DEPARTMENT OF THE NAVY
NAVAL WEAPONS STATION SEAL BEACH
800 SEAL BEACH BOULEVARD
SEAL BEACH, CA 90740-5000

IN REPLY REFER TO:
5090
Ser 45W/0032
27 Mar 09

California Regional Water Quality Control Board
Santa Ana Region
3737 Main Street, Suite 500
Riverside, CA 92501-3348

Attention: Patricia Hannon

Ladies and Gentlemen:

The enclosed is forwarded for your concurrence. Please provide your written concurrence by April 27, 2009.

If you have any questions, please contact me at (562) 626-7897.

Sincerely,

PEI-FEN TAMASHIRO
Installation Restoration Coordinator
By direction of the
Commanding Officer

Enclosure: 1. Final Work Plan, Extended Site Assessment of Former Underground Storage Tank Site 229, Naval Weapons Station Seal Beach, dated March 16, 2009

Copy to:
Naval Facilities Engineering Command
Southwest
Attention: Jennifer A. Sullivan
1220 Pacific Highway
San Diego, CA 92132-5190

DEPARTMENT OF THE NAVY
NAVAL WEAPONS STATION SEAL BEACH
800 SEAL BEACH BOULEVARD
SEAL BEACH, CA 90740-5000

IN REPLY REFER TO:
5090
Ser N45W/0034
27 Mar 09

California Environmental Protection Agency
Department of Toxic Substances Control
5796 Corporate Avenue
Cypress CA 90630

Attention: Stephen Niou

Ladies and Gentlemen:

The enclosed is forwarded for your information only.

If you have any questions, please contact me at (562) 626-7897.

Sincerely,

PEI-FEN TAMASHIRO
Installation Restoration Coordinator
By direction of the
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800 SEAL BEACH BOULEVARD
SEAL BEACH, CA 90740-5000

IN REPLY REFER TO:
5090
Ser N45W/0035
27 Mar 09

County of Orange Health Care Agency
Environmental Health
1241 E. Dyer Road, Suite 120
Santa Ana CA 92705-5611

Attention: Patricia Henshaw

Ladies and Gentlemen:

The enclosed is forwarded for your information only.

If you have any questions, please contact me at (562) 626-7897.

Sincerely,

PEI-FEN TAMASHIRO
Installation Restoration Coordinator
By direction of the
Commanding Officer

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NAVAL WEAPONS STATION SEAL BEACH
800 SEAL BEACH BOULEVARD
SEAL BEACH, CA 90740-5000

IN REPLY REFER TO:
5090
Ser N45W/0036
27 Mar 09

Mr. Lee Whittenberg
211 8th Street
Seal Beach, CA 90740

Dear Mr. Whittenberg:

The enclosed is forwarded for your information only.

If you have any questions, please contact me at (562) 626-7897.

Sincerely,

PEI-FEN TAMASHIRO
Installation Restoration Coordinator
By direction of the
Commanding Officer

Enclosure: 1. Final Work Plan, Extended Site Assessment of Former Underground Storage Tank Site 229, Naval Weapons Station Seal Beach, dated March 16, 2009

Copy to:
Naval Facilities Engineering Command
Southwest
Attention: Jennifer A. Sullivan
1220 Pacific Highway
San Diego, CA 92132-5190

Richard Brady & Associates
Engineering and Construction

March 23, 2009

Ms. Jennifer Sullivan
Remedial Project Manager
Attn: Code OPED.JS
Naval Facilities Engineering Command Southwest
1220 Pacific Highway
San Diego, CA 92132

SUBJECT: TRANSMITTAL OF FINAL WORK PLAN, EXTENDED SITE ASSESSMENT OF FORMER UNDERGROUND STORAGE TANK SITE 229, NAVAL WEAPONS STATION SEAL BEACH, CALIFORNIA

DOCUMENT NUMBER: RBAE-4302-0120-0028
CONTRACT NUMBER: N68711-03-D-4302

Dear Ms. Sullivan,

Richard Brady & Associates is pleased to submit two copies of the Final Work Plan, Extended Site Assessment of Former Underground Storage Tank Site 229, Naval Weapons Station Seal Beach, California. This work was performed under the contract cited above. Please contact me at 619-571-4176 if you have any questions or comments.

Sincerely,

Timothy Shields
Program Manager
Richard Brady & Associates

CC. Ms. Pei-Fen Tamashiro, NWS Seal Beach (2 bound, 2 electronic)
Ms. Patricia Hannon, RWQCB (1 bound, 1 electronic)
Mr. Stephen Niou, DTSC (1 bound, 1 electronic)
Mr. Lee Whittenberg, City of Seal Beach (1 bound, 1 electronic)
Ms. Patricia Henshaw, Orange County HCA (1 bound, 1 electronic)
Mr. Dwayne Ishida, SHAW Infrastructure, Inc. (1 electronic)
Ms. Diane Silva, Administrative Records (1 bound, 1 unbound, 2 electronic)
Mr. Rod Soule, NTR NAVFAC SW (1 electronic)

3710 Ruffin Road • San Diego, California 92123
Tel (858) 496-0500 Fax (858) 496-0505

DEPARTMENT OF THE NAVY – NAVFAC SOUTHWEST
Naval Facilities Engineering Command
1220 Pacific Highway, San Diego, California 92132-5190

FINAL

WORK PLAN

EXTENDED SITE ASSESSMENT OF FORMER UNDERGROUND STORAGE TANK SITE 229, NAVAL WEAPONS STATION SEAL BEACH, CALIFORNIA

Contract Number: N68711-03-D-4302
NAVFAC SW CTO 0120

DCN: RBAE-4302-0120-0028

March 23, 2009

Prepared by:

Richard Brady & Associates
Engineering and Construction

3710 Ruffin Road
San Diego, California 92123-4349

DEPARTMENT OF THE NAVY – NAVFAC SOUTHWEST
Naval Facilities Engineering Command
1220 Pacific Highway, San Diego, California 92132-5190

NAVFAC
Naval Facilities Engineering Command

FINAL

WORK PLAN

EXTENDED SITE ASSESSMENT OF FORMER UNDERGROUND STORAGE TANK SITE 229, NAVAL WEAPONS STATION SEAL BEACH, CALIFORNIA

Contract Number: N68711-03-D-4302
NAVFAC SW CTO 0120

DCN: RBAE-4302-0120-0028

Prepared by:

3-23-09

Donald McHugh, PG 8219 Date
Project Manager

PROFESSIONAL GEOLOGIST
DONALD McHUGH
No. 8219
STATE OF CALIFORNIA

Review by:

3-23-09

Timothy Shields Date
Program Manager

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APPENDICES

ACRONYMS/ABBREVIATIONS

APP	Accident Prevention Plan
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene and total xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CPT	cone penetrometer testing
CSM	conceptual site model
DQO	Data Quality Objective
FSP	Field Sampling Plan
GPS	global positioning system
IDW	industrial derived waste
IR	Installation Restoration
JEG	Jacobs Engineering Group
LIF	laser induced fluorescence
LUFT	Leaking Underground Fuel Tank
mg/kg	milligrams per kilogram
µg/kg	micrograms per kilogram
MTBE	methyl tertiary butyl ether
NAVFAC SW	Naval Facilities Engineering Command Southwest
NFA	no further action
NAVWPNSTA	Naval Weapons Station
PAHs	polycyclic aromatic hydrocarbons
PRGs	Preliminary Remediation Goals
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RBA	Richard Brady & Associates
RES	Riedel Environmental Services, Inc
RPM	Remedial Program Manager
RWQCB	Regional Water Quality Control Board

SAP	Sampling and Analysis Plan
SCAPS	Site Characterization Analysis Penetrometer System
SHAW	Shaw Environmental and Infrastructure, Inc.
SIM	selected ion monitoring
SOP	Standard Operating Procedure
SSHP	Site-specific Safety and Health Plan
TPH-d	total petroleum hydrocarbons as diesel
US EPA	United States Environmental Protection Agency
UST	underground storage tank

1.0 INTRODUCTION

This Draft Work Plan has been prepared by Richard Brady & Associates (RBA) for an Extended Site Assessment of Underground Storage Tank (UST) Site 229, Naval Weapons Station (NAVWPNSTA) Seal Beach, California (Figure 1). The Extended Site Assessment will utilize the Site Characterization and Analysis Penetrometer System (SCAPS) Laser Induced Fluorescence (LIF) technology and validated fixed-base laboratory analysis of soil and groundwater samples. This plan was prepared under subcontract to Shaw Environmental and Infrastructure, Inc. (SHAW), for Naval Facilities Engineering Command Southwest (NAVFAC SW). This Work Plan has been prepared in general accordance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and NAVFAC SW Petroleum Program requirements.

