plume terminates within 200 feet of a slough that conveys stormwater runoff to the Pacific Ocean. The plume has the potential to migrate to the slough in the future.

You Are Invited to Attend

To learn more about the proposed removal action, the public is invited to attend the Restoration Advisory Board meeting on August 23, 2001, at 6:30 p.m. in the Winn Room of the Coronado Public Library, 620 Orange Avenue, Coronado.

REMOVAL ACTION

The Action Memorandum, published in December 1999, stated that the contaminants at Site 5, Unit 2 might endanger public health or the environment in the future if a removal action is not conducted. Published in February 2001, the RAW concluded that, based on a pilot study (or test run) conducted at the site, *in situ* chemical oxidation would effectively reduce the mass of VOCs in the soil and groundwater, thereby reducing future threats to public health and the environment.

Oxidation is a rapid and heat-producing reaction. Contaminants are oxidized to carbon dioxide, water, and chloride and do not adversely affect groundwater. *In situ* chemical oxidation is accomplished by creating a reaction in the subsurface by injecting hydrogen peroxide (an oxidizer), ferrous sulfate (a catalyst), and hydrochloric acid (for pH treatment) into the contaminated groundwater.

During the removal action, approximately 45 injection wells will be installed, covering the majority of Site 5, Unit 2. The area of treatment will be divided into two areas (Figure 3). Area 1 will encompass the former disposal pits, which make up the estimated source area. Area 2, the plume extent outside of Area 1, will be used to monitor the treatment progress and will be used for treatment injections, as needed, based on the monitoring results.

The RAW Addendum, published in June 2001, recommended excavation of approximately 600 cubic yards of VOC-contaminated soil under the easternmost former disposal pit (Figure 3), in addition to *in situ* chemical oxidation, to further reduce future threats to public health and the environment. The work (excavation and subsequent backfilling with clean soil) will take place on a Friday night, in order to limit human exposure. Sherman Road will be closed during the weekend and on the following Monday, while it is repaved. Traffic will be diverted through the main entrance during that time.

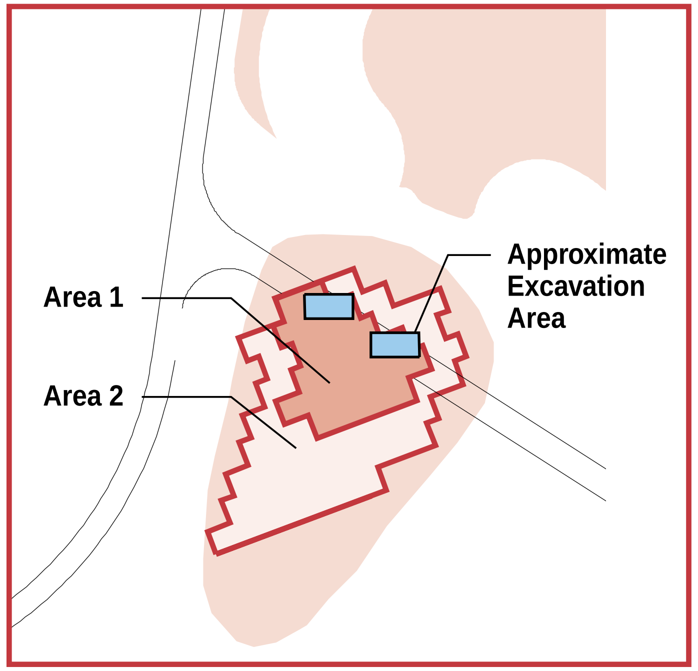


Figure 3 — Site 5, Unit 2 Removal Areas

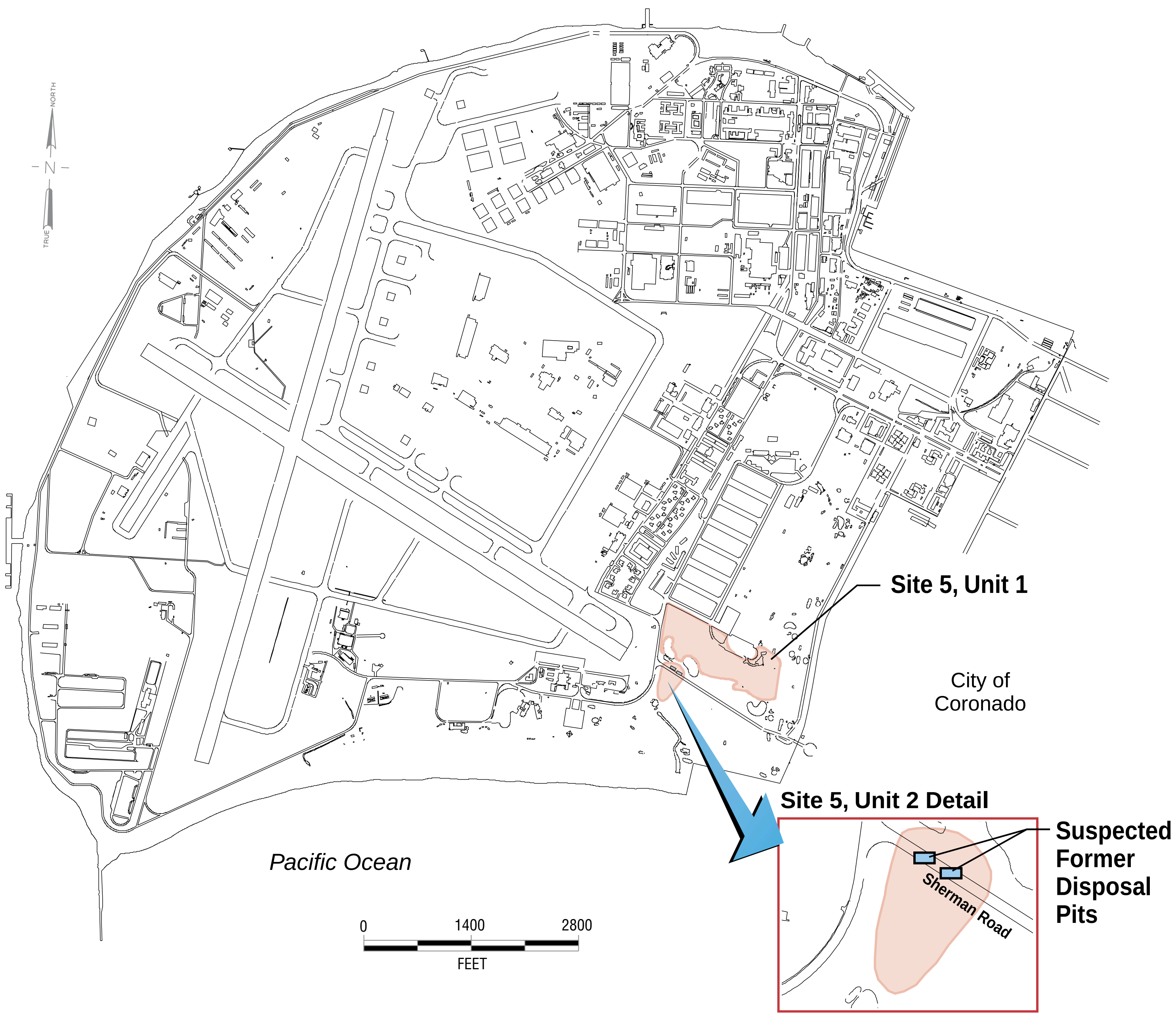


Figure 2 — Site 5, Unit 2 Location Map

Dust-control measures and air-monitoring equipment will be used to assure strict compliance with state and federal requirements and protect public health. Vapors will be kept to a minimum by keeping the excavation area moist and by placing the excavated soil directly into storage bins, which will then be sealed. Work will be conducted at night to minimize production of vapors. Although vapors are not expected to migrate to nearby residential areas, the NAS North Island/city of Coronado boundary and other perimeter locations will be monitored to assure safe conditions. Noise levels will also be monitored. Safety will be the top priority during the removal action. The site will be fenced and warning signs will be posted to keep unauthorized persons from entering the cleanup area.

The sealed bins of material will be stored near the contractor's staging area in the south-central portion of NAS North Island. The sealed bins will be incrementally hauled off the base to an appropriate, permitted disposal facility. Material will be transported at a rate of approximately five trucks per day, during a 3-week period, in order to limit truck traffic. All trucks will carry placards signifying the type of material being hauled. The trucks will exit the base via the main gate and will be routed through the city of Coronado via Fourth Street, across the Coronado Bridge to Interstate 5. The Navy will notify and implement requirements of state and local highway, transportation, and public safety authorities.

The California Environmental Protection Agency Department of Toxic Substances Control (DTSC) is responsible for enforcing both the federal and state hazardous waste regulations associated with this removal action. All aspects of the removal action will comply with applicable laws and requirements, including the Endangered Species Act (concerning bird species at NAS North Island), land disposal restrictions, and Air Pollution Control District requirements.

PUBLIC COMMENT PERIOD

The RAW and RAW Addendum will be available at the information repository at the Coronado Public Library for public review and comment from August 13 to September 12, 2001. Written comments on the documents may be sent to John Locke, Navy Region Southwest, Environmental Department – N4512.JL, 33000 Nixie Way, Building 50, Suite 326, San Diego, CA 92147-5110, (619) 524-6405 or his e-mail address: locke.john.b@asw.cnrsw.navy.mil. **Comments must be postmarked by September 12, 2001.**

DTSC has proposed a negative declaration, pursuant to the California Environmental Quality Act, for the removal action. The proposed negative declaration indicates that the removal action will not have a significant effect on the environment as defined in the Public Resources Code, Section 21068. The negative declaration is available for public review at the information repository at the Coronado Public Library from August 13 to September 12, 2001. Comments on the negative declaration can be sent to Daniel Cordero, DTSC Project Manager, 5796 Corporate Avenue, Cypress, CA 90630, (714) 484-5428, or his e-mail address: dcordero@dtsc.ca.gov.

The information repository is a publicly accessible location where Navy Installation Restoration Program-related documents and information are kept. It is located at the Coronado Public Library, 620 Orange Avenue, in the city of Coronado. Library hours are:

Monday – Thursday:
10:00 a.m. – 9:00 p.m.
Friday – Saturday:
10:00 a.m. – 6:00 p.m.
Sunday:
1:00 p.m. – 5:00 p.m.

John Locke
Navy Region Southwest
Environmental Department – N4512.JL
33000 Nixie Way, Building 50, Suite 326
San Diego, CA 92147-5110

Inside:

Information on Removal of
Volatile Organic Compounds
NAS North Island

For More Information

For more information on the Installation Restoration Program underway at NAS North Island, or to find out more about the Restoration Advisory Board, please contact:

John Locke
Navy Region Southwest
Environmental Department – N4512.JL
33000 Nixie Way, Building 50, Suite 326
San Diego, CA 92147-5110
(619) 524-6405
e-mail: locke.john.b@asw.cnrsw.navy.mil

Leticia Hernandez
Public Participation Specialist
Department of Toxic Substances Control
5796 Corporate Avenue
Cypress, CA 90630
(714) 484-5488
e-mail: lhernand@dtsc.ca.gov

Also visit the Navy's Web Sites: http://nelp.navy.mil or http://www.efdsw.navfac.navy.mil/pages/Environmental/EnvHome.htm

MAILING LIST

If you did not receive this fact sheet in the mail, then you are not on our mailing list. If you wish to be placed on the NAS North Island mailing list, please complete this form, clip, and mail to: **John Locke, Navy Region Southwest, Environmental Department – N4512.JL, 33000 Nixie Way, Building 50, Suite 326, San Diego, CA 92147-5110, (619) 524-6405, e-mail:** locke.john.b@asw.cnrsw.navy.mil

Name ______________________________

Address ______________________________

City ____________________ State ________ Zip ________

Phone (   ) ______________________________

Affiliation (optional) ______________________________

E-mail address ______________________________

D-2
December 2001 Communication Plan

NAVAL AIR STATION
NORTH ISLAND
December 2001

Communications Plan

for Removal Action at Site 5, Unit 2

Introduction

A removal action is currently being performed at Installation Restoration Site 5, Unit 2 (see Figure 1) on Naval Air Station (NAS) North Island. This Communications Plan provides information on the activities, a schedule for the removal action, answers to frequently asked questions, and persons to contact for further information.

The objective of the action is to remove approximately 700 cubic yards of contaminated soil from the site, and then to treat impacted groundwater, in order to protect human health and the environment. The contaminants of concern at this site are volatile organic compounds (VOCs).

The removal action involves two major field activities: excavation and groundwater treatment.

- **Excavation:** During this phase, the contaminated soil will be excavated (dug up) and placed in large, sealed bins. These bins of excavated soil will be tested and then transported off-site, by truck, to a permitted disposal facility. The excavation area will subsequently be filled in (or "backfilled") with clean soil.

  Heavy construction equipment and trucks will be used throughout this phase. The actual digging work, however, will occur during only one 12-hour period (December 14th-15th). After the excavation and backfilling, use of Sherman Road will be limited for approximately one week in order to repave the area. The road will be made passable for mission-essential traffic. Once repaved, Sherman Road will be fully reopened.

- **Groundwater treatment:** The groundwater will be treated with a process known as *in situ* chemical oxidation. This is a process that breaks down contaminants into smaller, naturally occurring compounds that do not adversely affect groundwater. Chemical oxidation is accomplished by injecting "oxidizing agents" (e.g., hydrogen peroxide) into the subsurface.

  Common site activities during groundwater treatment will include: drill rigs at various locations, pipes being installed and pipes sticking out of the ground, a staging area with drums and equipment, various light vehicles, and project personnel working in the Site 5, Unit 2 area.

Frequently Asked Questions

VOLATILE ORGANIC COMPOUNDS (VOCs)

What are VOCs?

VOCs are chemicals (many of which are cancer-causing) that readily evaporate at room temperature. VOCs are found in everything from paints and coatings to underarm deodorant and cleaning fluids. The presence of VOCs at this site resulted from the historic disposal of waste solvents and fuels.

VAPORS

Will vapors be present during the excavation of contaminated soil?

Some VOC vapors are likely to be present during excavation activities. However, the work will be performed in the best manner possible to minimize vapor emissions. Project engineers calculated the potential vapor migration and concluded that the work poses no health risk to residents of the city of Coronado and NAS North Island.

continued inside

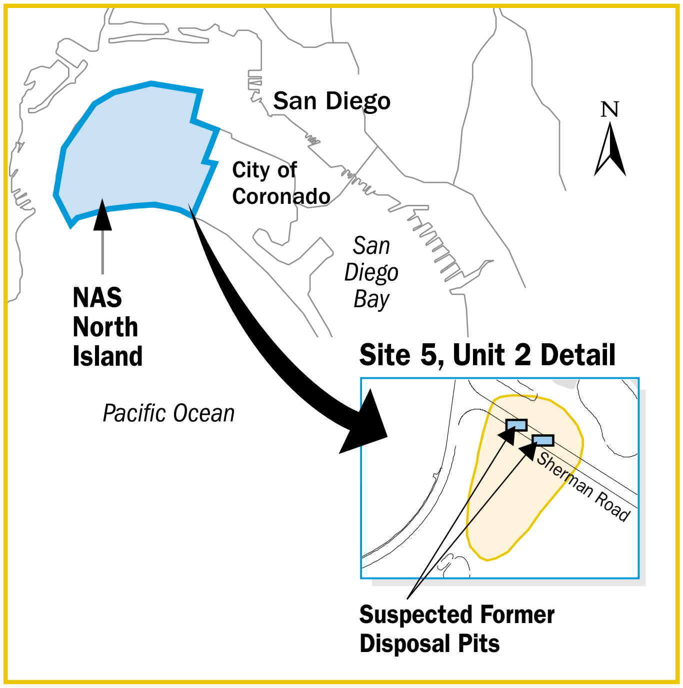


Figure 1 — Vicinity Map

Schedule

Activity	Expected Duration
Soil excavation	6:00 p.m., December 14 - 6:00 a.m., December 15, 2001 (12 hours only)
Backfill and compaction of clean soil	December 15 - December 16, 2001
Sherman Road repairs (limited access)	December 14 - December 21, 2001
Re-open Sherman Road	December 21, 2001
Transportation of bins of excavated soil from site to permitted disposal facility	January 11 - January 31, 2002
Groundwater treatment	February 12 - May 20, 2002

FAQs *continued from page 1*

The following vapor emission controls were developed for this project and will be in place during excavation activities:

- The perimeter of the work area, the NAS North Island/city of Coronado boundary, and other perimeter locations will be continually monitored to assure safe conditions.
- Excavation activities will be performed during evening hours.
- Full-time health and safety professionals will stop the excavation and the site will be secured to minimize the release of vapors if perimeter monitoring justifies this action.
- Excavated soil will be placed in sealable, closed-top bins.
- The soil will be kept moist for the duration of the work.

ODORS

Residents may detect nuisance odors during the course of the excavation activities (the night of December 14th, 2001).

If I smell something what should I do?

If strong odors are detected, we ask that you contact the Command Duty Officer. If desired, a technician will be sent to your location, take readings—to assure the odors are not harmful—and provide surfactants and other ways to suppress undesired odors.

Why don't you put a tent over the site?

Tenting the site was considered. The height restriction of 20 feet imposed by NAS North Island flight operations precludes the use of a tent. Additionally, construction activities involving heavy earth moving equipment and laborers in the confined space of a tent is inherently dangerous.

Will this activity pollute the air?

Excavation activities will be completed within a very short time frame (12 hours to excavate, then fill operations will begin immediately) and vapors potentially present during excavation activities will be minimized through engineering controls, as necessary. Project engineers have calculated the potential for air pollution from the site and concluded that the amount of pollution released to the air will be negligible.

Is there a risk of cancer?

Carcinogenic health effects are generally not of concern for one-day exposures since the risk of cancer from VOCs is associated with the lifetime average exposure.

NOISE

What noise can be expected during excavation activities?

The heavy construction equipment will have backup alarms as required by OSHA (Occupational Safety and Health Administration). These alarms are mandatory in order to protect the safety of the workers. In addition, the track-mounted excavator will create noise when it is operating on the asphalt pavement. The excavation work will not take longer than 12 hours (see above Schedule), and site restoration activities will be performed during regular work hours. For the 12-hour period (starting December 14th and concluding December 15th) residents in Coronado near the North Island property line, and North Island residents next to the runway, can expect to hear typical construction site noise, such as large engines, scraping, banging, and backup alarms.

December 2001

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
						1
2	3 ◀ Start November 21, 2001, Transportation and Staging of Bins	4	5	6	7	8
9	10	11	12	13	14 Excavation Start 6:00 p.m.	15 Excavation Finish 6:00 a.m. Backfill and Compaction
16 Backfill and Compaction	17 Restoration of Sherman Road	18	19	20	21 Re-open Sherman Rd.	22
23 30	24 31	**25**	26	27	28	29

January 2002

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
		1	2	3	4	5
6	7	8	9	10	11 Transportation of Soil Bins	12
13	14 Transportation of Soil Bins	15	16	17	18	19
20	21 Transportation of Soil Bins	22	23	24	25	26
27	28 Transportation of Soil Bins	29	30	31		

February 2002

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
					1	2
3	4	5	6	7	8	9
10	11	12 Start Groundwater Treatment	13	14	15	16
17	18 Groundwater Treatment	19	20	21	22	23
24	25 Groundwater Treatment	26	27 Groundwater Treatment Continues to May 20, 2002 ▶	28		

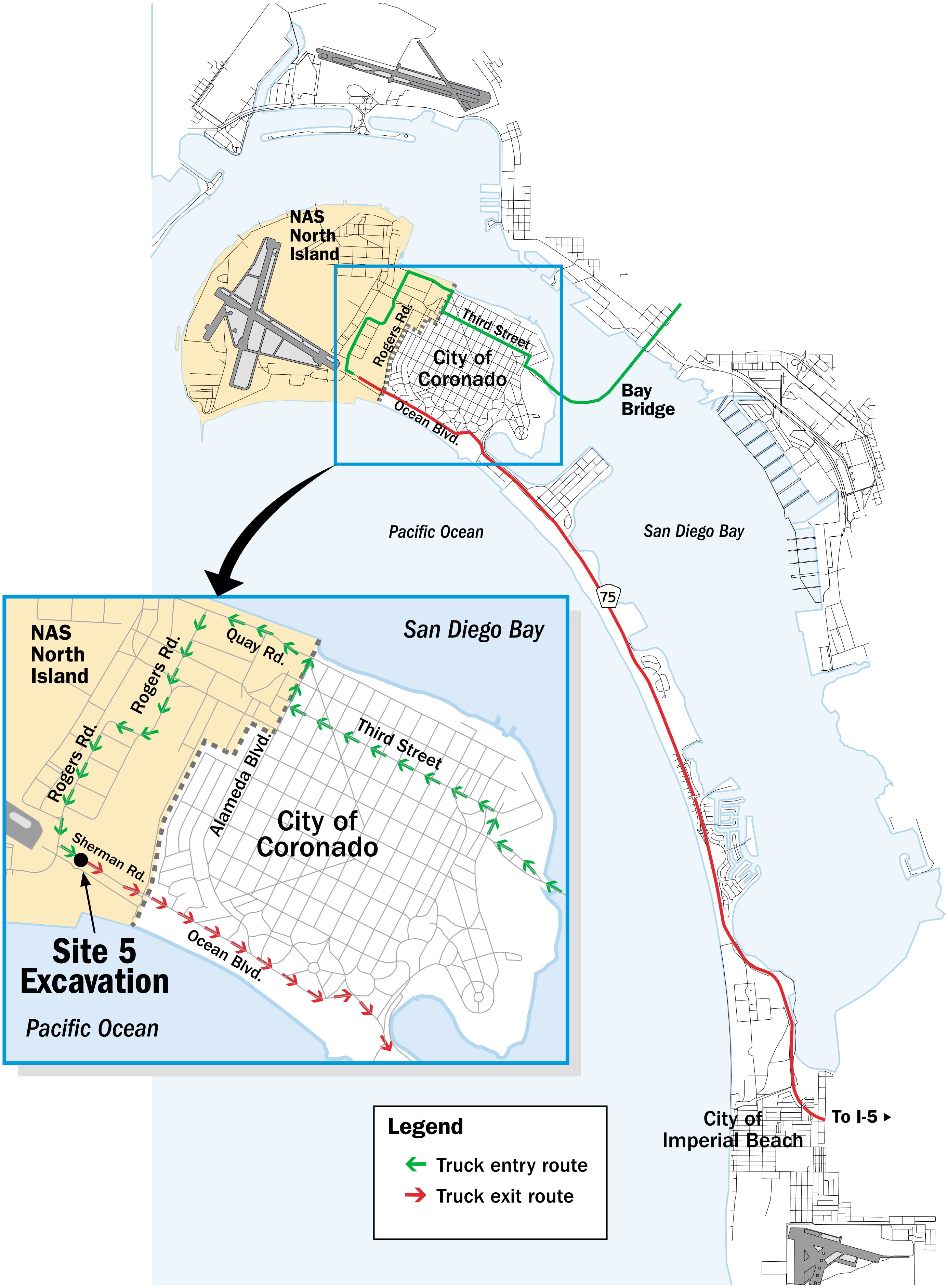


Figure 2 — Truck Route

Who do I call to complain about the noise?

First, we ask that you be as patient and understanding as possible. The construction aspect of the project was condensed to one night in order to minimize the impact on surrounding activities and communities. Shutting doors and windows will likely eliminate any noise. If you still wish to speak to someone about noise levels, contact the Command Duty Officer. The Command Duty Officer will relay all calls about noise to the Site Superintendent.

TRANSPORTATION

What is the impact to traffic?

The Navy is aware that the city of Coronado is very sensitive to the amount and type of truck traffic that may be used to support this removal action. The following impacts to vehicle traffic are expected:

- Access to Sherman Road will be limited at certain times.

The following traffic management controls have been developed and will be implemented:

- Barricades and signs will be used to prevent traffic from entering the vicinity of the planned excavation.
- NAS North Island traffic that ordinarily uses Gate 5 will be re-routed to Gate 1 (the Main Gate) and Gate 2.
- Trucks will use identified routes that have been established by the city of Coronado, the Navy, and the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) to transport construction materials and excavated soil (see Figure 2.)
- Trucks will be scheduled to arrive and depart NAS North Island during non-peak traffic hours (9:00 a.m. to 3:00 p.m.).
- For this project, the Navy will minimize the impact of truck traffic by scheduling no more than five trucks per day entering or exiting the base.

Has the Navy considered barging the waste off of North Island?

The Navy has considered barging; however, barges will not be used. Barging creates new potential significant impacts that disqualify it as a viable means of transporting excavated soil. Barging would only reduce the ground transportation through the city of Coronado, as trucks would still be required to transport the soil bins to the waste disposal facilities. Relative to trucking, barging would require handling the bins more times, thereby increasing the probability for an accident and injury to the workers. In addition, an accident during barging (e.g., barge upset or ship collision with bins falling into the San Diego Bay) would result in a more difficult cleanup response and greater impact to the environment than if the soil were released during ground transportation.

What happens if one of the trucks gets in an accident while on the road?

The soil excavated from the site will be contained in closed bins during transport to the disposal facility. Therefore, it is unlikely for the soil to be spilled in the event of an accident. The transport of bins containing excavated soil will comply with all appropriate U.S. Department of Transportation regulations and local and state traffic laws. Trucks and bins will be inspected for safety and cleanliness prior to leaving NAS North Island. In the unlikely event of a leak or spill during transportation, the truck driver will notify the appropriate civilian authorities at the earliest practical moment. The civilian incident commander will have full control of all facets of the emergency response and cleanup. The Navy has a cleanup crew on call 24 hours a day. If needed, this team will be dispatched.

REGULATION

Who is regulating this work?

The Navy is working closely with the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC). In June 2001, the Navy completed a detailed work plan for cleanup of this site. This plan received approval from DTSC — the lead state regulatory agency for the site. DTSC completed a review of the project for compliance with the California Environmental Quality Act (CEQA) and has issued a negative declaration (approval of the project in CEQA terms). The negative declaration contained the following statements:

> *"DTSC has determined that the project will not have a significant effect on the environment as defined in the Public Resources Code Section 21068."*
>
> *"... there is no evidence before DTSC that the proposed project will have potential for an adverse effect on wildlife resources or the habitat upon which the wildlife depends."*

Information Repository

The information repository is a publicly accessible location where Navy Installation Restoration Program-related documents and information are kept. Previous fact sheets regarding NAS North Island sites (including Site 5, Unit 2) can be viewed there. The information repository for NAS North Island is located at the Coronado Public Library, 620 Orange Avenue, in the city of Coronado.

Library hours are:

Monday – Thursday:	**10:00 a.m. – 9:00 p.m.**
Friday – Saturday:	**10:00 a.m. – 6:00 p.m.**
Sunday:	**1:00 p.m. – 5:00 p.m.**

You can also find more information about the Navy's Installation Restoration Program at the following web site: *http://www.efdsw.navfac.navy.mil/environmental/envhome.htm*

John Locke
Navy Region Southwest
Environmental Department – N4512.JL
33000 Nixie Way, Building 50, Suite 326
San Diego, CA 92147-5110

Contact Information

If you urgently need to speak with someone about the activities, please call the Command Duty Officer (CDO) first. The CDO will log the call, then contact the appropriate parties.

For Specific Information During the Excavation Work:

On call 24 hours a day:
Command Duty Officer (CDO), Naval Air Station North Island **(619) 545-8123**

To contact the on-site superintendent for the Site 5, Unit 2 removal action:
Richard Wong, Project Manager, IT Corporation **(619) 778-6122 (mobile)**
email: rwong@theITgroup.com **(619) 437-6328 (office)**

For General Information During Regular Working Hours:

Questions regarding the Navy's Installation Restoration Program:
John Locke, Environmental Engineer, Navy Region Southwest **(619) 524- 6405**
email: locke.john.b@asw.cnrsw.navy.mil

Questions regarding the Site 5, Unit 2 removal action:
Mark Bonsavage, Remedial Project Manager **(619) 556-7315**
Naval Facilities Engineering Command, Southwest Division
email: BonsavageMJ@efdsw.navfac.navy.mil

For general questions regarding NAS North Island Public Affairs:
Ken Mitchell, Public Affairs Officer (PAO), Naval Station North Island **(619) 545-8167**
email: KMitchell@emh.nasni.navy.mil

NAS North Island construction activities:
Donald Hough, Assistant Resident Officer In Charge of Construction (AROICC) **(619) 545-4904**
Naval Facilities Engineering Command
email: HoughDC@efdsw.navfac.navy.mil

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Appendix E
Excavation Subcontractor Reports and Waste Disposal Manifests

(1) GC/MS Air Monitoring Report
(2) Compaction Testing Report
(3) Excavated Soil Waste Disposal Manifests

E-1
GC/MS Air Monitoring Report

Field-Portable Analytical, Inc.
3330 Cameron Park Drive, Suite 850, Cameron Park, CA 95682 (530) 676-6620

IR Site 5 – Unit 2 Perimeter Air Monitoring Report
Naval Air Station North Island, California
December 14th and 15th, 2001

Introduction

IT Corporation contracted Field-Portable Analytical, Inc. (*FPA*) to provide perimeter monitoring during a soil excavation project at the North Island Naval Air Station. During the excavation process, real time analysis along the Naval Base fence line and fixed points around the site were conducted to determine if any compounds were migrating away from the excavation or off site.

Direct ambient air analyses were conducted using 2 separate Field-Portable GC/MS systems. This report presents the results obtained during this event.

Craig Crume and Dave Curtis of *FPA* conducted the sampling and analysis for the event.

Seven compounds (listed in Table 1) were monitored around the area of excavation. The detection limits for all compounds listed in the table was 0.2 ppmv.

Table 1

Methylene Chloride
Benzene
Toluene
Vinyl Chloride
Tetrachloroethene
Trichloroethene
1,1-Dichloroethane

Technical Approach

Sample Collection

Sample locations were determined by IT personnel. The ambient air samples were collected by placing the instrument's sample probe at the specified locations and directly acquiring the sample. The fence line locations started at the guard shack and then every 400 feet to the North for a total of 7 locations. The perimeter monitoring followed a grid that expanded in a circle determined by IT personnel in a pattern away from the excavation site. In addition, several samples were collected directly at the excavation site.

GC/MS Analysis

Analytical System

For this project *FPA* utilized two Inficon Hapsite GC/MS systems. A portable GC/MS designed specifically for the analysis of volatile compounds. The Hapsite is a full featured quadrupole GC/MS capable of meeting all of the EPA's stringent SW-846 QC criteria even though it weighs only 37 pounds and can be carried over the shoulder.

The Hapsite GC/MS uses a sampling wand with an internal pump to collect the sample. The sample is pulled into a sample loop with variable injection capabilities. The column is a 30 meter OV-1 with a 3 meter backflush column. The backflush column allows the volatile organic target compounds to get onto the column, then backflushes off the non-target semivolatile compounds. This keeps the instrument free of contamination and eliminates the need to 'bake out' the contamination between analyses. This backflush feature also allows for the analysis of Vinyl Chloride at the normal detection limit even in the presence of high concentrations of other compounds. The interface between the GC and MS is a methyl silicone membrane. This membrane allows organics to migrate through to the MS while sweeping most non-organics out through the vent.

By minimizing what gets into the MS, this instrument is able to utilize a chemical 'getter' pump rather than a mechanical pump. The getter pump maintains adequate vacuum for weeks at a time. It is very compact and allows the GC/MS to be used in a portable mode without the need to drag heavy mechanical pumps around.

In addition to target compounds, the Hapsite GC/MS produces standard NIST searchable spectra to identify and semi-quantitate unknown compounds. The Hapsite GC/MS co-injects 2 compounds as internal standards with every analysis. These compounds are used for semi-quantitation of any unknowns and as additional QA/QC for each analysis.

Quality Assurance/Quality Control

- Five Point Calibration

The GC/MS systems were calibrated for the VOC's listed in Table 1. The standard were prepared from neat liquids. A five point calibration was performed. The five concentration levels spanned the linear range of the instrument. The calibration had a relative standard deviation (RSD) of less than or equal to 25%.

- Mass Spectral Ion Intensity Verification

The mass spectral ion intensities were verified at the beginning each day of analyses using 4-Bromofluorobenzene (BFB). Criteria set forth in Method 8260B were used for acceptance.

- Method Blanks

A method blank was analyzed prior to analysis of any samples. The acceptance criteria for the blank samples were that there are no compounds above the quantitation limits. Corrective action will be to determine the source of the contamination, eliminate it and reanalyze the blank.

- End Check

There was a mid-level calibration check standard analyzed on each GC/MS at the end of each day of analyses. The acceptance criteria for the calibration check standards were ±

30% difference from the expected concentration for 90% of the target compounds. Corrective action will be to reprepare and analyze the end check. If criteria are still not met, any targets that are flagged will be flagged on the sample results as well for that day.

- Internal Standards / Surrogates

An internal standard was co-injected with every sample. Acceptance for the internal standard recovery was –50% to 200%.

A surrogate was co-injected with every sample. The acceptance criteria for the surrogate were 70% to 130% recovery.

- Tentatively Identified Compounds (TIC's)

Each sample chromatogram was scanned for unknown compounds. No unknowns were detected.

Conclusions

The data produced for this monitoring event are of useable quality. See the attached tables: Fenceline Analysis, Perimeter Analysis, Hand Held Readings - Outer Perimeter, and Hand Held Readings - Inner Perimeter for GC/MS air monitoring results.

FPA
Field-Portable Analytical, Inc.
3330 Cameron Park Drive, Suite 850, Cameron Park, CA 95682 (530) 676-6620

IT North Island

Fenceline Analysis

14-Dec-01 thru 15-Dec-01

Location and Round	Time	Vinyl Chloride Concentration (ppmv)	Methylene Chloride Concentration (ppmv)	Benzene Concentration (ppmv)	Trichloroethene Concentration (ppmv)	Toluene Concentration (ppmv)	Tetrachloroethene Concentration (ppmv)	Tris (Surrogate) Recovery (%)	FID (OVA) Concentration (ppmv)
GS-1	19:06	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	101	< 1.0
F1-1	19:19	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	101	< 1.0
F2-1	19:26	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	108	< 1.0
F3-1	19:39	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	111	< 1.0
F4-1	19:48	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	113	< 1.0
F5-1	19:58	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	109	< 1.0
F6-1	20:07	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	111	< 1.0
F7-1	20:16	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	103	< 1.0
GS-2	20:25	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	111	< 1.0
F1-2	20:35	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	111	< 1.0
F2-2	20:44	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	116	< 1.0
F3-2	20:53	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	114	< 1.0
F4-2	21:02	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	108	< 1.0
F5-2	21:12	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	102	< 1.0
F6-2	21:22	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	109	< 1.0
F7-2	21:35	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	106	< 1.0
GS-3	22:29	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	141 Q	< 1.0
F1-3	22:43	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	125	< 1.0
F2-3	22:53	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	112	< 1.0
F3-3	23:01	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	111	< 1.0
F4-3	23:15	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	107	< 1.0
F5-3	23:28	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	102	< 1.0
F6-3	23:42	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	102	< 1.0
F7-3	23:52	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	102	< 1.0
GS-4	0:08	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	112	< 1.0
F1-4	0:18	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	102	< 1.0
F2-4	0:28	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	101	< 1.0
F3-4	0:37	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	99.6	< 1.0
F4-4	0:45	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	98.2	< 1.0
F5-4	0:56	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	97.3	< 1.0
F6-4	1:06	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	99.3	< 1.0
F7-4	1:15	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	95.4	< 1.0
GS-5	2:07	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	117	< 1.0
F1-5	2:19	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	120	< 1.0
F2-5	2:29	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	107	< 1.0
F3-5	2:38	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	106	< 1.0
F4-5	2:47	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	105	< 1.0
F5-5	2:56	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	105	< 1.0
F6-5	3:06	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	98.6	< 1.0
F7-5	3:15	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	101	< 1.0
GS-6	4:27	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	130	< 1.0
F1-6	4:37	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	116	< 1.0
F2-6	4:47	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	102	< 1.0
F3-6	4:57	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	92.9	< 1.0
F4-6	5:08	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	98.3	< 1.0
F5-6	5:18	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	90.6	< 1.0
F6-6	5:27	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	88.9	< 1.0
F7-6	5:36	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	82.6	< 1.0

Q = Outside Established Acceptance Limits of 70 - 130 %

IT North Island

Perimeter Analysis

14-Dec-01 thru 15-Dec-01

Location	Time	Vinyl Chloride Concentration (ppmv)	Methylene Chloride Concentration (ppmv)	1,1-Dichloroethane Concentration (ppmv)	Benzene Concentration (ppmv)	Trichloroethene Concentration (ppmv)	Toluene Concentration (ppmv)	Tetrachloroethene Concentration (ppmv)	Tris (Surrogate) Recovery (%)
Directly Downwind (East) ~30 ft from Pit	20:20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	86.8%
Directly Downwind (East) ~11 ft from Pit	20:31	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	79.9%
Directly Downwind (East) ~11 ft from Pit	20:39	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	90.0%
OP# 5 - Admirals Quarters	21:21	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	88.8%
North of Pit - At Car Wash	21:29	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	80.7%
IP# 4	21:36	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	75.6%
12' East of Pit - During Exposed Drum	22:11	< 0.2	0.32	< 0.2	< 0.2	2.3	0.25	< 0.2	72.2%
12' East of Pit - After Exposed Drum	22:19	< 0.2	< 0.2	< 0.2	< 0.2	0.57	< 0.2	< 0.2	89.8%
12' East of Pit - After Exposed Drum	22:27	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	83.1%
12' East of Pit - No Excavation (Shift Change)	23:09	< 0.2	< 0.2	< 0.2	< 0.2	0.64	< 0.2	< 0.2	83.1%
12' East of Pit - Excavation Resumed	23:19	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	74.7%
OP# 5 - Admirals Quarters	23:31	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	75.4%
12' East of Pit - During Excavation	23:42	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	69.4% Q
12' East of Pit - During Excavation	0:16	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	78.8%
12' East of Pit - During Excavation	0:24	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	74.2%
Corner of J and Wright	0:34	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	80.8%
12' East of Pit - During Excavation	0:41	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	69.0% Q
12' East of Pit - During Excavation	0:49	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	66.7% Q
12' East of Pit - During Excavation	1:11	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	77.5%
IP# 4	1:23	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	77.3%
Corner of J and Wright	1:42	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	67.9%
OP# 5 - Admirals Quarters	1:50	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	70.0%
12' East of Pit - During Excavation	2:00	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	88.1%
12' East of Pit - During Excavation	2:08	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	92.9%
12' East of Pit - During Excavation	2:16	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	96.2%
North Edge of Pit - During Excavation	2:26	< 0.2	0.25	3.0	< 0.2	20	1.6	0.89	108%
OP# 5 - Admirals Quarters	2:35	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	105%
OP# 5 - Admirals Quarters	2:43	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	101%
IP# 5 - Direct Line with Admirals Quarters	2:51	< 0.2	< 0.2	< 0.2	< 0.2	0.37	< 0.2	< 0.2	98.9%
Corner of J and Wright	3:01	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	93.6%
12' East of Pit - No Excavation	3:29	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	101%
12' East of Pit - During Excavation	3:39	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	98.6%
12' East of Pit - During Backfill	3:54	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	109%
12' East of Pit - During Backfill	4:07	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	111%
OP# 5 - Admirals Quarters	4:37	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	93.0%
Corner of J and Wright	4:44	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	81.9%
12' East of Pit - During Backfill	5:06	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	89.3%
12' East of Pit - During Backfill	5:19	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	91.6%
12' East of Pit - During Backfill	5:30	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	98.8%
OP# 5 - Admirals Quarters	5:43	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	95.6%
Corner of J and Wright	5:51	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	95.4%
IP# 5 - Direct Line with Admirals Quarters	5:59	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	101%
12' East of Pit - During Backfill	6:36	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	99.4%
12' East of Pit - During Backfill	6:46	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	97.2%

Q = Outside Established Acceptance Limits of 70 - 130 %

IT - North Island

Hand Held Readings
Outer Perimeter

14-Dec-01 thru 15-Dec-01

OP# 1		OP# 2		OP# 3		OP# 4		OP# 5		OP# 6		OP# 7		OP# 8	
Time	Conc. (ppmv)	Time	Conc. (ppmv)	Time	Conc. (ppmv)	Time	Conc. (ppmv)	Time	Conc. (ppmv)	Time	Conc. (ppmv)	Time	Conc. (ppmv)	Time	Conc. (ppmv)
20:01	0.0	19:57	0.0	19:55	0.0	NA	NA	20:10	0.0	20:07	0.0	20:06	0.0	20:01	0.0
21:00	0.0	20:58	0.0	20:57	0.0	NA	NA	21:07	0.0	21:03	0.0	21:02	0.0	21:01	0.0
21:58	0.0	21:55	0.0	21:54	0.0	NA	NA	22:05	0.0	22:02	0.0	22:01	0.0	21:59	0.0
23:02	0.0	23:00	0.0	22:58	0.0	NA	NA	23:13	0.0	23:05	0.0	23:08	0.0	23:04	0.0
23:59	0.0	23:56	0.0	23:54	0.0	NA	NA	0:07	0.0	0:04	0.0	0:03	0.0	0:00	0.0
2:09	0.0	2:06	0.0	2:04	0.0	NA	NA	2:26	0.0	2:23	0.0	2:21	0.0	2:18	0.0
3:57	0.0	3:55	0.0	3:55	0.0	NA	NA	4:05	0.0	4:01	0.0	4:00	0.0	3:58	0.0
5:28	0.0	5:25	0.0	5:23	0.0	NA	NA	5:35	0.0	5:32	0.0	5:31	0.0	5:29	0.0

IT - North Island

Hand Held Readings
Inner Perimeter

14-Dec-01 thru 15-Dec-01

IP# 1		IP# 2		IP# 3		IP# 4		IP# 5		IP# 6		IP# 7		IP# 8	
Time	Conc. (ppmv)	Time	Conc. (ppmv)	Time	Conc. (ppmv)	Time	Conc. (ppmv)	Time	Conc. (ppmv)	Time	Conc. (ppmv)	Time	Conc. (ppmv)	Time	Conc. (ppmv)
20:00	0.0	19:58	0.0	19:54	0.0	20:11	0.0	20:09	0.0	20:08	0.0	20:05	0.0	20:02	0.0
21:00	0.0	20:59	0.0	20:57	0.0	21:08	0.0	21:06	0.0	21:05	0.0	21:02	0.0	21:01	0.0
21:57	0.0	21:56	0.0	21:53	0.0	22:07	0.0	22:04	0.0	22:03	0.0	22:00	0.0	21:59	0.0
23:01	0.0	23:00	0.0	22:56	0.0	23:15	0.0	23:12	0.0	23:07	0.0	23:06	0.0	23:05	0.0
23:58	0.0	23:57	0.0	23:53	0.0	0:09	0.0	0:06	0.0	0:05	0.0	0:02	0.0	0:01	0.0
2:08	0.0	2:07	0.0	2:04	0.0	2:27	0.0	2:24	0.0	2:24	0.0	2:20	0.0	2:19	0.0
3:56	0.0	3:56	0.0	3:54	0.0	4:00	0.0	4:03	0.0	4:06	0.0	3:59	0.0	3:59	0.0
5:27	0.0	5:26	0.0	5:22	0.0	5:36	0.0	5:34	0.0	5:33	0.0	5:30	0.0	5:30	0.0

E-2
Compaction Testing Report

KEANTAN
LABORATORIES

www.keantanlabs.com
email: keantanlab@aol.com

June 27, 2002

IT Corporation
P.O.Box 182137
Coronado, CA 92718

Attn: Brian White

Subject: **Final Compaction Report**
Naval Air Station North Island
San Diego, California
KTL Project No.: 01-057-003

Gentlemen:

Representatives of Keantan Laboratories visited the project site and performed compaction testing for backfill and trenches for the abovementioned site on 12/15/01 and 12/17/01.

The site was overexcavated to competent layer and recompacted to finish grade as specified in the grading and foundation plans.

Testing was performed in general accordance with testing procedures as follows:

TYPE OF TEST	TEST PROCEDURE
Modified Proctor	ASTM D 1557
In-place Density	ASTM D 1556

Compaction of fill for various backfill and trenches have been tested and certified to be at least 90% of maximum dry density determined using ASTM procedures described above and for base and asphalt at least 95%.

Compaction test results are presented in the attached Table 1. Test Nos. 1 through 4 represent compaction tests for recompacted backfill and Nos. 5 through 6 for base and 7 through 10 for pavement. (Also see attached daily reports)

We appreciate the opportunity to provide geotechnical services to IT Corporation. If you have any questions regarding our reports, please contact us at (714)535-7616.

Very truly yours,
Keantan Laboratories

Kean Tan, PE
Principal

KEAN TAN
50498
Exp 6/30/05

720 North Valley Street, Suite B, Anaheim, CA 92801 • Tel.: (714) 535-7616 • Fax: (714) 535-7568

KEANTAN LABORATORIES

www.keantanlabs.com
email: keantanlab@aol.com

TABLE NO. 1
COMPACTION TEST RESULTS

PROJECT NAME: Naval Air Station North Island

KTL NO.: 01-057-003

PROJECT NO.: 184759OP

CLIENT: IT Corporation

DATE: 6-27-02

SUMMARIZED BY: K. Tan

TEST NO.	DEPTH BELOW SURFACE (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	MAX .DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	PURPOSE OF FILL	REMARKS
1	2.5	14.6	96.6	104.5	92.5	RECOMPACT	PASS
2	2.5	13.9	96.3	104.5	92.2	RECOMPACT	PASS
3	6”	12.0	97.9	104.5	93.7	RECOMPACT	PASS
4	6”	14.8	96.5	104.5	92.4	RECOMPACT	PASS
5	base	5.0	129.2	133	97.2	BASE	PASS
6	base	5.8	128.7	133	96.8	BASE	PASS
7	asphalt	n/a	136.2	143	95.2	ASPHALT	PASS
8	asphalt	n/a	136.9	143	95.7	ASPHALT	PASS
9	asphalt	n/a	137.8	143	96.4	ASPHALT	PASS
10	asphalt	n/a	138.1	143	96.6	ASPHALT	PASS

E-3
Excavated Soil Waste Disposal Manifests

CTO-027 Manifest List and Bin Disposal Summary

Manifest # (993875_ _)	Bin Number	IT Bin #	Waste Type	DOT Description	Departure Date	Destination
32	4873	1	California	Non-RCRA hazarcous waste solid	03/01/02	Safety Kleen - Buttonwillow, CA
33	R18291ML	50	California	Non-RCRA hazarcous waste solid	03/01/02	Safety Kleen - Buttonwillow, CA
34	4961	2	California	Non-RCRA hazarcous waste solid	03/01/02	Safety Kleen - Buttonwillow, CA
35	89363	29	California	Non-RCRA hazarcous waste solid	03/01/02	Safety Kleen - Buttonwillow, CA
36	4938	3	California	Non-RCRA hazarcous waste solid	03/01/02	Safety Kleen - Buttonwillow, CA
37	5001	5	California	Non-RCRA hazarcous waste solid	03/02/02	Safety Kleen - Buttonwillow, CA
38	5321	12	California	Non-RCRA hazarcous waste solid	03/02/02	Safety Kleen - Buttonwillow, CA
39	3168	37	California	Non-RCRA hazarcous waste solid	03/02/02	Safety Kleen - Buttonwillow, CA
40	5060	4	California	Non-RCRA hazarcous waste solid	03/02/02	Safety Kleen - Buttonwillow, CA
41	89300	18	California	Non-RCRA hazarcous waste solid	03/02/02	Safety Kleen - Buttonwillow, CA
42	5034	36	California	Non-RCRA hazarcous waste solid	03/02/02	Safety Kleen - Buttonwillow, CA
43	89364	27	California	Non-RCRA hazarcous waste solid	03/04/02	Safety Kleen - Buttonwillow, CA
44	89360	6	California	Non-RCRA hazarcous waste solid	03/04/02	Safety Kleen - Buttonwillow, CA
California Hazardous Count:			13			
45	5320	8	RCRA Direct	Hazardous waste, solid, n.o.s. (tetrachloroethylene, trichloroethylene)	03/04/02	Safety Kleen - Buttonwillow, CA
46	89301	20	RCRA Direct	Hazardous waste, solid, n.o.s. (tetrachloroethylene, trichloroethylene	03/04/02	Safety Kleen - Buttonwillow, CA
RCRA Direct Count:			2			
47	5326	7	RCRA Stabilization	Hazardous waste, solid, n.o.s. (lead, cadmium, tetrachloroethylene)	03/04/02	Safety Kleen - Buttonwillow, CA
48	5331	26	RCRA Stabilization	Hazardous waste, solid, n.o.s. (lead, cadmium, tetrachloroethylene	03/04/02	Safety Kleen - Buttonwillow, CA
RCRA Stabilization Count:			2			
61	3165	21	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/19/02	Safety Kleen - Aragonite, UT
62	3163	33	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/19/02	Safety Kleen - Aragonite, UT
63	4996	41	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/19/02	Safety Kleen - Aragonite, UT
64	89302	19	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/19/02	Safety Kleen - Aragonite, UT
65	3140	34	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/20/02	Safety Kleen - Aragonite, UT
66	3167	22	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/20/02	Safety Kleen - Aragonite, UT
67	5037	35	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/20/02	Safety Kleen - Aragonite, UT
68	3164	23	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/20/02	Safety Kleen - Aragonite, UT
69	3166	24	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/20/02	Safety Kleen - Aragonite, UT
70	5042	32	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/21/02	Safety Kleen - Aragonite, UT
71	3162	25	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/21/02	Safety Kleen - Aragonite, UT
72	5074	30	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/21/02	Safety Kleen - Aragonite, UT
73	89306	28	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/21/02	Safety Kleen - Aragonite, UT
74	89305	31	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/21/02	Safety Kleen - Aragonite, UT
78	R1939ML	44	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/14/02	Safety Kleen - Aragonite, UT
79	4604	42	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/14/02	Safety Kleen - Aragonite, UT
80	4636	45	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/14/02	Safety Kleen - Aragonite, UT
81	5256	43	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/14/02	Safety Kleen - Aragonite, UT
82	3149	46	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/14/02	Safety Kleen - Aragonite, UT
83	R1808ML	38	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/19/02	Safety Kleen - Aragonite, UT
84	R1914ML	47	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/15/02	Safety Kleen - Aragonite, UT
85	R1882ML	39	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/15/02	Safety Kleen - Aragonite, UT
86	274787	48	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/15/02	Safety Kleen - Aragonite, UT
87	R1949ML	40	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/15/02	Safety Kleen - Aragonite, UT
88	89362	49	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/13/02	Safety Kleen - Aragonite, UT
89	5187	51	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/13/02	Safety Kleen - Aragonite, UT
90	5303	11	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/13/02	Safety Kleen - Aragonite, UT
91	5324	10	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/13/02	Safety Kleen - Aragonite, UT
92	5325	9	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/13/02	Safety Kleen - Aragonite, UT
93	89298	17	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/12/02	Safety Kleen - Aragonite, UT
94	5329	15	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/12/02	Safety Kleen - Aragonite, UT
95	89303	16	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/12/02	Safety Kleen - Aragonite, UT
96	5328	14	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead)	02/12/02	Safety Kleen - Aragonite, UT
97	89304	13	RCRA Incineration	Hazardous waste, solid, n.o.s. (trichloroethylene, perchloroethene, lead	02/12/02	Safety Kleen - Aragonite, UT
RCRA Incineration Count:			34			
	Total Bin Count:		51			

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

See Instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

99387532

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802: WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87532
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

GENERATOR

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone (619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number 99387532
B. State Generator's ID HAHQ36043249

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247
C. State Transporter's ID [Reserved]
D. Transporter's Phone (800) 458-3036

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID [Reserved]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Lokern)
2500 Lokern Road P.O. Box 787
Buttonwillow CA 93206
10. US EPA ID Number CAD980675276
G. State Facility's ID CAD980675276
H. Facility's Phone 805-762-7372

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
Non-RCRA hazardous waste solid	001	CM	00020	Y	State 611 EPA/Other
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile 4A124- IBDC - 03021 193/54
Soil contaminated with trace organics
Send photocopy of TSDF signed manifest, weight ticket, and certificate of disposal to
Steve Chandler, IT Corporation, 2347 Michelson Dr., Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 03
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
99 80710
Site pick up address:
NASNI, San Diego Site 5
IT #1 BIN 4873 C-193/54

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name	Signature	Month	Day	Year
DAVID L. BUERSTER		03	01	02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year
MARIO VELASQEZ	Mario Velasquez	03	01	02

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month	Day	Year
KEITH NOTO	Keith	03	04	02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
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See Instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

99387533

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87533
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

GENERATOR

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone ((619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number 99387533
B. State Generator's ID HAHQ36043249

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247

C. State Transporter's ID [Reserved]
D. Transporter's Phone (800) 458-3036

7. Transporter 2 Company Name
8. US EPA ID Number

E. State Transporter's ID [Reserved]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Lokern)
2500 Lokern Road P.O. Box 787
Buttonwillow CA 93206
10. US EPA ID Number CAD980675276

G. State Facility's ID CAD980675276
H. Facility's Phone 805-762-7372

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Non-RCRA hazardous waste solid	001	CM	06626	Y	State 611 EPA/Other NR
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
TM Profile# 35124 - EDC - 02021 99 90708
Soil contaminated with trace organics
Send photocopy of TSDF signed manifest, weight ticket, and certificate-of-disposal to Steve Calendar, IT Corporation, 3347 Michelson Dr., Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 03
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
Site pick up address: IT # 50 BIN R18291 ML
NASNI San Diego Site 5

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name	Signature	Month	Day	Year
DAVID L. BUERSTER		03	01	02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year
Ron King		03	01	02

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month	Day	Year
Keith Nobo	Keith Nob	02	04	02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
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Department of Toxic Substances Control
Sacramento, California

99387534

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016
Manifest Document No. 87534
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

GENERATOR

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone (619) 545-5520 Attn: Manifest Desk

A. State Manifest Document Number 99387534
B. State Generator's ID HAHQ36043149

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247
C. State Transporter's ID [Reserved]
D. Transporter's Phone (800) 458-3036

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID [Reserved]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Lokern)
2500 Lokern Road P.O. Box 787
Buttonwillow CA 93206
10. US EPA ID Number CAD980675276
G. State Facility's ID
H. Facility's Phone 805-762-7372

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Non-RCRA hazardous waste solid	001	CM	00070	Y	State 611 EPA/Other [illegible]
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
The Profile 25134-BXC-02621
Soil contaminated with trace organics
Send photocopy of TSDF signed manifest, weight ticket, and certificate of disposal to:
Steve Chandler, IT Corporation, 3347 Michelson Dr., Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
03

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling
Site pick up address: IT # 2 BIN # 4961
NASNI, San Diego Site 5

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name DAVID L. BUERSTER
Signature
Month 03 Day 01 Year 02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name MIKE FOUTCH
Signature
Month 03 Day 01 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name Keith Abbo
Signature
Month 03 Day 05 Year 02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
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Department of Toxic Substances Contro
Sacramento, California

9938 7535

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016
Manifest Document No. 87535
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street San Diego, CA 92136
Attn: Manifest Desk
4. Generator's Phone (619) 545-6526

A. State Manifest Document Number 9938753
B. State Generator's ID HAHQ36043249

5. Transporter 1 Company Name M.P. Environmental
6. US EPA ID Number CAT000624247

C. State Transporter's ID [Reserved]
D. Transporter's Phone (800) 458-30

7. Transporter 2 Company Name
8. US EPA ID Number

E. State Transporter's ID [Reserved]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Lokern)
2500 Lokern Road P.O. Box 787
Buttonwillow CA 93206
10. US EPA ID Number CAD980675276

G. State Facility's ID [illegible]
H. Facility's Phone 806-762-7372

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Non-RCRA hazardous waste solid	001	CM	00020	Y	State EPA/Other
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile# 25124 - BDC #22021
Soil contaminated with trace organics
Send photocopy of TSDF signed manifest, weight ticket, and certificate of disposal to:
Steve Chandler, IT Corporation, 3347 Michelson Dr., Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 03
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
Site pick up address: J7 # 29 B/N 89363 / N817524
NASNI, San Diego Site 5

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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GENERATOR

Printed/Typed Name	Signature	Month	Day	Year
DAVID L. BUESSTER		03	01	02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year
Tim Goldman		03	01	02

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month	Day	Year
Keith [illegible]		05	05	08

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
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Department of Toxic Substances Contr
Sacramento, California

99387536

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802: WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: CA7170090016
Manifest Document No.: 87536
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

A. State Manifest Document Number: 99387536
B. State Generator's ID: HAHQ36043249

3. Generator's Name and Mailing Address:
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone ( ) (619) 545-6520 Attn: Manifest Desk

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247
C. State Transporter's ID [Reserved.]
D. Transporter's Phone: (800) 458-3036

7. Transporter 2 Company Name:
8. US EPA ID Number:
E. State Transporter's ID [Reserved.]
F. Transporter's Phone:

9. Designated Facility Name and Site Address:
Safety Kleen (Lokern)
2500 Lokern Road P.O. Box 787
Buttonwillow,CA 93206
10. US EPA ID Number: CAD980675276
G. State Facility's ID: CAD980675276
H. Facility's Phone: 805-762-7372

GENERATOR

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Non-RCRA hazardous waste solid	001	CM	00070	Y	State 611 EPA/Other
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above [illegible] = 02021 9930709
Soil contaminated with trace organics
Send photocopy of TSDF signed manifest, weight ticket, and certificate of disposal to
Steve Chandler, IT Corporation, 3347 Michelson Dr., Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 03
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.