1.1 Investigation Objectives

The main objective of this Extended Site Assessment is to provide an up-to-date delineation of the extent of petroleum contamination at UST Site 229, NAVWPNSTA Seal Beach, and to make recommendations for either future work or no further action (NFA). Sampling shall be developed to adequately evaluate the nature, type and source of potential soil and groundwater contamination. Sample results shall be compared to screening levels to determine if the release is significant enough to pose a risk to human health or the environment.

1.2 Scope of Work

The existing data set leaves uncertainty regarding the thickness and spatial distribution of diesel fuel released from the two former 10,000-gallon USTs at the site. These uncertainties in the conceptual site model (CSM) make it difficult to determine if corrective action is warranted.

The Navy has identified the SCAPS LIF technology combined with fixed-base laboratory testing of soil and groundwater samples as being appropriate to provide additional data that will reduce uncertainty about the distribution of diesel fuel at NAVWPNSTA Seal Beach UST Site 229.

SCAPS uses a cone penetrometer test (CPT) probe with integrated LIF capabilities to detect petroleum hydrocarbons in the subsurface. Lithologic data is collected by an instrumented probe that measures the tip resistance and sleeve friction of the probe penetration, which is processed to and mapped to corresponding standardized soil behavior classifications. As the LIF/CPT probe is pushed into the ground, laser light is transmitted through an optical window mounted on the side of the probe via fiber optic cables. As the laser light passes over the soil, the two ringed or greater polycyclic aromatic hydrocarbons (PAHs) contained in petroleum hydrocarbons, if present, are induced to fluoresce within a diagnostic wavelength range. The returning fluorescent signal is analyzed by a linear photodiode array spectrophotometer and recorded on the onboard computer. As the probe is advanced, computer-generated real-time continuous logs of fluorescence intensity and wavelength are produced simultaneously with the CPT tip pressure, sleeve friction, and soil classification logs.

The purpose of the proposed SCAPS LIF portion of the investigation is to provide data that will be used to update and refine the CSM including: increasing resolution of the horizontal and vertical extent of petroleum impacts, sampling limited locations to verify the concentration and mass of contaminants of concern on-site, and determining useful soil sampling and groundwater monitoring well locations. The data from this investigation will be used to refine the CSM.

The primary objectives of this proposed investigation are to advance the site towards NFA status or provide recommendations for further actions that are protective of human health and the environment. In order to meet these objectives, the following tasks are proposed:

1. The SCAPS investigation will proceed by pushing the LIF probe to a maximum depth of 30 feet below ground surface (bgs) using dynamic work strategies and decision rules to determine step-out locations. The CPT/LIF investigation will target an area of approximately 4,500 square feet. The actual investigation boundary and the actual number of LIF locations investigated will be determined by applying decision rules to real-time data and, if possible, by preliminary regulatory review of field data prior to finalizing sampling locations. It is anticipated that less than 50 LIF locations will be required.
2. Soil samples will be collected from a minimum of 10 percent of SCAPS push locations using the SCAPS direct push soil sampler. Soil sample locations will be selected in accordance with the Sampling and Analysis Plan (SAP) based on real-time data LIF to evaluate SCAPS LIF effectiveness and to compare to the United States Environmental Protection Agency (US EPA) Region 9 Regional Screening Levels for Chemical Contaminants at Superfund Sites of September, 2008 and the Leaking Underground Fuel Tank (LUFT) Manual recommended soil cleanup level for diesel. The soil samples will be analyzed by a fixed-base laboratory for:

    - benzene, toluene, ethylbenzene, and total xylenes (BTEX) by United States Environmental Protection Agency (US EPA) Method 8060B,
    - PAHs by US EPA Method 8270 – Selected Ion Monitoring (SIM), and
    - total petroleum hydrocarbons as diesel (TPH-d) by US EPA 8015 Modified.

    Aqueous quality control (QC) samples will also be collected and analyzed during this portion of the proposed field work. All soil data obtained during the planned investigation will be independently validated in accordance with the Navy Installation Restoration (IR) Program guidelines for data validation.
3. Temporary and/or permanent groundwater monitoring wells will be installed within and around the former UST excavation to gauge for the presence of free phase petroleum and to collect groundwater samples. Groundwater sample

locations will be selected in accordance with the SAP based on LIF data to evaluate a potential dissolved phase hydrocarbon plume. Groundwater samples will be analyzed by a fixed-base laboratory for:

- BTEX by US EPA Method 8060B,
- PAHs by US EPA Method 8270SIM, and
- TPH-d by US EPA 8015 Modified.

If elevated BTEX compounds are reported, subsequent groundwater samples will be analyzed for:

- BTEX and methyl tertiary butyl ether (MTBE) by US EPA Method 8260B.

Aqueous QC samples will also be collected and analyzed during this portion of the proposed field work. Groundwater samples will be collected using low-flow purging and sampling techniques in accordance with RBA Standard Operating Procedure (SOP) T-002. Copies of the SOPs for this project are provided in Appendix A, Attachment 2. Groundwater samples for BTEX analysis will be collected first using a bladder pump, and groundwater samples collected for TPH-d and PAH analyses will be collected last using a bladder or peristaltic pump.

4. The existing CSM will be refined using newly obtained data and usable historical data. This task will allow for optimization of the CSM and a recommendation for either corrective action or no further action.

1.3 Regulatory Status

The Navy conducts site investigations at NAVWPNSTA Seal Beach in the IR Program in accordance with CERCLA. For petroleum sites such as UST Site 229 at NAVWPNSTA Seal Beach, the California Regional Water Quality Control Board – Santa Ana Region (RWQCB) is the lead regulatory agency.

Regulatory correspondence associated with this project is provided in Appendix C.

1.4 Project Organization and Responsibilities

Ms. Jennifer Sullivan is the Remedial Project Manager (RPM) at NAVFAC SW. A project organization chart and brief descriptions of key project team member qualifications and responsibilities are included in the SAP (Appendix A).

1.5 Project Schedule

The currently proposed schedule (Figure 2), subject to change based on direction from the Navy or adjustments due to field conditions, is:

- November 19 through January 11, 2009 – RWQCB review of the Draft Project Plans;

- January 23, 2009 through March 5, 2009 - responses to RWQCB comments and resolution of any outstanding comments; and
- March 13, 2009 - Submittal of the Final Project Plans to the Navy and the RWQCB.

Field work for the initial field deployment will commence as soon as possible after RWQCB approval of Final Project Plans. The initial field deployment will consist of the SCAPS LIF investigation and soil sampling. Depending on the results from the LIF investigation, temporary groundwater monitoring wells may or may not be installed and sampled as part of the initial field deployment. The currently forecasted schedule has the initial field work performed during one 5-day deployment within the period of March 17^{th}- 24^{th} . Current plans are:

- March 16, 2009 - Mobilization Activities;
- March 17 through March 24, 2009 – Field Deployment 1, Tentative; and
- March 25, 2009 - Demobilization Activities, Tentative.

Subsequent field deployments will be scheduled by the Navy RPM.

2.0 SITE BACKGROUND AND ENVIRONMENTAL SETTING

This section summarizes background information associated with NAVWPNSTA Seal Beach UST Site 229 including site description and history, physical setting, previous investigations, geology and hydrogeology. This information provides the basis for development of the preliminary CSM presented in Section 3 and presented as Figure 5 of this Work Plan.

2.1 Site Description and History

The NAVWPNSTA Seal Beach is located in the northwest corner of Orange County, approximately 20 miles south of Los Angeles, California (Figure 1). Comprised of 5,256 acres, NAVWPNSTA Seal Beach is a Navy weapons and munitions loading, storage, and maintenance facility. NAVWPNSTA Seal Beach consists of 230 buildings and 128 ammunition magazines providing over 500,000 square feet of ammunition storage space. NAVWPNSTA Seal Beach has been operated by the Navy and its contractors since its inception in 1944. NAVWPNSTA Seal Beach is located in the City of Seal Beach. Nearby communities include the Cites of Huntington Beach, Westminster, Los Alamitos, and Garden Grove.

2.1.1 Historical Property Use and Operations

UST Site 229 is located southwest of the intersection of Industrial Road and Kitts Highway adjacent to the eastern edge of former Building 229 (Figure 3). The former UST tank pit consists of an area of approximately 200 square feet. Building 229 was demolished in the 1990s and no surface expression of the building remains. Building 229 was the office of the NAVWPNSTA Seal Beach Comptroller/Controller and was used for accounting functions. The USTs were reportedly used to fuel a boiler that provided heat for the building.

Two 10,000-gallon steel USTs that formerly stored diesel fuel were removed from the site in 1991 by Riedel Environmental Services, Inc., (RES) (RES, 1991). RES collected four soil samples from the UST excavation for analysis of TPH-d by US EPA Method 8015; and BTEX by US EPA Method 8020. The laboratory reported the following range of concentrations:

Analyte	Total Number of Samples	Number of Detections	Range of Concentrations
TPH-d	4	3	770 to 3,500 mg/kg
Benzene	4	1	43 µg/kg
Toluene	4	2	29 and 34 µg/kg
Ethylbenzene	4	1	560 µg/kg
Total xylenes	4	4	18 to 920 µg/kg

<u>Acronyms:</u>
mg/lg milligrams per kilogram
µg/kg micrograms per kilogram

Upon completion of the excavation, UST removal, and sampling activities, RES backfilled the excavation with fill material. The concrete anchor pad for the two USTs was left in-place at a depth of approximately 11 feet bgs. Based on the TPH-d and BTEX concentrations reported in soil samples from the UST excavation, RES recommended further investigation of NAVWPNSTA Seal Beach UST Site 229 (RES, 1991).

In 1992, Jacobs Engineering Group (JEG) conducted a UST Study Site Assessment at NAVWPNSTA Seal Beach UST Site 229 (JEG, 1993). This UST Site Assessment consisted of a geophysical survey, a screening level soil gas study consisting of the collection of five soil gas samples, the advancement of seven soil borings, and the conversion of three of seven soil borings to groundwater monitoring wells. Eleven soil samples were analyzed for TPH-extractable as diesel by US EPA Method 8015 and BTEX by US EPA Method 8020. Soil boring, soil sampling points, and groundwater monitoring well locations are depicted on Figure 4. Five soil gas samples were analyzed for TPH by an unspecified method; and three groundwater samples collected from monitoring wells MW-1, MW-4, and MW-5 were analyzed for TPH-extractable as diesel by US EPA Method 8015 and BTEX by US EPA Method 8020 (JEG, 1993).

Hydrocarbon concentrations were not reported in any of the five soil gas samples. However, residual petroleum product was visible on temporary soil gas probes V-1 and V-4 upon removal of the probes (which were installed above the water table) indicating product had migrated away from the UST location (Figure 4).

Benzene and toluene were not reported in any of the 11 soil samples analyzed during the JEG assessment. Ethylbenezene and total xylenes were reported in the 11 foot bgs sample in soil boring MW1 at concentrations of 230 and 170 µg/kg, respectively (Figure 4). TPH-extractable as diesel was reported in 5 of the 11 soil samples analyzed with concentrations ranging from 53 mg/kg in the 5.5 foot bgs sample from MW3, to 2,600 mg/kg in the 11 foot bgs sample from MW4. TPH-extractable as diesel was also reported in soil samples collected from 8.5 feet bgs in soil borings SB6 and SB7 (Figure 4).

Soil borings MW1, MW4, and MW5 were advanced to a depth of 28 feet bgs and were converted to groundwater monitoring wells (Figure 4). Groundwater was encountered at approximately 8.5 feet bgs in each of the three monitoring wells which were generally screened from 5 to 28 ft bgs to the total depth drilled of 28 feet. The three monitoring wells were developed and sampled. TPH-extractable as diesel and BTEX were not reported in any of the three groundwater samples collected at NAVWPNSTA Seal Beach UST Site 229 (JEG, 1993).

JEG concluded that free product potentially exists on the groundwater above the in-place anchor pad from the former two 10,000-gallon USTs. In addition, JEG concluded that hydrocarbons in groundwater appeared to be confined within approximately 10 feet north of the former excavation, and the soil was impacted with hydrocarbons above the groundwater in the former excavation and approximately 25 feet northwest of the excavation beyond soil boring SB6 and monitoring well MW4 (Figure 4). JEG recommended that hydrocarbon impacted soil be removed and remediated, and that any free product be removed during excavation activities (JEG, 1993). At the conclusion of the JEG site assessment all three groundwater monitoring wells were properly destroyed.

No other additional work was conducted at the site after 1993 due to an experimental bioremediation study conducted by Stanford University (Reinhard, et. al 2000) at IR Site 14, located directly to the east of UST Site 229. This study was conducted under the Department of Defense Environmental Security Technology Certification Program. The investigators of the study at IR Site 14 requested that no intrusive work be conducted at UST 229 during the bioremediation study. Additionally, IR Site 14 was recently granted NFA status based on an assessment and ecological risk screening conducted by MARRS Services, Inc. The ecological risk assessment was conducted because IR Site 14 is located directly adjacent to the Seal Beach National Wildlife Refuge (MARRS, 2007). Groundwater isocontours for benzene and MTBE and the locations of UST Site 229, IR Site 14, and the Seal Beach National Wildlife Refuge are depicted on Figure 5.

On May 31, 2007, the RWQCB issued *"Information Request for Underground Storage tank Site 229, U.S. Naval Weapons Station Seal Beach, Geotracker ID: T0605901373"* requesting any additional information pertaining to additional studies or remedial activities at UST Site 229. The letter also requested the above referenced information and a Work Plan for the site by July 31, 2007 however, based on funding prioritization, the investigation was delayed (RWQCB, 2007).

In August 2008, NAVFAC SW authorized RBA through Shaw to complete a Site Characterization of NAVWPNSTA Seal Beach UST Site 229 using SCAPS. This Work Plan is designed to address the RWQCBs' request and to investigate the site for further action.

2.1.2 Land Use

Since NAVWPNSTA Seal Beach was first commissioned in 1944, land use at the facility has been for weapons and munitions loading, storage, and maintenance. Prior to 1962 it was known as the Naval Ammunition and Net Depot and was used to service anti-submarine nets used to protect fleet bases and anchorages around the world. NAVWPNSTA Seal Beach has evolved into the Navy's primary West Coast ordinance storage, loading and maintenance facility. All current facility operations are industrial, and the Navy's proposed future use for the entire facility will remain industrial, with controlled access restricted to authorized badged personnel.

As discussed above, former Building 229 was the offices of the NAVWPNSTA Seal Beach Comptroller/Controller and was used for accounting functions. The two former 10,000-gallon USTs were used to fuel a boiler that provided heat for former Building 229. In the Kickoff meeting for this project, held August 22, 2008 at NAVWPNSTA Seal Beach, the team discussed that the currently vacant and unpaved site is not planned for redevelopment. In addition, any potential site redevelopment would be industrial (RBA, 2008)

3.0 SITE EVALUATION

This section summarizes the identification of potential contaminants of concern, potential sources of contamination, and presents the CSM.

3.1 Conceptual Site Model

The initial CSM for the NAVWPNSTA Seal Beach UST Site 229 study area was compiled from historical research, site visits and available hydrogeological and chemical data from previous investigations. A more refined CSM will be developed based on the results of this investigation. The initial CSM is presented in the following sections.

3.1.1 Potential Sources and Contaminants

A release of diesel fuel related to the former operations of the two 10,000-gallon USTs occurred within a limited area of the site. The area appears limited to the immediate vicinity of the former UST excavation. A three-dimensional depiction of the conceptual CSM is shown on Figure 5.

3.1.2 Pathways

The primary pathway for contaminant migration in the current CSM is infiltration of diesel in the vadose zone soil extending downward to groundwater. Free product is potentially present on the groundwater in the immediate vicinity of the former UST excavation. Dissolved-phase fuel has the potential to migrate away from the source area in the down-gradient direction, presumed to be towards the southeast.

3.1.3 Receptors

Shallow groundwater resources in the immediate vicinity of the former tank excavation are a potential receptor. No other current complete pathways have been identified for diesel to reach human or ecological receptors. The nearest edge of the Seal Beach National Wildlife Refuge to the site is located approximately 400 feet east southeast of the center of the former UST excavation at UST Site 229.