Site pick up address:
NASNI, San Diego Site 5 /IT Bin 4938

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name: DAVID L. BUERGER
Signature:
Month Day Year: 03 01 02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: [illegible] J. Webster
Signature: [illegible] J. Webster
Month Day Year: 03 01 02 ~~[illegible]~~

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature:
Month Day Year:

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: [illegible]
Signature:
Month Day Year: 03 04 02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
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See Instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

99387537

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87537
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone (619) 545-6620 Attn: Manifest Desk

A. State Manifest Document Number 99387537
B. State Generator's ID NAHQ36043246

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247
C. State Transporter's ID [Reserved]
D. Transporter's Phone (800) 458-3036

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID [Reserved]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Lokern)
2500 Lokern Road P.O. Box 787
Buttonwillow CA 93206
10. US EPA ID Number CAD980675276
G. State Facility's ID
H. Facility's Phone 805-762-7372

GENERATOR

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Non-RCRA hazardous waste solid	001	CM	00020	Y	State 611 EPA/Other NA
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile# 23124 - SDC - 0344 9980215
Soil contaminated with trace organics
Send photocopy of TSDF signed manifest, weight ticket, and certificate of disposal to
Steve Chandler, IT Corporation, 3347 Michelson Dr., Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. b.
c. d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling IT #5 Bin 5001
Site pick up address:
NASNI, San Diego, Site 5 ~~[illegible]~~ 2nd ~~[illegible]~~ C193701

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name DAVID L. BUERSTER
Signature
Month 03 Day 02 Year 02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name JOHN T. HALP
Signature John T. Alap
Month 03 Day 02 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name
Signature
Month 03 Day 04 Year 02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAIN

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

See Instructions on back of page 6.

Department of Toxic Substances Contro
Sacramento, California

99387538

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802: WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016
Manifest Document No. 87538
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

GENERATOR

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136

4. Generator's Phone (619) 546-6520 Attn: Manifest Desk

A. State Manifest Document Number 99387538
B. State Generator's ID HAHQ36043249

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247

C. State Transporter's ID [Reserved]
D. Transporter's Phone (800) 458-3036

7. Transporter 2 Company Name
8. US EPA ID Number

E. State Transporter's ID [Reserved]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Lokern)
2500 Lokern Road P.O Box 787
Buttonwillow CA 93206

10. US EPA ID Number CAD980675276

G. State Facility's ID [illegible]
H. Facility's Phone 805-762-7372

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Non-RCRA hazardous waste solid	001	CM	00020	Y	State 611 EPA/Other [illegible]
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
1a. Profile: 55124-DNC-0202 197054
Soil contaminated with trace organics
Send photocopy of TSDF signed manifest, weight ticket, and certificate of disposal to
Steve Chandler, IT Corporation, 3347 Michelson Dr., Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 04
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.

Site pick up address: 9980714 LOC 40 IT 4/12 BIN 5321
NASNI, San Diego Site 5

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name	Signature	Month	Day	Year
DAVID L. BUELSTER		03	02	02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year
[illegible] J. [illegible]		03	02	02

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month	Day	Year
MARIO A. [illegible]		05	04	02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

See Instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

99387539

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

GENERATOR

1. Generator's US EPA ID No.: CA7170090016
Manifest Document No.: 87539
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address: Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone (619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number: 99387539
B. State Generator's ID: HAHQ36011249

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247

C. State Transporter's ID [Reserved.]
D. Transporter's Phone (209) 458-3038

7. Transporter 2 Company Name:
8. US EPA ID Number:

E. State Transporter's ID [Reserved.]
F. Transporter's Phone

9. Designated Facility Name and Site Address: Safety Kleen (Lokern)
2500 Lokern Road P.O. Box 787
Buttonwillow CA 93206
10. US EPA ID Number: CAD980675276

G. State Facility's ID: [illegible]
H. Facility's Phone: 805 762-7372

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Non-RCRA hazardous waste solid	001	CM	00020	Y	State EPA/Other
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile# 35124 - BDC-1603
Soil contaminated with trace organics
Send photocopy of TSDF signed manifest, weight ticket, and certificate of disposal to:
Steve Chandler, IT Corporation, 3347 Michelson Dr., Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 03
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
WO# 008-164
Site pick up address: NASNI, San Diego, Site 5 IT# 37 Bin 3168

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name: David L. Buerstatte
Signature:
Month 03 Day 02 Year 02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Mike Foutch
Signature:
Month 03 Day 02 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature:
Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Keith Nobo
Signature: Keith Nobo
Month 03 Day 05 Year 02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

See Instructions on back of page 6.

Department of Toxic Substances Contr
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87540
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
Attn: Manifest Desk
4. Generator's Phone (619) 545-0520

A. State Manifest Document Number 99387540
B. State Generator's ID HAHQ36043249

5. Transporter 1 Company Name N.P. Environmental
6. US EPA ID Number CAT000624247
C. State Transporter's ID [Reserved]
D. Transporter's Phone (800) 458-3036

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID [Reserved]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Lokern)
2500 Lokern Road P.O. Box 737
Buttonwillow, CA 93206
10. US EPA ID Number CAD980675276
G. State Facility's ID CAD980675276
H. Facility's Phone 805-762-7372

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Non-RCRA hazardous waste solid	001	CM	00026	Y	State 611 EPA/Other [illegible]
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile# 25121-TDC-0202
Soil contaminated with trace organics
Send photocopy of TSDF signed manifest, weight ticket, and certificate of disposal to:
Steve Chandler, IT Corporation, 3347 Michelson Dr., Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 03
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
WO# [illegible]
Site pick up address: JT# 4 Bin ~~[illegible]~~ 5060 / N817521
NASNI, San Diego, Site 5

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name DAVID L. BUERSTER
Signature
Month 03 Day 02 Year 02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name Tim Golden
Signature
Month 03 Day 02 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name Keith Noble
Signature Keith N
Month 03 Day 05 Year 02

GENERATOR
TRANSPORTER
FACILITY

99387540
IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802: WITHIN CALIFORNIA, CALL 1-800-852-7550

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

See Instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

99387541
IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802: WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87541
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

GENERATOR

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone (619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number 99387541
B. State Generator's ID HAHQ36643249

5. Transporter 1 Company Name M.P. Environmental
6. US EPA ID Number CAT000624247
C. State Transporter's ID [Reserved]
D. Transporter's Phone (800) 452-3036

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID [Reserved]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Lokern)
2500 Lokern Road P.O. Box 787
Buttonwillow CA 93206
10. US EPA ID Number CAD980675276
G. State Facility's ID
H. Facility's Phone 805-762-7372

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Non-RCRA hazardous waste solid	001	CM	00K2K	Y	State EPA/Other
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile# 25124/-BDC-0362 C2007-3
Soil contaminated with trace organics
Send photocopy of TSDF signed manifest, weight ticket, and certificate of disposal to
Steve Chandler, IT Corporation, 3347 Michelson Dr., Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 03
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
W 998-705
Site pick up address:
NASNI, San Diego, Site 5 IT# 18 BIN 89300

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name	Signature	Month	Day	Year
DAVID L. BUERSTER		03	02	02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year
Mike Giulietti		03	02	02

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month	Day	Year
Keith Noble		03	05	02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

5.5

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

See Instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

9938754 2

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

GENERATOR

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87542
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone (619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number 9938754
B. State Generator's ID HAHQ36043249

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247
C. State Transporter's ID [Reserved]
D. Transporter's Phone (800) 458-303

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID [Reserved]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Lokern)
2500 Lokern Road P.O. Box 787
Buttonwillow CA 93206
10. US EPA ID Number CAD980675276
G. State Facility's ID CAD980675276
H. Facility's Phone 805-762-7372

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Non-RCRA hazardous waste solid	001	CM	00120	Y	State EPA/Other
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
ITS Profile #5134 1SDC - 0202
Soil contaminated with trace organics
Send photocopy of TSDF signed manifest, weight ticket, and certificate of disposal to
Steve Chandler, IT Corporation, 3347 Michelson Dr., Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 03
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling
WO# (998-765)

Site pick up address:
NASNI, San Diego Site 5 IT #36 Bin 5034

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name David L. Buerster
Signature
Month 03 Day 02 Year 02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name Roy Alan King
Signature
Month 03 Day 02 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name Keith Noble
Signature Keith
Month 03 Day 05 Year 02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

See Instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

9938754 3

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

GENERATOR

1. Generator's US EPA ID No. CA717009001 8
Manifest Document No. 87543
2. Page 1 of 1
Information in the shaded areas is not required by Federal law. ← 99387543

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone (619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number 993875
B. State Generator's ID HAHQ31004124
C. State Transporter's ID [Reserved]
D. Transporter's Phone (800) 458

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247

E. State Transporter's ID [Reserved]
F. Transporter's Phone

7. Transporter 2 Company Name
8. US EPA ID Number

G. State Facility's ID [illegible]
H. Facility's Phone 805-762-737

9. Designated Facility Name and Site Address
Safety Kleen (Lokern)
2500 Lokern Road P.O. Box 787
Buttonwillow CA 93206
10. US EPA ID Number CAD980675276

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Non-RCRA hazardous waste solid	001	CM	00026	Y	State EPA/Other
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
1a. Profile# 575121-BDC-~~0908~~ 9980712
Soil contaminated with trace organics
Send photocopy of TSDF signed manifest, weight ticket, and certificate of disposal to
Steve Chandler, IT Corporation, 3347 Michelson Dr., Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 03
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
Site pick up address:
NASNI San Diego Site 5 IT# 27 BIN 89364 (L-19355

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name DAVID L. BUERSTER
Signature
Month 03 Day 04 Year 02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name MARIO VELASQUEZ
Signature Mario
Month 03 Day 04 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name Keith Noble
Signature
Month 03 Day 06 Year 02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

See Instructions on back of page 6.

Department of Toxic Substances Contr
Sacramento, California

99387544

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87544
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

A. State Manifest Document Number 99387544

B. State Generator's ID HAHQ16043249

C. State Transporter's ID [Reserved]

D. Transporter's Phone (800) 456-3038

E. State Transporter's ID [Reserved]

F. Transporter's Phone

G. State Facility's ID [illegible]

H. Facility's Phone 805-762-7372

GENERATOR

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136

4. Generator's Phone (619) 545-6520 Attn: Manifest Desk

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247

7. Transporter 2 Company Name
8. US EPA ID Number

9. Designated Facility Name and Site Address
Safety Kleen (Lokern)
2500 Lokern Road P.O. Box 787
Buttonwillow CA 93206

10. US EPA ID Number CAD980675276

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Non-RCRA hazardous waste solid	001	CM	00020	Y	State 611 EPA/Other
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
The Profile# 25134-13DC-0202 ~ 20354-01
Soil contaminated with trace organics 9980711
Send photocopy of TSDF signed manifest, weight ticket, and certificate of disposal to
Steve Chandler, IT Corporation, 3347 Michelson Dr., Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 03
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.

Site pick up address: IT # 6 BIN 89360
NASNI, San Diego, Site 5

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name	Signature	Month	Day	Year
DAVID L. BUERSTER		03	04	02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year
Mike Guliett	Mike Guliett	03	04	02

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month	Day	Year
Keith Noke		03	04	02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

See Instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

99387545

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87545
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

A. State Manifest Document Number 99387545

B. State Generator's ID HAR0380043240

C. State Transporter's ID [Reserved.]

D. Transporter's Phone (800) 488-2038

E. State Transporter's ID [Reserved.]

F. Transporter's Phone

G. State Facility's ID [illegible]

H. Facility's Phone 805-762-7372

GENERATOR

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
Attn: Manifest Desk

4. Generator's Phone (619) 545-8520

5. Transporter 1 Company Name M P Environmental

6. US EPA ID Number CAT000624247

7. Transporter 2 Company Name

8. US EPA ID Number

9. Designated Facility Name and Site Address
Safety Kleen (Lokern)
2500 Lokern Road P.O. Box 787
Buttonwillow CA 93206

10. US EPA ID Number CAD980675276

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (tetrachloroethylene, trichloroethylene), 9 NA3077, III	001	CM	00020	~~P~~ Y	State 611 EPA/Other D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile # 25191 - BDK - OWL2
soil contaminated with lead, tetrachloroethylene, trichloroethylene
Fax copy of TSDF signed manifest to: Steve Chandler, IT Corporation at fax number (949) 474-8309 948 0741 VOC 30

K. Handling Codes for Wastes Listed Above
a. 03
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924
Site pick up address: NASNI, Coronado, San Diego, CA Site 5 IT # 7 B10 5320

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name DAVID L. BUERSTER
Signature
Month 03 Day 04 Year 02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name Michael J. Worsham
Signature
Month 03 Day 04 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name Keith Noble
Signature Keith Noble
Month 03 Day 04 Year 02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

See Instructions on back of page 6.

618

Department of Toxic Substances Control
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87546
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone (619) 545-6620 Attn: Manifest Desk

A. State Manifest Document Number 993875
B. State Generator's ID HAHQ38043249

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247
C. State Transporter's ID [Reserved]
D. Transporter's Phone (800) 468-30

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID [Reserved]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Lokern)
2500 Lokern Road P.O. Box 787
Buttonwillow,CA 93206
10. US EPA ID Number CAD980675276
G. State Facility's ID CAD980675276
H. Facility's Phone 805-762-7377

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (tetrachloroethylene, trichloroethylene), 9 NA3077, III	001	CM	00020	~~P~~ Y Rm	State EPA/Other D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile # J5181 - 002-0262
soil contaminated with lead, tetrachloroethylene, trichloroethylene
Fax copy of TSDF signed manifest to: Steve Chandler IT Corporation at fax number (949) 474-8309 998079 0 VOC 50

K. Handling Codes for Wastes Listed Above
a. 03
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924
C219116
Site pick up address:
NASNI, Coronado, San Diego, CA Site 5 IT # 20 BIN 89301

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name DAVID L. BUENSTER Signature Month 03 Day 04 Year 02

GENERATOR

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name RANDY MATHEWS Signature Randy Mathews Month 03 Day 04 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name Signature Month Day Year

TRANSPORTER

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name Keith [illegible] Signature Month 03 Day 05 Year 02

FACILITY

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

99387546

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

515

See Instructions on back of page 6.

Department of Toxic Substances Contr
Sacramento, California

9938 7547

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

GENERATOR

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: CA7170090016
Manifest Document No.: 87547
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

A. State Manifest Document Number: 993875[illegible]

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
Attn: Manifest Desk

4. Generator's Phone (619) 545-6520

B. State Generator's ID: HAHQ36043249

C. State Transporter's ID [Reserved]

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247

D. Transporter's Phone: (800) 458-302[illegible]

7. Transporter 2 Company Name:
8. US EPA ID Number:

E. State Transporter's ID [Reserved]

F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Lokern)
2500 Lokern Road P.O. Box 787
Buttonwillow, CA 93206

10. US EPA ID Number: CAD980675276

G. State Facility's ID: [illegible]

H. Facility's Phone: 805-762-7372

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (lead, cadmium, tetrachloroethylene), 9, NA3077, III	601	CM	00020	Y P	State EPA/Other D008 D039
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile # 05133 - BTK - 0803
soil contaminated with cadmium, lead, chlorinated organics
Fax copy of TSDF signed manifest to Steve Chandler, IT Corporation at fax number (949) 474-5309
949 2079 3 VOC 35

K. Handling Codes for Wastes Listed Above
a. 15/03
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handing.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924
Site pick up address:
NASNI, Coronado, San Diego, CA Site 5 IT # 7 Bin 5326

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name	Signature	Month	Day	Year
David L. Buerster		03	04	02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year
Garry D. Howard	Garry D. Howard	03	04	02

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month	Day	Year
Keith Noble	Keith Noble	03	04	02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

See Instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

99387548

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016
Manifest Document No. 87548
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

A. State Manifest Document Number 9938754

B. State Generator's ID HAHQ380043249

C. State Transporter's ID [Reserved.]

D. Transporter's Phone (800) 458-303

E. State Transporter's ID [Reserved.]

F. Transporter's Phone

G. State Facility's ID CAD980675276

H. Facility's Phone 805-762-7372

GENERATOR

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136

4. Generator's Phone (619) 545-6520 Attn: Manifest Desk

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247

7. Transporter 2 Company Name
8. US EPA ID Number

9. Designated Facility Name and Site Address
Safety Kleen (Lokern)
2500 Lokern Road P.O. Box 787
Buttonwillow,CA 93206

10. US EPA ID Number CAD980675276

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (lead, cadmium, tetrachloroethylene), 9, NA3077, III	001	CM	00020	~~Y~~ R	State EPA/Other D008 D03
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
IT
ITM. Profile # 25189-BAA-C2C2
Soil contaminated with cadmium, lead, chlorinated organics
Fax copy of TSDF signed manifest to Steve Chevalier, IT Corporation at fax number (949) 474-8309
(4480796) VOC 35

K. Handling Codes for Wastes Listed Above
a. 15-03
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handing. < MOA C201238 >
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924
Site pick up address:
NASNI, Coronado, San Diego, CA Site 5 IT# 26 Bin 5331

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name DAVID L. BUERSTER
Signature
Month 03 Day 04 Year 02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name Gary Moore
Signature Gary Moore
Month 03 Day 04 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name Keith NORD
Signature Keith Nord
Month 03 Day 04 Year

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

L1033

See Instructions on back of page 6.

1051

Department of Toxic Substances Control
Sacramento, California

02/02

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87561
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone ((619) 545-8520 Attn: Manifest Desk

A. State Manifest Document Number 99387561
B. State Generator's ID HAHQ36043249

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247
C. State Transporter's ID [Reserved]
D. Transporter's Phone (800) 458-3036

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID [Reserved]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite,UT 84029
10. US EPA ID Number UTD981552177
G. State Facility's ID
H. Facility's Phone (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00026	Y	State 181 EPA/Other D008 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
[illegible] soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr., Suite 200, Irvine, CA 92612
[illegible]

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 **ERG #171**
Site pick up address:
NAS North Island Site 5

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name agt David L. Buerster
Signature
Month Day Year 02 19 02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name Allen Coger
Signature
Month Day Year 02 19 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

0010
6910

19. Discrepancy Indication Space

6908

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name Carrie Thomas
Signature Carrie Thomas
Month Day Year 02 20 02

GENERATOR
TRANSPORTER
FACILITY

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

99387561

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

L1031

See Instructions on back of page 6.

10649

Department of Toxic Substances Control
Sacramento, California

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

99387562

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016
Manifest Document No. 87562
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone ((619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number 99387562
B. State Generator's ID HAHQ36043149

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247
C. State Transporter's ID [Reserved.]
D. Transporter's Phone (800) 458-3036

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID [Reserved.]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite,UT 84029
10. US EPA ID Number UTD981552177
G. State Facility's ID
H. Facility's Phone (801) 323-8190

GENERATOR

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00024	Y	State 181 EPA/Other D008 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
[illegible] soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr., Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island Site 5 IT# 33 Bin# 3163

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name DAVID L. BIERSTER
Signature
Month 02 Day 19 Year 02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name Tim Golden
Signature
Month 02 Day 19 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name Carrie Thomas
Signature Carrie Thomas
Month 02 Day 20 Year 02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

L1035

See Instructions on back of page 6.

10683

212

Department of [illegible] Substances Control
Sacramento, California

99387563

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: CA7170090016
Manifest Document No.: 87563
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address:
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone: (619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number: 99387563
B. State Generator's ID: [illegible]

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247
C. State Transporter's ID [Reserved.]
D. Transporter's Phone: (800) 458-3036

7. Transporter 2 Company Name:
8. US EPA ID Number:
E. State Transporter's ID [Reserved.]
F. Transporter's Phone:

9. Designated Facility Name and Site Address:
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite,UT 84029
10. US EPA ID Number: UTD981552177
G. State Facility's ID:
H. Facility's Phone: (801) 323-8100

GENERATOR

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00020	Y	State: 181 EPA/Other: D008 D006 [illegible] D039 D040
b.					EPA/Other:
c.					State: EPA/Other:
d.					State: EPA/Other:

J. Additional Descriptions for Materials Listed Above
11a. Profile #AP2401477, soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr.
Suite 200, Irvine, CA 92612
J # 41 BIN 4996 C201910

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island Site 5

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name: DAVID L. BUERSTER
Signature:
Month Day Year: 02 19 02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: RANDY MATTHEWS
Signature: Randy Matthews
Month Day Year: 02 19 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature:
Month Day Year:

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Carrie Thomas
Signature: Carrie Thomas
Month Day Year: 02 21 02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

W034 **See Instructions on back of page 6.** 10562 0402

Department of Toxic Substances Control
Sacramento, California

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

99387564

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA717009001 6
Manifest Document No. 87564
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

GENERATOR

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone (619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number 99387564
B. State Generator's ID HAHQ36943249

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247
C. State Transporter's ID [Reserved.]
D. Transporter's Phone (800) 455-3036

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID [Reserved.]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite,UT 84029
10. US EPA ID Number UTD981552177
G. State Facility's ID
H. Facility's Phone (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00020	Y	State 181 EPA/Other D008 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above [illegible]minated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr Suite 200, Irvine, CA 92612
JTL 19 CN 99562

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island Site 5

16. **GENERATOR'S CERTIFICATION:** "I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name DAVID L. BUERSTER
Signature
Month 02 Day 19 Year 02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name Gary D. Howard
Signature Gary D. Howard
Month 02 Day 19 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature 6010
Month Day Year

FACILITY

19. Discrepancy Indication Space
6710
6908

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name Carrie Thomas
Signature Carrie Thomas
Month 02 Day 20 Year 02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

L1039

See Instructions on back of page 6.

10656

Department of Toxic Substances Control
Sacramento, California

02/02

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: CA7170090016
Manifest Document No.: 87565

2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

A. State Manifest Document Number: 93387565

3. Generator's Name and Mailing Address:
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
Attn: Manifest Desk

4. Generator's Phone: (619) 545-8520

B. State Generator's ID: MAH016604324d

5. Transporter 1 Company Name: M P Environmental

6. US EPA ID Number: CAT000624247

C. State Transporter's ID [Reserved.]

D. Transporter's Phone: (800) 458-3036

7. Transporter 2 Company Name:

8. US EPA ID Number:

E. State Transporter's ID [Reserved.]

F. Transporter's Phone:

9. Designated Facility Name and Site Address:
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite UT 84029

10. US EPA ID Number: UTD981552177

G. State Facility's ID:

H. Facility's Phone: (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00026	Y	State 611 EPA/Other D008 D009 D028 D039 D04
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
I.e. Profile BAF2401477 soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr. Suite 200, Irvine, CA 92612.
JT # 34 BW 3146

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924
ERG #171
Site pick up address:
NAS North Island Site 5

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Printed/Typed Name: DAVID L. BUERSTER
Signature:
Month/Day/Year: 02 20 02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: GARY HILL
Signature: Gary Hill
Month/Day/Year: 02 21 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature: 600
Month/Day/Year:

19. Discrepancy Indication Space
6910
6905

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Carrie Thomas
Signature: Carrie Thomas
Month/Day/Year: 02 21 02

GENERATOR
TRANSPORTER
FACILITY

99387565
IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802: WITHIN CALIFORNIA, CALL 1-800-852-7550

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

L9038

See Instructions on back of page 6.

10655 02/02

Department of Toxic Substances Control
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: CA7170090016
Manifest Document No.: 87566
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136

4. Generator's Phone ((619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number: 99387566
B. State Generator's ID: HAHQ36043249

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247

C. State Transporter's ID [Reserved.]
D. Transporter's Phone: (800) 458-3036

7. Transporter 2 Company Name:
8. US EPA ID Number:

E. State Transporter's ID [Reserved.]
F. Transporter's Phone:

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite UT 84029

10. US EPA ID Number: UTD981552177

G. State Facility's ID:
H. Facility's Phone: (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	011	CM	00026	Y	State 181 EPA/Other D008 [illegible] D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
[illegible] soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr., Suite 200, Irvine, CA 92612
IT# 23 DIV 3117

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island Site 5

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name: David L. Buerster
Signature:
Month Day Year: 02 20 02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Lewis Hedges
Signature: Lewis Hedges
Month Day Year: 02 20 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature:
Month Day Year:

6010
6710
6908

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Carrie Thomas
Signature: Carrie Thomas
Month Day Year: 02 21 02

GENERATOR
TRANSPORTER
FACILITY

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

99387566

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
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See Instructions on back of page 6. 10654 02102

Department of Toxic Substances Control
Sacramento, California

99387567

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802: WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

GENERATOR

1. Generator's US EPA ID No.: CA7170090016
Manifest Document No.: 87567
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address 20
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
Attn: Manifest Desk

4. Generator's Phone (619) 545-6520

A. State Manifest Document Number 99387567

B. State Generator's ID [illegible]

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247

C. State Transporter's ID [Reserved.]

D. Transporter's Phone [illegible]

7. Transporter 2 Company Name:
8. US EPA ID Number:

E. State Transporter's ID [Reserved.]

F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite UT 84029

10. US EPA ID Number: UTD981552177

G. State Facility's ID

H. Facility's Phone (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	000026	Y	State: [illegible] EPA/Other: D008 [illegible] D028 D039 D040
b.					State: EPA/Other:
c.					State: EPA/Other:
d.					State: EPA/Other:

J. Additional Descriptions for Materials Listed Above
11a. Profile #AP[illegible], soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr., Suite 200, Irvine, CA 92612
TT#35 BW 5037

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island Site 5

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name: DAVID L. BUSEKER
Signature:
Month Day Year: 02 20 02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Greg Rubio S
Signature: VNO
Month Day Year: 02 20 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature: VNO
Month Day Year:

FACILITY

19. Discrepancy Indication Space
VNOT

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Carrie Thomas
Signature: Carrie Thomas
Month Day Year: 02 21 02

DO NOT WRITE BELOW THIS LINE.

5037

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

L1041 **See Instructions on back of page 6.** 10658

Department of Toxic Substances Control
Sacramento, California

02/02

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87568
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136

4. Generator's Phone (619) 545-6520 Attn: Manifest Desk

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247

7. Transporter 2 Company Name
8. US EPA ID Number

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite, UT 84029

10. US EPA ID Number UTD981552177

A. State Manifest Document Number 99387568
B. State Generator's ID HAHQ38043749
C. State Transporter's ID [Reserved.]
D. Transporter's Phone (800) 458-3036
E. State Transporter's ID [Reserved.]
F. Transporter's Phone
G. State Facility's ID
H. Facility's Phone (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00020	Y	State 181 EPA/Other D008 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
[illegible] soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr.
Suite 200, Irvine, CA 92612
J7#23 B/N 3164

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island Site 5
MP#200661

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name	Signature	Month	Day	Year
David L. Buberstine		02	20	02

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year
Steve Tison	Steve Tison	02	20	02

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month	Day	Year
Carrie Thomas	Carrie Thomas	02	21	02

DO NOT WRITE BELOW THIS LINE.

GENERATOR
TRANSPORTER
FACILITY

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802: WITHIN CALIFORNIA, CALL 1-800-852-7550

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.* LDL1040

See Instructions on back of page 6. 8466 3161 02/02
10657

Department of Toxic Substances Control
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: CA7170090016
Manifest Document No.: 87569
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address:
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
Attn: Manifest Desk

4. Generator's Phone: (619) 545-6520

A. State Manifest Document Number: 99387569

B. State Generator's ID: [illegible]

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247
C. State Transporter's ID [Reserved.]
D. Transporter's Phone: (800) 458-3036

7. Transporter 2 Company Name:
8. US EPA ID Number:
E. State Transporter's ID [Reserved.]
F. Transporter's Phone:

9. Designated Facility Name and Site Address:
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite, UT 84029

S/K Aptus

10. US EPA ID Number: UTD981552177
G. State Facility's ID:
H. Facility's Phone: (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	06620	Y	State: 181 EPA/Other: D008 D006 D028 D039 D040
b. 2-20					State: EPA/Other:
c. 930					State: EPA/Other:
d.					State: EPA/Other:

2-21 334

J. Additional Descriptions for Materials Listed Above:
11a. Profile RAP 2401477, soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr., Suite 300, Irvine, CA 92612.
I.T.# 24 BIN 3161

K. Handling Codes for Wastes Listed Above:
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information:
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island, Site 5

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Printed/Typed Name: David L. Buerster
Signature:
Month/Day/Year: 02 20 02

GENERATOR

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Quince Horn
Signature: Quince Horn
Month/Day/Year: 02 22 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature:
Month/Day/Year:

TRANSPORTER

19. Discrepancy Indication Space

6010
6010
6908

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Carrie Thomas
Signature: Carrie Thomas
Month/Day/Year: 02 21 02

FACILITY

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802: WITHIN CALIFORNIA, CALL 1-800-852-7550

99387569

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

5042 LD968

See Instructions on back of page 6.

10682

Department of Toxic Substances Control
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87570

2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136

4. Generator's Phone ( ) (619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number 99387570

B. State Generator's ID HAHQ36043349

5. Transporter 1 Company Name M P Environmental

6. US EPA ID Number CAT000624247

C. State Transporter's ID [Reserved.]

D. Transporter's Phone (800) 458-3036

7. Transporter 2 Company Name

8. US EPA ID Number

E. State Transporter's ID [Reserved.]

F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite UT 84029

10. US EPA ID Number UTD981552177

G. State Facility's ID

H. Facility's Phone (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00020	Y	State 181 EPA/Other D008 D006 D028 D039 D04
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
[illegible] soil contaminated with chlorinated organics and metals
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr
Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island Site 5 IT# 32 B1U5042

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name DAVID L. BREWSTER Signature Month 02 Day 21 Year 02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name GARY D. HOWARD Signature Gary D. Howard Month 02 Day 21 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name Signature Month Day Year

6910

19. Discrepancy Indication Space

6903

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name Glenna Lawrence Signature Month 03 Day 22 Year 02

DO NOT WRITE BELOW THIS LINE.

GENERATOR
TRANSPORTER
FACILITY

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

99387570

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

3162 L1103

See Instructions on back of page 6.

10045 2/02

Department of Toxic Substances Control
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016
Manifest Document No. 87571
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone (619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number 99387571

B. State Generator's ID HAH010041149

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247

C. State Transporter's ID [Reserved.]

D. Transporter's Phone (800) 458-3036

7. Transporter 2 Company Name
8. US EPA ID Number

E. State Transporter's ID [Reserved.]

F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite,UT 84029
10. US EPA ID Number: UTD981552177

G. State Facility's ID

H. Facility's Phone (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00020	Y	State 181 EPA/Other D008 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
1 lb. Profile #AP2401477, soil contaminated with chlorinated organics and metals. Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island Site 5 77th 25 Bin 3162 {MP# C201301}

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name: David L. Buelster
Signature:
Month 02 Day 21 Year 02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Greg Moore
Signature: Greg Moore
Month 02 Day 21 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

19. Discrepancy Indication Space
6710
6908

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Glenna Lawrence
Signature:
Month 02 Day 22 Year 02

GENERATOR

TRANSPORTER

FACILITY

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802: WITHIN CALIFORNIA, CALL 1-800-852-7550

99387571

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

5074 L 1104

See Instructions on back of page 6.

10641 D218

Department of Toxic Substances Control
Sacramento, California

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

99387572

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87572
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

GENERATOR

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136

4. Generator's Phone (619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number 99387572

B. State Generator's ID HAHQ16043249

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247

C. State Transporter's ID [Reserved.]

D. Transporter's Phone (800) 458-3036

7. Transporter 2 Company Name
8. US EPA ID Number

E. State Transporter's ID [Reserved.]

F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite UT 84029

10. US EPA ID Number UTD981552177

G. State Facility's ID

H. Facility's Phone (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00020	Y	State 181 EPA/Other D008 D006 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile #AP24-1877, soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr., Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island Site 5 J7# 30 BIN 5074 C201911

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name DAVID L. BUERSTER Signature Month 02 Day 21 Year 02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name RANDY MATHEWS Signature Randy Mathews Month 02 Day 21 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name Signature Month Day Year

FACILITY

19. Discrepancy Indication Space

6910

6908

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name Glenna Lawrence Signature Month 02 Day 23 Year 02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

L 1105

See Instructions on back of page 6.

02/03

Department of Toxic Substances Control
Sacramento, California

99387573

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

GENERATOR

1. Generator's US EPA ID No. CA7170090016
Manifest Document No. 87573
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
Attn: Manifest Desk
4. Generator's Phone (619) 545-6520

A. State Manifest Document Number 99387573
B. State Generator's ID [illegible]

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247
C. State Transporter's ID [Reserved]
D. Transporter's Phone [illegible]

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID [Reserved]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite UT 84029
10. US EPA ID Number UTD981552177
G. State Facility's ID
H. Facility's Phone (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00020	Y	State 181 EPA/Other D008 D006 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile #AP2401477, soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr, Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a.
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island Site 5 7th ST Bin 79306

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name David L. Buechter
Signature
Month 02 Day 21 Year 02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name Troy Alan King
Signature
Month 02 Day 21 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name
Signature
Month Day Year

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
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85305 L0967

See Instructions on back of page 6.

10094/02

Department of Toxic Substances Control
Sacramento, California

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: CA7170090016
Manifest Document No.: 87574
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone ( ) (619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number: 99387574
B. State Generator's ID: HAHQ31101214 9

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247
C. State Transporter's ID [Reserved.]
D. Transporter's Phone: (800) 458-3036

7. Transporter 2 Company Name:
8. US EPA ID Number:
E. State Transporter's ID [Reserved.]
F. Transporter's Phone:

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite UT 84029
10. US EPA ID Number: UTD981552177
G. State Facility's ID:
H. Facility's Phone: (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	004	CM	00020	Y	State 181 EPA/Other D008 D006 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile #AP2401477, soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr.,
Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 **ERG #171**
Site pick up address: NAS North Island Site 5 JT # 31 BIN 87305

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name: DAVID L. BUERSTER
Signature:
Month Day Year: 02 21 02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: DAVID E. RUSHOFSKY
Signature: David E Rushofsky
Month Day Year: 02 21 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature: 1110
Month Day Year:

19. Discrepancy Indication Space
1405

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Jenna Lawrence
Signature:
Month Day Year: 02 22 02

GENERATOR
TRANSPORTER
FACILITY

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

[illegible] L09[illegible]58

See instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

[illegible]

99387578

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

GENERATOR

1. Generator's US EPA ID No.: CA7170090016
Manifest Document No.: 87578
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone ( ) (619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number 99387578
B. State Generator's ID HAHQ36043349

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247
C. State Transporter's ID [Reserved.]
D. Transporter's Phone (800) 452-3036

7. Transporter 2 Company Name:
8. US EPA ID Number:
E. State Transporter's ID [Reserved.]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite UT 84029
10. US EPA ID Number: UTD981552177
G. State Facility's ID
H. Facility's Phone (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00020	Y	State 181 EPA/Other 0008 0028 0039 0040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
[illegible] contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr. Suite 200, Irvine, CA 92612
IT# 44 [illegible]

K. Handling Codes for Wastes Listed Above
a. 01
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island Site 5
MP# 200659

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name	Signature	Month	Day	Year
David L. Buerster		02	14	02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year
Steve Tison	Steve Tison	02	14	02

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

FACILITY

19. Discrepancy Indication Space
1010

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month	Day	Year
Glenna Lawrence		02	15	02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

10930

See Instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA717000900016 — Manifest Document No. 87579
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego , CA 92136
4. Generator's Phone ((619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number 99387579
B. State Generator's ID HAHQ11143249

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247
C. State Transporter's ID [Reserved.]
D. Transporter's Phone (909) 458-3036

7. Transporter 2 Company Name:
8. US EPA ID Number:
E. State Transporter's ID [Reserved.]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite,UT 84029
10. US EPA ID Number: UTD981552177
G. State Facility's ID
H. Facility's Phone (801) 323-8100

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00060	Y	State 181 EPA/Other D008 D008
b.					State D028 D039 D040 EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile BAP2401577, soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr.
Suite 200, Irvine, CA 92612
77 # 40 Bw 11604

K. Handling Codes for Wastes Listed Above
a. 01
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island Site 5

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Printed/Typed Name: David L. Buerstner — Signature: — Month Day Year: 02 14 02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Darrell Jacobson — Signature: — Month Day Year: 02 14 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name: — Signature: — Month Day Year:

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Glenna Lawrence — Signature: — Month Day Year: 02 15 02

DO NOT WRITE BELOW THIS LINE.

GENERATOR — TRANSPORTER — FACILITY

99387579

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

L0937

See Instructions on back of page 6.

02/26/02

Department of Toxic Substances Control
Sacramento, California

99337580

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

GENERATOR

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87580
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
Attn: Manifest Desk

4. Generator's Phone (619) 545-6520

A. State Manifest Document Number 99337580

B. State Generator's ID IHAHQBBDEBPAB

5. Transporter 1 Company Name M P Environmental

6. US EPA ID Number CAT000624247

C. State Transporter's ID [Reserved.]

D. Transporter's Phone (800) 458-3036

7. Transporter 2 Company Name

8. US EPA ID Number

E. State Transporter's ID [Reserved.]

F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite UT 84029

10. US EPA ID Number UTD981552177

G. State Facility's ID

H. Facility's Phone (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00030	Y	State 181 EPA/Other D008 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile #AP2401477, soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr Suite 200, Irvine, CA 92612
T# 45 D. #1636

K. Handling Codes for Wastes Listed Above
a. 01
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island Site 5

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name DAVID L. BUERSTER
Signature
Month 02 Day 14 Year 02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name Allen Coger
Signature
Month 02 Day 14 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name Glenna Lawrence
Signature
Month 02 Day 15 Year 02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

5930 L0924

See Instructions on back of page 6.

02/02-34

Department of Toxic Substances Control
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87581
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
Attn: Manifest Desk
4. Generator's Phone (619) 545-8520

A. State Manifest Document Number 99387581
B. State Generator's ID [illegible]
C. State Transporter's ID [Reserved]
D. Transporter's Phone (800) 458-3036
E. State Transporter's ID [Reserved]
F. Transporter's Phone
G. State Facility's ID
H. Facility's Phone (801) 323-8100

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247
7. Transporter 2 Company Name
8. US EPA ID Number

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite UT 84029
10. US EPA ID Number UTD981552177

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00020	Y	State 181 EPA/Other D008 D006 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile #AP2401477, soil contaminated with chlorinated organics and metals
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr., Suite 200, Irvine, CA 92612
7 x 4 16 [illegible]

K. Handling Codes for Wastes Listed Above
a.
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island, Site 5

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name 993 David L. Burrester
Signature
Month 02 Day 14 Year 02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name Albert G. Lowe
Signature Albert G. Lowe
Month 02 Day 14 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name
Signature
Month Day Year

GENERATOR

TRANSPORTER

FACILITY

9938 7581

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802. WITHIN CALIFORNIA, CALL 1-800-852-7550

DO NOT WRITE BELOW THIS LINE.

6710
6902

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

4/13 L0935

See Instructions on back of page 6.

02/02/1005

Department of Toxic Substances Control
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: CA7170090016
Manifest Document No.: 87582
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address:
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136

4. Generator's Phone (619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number: 99387582
B. State Generator's ID: HAHQ36043249

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247

C. State Transporter's ID [Reserved.]
D. Transporter's Phone: (800) 458-3036

7. Transporter 2 Company Name:
8. US EPA ID Number:

E. State Transporter's ID [Reserved.]
F. Transporter's Phone:

9. Designated Facility Name and Site Address:
Safety Kleen (Aragonite), Inc.
11600 North Aplus Road
Aragonite, UT 84029

10. US EPA ID Number: UTD981552177

G. State Facility's ID:
H. Facility's Phone: (801) 323-5100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00030	Y	State 611 EPA/Other D008 D006 D028 D039 D04
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
[illegible] Soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr.,
Suite 200, Irvine, CA 92612
ST # 16 B.K. 3119

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG # 171
Site pick up address:
NAS North Island Site 5 N817514

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name: David L. Buerster
Signature:
Month Day Year: 02 14 02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Tim Golden
Signature:
Month Day Year: 02 14 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature:
Month Day Year:

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Sienna Lawrence
Signature:
Month Day Year: 02 15 02

GENERATOR
TRANSPORTER
FACILITY

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

99387582

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

L1032

See Instructions on back of page 6.

0202
101501

Department of Toxic Substances Control
Sacramento, California

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

99387583

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: CA7170090016
Manifest Document No.: 87583
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address:
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
Attn: Manifest Desk
4. Generator's Phone: (619) 545-6520

A. State Manifest Document Number: 99387583
B. State Generator's ID: [illegible]
C. State Transporter's ID [Reserved.]

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247
D. Transporter's Phone: (800) 458-3036

7. Transporter 2 Company Name:
8. US EPA ID Number:
E. State Transporter's ID [Reserved.]
F. Transporter's Phone:

9. Designated Facility Name and Site Address:
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite UT 84029
10. US EPA ID Number: UTD981552177
G. State Facility's ID:
H. Facility's Phone: (801) 323-8100

GENERATOR

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00026	Y	State 611 EPA/Other D008 D006 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile #AP2801477, soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr., Suite 200, Irvine, CA 92612
27 # 35 [illegible]

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address: NAS North Island Site 5

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name	Signature	Month	Day	Year
David L. Buerster		02	19	02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year
Kerry Barwick	Kerry Barwick	02	19	02

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

FACILITY

19. Discrepancy Indication Space

6410
6908
3

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month	Day	Year
Carrie Thomas	Carrie Thomas	02	20	02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

L0964

See Instructions on back of page 6.

10639

02/02

Department of Toxic Substances Control
Sacramento, California

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87584
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone ((619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number 99387584
B. State Generator's ID HAHQ36043249

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247
C. State Transporter's ID [Reserved.]
D. Transporter's Phone (800) 458-3036

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID [Reserved.]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite UT 84029
10. US EPA ID Number UTD981552177
G. State Facility's ID
H. Facility's Phone (801) 323-8100

GENERATOR

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00020	Y	State 181 EPA/Other D008 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
[illegible] contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr.
Suite 200, Irvine, CA 92612
J7 #47 BIN 1714 ML

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island Site 5 84136268

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name DAVID L. BUBBSTER Signature Month Day Year 02 15 02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name J.D. OHL Signature Month Day Year 02 15 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name Signature Month Day Year

1710

FACILITY

19. Discrepancy Indication Space

6908

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name Carrie Thomas Signature Carrie Thomas Month Day Year 02 18 02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

L0965

See Instructions on back of page 6.

10640

02/02

Department of Toxic Substances Control
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87585
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

A. State Manifest Document Number 99387585

B. State Generator's ID [illegible]

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136

4. Generator's Phone (619) 545-6520 Attn: Manifest Desk

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247

C. State Transporter's ID [Reserved.]

D. Transporter's Phone (800) 450-3035

7. Transporter 2 Company Name
8. US EPA ID Number

E. State Transporter's ID [Reserved.]

F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite UT 84029

10. US EPA ID Number UTD981552177

G. State Facility's ID

H. Facility's Phone (801) 323-8160

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	06626	Y	State 181 EPA/Other D008 D006 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile BAP2401477 soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr
Suite 200, Irvine, CA 92612
7Y # 27 Bin [illegible]

K. Handling Codes for Wastes Listed Above
a. 67
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG # 171
Site pick up address:
NAS North Island Site 5

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name DAVID L. BUERSTER Signature Month 02 Day 15 Year 02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name Kevin Hedges Signature Kevin Hedges Month 02 Day 15 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name Signature 0910 Month Day Year

19. Discrepancy Indication Space
0908

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name Carrie Thomas Signature Carrie Thomas Month 02 Day 18 Year 0

DO NOT WRITE BELOW THIS LINE.

GENERATOR / TRANSPORTER / FACILITY

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

99387585

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RE

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

See Instructions on back of page 6.

0240

Department of Toxic Substances Control
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87586
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone (619) 545-6570 Attn: Manifest Desk

A. State Manifest Document Number 99387586
B. State Generator's ID HAHQ36043249

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247
C. State Transporter's ID [Reserved.]
D. Transporter's Phone (800) 456-3036

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID [Reserved.]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc
11600 North Aptus Road
Aragonite UT 84029
10. US EPA ID Number UTD981552177
G. State Facility's ID
H. Facility's Phone (801) 323-8100

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00020	Y	State 181 EPA/Other D008 [illegible] D028 D039 D040
b.					EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile BA 2401477, soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr., Suite 200, Irvine, CA 92612
378 48 B/L 274727 C201909

K. Handling Codes for Wastes Listed Above
a. 117
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handing.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island Site 5

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name DAVID L. BUERSTER
Signature
Month Day Year 02 15 02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name RANDY MATHEWS
Signature Randy Mathews
Month Day Year 02 15 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

19. Discrepancy Indication Space
6910
6908

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name Carrie Thomas
Signature Carrie Thomas
Month Day Year 02 17 02

GENERATOR

TRANSPORTER

FACILITY

99387586

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (expires 9-30-99)
Please print or type. *Form designed for use on elite (12-pitch) typewriter.*

L0971

See Instructions on back of page 6.