4.0 TECHNICAL APPROACH

Execution of environmental assessment tasks will follow standard technical guidelines to meet program-specific needs and to comply with existing regulatory requirements. Data Quality Objectives (DQOs) and general project technical requirements have been established in the SAP (Appendix A). The DQO process is a series of planning steps based on scientific method and designed to ensure that the type, quantity, and quality of environmental data used in decision-making are appropriate for the intended application. The DQOs are then used to develop a scientific and resource-effective sampling design. DQOs for this investigation have been developed in accordance with the US EPA seven-step DQO process (US EPA, 2006). A detailed description of the project DQOs is included in the SAP (Appendix A). DQOs are qualitative and quantitative statements derived from the outputs of each step of the DQO process that:

- Clarify the study objective,
- Define the most appropriate type of data to collect,
- Determine the most appropriate conditions at which to collect the data, and
- Specify acceptable levels of decision errors that will be used as the basis for establishing the quantity and quality of data needed to support the decision.

The Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPP) have been combined into one document, the project-specific SAP (Appendix A). The SAP will be followed in order to achieve a consistent technical approach in the field investigation phase.

Subcontractors for underground utility surveying, analytical laboratory testing, and management of investigation-derived wastes (IDW) will be evaluated, selected, and scheduled for fieldwork. An IDW management plan is provided as Appendix B.

After data from the proposed site assessment and field investigation work have been obtained and evaluated, project efforts will focus on preparation of a project report, which will contain the findings, conclusions, and recommendations pertaining to the site.

4.1 Sampling Locations, Analyses, and Rationale

The selection of sampling locations and analytical methodologies was based on the nature of the contaminants and potentially contaminated media at the site. Analytical methods were selected on the basis of site operation practices and compounds identified during previous investigations, and to accomplish the site assessment objectives and achieve desired detection limits. A detailed discussion of analytical methodologies, including a tabulation of analytical methods, target method detection limits, and project-specific threshold levels, is provided in the SAP (Appendix A).

This investigation is designed to use field methods, specifically SCAPS LIF, to delineate the nature and extent of petroleum hydrocarbon impacts to soil at UST Site 229. SCAPS

LIF and CPT real-time data will be interpreted to identify the presence of petroleum hydrocarbons in the subsurface. Potential SCAPS LIF pushes locations are depicted on Figure 5. The LIF investigation will begin adjacent to the buried concrete anchor pad at the former UST location, and proceed at step-out locations using the decision rules in the SAP Worksheet #11.

Five soil samples are planned be collected for fixed-based laboratory analysis. Soil samples will be collected and analyzed to evaluate SCAPS LIF data, to confirm the boundary of petroleum-contaminated soil, to compare to the Project Action in the SAP Worksheet #15, and to estimate the mass of petroleum hydrocarbons left in place for input in the CSM. To evaluate the SCAPS LIF effectiveness, one soil sample will be proposed from the depth interval of the highest site-wide fluorescence. A second soil sample will be proposed from a depth interval of background fluorescence directly above sample with the highest fluorescence. A third soil sample will be proposed from an area where background fluorescence is measured through the entire push interval, (from a depth corresponding to the highest fuel fluorescence at an adjacent push location). Other soil samples will be proposed by SCAPS Field Team on judgmental basis with input from the DQO Planning Team. The LIF data and proposed soil sample locations will be distributed as a Field Memo to the Navy Project Team, and after the Navy's review and concurrence, to the RWQCB POC with a request for concurrence to sample the proposed locations in accordance with the SAP (Appendix A).

Groundwater samples will be collected to evaluate potential dissolved phase groundwater plumes at UST Site 229. The groundwater sampling may occur during a second field deployment to be scheduled by the Navy RPM. Groundwater samples will be collected for fixed-based laboratory analysis to evaluate site groundwater conditions. Groundwater samples may be collected from either temporary or permanent groundwater monitoring wells. Groundwater sampling locations will be optimized by the LIF data, and proposed groundwater sample locations will be distributed as a Field Memo to the Navy Project Team, and after the Navy's review and concurrence, to the RWQCB POC with a request for concurrence to sample the proposed locations in accordance with the SAP (Appendix A). Decision rules regarding groundwater sampling are presented in the SAP Worksheet #14. Groundwater samples will be collected using low-flow purging and sampling techniques in accordance with RBA SOP T-002. Copies of the SOPs for this project are provided in Appendix A, Attachment 2. Groundwater samples for BTEX analysis will be collected first using a bladder pump, and groundwater samples collected for TPH-d and PAH analyses will be collected last using a bladder or peristaltic pump.

4.2 Quality Assurance and Data Evaluation

The overall quality of tasks performed for investigation will be assured by conformance to protocols established for sample collection, analytical procedures, and data management. A summary of the quality assurance/quality control (QA/QC) protocols that will be implemented throughout the investigation is provided in detail in the SAP (Appendix A).

QA objectives and detail regarding data management, verification, and validation are also provided in the SAP. Previously collected data will be integrated with the SCAPS LIF investigation-generated data to compile a database that will be used to support risk-based decisions made for this site. Data management and database protocols are described in detail in the SAP (Appendix A).

5.0 SUMMARY OF SCAPS LIF INVESTIGATION ACTIVITIES

This section provides a list of components planned for the SCAPS LIF investigation at NAVWPNSTA Seal Beach UST Site 229 to achieve the DQOs described in Section 4.0. The SAP (Appendix A), and the Accident Prevention Plan (APP) and Site Specific Safety and Health Plan (SSHP) presented under separate cover present a full discussion of sampling activities, including detail on locations, analyses, field quality control, field safety procedures, and data evaluation and validation. In summary, the following activities will be conducted during this investigation.

1. Project Planning
    - Preparation of Work Plan, SAP, APP and SSHP
    - Procurement of subcontractors
    - Coordination with NAVWPNSTA Seal Beach personnel and Orange County Health Care Agency; submittal of field initiation notice and site approval request
2. Field Investigation – Initial Field Deployment
    - Mobilize
    - Geophysical survey for utility clearance
    - Establish decontamination area to control potential site contamination
    - Advance LIF CPT pushes
    - Collect soil samples
    - Optionally collect groundwater samples from temporary groundwater monitoring wells (if it can be successfully completed within current project resource constraints).
    - Package and ship samples to laboratory for chemical analysis
    - Global positioning system (GPS) survey of all borings locations
    - Manage and dispose liquids and solids generated during the field activities.
3. Field Investigation – Subsequent Field Deployment
    - Groundwater sampling – to be scheduled by Navy RPM.
4. Data Management
5. Data Validation
6. Data Evaluation
7. Report Preparation and submittal.

The findings, conclusions, and recommendations for further actions (if needed) pertaining to this investigation will be presented in the Extended Site Assessment report. The report will address the findings of the above work elements and recommend additional action or NFA. The report will be prepared in general accordance with US EPA (2001) guidelines, and will generally include but not be limited to the following information:

- Site history, development, and usage;
- Site plot plan with known subsurface utilities;
- Geology and hydrogeology;
- CPT data;
- LIF data profiles;
- Boring and Monitoring Well Construction logs;
- Sampling procedures;
- Laboratory results;
- Data Quality Assessment;
- Cross-sections;
- Characterization of impact;
- Updated CSM; and
- Summary, conclusions and recommendations.

6.0 REFERENCES

California Regional Water Quality Control Board – Santa Ana Region (RWQCB), 2007. Information Request for Underground Storage Tank Site 229, U.S. Naval Weapons Station Seal Beach, GeoTracker ID: T0605901373. May 31.

Jacobs Engineering Group (JEG), 1993. Naval Weapons Station Seal Beach, California, Underground Storage Tank Studies Site Assessment Report. April 30.

MARRS Services, Inc. (MARRS), 2007. Final Groundwater Monitoring Report, Installation Restoration Program (IRP) Site 14, Naval Weapons Station Seal Beach, Seal Beach, California. June 1.

Reinhard, Dr. M.; Hopkins, G; Cunningham, Dr. J. A.; and Lebron, C. 2000. Enhanced In Situ Anaerobic Bioremediation of Fuel-Contaminated Ground Water. Stanford University, Department of Civil and Environmental Engineering. September.

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_____, 2006. Guidance for The Data Quality Objectives Process, EPA QA/G-4, EPA/600/R-96/055. February.

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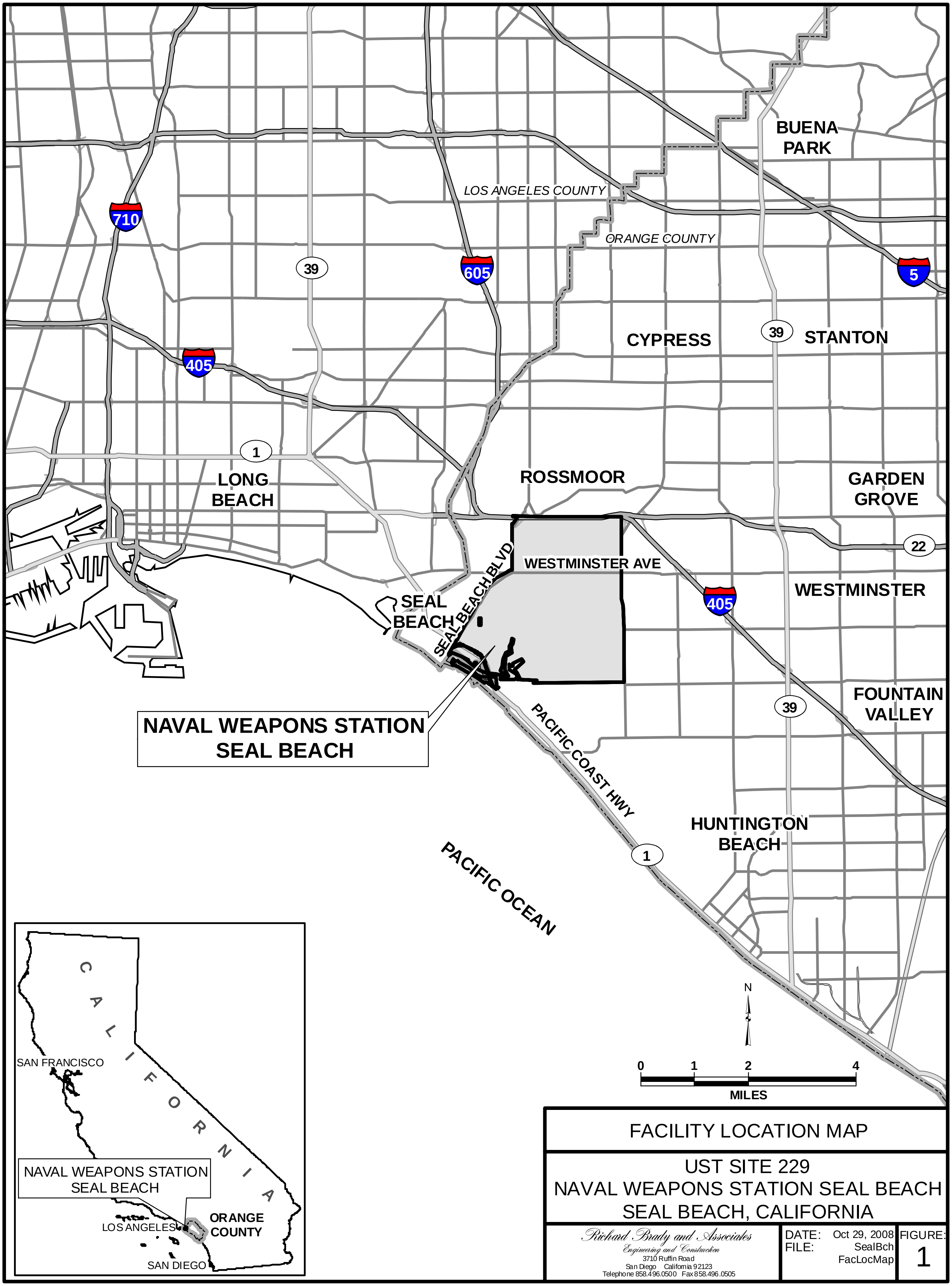
FIGURES



FACILITY LOCATION MAP

UST SITE 229
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

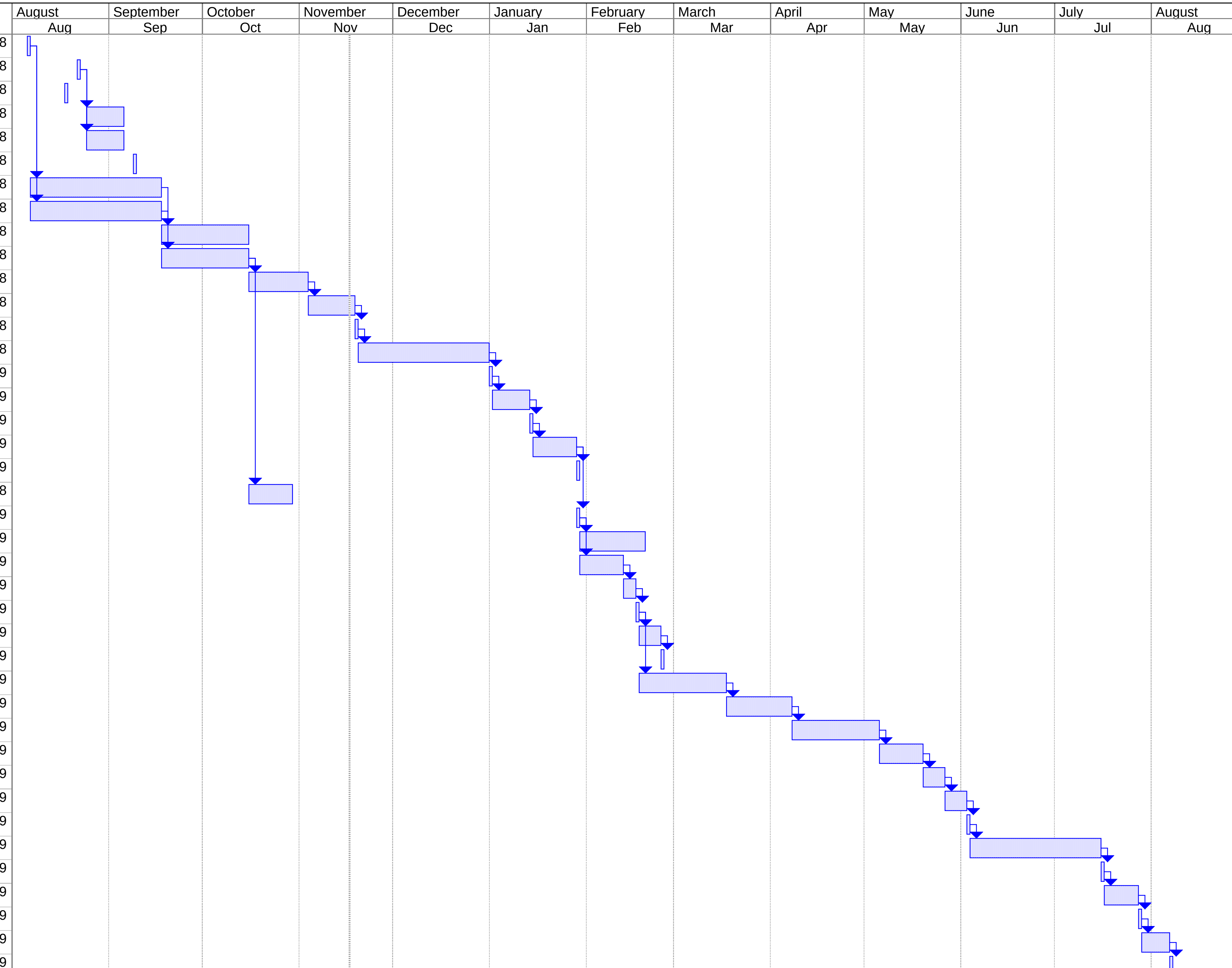
Richard Brady and Associates
Engineering and Construction
3710 Ruffin Road
San Diego California 92123
Telephone 858.496.0500 Fax 858.496.0505