10639

0402

Department of Toxic Substances Control
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: CA7170090016
Manifest Document No.: 87587
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address:
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone: (619) 545-8520 Attn: Manifest Desk

A. State Manifest Document Number: 99387587
B. State Generator's ID: NAH0110043249

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247

C. State Transporter's ID [Reserved.]
D. Transporter's Phone: (800) 458-3036

7. Transporter 2 Company Name:
8. US EPA ID Number:

E. State Transporter's ID [Reserved.]
F. Transporter's Phone

9. Designated Facility Name and Site Address:
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite, UT 84029
10. US EPA ID Number: UTD981552177

G. State Facility's ID
H. Facility's Phone: (801) 323-8100

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	06020	Y	State 181 EPA/Other D008 D006 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile #AP2401477, soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr., Suite 200, Irvine, CA 92612
77 #40 R 1940 ml

K. Handling Codes for Wastes Listed Above
a.
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ORG #171
Site pick up address:
NAS North Island, Site 5

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name: David L. Buerster
Signature:
Month Day Year: 02 15 02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Gary A. Howard
Signature: Gary A. Howard
Month Day Year: 02 15 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature: 6010
Month Day Year:

19. Discrepancy Indication Space
6710
6908

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Carrie Thomas
Signature: Carrie Thomas
Month Day Year: 02 18 02

GENERATOR

TRANSPORTER

FACILITY

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

99387587

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

I.T. CORP   14907   0210033

See Instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

99387588

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802: WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: CA717009001 6
Manifest Document No.: 87588
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

GENERATOR

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone (619) 545-6520   Attn: Manifest Desk

A. State Manifest Document Number: 99387588
B. State Generator's ID: HAHQ36043249

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247
C. State Transporter's ID [Reserved.]
D. Transporter's Phone: (800) 458-3036

7. Transporter 2 Company Name:
8. US EPA ID Number:
E. State Transporter's ID [Reserved.]
F. Transporter's Phone:

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc
11600 North Aptus Road
Aragonite,UT 84029
10. US EPA ID Number: UTD981552177
G. State Facility's ID:
H. Facility's Phone: (801) 323-8100

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00020	Y	State 181 EPA/Other D008 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. [illegible] contaminated with chlorinated organics and metals
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr.
Suite 200, Irvine, CA 92612
JT # 49   SW 89362

K. Handling Codes for Wastes Listed Above
a. 01
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924   ERG # 171
Site pick up address:
NAS North Island Site 5

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name: DAVID L. BUERSTER
Signature:
Month Day Year: 02 13 02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Lynn Stanley
Signature: Lynn Stanley
Month Day Year: 02 13 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature: 1010   1910
Month Day Year:

FACILITY

19. Discrepancy Indication Space
1900

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Glenna Lawrence
Signature:
Month Day Year: 02 14 02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050–0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

I.T. CORP. (6900

See Instructions on back of page 6. 5187

Department of Toxic Substances Control
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: CA7170090016
Manifest Document No.: 87589
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
Attn: Manifest Desk
4. Generator's Phone (619) 545-6520

A. State Manifest Document Number: 93387589
B. State Generator's ID: HAHQ110041249

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247

C. State Transporter's ID [Reserved.]
D. Transporter's Phone: (800) 455-3036

7. Transporter 2 Company Name:
8. US EPA ID Number:

E. State Transporter's ID [Reserved.]
F. Transporter's Phone:

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite UT 84029
10. US EPA ID Number: UTD981552177

G. State Facility's ID:
H. Facility's Phone: (801) 323-8100

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00020	Y	State 181 EPA/Other D008 D006 D028 D039 D04
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile #AP2401477, soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr Suite 200, Irvine, CA 92612
IT # 51 BN 5187

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island, Site 5

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name: DAVID L BREWSTER
Signature:
Month Day Year: 02 13 02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Quince Horn
Signature: Quince Horn
Month Day Year: 02 13 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature: 1010
Month Day Year:

19. Discrepancy Indication Space
6908

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Glenna Lawrence
Signature:
Month Day Year: 02 14 02

DO NOT WRITE BELOW THIS LINE.

GENERATOR

TRANSPORTER

FACILITY

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

93387589

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

F.T. CorA
5303
C0903

See Instructions on back of page 6.

10/29/02

Department of Toxic Substances Control
Sacramento, California

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: CA7170090016
Manifest Document No.: 87590
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address:
Navy Public Works Center
2730 McKeen Street, San Diego, CA 92136

4. Generator's Phone: (619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number: 99387590
B. State Generator's ID: HAHQ38043249

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247
C. State Transporter's ID [Reserved.]
D. Transporter's Phone: (800) 468-3036

7. Transporter 2 Company Name:
8. US EPA ID Number:
E. State Transporter's ID [Reserved.]
F. Transporter's Phone

9. Designated Facility Name and Site Address:
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite, UT 84029

10. US EPA ID Number: UTD981552177
G. State Facility's ID
H. Facility's Phone: (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00020	Y	State 181 EPA/Other D008 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
1a. Profile #AP00... soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr., Suite 200, Irvine, CA 92612

77#11 5303(BIN)

K. Handling Codes for Wastes Listed Above
a. 01
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924
ERG #171
Site pick up address:
NAS North Island Site 5

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name: DAVID L. BURSTER
Signature:
Month/Day/Year: 02/13/02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Jack Worthy
Signature: Jack Worthy
Month/Day/Year: 02/13/02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature:
Month/Day/Year:

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Glenna Lawrence
Signature:
Month/Day/Year: 02/14/02

GENERATOR
TRANSPORTER
FACILITY

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

5394 J.T. CORP. 10905 108781

See Instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016
Manifest Document No. 87591
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone (619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number 99387591
B. State Generator's ID

5. Transporter 1 Company Name
6. US EPA ID Number CAT000624247

C. State Transporter's ID (Reserved) [illegible]43248
D. Transporter's Phone (800) 458-3036

7. Transporter 2 Company Name MP Environmental
8. US EPA ID Number

E. State Transporter's ID (Reserved)
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite UT 84029
10. US EPA ID Number UTD981552177

G. State Facility's ID
H. Facility's Phone (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00020	Y	State 181 EPA/Other D008 D006 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile #AP2401477, soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr Suite 200, Irvine, CA 92612
STP 10 BW 5524

K. Handling Codes for Wastes Listed Above
a. 01
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island, Site 5

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Printed/Typed Name DAVID L BURASTER
Signature
Month Day Year 02 13 02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name [illegible] Gannon
Signature Ron [illegible]
Month Day Year 02 13 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name Glenn Lawrence
Signature
Month Day Year 02 14 02

DO NOT WRITE BELOW THIS LINE.

GENERATOR

TRANSPORTER

FACILITY

99387591

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

Int. CORA.
C0904

See Instructions on back of page 6.

10638 2/28/02

Department of Toxic Substances Control
Sacramento, California

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

99387592

UNIFORM HAZARDOUS WASTE MANIFEST

GENERATOR

1. Generator's US EPA ID No. CA717009001 6
Manifest Document No. 87592
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone (619) 545-6520 Attn: Manifest Desk

A. State Manifest Document Number 99387592
B. State Generator's ID HAHQ39043249

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247
C. State Transporter's ID [Reserved.]
D. Transporter's Phone (800) 458-3036

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID [Reserved.]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite, UT 84029
10. US EPA ID Number UTD981552177
G. State Facility's ID
H. Facility's Phone (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III	001	CM	00020	Y	State 181 EPA/Other D008 D006 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
[illegible] soil contaminated with chlorinated organics and metals
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr. Suite 200, Irvine, CA 92612.
3T#9 Bin 5325

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island Site 5

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Printed/Typed Name David L. Buerster
Signature
Month 02 Day 13 Year 02

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name Lewis Hedges
Signature Lewis Hedges
Month 02 Day 13 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

FACILITY

19. Discrepancy Indication Space
6410
1408

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name Donna Lawrence
Signature
Month 02 Day 14 Year 02

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

IT CORP
L0867

See Instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: CA717009001 6
Manifest Document No.: 87593
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address:
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136

4. Generator's Phone (619) 545-8520 Attn: Manifest Desk

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247

7. Transporter 2 Company Name:
8. US EPA ID Number:

9. Designated Facility Name and Site Address:
Safety Kleen (Aragonite), Inc
11600 North Aptus Road
Aragonite UT 84029

10. US EPA ID Number: UTD981552177

A. State Manifest Document Number: 99387593
B. State Generator's ID:
C. State Transporter's ID [Reserved.]
D. Transporter's Phone: (909) 468-3036
E. State Transporter's ID [Reserved.]
F. Transporter's Phone:
G. State Facility's ID:
H. Facility's Phone: (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III ~~Site 17 Bldg 89398~~	001	CM	00020	Y	State 181 EPA/Other D005 D006 D028 D039 D040
b.					EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile #AP0401477, soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr. Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address: NAS North Island, Site 5 17 & 17 Bu 89398

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name: David L. Buerster
Signature:
Month Day Year: 02 12 02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Allen Cagar
Signature:
Month Day Year: 02 12 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature:
Month Day Year:

6076
6710
6408

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Glenna Lawrence
Signature: Glenna Lawrence
Month Day Year: 02 13 02

DO NOT WRITE BELOW THIS LINE.

GENERATOR
TRANSPORTER
FACILITY

99387593
IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

I.T. Corp.

5321 L0873 02/02 1002

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

See Instructions on back of page 6.

Department of Toxic Substances Control
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87594
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136

4. Generator's Phone (619) 545-6520 Attn: Manifest Desk

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247

7. Transporter 2 Company Name:
8. US EPA ID Number:

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc
11600 North Aptus Road
Aragonite, UT 84029

10. US EPA ID Number: UTD981552177

A. State Manifest Document Number: 99387594
B. State Generator's ID: HAHQ36043349
C. State Transporter's ID [Reserved.] 1020
D. Transporter's Phone: (800) 458-3036
E. State Transporter's ID [Reserved.]
F. Transporter's Phone:
G. State Facility's ID:
H. Facility's Phone: (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III ~~[illegible] 5329~~ 8	001	CM	00020	Y	State 181 EPA/Other D008 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile #AP240477, soil contaminated with chlorinated organics and metals.
Send photocopy of 150F signed manifest to: Steve Chandler, 3347 Michelson Dr., Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 01
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling. 1T# 15 BIN 5329
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island Site 5 C201908

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name: David L. Burrster Signature: Month Day Year 02/12/02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Rudy Mathews Signature: Rusty Mathews Month Day Year 02/12/02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name: Signature: 1710 Month Day Year

19. Discrepancy Indication Space
1402

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Glenna Lawrence Signature: Month Day Year 02/13/02

DO NOT WRITE BELOW THIS LINE.

GENERATOR

TRANSPORTER

FACILITY

99387594

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

89303 608120 IT CORP

See Instructions on back of page 6.

108/02

Department of Toxic Substances Control
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016 Manifest Document No. 87595
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

A. State Manifest Document Number 99387595

B. State Generator's ID [illegible]

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
Attn: Manifest Desk

4. Generator's Phone (619) 545-6520

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247

C. State Transporter's ID [Reserved.]
D. Transporter's Phone (800) 458-3036

7. Transporter 2 Company Name
8. US EPA ID Number

E. State Transporter's ID [Reserved.]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite UT 84029

10. US EPA ID Number UTD981552177

G. State Facility's ID
H. Facility's Phone (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III ~~[illegible] 89303~~	001	CM	00026	Y	State 181 EPA/Other D008 D006 D028 D039 D040
b.					EPA/Other
c.					State EPA/Other
d. 2/13/02					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile #AP2401477, soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr., Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address NAS North Island Site 5 Bid# 89303 [illegible]

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name David L. Buerster
Signature
Month Day Year 02 1 2002

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name Elliot A. Lane
Signature
Month Day Year 02 13 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

0710

19. Discrepancy Indication Space

6908

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name Glenna Lawrence
Signature
Month Day Year 2/13/02

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802: WITHIN CALIFORNIA, CALL 1-800-852-7550

GENERATOR

TRANSPORTER

FACILITY

DO NOT WRITE BELOW THIS LINE.

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California – Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

5380 L0874 I.T. CORP.

See Instructions on back of page 6.

2402606

Department of Toxic Substances Control
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: CA7170090016
Manifest Document No.: 87596
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

A. State Manifest Document Number: 99387596
B. State Generator's ID: HAHQ38043349

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
4. Generator's Phone (619) 545-6520 Attn: Manifest Desk

5. Transporter 1 Company Name: M P Environmental
6. US EPA ID Number: CAT000624247
C. State Transporter's ID [Reserved.]
D. Transporter's Phone (800) 458-3036

7. Transporter 2 Company Name:
8. US EPA ID Number:
E. State Transporter's ID [Reserved.]
F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite, UT 84029
10. US EPA ID Number: UTD981552177
G. State Facility's ID
H. Facility's Phone (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III ~~[illegible]~~	001	CM	00020 ~~[illegible]~~ 21	Y	State 181 EPA/Other D008 [illegible] D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
11a. Profile #AP2601477 soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr. Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 01
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924 ERG #171
Site pick up address:
NAS North Island Site 5 17th 14 Bin 5328

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name: DAVID L. BUBSTER
Signature:
Month 02 Day 12 Year 02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Gary D. Hunsaker
Signature: Gary D. Hunsaker
Month 02 Day 12 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature:
Month Day Year

1010
0910
0908

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Jeanne Lawrence
Signature:
Month 02 Day 15 Year 02

DO NOT WRITE BELOW THIS LINE.

GENERATOR
TRANSPORTER
FACILITY

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802; WITHIN CALIFORNIA, CALL 1-800-852-7550

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

State of California—Environmental Protection Agency
Form Approved OMB No. 2050-0039 (Expires 9-30-99)
Please print or type. Form designed for use on elite (12-pitch) typewriter.

I.T. CORP

L0804

See Instructions on back of page 6.

02/20/02

Department of Toxic Substances Control
Sacramento, California

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. CA7170090016
Manifest Document No. 87597
2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Navy Public Works Center
2730 McKean Street, San Diego, CA 92136
Attn: Manifest Desk

4. Generator's Phone (619) 545-6520

A. State Manifest Document Number 99387597

B. State Generator's ID [illegible]

5. Transporter 1 Company Name M P Environmental
6. US EPA ID Number CAT000624247

C. State Transporter's ID [Reserved.]

D. Transporter's Phone (800) 458-3036

7. Transporter 2 Company Name
8. US EPA ID Number

E. State Transporter's ID [Reserved.]

F. Transporter's Phone

9. Designated Facility Name and Site Address
Safety Kleen (Aragonite), Inc.
11600 North Aptus Road
Aragonite, UT 84029

10. US EPA ID Number UTD981552177

G. State Facility's ID

H. Facility's Phone (801) 323-8100

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste Number
a. Hazardous waste, solid, n.o.s. (trichloroethene, perchloroethene, lead), 9, NA3077, III ~~[illegible]~~ # [illegible]	001	CM	36020	Y	State 181 EPA/Other D008 D006 D028 D039 D040
b.					State EPA/Other
c.					State EPA/Other
d.					State EPA/Other

J. Additional Descriptions for Materials Listed Above
1a. Profile #AP2401477, soil contaminated with chlorinated organics and metals.
Send photocopy of TSDF signed manifest to: Steve Chandler, 3347 Michelson Dr., Suite 200, Irvine, CA 92612

K. Handling Codes for Wastes Listed Above
a. 07
b.
c.
d.

15. Special Handling Instructions and Additional Information
Caution: Wear appropriate protective clothing and respiratory protection when handling.
IN CASE OF EMERGENCY CONTACT: Chem -Tel, Inc. at 1-800-255-3924
ERG #171
Site pick up address: NAS North Island, Site 5
IT # Bin 13 (Bin # MP 893004)
N817513

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name: David L. Burastero
Signature:
Month 02 Day 20 Year 02

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Tim Golden
Signature:
Month 02 Day 21 Year 02

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name:
Signature:
Month Day Year

0710

19. Discrepancy Indication Space

1408

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Glenna Lawrence
Signature:
Month 02 Day 21 Year 02

DO NOT WRITE BELOW THIS LINE.

IN CASE OF EMERGENCY OR SPILL, CALL THE NATIONAL RESPONSE CENTER 1-800-424-8802. WITHIN CALIFORNIA, CALL 1-800-852-7550

99387597

GENERATOR
TRANSPORTER
FACILITY

DTSC 8022A (1/99)
EPA 8700—22

Green: TRANSPORTER RETAINS

Appendix F
Boring Logs

AUTOCAD FILE NAME: 818725-Boring Log Legend p1of2.dwg

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) (ASTM D2488-90)

Description and Identification of Soils (Visual-Manual Procedure)

MAJOR DIVISIONS			GROUP SYMBOL	GRAPHIC SYMBOL	GROUP NAME
COARSE-GRAINED SOILS <50% Passing #200 Sieve	GRAVELS	CLEAN GRAVELS	GW	▨	Well-graded gravel Well-graded gravel with sand
			GP	▨	Poorly graded gravel Poorly graded gravel with sand
		GRAVELS WITH FINES	GW-GM	▨	Well-graded gravel with silt Well-graded gravel with silt and sand
			GW-GC	▨	Well-graded gravel with clay Well-graded gravel with clay and sand
			GP-GM	▨	Poorly graded gravel with silt Poorly graded gravel with silt and sand
			GP-GC	▨	Poorly graded gravel with clay Poorly graded gravel with clay and sand
			GM	▨	Silty gravel Silty gravel with sand
			GC	▨	Clayey gravel Clayey gravel with sand
	SANDS	CLEAN SANDS	SW	▨	Well-graded sand Well-graded sand with gravel
			SP	▨	Poorly graded sand Poorly graded sand with gravel
		SANDS WITH FINES	SW-SM	▨	Well-graded sand with silt Well-graded sand with silt and gravel
			SW-SC	▨	Well-graded sand with clay Well-graded sand with clay and gravel
			SP-SM	▨	Poorly graded sand with silt Poorly graded sand with silt and gravel
			SP-SC	▨	Poorly graded sand with clay Poorly graded sand with clay and gravel
			SM	▨	Silty sand Silty sand with gravel
			SC	▨	Clayey sand Clayey sand with gravel
FINE-GRAINED SOILS >50% Passing #200 Sieve	SILTS AND CLAYS		CL	▨	Lean clay · Lean clay with sand or gravel Sandy lean clay · Sandy lean clay with gravel Gravelly lean clay · Gravelly lean clay with sand
			ML	▨	Silt · Silt with sand or gravel Sandy silt · Sandy silt with gravel Gravelly silt · Gravelly silt with sand
			CH	▨	Fat clay · Fat clay with sand or gravel Sandy fat clay · Sandy fat clay with gravel Gravelly fat clay · Gravelly fat clay with sand
			MH	▨	Elastic silt · Elastic silt with sand or gravel Sandy elastic silt · Sandy elastic silt with gravel Gravelly elastic silt · Gravelly elastic silt with sand
			OL/OH	▨	Organic soil · Organic soil with sand or gravel Sandy organic soil · Sandy organic soil with gravel Gravelly organic soil · Gravelly organic soil with sand

COLOR

MUNSELL CHART
ex: BROWN (10YR 5/3)

WATER LEVEL SYMBOLS

▽ IDENTIFIED GROUNDWATER DEPTH DURING DRILLING

▼ STATIC GROUNDWATER LEVEL

GRAIN-SIZE DESCRIPTIONS (PER ASTM D2488-90)

BOULDERS	—Particles of rock that will not pass a 12-inch square opening.
COBBLES	—Particles of rock that will pass a 12-inch square opening and can be retained on a 3-inch sieve.
GRAVEL	—Particles of rock that will pass a 3-inch sieve and can be retained on a No. 4 (4.75 mm) sieve.
SAND	—Particles of rock that will pass a No. 4 sieve and can be retained on a No. 200 (75 μm) sieve.
SILT	—Soil passing a No. 200 sieve that is nonplastic or very slightly plastic and that exhibits little or no strength when air dry.
CLAY	—Soil passing a No. 200 sieve that can be made to exhibit plasticity within a range of water contents.

ADAPTED FROM: 1990 ANNUAL BOOK OF ASTM STANDARDS, SECTION 4, VOLUME 04.08

DENSITY/CONSISTENCY CLASSIFICATION

DENSITY OF COARSE-GRAINED SOILS

DENSITY	BLOWS PER FOOT*
VERY LOOSE	0–4
LOOSE	5–10
MEDIUM DENSE	11–30
DENSE	31–50
VERY DENSE	OVER 50

CONSISTENCY OF FINE-GRAINED SOILS

CONSISTENCY		BLOWS PER FOOT*
VERY SOFT	–Thumb penetrates > 1 in.	<4
SOFT	–Thumb penetrates = 1 in.	4–8
FIRM	–Thumb penetrates >.25in.	9–15
HARD	–Thumbnail indents soil	15–30
VERY HARD	–Thumbnail won't indent soil	>30

*Blows with a 140-pound hammer falling 30 inches required to drive the designated sampler 12 inches into undisturbed materials.

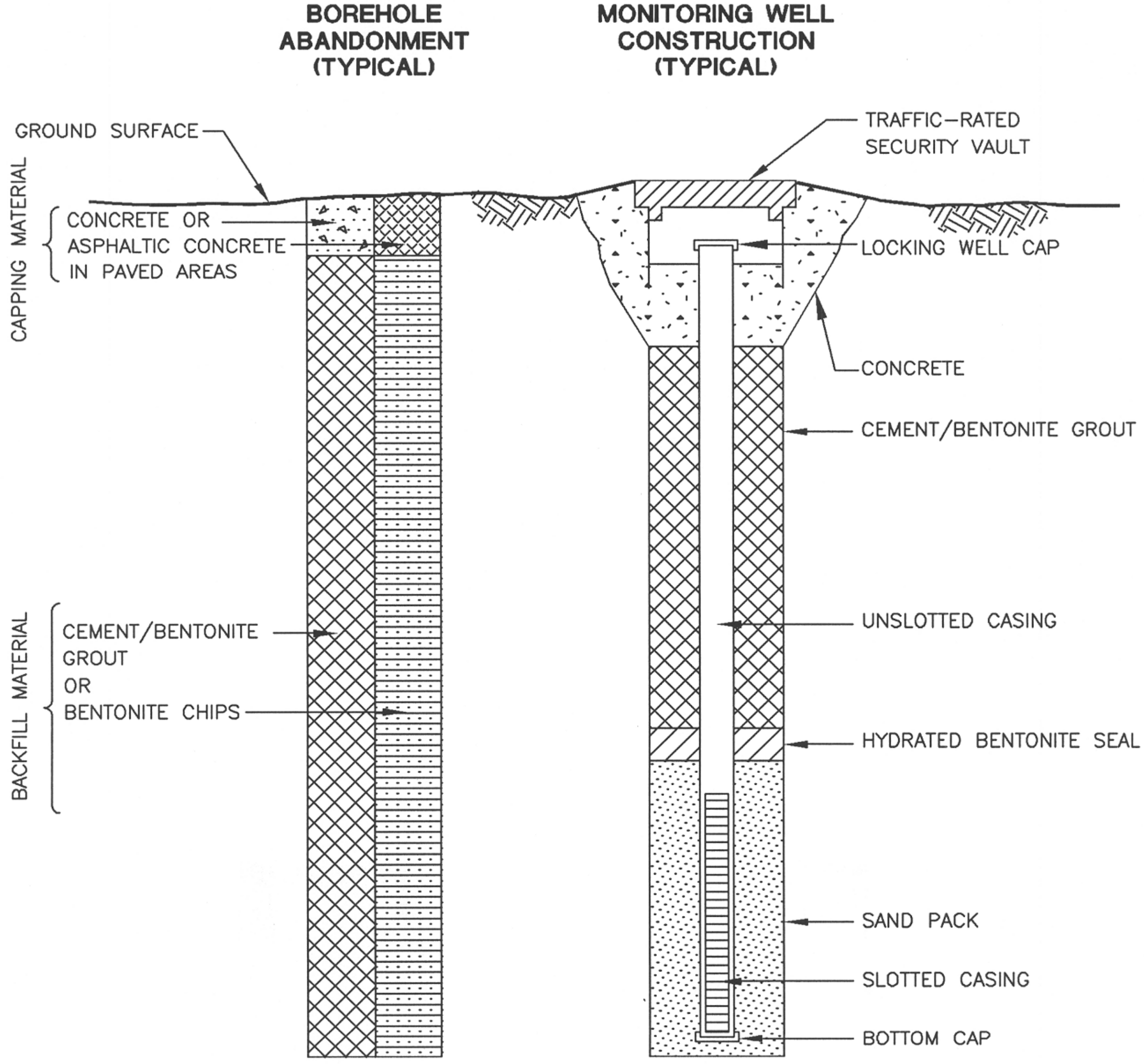
CONTACTS

———————	— — — — — —	- - - - - - - - - - - -
CONTACT (Observed)	APPROXIMATE (±2 Feet)	INFERRED (±5 Feet)

Shaw™ Shaw Environmental, Inc.

SOILS CLASSIFICATION
BORING LOG LEGEND
(PAGE 1 of 2)

AUTOCAD FILE NAME: 818725-Boring Log Legend p2of2.dwg



NOT TO SCALE

Shaw™ Shaw Environmental, Inc.

SOILS CLASSIFICATION BORING LOG LEGEND

(PAGE 2 of 2)

IT CORPORATION
A Member of The IT Group

Soil Boring S5-B-01B

Page: 1 of 1

Site Name IR Site 5 - Unit 2
Location NAVAL AIR STATION NORTH ISLAND, CA.
Client USN SWDIV
Project Name CTO-027
Project Number 818725
Drilling Company BC^2 Environmental Corp.

Date Boring Began 6/27/02 Finished 6/27/02
Logged By/Field Geologist Brian C. White
Log Checked By Richard Wong
Surface Elevation 12.53 feet Mean Lower Low Water
Coordinates N 1832462.61 feet E 6269947.92 feet

*See drilling details at the end of this log and accompanying legend for explanation of symbols and terms

Depth (feet)	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Classification	Description Geologic Descriptions are Based on the Unified Soil Classification System (USCS)
0						
5						
	115	818725-109 818725-110 60%	▮	▨	SP	Sand, black (2.5/0), poorly graded, ~4-5% silt, strong solvent type odor, oil sheen when water added to soil, 7.9 to 8.0 ~ 0.1 foot layer of fat clay.
10						Total boring depth is 10 feet below grade
15						
20						
25						
30						
35						

Drilling Details:

1. Borehole drilled with direct push drill rig.
2. Soil samples collected using a 4-foot long piston sampler to collect soil from discrete intervals.
3. Boreholes abandoned by filling void with grannular bentonite that was then hydrated.
4. Photo ionization detector (PID) readings were taken from headspace of bagged soil samples after an approximate 10-minute waiting period.

IT CORPORATION
A Member of The IT Group

Soil Boring S5-B-02B

Page: 1 of 1

Site Name IR Site 5 - Unit 2
Location NAVAL AIR STATION NORTH ISLAND, CA.
Client USN SWDIV
Project Name CTO-027
Project Number 818725
Drilling Company BC^2 Environmental Corp.

Date Boring Began 6/27/02 Finished 6/27/02
Logged By/Field Geologist Brian C. White
Log Checked By Richard Wong
Surface Elevation 12.04 feet Mean Lower Low Water
Coordinates N 1832421.15 feet E 6269890.94 feet

*See drilling details at the end of this log and accompanying legend for explanation of symbols and terms

Depth (feet)	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Classification	Description Geologic Descriptions are Based on the Unified Soil Classification System (USCS)
0	33.5	85%				Sand, olive gray (5Y 5/2), poorly graded, very fine grained, dry, becomes moist at ~ 1.5 feet.
5	882	818725-111 45%			SP	Sand, dark grayish brown (2.5Y 4/2), poorly graded, very fine grained, moist, becoming very moist to wet, at 4.4 feet, solvent type odor and oil sheen when water added to soil.
		818725-112 75%			SP SM	Sand with silt, black (2.5Y /1), poorly graded, very fine grained, wet ~ 7-8% silt, solvent type odor.
10	286	818725-113 20% 50%				
					CH	Fat clay, very dark gray (3/0), very soft, very moist, organic black color.
						Total boring depth is 13 feet below grade
15						
20						
25						
30						
35						

Drilling Details:

1. Borehole drilled with direct push drill rig.
2. Soil samples collected using a 4-foot long piston sampler to collect soil from discrete intervals.
3. Boreholes abandoned by filling void with grannular bentonite that was then hydrated.
4. Photo ionization detector (PID) readings were taken from headspace of bagged soil samples after an approximate 10-minute waiting period.

IT CORPORATION
A Member of The IT Group

Soil Boring S5-B-03B

Page: 1 of 1

Site Name IR Site 5 - Unit 2
Location NAVAL AIR STATION NORTH ISLAND, CA.
Client USN SWDIV
Project Name CTO-027
Project Number 818725
Drilling Company BC^2 Environmental Corp.

Date Boring Began 6/27/02 Finished 6/27/02
Logged By/Field Geologist Brian C. White
Log Checked By Richard Wong
Surface Elevation 11.56 feet Mean Lower Low Water
Coordinates N 1832400.75 feet E 6269824.43 feet

*See drilling details at the end of this log and accompanying legend for explanation of symbols and terms

Depth (feet)	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Classification	Description Geologic Descriptions are Based on the Unified Soil Classification System (USCS)
0						
5						
			■	▨	CH	Fat Clay, very dark gray (3/0), very soft, very moist, organic black color.
	25.8	818725-108 75%	■	░	SP	Sand, dark gray (5Y 4/1), poorly graded, very fine grained, wet, < 1% silt.
10			☐	░		Total boring depth is 10 feet below grade
15						
20						
25						
30						
35						

Drilling Details:

1. Borehole drilled with direct push drill rig.
2. Soil samples collected using a 4-foot long piston sampler to collect soil from discrete intervals.
3. Boreholes abandoned by filling void with grannular bentonite that was then hydrated.
4. Photo ionization detector (PID) readings were taken from headspace of bagged soil samples after an approximate 10-minute waiting period.

IT CORPORATION
A Member of The IT Group

Soil Boring S5-B-04B

Page: 1 of 1

Site Name: IR Site 5 - Unit 2
Location: NAVAL AIR STATION NORTH ISLAND, CA.
Client: USN SWDIV
Project Name: CTO-027
Project Number: 818725
Drilling Company: BC^2 Environmental Corp.

Date Boring Began: 6/27/02 Finished: 6/27/02
Logged By/Field Geologist: Brian C. White
Log Checked By: Richard Wong
Surface Elevation: 12.68 feet Mean Lower Low Water
Coordinates N: 1832391.88 feet E: 6269934.31 feet

*See drilling details at the end of this log and accompanying legend for explanation of symbols and terms

Depth (feet)	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Classification	Description Geologic Descriptions are Based on the Unified Soil Classification System (USCS)
0						
5						
	504		■	░	SP	Sand, very dark gray (2.5Y 3/1), poorly graded, very fine grained, wet, ~ 1-2% silt, solvent type odor, ~ 10% golden biotite.
	607	818725-105 90%	■	▨	CH	Fat clay, very dark gray (3/0), very soft, very moist, organic black color.
10						Total boring depth is 9.5 feet below grade
15						
20						
25						
30						
35						

Drilling Details:

1. Borehole drilled with direct push drill rig.
2. Soil samples collected using a 4-foot long piston sampler to collect soil from discrete intervals.
3. Boreholes abandoned by filling void with grannular bentonite that was then hydrated.
4. Photo ionization detector (PID) readings were taken from headspace of bagged soil samples after an approximate 10-minute waiting period.

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Soil Boring S5-B-05B

Page: 1 of 1

Site Name IR Site 5 - Unit 2
Location NAVAL AIR STATION NORTH ISLAND, CA.
Client USN SWDIV
Project Name CTO-027
Project Number 818725
Drilling Company BC^2 Environmental Corp.

Date Boring Began 6/27/02 Finished 6/27/02
Logged By/Field Geologist Brian C. White
Log Checked By Richard Wong
Surface Elevation 11.21 feet Mean Lower Low Water
Coordinates N 1832366.08 feet E 6269789.93 feet

*See drilling details at the end of this log and accompanying legend for explanation of symbols and terms

Depth (feet)	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Classification	Description Geologic Descriptions are Based on the Unified Soil Classification System (USCS)
0						
5						
	20	818725-107	■	░	SP	Sand, very dark gray (5Y 3/1), poorly graded, very fine grained, wet, ~ 4-5% silt, ~ 5% golden biotite.
	20	77%	■	▨	CH SP	Fat clay, very dark gray (2.5Y 3/1), very soft, very moist, interbedded with above sand in 0.4 foot layers.
10						Total boring depth is 10 feet below grade
15						
20						
25						
30						
35						

Drilling Details:

1. Borehole drilled with direct push drill rig.
2. Soil samples collected using a 4-foot long piston sampler to collect soil from discrete intervals.
3. Boreholes abandoned by filling void with grannular bentonite that was then hydrated.
4. Photo ionization detector (PID) readings were taken from headspace of bagged soil samples after an approximate 10-minute waiting period.

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Soil Boring S5-B-06B

Page: 1 of 1

Site Name *IR Site 5 - Unit 2*

Location *NAVAL AIR STATION NORTH ISLAND, CA.*

Client *USN SWDIV*

Project Name *CTO-027*

Project Number *818725*

Drilling Company *BC^2 Environmental Corp.*

Date Boring Began *6/27/02* Finished *6/27/02*

Logged By/Field Geologist *Brian C. White*

Log Checked By *Richard Wong*

Surface Elevation *11.05 feet Mean Lower Low Water*

Coordinates N *1832342.56 feet* E *6269856.28 feet*

*See drilling details at the end of this log and accompanying legend for explanation of symbols and terms

Depth (feet)	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Classification	Description Geologic Descriptions are Based on the Unified Soil Classification System (USCS)
0						
5						
	121	818725-106	■	▨	CH	Fat clay, very dark gray (3/0), very soft, very moist, organic black color.
	128	60%	■	░	SP SM	Sand with silt, very dark gray (2.5Y 3/1), poorly graded, wet, ~ 7 to 8% silt, ~ 8-10% golden biotite, weak solvent type odor.
10			☐			Total boring depth is 10 feet below grade
15						
20						
25						
30						
35						

<u>Drilling Details:</u>

1. Borehole drilled with direct push drill rig.
2. Soil samples collected using a 4-foot long piston sampler to collect soil from discrete intervals.
3. Boreholes abandoned by filling void with grannular bentonite that was then hydrated.
4. Photo ionization detector (PID) readings were taken from headspace of bagged soil samples after an approximate 10-minute waiting period.

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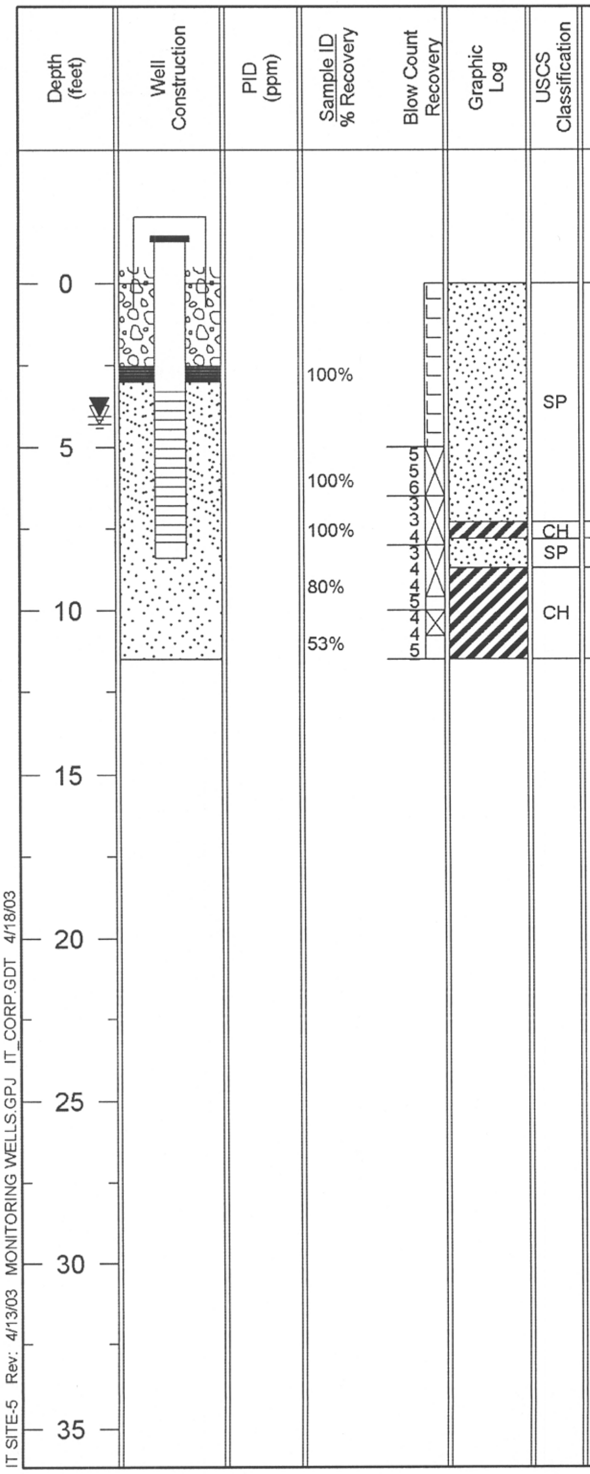
Monitoring Well S5-MW-31

Page: 1 of 2

Site Name IR Site 5 - Unit 2
Location NAVAL AIR STATION NORTH ISLAND, CA.
Client USN SWDIV
Project Name CTO-027
Project Number 818725
Drilling Company BC^2 Environmental Corp.

Date Boring Began 5/1/02 Finished 5/1/02
Logged By/Field Geologist Brian C. White
Log Checked By Richard Wong
Top of Casing Elevation 13.10 feet Mean Lower Low Water
Surface Elevation 11.1 feet Mean Lower Low Water
Coordinates N 1832278.51 feet E 6269928.57 feet

*See drilling and well construction details at the end of this log and accompanying legend for explanation of symbols and terms



Description

Geologic Descriptions are Based on the Unified Soil Classification System (USCS)

Sand, very dark grayish brown (2.5Y 3/2), loose, poorly graded, very fine grained, dry, ~1% silt, becomes moist at 1 foot.

Sand, dark gray (5Y 4/1), loose, poorly graded, very fine grained, very moist, <1% silt, weak solvent type odor, becomes wet at ~ 4.3 feet with heavy staining and odor.

Sand, olive gray (5Y 4/2), loose, poorly graded, very fine grained, wet, <1% silt.

Fat clay, very dark gray (3/0), very soft, very, moist, no odor - organic black color or stained (?).

Sand, olive gray (5Y 4/2), loose, poorly graded, very fine grained, wet, <1% silt.

Fat clay, very dark gray (3/0), very soft, very moist, no odor - organic black color or stained (?).

Total boring depth is 11.5 feet below grade

Drilling Details:

1. Borehole drilled with CME-75 drill rig equipped with 10-inch outside diamter (O.D.) hollow stem auger.
2. Core samples were recovered in a 2.0-foot long drive sampler (1.25-inch inside diameter[I.D.]).
3. Odor and staining detected at 4.3 feet below ground surface (bgs).
4. Photo ionization detector (PID) readings were taken from headspace of bagged soil samples after an approximate 10-minute waiting period.
5. Soil color clasification (i.e. olive yellow (5Y 6/3)) are from Munsell Soil Color Chart: 1994 Edition.

Well Construction:

1. Sediment trap: 0.5-foot long, 4-inch I.D. schedule 40 PVC, flush thread.
2. Well Screen: 5-foot long, 4-inch I.D. schedule 40 PVC, 0.01-inch slot, flush thread, slotted interval at 3.3 to 7.9 feet bgs.
3. Well Casing: 4-inch I.D. schedule 40 PVC, flush thread.
4. Filter Pack: Lonestar 2/12 grade silica sand (3 each 100 pound bags or approximately 3 cubic feet).

Continued Next Page

Monitoring Well S5-MW-31

Depth (feet)	Well Construction	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Classification	Description Geologic Descriptions are Based on the Unified Soil Classification System (USCS)
							Continued
35							5. Bentonite Seal: 3/8 inch diamter pellets (0.5 bags or approximately 0.5 cubic feet). 6. Surface Completion: Concrete (5 each 90 pound bags or approximately 3 cubic feet).
40							
45							
50							
55							
60							
65							
70							
75							
80							

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Monitoring Well S5-MW-32

Page: 1 of 2

Site Name: *IR Site 5 - Unit 2*

Location: *NAVAL AIR STATION NORTH ISLAND, CA.*

Client: *USN SWDIV*

Project Name: *CTO-027*

Project Number: *818725*

Drilling Company: *BC^2 Environmental Corp.*

Date Boring Began: *5/1/02* Finished: *5/1/02*

Logged By/Field Geologist: *Brian C. White*

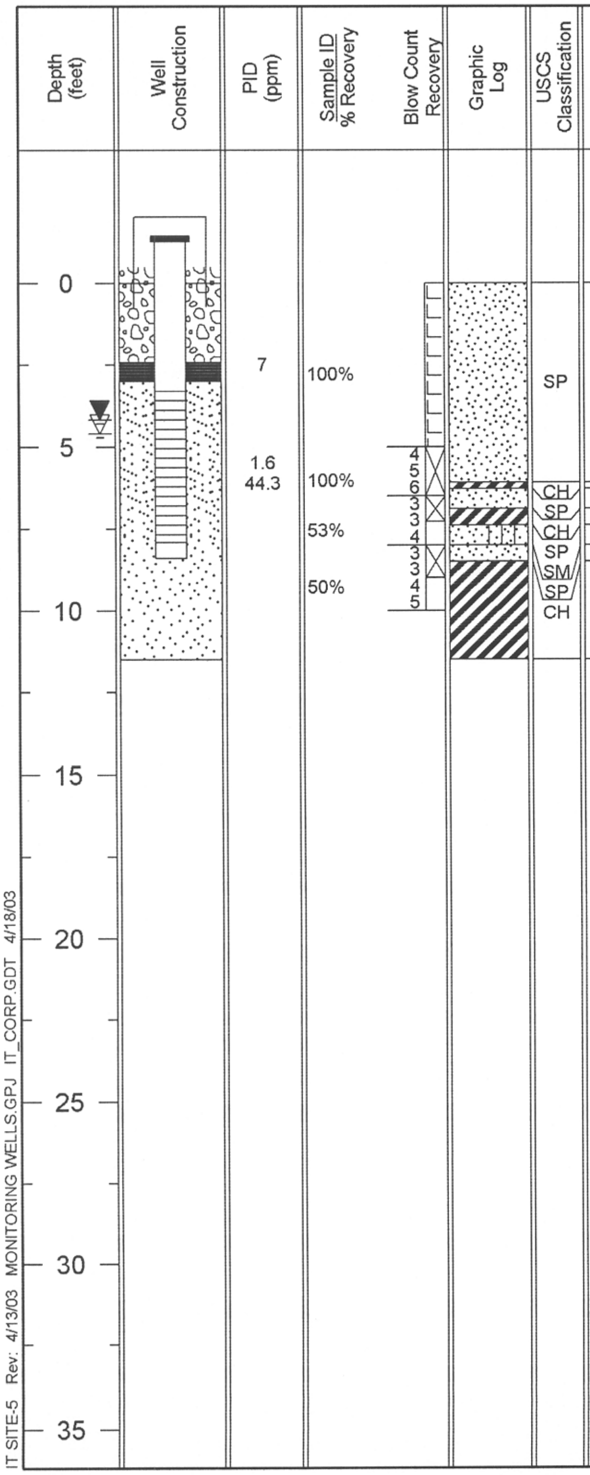
Log Checked By: *Richard Wong*

Top of Casing Elevation: *13.12 feet Mean Lower Low Water*

Surface Elevation: *11.22 feet Mean Lower Low Water*

Coordinates N *1832309.09 feet* E *6269853.57 feet*

*See drilling and well construction details at the end of this log and accompanying legend for explanation of symbols and terms



Description

Geologic Descriptions are Based on the Unified Soil Classification System (USCS)

Sand, dark grayish brown (2.5Y 4/2), loose, poorly graded, very fine grained, dry, becomes moist at 1 foot, <1% silt.

Sand, dark gray (5Y 4/1), loose, poorly graded, very fine grained, very moist, becomes wet at ~ 4.6 feet, <1% silt, slight staining and solvent type odor in wet soil.

Fat clay, very dark gray (3/0), very soft, very moist, clay appears to be stained or has black organic color.

Sand, dark gray (5Y 4/1), loose, poorly graded, very fined grained, wet, <1% silt.

Fat clay, very dark gray (3/0), very soft, very moist, clay appears to be stained or has black organic color.

Sand with silt, dark gray (2.5 Y 4/1), loose, poorly graded, very fine grained, wet, ~10-12% silt, ~20% golden biotite.

Fat clay, very dark gray (3/0), very soft, very moist, clay appears to be stained or has black organic color.

Total depth is 11.5 feet below grade.

Drilling Details:

1. Borehole drilled with CME-75 drill rig equipped with 10-inch outside diamter (O.D.) hollow stem auger.
2. Core samples were recovered in a 2.0-foot long drive sampler (1.25-inch inside diameter[I.D.]).
3. Odor and staining detected at 4.6 feet below ground surface (bgs).
4. Photo ionization detector (PID) readings were taken from headspace of bagged soil samples after an approximate 10-minute waiting period.
5. Soil color clasification (i.e. olive yellow (5Y 6/3)) are from Munsell Soil Color Chart: 1994 Edition.

Well Construction:

1. Sediment trap: 0.5-foot long, 4-inch I.D. schedule 40 PVC, flush thread.
2. Well Screen: 5-foot long, 4-inch I.D. schedule 40 PVC, 0.01-inch slot, flush thread, slotted interval at 3.3 to 7.9 feet bgs.
3. Well Casing: 4-inch I.D. schedule 40 PVC, flush thread.

Continued Next Page

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Monitoring Well **S5-MW-32**

Depth (feet)	Well Construction	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Classification	Description Geologic Descriptions are Based on the Unified Soil Classification System (USCS)
							Continued
35							4. Filter Pack: Lonestar 2/12 grade silica sand (3 each 100 pound bags or approximately 3 cubic feet). 5. Bentonite Seal: 3/8 inch diamter pellets (0.5 bag or approximately 0.5 cubic feet). 6. Surface Completion: Concrete (5 each 90 pound bags or approximately 3 cubic feet).
40							
45							
50							
55							
60							
65							
70							
75							
80							

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Monitoring Well S5-MW-33

Page: 1 of 2

Site Name: *IR Site 5 - Unit 2*

Location: *NAVAL AIR STATION NORTH ISLAND, CA.*

Client: *USN SWDIV*

Project Name: *CTO-027*

Project Number: *818725*

Drilling Company: *BC^2 Environmental Corp.*

Date Boring Began: *5/1/02* Finished: *5/1/02*

Logged By/Field Geologist: *Brian C. White*

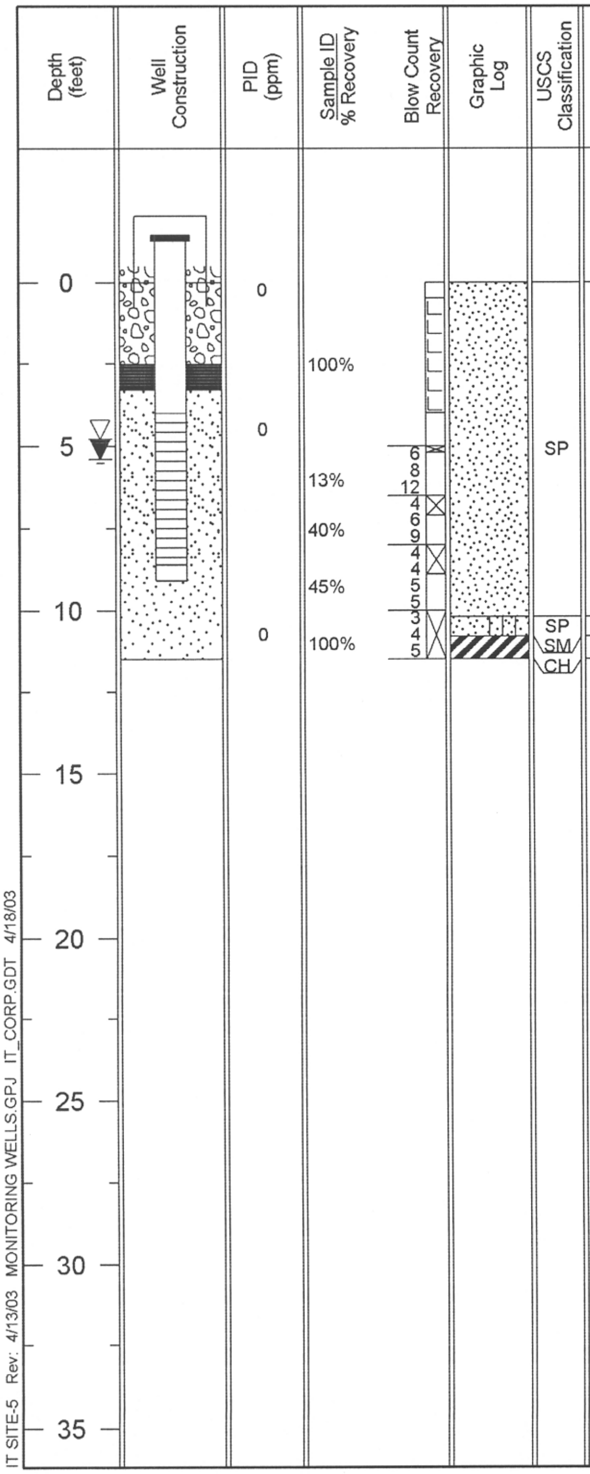
Log Checked By: *Richard Wong*

Top of Casing Elevation: *14.75 feet Mean Lower Low Water*

Surface Elevation: *12.75 feet Mean Lower Low Water*

Coordinates N *1832377.35 feet* E *6269967.29 feet*

*See drilling and well construction details at the end of this log and accompanying legend for explanation of symbols and terms



Description

Geologic Descriptions are Based on the Unified Soil Classification System (USCS)

Sand, dark grayish brown (2.5Y 4/2), loose, poorly graded, very fine grained, dry, <1% silt, becomes moist at 1 foot and very moist at 4 feet.

Sand, dark gray (5Y 4/1), loose, poorly graded, very fine grained, wet, weak solvent type odor, <1% silt.

Sand, dark greenish gray (3/3/1), loose, poorly graded, very fine grained, wet, weak staining and solvent type odor, ~2-3% silt.

Sand with silt, dark gray (2.5Y 4/1), loose, poorly graded, very fine grained, wet, ~10-12% silt, ~20% golden biotite.

Fat clay, black (2.5/0), very soft, very moist, clay appears stained black or has black oranic color

Total depth is 11.5 feet below grade.

Drilling Details:

1. Borehole drilled with CME-75 drill rig equipped with 10-inch outside diamter (O.D.) hollow stem auger.
2. Core samples were recovered in a 2.0-foot long drive sampler (1.25-inch inside diameter[I.D.]).
3. Odor and staining detected at 6.8 feet below ground surface (bgs).
4. Photo ionization detector (PID) readings were taken from headspace of bagged soil samples after an approximate 10-minute waiting period.
5. Soil color clasification (i.e. olive yellow (5Y 6/3)) are from Munsell Soil Color Chart: 1994 Edition.