DATE: Oct 29, 2008
FILE: SealBch FacLocMap

FIGURE: 1

Project Schedule
NWS Seal Beach SCAPS Investigation
UST 229

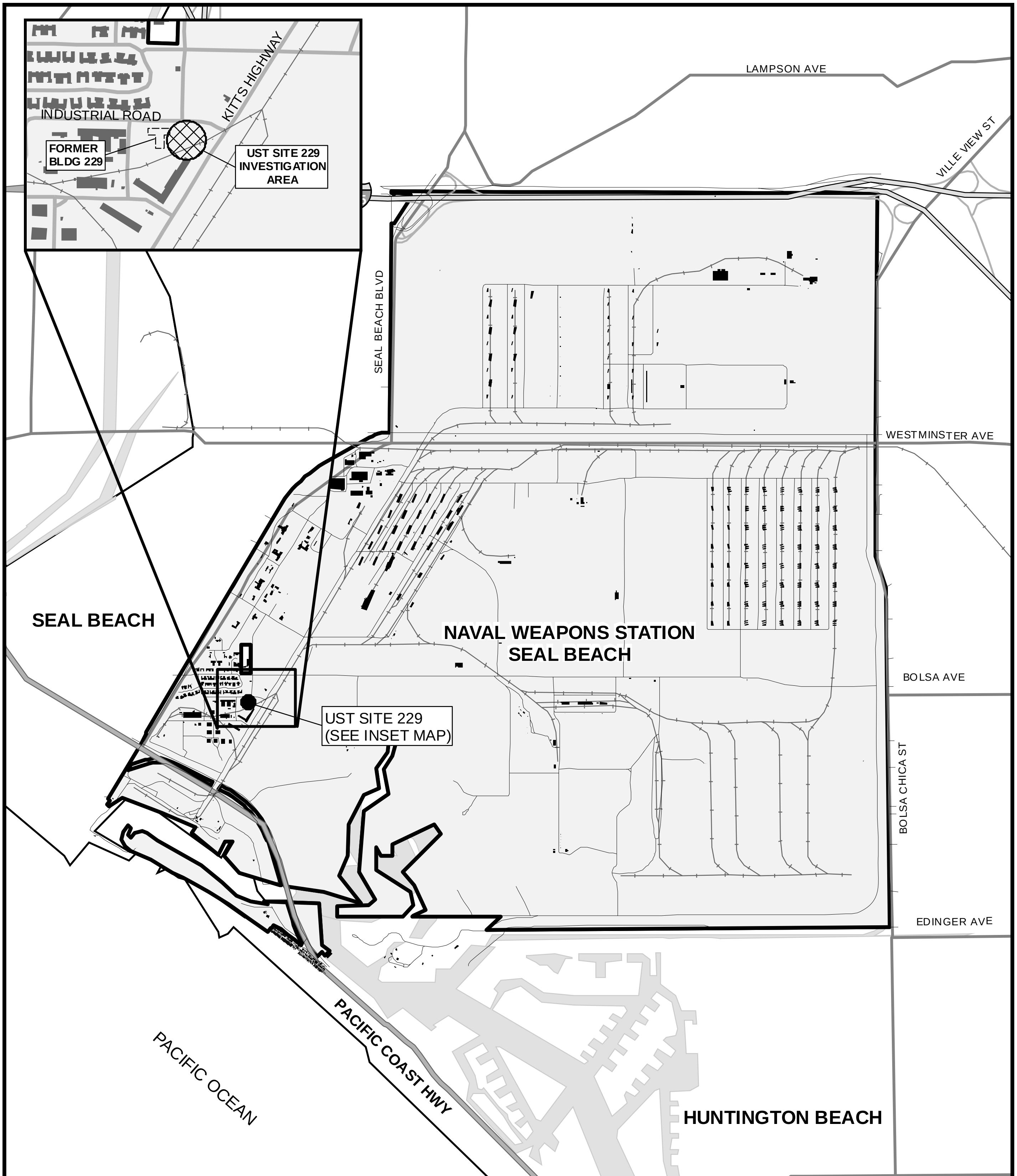
ID	Task Name	Duration	Start	Finish
1	Project Award	1 day	Wed 8/6/08	Wed 8/6/08
2	Kickoff Meeting	1 day	Fri 8/22/08	Fri 8/22/08
3	Draft Schedule	1 day	Mon 8/18/08	Mon 8/18/08
4	Kickoff Meeting Minutes	10 days	Mon 8/25/08	Fri 9/5/08
5	Final Schedule	10 days	Mon 8/25/08	Fri 9/5/08
6	Planning Meeting with Agencies	1 day	Tue 9/9/08	Tue 9/9/08
7	Pre-Draft WP and SAP Preparation	30 days	Thu 8/7/08	Wed 9/17/08
8	Draft APP, SSHP, and AHA Preparation	30 days	Thu 8/7/08	Wed 9/17/08
9	Navy Review of Pre-Draft WP and SAP	20 days	Thu 9/18/08	Wed 10/15/08
10	Navy Review of Draft APP, SSHP, and AHA	20 days	Thu 9/18/08	Wed 10/15/08
11	Response to Navy on Pre-Draft WP and SAP	13 days	Thu 10/16/08	Mon 11/3/08
12	Draft WP and SAP Preparation	11 days	Tue 11/4/08	Tue 11/18/08
13	Submittal of Draft WP and SAP to Agencies	1 day	Wed 11/19/08	Wed 11/19/08
14	Agency Review of Draft WP and SAP	30 days	Thu 11/20/08	Wed 12/31/08
15	Submittal of Agency Comments on Draft WP & SAP	1 day	Thu 1/1/09	Thu 1/1/09
16	Response to Agency Comments on Draft WP & SAP	8 days	Fri 1/2/09	Tue 1/13/09
17	Comment Resolution on Draft WP and SAP	1 day	Wed 1/14/09	Wed 1/14/09
18	Preparation of Final WP and SAP	10 days	Thu 1/15/09	Wed 1/28/09
19	Submittal of Final WP and SAP	1 day	Thu 1/29/09	Thu 1/29/09
20	Preparation of Final APP, SSHP, and AHA	10 days	Thu 10/16/08	Wed 10/29/08
21	Submittal of Final APP, SSHP, and AHA	1 day	Thu 1/29/09	Thu 1/29/09
22	Pre-Field Activities	15 days	Fri 1/30/09	Thu 2/19/09
23	Permitting	10 days	Fri 1/30/09	Thu 2/12/09
24	Utility Clearance	2 days	Fri 2/13/09	Mon 2/16/09
25	Mobilization	1 day	Tue 2/17/09	Tue 2/17/09
26	Fieldwork	5 days	Wed 2/18/09	Tue 2/24/09
27	Demobilization	1 day	Wed 2/25/09	Wed 2/25/09
28	Laboratory Analysis of Samples	20 days	Wed 2/18/09	Tue 3/17/09
29	Data Validation	15 days	Wed 3/18/09	Tue 4/7/09
30	Preparation of Pre-Draft SC Report	20 days	Wed 4/8/09	Tue 5/5/09
31	Navy Review of Pre-Draft SC Report	10 days	Wed 5/6/09	Tue 5/19/09
32	Response to Navy on Pre-Draft SC Report	5 days	Wed 5/20/09	Tue 5/26/09
33	Preparation of Draft SC Report	5 days	Wed 5/27/09	Tue 6/2/09
34	Submittal of Draft SC Report	1 day	Wed 6/3/09	Wed 6/3/09
35	Agency Review of Draft SC Report	30 days	Thu 6/4/09	Wed 7/15/09
36	Submittal of Agency Comments on Draft SC Rpt	1 day	Thu 7/16/09	Thu 7/16/09
37	Response to Agency Comments on Draft SC Rpt	7 days	Fri 7/17/09	Mon 7/27/09
38	Comment Resolution on Draft SC Report	1 day	Tue 7/28/09	Tue 7/28/09
39	Preparation of Final SC Report	7 days	Wed 7/29/09	Thu 8/6/09
40	Submittal of Final SC Report	1 day	Fri 8/7/09	Fri 8/7/09



Project: NWS SB UST 229 Final Sche
Date: Mon 11/17/08

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Figure 2 Project Schedule



N

0 0.25 0.5 1

MILES

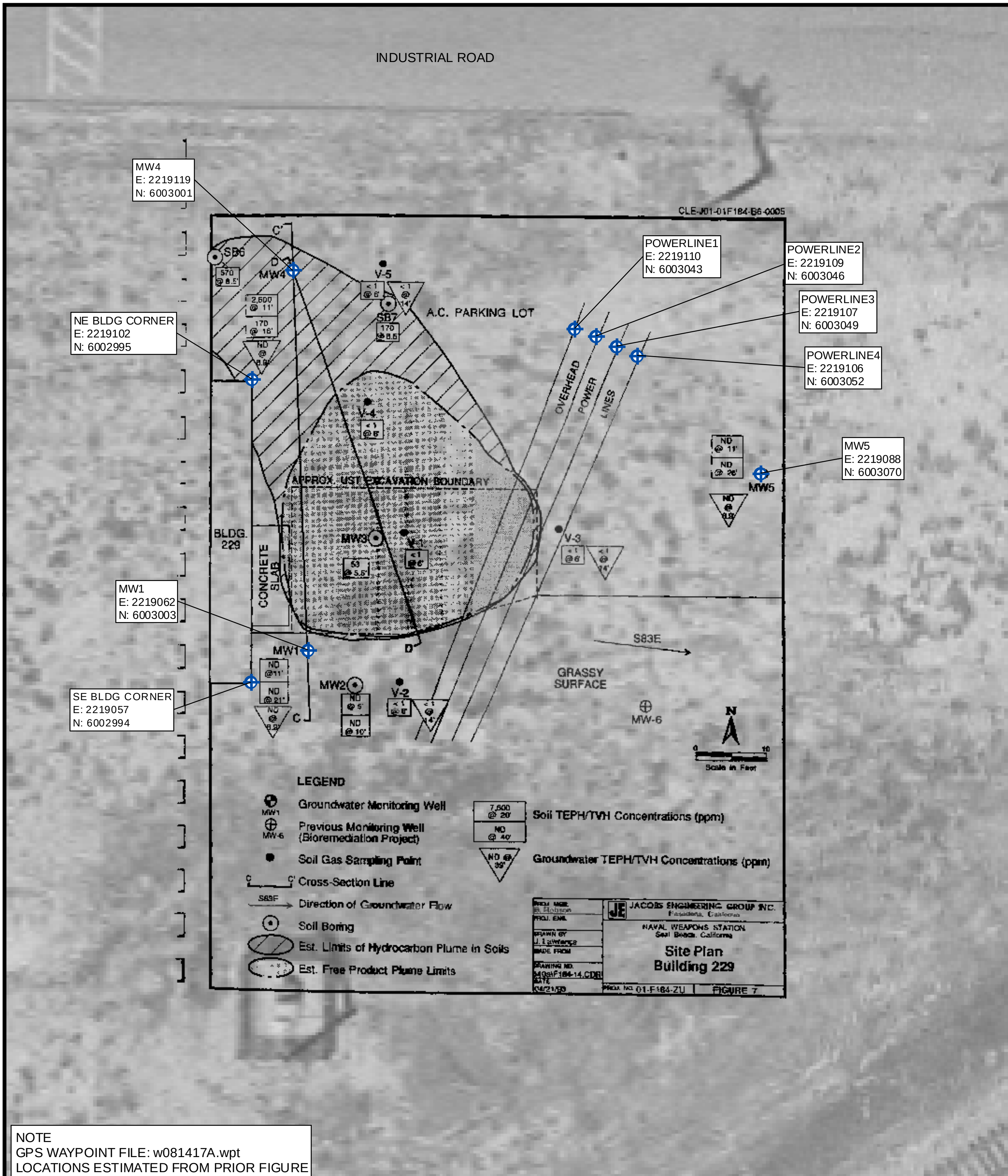
SITE LOCATION MAP

UST SITE 229
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

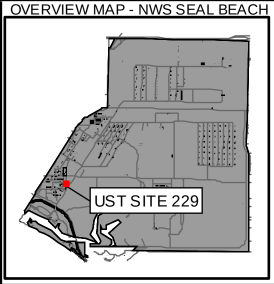
Richard Brady and Associates
Engineering and Construction
3710 Ruffin Road
San Diego California 92123
Telephone 858.496.0500 Fax 858.496.0505

DATE: Oct 29, 2008
FILE: SealBch BaseMap2

FIGURE: 3



OVERVIEW MAP - NWS SEAL BEACH



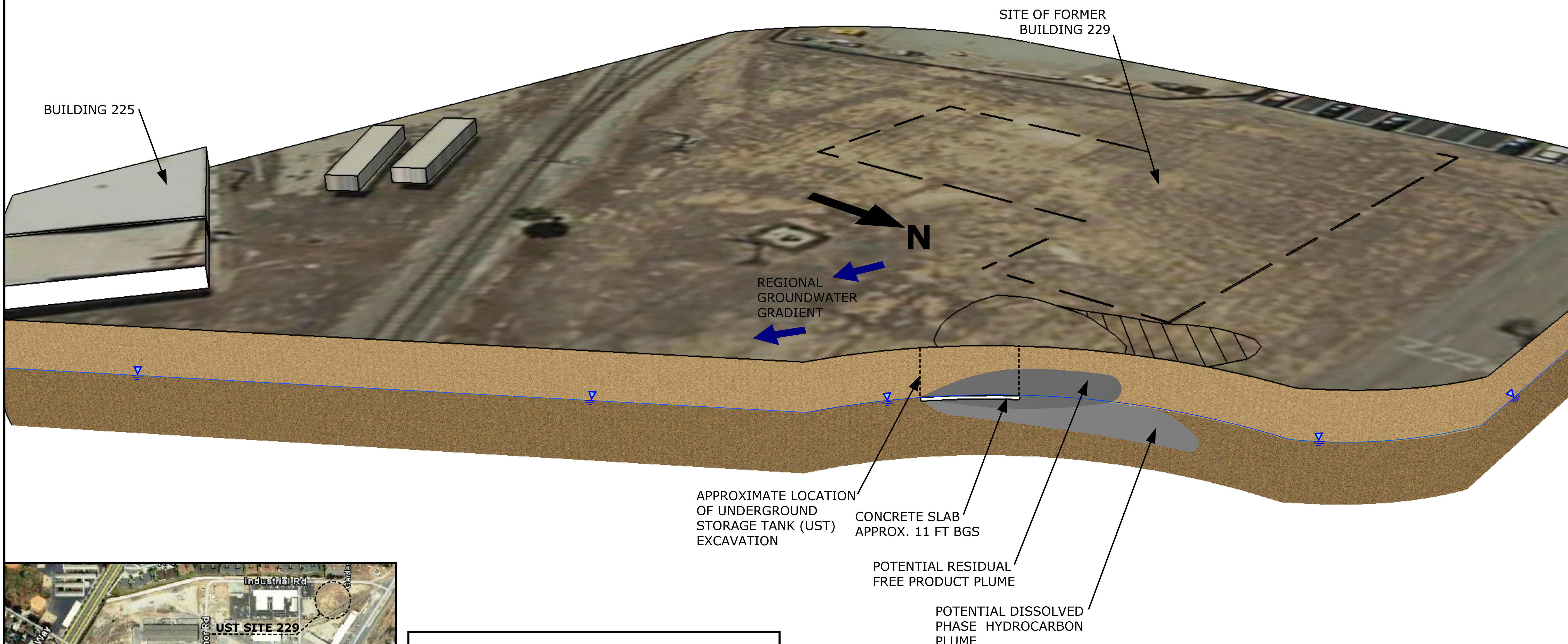
PREVIOUS INVESTIGATION

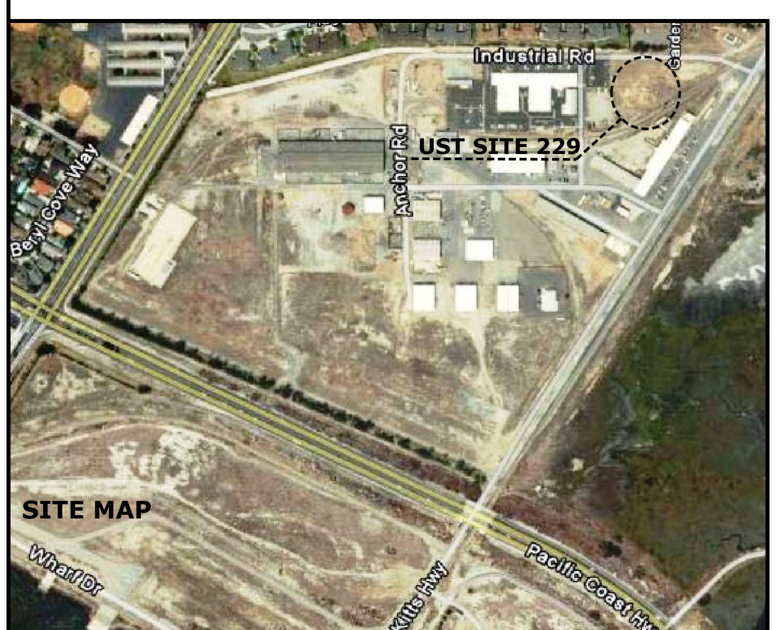
UST SITE 229
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

Richard Brady and Associates
Engineering and Construction
3710 Ruffin Road
San Diego California 92123
Telephone 858.496.0500 Fax 858.496.0505