Well Construction:

1. Sediment trap: 0.5-foot long, 4-inch I.D. schedule 40 PVC, flush thread.
2. Well Screen: 5-foot long, 4-inch I.D. schedule 40 PVC, 0.01-inch slot, flush thread, slotted interval at 4.0 to 8.6 feet bgs.
3. Well Casing: 4-inch I.D. schedule 40 PVC, flush thread.
4. Filter Pack: Lonestar 2/12 grade silica sand (3 each 100 pound

Continued Next Page

Monitoring Well **S5-MW-33**

Depth (feet)	Well Construction	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Classification	Description Geologic Descriptions are Based on the Unified Soil Classification System (USCS)
35							*Continued* bags or approximately 3 cubic feet). 5. Bentonite Seal: 3/8 inch diamter pellets (0.5 bag or approximately 0.5 cubic feet). 6. Surface Completion: Concrete (5 each 90 pound bags or approximately 3 cubic feet).
40							
45							
50							
55							
60							
65							
70							
75							
80							

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Monitoring Well S5-MW-34

Site Name *IR Site 5 - Unit 2*

Location *NAVAL AIR STATION NORTH ISLAND, CA.*

Client *USN SWDIV*

Project Name *CTO-027*

Project Number *818725*

Drilling Company *BC² Environmental Corp.*

Date Boring Began *5/1/02* Finished *5/1/02*

Logged By/Field Geologist *Brian C. White*

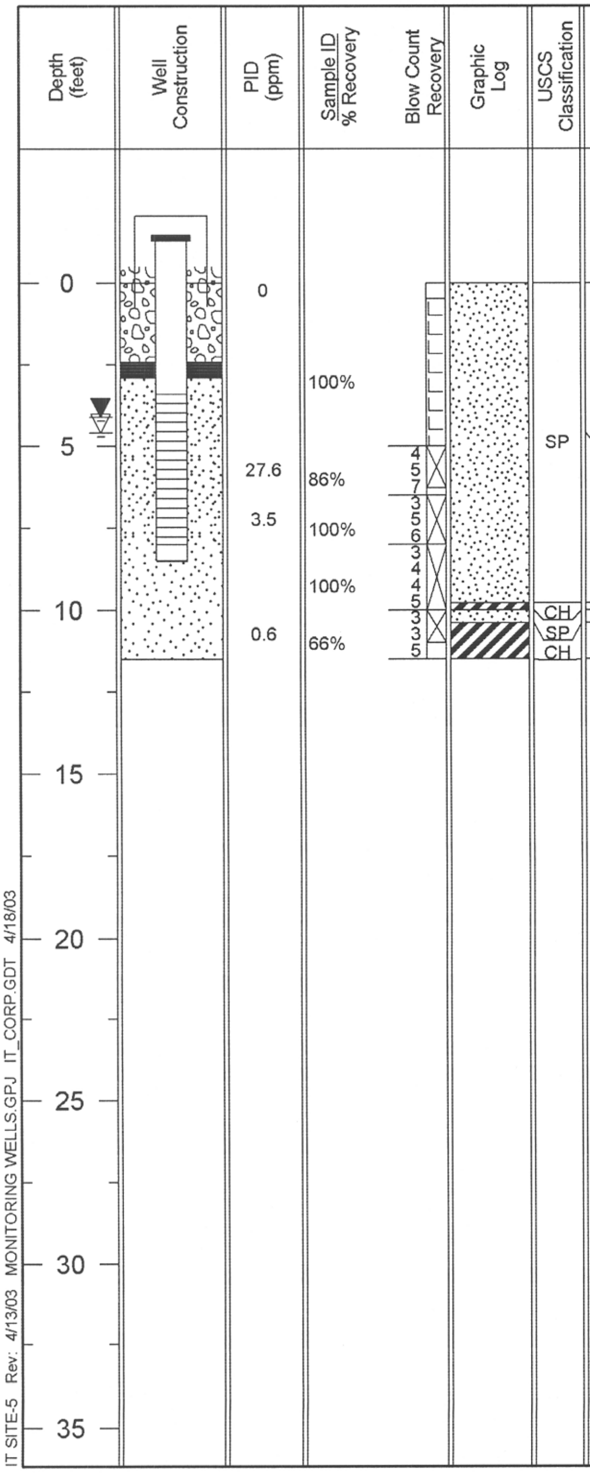
Log Checked By *Richard Wong*

Top of Casing Elevation *13.18 feet Mean Lower Low Water*

Surface Elevation *11.38 feet Mean Lower Low Water*

Coordinates N *1832349.95 feet* E *6269895.22 feet*

*See drilling and well construction details at the end of this log and accompanying legend for explanation of symbols and terms



Description

Geologic Descriptions are Based on the Unified Soil Classification System (USCS)

Sand, dark grayish brown (2.5Y 4/2), loose, poorly graded, very fine grained, dry, becomes moist at 1.0 foot, <1% silt.

Sand, olive gray (5Y5 5/2), loose, poorly graded, very fine grained, very moist, slight solvent type odor, <1% silt, becomes wet at 4.6 feet.

Sand, dark gray (4/0), loose, poorly graded, very fine grained, wet, sand is stained and has solvent type odor.

Sand has less staining (olive gray [5Y5 5/2]).

Fat clay, olive gray (5Y 4/2), very soft, very moist, slight solvent odor and stained layers

Sand, olive gray (5Y5 5/2), loose, poorly graded, very fine grained, wet, < 1% silt.

Fat clay, olive gray (5Y 4/2), very soft, very moist, slight solvent odor and stained layers.

Total depth is 11.5 feet below grade

Drilling Details:

1. Borehole drilled with CME-75 drill rig equipped with 10-inch outside diamter (O.D.) hollow stem auger.
2. Core samples were recovered in a 2.0-foot long drive sampler (1.25-inch inside diameter[I.D.]).
3. Odor and staining detected at 4.6 feet below ground surface (bgs).
4. Photo ionization detector (PID) readings were taken from headspace of bagged soil samples after an approximate 10-minute waiting period.
5. Soil color clasification (i.e. olive yellow (5Y 6/3)) are from Munsell Soil Color Chart: 1994 Edition.

Well Construction:

1. Sediment trap: 0.5-foot long, 4-inch I.D. schedule 40 PVC, flush thread.
2. Well Screen: 5-foot long, 4-inch I.D. schedule 40 PVC, 0.01-inch slot, flush thread, slotted interval at 3.4 to 8.0 feet bgs.
3. Well Casing: 4-inch I.D. schedule 40 PVC, flush thread.

Continued Next Page

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Monitoring Well S5-MW-34

Depth (feet)	Well Construction	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Classification	Description Geologic Descriptions are Based on the Unified Soil Classification System (USCS)
							Continued
35							4. Filter Pack: Lonestar 2/12 grade silica sand (3 each 100 pound bags or approximately 3 cubic feet). 5. Bentonite Seal: 3/8 inch diamter pellets (0.5 bag or approximately 0.5 cubic feet).
40							6. Surface Completion: Concrete (5 each 90 pound bags or approximately 3 cubic feet).
45							
50							
55							
60							
65							
70							
75							
80							

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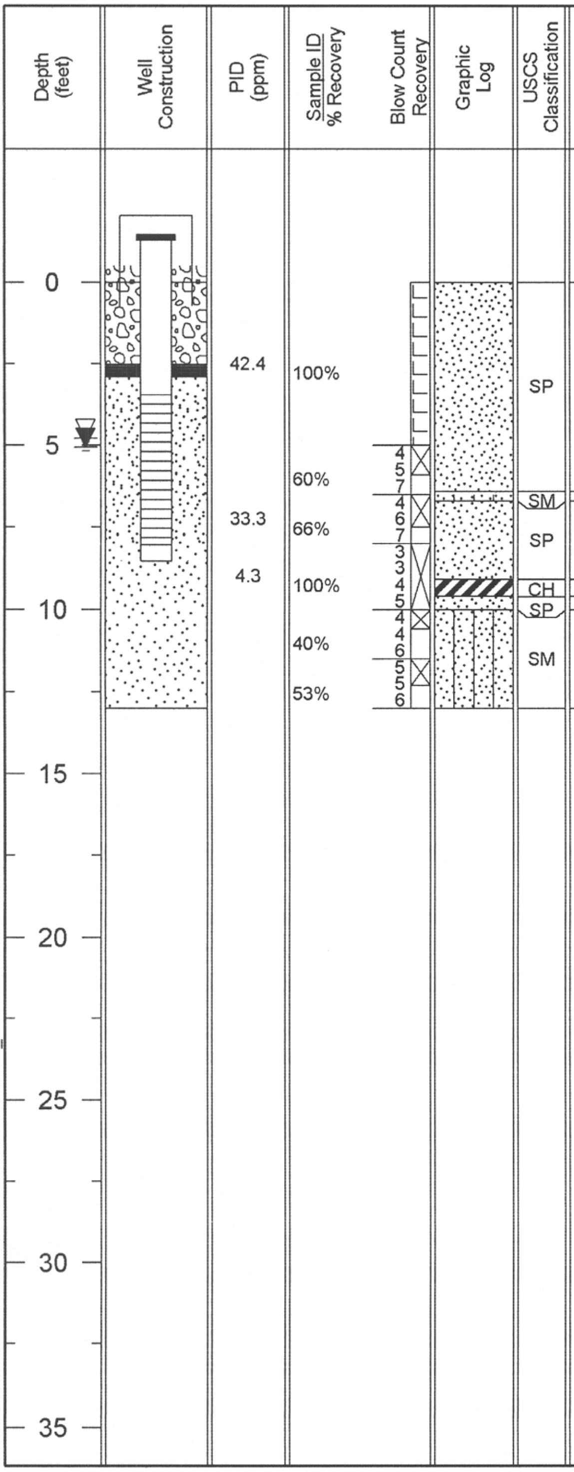
Mointoring Well S5-MW-35

Page: 1 of 2

Site Name IR Site 5 - Unit 2
Location NAVAL AIR STATION NORTH ISLAND, CA.
Client USN SWDIV
Project Name CTO-027
Project Number 818725
Drilling Company BC^2 Environmental Corp.

Date Boring Began 5/2/02 Finished 5/2/02
Logged By/Field Geologist Brian C. White
Log Checked By Richard Wong
Top of Casing Elevation 13.82 feet Mean Lower Low Water
Surface Elevation 11.82 feet Mean Lower Low Water
Coordinates N 1832368.5 feet E 6269747.85 feet

*See drilling and well construction details at the end of this log and accompanying legend for explanation of symbols and terms



Description

Geologic Descriptions are Based on the Unified Soil Classification System (USCS)

Sand, very dark grayish brown (10YR 3/2), loose, poorly graded, very fine grained, dry, becomes moist at 1.5 feet and very moist at 3 feet, <1% silt.

Sand, dark gray (5Y 4/1), loose, poorly graded, very fine grained, very moist, weak staining and degraded solvent type odor, <1% silt, becomes wet at 4.8 feet, stained black at 5.5 feet.

Silty sand, black (2.5/0), loose, poorly graded, very fine grained, wet, stained black, degraded solvent type odor, ~15-20% silt.

Sand, dark gray (5Y 4/1), loose, poorly graded, very fine grained, degraded solvent type odor, <1% silt, wet.

Fat clay, black (2.5/0), very soft, very moist.

Sand, dark gray (5Y 4/1), loose, poorly graded, very fine grained, degraded solvent type odor, <1% silt, wet.

Silty sand, olive brown (2.5Y 4/3), loose, poorly graded, very fine grained, wet, ~15-20% silt.

Total depth is 13 feet below grade

Drilling Details:

1. Borehole drilled with CME-75 drill rig equipped with 10-inch outside diamter (O.D.) hollow stem auger.
2. Core samples were recovered in a 2.0-foot long drive sampler (1.25-inch inside diameter[I.D.]).
3. Odor and staining detected at 5 feet below ground surface (bgs).
4. Photo ionization detector (PID) readings were taken from headspace of bagged soil samples after an approximate 10-minute waiting period.
5. Soil color clasification (i.e. olive yellow (5Y 6/3)) are from Munsell Soil Color Chart: 1994 Edition.

Well Construction:

1. Sediment trap: 0.5-foot long, 4-inch I.D. schedule 40 PVC, flush thread.
2. Well Screen: 5-foot long, 4-inch I.D. schedule 40 PVC, 0.01-inch slot, flush thread, slotted interval at 3.45 to 8.05 feet bgs.
3. Well Casing: 4-inch I.D. schedule 40 PVC, flush thread.

Continued Next Page

Mointoring Well S5-MW-35

Depth (feet)	Well Construction	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Classification	Description Geologic Descriptions are Based on the Unified Soil Classification System (USCS)
35							*Continued* 4. Filter Pack: Lonestar 2/12 grade silica sand (3.75 each 100 pound bags or approximately 3.75 cubic feet). 5. Bentonite Seal: 3/8 inch diamter pellets (0.5 bag or approximately 0.5 cubic feet). 6. Surface Completion: Concrete (5 each 90 pound bags or approximately 3 cubic feet).
40							
45							
50							
55							
60							
65							
70							
75							
80							

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Monitoring Well S5-MW-36

Site Name *IR Site 5 - Unit 2*

Location *NAVAL AIR STATION NORTH ISLAND, CA.*

Client *USN SWDIV*

Project Name *CTO-027*

Project Number *818725*

Drilling Company *BC^2 Environmental Corp.*

Date Boring Began *5/3/02* Finished *5/3/02*

Logged By/Field Geologist *Brian C. White*

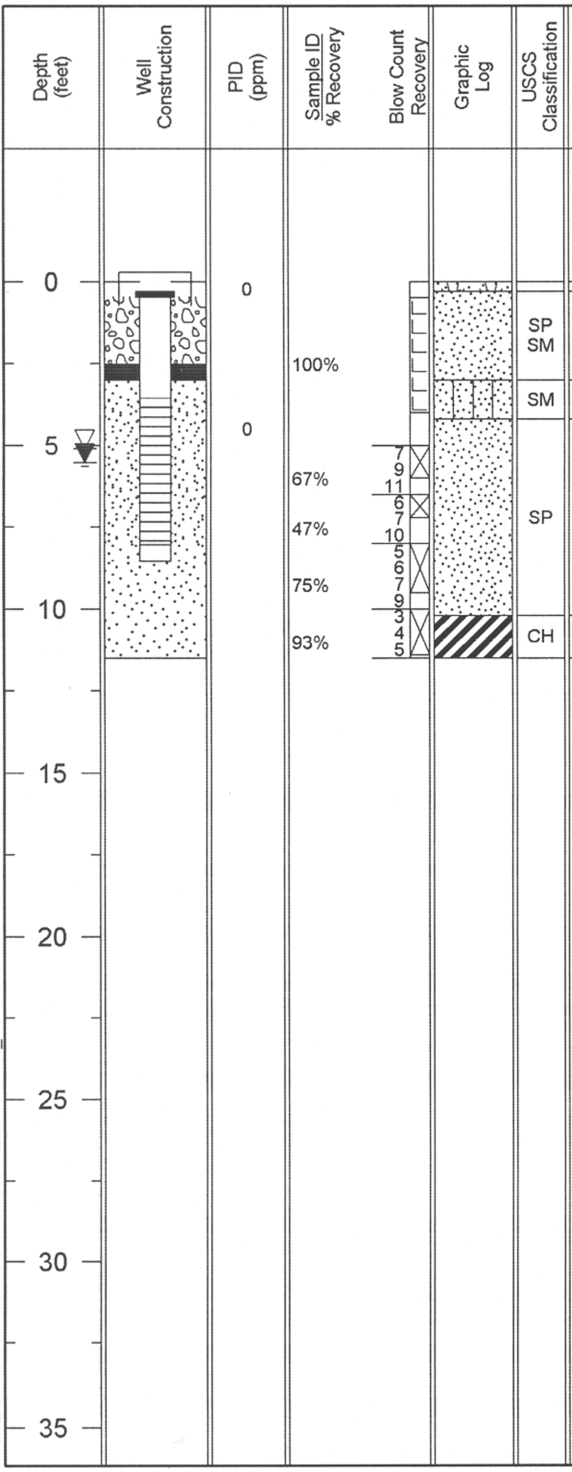
Log Checked By *Richard Wong*

Top of Casing Elevation *12.74 feet Mean Lower Low Water*

Surface Elevation *13.19 feet Mean Lower Low Water*

Coordinates N *1832523.54 feet* E *6269983.66 feet*

*See drilling and well construction details at the end of this log and accompanying legend for explanation of symbols and terms



Description

Geologic Descriptions are Based on the Unified Soil Classification System (USCS)

Grass sod/organic soil.

Sand with silt, dark yellowish brown (10 YR 4/4), loose, poorly graded, very fine grained, moist, ~10-12% silt, landfill cover material (?).

Silty sand, black (2.5/0), loose to medium dense, very fine grained, moist, Unit - 1 landfill debris, soil is stained or burnt black, metal, glass, and wood debris, no odor.

Sand, dark gray (5Y 4/1), loose, poorly graded, very fine grained, very moist, <1% silt, wet at ~ 5.1 feet.

Fat clay, interbedded 0.05 foot thick layers of very dark gray (3/0) and dark olive gray (5Y 3/2) color clay, very soft, very moist, 0.1 feet layer of silt at top of clay layer.

Total depth is 11.5 feet below grade.

Drilling Details:

1. Borehole drilled with CME-75 drill rig equipped with 10-inch outside diamter (O.D.) hollow stem auger.

2. Core samples were recovered in a 2.0-foot long drive sampler (1.25-inch inside diameter[I.D.]).

3. Staining detected at 3.0 feet below ground surface (bgs).

4. Photo ionization detector (PID) readings were taken from headspace of bagged soil samples after an approximate 10-minute waiting period.

5. Soil color clasification (i.e. olive yellow (5Y 6/3)) are from Munsell Soil Color Chart: 1994 Edition.

Well Construction:

1. Sediment trap: 0.5-foot long, 4-inch I.D. schedule 40 PVC, flush thread.

2. Well Screen: 5-foot long, 4-inch I.D. schedule 40 PVC, 0.01-inch slot, flush thread, slotted interval at 3.55 to 8.05 feet bgs.

3. Well Casing: 4-inch I.D. schedule 40 PVC, flush thread.

4. Filter Pack: Lonestar 2/12 grade silica sand (3 each 100 pound

Continued Next Page

Monitoring Well S5-MW-36

Depth (feet)	Well Construction	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Classification	Description Geologic Descriptions are Based on the Unified Soil Classification System (USCS)
35							*Continued* bags or approximately 3 cubic feet). 5. Bentonite Seal: 3/8 inch diamter pellets (0.5 bag or approximately 0.5 cubic feet). 6. Surface Completion: Concrete (5 each 90 pound bags or approximately 3 cubic feet).
40							
45							
50							
55							
60							
65							
70							
75							
80							

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Monitoring Well S5-MW-37

Site Name *IR Site 5 - Unit 2*

Location *NAVAL AIR STATION NORTH ISLAND, CA.*

Client *USN SWDIV*

Project Name *CTO-027*

Project Number *818725*

Drilling Company *BC² Environmental Corp.*

Date Boring Began *5/3/02* Finished *5/3/02*

Logged By/Field Geologist *Brian C. White*

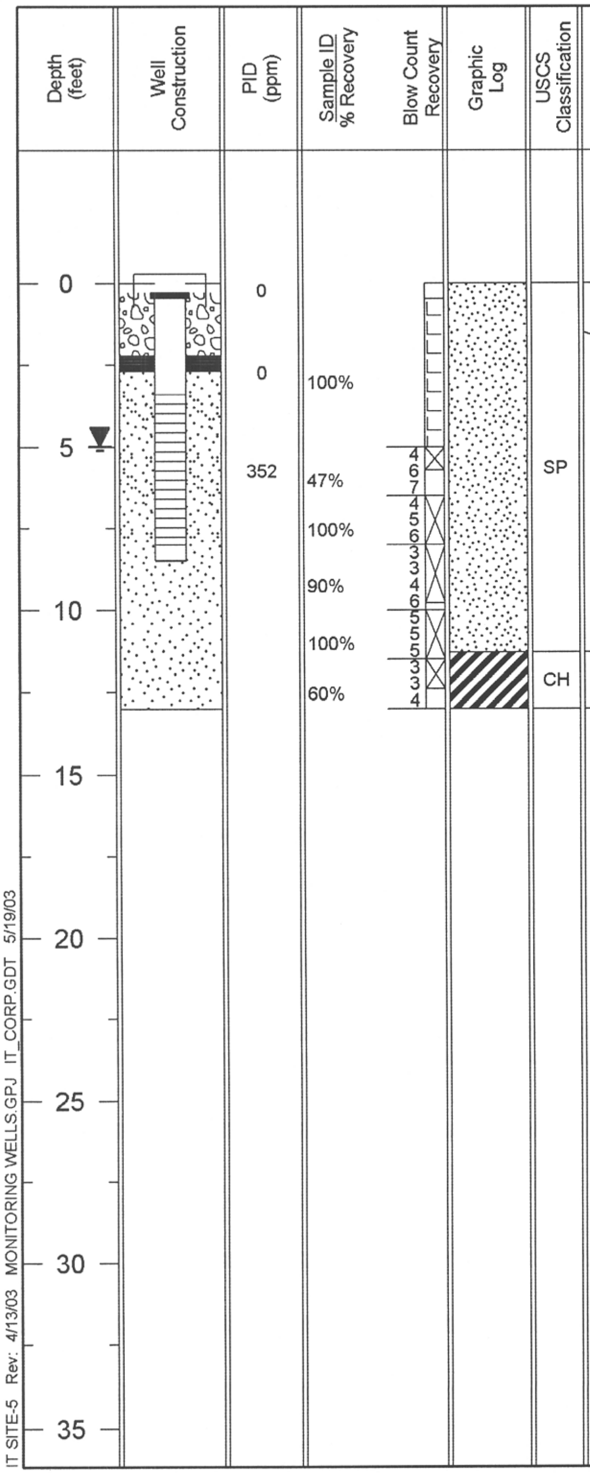
Log Checked By *Richard Wong*

Top of Casing Elevation *12.02 feet Mean Lower Low Water*

Surface Elevation *12.32 feet Mean Lower Low Water*

Coordinates N *1832486.27 feet* E *6269911.30 feet*

*See drilling and well construction details at the end of this log and accompanying legend for explanation of symbols and terms



Description

Geologic Descriptions are Based on the
Unified Soil Classification System (USCS)

Sand, very dark grayish brown (2.5Y 3/2), loose, poorly graded, very fine grained, dry, becomes moist at 1 foot, ~2% silt.

Sand, olive brown (2.5Y 4/3), loose, poorly graded, very fine grained, moist, <1% silt.

Sand, black (2.5/0), loose, poorly graded, very moist, becomes wet at 5 feet, soil is very stained and has strong solvent type odor.

Fat clay, very dark gray (3/0), very soft, very moist, stained or organic black color, drive sample suggested sand at this interval but soil at end of augger indicated clay to total depth.

Total depth is 13 feet below grade.

Drilling Details:

1. Borehole drilled with CME-75 drill rig equipped with 10-inch outside diamter (O.D.) hollow stem auger.
2. Core samples were recovered in a 2.0-foot long drive sampler (1.25-inch inside diameter[I.D.]).
3. Odor and staining detected at 5.0 feet below ground surface (bgs).
4. Photoionization detector (PID) readings were taken from headspace of bagged soil samples after an approximate 10-minute waiting period.
5. Soil color clasification (i.e. olive yellow (5Y 6/3)) are from Munsell Soil Color Chart: 1994 Edition.

Well Construction:

1. Sediment trap: 0.5-foot long, 4-inch I.D. schedule 40 PVC, flush thread.
2. Well Screen: 5-foot long, 4-inch I.D. schedule 40 PVC, 0.01-inch slot, flush thread, slotted interval at 3.4 to 8.0 feet bgs.
3. Well Casing: 4-inch I.D. schedule 40 PVC, flush thread.

Continued Next Page

Monitoring Well **S5-MW-37**

Depth (feet)	Well Construction	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Classification	Description Geologic Descriptions are Based on the Unified Soil Classification System (USCS)
							Continued
35							4. Filter Pack: Lonestar 2/12 grade silica sand (3.75 each 100 pound bags or approximately 3.75 cubic feet). 5. Bentonite Seal: 3/8 inch diamter pellets (0.5 bag or approximately 0.5 cubic feet). 6. Surface Completion: Cconcrete (5 each 90 pound bags or approximately 3 cubic feet).
40							
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65							
70							
75							
80							

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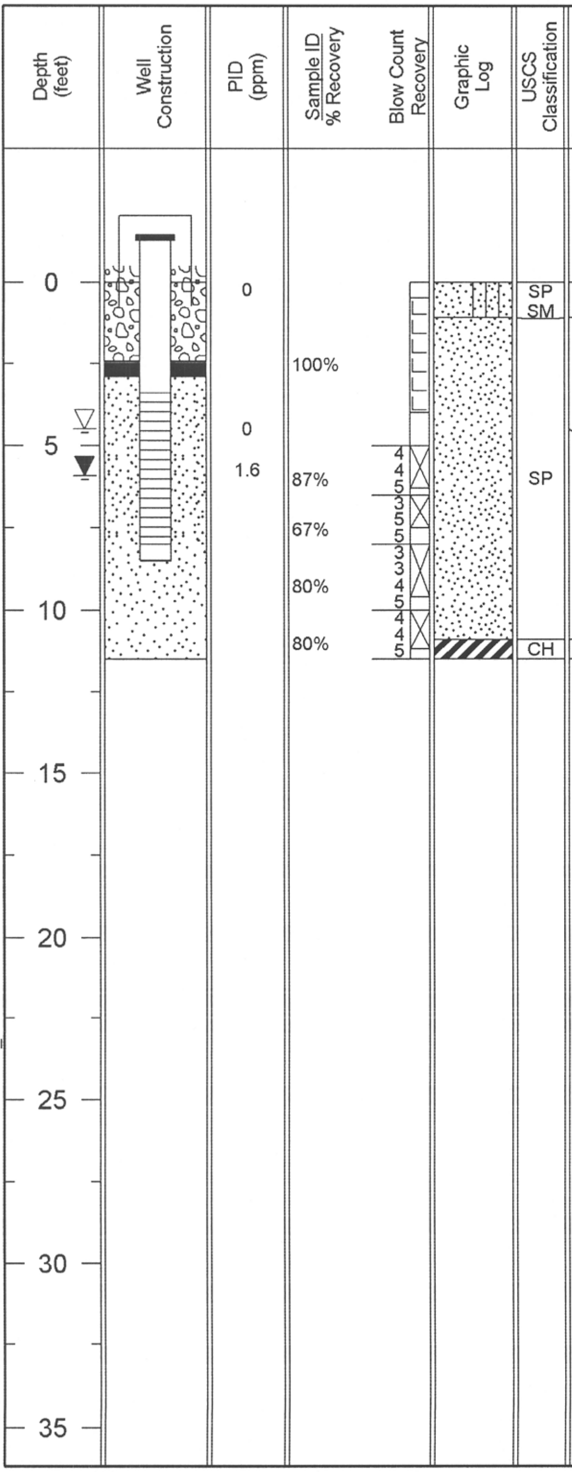
Monitoring Well S5-MW-38

Site Name IR Site 5 - Unit 2
Location NAVAL AIR STATION NORTH ISLAND, CA.
Client USN SWDIV
Project Name CTO-027
Project Number 818725
Drilling Company BC^2 Environmental Corp.

Date Boring Began 5/2/02 Finished 5/2/02
Logged By/Field Geologist Brian C. White
Log Checked By Richard Wong
Top of Casing Elevation 14.86 feet Mean Lower Low Water
Surface Elevation 12.86 feet Mean Lower Low Water
Coordinates N 1832452.35 feet E 6269799.01 feet

*See drilling and well construction details at the end of this log and accompanying legend for explanation of symbols and terms



Description

Geologic Descriptions are Based on the Unified Soil Classification System (USCS)

Sand with silt, dark brown (7.5 R 3/2), loose, poorly graded, fine to very fine grained, dry to slightly moist, ~8-12% silt, material appears to be imported road base with scattered subrounded gravel.

Sand, dark grayish brown (2.5Y 4/2), loose, poorly graded, very fine grained, moist, 1-2% silt, becomes very moist at 3 feet and wet at ~4.5 feet.

Sand, very dark gray (3/0), loose, poorly graded, very fine grained, wet, soil is stained and has weak degraded solvent type odor, <1% silt.

At 7.5 feet the silt percent increases to 2-4%.

Fat clay, very dark gray (3/0), very soft, very moist, stained or oganic black color.

Total depth is 11.5 feet below grade.

Drilling Details:

1. Borehole drilled with CME-75 drill rig equipped with 10-inch outside diamter (O.D.) hollow stem auger.
2. Core samples were recovered in a 2.0-foot long drive sampler (1.25-inch inside diameter[I.D.]).
3. Odor and staining detected at 4.5 feet below ground surface (bgs).
4. Photo ionization detector (PID) readings were taken from headspace of bagged soil samples after an approximate 10-minute waiting period.
5. Soil color clasification (i.e. olive yellow (5Y 6/3)) are from Munsell Soil Color Chart: 1994 Edition.

Well Construction:

1. Sediment trap: 0.5-foot long, 4-inch I.D. schedule 40 PVC, flush thread.
2. Well Screen: 5-foot long, 4-inch I.D. schedule 40 PVC, 0.01-inch slot, flush thread, slotted interval at 3.4 to 8.0 feet bgs.
3. Well Casing: 4-inch I.D. schedule 40 PVC, flush thread.
4. Filter Pack: Lonestar 2/12 grade silica sand (3 each 100 pound

Continued Next Page

Monitoring Well S5-MW-38

Depth (feet)	Well Construction	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Classification	Description Geologic Descriptions are Based on the Unified Soil Classification System (USCS)
35							*Continued* bags or approximately 3 cubic feet). 5. Bentonite Seal: 3/8 inch diamter pellets (0.5 bag or approximately 0.5 cubic feet). 6. Surface Completion: Concrete (5 each 90 pound bags or approximately 3 cubic feet).
40							
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75							
80							

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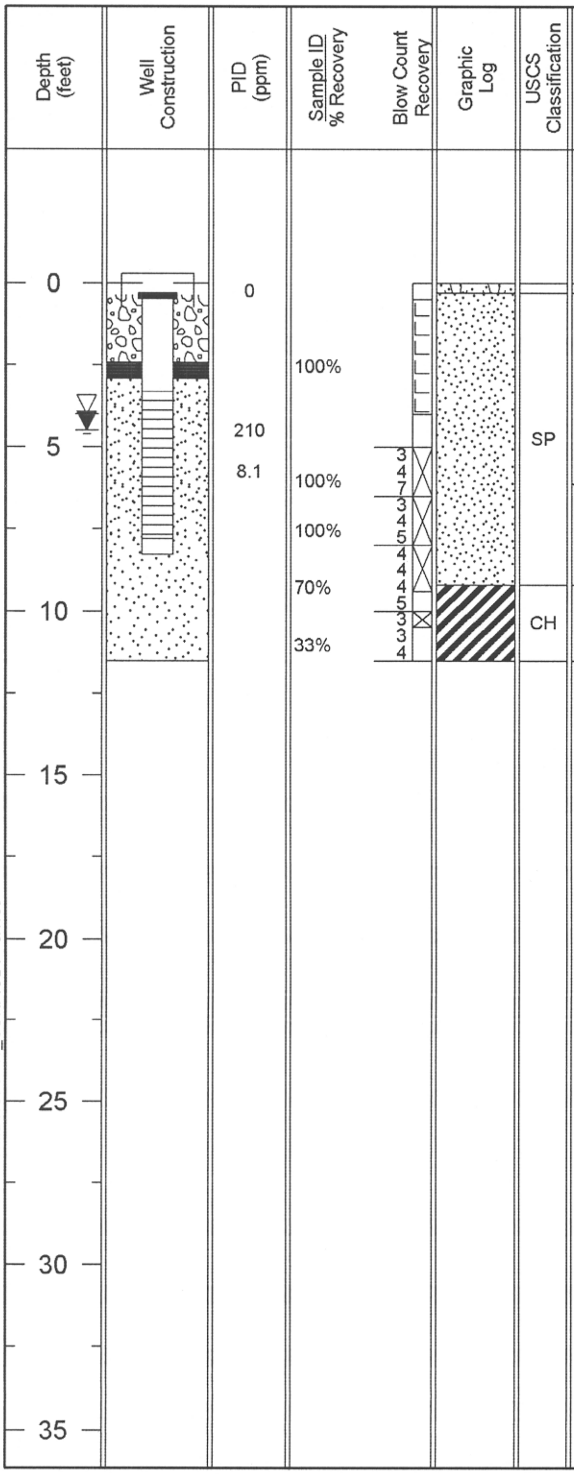
Monitoring Well S5-MW-39

Page: 1 of 2

Site Name IR Site 5 - Unit 2
Location NAVAL AIR STATION NORTH ISLAND, CA.
Client USN SWDIV
Project Name CTO-027
Project Number 818725
Drilling Company BC^2 Environmental Corp.

Date Boring Began 5/2/02 Finished 5/2/02
Logged By/Field Geologist Brian C. White
Log Checked By Richard Wong
Top of Casing Elevation 11.55 feet Mean Lower Low Water
Surface Elevation 11.90 feet Mean Lower Low Water
Coordinates N 1832525.74 feet E 6269873.60 feet

*See drilling and well construction details at the end of this log and accompanying legend for explanation of symbols and terms



Description

Geologic Descriptions are Based on the Unified Soil Classification System (USCS)

Grass sod/organic soil.

Grass at surface. Sand, dark grayish brown (2.5Y 4/2), loose, poorly graded, very fine grained, dry, becomes moist at 1 foot and wet at ~4 feet, < 1% silt.

Sand, black (2.5Y 2.5/1), loose, poorly graded, very fine grained, wet, stained and has solvent type odor, less than 1% silt. At 6 foot very black stained layer that is 0.1 feet thick.

Sand, dark gray (5Y 4/1), loose, poorly graded, very fine grained, wet, stained and has solvent type odor, < 1% silt.

Fat clay, black (2.5/0), very soft, very moist, stained or organic black color

Total depth is 11.5 feet below grade.

Drilling Details:

1. Borehole drilled with CME-75 drill rig equipped with 10-inch outside diamter (O.D.) hollow stem auger.
2. Core samples were recovered in a 2.0-foot long drive sampler (1.25-inch inside diameter[I.D.]).
3. Odor and staining detected at 4.0 feet below ground surface (bgs).
4. Photo ionization detector (PID) readings were taken from headspace of bagged soil samples after an approximate 10-minute waiting period.
5. Soil color clasification (i.e. olive yellow (5Y 6/3)) are from Munsell Soil Color Chart: 1994 Edition.

Well Construction:

1. Sediment trap: 0.5-foot long, 4-inch I.D. schedule 40 PVC, flush thread.
2. Well Screen: 5-foot long, 4-inch I.D. schedule 40 PVC, 0.01-inch slot, flush thread, slotted interval at 3.3 to 7.8 feet bgs.
3. Well Casing: 4-inch I.D. schedule 40 PVC, flush thread.
4. Filter Pack: Lonestar 2/12 grade silica sand (3 each 100 pound

Continued Next Page

Monitoring Well S5-MW-39

Depth (feet)	Well Construction	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Classification	Description Geologic Descriptions are Based on the Unified Soil Classification System (USCS)
35							*Continued* bags or approximately 4 cubic feet). 5. Bentonite Seal: 3/8 inch diamter pellets (0.5 bag or approximately 0.5 cubic feet). 6. Surface Completion: Concrete (5 each 90 pound bags or approximately 3 cubic feet).
40							
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65							
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80							

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Monitoring Well S5-MW-40

Page: 1 of 2

Site Name IR Site 5 - Unit 2

Location NAVAL AIR STATION NORTH ISLAND, CA.

Client USN SWDIV

Project Name CTO-027

Project Number 818725

Drilling Company BC² Environmental Corp.

Date Boring Began 5/2/02 Finished 5/2/02

Logged By/Field Geologist Brian C. White

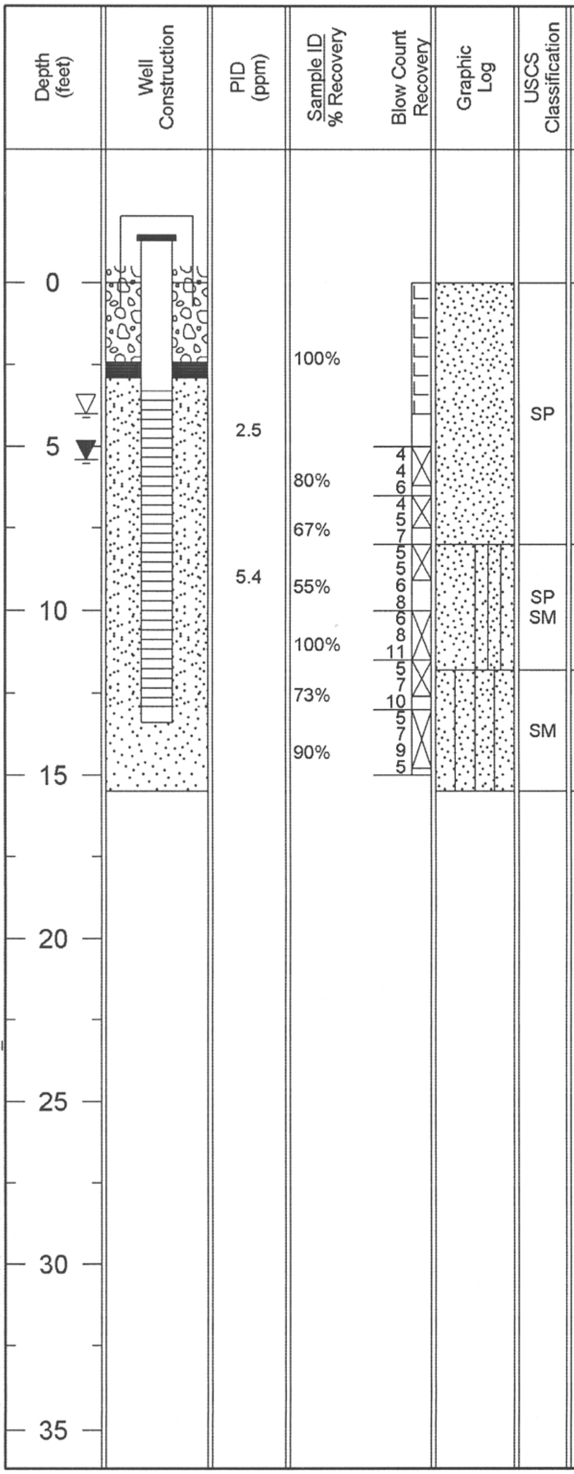
Log Checked By Richard Wong

Top of Casing Elevation 14.18 feet Mean Lower Low Water

Surface Elevation 12.18 feet Mean Lower Low Water

Coordinates N 1832489.88 feet E 6269748.78 feet

*See drilling and well construction details at the end of this log and accompanying legend for explanation of symbols and terms



Description

Geologic Descriptions are Based on the Unified Soil Classification System (USCS)

Sand, dark grayish brown (2.5Y 4/2) loose, poorly graded, very fine grained, dry, < 1% silt, becomes moist at 2 feet and very moist at 3 feet.

Sand, dark gray (2.5Y 4/1), loose, poorly graded, very fine grained, moist, < 1% silt, becomes wet at ~4 feet and has solvent type odor. From 5 feet to 6.5 feet sand is stained, very dark gray (3/0) and has strong solvent type odor.

Sand with silt, very dark grayish brown, (2.5Y 3/2), loose, poorly graded, very fine grained, wet, ~10-12% silt, scattered layers and stringers of stained soil that is black.

Silty sand, dark olive gray (5Y 3/2), loose, poorly graded, very fine grained, wet, ~15-20% silt.

Total depth is 15.5 feet below grade.

Drilling Details:

1. Borehole drilled with CME-75 drill rig equipped with 10-inch outside diamter (O.D.) hollow stem auger.
2. Core samples were recovered in a 2.0-foot long drive sampler (1.25-inch inside diameter[I.D.]).
3. Odor and staining detected at 5.0 feet below ground surface (bgs).
4. Photo ionization detector (PID) readings were taken from headspace of bagged soil samples after an approximate 10-minute waiting period.
5. Soil color clasification (i.e. olive yellow (5Y 6/3)) are from Munsell Soil Color Chart: 1994 Edition.

Well Construction:

1. Sedimant trap: 0.5-foot long, 4-inch I.D. schedule 40 PVC, flush thread.
2. Well Screen: 10-foot long, 4-inch I.D. schedule 40 PVC, 0.01-inch slot, flush thread, slotted interval at 3.3 to 12.9 feet bgs.

Continued Next Page

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Monitoring Well **S5-MW-40**

Page: 2 of 2

Depth (feet)	Well Construction	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Classification	Description Geologic Descriptions are Based on the Unified Soil Classification System (USCS)
							Continued
35							3. Well Casing: 4-inch I.D. schedule 40 PVC, flush thread. 4. Filter Pack: Lonestar 2/12 grade silica sand (4.5 each 100 pound bags or approximately 4.5 cubic feet).
40							5. Bentonite Seal: 3/8 inch diamter pellets (0.5 bag or approximately 0.5 cubic feet). 6. Surface Completion: Concrete (5 each 90 pound bags or approximately 3 cubic feet).
45							
50							
55							
60							
65							
70							
75							
80							

Appendix G
Full-Scale Chemical Oxidation Reports

(1) Fenton's Reagent Bench Test Report (June 28, 2002)
(2) $KMnO_4$ Bench Test Report (November 21, 2002)
(3) EBSI Groundwater Treatment Summary Report (June 2003)

G-1

Fenton's Reagent Bench Test Report (June 28, 2002)

Chemical Oxidation Bench-Scale Evaluation
Prepared For EBSI, Inc.
Naval Air Station North Island, Site 5
June 28, 2002

Test Protocol

A bench-scale test was designed to evaluate the efficiency of chemical oxidation of chlorinated volatile organic compounds (CVOC), particularly dichloroethylene (DCE) and vinyl chloride (VC), from soils and groundwater. Three treatment applications were compared:

Hydrogen Peroxide

Hydrogen Peroxide/COAM*

Hydrogen Peroxide/COAM/Iron

These applications were selected based upon site groundwater data which indicate that (1) the site exhibits a significant buffering capacity; and, (2) naturally-occurring dissolved iron may support Fenton-like chemical reactions.

Contaminated soil from the site was homogenized and distributed to sealed test jars. Impacted soil at the water table and clay from the confining layer from an area near MW-37 was used in the tests. Groundwater from the site was added to each jar to give a final slurry composition of approximately 30% solids by weight. The sealed jars were equipped with sampling ports to minimize volatile loss of CVOC associated with sampling. Each jar had a tedlar bag connected to one of the sampling ports to collect offgas from the chemical oxidation.

Monitoring of chemical oxidation of CVOC was accomplished through periodic sampling and analysis of liquid samples from each of the test jars. It was assumed that the concentration of CVOC bound to the soil was proportional to the concentration of CVOC in the liquid. Thus the percentage of CVOC oxidized in the system could be approximated based solely upon changes in liquid-phase CVOC concentrations. Since the naturally-occurring organic carbon in the soils is also oxidized, the CVOC adsorption capacity is reduced. This approach likely gives a conservative (low) estimate of destruction percentage.

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* COAM – Complex Organic Acids Mixture

All results for CVOC oxidation were calculated relative to concentrations in a control slurry which received no chemical oxidants.

Initial Characterization

Each of the test jars was sampled prior to the addition of any chemical oxidants to estimate the concentrations of CVOC in the slurry. Results from these analyses are presented in Table 1 as "treatment 0".

Results & Discussion

The tests were conducted with the addition of 10% hydrogen peroxide in the test slurries. After two treatments with the hydrogen peroxide, all three treatment applications efficiently removed the VC and DCE from the slurries. The Peroxide, COAM, and COAM/Iron treatments removed 94%, 94% and 95% of the VC, respectively. The Peroxide, COAM, and COAM/Iron treatments removed 94%, 92% and 99% of the DCE, respectively. The results are presented in Figures 1 and 2.

Considering the relatively small difference in removal efficiency between the three treatments, the simplest treatment (hydrogen peroxide alone) is recommended. There appears to be enough naturally-occurring iron at the site to support Fenton-like chemical reactions without the addition of catalyst.

Analytical data for all of the samples are presented in Table 1.

Table 1. Raw Data From Chemical Oxidation Test

Aqueous Sample Analysis		**Concentration (ug/L)**	
Sample	**Treatment**	**DCE**	**VC**
Control	0	1180	5880
	1	1190	5850
	2	1170	5800
Peroxide	0	1070	5970
	1	208	772
	2	72	334
COAM	0	1020	6320
	1	132	554
	2	93	346
COAM/Iron	0	1080	6430
	1	0	604
	2	16	294

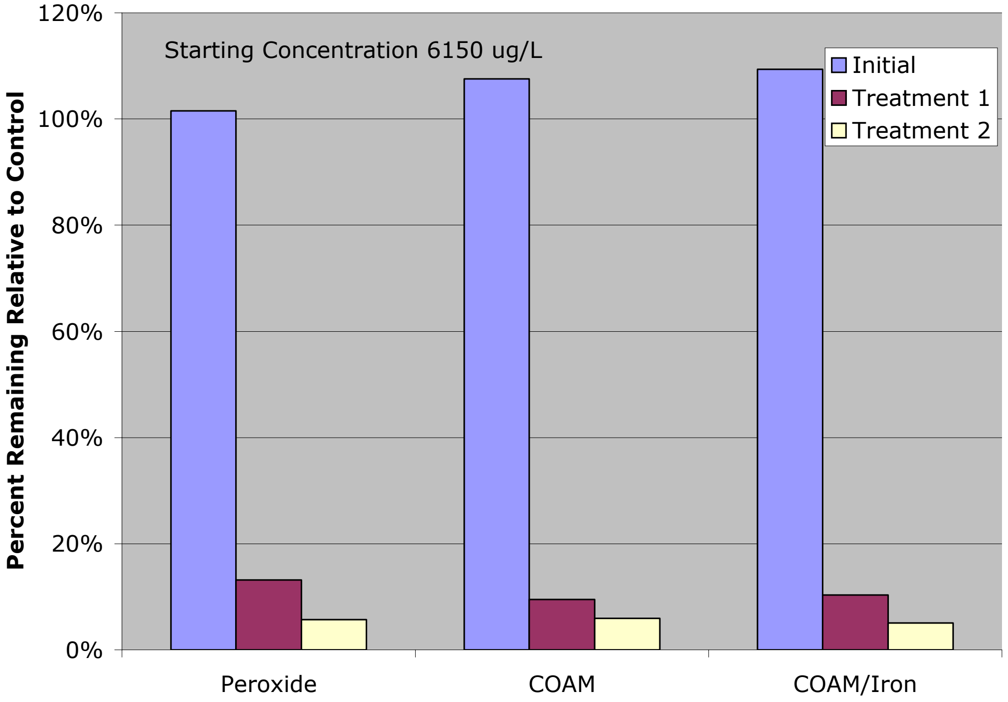


Figure 1. Vinyl Chloride Chemical Oxidation.

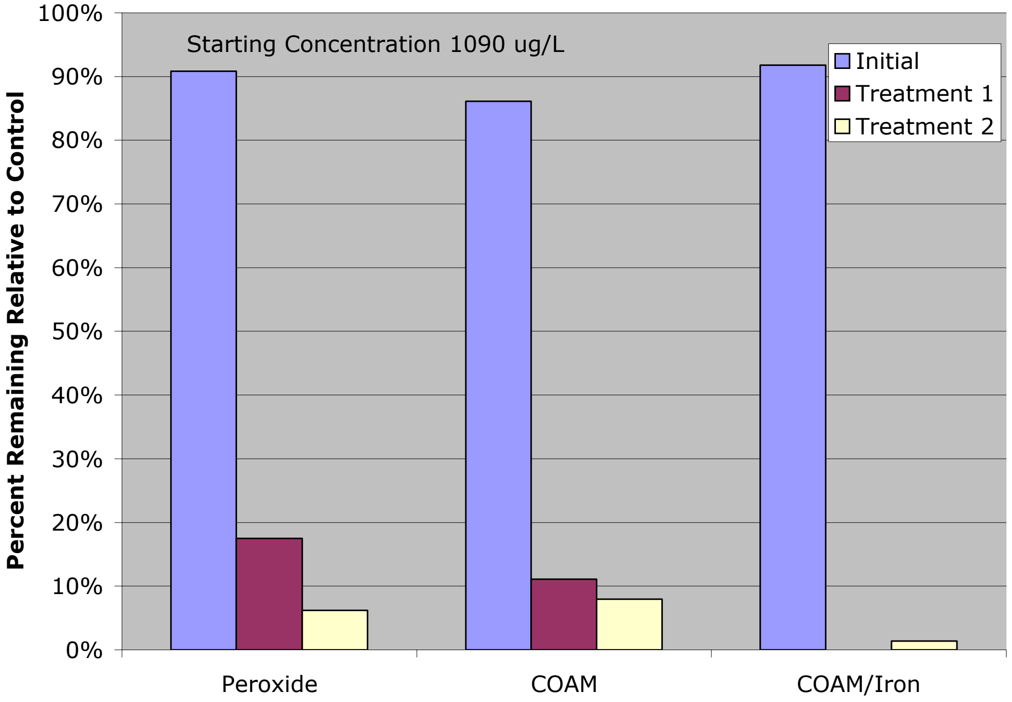


Figure 2. DCE Chemical Oxidation.

G-2
$KMnO_4$ Bench Test Report (November 21, 2002)

Chemical Oxidation Bench-Scale Evaluation
Prepared For EBSI, Inc.
Naval Air Station North Island, Site 5
November 21, 2002

Test Protocol

A bench-scale test was designed to evaluate the efficiency of using permanganate for the chemical oxidation of chlorinated volatile organic compounds (CVOC), particularly dichloroethylene (DCE) and vinyl chloride (VC), from soils and groundwater.

Contaminated soil from the site was homogenized and distributed to sealed test jars. Impacted soil at the water table and clay from the confining layer from an area near MW-37 was used in the tests. Groundwater from the site was added to each jar to give a final slurry composition of approximately 40% solids by weight. The sealed jars were equipped with sampling ports to minimize volatile loss of CVOC associated with sampling.

Monitoring of chemical oxidation of CVOC was accomplished through periodic sampling and analysis of liquid samples from each of the test jars. It was assumed that the concentration of CVOC bound to the soil was proportional to the concentration of CVOC in the liquid. Thus the percentage of CVOC oxidized in the system could be approximated based solely upon changes in liquid-phase CVOC concentrations. Since the naturally-occurring organic carbon in the soils is also oxidized, the CVOC adsorption capacity is reduced. This approach likely gives a conservative (low) estimate of destruction percentage.

All results for CVOC oxidation were calculated relative to concentrations in a control slurry which received no chemical oxidants.

Initial Characterization

Each of the test jars was sampled prior to the addition of any chemical oxidants to estimate the concentrations of CVOC in the slurry. Results from these analyses are presented in Table 1 as “treatment 0”.

Results & Discussion

The tests were conducted with the addition of 1% potassium permanganate in the test slurries for the first two treatments, and 0.25% for the second two treatments. The permanganate concentration in the later treatments was reduced to increase the efficiency of permanganate consumption. Following the treatments with potassium permanganate, the VC concentration was reduced by 96% relative to the control, and the DCE concentration was reduced by 94% relative to the control. The permanganate consumption in the test was significantly higher than the theoretical requirement for complete oxidation of the CVOC, indicating that the natural oxidant demand (NOD) of the soil will make a significant contribution to the overall oxidant requirements.

It is important to note, however, that since the site has been previously treated with Fenton's Reagent, a significant fraction of the NOD may have already been oxidized. Since virgin soils from the site were used for this bench-scale permanganate test, the *in-situ* permanganate demand may be somewhat lower than that observed during these bench-scale tests.

Analytical data for all of the samples are presented in Table 1.

Table 1. Raw Data From Permanganate Test

Aqueous Sample Analysis		**Concentration (ug/L)**	
Sample	**Treatment**	**DCE**	**VC**
Control	0	20,700	4,670
	1	17,900	3,380
	2	14,200	3,130
	3	11,500	1,680
	4	12,800	1,610
Permanganate	0	21,100	5,580
	1	4,950	1,120
	2	874	196
	3	783	131
	4	758	58

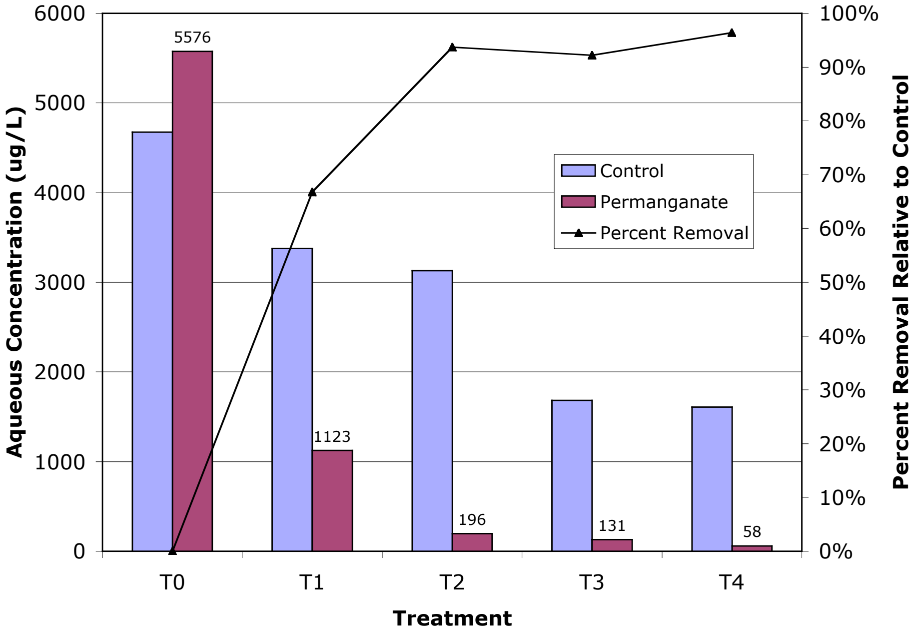


Figure 1. Vinyl Chloride Chemical Oxidation.

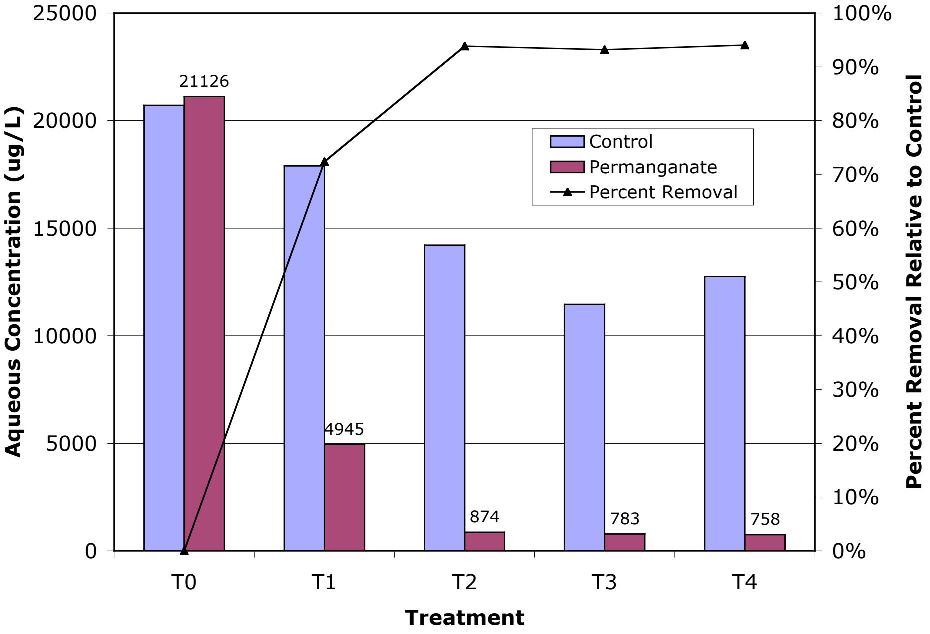


Figure 2. DCE Chemical Oxidation.

G-3
EBSI Groundwater Treatment Summary Report (June 2003)

PROJECT SUMMARY

IR Site 5 - Unit 2, Naval Air Station North Island
San Diego, California

Prepared for:

Shaw Environmental Inc.
1230 Columbia Street, Suite 1200
San Diego, California 92101

Prepared by:

Environmental Business Solutions International, Inc.
1127 Crossing Way
Wayne, New Jersey 07470

June 2003

Table of Contents

List of Figures

List of Tables

LIST OF ACRONYMS AND ABBREVIATIONS

EBSI	Environmental Business Solutions International, Inc.
NAS	Naval Air Station
IR	Installation Restoration
Shaw	Shaw Environmental Inc.
CVOC	chlorinated volatile organic compound
bgs	below ground surface
RAW	Remedial Action Workplan
DCE	dichloroethylene
VC	vinyl chloride
COAM	complex organic acids mixture
μg/L	micrograms per liter
MW	monitor well
PIW	propagation injection point
VIW	vertical injection point
CPVC	chemical polyvinyl chloride
HIW	horizontal injection well
PVC	polyvinyl chloride
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

1.0 Introduction

Environmental Business Solutions International, Inc. (EBSI) conducted in-situ chemical oxidation using the On-Contact Process at Naval Air Station (NAS) North Island Installation Restoration (IR) Site 5 - Unit 2. The work was conducted under Shaw Environmental Inc. (Shaw) Purchase Order number 189758.

In summary, EBSI installed twenty nine total injection points and conducted four treatment events (Phase I through Phase IV) on the site from June 2002 to February 2003. Injection points were a combination of propagation injection points (PIW), horizontal injection wells (HIW) and vertical injection wells (VIW). Chemical treatment included both hydrogen peroxide and potassium permanganate injections. Shaw collected all baseline and post-treatment samples.

1.1 Project Objectives

The purpose of this project was to achieve 90% chlorinated volatile organic compounds (CVOCs) concentration reduction in selected groundwater samples. This was to be accomplished using combined injection techniques and sequences of chemical oxidation injected to degrade target compounds.

1.2 Project Personal

The EBSI professional staff includes research chemists, scientists, engineers and geologists who are all experienced in conducting in-situ chemical oxidation projects.

Dr. Bill Mahaffey – An industry recognized leader in bio-treatment and chemical oxidation treatment, Dr. Mahaffey specifies the chemical formulations to be used in the varies stages of EBSI cleanup projects. From surfactants and oxidizing formulations to biodegradation augmentation treatments, Dr. Mahaffey has conducted bench and field scale treatments using a variety of techniques.

Dr. Bill Slack – Recognized as an expert in hydraulic fracturing and the physical delivery of subsurface chemical treatments, Dr. Slack has experience with geologic conditions across North America. The wide area coverage achieved in the On-Contact Process® stems from Dr. Slack's delivery method developments.

Ron Adams, P.E. – A chemical engineer with more than a dozen years in designing and implementing remedial actions at contaminated sites, Mr. Adams has managed over 65 in-situ chemical oxidation projects using the CleanOX Process. Mr. Adams designed and was the technical lead for the pilot testing conducted at Site 5 - Unit 2 using the CleanOX Process.

Tony Scittorale – Mr. Scittorale manages the day to day activities of the EBSI field crews and has become expert in resolving logistic and technical issues that arise during any field remediation effort. Mr. Scittorale has over 7 years of experience in implementing site solutions – from treatment system construction to operation and maintenance.

Ron Resseguie - Mr. Resseguie was an EBSI Field Manager from August 2001 to through December 2002. Beginning in June 2002, Mr. Resseguie managed the field operations of the On-Contact Process at Site 5 - Unit 2.

Brian Kennedy – Mr. Kennedy has been a field geologist and technician with EBSI since August of 2001. Throughout the duration of the Site 5 – Unit 2 project, Mr. Kennedy acted as an onsite technician for the application of the On-Contact Process. In January 2003, Mr. Kennedy took over the Field Management responsibilities at Site 5 – Unit 2.

Donald McFadden – Mr. McFadden has been a field technician with EBSI since December 2002. Mr. McFadden worked at Site 5 – Unit 2 during the final injection phase IV. During this time he was responsible for applying the On-Contact Process.

1.3 Site Information

The former liquid waste disposal pits of Site 5 - Unit 2 were used for the disposal of petroleum products and chlorinated solvents and their respective containers by the Navy. Most solid materials have been removed from the subsurface, however some drums were discovered during excavation of the non-saturated source area. This site is no longer used for hazardous material disposal. The subsurface at Site 5 - Unit 2 is composed of fill material to approximately ten feet below ground surface (bgs). The fill was apparently dredged from the nearby San Diego Bay and is mostly very fine sands.

The following describes baseline conditions.

- Site 5 - Unit 1 is currently covered by the NAS North Island base golf course. Impacts at Site 5 - Units 1 and 2 are the result of previous military landfill activities in the area. Site 5 - Unit 2 geology consists of fine to medium sands to about 10 to 15 feet bgs, where silty clay (Spanish Bight) is encountered. Depth to the water table is approximately 5 feet bgs. The vertical interval of treatment is from 5 to 10-15 feet bgs. Great care was taken during drilling to ensure the integrity of Spanish Bight layer was not compromised, potentially spread contaminants;

- Site investigations have determined that chlorinated CVOCs were found at elevated levels in shallow groundwater at the site. Shaw has identified an approximately 40,000 square foot area shown in the MIP data maps provided in the bid package;

- Shaw intends to excavate the source area soils as shown as the purple zone of the MIP data maps. Location and dimensions are described in the Remedial Action Workplan (RAW) addendum.

2.0 Approach for VOC reduction

2.1 In situ chemical oxidation

EBSI's technical approach to the project was based on our site understanding and on our assessment of the CleanOX pilot testing results. Our approach differed in several respects:

2.1.1 Emerging technology

EBSI proposed using propagations (described below) which provide a preferential pathway for rapid, radial distribution of On-Contact chemistry. While site soils are sandy (as is the propagant material), the propagation is formed from well-sorted, 'clean' sand (among other, proprietary ingredients) which provides more uniform flow paths for reagents. Once reagents are distributed radially, they need only to migrate vertically a few feet in order to contact contaminants.

The On-Contact Process® is a proprietary in-situ technology which involves the application of physical and chemical methods to degrade organic contamination in soil and groundwater into harmless compounds like carbon dioxide and water. Specifically, the On-Contact Process® consists of the following four stages: 1) a physical method to enhance the disbursement of reagents into the contaminated area, 2) a chemical method involving the injection of a proprietary biodegradable conditioning mixture to enhance the availability of target contaminants, 3) a chemical method involving the injection of a proprietary oxidation mixture to degrade target contaminants, and 4) a chemical method to complete the degradation process and restore subsurface conditions, if necessary. These stages were applied through the injection points discussed above with exception to Stage 4.

2.1.2 Advantages of the On-Contact Process®

EBSI applied this technical approach because: (1) traditional approaches would require 45 injection wells be installed whereas the On-Contact Process® approach requires roughly one-half to two-thirds that amount. Well methods require that reagents flow through the tortuous path of native soil mixtures both radially and vertically in order to contact contaminants. Injection point installation is included in our lump sum costs; (2) the high degree of contaminant dissolution that occurs during the initial Fenton-like treatments accomplished using small volumes of less costly conditioners; (3) the oxidation stage can be accomplished at neutral pH conditions, eliminating the need for excessive amounts of mineral acids; and, (4) the On-Contact Process® oxidation formulations are more efficient therefore less oxidizer is required to achieve similar goals.

A single propagation has the ability to do the work of 5 to 35 vertical injection wells (depending on site soils and treatment interval) at a fraction of the cost. Reagents were injected into the propagation area using fixed manifolds on the surface. Propagations are filled like bladders at low pressure and are used to feed reagents into subsurface environments.

2.2 Summary of bench test results

2.2.1 Test Protocol

A bench-scale test was designed to evaluate the efficiency of chemical oxidation of CVOCs, particularly dichloroethylene (DCE) and vinyl chloride (VC), from soils and groundwater. Three treatment applications were compared:

Hydrogen Peroxide

Hydrogen Peroxide/COAM (complex organic acids mixture)

Hydrogen Peroxide/COAM/Iron

These applications were selected based upon site groundwater data which indicated that (1) the site exhibits a significant buffering capacity; and, (2) naturally-occurring dissolved iron may support Fenton-like chemical reactions.

Contaminated soil from the site was homogenized and distributed to sealed test jars. Impacted soil at the water table and clay from the confining layer from an area near monitor well (MW) 37 was used in the tests. Groundwater from the site was added to each jar to give a final slurry composition of approximately 30% solids by weight. The sealed jars were equipped with sampling ports to minimize volatile loss of CVOC associated with sampling. Each jar had a tedlar bag connected to one of the sampling ports to collect offgas from the chemical oxidation reaction.

Monitoring of chemical oxidation of CVOC was accomplished through periodic sampling and analysis of liquid samples from each of the test jars. It was assumed that the concentration of CVOC bound to the soil was proportional to the concentration of CVOC in the liquid. Thus the percentage of CVOC oxidized in the system could be approximated based solely upon changes in liquid-phase CVOC concentrations. Since the naturally-occurring organic carbon in the soils is also oxidized, the CVOC adsorption capacity is reduced. This approach likely gives a conservative (low) estimate of destruction percentage.

All results for CVOC oxidation were calculated relative to concentrations in a control slurry which received no chemical oxidants.

2.2.2 Initial Characterization

Each of the test jars was sampled prior to the addition of any chemical oxidants to estimate the concentrations of CVOC in the slurry. Results from these analyses are presented in Table 1 as “treatment 0”.

2.2.3 Results & Discussion

The tests were conducted with the addition of 10% hydrogen peroxide in the test slurries. After two treatments with the hydrogen peroxide, all three treatment applications efficiently removed the VC and DCE from the slurries. The hydrogen peroxide, hydrogen peroxide/COAM, and hydrogen peroxide/COAM/iron treatments removed 94%, 94% and 95% of the VC, respectively; and removed 94%, 92% and 99% of the DCE, respectively. The results are presented in Figures 1 and 2.

Considering the relatively small difference in removal efficiency between the three treatments, the simplest treatment (hydrogen peroxide alone) is recommended. There appears to be enough naturally-occurring iron at the site to support Fenton-like chemical reactions without the addition of catalyst.

Analytical data for all bench test samples are presented in Table 1.

Table 1. Raw Data From Chemical Oxidation Test

Aqueous Sample Analysis		Concentration (ug/L)	
Sample	**Treatment**	**DCE**	**VC**
Control	0	1180	5880
	1	1190	5850
	2	1170	5800
Peroxide	0	1070	5970
	1	208	772
	2	72	334
COAM	0	1020	6320
	1	132	554
	2	93	346
COAM/Iron	0	1080	6430
	1	0	604
	2	16	294

Figure 1. Vinyl Chloride Chemical Oxidation.

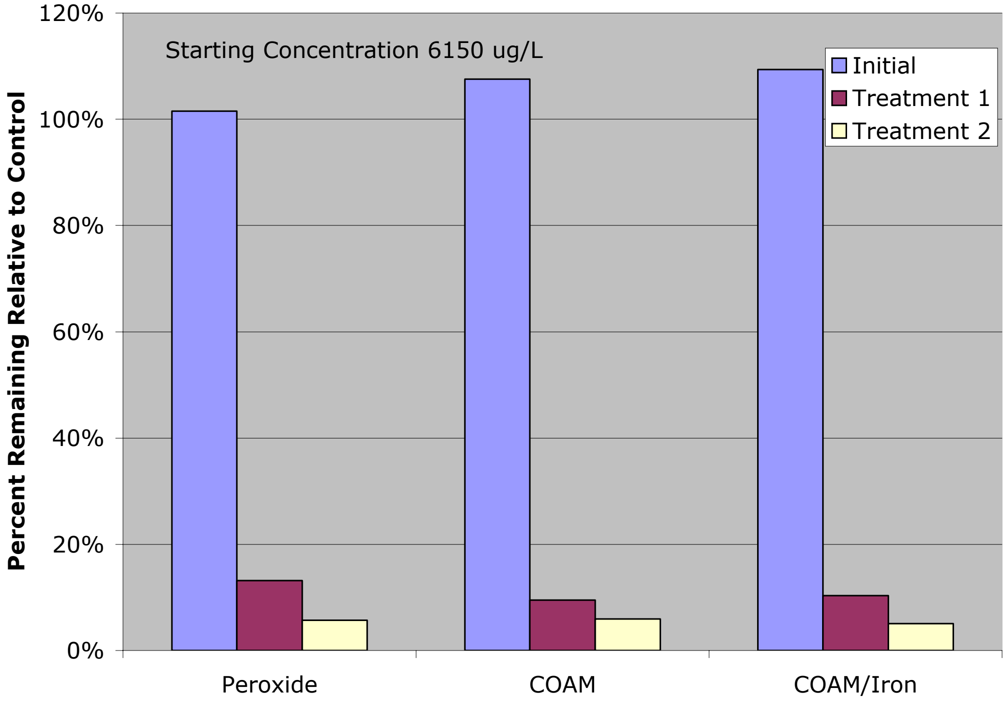
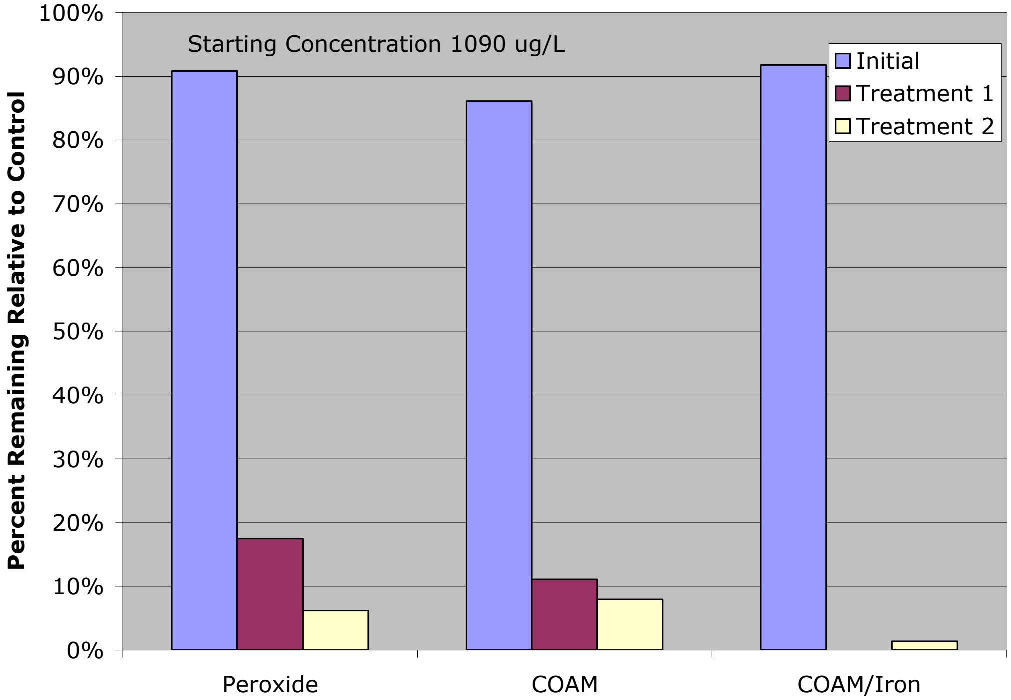


Figure 2. DCE Chemical Oxidation.



3.0 General Procedures Used

EBSI installed a combination of vertical injection points and propagation injection points within the impacted area to create a conduit for chemical oxidizing reagents. Following installation of the delivery network, reagents associated with the On-Contact® Process were infiltrated into the subsurface.

Physical Stage –The On-Contact® process at Site 5 Unit – 2 was conducted with the use of propagations and vertical injection wells. Propagation locations were plotted using a grid format spaced at twenty foot intervals. Each point was then completed using a fracturing like technology to create a disk from 50 to 120 foot across and approximately 2 cm in average thickness. This creates a plane of approximately 11,000 square feet to infiltrate reagents into the subsurface independent of geological limitations. EBSI installed a combination of 10 vertical injection points and 19 propagation injection points within the impacted area creating a conduit for chemical oxidizing reagents. Following installation of the delivery network, reagents associated with the On-Contact® Process were infiltrated into the subsurface.

Preparation Stage – In all On-Contact® designs, contaminated areas are prepared in the subsurface for a higher efficiency of contaminant conversion to base states or harmless compounds. To prevent rebound effects, contaminants need to be removed from adhering to or encapsulating site soils. To accomplish this, very low concentration and volume mixtures of conditioning agents are used to enhance the chemical remediation within the influence of the propagations.

Conversion Stage – Using oxidizers, food grade acids, catalysts, reducing compounds and / or transitional compounds specifically configured for the site, contaminants were converted to harmless states “on-contact”. Please note one of the major innovations of the On-Contact® family is the use of sub-surface electronics to monitor the condition and travel of remediation fluids and the real-time survivability of the contaminants. EBSI anticipates that multiple (at least two) round of chemical treatment will be needed to achieve project goals. **Injections will be conducted to prevent contaminant migration to areas outside the treatment area.**

Based on Dr. Mahaffey’s review of the site information provided, it appears that the reducing conditions at the site together with relatively high naturally occurring iron concentrations have led to there being between 15 mg/l to 30 mg/l ferrous iron in site groundwater. EBSI’s first attempt at oxidation was therefore conducted without addition of any supplemental iron to the aquifer. Based on field observations, EBSI then applied a solution of dilute organic acid that will both reduce any oxidized iron back to ferrous and maintain it in solution for subsequent use as a catalyst. **Our approach to chemical treatment is to make the smallest impact to site conditions as possible while still achieving our goal of oxidizing contaminants.**

All On-Contact® chemistry is adjusted on-site. Real-time monitoring allows for tuning of application stages and ends the unpredictability of batch in-situ application, especially infiltration through conventional wells. The Monitoring Plan is displayed as Table 2. There is no long-term chemical inventory stored at the site. All On-Contact® chemistry is environmentally friendly, neutralized by water, if spilled. Site work is conducted by OSHA certified / EBSI trained technicians and normally requires Level D OSHA equipment.

Table 2. Monitoring Plan

Parameter	Baseline	During Treatment	Interim/Post Treatment
Monitoring well headspace			
OVA*	Shaw	EBSI	Shaw
LEL*	Shaw	EBSI	Shaw
O2*	Shaw	EBSI	Shaw
CO2*	Shaw	EBSI	Shaw
Free Chlorine*	Shaw	EBSI	Shaw
Groundwater samples			
VOCs (8260)	Shaw		Shaw
Total & dissolved iron (AA or ICP)	Shaw		Shaw
pH*	Shaw	EBSI	Shaw
Dissolved O2*	Shaw	EBSI	Shaw
Specific Conductance*	Shaw	EBSI	Shaw
ORP*	Shaw	EBSI	Shaw
Soil Samples			
VOCs (8260)	Shaw		Shaw

*measured using field instrument

4.0 Sequence of Events

4.1 Introduction

The area of concern consists of 10 to 12 feet of beach sand covering the Spanish Bight clay layer. It is believed that the Spanish Bight clay has prevented the downward vertical migration of contaminants. Figure 3 is a site map including injection well locations. EBSI installed 19 PIWs (S5-PIW-1 through 19) and 4 VIWs (S5-VIW-2 through 5) starting on June 12, 2002. FRx fractured PIWs beginning on June 21, 2002. Figure 4 shows the PIW well construction diagram. Figure 5 shows the VIW well construction diagrams. Six supplemental injection wells (S5-VIW-6 through 11) were installed on January 29, 2003 by Tri-County Drilling. A well construction diagram including a general soil description for the supplemental VIWs is depicted in Figure 6.

A two tank setup was implemented for pumped chemical injection with a third tank utilized for gravity feed injection. The two tank setups each consisted of a 110 gallon polyethylene cone tank connected to a multiphase magnetic drive inverter pump. The manifold setup is constructed out of 1-inch I.D. schedule 80 CPVC. Each manifold has a pressure gauge that reads pump pressure and one that reads head resistance pressure gauge. A 1-inch stainless steel pressure release valve prevents the potential buildup of excess pressure within the system. A ball valve is used to manually de-gas the system. The third tank consisted only of a Polyethylene cone tank connected directly to a manifold. This tank was primarily used on the HIWs because the system did not require pressurization. A two-inch Cam Lock is used to fasten the manifold to a 12-inch riser pipe. For the PIWs, a steel 2-inch threaded collar was used to fasten the riser to the well. For the HIWs and the VIWs, a 2-inch fernco fitting was used.

A total of four injection phases were conducted between July 15, 2002 and February 22, 2003. Phase I and Phase II injections totaled 103,982 pounds of solution injected into the subsurface. Phase III and Phase IV totaled 345,682 pounds of solution injected into the subsurface. Total water usage was 46,780 gallons. Cumulative project time spanned 70 days of mobilization.

4.1.1 Hydraulic Fracturing Summary

This section summarizes fieldwork performed at Site 5 - Unit 2 from June 19 to 23, 2002. During that time FRX created 19 sand-filled fractures to facilitate the injection of treatment chemicals into the subsurface by EBSI.

The remedial design for the site used hydraulic fracturing to create preferential pathways for the installation of sand propagations for improved in situ distribution and enhanced injection of proprietary chemical treatments by EBSI.

Fractures were created using methods and specialty equipment provided by FRx. These procedures include (1) installing a dedicated propagation conduit consisting of a 2-inch pipe fitted with a drive point, (2) dislodging the drive point downward to expose a short section of open hole, (3) cutting a thin kerf in the wall of the borehole below the driven pipe by means of a horizontal hydraulic jet, (4) pressurizing the kerf with liquid so as to nucleate a horizontal fracture from the hoop that constitutes its outer edge, (5) delivering sand-laden slurry to the open hole section of the well so as to propagate the fracture, and (6) monitoring the injection pressure and surface deformation, which permits deduction of the fracture form.

Wells were installed at locations specified by Environmental Business Solutions, Inc. by EBSI personnel and their drilling contractor prior to the arrival of FRx personnel on site. The drive points were dislodged prior to fracturing by FRx personnel using FRx equipment.

Cutting the notch for the 19 propagation locations yielded approximately 400 gallons of slurry composed of soil particles (very fine to fine grained sands, dark gray to black in color) and groundwater. Slurry derived from notching was disposed of by Shaw. Fracture nucleation and propagation installation proceeded easily at all propagations. Fractures were filled with sand obtained from Sinclair Drilling Supplies of San Diego, California. Table 3 details the materials used to create each fracture.

Following fracture formation at the site, FRx personnel installed an inner screened PVC casing and screen within the steel pipe installed by EBSI for each of the 19 propagation locations. Six to eight inches of 1.25 inch 20-slot screen was washed with water to the steel drive point. Inner casings were completed with 1.25 inch Schedule 40 PVC riser to ground surface. The annular space between the inner and outer casings was filled with 12/20 screen sand to within two to three feet of the ground surface. The inner casing should assure that the connection with each fracture, or the area where the fractures intersect their respective riser pipe can be washed with water without the risk of dislodging the propagate material upward into the propagation riser pipe and disrupting the connection between the surface and sand propagation.

Wellhead injection pressure was monitored during fracturing. A nucleation pressure, or breakdown pressure, could be identified for each fracture, which suggests the fractures were horizontal or sub-horizontal. The upward surface displacement caused by opening the aperture of each fracture, a feature called uplift, was observed and recorded for all fractures created at this site. Similarity among pressure logs and near ideal uplift patterns for all of the fractures created at this site are strong indicators that these fractures are horizontal. Uplift data indicates that these fractures are approximately centered on their respective injection wells and that each fracture is at least 10 to 15 feet in radius.

Sand-filled horizontal fractures in fine-grained soils should greatly enhance injection rates and distribution of injected fluid in the soil. Development of hydraulic fractures at the United States Environmental Protection Agency (USEPA) in the early 1990s showed that such fractures would affect at least an order of magnitude increase in discharge or delivery and cause significant flow at radii twice the extent of the sand-filled fracture. In any case, injection into the propagation should be constrained to pressures less than the final propagation pressure of the fracture, least the fracture aperture is opened and sand be dislodged away from the propagation conduit. If propagation sand near the conduit pipe is displaced, that action might inhibit subsequent delivery or recovery of fluids. Final injection pressures for each propagation are listed in Table 3.

Table 3. Fracture Description

FracID	Date	Depth (Ft bgs)	Sand (Lb)	Sand Type	Gel (Gal)	Final Injection Pressure (psi)
PIW-1	June 23, 2002	10	500	12/20 Sinclair	110	15
PIW-2	June 21, 2002	10	450	12/20 Sinclair	80	13
PIW-3	June 21, 2002	10	450	12/20 Sinclair	100	15
PIW-4	June 21, 2002	10	450	12/20 Sinclair	40	22
PIW-5	June 23, 2002	10	500	12/20 Sinclair	50	15
PIW-6	June 21, 2002	10	450	12/20 Sinclair	60	19
PIW-7	June 21, 2002	10	450	12/20 Sinclair	70	20
PIW-8	June 21, 2002	10	450	12/20 Sinclair	70	20
PIW-9	June 21, 2002	10	450	12/20 Sinclair	85	15
PIW-10	June 21, 2002	10	500	12/20 Sinclair	100	13
PIW-11	June 22, 2002	10	450	12/20 Sinclair	85	16
PIW-12	June 21, 2002	10	500	12/20 Sinclair	100	15
PIW-13	June 21, 2002	10	450	12/20 Sinclair	80	11
PIW-14	June 22, 2002	10	450	12/20 Sinclair	55	18
PIW-15	June 15, 2002	10	450	12/20 Sinclair	60	18
PIW-16	June 22, 2002	10	450	12/20 Sinclair	80	10
PIW-17	June 22, 2002	10	450	12/20 Sinclair	40	14
PIW-18	June 22, 2002	10	450	12/20 Sinclair	60	12
PIW-19	June 22, 2002	10	450	12/20 Sinclair	90	13
Total			8750			

On June 14, 2002, EBSI personnel oversaw the installation of four vertical injection wells by Vironex, locations S5-VIW-02, S5-VIW-03, S5-VIW-04 and S5-VIW-05. Injection well logs are provided as Figures 5. Each well was advanced to a depth of approximately 11 feet bgs and a 2-inch well installed in a 3.25 inch borehole. 6-inches of 10/20 silica sand were placed at the bottom of the borehole followed by a 2-inch diameter silt cap 6-inches in length. A 5 foot length of Tri-Lock 2-inch schedule 40 PVC screen was installed. The screen is 0.01 slot size. A 4.5 foot long riser pipe was installed from 5 feet bgs to 0.5 feet bgs. A no. 10/20 silica sand pack was added to the borehole from 11 feet bgs to 7 feet bgs, one foot above the riser/screen union. One foot of hydrated bentonite granules were added followed by 2.5 feet of Type-1 Portland cement. Vertical injection wells were completed using a 12-inch round traffic box encapsulated by a 4-inch thick 2 foot by 2 foot concrete pad.

On January 29, 2003, EBSI personnel installed 6 supplemental vertical injection wells labeled S5-VIW-06 through 11. Supplemental injection wells were installed using an 8-

inch auger to drill each borehole. Two-inch PVC was advanced to 10 feet bgs. The well was finished with a 0.01 cut slotted screened length from 5 to 10 feet bgs and riser to grade. Sand (2/12) was used to complete the filter pack which extends 6 inches above the screened/unscreened union. Due to the shallow depth of the VIWs, the bentonite annular seal was reduced from the standard 3 foot thick section to a 1 foot section. This modification (specified by Shaw) allowed for the installation of the 3 foot thick Class A concrete surface seal. The driller settled the gravel pack in each well by surging with a surge block for approximately 5 minutes to attain hydraulic conductivity. A 12-inch diameter security vault was installed on each well with a 2-inch locking cap. The concrete surface seal has a diameter of 3 feet. Well logs are presented as Figure 6.

4.1.2 Phase I – Hydrogen Peroxide and Iron + Hydrogen Peroxide

The first injections round of Phase 1 was started on July 15, 2002 and continued through July 19, 2002, 5 days consecutively. During this time 19 PIWs, 4 VIWs and 3 HIWs were utilized for injections. The first round of injections consisted of a 17% solution of hydrogen peroxide (technical grade), being injected into the fore mentioned PIW, HIW and VIW points at an average flow rate of 1 gallon per minute (gpm). To achieve a 17% solution of hydrogen peroxide for injection, 50 gallons of water was added to 35% hydrogen peroxide. Table 4 is a summary table containing injection quantities for the first half of Phase I chemical injections. Chemical injections for this injection period totaled 36,660 pounds of solution using 2,000 gallons of water.

The second round of Phase 1 injections started on July 22, 2002 and continued through July 26, 2002, 5 days consecutively. The same points as the first round were treated, with the difference being that each point received 30 gallons of ferrous chloride solution, prior to the injection of a 17% hydrogen peroxide solution at an injection rate of $1^1/_2$ gpm. Ferrous iron and total iron measurements were taken before and after the first round of injection. Prior to the injection rounds, base line readings were established in the surrounding monitoring wells (MWs) and recorded (Table 5). During the treatments, surrounding MWs were monitored to establish an effective radius of influence. An average radius was visually confirmed by the visual monitoring of off-gassing, increased hydraulic head and use of field equipment in nearby monitor wells at 30 feet, although instances of up to 60 ft radius were also observed on several occasions. During the treatments no significant temperature rises were observed in the surrounding MWs. Several of the PIWs did see an increase in temperature after treatment (steaming and occasional hot fluid rising up the casing, in small quantities). Peroxide rose to the surface in several of the MWs within the main body/area of treatment, but none of the reactions were hot. Table 6 is a summary table containing injection quantities for the second half of Phase I chemical injections. Total chemistry injected was 43,998 pounds of solution with 2,840 gallons of water added.

4.1.3 Phase II - Iron + Hydrogen Peroxide

Phase 2 injections began on September 17, 2002 and concluded on September 22, 2002. Prior to the Phase II injection round, base line readings were established in the surrounding MWs and recorded (Table 7). The injection was conducted in this treatment event as is described above for the second round of Phase 1 (Section 4.1.2). A solution of 1.5 gallons of iron sulfate added to 30 gallons of water was injected into each of the injection locations at a rate of 2.5 gallons per minute. This was followed by a 17% hydrogen peroxide solution pumped at a rate of 1 to 1.5 gallons per minute. The chemical quantities for each injection location are given in Table 8. Total chemistry injected was 43,998 pounds of solution with 2,840 gallons of water added.

During the injection process PIW-04, PIW-7, PIW-12 and PIW-17 were damaged. As observed, several factors that may have contributed to the damaging of these points;

- Inadequate bentonite/grout and cement seals can create undesired plains of weakness for fluid to migrate through.
- Over pressurization of the system caused by the chemical reaction can force fluid through the soil/seal interfaces resulting in the surfacing of chemistry.

These injection points should be abandoned since they no longer function and may provide an undesired conduit to the subsurface.

4.1.4 Phase III – Potassium Permanganate

Phase 3 injections included the use of potassium permanganate in proxy of Fenton's Reagent. Injections began on December 9, 2002 and concluded December 18, 2002. A total of 2000 pounds of potassium permanganate was injected into 18 different VIW, PIWs and HIWs. Injections were conducted mostly by gravity feed, although pumping was required for some points. Apart from the technique utilized, an average pumping rate of 2 gallons per minute was not exceeded. 36,656 pounds of solution was added to the subsurface with 4,300 gallons of water added (Table 9). MWs were monitored for the presence or absence of potassium permanganate. Potassium permanganate was not detected in any of the monitor wells.

Potassium Permanganate was injected into PIW-7, PIW-12 and PIW-17 even though these points had been damaged during previous injections. Successful acceptance of fluid during this phase without surfacing is attributed to a pressure free system. The chemistry added to these points was done by gravity feed at a rate of 0.25 gallons per minute. This slow rate allowed for fluid to slowly infiltrate into the surrounding soil and groundwater with no mounding effect.

4.1.5 Phase IV Potassium Permanganate

On January 28, 2003 EBSI personal arrived in San Diego, California to begin Phase IV of the in-situ chemical remediation. Following the installation of the 6 additional VIWs that occurred on January 29, 2003, EBSI initiated chemical injections on January 30, 2003 and continued through February 19, 2003. The total quantity of injected solution consisted of 309,026 pounds of solution. An approximate 4% potassium permanganate solution was distributed to the new VIWs as well as other pre-existing PIWs, VIWs and

HIWs (Table 10). MWs were monitored for the presence or absence of potassium permanganate throughout the injection process. Visual samples were collected with 1-inch bailers (Table 11). The general aquifer response to the injections included the presence of potassium permanganate within an 800 gallon injection of solution in the up gradient VIWs.

Several monitor wells were purged throughout this phase. On February 5, 2003, MW-27 was purged for 80 gallons, MW-24 for 10 gallons and MW-30 for 5 gallons. On February 6, 2003, MW-28 was purged for 150 gallons and on February 9, 2003, MW-21 was purged for 50 gallons.

Purging of the monitor wells was implemented in order to stimulate hydraulic conductivity through out the subsurface as well as an attempt to minimize the volume of potable water used for mixing. The purge water was in turn utilized as mixing water/treated with potassium permanganate and‘re-circulated’ into the subsurface. The treating and re-circulation of groundwater was limited due to the inefficiency of accessible site pumps.

Surface breakthrough of injected fluids occurred during injection at two of the new wells. VIW-09 was the first to breakthrough on February 3, 2003. The pumping rate was approximately 3 gpm with a pressure reading of 1.5 psi. The well took a total of 600 gallons before surfacing. On February 4, 2003, EBSI personal dug out the well out and resealed the concrete. No breakthrough occurred at VIW-09 during the remaining injections. VIW-10 was the second well to undergo breakthrough on February 6, 2003. This well took a total of 1,600 gallons of solution before surfacing, 300 gallons on the day it broke through. EBSI personal repaired the well on the same day and found that settling of the sand pack had opened a void, thus creating a plain of weakness. On February 7, 2003, EBSI personal resumed injections on VIW-10. Within the first 20 gallons of water injected, breakthrough occurred. On February 15, 2003, EBSI personal again repaired the well. Upon digging out the seal to a depth of 2.5 feet bgs, garbage and metal debris was encountered. Permanganate was observed flowing along the interface between steel wire debris and the soil. The excavated area was then filled with 150 pounds of cat litter to act as a clay seal followed by 350 pounds of cement. An additional 800 gallons of solution was injected into VIW-10 before surface breakthrough occurred. No further injections were conducted at location VIW-10.

5.0 Data Analysis and Conclusions

5.1 Background

It is understood and accepted in the environmental industry that site characterization data represents a summary of discrete sampling points that are generalized to form a conceptual model of site conditions. The final form of the site characterization is determined after an analysis of data needs compared to the costs of collecting data. Cost considerations dictate that soil and groundwater sampling locations and depth intervals must be placed far enough apart so that large areas can be investigated and characterized at a reasonable cost. Data needs require that sample points be placed close enough together to allow inference of the conditions in the areas lying between data points. This approach is the standard industry practice and was the method used in characterizing Site 5 - Unit 2. A key assumption in following this approach is that site conditions are fairly homogeneous so that site conditions between data points can be inferred. Based on our review of the site data following several chemical oxidation treatment events, EBSI feels that Site 5 - Unit 2 is significantly heterogeneous, to the extent that EBSI, the Navy, and Shaw could not have possibly accounted for every heterogeneity even if unlimited spending were authorized for extensive site characterization studies. Based on the data collected in all the site activities to date, EBSI concludes that the Navy and its consultants made a reasonable efforts to fully characterize the site; however, the significant heterogeneity of the site effects the customary or standard assumptions that can be made about the mass of contamination present and its distribution at the site.

The discussion below presents an overview of the baseline, interim, and post-treatment sampling results collected and provided by Shaw. More detailed information regarding these activities can be found in the project report prepared by Shaw. Since DCE and VC make up the vast majority of the site total CVOCs, the sum of DCE and VC will be taken to mean total CVOCs.

5.2 Baseline Sampling

Baseline sampling was conducted by Shaw and consisted of installing additional monitoring wells and collecting a round of groundwater samples from monitoring wells (new and existing) which had been identified as target wells by the Project Team. Total CVOCs were estimated at 212,000 ug/l for baseline. The total consisted of a large contribution from well MW-21 (112,000 ug/l), MW-25 (7,900 ug/l), MW-26 (13,000 ug/l), MW-28 (40,000 ug/l), and MW-30 (22,800 ug/l), and MW-34 (3,700 ug/l).

5.3 Interim Sampling

Shaw collected three rounds of interim samples from some or all of the target wells. Interim number 1 data were collected following EBSI's first set of peroxide treatments that occurred in August 2002. Overall, total CVOCs dropped nearly 50% across the site with all wells showing decreases except MW-26, MW-30, and MW-34. Interim number 2 data were collected following EBSI's last peroxide treatment performed during

September 2002 and indicated that overall CVOC reduction remained at nearly 50% with increases noted at wells MW-21, MW-26, and MW-34. Interim number 3 data were collected following EBSI's first permanganate treatment at the site completed in December 2002. Only selected wells out of the target group were sampled; however, the wells sampled indicated a significant increase in total CVOC, especially at wells MW-21, MW-26, and MW-34.

5.4 Post Treatment Sampling

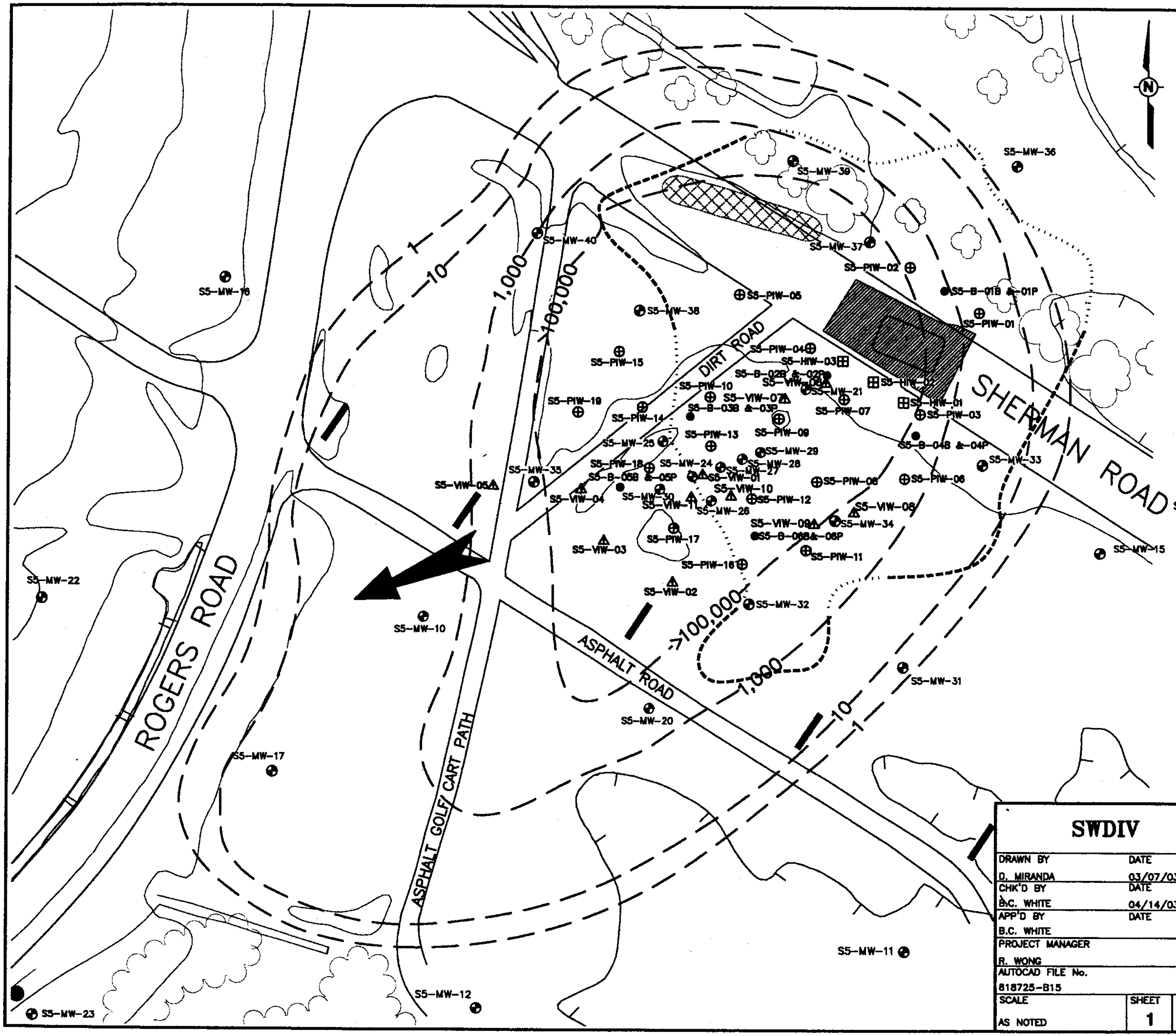
Following review of Interim number 3 data, EBSI developed a permanganate injection program using newly installed injection wells near monitoring wells MW-21, MW-26, and MW-34 since it appeared that significant contaminant mass resided in the subsurface surrounding these wells. Following almost four weeks of injection that deliver approximately 13,000 pounds of potassium permanganate to selected site injection wells, Shaw collected 30-day post-treatment samples from all target wells to evaluate site cleanup (Post-Treatment number 1). As a result of elevated groundwater CVOC concentrations detected during Post-Treatment number 1 groundwater samples, a second post-treatment sampling event was performed 14-days subsequent to the 30-day post-treatment sampling event. EBSI noted the following after review of the two post-treatment sampling events:

- Wells MW-26 and MW-34 were not sampled since the groundwater was still purple indicating the presence of permanganate at those locations.
- Analytical results of the remaining well samples indicated that CVOC had decreased in well MW-21 but had increased dramatically in wells MW-25, MW-28, MW-32, and MW-35.
- The total CVOC concentration detected in well MW-25 during this sampling round was as high as the total CVOC detected in all the wells during baseline (e.g. greater than 200,000 ug/l).
- Post-Treatment number 2 CVOC results indicated that concentrations increased in well MW-21 while they were displaying a decreasing trend in wells MW-25, MW-28, MW-32, and MW-35.
- Total CVOC concentrations dropped over 50% in well MW-25 from the first to the second post-treatment sampling event.

6.0 Conclusions

Based on our review of the field data and observations made during injection, and on the interim and post-treatment sampling data, EBSI concludes that the conditions at Site 5 - Unit 2 are more heterogeneous than had been anticipated. EBSI has drawn the following conclusions:

- Since the site had been impacted by its former use as a military debris landfill, it is highly likely that buried materials, large and small, created preferential flow paths for groundwater, contaminants, and remediation reagents and also concealed pockets of contaminant mass in the subsurface.
- The remedial actions implemented by EBSI are known to be effective at similar sites. The amount of contaminant destruction completed at the site cannot be calculated since any contaminant destruction was masked by contaminant liberation, as seen in the increased groundwater concentrations in target wells.
- Based on the trend observed from Post-Treatment number 1 to Post-Treatment number 2 sampling events, EBSI expects that a new equilibrium concentration of CVOC at the target wells will be achieved within three months where the total CVOC concentrations are lower than baseline.
- Continued chemical oxidation at the site is possible but is expected to take longer and cost more than originally estimated. Large doses of chemical oxidants would need to be injected over a 6 to 12 month period in order to achieve a goal of 90% mass destruction. Alternatively, a recirculation system where downgradient groundwater is extracted, mixed with permanganate, and re-injected upgradient could be done at lower cost but would require approximately 9 to 18 months to complete.



LEGEND:

▨	ESTIMATED LOCATION OF SUSPECTED WESTERN FORMER DISPOSAL POND
▨	EXTENT OF SOIL EXCAVATION
▢	SOURCE AREA/IDENTIFIED EXTENT OF EASTERN FORMER LIQUID DISPOSAL PIT
←	GROUNDWATER FLOW DIRECTION
‥- - -	MIP TOTAL ION COUNTS EXCEEDING 50,000 – DASHED WHERE ESTIMATED, DOTTED WHERE SURMIZED
—10—	ESTIMATED EXTENT OF TOTAL SELECTED VOCs IN μg/L
S5-MW-30 ⊕	MONITORING WELL
S5-PIW-10 ⊕	PROPAGATION INJECTION WELL
S5-HIW-03 ⊞	HORIZONTAL INJECTION WELL
S5-VIW-05 △	VERTICAL INJECTION WELL
S5-B-01B&-01P ●	TREATMENT ASSESSMENT SOIL BORING
▬	RUNWAY LIGHTS

NOTE:

1. SELECTED VOC CONTOURS DERIVED FROM PARSONS (1999).
2. SELECTED VOCs INCLUDE CHLORINATED ETHENES, CHLORINATED ETHANES, AND BTEX.

SCALE
0 50 100 FEET

SWDIV

DRAWN BY	DATE
D. MIRANDA	03/07/03
CHK'D BY	DATE
B.C. WHITE	04/14/03
APP'D BY	DATE
B.C. WHITE	
PROJECT MANAGER	
R. WONG	
AUTOCAD FILE No.	
818725-B15	

SCALE	SHEET	OF
AS NOTED	1	1

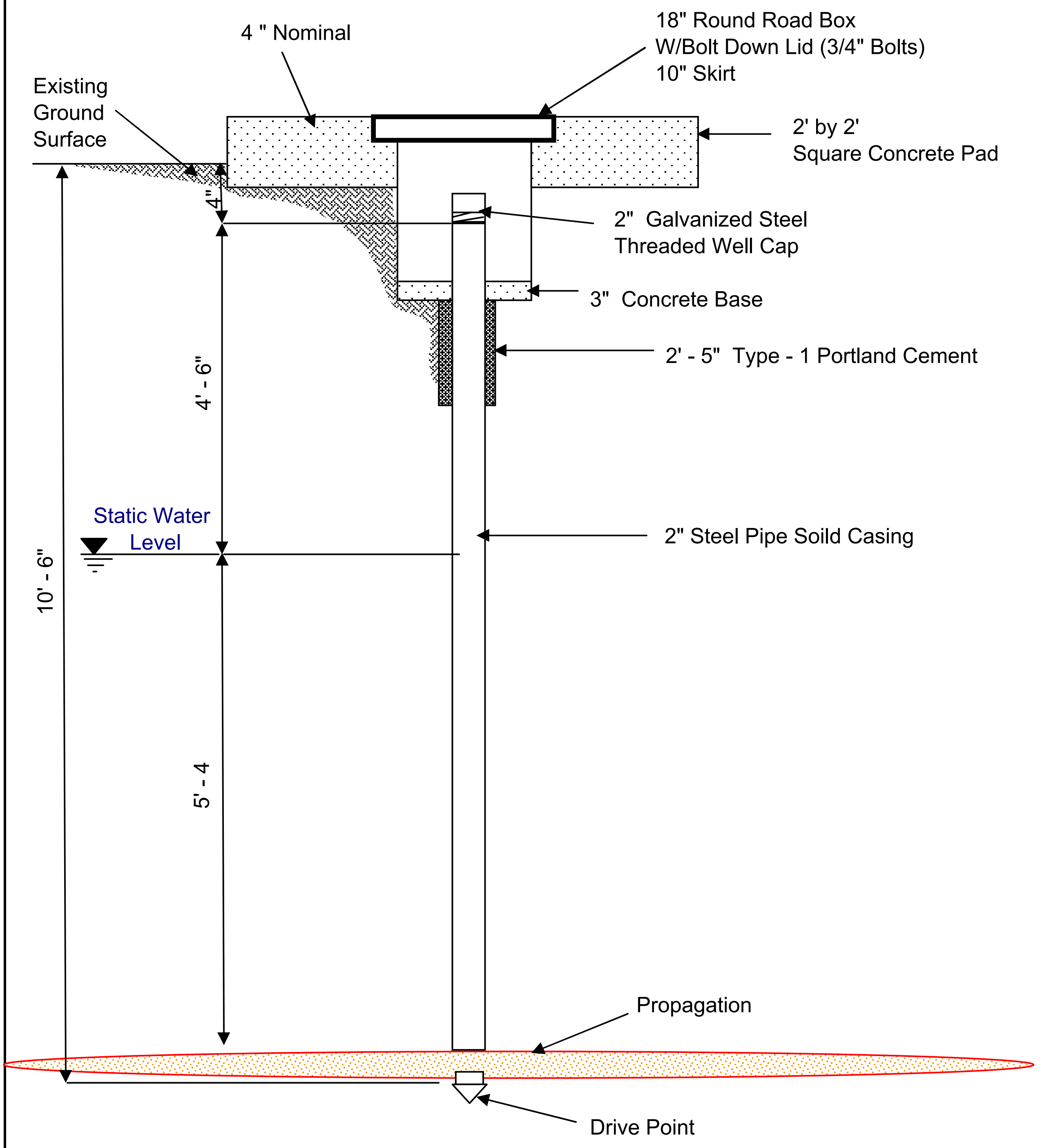
Shaw Shaw Environmental, Inc.

FIGURE 3

TREATMENT MONITORING WELL, INJECTION WELL, AND TREATMENT ASSESSMENT SOIL BORING LOCATIONS

IR SITE 5 - UNIT 2
NAVAL AIR STATION, NORTH ISLAND
SAN DIEGO, CALIFORNIA

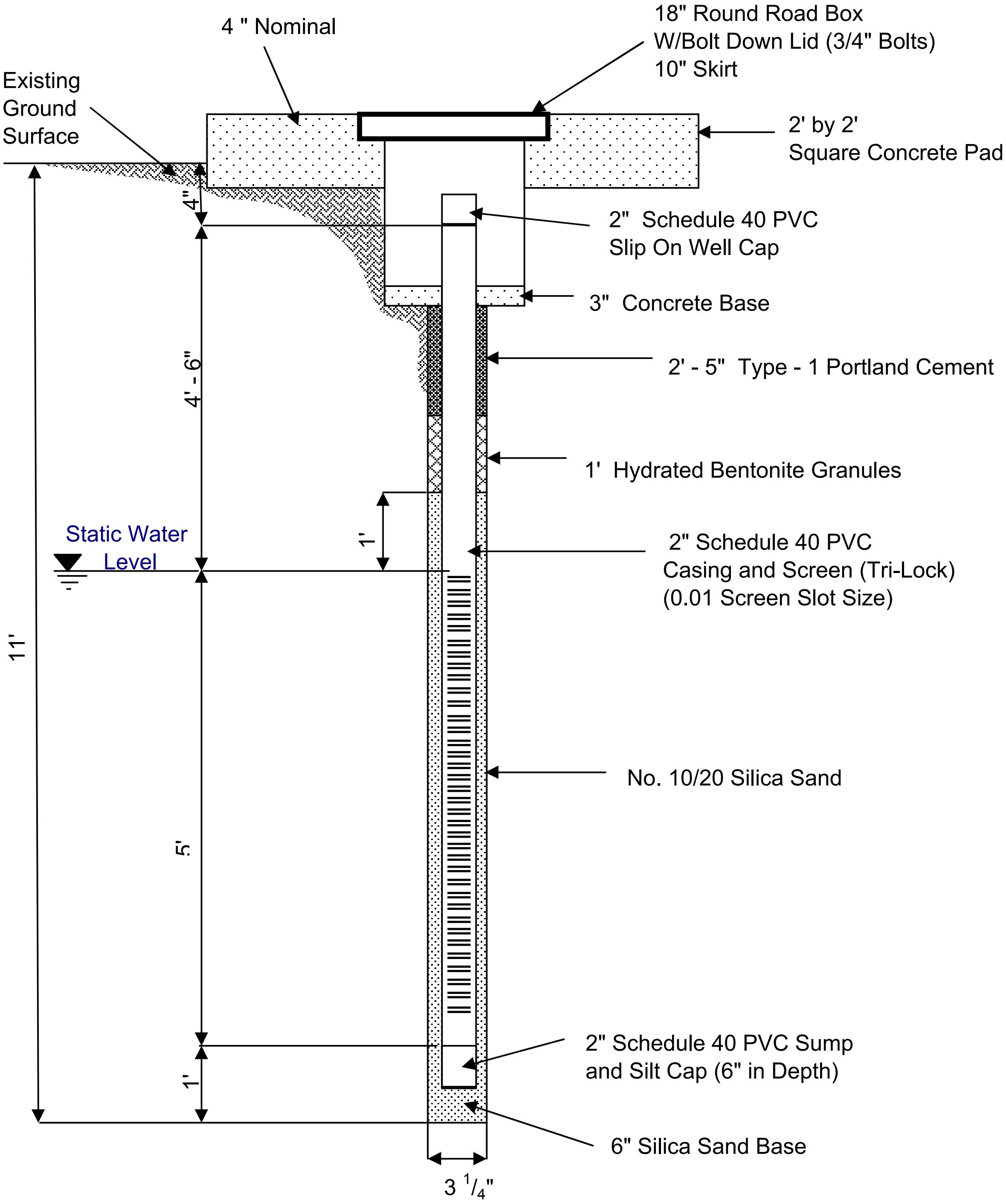
SHAW PROJECT No.	DOCUMENT CONTROL No.	REVISION
818725	5399	0



ENVIRONMENTAL
BUSINESS SOLUTIONS
INTERNATIONAL, Inc.

**FIGURE 4. EBSI Propagation Injection Well Design for S5-PIW-01 through S5-PIW-19
IR Site 5 - Unit 2
NAS North Island, San Diego County, California**

GEOPROBE COMPANY	SCALE	INSTALLED BY	DRAWN BY	DATE
VIRONEX	NOT TO SCALE	R. RESSEGUIE	R. RESSEGUIE	6/14/02



**ENVIRONMENTAL
BUSINESS SOLUTIONS
INERNATIONAL, Inc.**

**FIGURE 5. EBSI Vertical Injection Well Design
for S5-VIW-02 through S5-VIW-05
IR Site 5 - Unit 2
NAS North Island, San Diego County, California**

GEOPROBE COMPANY	SCALE	INSTALLED BY	DRAWN BY	DATE
VIRONEX	NOT TO SCALE	R. RESSEGUIE	R. RESSEGUIE	6/14/02

FIELD LOG OF BORING__S5-VIW-06 through 11__

Date Installed: 1/29/03
Geologist: Brian Kennedy, EBSI
Project Name: North Island Naval Air Station

Depth to Water: 4.6 feet
Depth of Well: 10 feet
Screen Length: 5 feet

FIGURE 6.

Depth (Feet)	Stratigraphy (Based on General Shaw Group Monitor Well Logs)
0	
1	SAND, Dark Grayish Brown, (2.5Y 4/2), Loose, Poorly Graded, very fine grained, dry, becomes moist at approximately 1 food bgs, < 1 % silt
2	
3	
4	SAND, Olive Gray, (5Y 5/2), Loose, Poorly Graded, V.F. Grained, V. Moist, becomes wet at approximately 4.6 feet
5	
6	SAND, Dark Gray, Loose, Poorly Graded, V.F. Grained, Wet,
7	
8	
9	SAND, Stained Soil, Olive Gray, < 1% Silt
10	FAT CLAY at approximately 10 feet

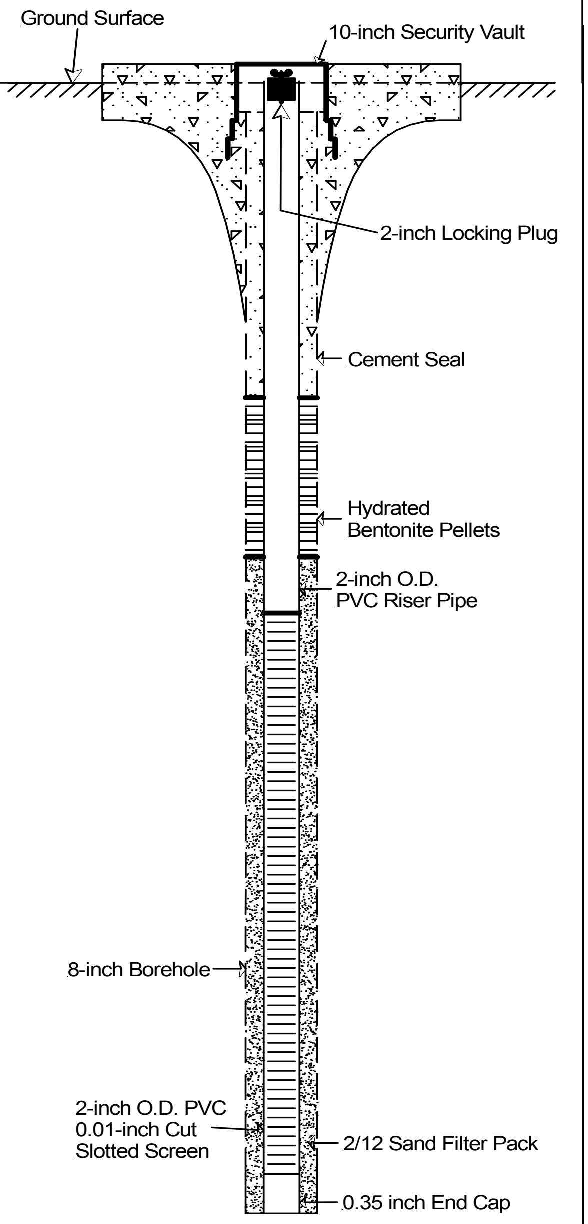


Table 4. PHASE I, ROUND 1 INJECTION QUANTITIES
Naval Air Station North Island, IR Site 5 - Unit 2
July 15, 2002 through July 23, 2002

	VIW-01	VIW-02	VIW-03	VIW-04	VIW-05	HIW-01	HIW-02	HIW-03	PIW-01	PIW-02	PIW-03	PIW-04	PIW-05	PIW-06	PIW-07	PIW-08	PIW-09	PIW-10	PIW-11	PIW-12	PIW-13	PIW-14	PIW-15	PIW-16	PIW-17	PIW-18
Drums H_2O_2	2	1	1	2	2	1	2	2	1	1	1	2	1	1	2	2	2	2	1	2	2	1	1	1	2	2
Water Used in Gallons	100	50	50	100	100	50	100	100	50	50	50	100	50	50	100	100	100	100	50	100	100	50	50	50	100	100
Pounds Solution H_2O_2	1,833	917	917	1,833	1,833	917	1,833	1,833	917	917	917	1,833	917	917	1,833	1,833	1,833	1,833	917	1,833	1,833	917	917	917	1,833	1,833

Total Hydrogen Peroxide (H_2O_2) Injected in Pounds Solution = 36,660
Total Water Injected in gallons = 2,000
1 Drum Hydrogen Peroxide = 500 pounds
50 gallons water = 416.5 pounds

Table 5. PHASE I - MONITORING SCHEDULE
Naval Air Station North Island, IR Site 5 - Unit 2
July 15, 2002 through July 22, 2002

Monitoring Well ID	Date	Fe2+ (mg/L)	Total Iron (mg/L)	LEL % (Vapor)	O2 % (Vapor)	CO2 ppm (Vapor)	Cl2 ppm (Vapor)	VOC ppm (Vapor)	pH	Cond.	DO	Temp. (º C)	DEP	SAL	TDS	ot	ORP	Turb.
(Background)																		
S5-MW-36	7/15/2002	0.51	0.76	0	3.7	OR+20K	0	3.1	7.19	0.35	1.2	21.9	2.0	0.1	1.3	0	-186	2.7
S5-MW-27	7/15/2002	0.40	0.67	0	20.6	2,700	0	6.0	7.34	0.82	1.2	22.4	2.9	0.5	5.2	1	-181	5.0
S5-MW-35	7/15/2002	0.23	3.77	0	5.6	15,840	0	2.0	7.16	0.28	1.4	22.0	2.0	0.1	1.8	0	-69	3.5
(During Treatment of Surrounding PIW's)																		
S5-MW-36	7/15/2002	NT	NT	0	12.0	OR+20K	0	1.2	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
S5-MW-27	7/19/2002	NT	NT	4	OR+40	11,000	0	166.0	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
S5-MW-35	7/19/2002	NT	NT	8	OR+40	OR+20K	0	38.0	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
(After First Round of Treatment)																		
S5-MW-36	7/22/2002	0.24	0.97	0	20.9	OR+20K	0	2.5	7.89	0.14	1.1	19.6	2.0	0.1	0.9	0	-28	-10.0
S5-MW-27	7/22/2002	0.05	1.78	3	36.0	11,000	0	15.0	6.76	0.44	2.7	24.6	2.3	0.2	2.8	0	70	-10.0
S5-MW-35	7/22/2002	0.09	4.60	2	OR+40	OR+20K	0	8.0	7.57	0.31	19.9	22.7	1.7	0.2	2	0	200	-2.0

NS - Sample not collected
OR - Parameter Over Threshold

Table 6. PHASE I, ROUND 2 INJECTION QUANTITIES
Naval Air Station North Island, IR Site 5 - Unit 2
July 22, 2002 through July 26, 2002

	VIW-01	VIW-02	VIW-03	VIW-04	VIW-05	HIW-01	HIW-02	HIW-03	PIW-01	PIW-02	PIW-03	PIW-04	PIW-05	PIW-06	PIW-07	PIW-08	PIW-09	PIW-10	PIW-11	PIW-12	PIW-13	PIW-14	PIW-15	PIW-16	PIW-17	PIW-18
Drums H_2O_2	2	1	1	2	2	1	2	2	1	1	1	2	1	1	2	2	2	2	1	2	2	1	1	1	2	2
H_2O added to H_2O_2 (Gallons)	100	50	50	100	100	50	100	100	50	50	50	100	50	50	100	100	100	100	50	100	100	50	50	50	100	100
Pounds H_2O_2 Solution	1833	916.5	916.5	1833	1833	916.5	1833	1833	916.5	916.5	916.5	1833	916.5	916.5	1833	1833	1833	1833	916.5	1833	1833	916.5	916.5	916.5	1833	1833
Ferrous Chloride Gallons	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	5	5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
H_2O added to Iron (Gallons)	30	30	30	30	30	30	30	30	60	60	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Ferrous Chloride in Pounds Solution	261.03	261.03	261.03	261.03	261.0294	261.03	261.029	261.03	536.76	536.76	261.03	261.03	261.03	261.03	261.03	261.03	261.03	261.03	261.03	261.03	261.03	261.03	261.03	261.03	261.03	261.03
Total Injected Chemistry in Pounds Solution	2,094	1,178	1,178	2,094	2,094	1,178	2,094	2,094	1,453	1,453	1,178	2,094	1,178	1,178	2,094	2,094	2,094	2,094	1,178	2,094	2,094	1,178	1,178	1,178	2,094	2,094

Total Hydrogen Peroxide (H_2O_2) Injected in Pounds Solution =	**36,660**
Total Ferrous Chloride Injected in Pounds Solution =	**7,338**
Total Chemistry Injected in Pounds Solution =	**43,998**
Total Water Used in Gallons =	**2,840**

1 Drum Hydrogen Peroxide = 500 pounds

50 gallons water = 416.5 pounds

1 Gallon Ferrous Chloride = 7.35 pounds

Table 7. Phase II - MONITORING SCHEDULE
Naval Air Station North Island, IR Site 5 - Unit 2
September 16, 2002

Monitoring Well ID	Date	Fe2+ (mg/L)	Total Iron (mg/L)	LEL % (Vapor)	O2 % (Vapor)	CO2 ppm (Vapor)	Cl2 ppm (Vapor)	VOC ppm (Vapor)	pH	Cond.	DO	Temp. (° C)	DTW	SAL	TDS	ot	ORP	Turb.
(Background)																		
S5-MW-36	9/16/2002	NS	NS	7	4.2	17000	0	2.0	6.56	0.37	1.2	20.6	4.84	0.2	2.4	0	-74	13.4
S5-MW-27	9/16/2002	NS	NS	0	20.6	0	0	20.0	5.53	2.10	1.9	24.2	7.23	1.3	13	7	2	OR
S5-MW-35	9/16/2002	NS	NS	0	17.0	OR+20K	0	100.0	5.25	0.95	0.9	22.8	6.95	0.5	6	2	21	-10.0
(During Treatment of Surrounding PIW's)																		
S5-MW-36	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
S5-MW-27	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
S5-MW-35	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
(After First Round of Treatment)																		
S5-MW-36	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
S5-MW-27	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
S5-MW-35	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS - Sample not collected
OR - Parameter Over Threshold

Table 8. PHASE II INJECTION QUANTITIES

Naval Air Station North Island, IR Site 5 - Unit 2

September 17, 2002 through September 22, 2002

	VIW-01	VIW-02	VIW-03	VIW-04	VIW-05	HIW-01	HIW-02	HIW-03	PIW-01	PIW-02	PIW-03	PIW-04	PIW-05	PIW-06	PIW-07	PIW-08	PIW-09	PIW-10	PIW-11	PIW-12	PIW-13	PIW-14	PIW-15	PIW-16	PIW-17	PIW-18
Drums H_2O_2	2	1	1	2	2	1	2	2	1	1	1	2	1	1	2	2	2	2	1	2	2	1	1	1	2	2
H_2O added to H_2O_2 (Gallons)	100	50	50	100	100	50	100	100	50	50	50	100	50	50	100	100	100	100	50	100	100	50	50	50	100	100
Pounds H_2O_2 Solution	1833	916.5	916.5	1833	1833	916.5	1833	1833	916.5	916.5	916.5	1833	916.5	916.5	1833	1833	1833	1833	916.5	1833	1833	916.5	916.5	916.5	1833	1833
Ferrous Chloride Gallons	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	5	5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
H_2O added to Iron (Gallons)	30	30	30	30	30	30	30	30	60	60	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Ferrous Chloride in Pounds Solution	261.03	261.03	261.03	261.03	261.0294	261.03	261.03	261.03	536.76	536.76	261.03	261.03	261.03	261.03	261.03	261.03	261.03	261.03	261.03	261.03	261.03	261.03	261.03	261.03	261.03	261.03
Total Injected Chemistry in Pounds Solution	2,094	1,178	1,178	2,094	2,094	1,178	2,094	2,094	1,453	1,453	1,178	2,094	1,178	1,178	2,094	2,094	2,094	2,094	1,178	2,094	2,094	1,178	1,178	1,178	2,094	2,094

Total Hydrogen Peroxide Injected in Pounds Solution = 36,660
Total Ferrous Chloride Injected in Pounds Solution = 7,338
Total Chemistry Injected in Pounds Solution = 43,998
Total Water Used in Gallons = 2,840
1 Drum Hydrogen Peroxide = 500 pounds
50 gallons water = 416.5 pounds
1 Gallon Ferrous Chloride = 7.35 pounds

Table 9. PHASE III POTASSIUM PERMANGANATE INJECTION QUANTITIES

Naval Air Station North Island, IR Site 5 - Unit 2

December 9, 2002 through December 19, 2002

	S5-VIW-04	S5-VIW-05	S5-HIW-01	S5-HIW-02	S5-HIW-03	S5-PIW-04	S5-PIW-05	S5-PIW-06	S5-PIW-07	S5-PIW-08	S5-PIW-09	S5-PIW-10	S5-PIW-11	S5-PIW-12	S5-PIW-13	S5-PIW-14	S5-PIW-17	S5-PIW-18
$KMnO_4$ Solution Injected in Pounds Solution	880	880	1,713	1,713	1,713	3,379	1,713	2,546	3,379	2,546	3,379	880	1,713	3,379	1,713	880	3,379	880
Water Used (Gallons)	100	100	200	200	200	400	200	300	400	300	400	100	200	400	200	100	400	100

TOTAL INJECTED $KMnO_4$ in Pounds Solution = 36,656
Total Water Injected in gallons = 4,300

Table 10. PHASE IV POTASSIUM PERMANGANATE INJECTION QUANTITIES
Naval Air Station North Island, IR Site 5 - Unit 2
January 30, 2003 through February 19, 2003

Date	VIW-1	VIW-04	VIW-06	VIW-07	VIW-08	VIW-09	VIW-10	VIW-11	HIW-01	HIW-02	HIW-03	PIW-04	PIW-08	PIW-09	PIW-10	PIW-13	PIW-15
30-Jan			6994	6994													
31-Jan			10491	10491													
3-Feb			5245.5	5245.5	5245.5	5245.5											
4-Feb					10436.04		6087.69										
5-Feb	3478.68					5218.02	5218.02	6087.69									
6-Feb					2609.01		2609.01	6957.36					5218.02				
7-Feb	4348.35							9566.37					4348.35				
9-Feb	1739.34							10436.04			2609.01	4348.35					
10-Feb																	
11-Feb			6087.69	7827.03													
12-Feb					4348.35	4348.35											
13-Feb			3478.68						2609.01	3478.68	2609.01	3478.68					
14-Feb			1739.34	12175.38				12175.38									
15-Feb			6087.69		6957.36	1739.34											
16-Feb				6087.69		869.67	6087.69	4348.35									
17-Feb					2609.01		869.67	8696.7		1740	2609.01						
18-Feb	2609.01	2609.01	6957.36												1739.34	1739.34	1739.34
19-Feb			4348.35		2609.01	1739.34			6957.36	6957.432	6957.36			1739.34			
Totals	**12,175**	**2,609**	**51,430**	**48,821**	**34,814**	**19,160**	**20,872**	**58,268**	**9,566**	**12,176**	**14,784**	**7,827**	**9,566**	**1,739**	**1,739**	**1,739**	**1,739**

Total Injected $KMnO_4$ in Pounds Solution = **309,027**

Total Water Injected in gallons = **28,800**

Table 11. PHASE IV POTASSIUM PERMANGANATE MIGRATION STATUS

Naval Air Station North Island, IR Site 5 - Unit 2

January 30, 2003 to February 20, 2003

	MW-21		MW-29			MW-26		MW-24		MW-30		MW-25		
Date	AM	PM	AM	PM	MW-34	AM	PM	AM	PM	AM	PM	AM	PM	MW-27
30-Jan	Unreacted	Unreacted												
31-Jan	Unreacted	Unreacted												
3-Feb	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted									
4-Feb	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted							
5-Feb	Clear	Clear	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Clear
6-Feb	Clear	Clear	Unreacted	Semireacted	Unreacted	Unreacted	Unreacted	Semireacted	Semireacted	Semireacted	Unreacted	Mostly Reacted	Unreacted	Clear
7-Feb	Clear	Clear	Semireacted	Semireacted	Unreacted	Unreacted	Unreacted	Semireacted	Unreacted	Unreacted	Unreacted	Mostly Reacted	Semireacted	Clear
9-Feb	Clear	Clear	Semireacted	Mostly Reacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Mostly Reacted	Clear	Clear
10-Feb	No Injections		No Injections		No Injections		No Injections							
11-Feb	Unreacted	Unreacted	Semireacted	Mostly Reacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Mostly Reacted	Clear	Unreacted
12-Feb	Unreacted	Unreacted	Mostly Reacted	Mostly Reacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Clear	Clear	Unreacted
13-Feb	Mostly Reacted	Unreacted	Unreacted	Unreacted	Phas	Semi/Unreacted	Semireacted	Unreacted	Unreacted	Unreacted	Unreacted	MnO Residue	MnO Residue	Unreacted
14-Feb	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Clear	Clear	Unreacted
15-Feb	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Semireacted	Semi/Unreacted	Semi/Unreacted	Unreacted	Unreacted	Unreacted	Clear	Clear	Unreacted
16-Feb	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
17-Feb	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
18-Feb	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Mostly Reacted	Mostly Reacted	Unreacted
19-Feb	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
20-Feb	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted	Unreacted

Unreacted = Fresh dark purple KMnO4 present
Semireacted = Purple color partly reacted or diluted
Mostly Reacted = Pink color with brown MnO residue
Clear = No KMnO4 present, clear water bailed from well
MnO Residue = Brown MnO biproduct in water
NS = Not Sampled

MW-28 and MW-35
CLEAR

Appendix H
Microbial Natural Attenuation Reports

(1) *Baseline Microbial Insights Laboratory Report (July 26, 2002)*
(2) *Baseline SIREM Laboratory Microbial Report (July 26, 2002)*
(3) *Posttreatment Summary Microbial Insights Laboratory Report (July 25, 2003)*

H-1

Baseline Microbial Insights Laboratory Report (July 26, 2002)

microbial insights

2340 Stock Creek Blvd.
Rockford TN 37853-3044
Phone (865) 573-8188
Fax: (865) 573-8133
Email: microbe@microbe.com

Microbial Analysis Report

Client: Jim French
Bechtel Environmental Inc.
1230 Columbia Street, Suite 400
San Diego, CA 92101

Phone: 619-744-3034

Fax: 619-687-8787

MI Identifier: 1bec **Date Rec.:** 7/12/02 **Report Date:** 7/26/02

Analysis Requested: PLFA, DNA, Culturing

Project:

Comments:

All samples within this data package were analyzed under U.S. EPA Good Laboratory Practice Standards: Toxic Substances Control Act (40 CFR part 790). All samples were processed according to standard operating procedures. Test results submitted in this data package meet the quality assurance requirements established by Microbial Insights, Inc.

Reported by: ____________________
(Data Analyst)

Reviewed by: ____________________
(Director)

2340 Stock Creek Blvd.
Rockford TN 37853-3044
Phone (865) 573-8188
Fax: (865) 573-8133
Email: microbe@microbe.com

Microbial Analysis Report

Executive Summary

The microbial communities from 8 samples were characterized by phospholipid fatty acid content (PLFA Analysis). Additionally these samples were screened for the presence of *Dehalococcoides ethenogenes* by a targeted gene detection approach. Results from these analyses revealed the following:

- Samples 203M001, 203M004, and 203M007 contained biomass levels which were at or below our detectable limits. Biomass estimates for the remaining samples (as defined by the total concentration of PLFA) ranged from ~10^4 to 10^5 cells/mL filtered, and was highest in the 203M006 sample.

- The PLFA profiles revealed moderately diverse community structures (as defined by the variety of PLFA detected) in samples 203M002, 203M003, 203M005, and 203M006. These samples were mainly comprised of Gram-negative bacteria (indicated by the percentage of monoenoic PLFA). High proportions of Gram-negative bacteria are of particular interest at contaminated sites due to their ability to utilize a wide range of carbon sources and adapt quickly to changing environmental conditions.

- Fatty acid biomarkers indicative of anaerobic metal reducing bacteria (branched monoenoic and mid-chain branched PLFA) were present in samples 203M002, 203M003, 203M005, and 203M006.

- Ratios of fatty acid biomarkers that provide indications of activity (turnover rate) showed that turnover rates ranged from slow in sample 203M003 to relatively fast in sample 203M008. Due to the low amount of biomass, samples 203M001, 203M004 and 203M007 did not contain detectable biomarkers for turnover rate.

- Ratios of fatty acid biomarkers that indicate a metabolic response to environmentally induced stress (decreased membrane permeability) revealed that sample 203M002 was showing the most evidence of this occurring.

- DNA results confirmed the presence of *Dehalococcoides ethenogenes* in all but samples 203M004 and 203M007.

Figures and Tables:

Biomass Content:

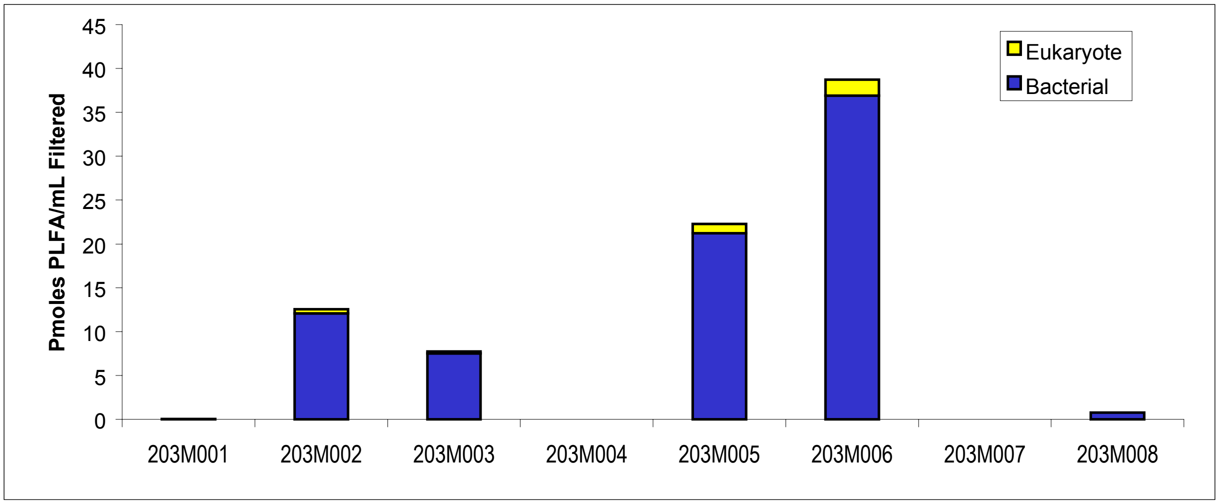


Figure 1. Biomass content is presented as the total amount of phospholipid fatty acids (PLFA) present in a given sample. PLFA comprise a large proportion of the membranes of all living cells, but decompose quickly upon cell death. Bacterial biomass is calculated based upon PLFA attributed specifically to bacteria whereas eukaryotic biomass is based on PLFA associated with higher organisms.

Community Structure:

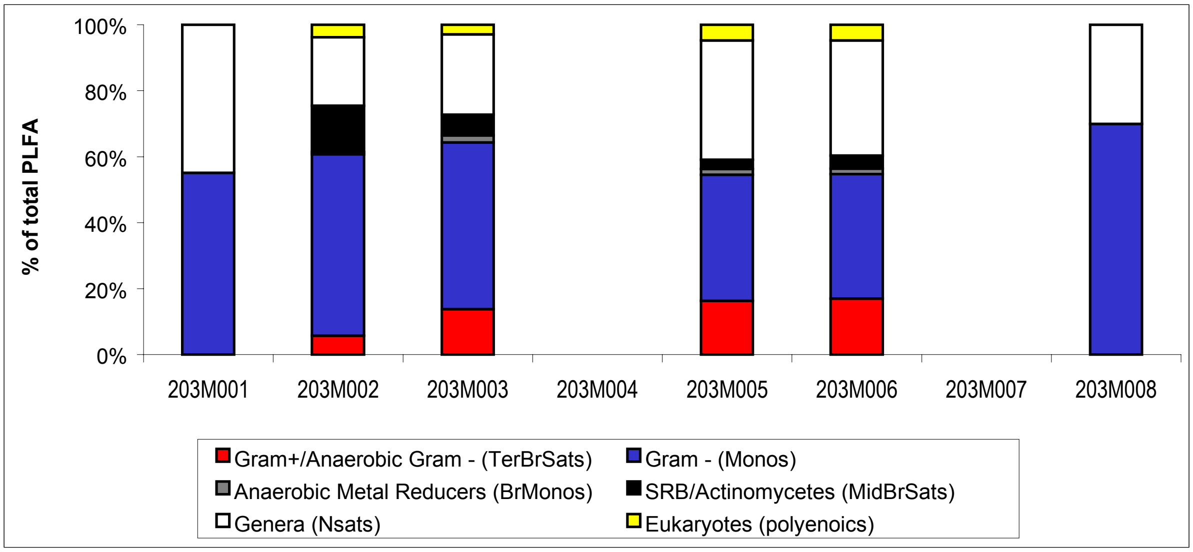


Figure 2. A comparison of the relative percentages of total PLFA structural groups in the samples described in Figure1. Structural groups are assigned according to PLFA chemical structure which is related to fatty acid biosynthesis. Normal saturate are ubiquitous, terminally branched saturates (TerBrSats) are attributed to Gram positive bacteria and some anaerobic Gram negatives, branched monoenoic fatty acids (f.a.) are found in anaerobic metal reducing bacteria, mid chain branched f.a. are common in metal reducers and aerobic Actinomycetes, monoenoic f.a. are in Gram negative bacteria, and polyenoic f.a. are found in eukaryotic organisms.

Profiles of individual fatty acids for each sample are available upon request.

Metabolic Activity:

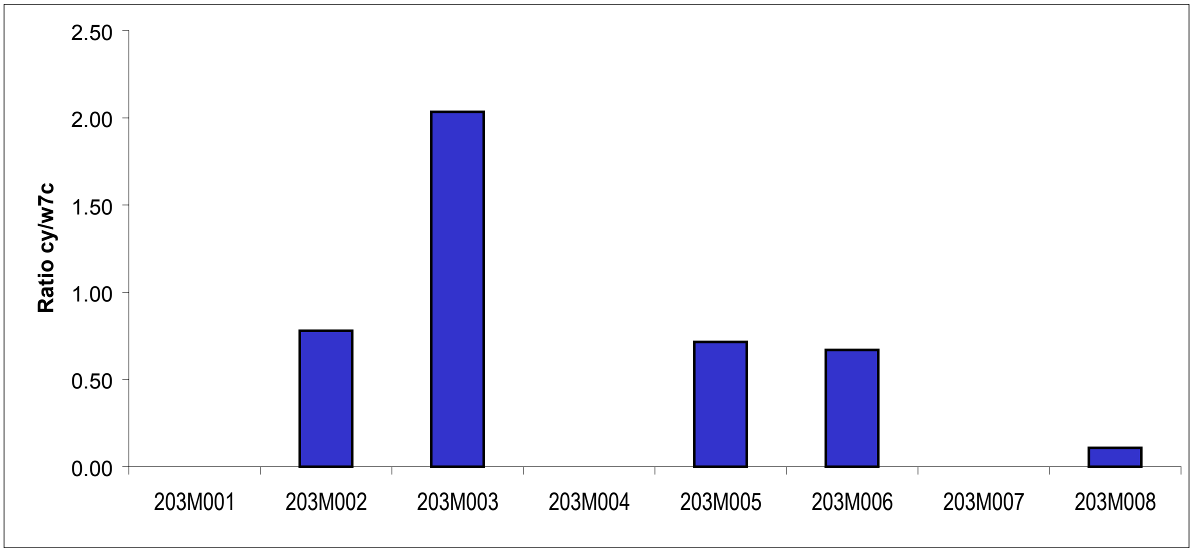


Figure 3. Growth rate of the Gram-negative community is assessed by the ratio cy/ω7c fatty acids. Specifically, 16:1ω7c and 18:1ω7c fatty acids are converted to cyclopropyl fatty acids (cy17:0 & cy19:0) as microbial growth slows down (decreased turnover rate).

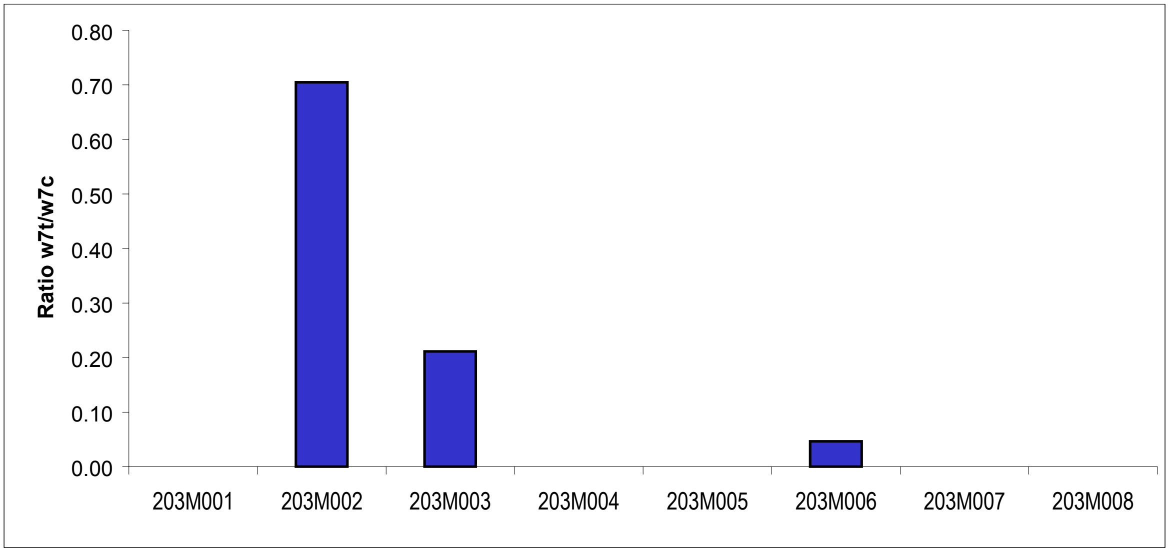


Figure 4. Adaptation of the Gram-negative community to changes in the environment is determined by the ratio of ω7t/ω7c fatty acids. Gram-negative bacteria generate *trans* fatty acids to minimize the permeability of their cellular membranes as adaptation to a more hostile environment. Ratios (16:1ω7t/16:1ω7c and 18:1ω7t/18:1ω7c) greater than 0.1 have been shown to indicate an adaptation to a toxic or stressful environment resulting in decreased membrane permeability

Table 1. Summary of PLFA results.

	Biomass (pmoles PLFA/ml of sample)					Community Structure (% of total PLFA)						Physiological status	
Sample Name	Total Biomass	Cell equivalent value[1]	Bacterial biomass	Eukaryotic biomass	ratio bacteria/ eukarya	Gram+/ anaerobic Gram - (TerBrSats)	Gram - (Monos)	Anaerobic metal reducers (BrMonos)	SRB/ Actinomycetes (MidBrSats)	Genera (Nsats)	Eukaryotes (polyenoics)	Growth Phase (cy/w7c)	Adaptation (w7t/w7c)
203M001	Trace	4.25E+02	Trace	ND	NC	0.0	55.2	0.0	0.0	44.9	0.0	0.00	0.00
203M002	13	2.51E+05	12	Trace	26	5.7	55.0	0.8	14.0	20.8	3.7	0.78	0.70
203M003	8	1.55E+05	8	Trace	33	13.7	50.6	2.1	6.3	24.3	3.0	2.03	0.21
203M004	ND	0.00E+00	ND	ND	NC	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00
203M005	22	4.46E+05	21	1	20	16.3	38.3	1.7	2.8	36.2	4.7	0.72	0.00
203M006	39	7.74E+05	37	2	20	17.0	37.8	1.7	3.9	35.0	4.7	0.67	0.05
203M007	ND	0.00E+00	ND	ND	NC	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00
203M008	1	1.50E+04	1	Trace	NC	0.0	70.0	0.0	0.0	30.0	0.0	0.11	0.00

---

[1] The cell equivalent value is calculated from experiments with typical bacteria isolated from soil and water. This value is based on 2.0×10^{12} cells per gram dry weight of cells and 10^{8} picomoles of phospholipid/gram dry weight of cells. The number of cells/gram of dry weight may vary and is dependent on the environmental conditions from which the microorganisms were recovered.

Overview of Targeted Gene Detection Approach

The recovery of DNA and its subsequent analysis provides a powerful tool for characterizing bacterial community structure. All cells (animals, plants, fungi, and bacteria) contain DNA that allows for their identification. These cells also contain ribosomes, which are required for normal cell functions. The favored target in DNA identification for bacteria is the small sub-unit ribosomal RNA gene, generally referred to as "16S rDNA" in prokaryotes). This target is favored because during the course of evolution, different regions of the ribosome have mutated (or changed) at different rates, with the overall result that some regions of this gene are virtually the same between all organisms (conserved), while other regions differ among even closely related species.

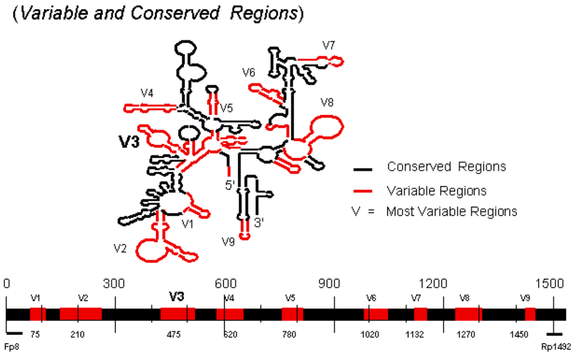


Figure 5. Diagramatic representation detailing the variable and conserved regions of the 16S rRNA gene. This figure was taken from ITRC Internet Training on Natural Attenuation of Chlorinated Solvents in Groundwater: Principles and Practices, Apr 00.

Specific primers directed to a variable region of the 16S rRNA gene of *Dehalococcoides ethenogenes* was used to determine its presence. Based upon Loffler et. al. the sensitivity of these primers is ~10^3 cells/mL or g of sample.

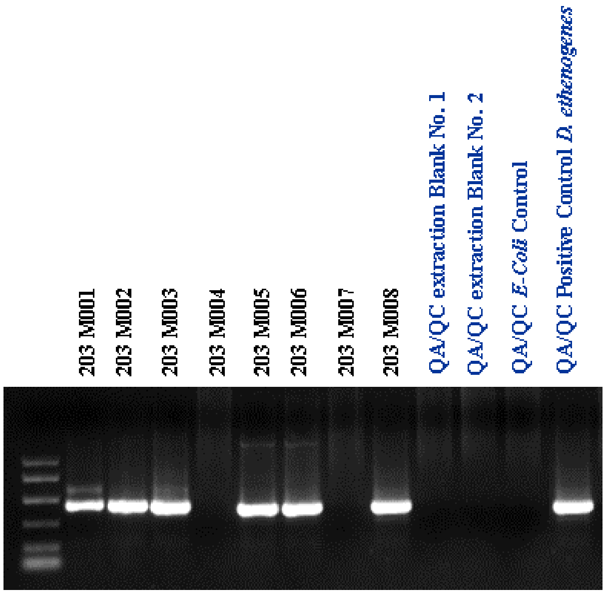


Figure 6. Results from the DNA amplification using primers specific for *Dehalococcoides ethenogenes.* QA/QC samples are listed in blue. Two extraction blanks were used to account for any contamination during the DNA extraction procedure. Two amplification samples were used to unsure a negative response for E-coli and a positive response for *D. ethenogenes.*

Quality Assurance Section

Sample Arrival and Holding Times:

Eight samples were received on 7/12/02, accompanied by a chain of custody form. All arrival conditions and required holding times were acceptable according to SOP #SREC.

Sample Analysis and QA/QC Parameters:

Samples were analyzed under the U.S. EPA Good Laboratory Practice Standards: Toxic Substances Control Act (40 CFR part 790). All samples were processed according to standard operating procedures.

Notes: No QC or analytical problems were encountered

Calibrations and Solvent Checks:

All laboratory equipment and instruments utilized throughout the analyses were calibrated and operating within acceptable ranges. The instruments were calibrated according to Standard Operating Procedures (EQ4). All solvents used in these analyses were validated for purity.

Data Validation:

All data analyses were performed correctly. All calculations and transcriptions of raw and final data were verified.

BECHTEL **CLEAN**

CHAIN-OF-CUSTODY RECORD

21075

Site Name: IR Site 5, NASNI
CTO Number: 22214-203
Site Contact/Supervisor: James French

Sampler(s): Anthony Rossi
Signature(s): Anthony Rossi

Analytical Laboratory Name: Microbial Insights, Inc.
Analytical Laboratory Address: 2340 Stock Creek Blvd, Rockford TN 37853
Field Logbook/Page Number: 203-003/23

Pay Items/ Analyses Required

PLFA Analysis	DNA Analysis + Archive	Culturing								
1	1	1	Preservation (4°C)							

TAT (in days): 2 7 [✓ 14] 30

Sample ID No. (8 digit)	Date/Time Collected	Station Description	Sample Matrix	Number of Containers	Archive (Container No.)	Container Nos. (2 digit)											Remarks (e.g., MS, MSD)
203M001	7/11/02 0930	S5-MW-36	GW	2		01	02										01: 2400 mL, 1 fil. 02: 1200 mL, 1 fil.
203M002	7/11/02 1045	S5-MW-20	GW	3		01	02	05									01: 2400 mL, 2 fil. 02: 1200 mL, 1 fil.
203M003	7/11/02 1145	S5-MW-21	GW	2		01	02										01: 600 mL, 2 filters 02: 300 mL, 1 filt.
203M004	7/11/02 1330	TK 7/11/02 Equipment ~~EF~~ Rinsate	BW	2		01	02										01: 2400 mL, 1 filt. 02: 1200 mL, 1 filt.
203M005	7/11/02 1445	S5-MW-30	GW	2		01	02										01: 600 mL, 2 filt. 02: 600 mL, 1 filt.
203M006	7/11/02 1500	S5-MW-30	GW	2		01	02										01: 600 mL, 2 filt. 02: 600 mL, 2 filt.
203M007	7/11/02 1530	Source Blank	BW	2		01	02										01: 2400 mL, 1 filt. 02: 1200 mL, 1 filt.
203M008	7/11/02 1635	S5-MW-38	GW	2		01	02										01: 900 mL, 2 filt. 02: 600 mL, 1 filt.

Relinquished By/Company	Received By/Company	Date	Time	Reason for Transfer
Anthony Rossi/BNI	Fed Ex	7/11/02	1800	Ship to Lab

Comments/Instructions:

Method of Shipment: Fed Ex
Airbill No.: 818658168406
Total No. of Containers: 17
Total No. of Coolers Shipped: 1

I:\word_processing\forms\cocrecor.doc

H-2

Baseline SiREM Laboratory Microbial Report (July 26, 2002)

SiREM
Site Recovery & Management

www.siremlab.com
130 Research Lane, Suite 2
Guelph, Ontario N1G 5G3
Phone: (519) 822-2265
Fax: (519) 822-3151

Test Results for Gene-Trac™ *Dehalococcoides* Assay

Client Name: Bechtel	**Test Reference Number:** DT-0016
Contact: Jim French	**Report Issued:** 26-Jul-02
Site Location: IR site 5, NASNI	**Site Sampling:** 11-July-02 **Sample(s) Received:** 15-July-02 **DNA Extraction:** 17-Jul-02
Telephone: (619) 744-3034	**Method Used:** Gene-Trac™ *Dehalococcoides* Assay
E-mail: jhfrench@Bechtel.com	**Positive Control (Pos. Ctrl.):** Assay with Cloned *Dehalococcoides* 16S rRNA gene
Fax:	**Negative Control (Neg. Ctrl)** Assay with DNA extraction blank

Test Results:

Client Sample ID	SiREM ID	Bacterial DNA Detected	*Dehalococcoides* Test, Intensity (% of Positive Control)	Intensity Score	Test Result
203M001	DHC-0097	yes	0%	-	Negative
203M002	DHC-0098	yes	200%	++++	Positive (3 of 3 primer sets)
203M003	DHC-0099	yes	468%	++++	Positive (3 of 3 primer sets)
203M004	DHC-0100	yes	64%	++	Positive (2 of 3 primer sets)
203M005	DHC-0101	yes	800%	++++	Positive (3 of 3 primer sets)
203M006	DHC-0102	yes	780%	++++	Positive (3 of 3 primer sets)
203M007	DHC-0103	no	0%	-	Negative
203M008	DHC-0104	yes	500%	++++	Positive (3 of 3 primer sets)
na	Pos. Ctrl.	na	100%	+++	Positive
na	Neg. Ctrl	na	0%	-	Negative

The above results refer only to that portion of the sample tested with the Gene-Trac assay. The test is based on PCR with primer sets specific to DNA sequences in the 16S rRNA gene of *Dehalococcoides*. A positive (+ to ++++) result in this assay indicates that a member of the *Dehalococcoides* group was detected in the water sample. *Dehalococcoides* organisms are the only microorganisms proven to possess the necessary enzymes for the complete dechlorination of PCE or TCE to ethene. The presence of *Dehalococcoides* has been positively correlated to complete dechlorination of chlorinated ethenes at contaminated sites.

*Intensity Score", categorizes PCR product quantity based on the "intensity (% of positive control)": ++++ = Very high band intensity (greater than 100% of positive control), +++ = high band intensity (67-100%), ++ moderate band intensity (34-66%) + = low band intensity (4- 33%), -/+ = inconclusive (1-3%), - = no band (0%)
"Intensity (% of Positive control)" = Quantitative assessment of electrophoresis gel band intensity of most abundant PCR product test result as a percentage of corresponding positive control reaction. This value provides a semi-quantitative assessment of the number of *Dehalococcoides* organisms present in the sample. While band intensity might reflect actual concentration of the target organism, GeneTrac™ is a semi-quantitative method and results are only meant to be a qualitative indicator for determination of the presence or absence of *Dehalococcoides*.

Authorized by: Philip **Date:** 26 - Jul - 02

Philip Dennis, M.A.Sc.,
SiREM Operations Manager

Gene-Trac™ *Dehalococcoides* Test, Case Narrative, Test DT-0016

Eight samples from IR Site 5 NASNI were received by SiREM 4 days post sampling, at this time the cooler temperature was measured at a warm but acceptable temperature of 15 C.

All field samples (with the exception of 203M001) tested positive for *Dehalococcoides*. Sample 203M001 tested positive for bacterial DNA (but not *Dehalococcoides* DNA) confirming that the DNA extraction for this sample was successful. Sample 203M004 ("equipment rinsate") tested mildly positive for *Dehalococcoides* DNA suggesting that some cross contamination between samples is a possibility, due to the very strong positives of the majority of samples, however, this would appear unlikely.
Sample 203M007 (Source Blank) tested negative for *Dehalococcoides* DNA as well as bacterial DNA suggesting this sample was completely free of bacteria.

PD

BECHTEL **CLEAN**

CHAIN-OF-CUSTODY RECORD

21072

Site Name: IR Site 5, NASNI
CTO Number: 22214-203
Site Contact/Supervisor: James French

Sampler(s): Anthony Rossi
Signature(s): Anthony Rossi

Analytical Laboratory Name: SiREM Laboratory
Analytical Laboratory Address: 130 Research Ln., Ste. 2, Guelph, Ontario, CANADA N1G 5G3
Field Logbook/Page Number: 203-003 / 23

Pay Items/ Analyses Required:
- DGGE Analysis
- Gene-Trac

Preservation (4°C): 1 | 1

TAT (in days): 2 7 [✓ 14] 30

Sample ID No. (8 digit)	Date/Time Collected	Station Description	Sample Matrix	Number of Containers	Archive (Container No.)	Container Nos. (2 digit)											Remarks (e.g., MS, MSD)
203M001	7/11/02 0930	S5-MW-36	GW	2		03	04										
203M002	7/11/02 1045	S5-MW-20	GW	2		03	04										
203M003	7/11/02 1145	S5-MW-21	GW	2		03	04										
203M004	7/11/02 1330	Equipment Rinsate	~~GW~~ BW TK 7/11/02	2		03	04										
203M005	7/11/02 1445	S5-MW-30	GW	2		03	04										
203M006	7/11/02 1500	S5-MW-30	GW	2		03	04										
203M007	7/11/02 1530	Source Blank	BW	2		03	04										
203M008	7/11/02 1635	S5-MW-38	GW	2		03	04										

Relinquished By/Company	Received By/Company	Date	Time	Reason for Transfer
Anthony Rossi /BNI	FedEx	7/11/02	1800	Ship to Lab
Jeff [illegible] /SiREM	SiREM	7/15/02	12:00	

Comments/Instructions: Please return cooler and blue ice w/ enclosed FedEx label.

Method of Shipment: FedEx
Airbill No.: 818658168391
Total No. of Containers: 16
Total No. of Coolers Shipped: 1
[illegible]
[illegible] 15°C

H-3
Posttreatment Summary Microbial Insights Laboratory Report
(July 25, 2003)

microbial insights

2340 Stock Creek Blvd.
Rockford TN 37853-3044
Phone (865) 573-8188
Fax: (865) 573-8133
Email: microbe@microbe.com

Microbial Analysis Report

Client: Shaw Environmental and Infrastructure
Brian White/ Dwayne Ishida
1230 Columbia St., Ste. 1200
Coronado, CA 92135

Phone: 619.437.6326

Fax: 619.437.6368

MI Identifier: 20shw **Date Rec.:** 7/10/03 **Report Date:** 8/18/03

Analysis Requested: PLFA and DNA

Project: CTO-027

Comments:

The following is an amended report reflecting an adjustment to the "crunch factor" used to report the number of 16S rDNA gene copies for *Dehalococcoides*.

All samples within this data package were analyzed under U.S. EPA Good Laboratory Practice Standards: Toxic Substances Control Act (40 CFR part 790). All samples were processed according to standard operating procedures. Test results submitted in this data package meet the quality assurance requirements established by Microbial Insights, Inc.

Reported by:

Susan D. Reynolds
-by YMP

Reviewed by:

Yvette Reeno

microbial insights

2340 Stock Creek Blvd.
Rockford TN 37853-3044
Phone (865) 573-8188
Fax: (865) 573-8133
Email: microbe@microbe.com

Microbial Analysis Report

Executive Summary

The microbial communities from five sampling events of two monitoring wells were characterized according to their phospholipid fatty acid composition (PLFA analysis). In addition, each sample was screened for the presence of *Dehalococcoides* using a targeted gene detection approach. Results from this study revealed the following key observations:

- Overall, MW-21 contained higher levels of biomass with greater variance among sampling events, than did MW-30.

- PLFA profiles showed that within MW-21 proportions of Firmicutes have increased while biomarkers for Proteobacteria have continued to decrease through the June 2003 sampling event. Results from the July 2003 sampling event showed a shift in the community composition at MW-21 in which the community became more similar to the March 30, 2003 sample. The community structure in MW-30 remained fairly consistent with that which was observed in the previous sampling event.

- Physiological status biomarkers indicated that starvation levels, for the most part, decreased steadily over time in MW-30. Starvation levels in sample MW-21 although having decreased following the chemical oxidation treatment increased through the third post – treatment event. Results from the July 2003 sampling event showed that starvation markers had decreased in MW-21. Neither MW-21 nor MW-30 was shown to be responding to environmentally induced stress at any time throughout the duration of the study.

- The presence of *Dehalococcoides* was detected at all sites except SS-MW-21 at the second sampling, and at S5-MW-30 at the third.

Overview of Approach:

Phospholipid Fatty Acid Analysis

Examining the phospholipid fatty acids (PLFA) in environmental samples is an effective tool for monitoring microbial responses to their environment. They are essential components of the membranes of all cells (except for the Archea, a minor component of most environments), so their sum includes all important actors of most microbial communities. There are four different types of information in PLFA profiles – biomass, community structure, diversity, and physiological status.

Biomass: PLFA analysis is the most reliable and accurate method available for the determination of viable microbial biomass. Since phospholipids break down rapidly upon cell death (21, 23), the PLFA biomass does not contain 'fossil' lipids of dead cells. The sum of the PLFA, expressed as picomoles (1 picomole = 1×10^{-12} mole), is proportional to the number of cells. The proportion used in this report, 20,000 cells/pmole, is taken from cells grown in laboratory media, and varies somewhat with type of organism and environmental conditions. Starving bacterial cells have the lowest cells/pmol, and healthy eukaryotic cells have the highest.

Community Structure:. The PLFA in an environmental sample is the sum of the microbial community's PLFA, and reflects the proportions of different organisms in the sample. PLFA profiles are routinely used to classify bacteria and fungi (19) and are one of the characteristics used to describe new bacterial species (25). Broad phylogenic groups of microbes have different fatty acid profiles, making it possible to distinguish among them (4, 5, 22, 24). Table 1 describes the six major structural groups employed in this report.

Table 1. Description of PLFA structural groups.

PLFA Structural Group	General classification
Monoenoic (Monos)	Abundant in Proteobacteria (Gram negative bacteria), typically fast growing, utilize many carbon sources, and adapt quickly to a variety of environments.
Terminally Branched Saturated (TerBrSats)	Characteristic of Firmicutes (Low G+C Gram-positive bacteria), and also found in Bacteriodes, and some Gram-negative bacteria (especially anaerobes).
Branched Monoenoic (BrMonos)	Found in the cell membranes of micro-aerophiles and anaerobes, such as sulfate- or iron-reducing bacteria
Mid-Chain Branched Saturated (MidBrSats)	Common in Actinobacteria (High G+C Gram-positive bacteria), and some metal-reducing bacteria.
Normal Saturated (Nsats)	Found in all organisms.
Polyenoic	Found in eukaryotes such as fungi, protozoa, algae, higher plants, and animals.

Diversity: The diversity of a microbial community is a measure of the number of different organisms and the evenness of their distribution. Natural communities in an undisturbed environment tend to have high diversity. Contamination with toxic compounds will reduce the diversity by killing all but the resistant organisms. The addition of a large amount of a food source will initially reduce the diversity as the opportunists (usually Proteobacteria) over-grow organisms less able to reproduce rapidly. The formulas used to calculate microbial community diversity from PLFA profiles have been adapted from those applied to communities of macro-organisms (8).

Physiological status: The membrane of a microbe must adapt to the changing conditions of it's environment, and these changes are reflected in the PLFA. Toxic compounds or environmental conditions that disrupt the membrane cause some bacteria to make trans fatty acids from the usual cis fatty acids (7). Many Proteobacteria and others respond to starvation or highly toxic conditions by making cyclopropyl (7) or mid-chain branched fatty acids (20). The physiological status biomarkers for Toxic Stress and Starvation/Toxicity are formed by dividing the amount of the stress-induced fatty acid by the amount of it's biosynthetic precursor.

PLFA were analyzed by extraction of the total lipid (21) and then separation of the polar lipids by column chromatography (6). The polar lipid fatty acids were derivatized to fatty acid methyl esters, which were quantified using gas chromatography (15). Fatty acid structures were verified by chromatography/mass spectrometry and equivalent chain length analysis.

Targeted Gene Detection:

DNA primers (short pieces of DNA) matching a conserved region of the 16S rRNA gene of Dehalococcoides were used to determine if this bacterium was present at detectable levels in the samples. Based on Loffler *et al*. (2) the sensitivity of these primers is ~10^3 cells/ liter or g of sample. Cloned *Dehalococcoides* 16S rDNA was used as a positive control to verify test results.

Results and Discussion

Phospholipid Fatty Acid Analysis

Overall, biomass estimates (as determined by the total concentration of PLFA) were highest in MW-21 throughout the study. During the baseline event both locations were ~10^5 cells/mL. Following the chemical oxidation treatment, both samples experienced an increase in biomass with MW-21 showing the most notable response (almost two orders of magnitude). However biomass levels in MW-21 were noticeably lower in the samples collected during the 4/30/03 and 6/5/03 sampling events, before rebounding to the highest recorded level (~10^7 cells/mL). It is speculated that the increase in biomass following the chemical oxidation treatment was most likely due to increased carbon availability from the partial breakdown of polymeric material (i.e. humics, fulvics, lignin, etc).

Biomass concentrations in MW-30 varied less than in MW-21 but generally increased through the 4/30/03 sampling event.

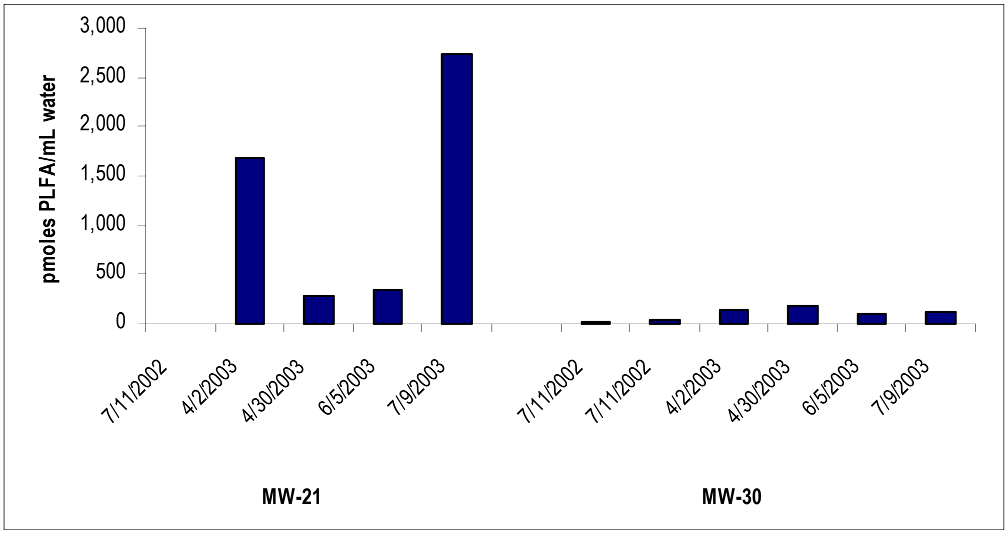


Figure 1. Biomass content is presented as the total amount of phospholipid fatty acids (PLFA) extracted from a given sample. Total biomass is calculated based upon PLFA attributed to bacterial and eukaryotic biomass (associated with higher organisms).

The PLFA profiles of the control (pre treatment) samples revealed a diverse microbial community at both sampling locations (Figure 2), similar to other subsurface groundwater samples. Upon *in situ* oxidation, the proportions of biomarkers for Proteobacteria increased, and the proportions of Firmicutes, anaerobic metal reducers, Actinomycetes, and Eukaryotes decreased. Many Proteobacteria are opportunists, and here they have taken advantage of the change in conditions to quickly increase their biomass.

Within MW-21, proportions of Firmicutes have increased while biomarkers for Proteobacteria decrease through the 6/5/03 sampling event. By the 7/9/03 event, the community structure within MW-21 had shifted to be similar to the community observed on 4/30/03. The community structure in MW-30 remained consistent with that which was observed in the previous sampling event.

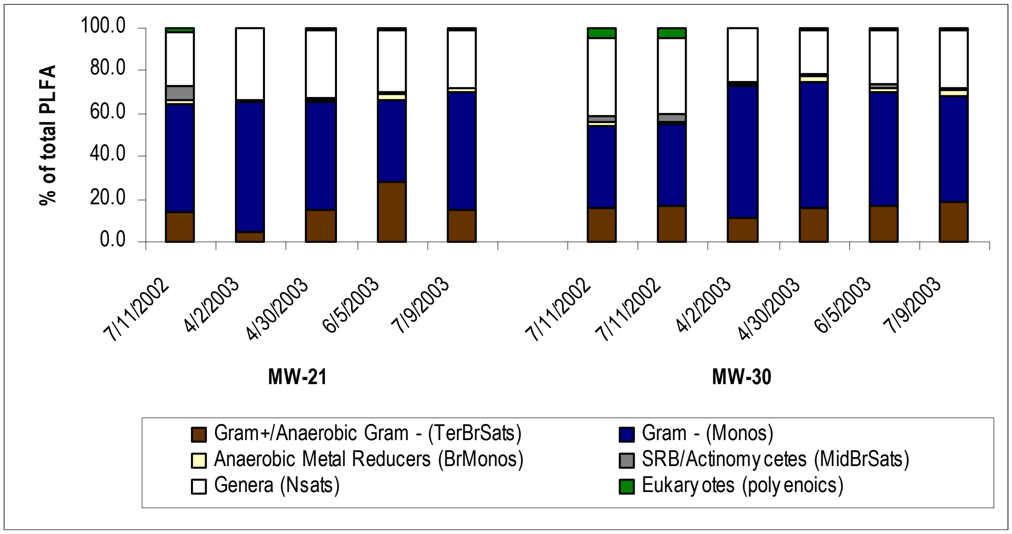


Figure 2. Relative percentages of total PLFA structural groups in the samples analyzed. Structural groups are assigned according to PLFA chemical structure, which is related to fatty acid biosynthesis. See Table 1 for detailed descriptions of structural groups.

Physiological status biomarkers indicated that starvation levels, for the most part, decreased steadily over time in MW-30. Starvation levels in sample MW-21 decreased following treatment and then increased through the third post-treatment event (6/5/03). Results from the last round of sampling showed that starvation indicators had decreased. Neither MW-21 nor MW-30 was shown to be responding to environmentally induced stress at any time throughout the duration of this study.

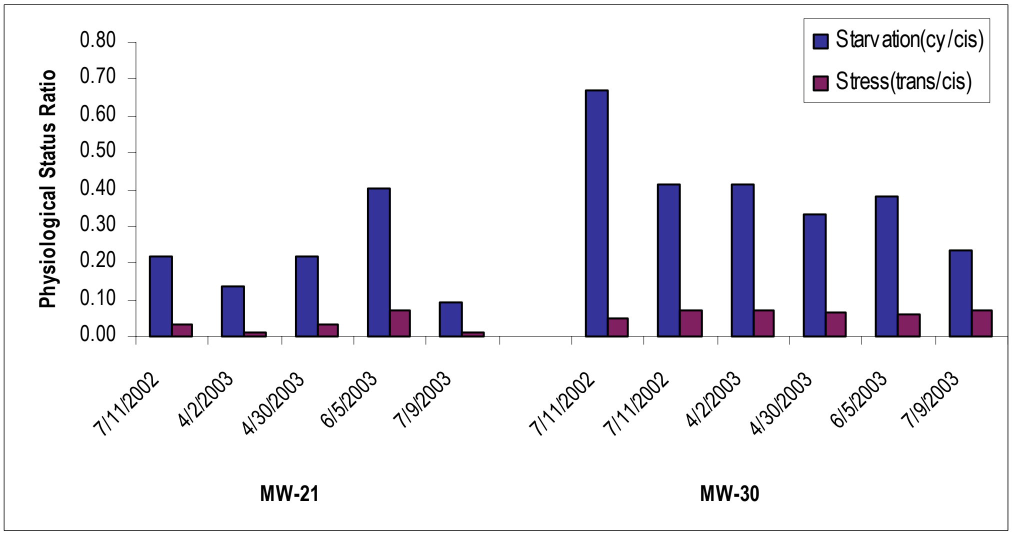


Figure 3. Microbial physiological stress markers. The starvation biomarker for the Gram-negative bacterial community is assessed by the ratios of cyclopropyl fatty acids to their metabolic precursors. An adaptation of the Gram-negative community to toxic stress is determined by the ratio of ω7t/ω7c fatty acids. Gram-negative bacteria generate *trans* fatty acids to minimize the permeability of their cellular membranes as an adaptation to a less favorable environment. Ratios (16:1ω7t/16:1ω7c and 18:1ω7t/18:1ω7c) greater than 0.1 have been shown to indicate an adaptation to a toxic or stressful environment, resulting in decreased membrane permeability.

Table 2. Values below are: viable microbial biomass expressed as picomoles of PLFA per mL of sample and as cells per mL of sample, fatty acid structural groups as percent of total PLFA, and physiological status biomarkers as mole ratio. "-" indicates data not available.

Samples		Biomass		Community Structure (% of total PLFA)						Physiological Status	
Sample Name	Sample Date	pmol/mL	cells/mL	Anaerobic Gram Neg./ Firmicutes (TerBrSats)	Proteobacteria (Monos)	Anaerobic metal reducers (BrMonos)	Actinomycetes/ SRB (MidBrSats)	General (Nsats)	Eukaryotes (polyenoics)	Starved cy/cis	Membrane Stress, trans/cis
S5-MW-21	7/11/02	8	1.55E+05	13.7	50.6	2.1	6.3	25.4	1.9	0.22	0.03
S5-MW-21	4/2/03	1,680	3.36E+07	4.8	60.5	0.5	0.2	33.9	0.1	0.14	0.01
S5-MW-21	4/30/03	275	5.50E+06	15.3	49.8	1.6	0.6	32.1	0.6	0.22	0.03
S5-MW-21	6/5/03	342	6.84E+06	28.4	38.2	2.6	0.8	29.4	0.7	0.40	0.07
S5-MW-21	7/9/2003	2,740	5.48E+07	15.3	54.6	1.7	0.4	27.4	0.6	0.09	0.01
S5-MW-30	7/11/02	22	4.46E+05	16.3	38.3	1.7	2.8	36.2	4.7	0.67	0.05
S5-MW30	7/11/02	39	7.74E+05	17.0	37.8	1.7	3.7	35.2	4.5	0.41	0.07
S5-MW-30	4/2/03	137	2.73E+06	11.1	61.3	1.6	1.1	24.6	0.2	0.41	0.07
S5-MW-30	4/30/03	192	3.83E+06	16.3	58.5	2.8	1.4	20.2	0.7	0.33	0.06
S5-MW-30	6/5/03	93	1.86E+06	17.1	52.9	1.8	1.7	25.4	1.3	0.38	0.06
S5-MW-30	7/9/2003	127	2.53E+06	18.5	49.5	2.6	1.7	26.5	1.2	0.23	0.07

Targeted Gene Detection

Dehalococcoides was detected in both samples from the last sampling event. Since the establishment of this study, Microbial Insights, Inc. has acquired the technology required to quantify the number of *Dehalococcoides* S16 rRNA gene copies/mL water. This technology was applied to the last sampling event in this study and therefore the results are also expressed (in brackets) as a numerical value. In general, the presence of *Dehalococcoides* was detected at all sites except SS-MW-21 at the second sampling, and at S5-MW-30 at the third.

Table 6. Results from DNA amplification using primers specific for *Dehalococcoides*. Specific primers directed to a conserved region of the 16S rRNA gene of *Dehalococcoides* were used to determine if this bacterium was present at detectable levels in the samples. The sensitivity of these primers is ~10^3 cells/liter or g of sample. Presence is noted with a plus sign, and the relative abundance is presented by the number of plus signs.

Sample		**Dehalococcoides ethenogenes**
S5-MW-21	(7/11/02)	+++
S5-MW-21	(4/2/03)	-
S5-MW-21	(4/30/03)	++
S5-MW-21	(6/5/03)	++
S5-MW-21	(7/9/03)	+++ (NQ (4.63E+02[a,b]))
S5-MW-30	(7/11/02)	+++
S5-MW30	(7/11/02)	+++
S5-MW-30	(4/2/03)	+++
S5-MW-30	(4/30/03)	-
S5-MW-30	(6/5/03)	+
S5-MW-30	(7/9/03)	+++ (1.53E+03[a,b])
Dehalococcoides etheneogenes positive control		+++
E.coli negative control		-

NQ = Detectable, but not quantifiable. These results were obtained using a Q-PCR analysis for Dehaolococcoides 16S rDNA.

[A] Assuming *Dehalococcoides ethenogenes* contains single rRNA operon per genome, the value given also may represent the number of cells per mL or g of sample for bacteria in this phylogenetic group.

[B] The detection limit is ~10^2 16S rRNA gene copies per g or mL of sample.

References

1. Amann, R. I., W. Ludwig, and K.-H. Schleifer. 1995. Phylogenetic identification and in situ detection of individual microbial cells without cultivation. Microbiological Reviews 59:143-169.
2. Cottrell, MT and David L. Kirchman. Appl Environ Microbiol. 2000 April; 66 (4): 16921697.
3. Gillis, M., V. Tran Van, R. Bardin, M. Goor, P. Hebbar, A. Willems, P. Segers, K. Kerstens, T. Heulin, and M. P. Fernadez. 1995. Polyphasic taxonomy in the genus Burkholderia leading to an amended description of the genus and proposition of Burkholderia vietnamiensis sp. nov. for N2-fixing isolates from rice in Vietnam. Int. J. Syst. Bacteriol. 45:274-289.
4. Dowling, N. J. E., F. Widdel, and D. C. White. 1986. Phospholipid ester-linked fatty acid biomarkers of acetate-oxidizing sulfate reducers and other sulfide forming bacteria. Journal of General Microbiology 132:1815-1825.
5. Edlund, A., P. D. Nichols, R. Roffey, and D. C. White. 1985. Extractable and lipopolysaccharide fatty acid and hydroxy acid profiles from Desulfovibrio species. Journal of Lipid Research 26:982-988.
6. Guckert, J. B., C. P. Antworth, P. D. Nichols, and D. C. White. 1985. Phospholipid ester-linked fatty acid profiles as reproducible assays for changes in prokaryotic community structure of estuarine sediments. FEMS Microbiol. Ecol. 31:147-158.
7. Guckert, J. B., M. A. Hood, and D. C. White. 1986. Phospholipid ester-linked fatty acid profile changes during nutrient deprivation of Vibrio cholerae: increases in the trans/cis ratio and proportions of cyclopropyl fatty acids. Appl. Environ. Microbiol. 52:794–801.
8. Hedrick, D.B., A Peacock, J.R. Stephen, S.J. Macnaughton, Julia Brüggemann, and David C. White. 2000. Measuring soil microbial community diversity using polar lipid fatty acid and denatured gradient gel electrophoresis data. J. Microbiol. Methods, 41, 235-248.
9. ITRC Internet Training on Natural Attenuation of Chlorinated Solvents in Groundwater: Principles and Practices, Apr 00.
10. Löffler, F. E., Q. Sun, et al. (2000). “16S rRNA gene-based detection of tetrachloroethene-dechlorinating Desulfuromonas and Dehalococcoides species.” Appl Environ Microbiol 66(4): 1369-1374.
11. Maymo-Gatell X, Chien Y, Gossett JM, Zinder SH. 1997. Isolation of a bacterium that reductively dechlorinates tetrachloroethene to ethene. Science 276(5318):1568-71.
12. Muyzer, G., E. C. De Waal, and A. G. Uitterlinden. 1993. Profiling of complex microbial populations by denaturing gradient gel electrophoresis analysis of polymerase chain reaction-amplified genes coding for 16S rRNA. Applied and Environmental Microbiology 59:695-700.
13. Ribosomal Database Project (http://rdp.cme.msu.edu. National Center for Biotechnology Information. (http://www.ncbi.nlm.nih.gov/)
14. Overman, J., "Family Chlorobiaceae," in M. Dworkin et al., eds., The Prokaryotes: An Evolving Electronic Resource for the Microbiological Community, 3rd edition, release 3.7, November 2, 2001, Springer-Verlag, New York, www.prokaryotes.com.
15. Ringelberg, D. B., G. T. Townsend, K. A. DeWeerd, J. M. Sulita, and D. C. White. 1994. Detection of the anaerobic dechlorinating microorganism Desulfomonile tiedjei in environmental matrices by its signature lipopolysaccharide branch-long-chain hydroxy fatty acids. FEMS Microbiol. Ecol. 14:9-18.
16. Schlötelburg, C. 2001. Mikrobielle Diversität und Dynamik einer 1,2-Dichlorpropan dechlorierenden Mischkultur (Microbial Diversity and Dynamics in a 1,2-Dichloropropane Dechlorinating Mixed Culture). Dissertation, Humbolt University, Berlin, Germany. In German: http://edoc.hu-berlin.de/dissertationen/schloetelburg-cord-2001-12-07/PDF/Schloetelburg.pdf
17. Sharp, R., D. Cossar, and R. Williams. 1995. Physiology and metabolism of Thermus. Biotechnol. Handb. 9:67-91.
18. Stephen, J. R., Y.-J. Chang, Y. D. Gan, A. Peacock, S. Pfiffner, M. Barcelona, D. C. White, and S. J. Macnaughton. 1999. Microbial characterization of a JP-4 fuel-contaminated site using a combined lipid biomarker/polymerase chain reaction-denaturing gradient gel electrophoresis (PCR-DGGE) based approach. Environmental Microbiology 1:231-241.
19. Tighe, S.W., de Lajudie, P., Dipietro, K., Lindström, K., Nick, G. & Jarvis, B.D.W. (2000). Analysis of cellular fatty acids and phenotypic relationships of Agrobacterium, Bradyrhizobium, Mesorhizobium, Rhizobium and Sinorhizobium species using the Sherlock Microbial Identification System. Int J Syst Evol Microbiol 50, 787-801.
20. Tsitko, I.V. Gennadi M. Zaitsev, Anatoli G. Lobanok, and Mirja S. Salkinoja-Salonen. 1999. Applied and Environmental Microbiology 65(2) 853-855.
21. White, D. C., W. M. Davis, J. S. Nickels, J. D. King, and R. J. Bobbie. 1979. Determination of the sedimentary microbial biomass by extractable lipid phosphate. Oecologia 40:51-62.

22. White, D. C., H. C. Pinkart, and D. B. Ringelberg. 1997. Biomass measurements: Biochemical approaches, p. 91-101. In C. J. Hurst, G. R. Knudsen, M. J. McInerney, L. D. Stetzenbach, and M. V. Walter (ed.), Manual of Environmental Microbiology. ASM Press, Washington.
23. White, D. C., and D. B. Ringelberg. 1995. Utility of signature lipid biomarker analysis in determining in situ viable biomass, community structure, and nutritional / physiological status of the deep subsurface microbiota. In P. S. Amy and D. L. Halderman (ed.), The microbiology of the terrestrial subsurface. CRC Press, Boca Raton.
24. White, D. C., J. O. Stair, and D. B. Ringelberg. 1996. Quantitative comparisons of in situ microbial biodiversity by signature biomarker analysis. Journal of Industrial Microbiology 17:185-196.
25. Vandamme P, Pot B, Gillis M, de Vos P, Kersters K, Swings J. Polyphasic taxonomy, a consensus approach to bacterial systematics. Microbiol Rev 1996 Jun;60(2):407-38.

CLEAN

CHAIN-OF-CUSTODY RECORD

21075

Site Name: IR Site 5, NASNT
CTO Number: 22214-203
Site Contact/Supervisor: James French

Sampler(s): Anthony Rossi
Signature(s): Anthony Rossi

Analytical Laboratory Name: Microbial Insights, Inc.
Analytical Laboratory Address: 2340 Stock Creek Blvd, Rockford TN 37853
Field Logbook/Page Number: 203-003/23

Pay Items/ Analyses Required

PLFA Analysis	DNA Analysis + Archive	Culturing								
Preservation (4°C)										
1	1	1								

TAT (in days): 2 7 [✓ 14] 30

Sample ID No. (8 digit)	Date/Time Collected	Station Description	Sample Matrix	Number of Containers	Archive (Container No.)	Container Nos. (2 digit)											Remarks (e.g., MS, MSD)
203M001	7/11/02 0930	S5-MW-36	GW	2		01	02										01: 2400 mL, 1 fil. 02: 1200 mL, 1 fil.
203M002	7/11/02 1045	S5-MW-20	GW	3		01	02	05									01: 2400 mL, 2 fil. 02: 1200 mL, 1 fil.
203M003	7/11/02 1145	S5-MW-21	GW	2		01	02										01: 600 mL, 2 filters 02: [illegible] mL, 1 filt.
203M004	7/11/02 1330	TK 7/11/02 ~~EF~~ Equipment Rinsate	BW	2		01	02										01: 2400 mL, 1 filt. 02: 1200 mL, 1 filt.
203M005	7/11/02 1445	S5-MW-30	GW	2		01	02										01: 600 mL, 2 filt. 02: 600 mL, 1 filt.
203M006	7/11/02 1500	S5-MW-30	GW	2		01	02										01: 600 mL, 2 filt. 02: 600 mL, 2 filt.
203M007	7/11/02 1530	Source Blank	BW	2		01	02										01: 2400 mL, 1 filt. 02: 1200 mL, 1 filt.
203M008	7/11/02 1635	S5-MW-38	GW	2		01	02										01: 900 mL, 2 filt. 02: 600 mL, 1 filt.

Relinquished By/Company	Received By/Company	Date	Time	Reason for Transfer
Anthony Rossi /BNI	Fed Ex	7/11/02	1800	Ship to Lab

Comments/Instructions:

Method of Shipment: Fed Ex
Airbill No.: 818658168406
Total No. of Containers: 17
Total No. of Coolers Shipped: 1

I:\word_processing\forms\cocrecor.doc

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CHAIN-OF-CUSTODY RECORD

LABORATORY COPY

A 18934

FORM 0019 REV. 9-99

IT'S LAB COORDINATOR: D. ISHIDA
LAB COORDINATOR'S PHONE: 949-660-7561
LAB COORDINATOR'S FAX: 949-660-5433
LABORATORY SERVICE ID: MICROBIAL INSIGHTS
LABORATORY CONTACT: GREG DAVIS
MAIL REPORT (COMPANY NAME): SHAW ENVIRONMENTAL

PROJECT NAME: CTO-027
PROJECT LOCATION: IR SITE 5- UNIT 2
PROJECT NUMBER: 818725
LABORATORY PHONE: 865-573-8188
LABORATORY FAX: 865-573-8133
RECIPIENT NAME: D. ISHIDA

PROJECT CONTACT: BRIAN WHITE
PROJECT PHONE NUMBER: 619-437-6326
PROJECT FAX: 619-437-6368
LABORATORY ADDRESS: 2340 STOCK CREEK BLVD.
ADDRESS: 3347 MICHLESON DR. SUITE 200

PROJECT ADDRESS: NASNI
CITY, STATE AND ZIP CODE: CORONADO, CA 92135
CLIENT: U.S.N.
CITY, STATE AND ZIP CODE: ROCKFORD, TN 37853
CITY, STATE AND ZIP CODE: IRVINE, CA 92705

PROJECT MANAGER: RICHARD WONG
PROJECT MANAGER'S PHONE: 619-437-6326
PROJECT MANAGER'S FAX: 619-437-6368

Item	Sample Identifier	Matrix	Date	Time	Preserved	# of Cont.	QC Level	T.A.T.	Analyses PLFA ANALYSIS	DNA ANALYSIS						Comments
1	818725-185	WATER	4.2.03	10:25	ICE	3 ea 1L POLY	III	PCR SOW	X	X						
2	818725-186	↓	4.2.03	11:35	↓	↓	III	↓	X	X						
3																
4																
5																
6	N/A															
7																
8																
9																
10																

SAMPLES COLLECTED BY: E. William Ragsdale
COURIER AND AIR BILL NUMBER:
COOLER TEMPERATURE UPON RECEIPT:

RELINQUISHED BY	RECEIVED BY	DATE	TIME	SAMPLE'S CONDITION UPON RECEIPT
E. William Ragsdale 4.2.03				

Distribution: White - Laboratory (To be returned with Analytical Report); Goldenrod - Project File; Manilla - Project Data Manager

Project Information Section For Project Personnel Only Do Not Submit to Laboratory

DHe SAMPLING FOR END OF MARCH / BEGINNING OF APRIL TO ASSESS DHe REBOUND

Sample Point Location	G	C	F	QC
① SS-MW-21 @ 8.6' BGS			X	
② SS-MW-30 @ 8.0' BGS			X	
N/A				

Comments

DEDICATED PUMP - LOW FLOW PURGE / SAMPLE

Sample Type: G - Grab, C - Composite, F - Field Sample, QC - Quality Control Sample

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CHAIN-OF-CUSTODY RECORD

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FORM 0019 REV. 9-99

IT'S LAB COORDINATOR D. ISHIDA	LAB COORDINATOR'S PHONE 949-660-7561	LAB COORDINATOR'S FAX 949-660-5433	LABORATORY SERVICE ID MICROBIAL INSIGHTS	LABORATORY CONTACT GREG DAVIS	MAIL REPORT (COMPANY NAME) SHAW ENVIRONMENTAL
PROJECT NAME: CTO-027	PROJECT LOCATION IR SITE 5-UNIT 2	PROJECT NUMBER 818725	LABORATORY PHONE 865-573-8188	LABORATORY FAX 865-573-8133	RECIPIENT NAME D. ISHIDA
PROJECT CONTACT BRIAN WHITE	PROJECT PHONE NUMBER 619-437-6326	PROJECT FAX 619-437-6368	LABORATORY ADDRESS 2340 STOCK CREEK BLVD		ADDRESS 3347 MICHLESON DR SUITE 200
PROJECT ADDRESS NASNI	CITY, STATE AND ZIP CODE CORONADO, CA 92135	CLIENT U.S.N.	CITY, STATE AND ZIP CODE ROCKFORD, TN 37853		CITY, STATE AND ZIP CODE IRVINE, CA 92705
PROJECT MANAGER RICHARD WONG	PROJECT MANAGER'S PHONE 619-437-6326	PROJECT MANAGER'S FAX 619-437-6368			

Item	Sample Identifier	Matrix	Date	Time	Preserved	# of Cont.	QC Level	T.A.T.	Analyses PLFA	DNA							Comments
1	818725-218	WATER	4/30/03	1236	ICE	3	PER SOW	14 DAYS	X	X							
2	818725-219	↓	↓	1422	↓	↓	↓	↓	X	X							
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

SAMPLES COLLECTED BY: BC WHITE

COURIER AND AIR BILL NUMBER:

COOLER TEMPERATURE UPON RECEIPT:

RELINQUISHED BY	RECEIVED BY	DATE	TIME	SAMPLE'S CONDITION UPON RECEIPT
				COOLER SEALED W/ TAPE & CUSTODY SEAL

Distribution: White - Laboratory (To be returned with Analytical Report); Goldenrod - Project File; Manilla - Project Data Manager

Project Information Section For Project Personnel Only Do Not Submit to Laboratory

MICROBE POST-TREATMENT #2 SAMPLING FOR END OF APRIL

Sample Point Location	Sample Type G	C	F	QC
① SS-MW-21@8.6' BGS			X	
② SS-MW-30@8.0' BGS			X	
N/A				

Comments

SAMPLES COLLECTED VIA DEDICATED PUMPS / LOW FLOW PURGING.

Sample Type: G - Grab, C - Composite, F - Field Sample, QC - Quality Control Sample

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CHAIN-OF-CUSTODY RECORD

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FORM 0019 REV. 9-99

IT'S LAB COORDINATOR: DWAYNE ISHIDA
LAB COORDINATOR'S PHONE: 949-660-7561
LAB COORDINATOR'S FAX: 949-660-5433
LABORATORY SERVICE ID: MICROBIAL INSIGHTS
LABORATORY CONTACT: GREG DAVIS
MAIL REPORT (COMPANY NAME): SHAW E&I
PROJECT NAME: CTO-027
PROJECT LOCATION: IR SITE 5-UNIT 2
PROJECT NUMBER: 818725
LABORATORY PHONE: 865-573-8188
LABORATORY FAX: 865-573-8133
RECIPIENT NAME: DWANE ISHIDA
PROJECT CONTACT: BRIAN WHITE
PROJECT PHONE NUMBER: 619-437-6326
PROJECT FAX: 619-437-6368
LABORATORY ADDRESS: 2340 Stock CREEK BLVD
ADDRESS: 3347 Michelson #200
PROJECT ADDRESS: NASNI
CITY, STATE AND ZIP CODE: CORONADO CA 92135
CLIENT: U.S.N.
CITY, STATE AND ZIP CODE: ROCKFORD, TN 37853
CITY, STATE AND ZIP CODE: IRVINE CA 92705
PROJECT MANAGER: RICHARD WONG
PROJECT MANAGER'S PHONE: 619-437-6326
PROJECT MANAGER'S FAX: 619-437-6368

Item	Sample Identifier	Matrix	Date	Time	Preserved	# of Cont.	QC Level	T.A.T.	Analyses PLFA	DNA								Comments
1	~~818725-BT~~ S5-MW-21 (818725-223)	Water	6/5/03	1125	ICE	2	Per SOW	14 DAYS	X	X								SAMPLE # 818725-223 FOR S5-MW-21 (FOR REPORT USE)
2	~~818725-BT~~ S5MW-30 (818725-224)	Water	6/5/03	1230	ICE	2	Per SOW	14 days	X	Y								SAMPLE # 818725-224 FOR S5-MW-30 (FOR USE IN REPORT)
3																		
4																		
5																		
6		N/A																
7																		
8																		
9																		
10																		

SAMPLES COLLECTED BY: B. Tanaka
COURIER AND AIR BILL NUMBER: UPS- 1Z 66Y 570 019828 7313
COOLER TEMPERATURE UPON RECEIPT:

RELINQUISHED BY	RECEIVED BY	DATE	TIME	SAMPLE'S CONDITION UPON RECEIPT
B. Tanaka		6/5/03	1420	SEAL W/ TAPE & CUSTODY SEAL

Distribution: White - Laboratory (To be returned with Analytical Report); Goldenrod - Project File; Manilla - Project Data Manager

Project Information Section For Project Personnel Only Do Not Submit to Laboratory

MNA - POST-TREATMENT #3 SAMPLING FOR END OF MAY

Sample Point Location	G	C	F	QC
① S5-MW-21			X	
② S5-MW-30			X	
N/A				

Comments

Collected VIA Dedicated pumps/Low flow purging

Sample Type: G - Grab, C - Composite, F - Field Sample, QC - Quality Control Sample

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CHAIN-OF-CUSTODY RECORD

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A 18958

FORM 0019 REV. 9-99

IT'S LAB COORDINATOR: Dwayne Ishida
LAB COORDINATOR'S PHONE: 949-660-7561
LAB COORDINATOR'S FAX: 949-660-5433
LABORATORY SERVICE ID: Microbial Insights
LABORATORY CONTACT: Greg Davis
MAIL REPORT (COMPANY NAME): Shaw E&I

PROJECT NAME: CTO-27
PROJECT LOCATION: IR Site 5 Unit 2
PROJECT NUMBER: 818725
LABORATORY PHONE: 865-573-8188
LABORATORY FAX: 865-573-8133
RECIPIENT NAME: Dwayne Ishida

PROJECT CONTACT: Brian White
PROJECT PHONE NUMBER: 6194376326
PROJECT FAX: 6194376368
LABORATORY ADDRESS: 2940 Stock Creek BL.
ADDRESS: 3347 Michelson #200

PROJECT ADDRESS: NASNI
CITY, STATE AND ZIP CODE: Coronado Ca 92135
CLIENT: USN
CITY, STATE AND ZIP CODE: Rockford TN 37853
CITY, STATE AND ZIP CODE: IRVINE CA 92705

PROJECT MANAGER: Richard Wong
PROJECT MANAGER'S PHONE: 619-437-6326
PROJECT MANAGER'S FAX: 619-437-6368

Item	Sample Identifier	Matrix	Date	Time	Preserved	# of Cont.	QC Level	T.A.T.	Analyses PLFA	DNA							Comments
1	S5-MW-30 (818725-241)	Water	7/9/03	0945	ICE	2	Per SOW	14 DAYS	X	X							Sample #818725-241 FOR S5-MW-30 (FOR Report USE)
2	S5-MW-21 (818725-242)	Water	↓	1100	ICE	2	Per SOW	↓	X	X							Sample #818725-242 FOR S5-MW-21 (FOR Report USE)
3																	
4																	
5																	
6																	
7			N/A														
8																	
9																	
10																	

SAMPLES COLLECTED BY: B. Tenaka K. Cary
COURIER AND AIR BILL NUMBER: UPS: 1Z 66V 570 01 9085 7784
COOLER TEMPERATURE UPON RECEIPT:

RELINQUISHED BY	RECEIVED BY	DATE	TIME	SAMPLE'S CONDITION UPON RECEIPT
		7/9/03	1500	Seal W/Tape & Custody SEAL

Distribution: White - Laboratory (To be returned with Analytical Report); Goldenrod - Project File; Manilla - Project Data Manager

Project Information Section For Project Personnel Only Do Not Submit to Laboratory

Post Rebound Sampling

Sample Point Location	G	C	F	QC
1) S5-MW-30			X	
2) S5-MW-21			X	
N/A				

Comments

Collected VIA Dedicated pumps / Low flow Purging

Sample Type: G - Grab, C - Composite, F - Field Sample, QC - Quality Control Sample

Appendix I
Posttreatment Monitored Natural Attenuation Evaluation Report

Posttreatment Evaluation of Site 5 – Unit 2 Groundwater Monitoring Data

August 6, 2003

This report provides an evaluation of the baseline, interim, and posttreatment analyses of groundwater samples obtained from the treatment area monitor wells at Site 5 – Unit 2. The evaluation focuses on determining if conditions are favorable for continued microbial degradation of chlorinated aliphatic hydrocarbons, and predicting the effectiveness of the remedial treatments that have been performed at the Site. The evaluation considers direct evidence based on observations of the changes in contaminant concentrations, and indirect evidence based on natural attenuation parameters. Available Data

Several rounds of groundwater samples have been obtained from ten treatment area monitoring wells. A single baseline sample round was obtained during May 2002 prior to the three in situ chemical oxidation treatment events that occurred at the Site. Two interim samples rounds were obtained during the three treatment events. These interim rounds were collected during August and October 2002, and some wells were sampled a third time during January 2003. The final treatment event occurred during February 2003. Following the final treatment, two posttreatment rounds occurred at approximately 30 days and 48 days after the final treatment, and some wells were also sampled 106 days after the final treatment. An additional round of samples was obtained during July 2003, 138 days after the final treatment.

All of these samples were analyzed for VOCs using EPA Method 8260B, which included *cis*-1,2-DCE (DCE) and vinyl chloride (VC). Concentrations of VC exceed regulatory standards at some locations, so it is a contaminant of concern. Concentrations of DCE do not exceed any standards, but DCE is a precursor that degrades to VC as explained in the following section. In addition, two of the treatment area wells were also analyzed for a set of natural attenuation parameters, which included chloride, nitrate, sulfate, sulfide, total organic carbon (TOC), ethane, ethene, and methane.

Evaluation of VOC Concentrations

Several natural attenuation processes can lower the concentrations of chlorinated aliphatic compounds, including DCE and VC. The most effective process is microbial reductive dechlorination (EPA, 1998), during which tetrachloroethene (PCE) is reduced to trichloroethene (TCE), which is then reduced to DCE, which is then reduced to VC, which is finally either reduced to ethene or completely mineralized.

The reaction sequence can be summarized as follows:

$$\text{PCE} \rightarrow \text{TCE} \rightarrow \text{DCE} \rightarrow \text{VC} \rightarrow [\text{Ethene} + H^+ + Cl^-] \text{ or } [CO_2 + H_2O + H^+ + Cl^-]$$

Each step in the sequence involves the replacement of a chlorine atom with a hydrogen atom. The final products (ethene or complete breakdown products) are non-toxic. The most likely original source of contamination is PCE and/or TCE, both of which are commonly used solvents and degreasing agents. DCE and VC are mostly used in the manufacturing of plastics and are not usually found as primary contaminants at military installations. Concentrations of PCE are entirely nondetectable, and concentrations of TCE are mostly non-detectable, so at the current stage of natural attenuation, there is considerable progress along the sequential reductive dechlorination reaction. The concern, however, is that the degradation product VC is more toxic than its parent compounds, so the presence of these compounds will remain a concern until degradation is nearly complete.

Figures 1 through 4 show the concentrations of DCE (square symbols), and VC (diamond symbols) that were detected in the baseline, interim, and posttreatment sample rounds at four of the ten treatment area wells. Some samples from two of the wells (S5-MW-21 and S5-MW-30) were also analyzed for ethene (triangle symbols). The four wells shown in the figures are located within the treatment area, and had the highest concentrations of DCE and VC (although some of the reported concentrations were estimated [J-flagged]). Note that a logarithmic concentration scale is used on the vertical axis so that changes at lower concentrations can be clearly seen. The vertical line in the four figures indicates the final treatment date.

Figures 1 through 4 show that concentrations of DCE (and VC to a lesser extent) display a rebound effect after the last treatment, but VC concentrations are lower in the last sample relative to the baseline at all four wells. Rebound effects (temporary increases in contaminant concentrations) after treatment are commonly observed at sites where in situ chemical oxidation has been performed. DCE is more susceptible than VC to rebound for several reasons (Interstate Technology and Regulatory Cooperation Work Group [ITRC], 2001). Adsorption coefficients for DCE are higher than those of VC (U.S. Environmental Protection Agency [EPA], 1998), so more DCE is in an adsorbed state relative to VC. The oxidants used in the treatment will preferentially oxidize the dissolved contaminants, so aqueous DCE concentrations can quickly become replenished after treatment by desorption from the naturally occurring organic carbon present in the sediment. In addition, Fenton’s reagent and permanganate can partially oxidize the organic substrate to which DCE (and VC to a lesser extent) are adsorbed, thus temporarily increasing their aqueous phase concentrations. Permanganate also causes large temporary increases in the dissolved concentrations of K^+ and MnO_4^-, which disrupts the adsorption-desorption equilibrium for all of the elements and compounds that compete for sorption sites.

Table 1 summarizes the monitoring data by showing the VC and DCE percentage change from the baseline (pre-treatment) sample round to the most recent posttreatment monitoring round. Concentrations of VC changed by +43 to –94 percent with an average change of –54 percent at the four wells. Concentrations of DCE decreased by as much as –93 percent at MW-28, but increased by +1557 percent at MW- 30 as a result of the rebound effect.

Table 1
Percent Change in VC and DCE Concentrations: Baseline to July 2003

Contaminant	% Change			
	S5-MW-21	S5-MW-25	S5-MW-28	S5-MW-30
VC	-74	-94	-91	43
DCE	80	-92	-93	1557

Continued monitoring at sites that display rebound effects usually shows a permanent reduction in contaminant concentrations after several months (ITRC, 2001). Ethene concentrations at the two treatment areas wells that were analyzed for natural attenuation parameters show increasing concentrations during the posttreatment period, suggesting that dechlorination of VC is still occurring.

Evaluation of Contaminant Ratios

Absolute concentrations of contaminants in shallow aquifers can be difficult to evaluate because they are subject to dilution effects from periodic recharge. One technique for removing the effects of recharge is to evaluate ratios of contaminant concentrations. Periodic recharge will dilute the concentrations of all contaminants by similar factors so that the concentrations change but the ratios remain the same. The VC/DCE ratio is useful in this case because increases in the ratio over time suggest continuing conversion of DCE to VC, which is expected during microbial reductive dechlorination. The ethene/VC ratio is also useful because increasing ratios over time suggest continuing conversion of VC to ethene. However, during in situ chemical oxidation treatments, additional processes may occur that can affect the VC/DCE ratios. For instance, preferential desorption of DCE would decrease the VC/DCE ratio, and preferential oxidation of DCE would increase the VC/DCE ratio.

Despite these complications, evaluation of changes in the ratios over time, in concert with changes in the absolute concentrations over time, can provide insight into the processes occurring at the Site. Figures 5 through 8 show the VC/DCE ratios over time at the four wells depicted in the previous figures. Two of the wells also include ethene/VC ratios. All four figures show a general upward trend in the ratios during the posttreatment period (except the last sample round at MW-30), suggesting that reductive dechlorination of DCE to VC to ethene is still occurring during the posttreatment phase.

Evaluation of Natural Attenuation Parameters

Natural attenuation of DCE and VC can occur by microbial reductive dechlorination, during which DCE is reduced to VC, which is then reduced to either ethene or $CO_2 + H_2O + H^+ + Cl^-$. These reactions are mediated by anaerobic bacteria, which require organic carbon and reducing conditions. One concern regarding the use of chemical oxidants is that it may destroy all of the organic carbon and permanently induce oxidizing conditions so that anaerobes cannot survive, especially if too much oxidant is used. The natural attenuation parameters oxidation-reduction potential (ORP), sulfide, methane, and TOC provide independent information on the redox state of the system before and after treatment, and are discussed below.

Oxidation-Reduction Potential—Measurements of ORP provide information on the redox potentials of some (but not all) of the electrochemical reactions that are occurring. The ORP measurements will yield very high potentials if permanganate is present, and will return to the negative range if anaerobic conditions are re-established after treatment. Reductive dechlorination is possible at potentials below +50 mV, and is likely at potentials below –100 mV (EPA, 1998). Figure 9 shows the ORP measurements at four of the most impacted wells in the treatment area. The vertical line indicates the last treatment event. The figure shows that pre-treatment ORP conditions were all below -100 mV. At Well MW-21, the treatment caused a pronounced spike to a potential of +84 mV, then dropped to values that were even lower than pre-treatment conditions, and then returned to –100 mV. Well MW-30 showed a similar but not as extreme pattern, also ending at a potential similar to baseline conditions. Wells MW-25 and MW-28 showed less of a response because they are farther from the injection points, but also ended at negative potentials that were similar to baseline conditions. These data suggest that anaerobic conditions similar to baseline have returned to these locations after the treatment phase.

Sulfide—Sulfide is produced by sulfate-reducing bacteria, which require very reducing conditions. Sulfide is quite reactive, and will form insoluble precipitates with several metals including iron. Because of its reactivity and tendency to precipitate, the absence of sulfide yields inconclusive information on the redox state, but the presence of sulfide is strong evidence for very reducing conditions.

Two of the treatment area wells were analyzed for sulfide. At MW-30, sulfide was nondetectable (<0.1 mg/L) in all five samples. At MW-21, sulfide concentrations were nondetectable (<0.1 mg/L) in the baseline sample, but had increased to 0.62, 0.36, and 0.54 mg/L in the last three posttreatment sample rounds (4/30/03, 6/5/03, and 7/9/03, respectively). The presence of detectable sulfide at MW-21 provides strong evidence that sulfate-reducing anaerobic conditions have returned at this location.

Methane—Methane is produced by methanogenic anaerobes which require even more reducing conditions than sulfate-reducing anaerobes. During methanogenesis, acetate is split to form carbon dioxide (CO_2) and methane (CH_4), or CO_2 is used as an electron acceptor and is reduced to methane. Methane concentrations above 0.5 mg/L indicate favorable conditions for degradation of chlorinated solvents (EPA, 1998). Figure 10 shows the pre- and posttreatment methane concentrations at Wells MW-21 and MW-30. The concentrations at both locations were lower after treatment, but have subsequently increased in the last sample round (7/9/03) and are close to their original pre-treatment concentrations, indicating that methanogenesis is continuing.

Total Organic Carbon—An adequate supply of dissolved TOC is an essential component required to drive anaerobic microbial activity and is consumed in the process. The carbon can be naturally occurring, or can be present as hydrocarbon fuel contamination or landfill leachate. The rates of reductive dechlorination of CAH compounds at many sites have been shown to be limited by TOC availability. If the subsurface environment is depleted of TOC before the chlorinated solvents are completely degraded, then biological reductive dechlorination will cease, and natural attenuation may no longer occur. Concentrations in excess of 20 mg/L are desirable to drive reductive dechlorination reactions (EPA, 1998). Figure 11 shows the TOC concentrations at MW-21 and MW-30 before and after the oxidation treatment. As can be seen from the figure, TOC concentrations have increased and then decreased at both locations after treatment. As of 7/9/03, concentrations are 440 and 94.4 mg/L, which are higher than the pre-treatment values, and are well above the minimum concentration of 20 mg/L that is required for reductive dechlorination.

The treatment events most likely completely oxidized some of the naturally occurring dissolved TOC, but also partially oxidized some of the solid organic carbon particles in the sediments, making them soluble and more bio-available. Although some of the organic carbon was undoubtedly destroyed, the net effect of the treatments was apparently an increase in the dissolved TOC.

Estimated Mass Reduction

It is not possible to determine the total mass of contaminants remaining, because some fraction of the remaining mass is present in a dissolved form, and the remaining fraction is present in an adsorbed state. The mass remaining in the dissolved state can be estimated from observed concentrations in groundwater samples, but the adsorbed mass cannot be estimated. Degradation of dissolved contaminants will drive the desorption of additional contaminants from the sediment, so the adsorbed mass represents an important but unquantifiable parameter.

An upper bound on the total mass of contaminants that could be destroyed by the treatments was calculated based on the total mass and concentrations of injected oxidants. The total equivalent of 280,185 moles of pure H_2O_2 and 44,279 moles of pure $KMnO_4$ were injected during four phases of treatment. These oxidants will destroy many different types of organic compounds including fuel hydrocarbons, chlorinated VOCs, and some naturally occurring organic carbon materials. Other reduced inorganic substances such as ferrous iron and sulfide can also consume some fraction of these oxidants.

The dominant organic contaminants detected in the treatment area wells are VC and DCE, with lesser amounts of toluene and naphthalene. The two types of oxidants used at the site will react with these organic compounds in different ratios, depending on the specific oxidant and target compound. For instance, five moles of H_2O_2 are required to oxidize one mole of VC, and four moles of H_2O_2 are required to oxidize one mole of DCE. In a similar manner, 3.3 moles of $KMnO_4$ are required to oxidize one mole of VC, and 2.7 moles of $KMnO_4$ are required to oxidize one mole of DCE.

The calculation of the destroyed contaminant mass is based on an assumption that all of the injected oxidants destroyed DCE and VC, and that the average VC/DCE mass ratio is 5.5, which is based on observed ratios in the treatment area wells. Based on these assumptions and the total mass of injected oxidants, the treatments were capable of destroying up to 2,352 pounds of DCE and 8,338 pounds of VC, for a total of 10,690 pounds of pure chlorinated VOCs. This estimate should be considered an upper bound because some fraction of the injected oxidants were undoubtedly consumed by the oxidation of other organic contaminants that were present at low concentrations, as well as by naturally occurring organic carbon.

Estimated Duration for MNA

Predicting the time required for attenuation of VC to concentrations that are below the regulatory limits is hampered by the pronounced rebound effect at some wells, which interferes with defining and extrapolating attenuation trends. Concentrations of DCE and VC are rapidly changing, and are increasing at some wells and decreasing at others, which is typical of a rebound effect. However, two treatment area wells have apparently recovered from the rebound phase, and were used to predict the time required for VC concentrations to fall below the regulatory limit.

An estimate of the time remaining until VC concentrations fall below the “Ocean Plan” limit of 36 µg/L has been calculated based the concentrations in the most recent samples at two selected wells and a range of previously determined VC degradation rates. Parsons (1999, Appendix F) calculated a range of VC degradation rates based on the Buscheck and Alcantar method (Buscheck and Alcantar, 1995). These degradation rates were applied to the most recent (July 2003) VC concentrations at Wells MW-25 and MW-28. These two treatment area wells were selected because VC concentrations have already undergone a posttreatment rebound and are currently below their respective baseline concentrations, as shown in Figures 2 and 3.

The Parsons report (1999) provided upper and lower bounds for first-order VC degradation rates considering advection, dispersion, sorption, and biodegradation along two different flow paths. The maximum calculated VC degradation rate was 0.054 day–1, and the minimum was 0.011 day^{-1}, which are equivalent to half-lives of 13 and 63 days, respectively.

Application of the Parsons (1999) degradation rates to current concentrations is valid only assuming that current chemical and microbiological conditions are similar to the pre-treatment conditions that existed when the degradation rates were developed. The above evaluation of natural attenuation parameters concluded that the ORP, as well as concentrations of methane and TOC, have returned to baseline values (Figures 9, 10, and 11), and the VC/DCE ratios (Figures 6 and 7) indicate that reductive dechlorination is continuing.

The predicted VC concentrations at MW-25 and MW-28 are provided in Figures 12 and 13. The initial concentrations are from the July 2003 samples, and the two curves in each plot are based on the high and low degradation rates calculated by Parsons (1999). The horizontal dashed line at the bottom of each plot is the "Ocean Plan" regulatory limit of 36 µ/L. Concentrations of VC at MW-25 are predicted to reach the regulatory limit between 43 and 212 days, and concentrations of VC at MW-28 are predicted to reach the regulatory limit between 83 and 405 days.

References

Buscheck, T.E. and C. M. Alcantar, 1995, “Regression Techniques and Analytical Solutions to Demonstrate Intrinsic Bioremediation,” in *Proceedings of the 1995 Battelle International Conference on In-Situ and On Site Bioreclamation*, April.

Interstate Technology and Regulatory Cooperation Work Group, 2001, *Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater*, In Situ Chemical Oxidation Work Team, June.

Parsons Engineering Science, Inc., 1999, *Evaluation of Monitored Natural Attenuation for Groundwater at Site 5, (Area of VOC Contamination) Golf Course Disposal Area, Naval Air Station North Island, California*, May.

U.S. Environmental Protection Agency, 1998, *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water*, United States Environmental Protection Agency, Office of Research and Development, Washington DC 20460, EPA/600/R-98/128, September.

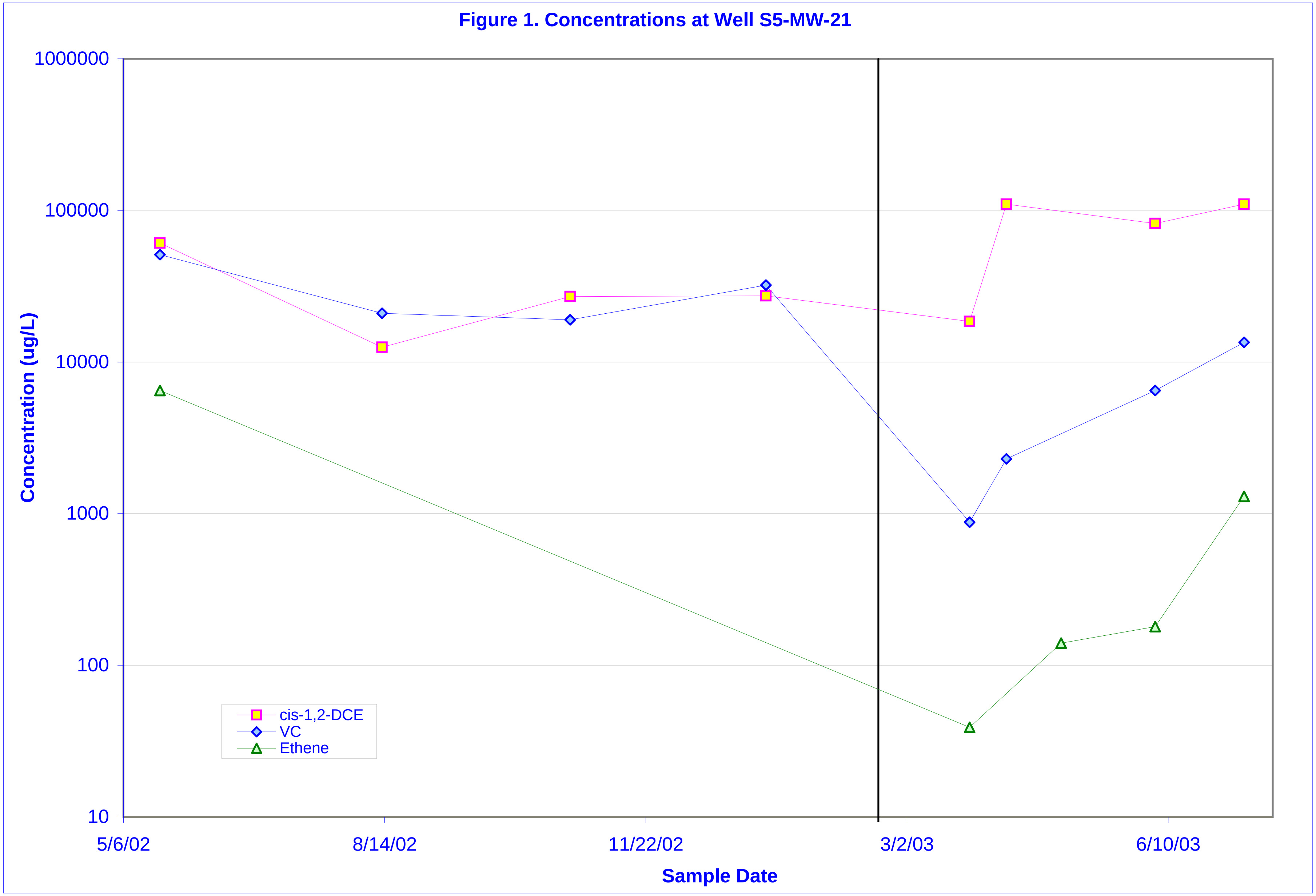
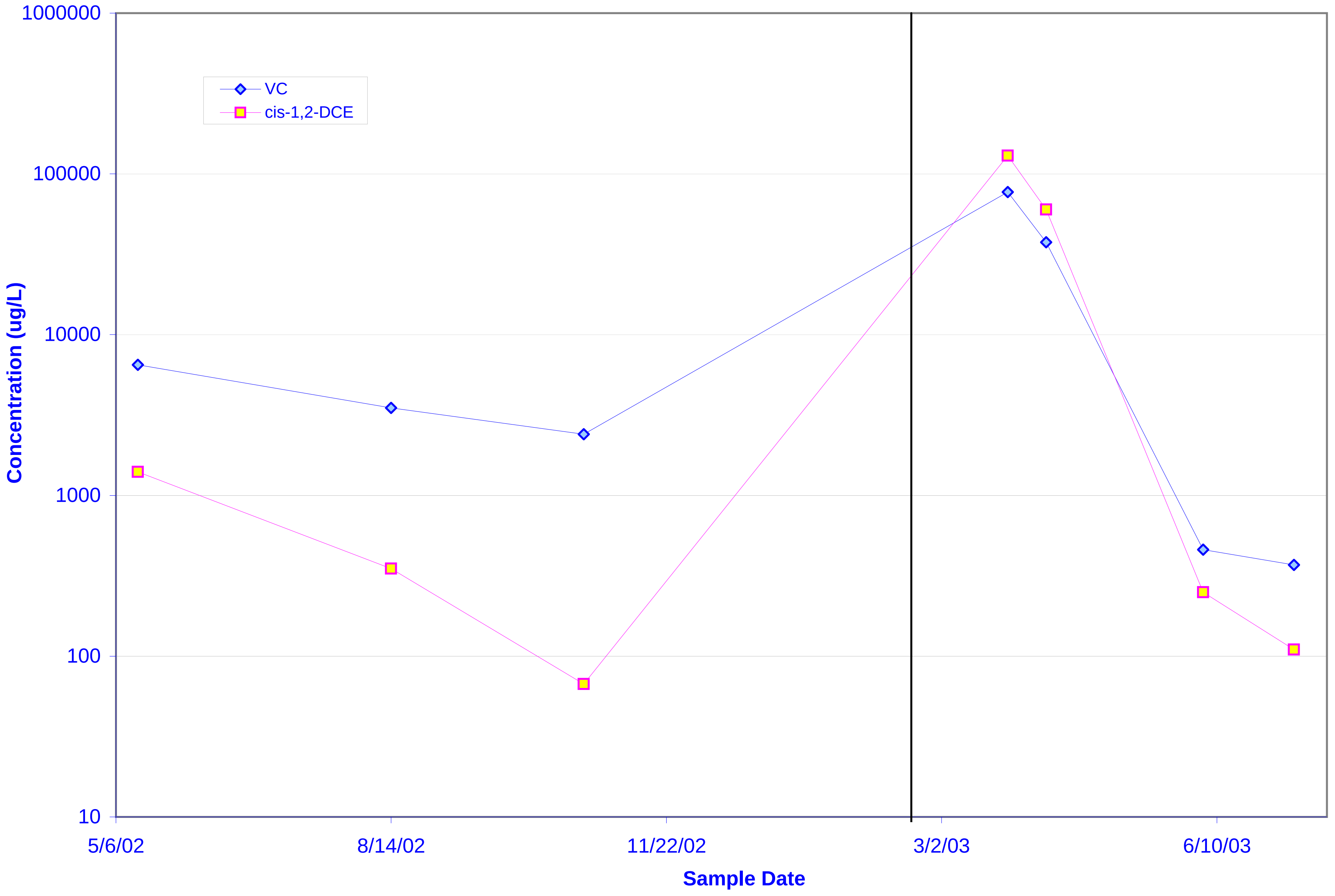


Figure 1. Concentrations at Well S5-MW-21

Figure 2. Concentrations at Well S5-MW-25



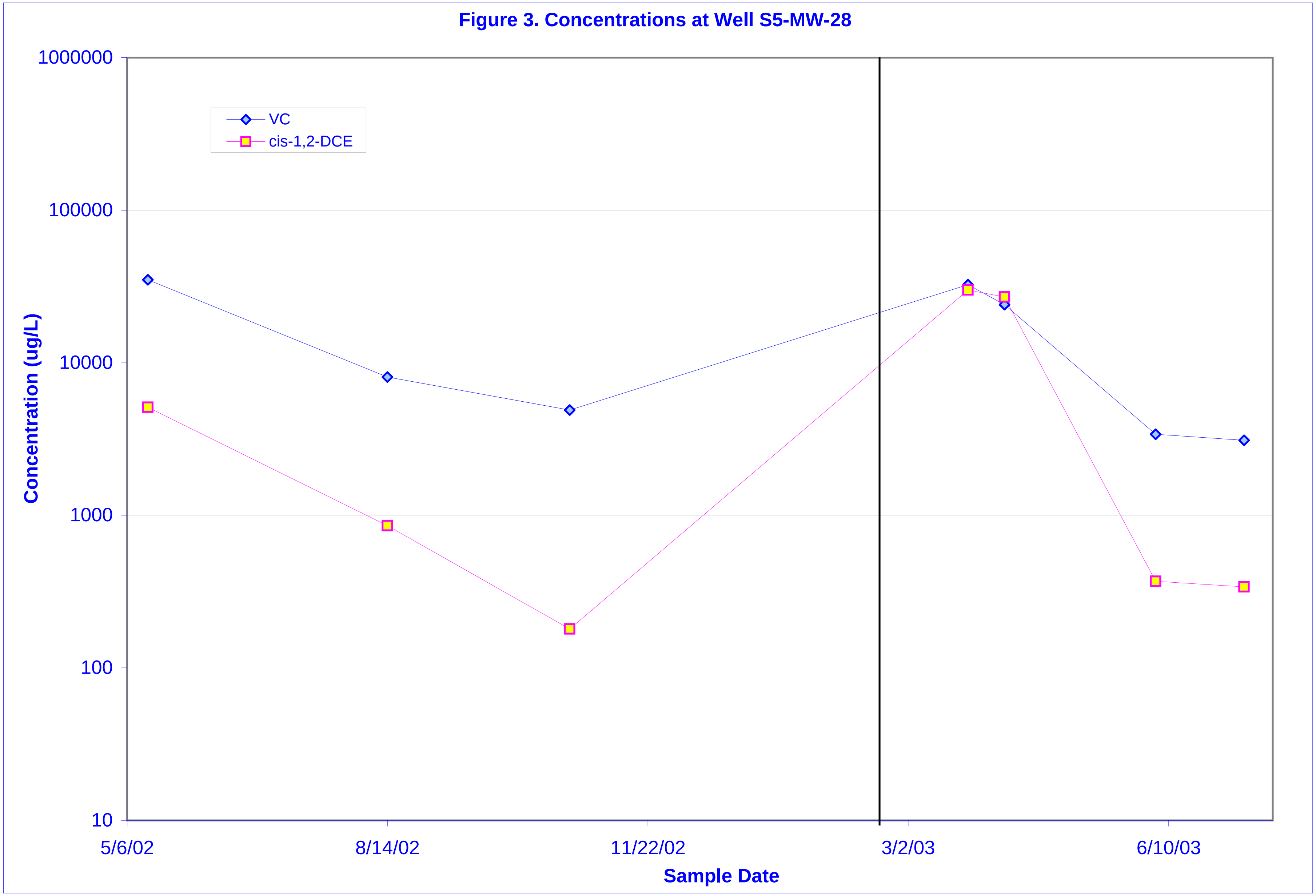


Figure 3. Concentrations at Well S5-MW-28
VC
cis-1,2-DCE
Concentration (ug/L)
1000000
100000
10000
1000
100
10
5/6/02
8/14/02
11/22/02
3/2/03
6/10/03
Sample Date

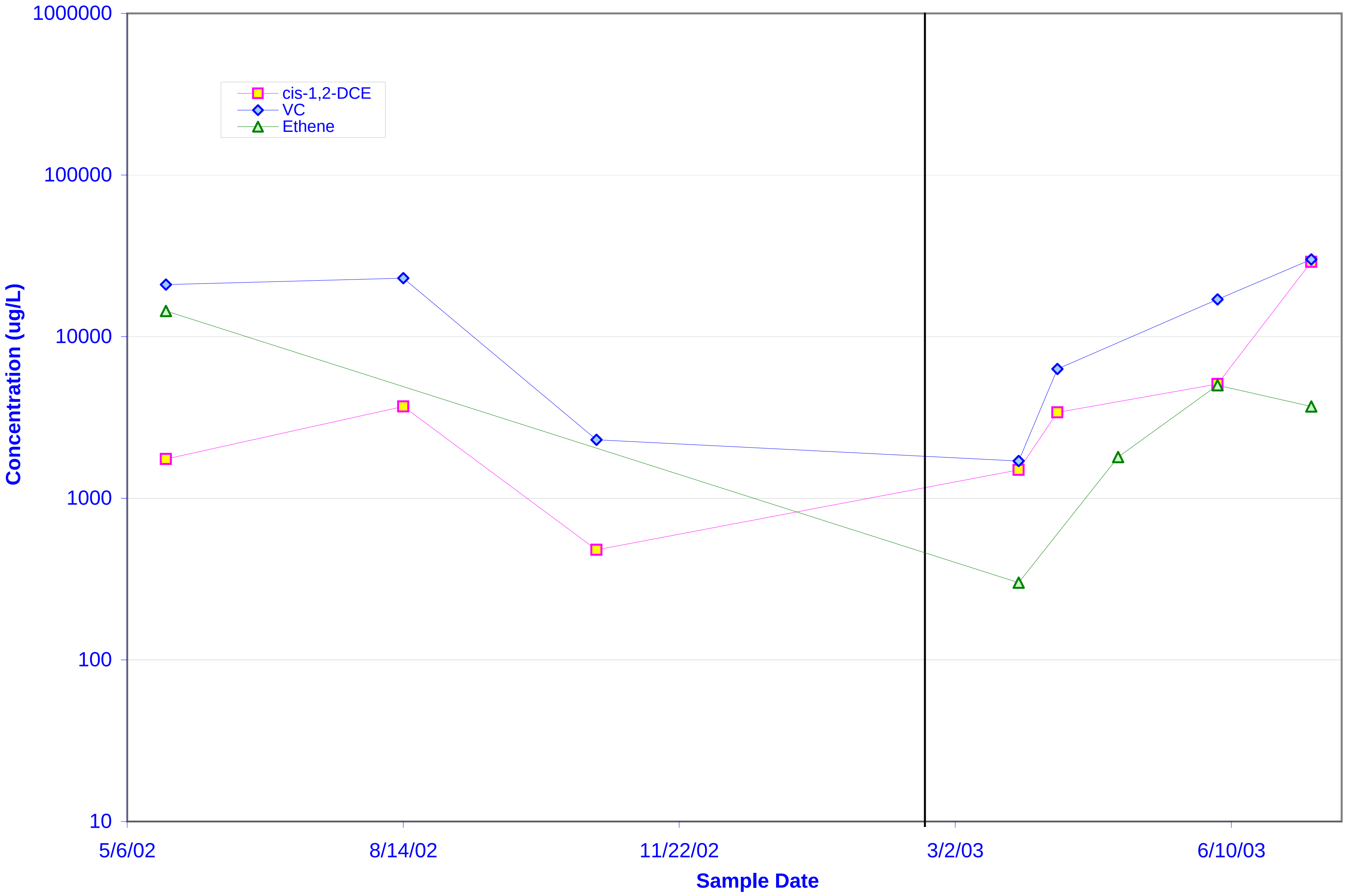


Figure 4. Concentrations at Well S5-MW-30

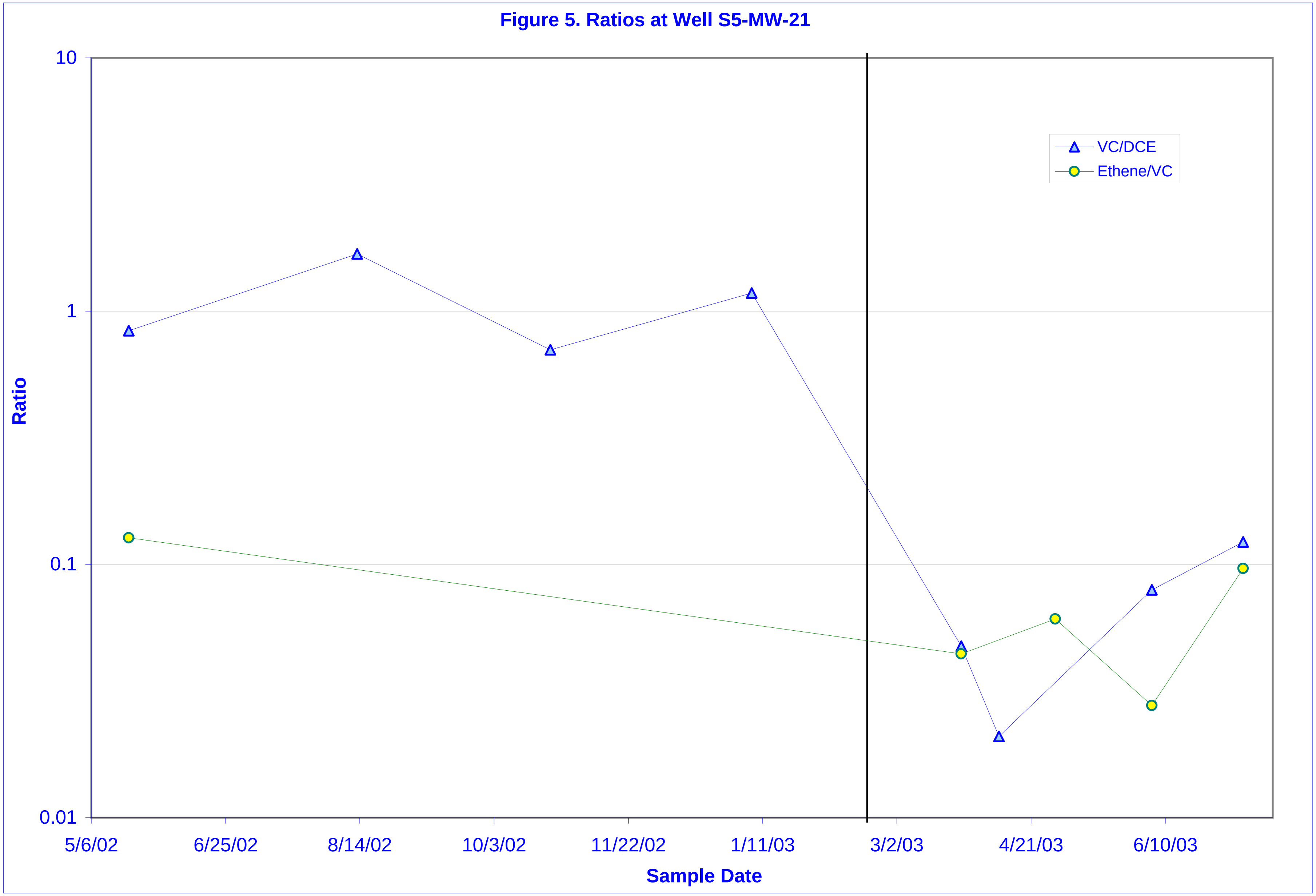
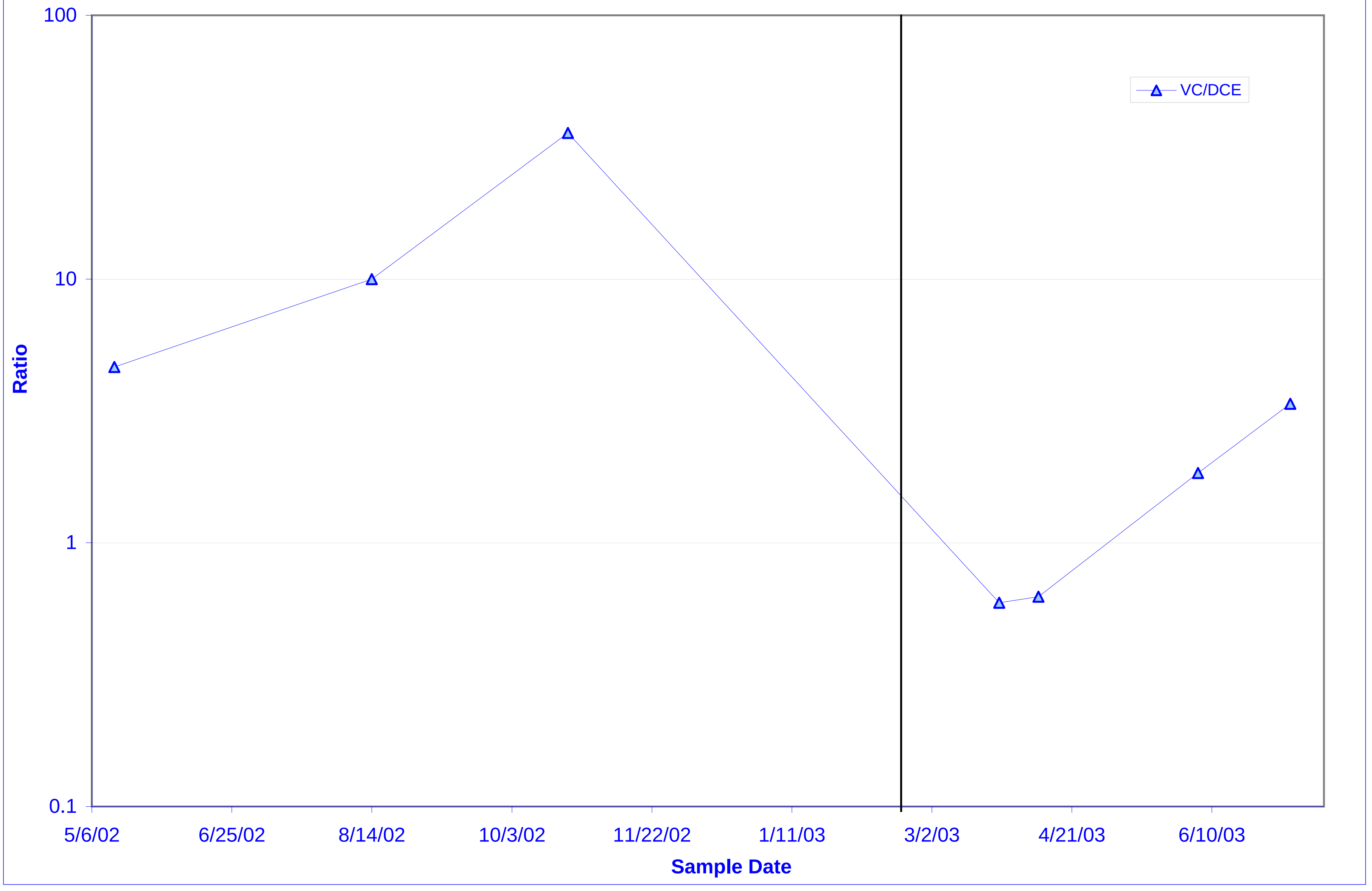


Figure 5. Ratios at Well S5-MW-21
10
1
0.1
0.01
Ratio
5/6/02
6/25/02
8/14/02
10/3/02
11/22/02
1/11/03
3/2/03
4/21/03
6/10/03
Sample Date
VC/DCE
Ethene/VC

Figure 6. Ratios at Well S5-MW-25



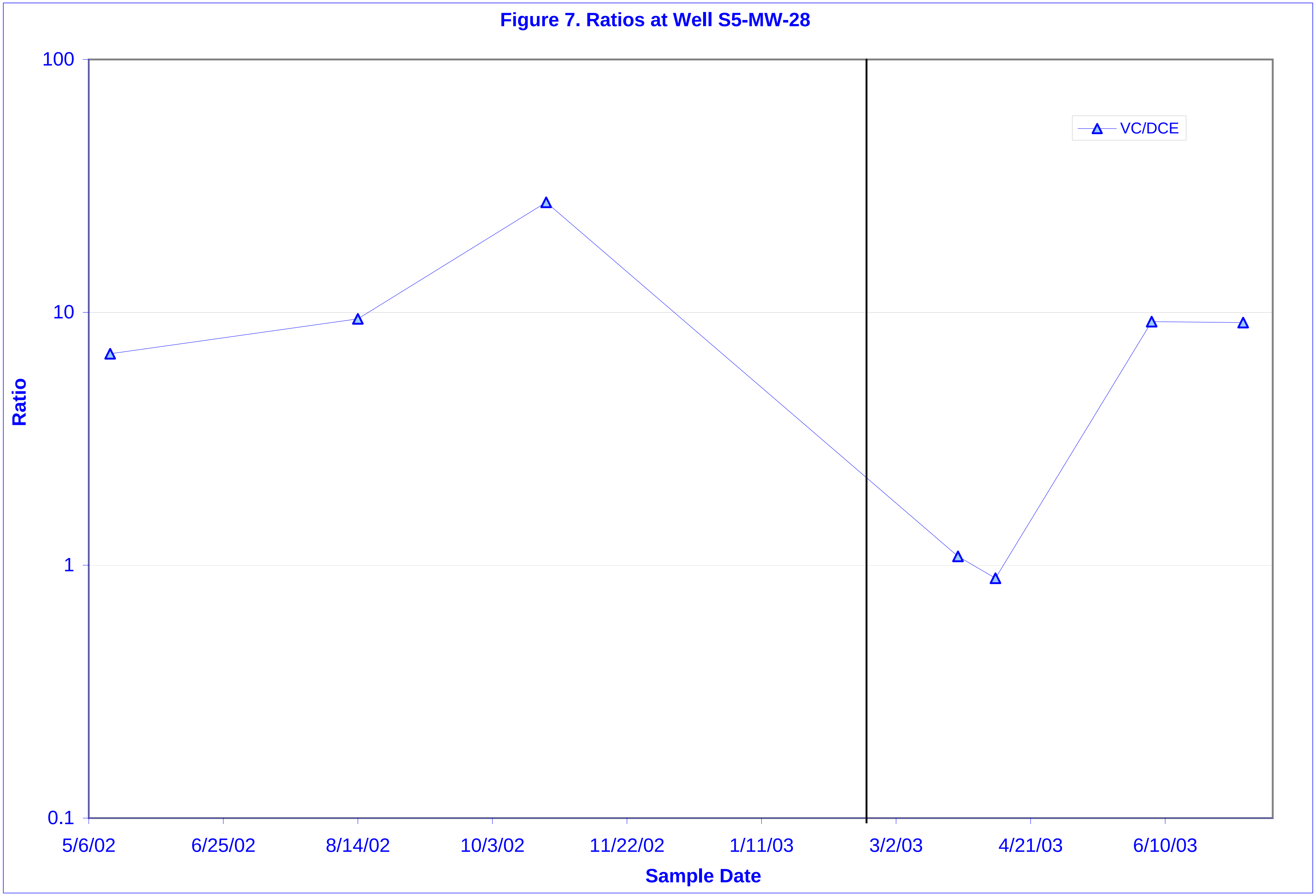
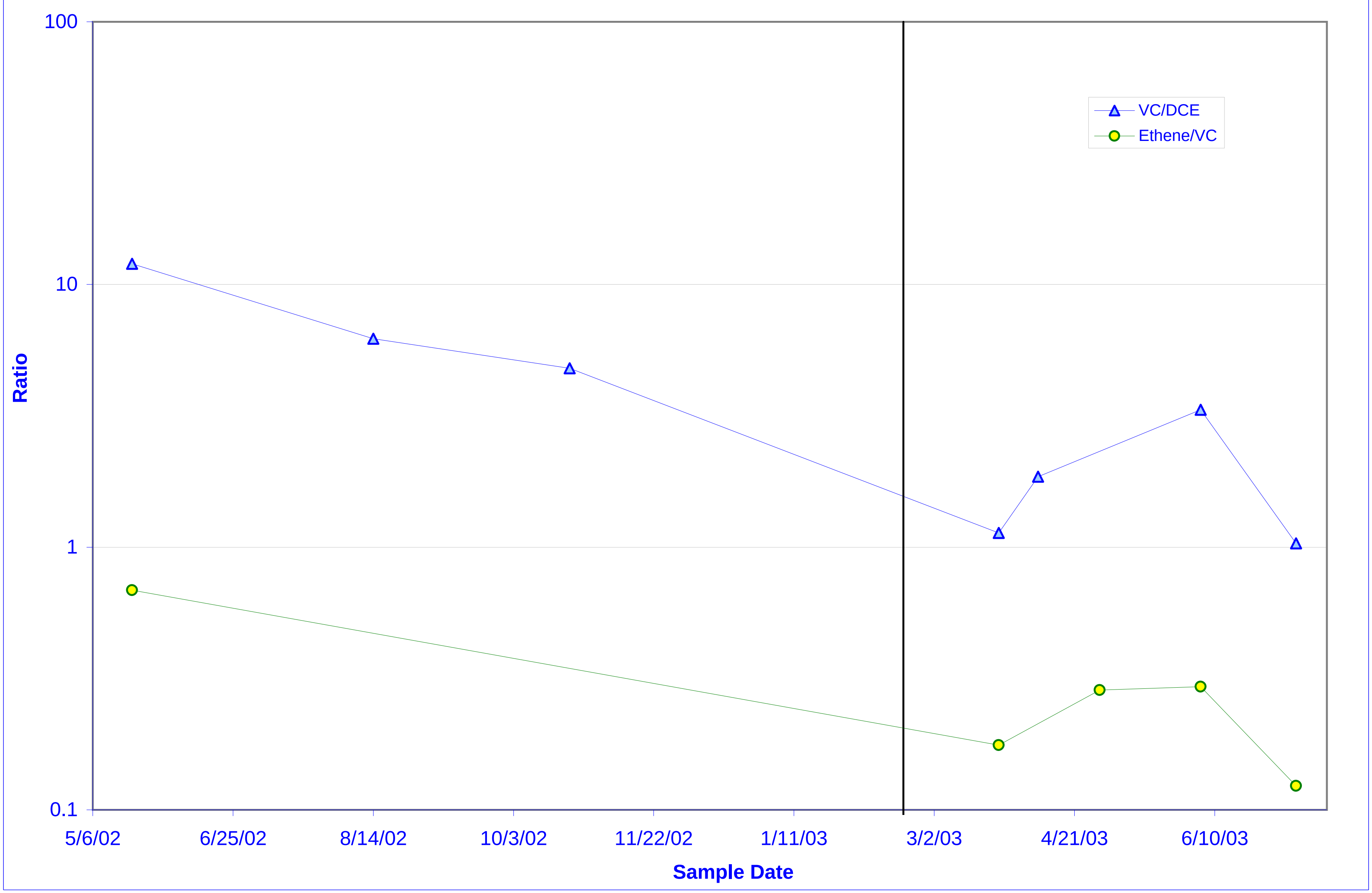


Figure 7. Ratios at Well S5-MW-28
100
10
1
0.1
Ratio
VC/DCE
5/6/02
6/25/02
8/14/02
10/3/02
11/22/02
1/11/03
3/2/03
4/21/03
6/10/03
Sample Date

Figure 8. Ratios at Well S5-MW-30



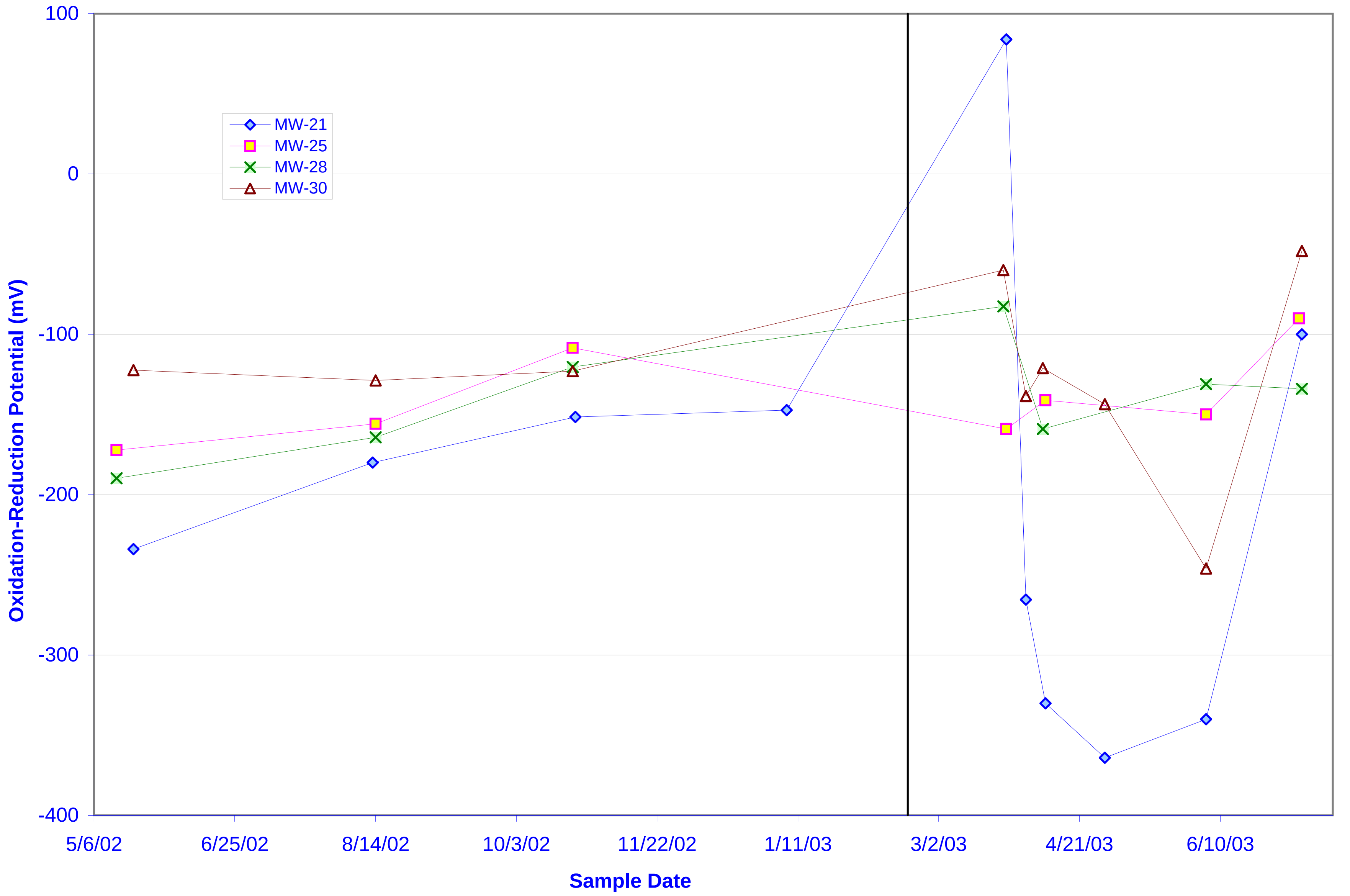


Figure 9. ORP Measurements

Figure 10. Methane Concentrations

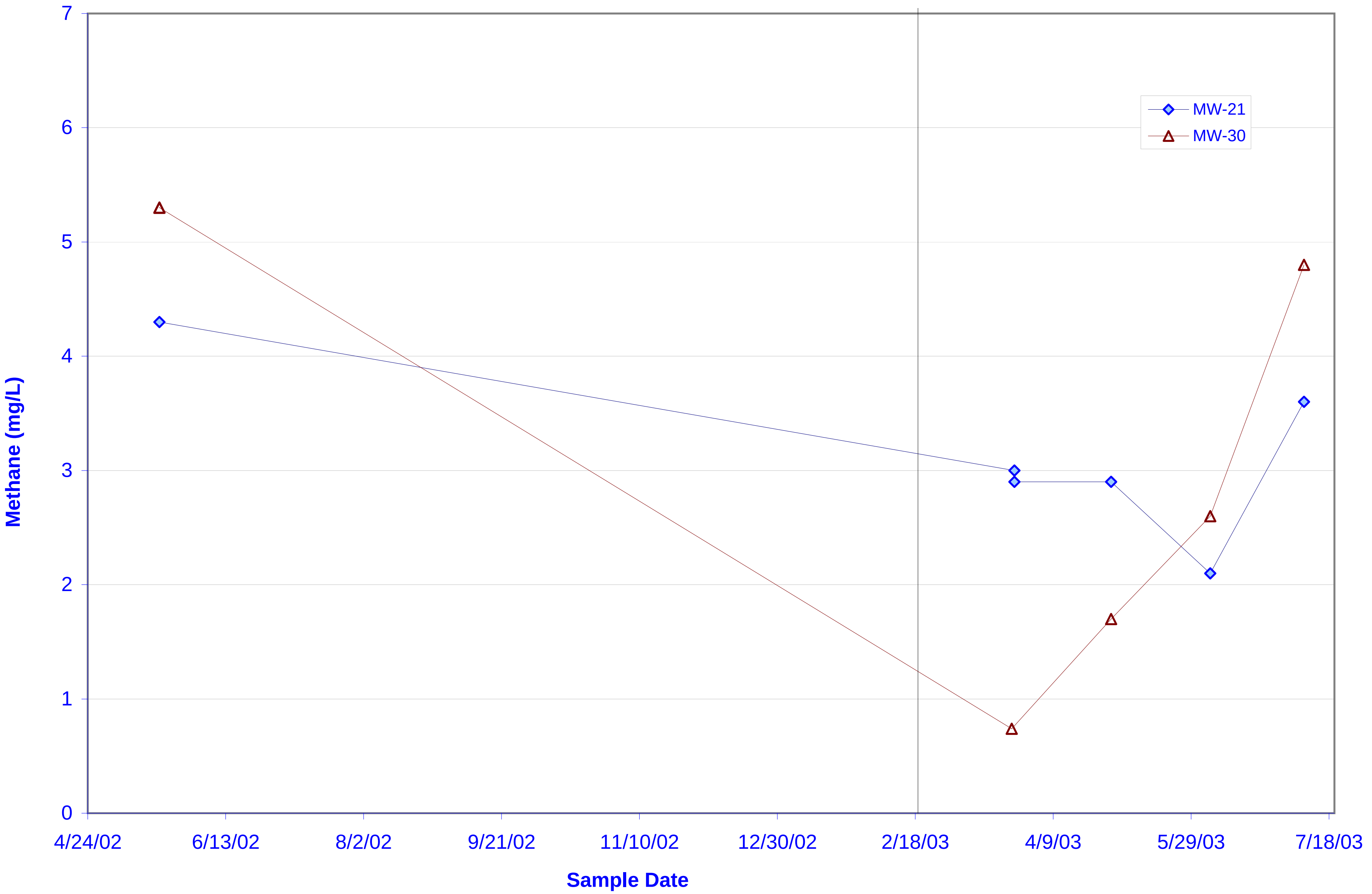


Figure 11. Total Organic Carbon Concentrations

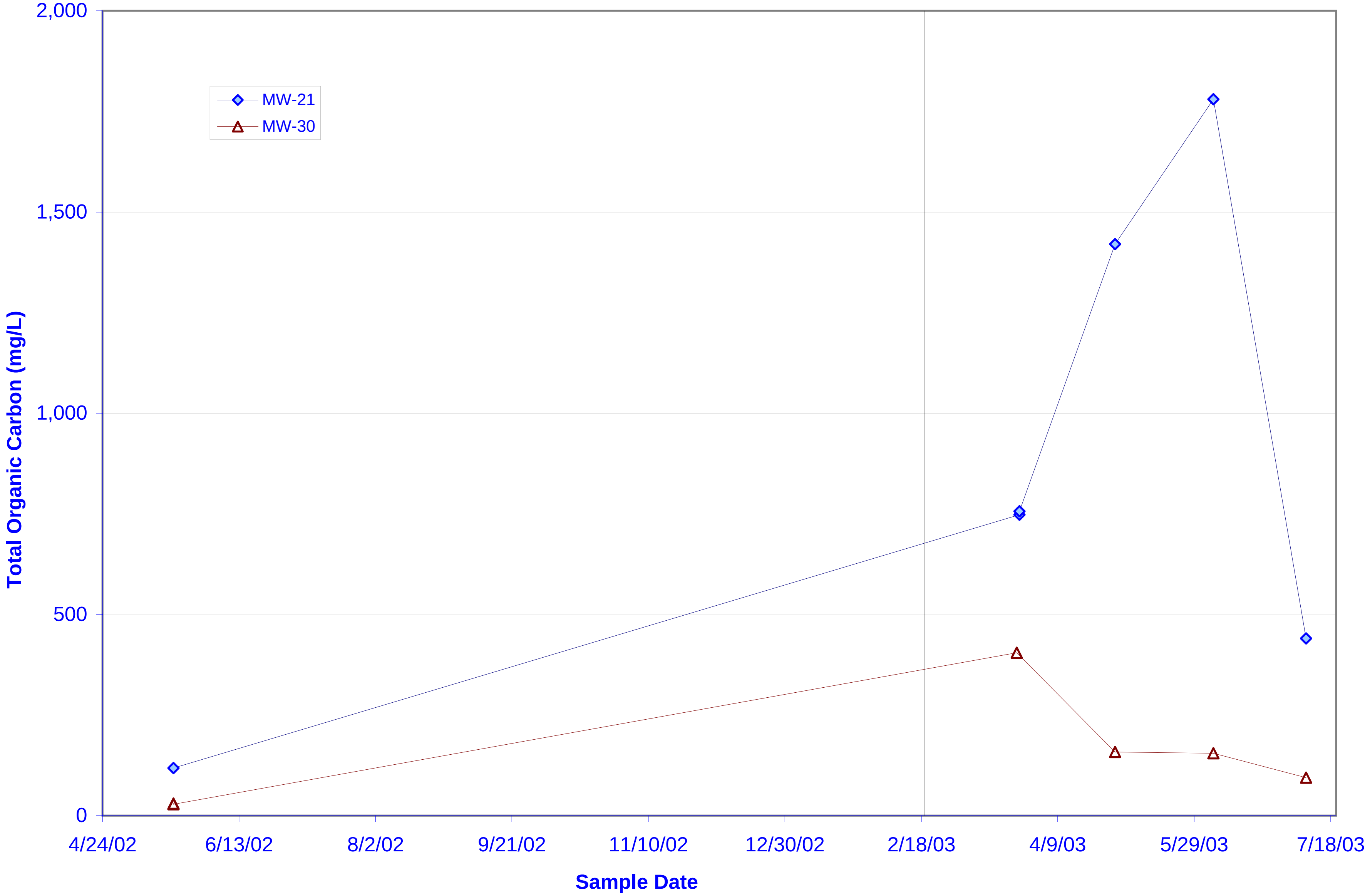


Figure 12. Predicted Degradation of VC at MW-25

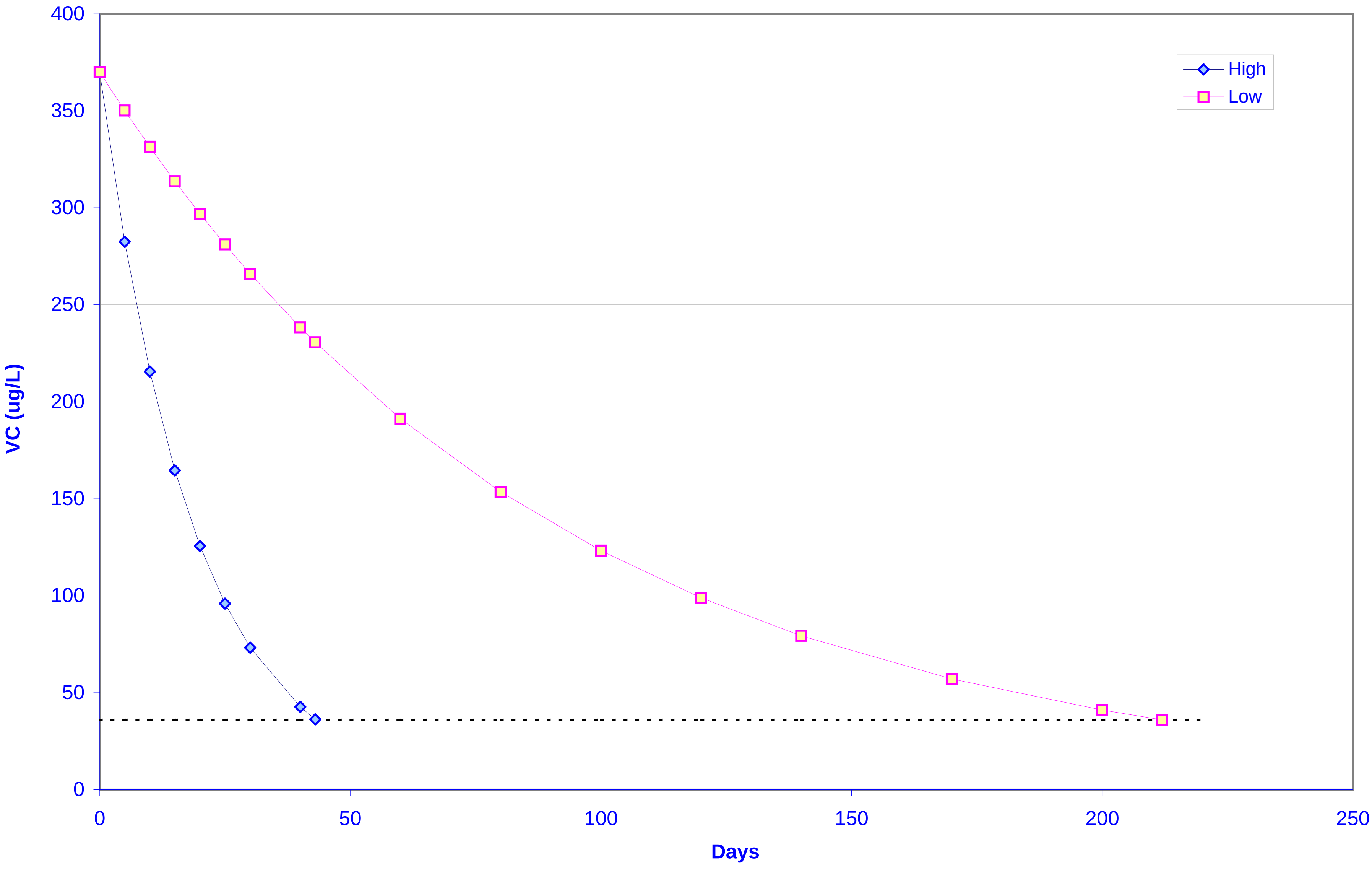


Figure 13. Predicted VC Degradation at MW-28