DATE: Sep 15, 2008
FILE: UstSite229_080814

FIGURE: 4





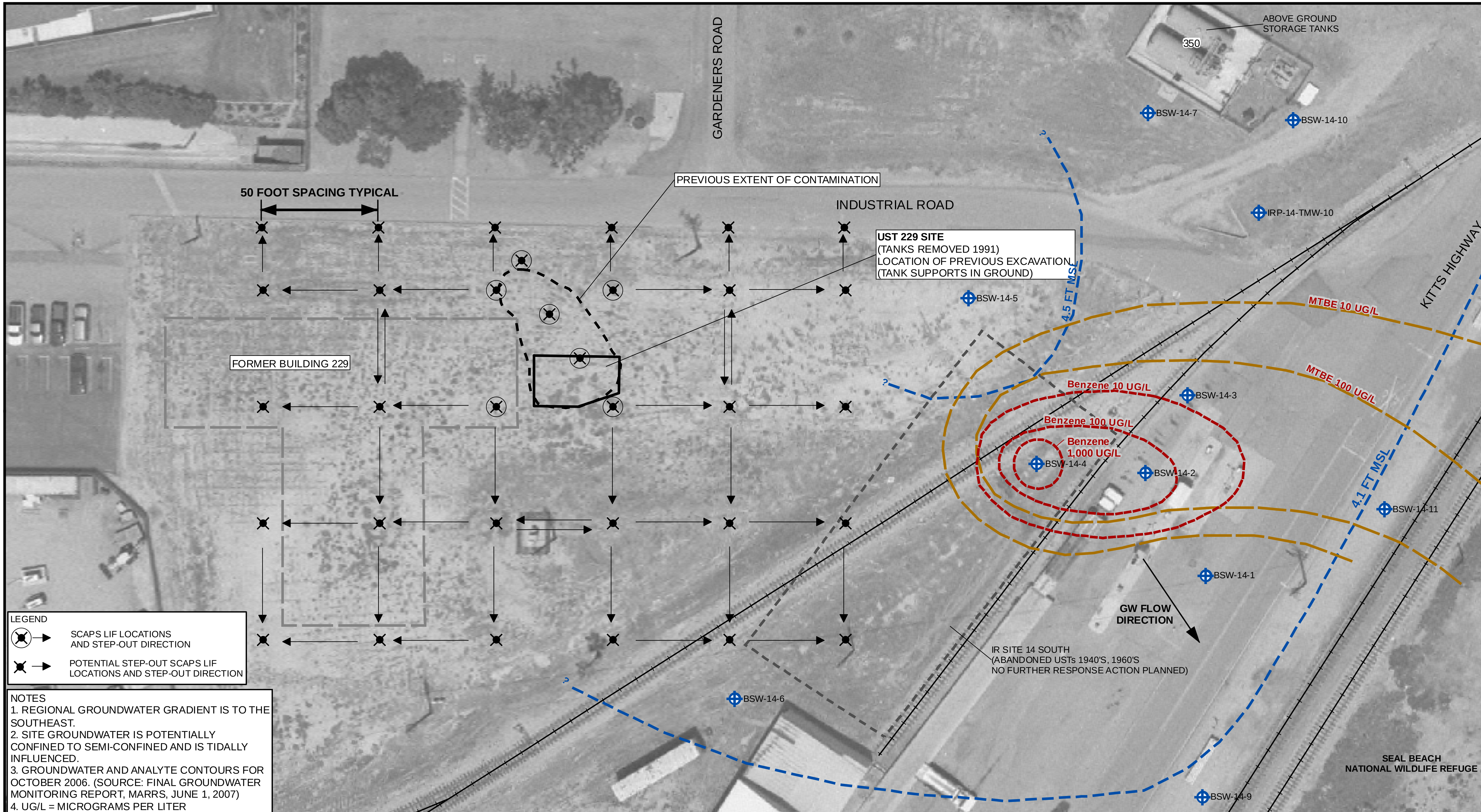
NOTES:

1. REGIONAL GROUNDWATER GRADIENT IS TO THE SOUTHEAST.
2. SITE GROUNDWATER IS POTENTIALLY CONFINED TO SEMI-CONFINED AND IS TIDALLY INFLUENCED.
3. MAP NOT TO SCALE.
4. THIS CONCEPTUAL SITE MODEL WAS DEVELOPED USING DATA PROVIDED IN THE 1993 SITE ASSESMENT REPORT BY JACOBS ENGINEERING GROUP, INC., ACTUAL SITE CONDITIONS MAY HAVE CHANGED.

LEGEND:

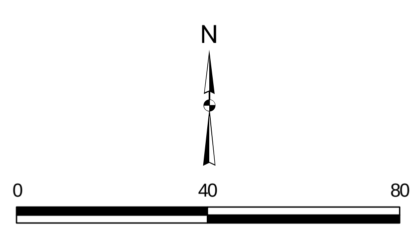
∇ GROUNDWATER TABLE (APPROX 8.5 FT BGS)

CONCEPTUAL SITE MODEL UST SITE 229	
NAVAL WEAPONS STATION SEAL BEACH SEAL BEACH, CALIFORNIA	
Richard Brady & Associates 3710 Ruffin Road San Diego California 92123 Telephone 858.496.0500 Fax 858.496.0505	DATE: SEPT 17 ,2008 FILE: CSM_skp — FIGURE 5



NOTES
1. REGIONAL GROUNDWATER GRADIENT IS TO THE SOUTHEAST.
2. SITE GROUNDWATER IS POTENTIALLY CONFINED TO SEMI-CONFINED AND IS TIDALLY INFLUENCED.
3. GROUNDWATER AND ANALYTE CONTOURS FOR OCTOBER 2006. (SOURCE: FINAL GROUNDWATER MONITORING REPORT, MARRS, JUNE 1, 2007)
4. UG/L = MICROGRAMS PER LITER

OVERVIEW MAP - NWS SEAL BEACH



MAP PROJECTION: NAD 83 CALIFORNIA STATE PLANE 6, SURVEY FEET

POTENTIAL SCAPS LIF LOCATIONS

UST SITE 229
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

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San Diego California 92123
Telephone 858.496.0500 Fax 858.496.0505

DATE: Mar 26, 2009
FILE: UstSite229 PropLoc080825

FIGURE: 6

APPENDIX A

SAMPLING AND ANALYSIS PLAN
(FSP-QAPP)

1.0 SAP WORKSHEET #1 – TITLE AND APPROVAL PAGE

FINAL

SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)

March 16, 2009

SCAPS LASER-INDUCED FLUORESCENCE INVESTIGATION
UNDERGROUND STORAGE TANK SITE 229,
NAVAL WEAPONS STATION SEAL BEACH, CALIFORNIA

Prepared for:
DEPARTMENT OF THE NAVY
Naval Facilities Engineering Command Southwest
1220 Pacific Highway, San Diego, California 92132-5190

NAVFAC
Naval Facilities Engineering Command

Prepared by:

Richard Brady & Associates
Engineering and Construction

3710 Ruffin Road, San Diego, Ca 92123
(858) 496-0500

PROFESSIONAL GEOLOGIST
DONALD McHUGH
No. 8219
STATE OF CALIFORNIA

Prepared under:
Contract No. N68711-03-D-4302
NAVFAC SW CTO 0120
DCN: RBAE-4302-0120-0028

Prepared by:

Date 3-16-09
Donald McHugh, P.G.
Project Manager

Reviewed by:

Date 3/16/2009
Timothy Shields
Program Manager

Approved by:

Date 3/16/09
Jesse MacNeill
Quality Assurance Manager

Approved by:

Date 3/23/2009
Narciso A. Ancog
NAVFAC SW Quality Assurance Officer

1.1 Executive Summary

This Extended Site Assessment Sampling and Analysis Plan (SAP) presents planned activities to determine the nature and extent of petroleum hydrocarbons impacts in soil and groundwater at the Underground Storage Tank (UST) Site 229 Naval Weapons Station (NAVWPNSTA), Seal Beach, California. Richard Brady & Associates (RBA) is conducting this investigation on behalf of Naval Facilities Engineering Command Southwest (NAVFAC SW), in accordance with Task Order 0120 issued under Contract No. N68711-03-D-4302, under subcontract to Shaw Infrastructure, Inc.(SHAW) The Department of the Navy (DoN) is the lead agency on this project, and the lead regulatory agency is the California Regional Water Quality Control Board - Santa Ana Region (RWQCB).

The primary goal of this investigation is to determine if remedial action is required or if a recommendation of no further action (NFA) can be made. To achieve this goal, this investigation is designed to characterize the nature and extent of petroleum hydrocarbon impacts associated with UST Site 229 at NAVWPNSTA Seal Beach. The site formerly contained two 10,000-gallon USTs that stored diesel fuel. The two USTs were removed from the site in 1991 and a subsequent site assessment in 1992 identified a release of petroleum hydrocarbons. Sampling shall be developed to adequately evaluate the nature, type and source of soil and groundwater impacts to determine if the release is significant enough to pose a risk to human health or the environment.

This SAP is designed to plan for the advancement of Site Characterization and Analysis Penetrometer System (SCAPS) laser-induced fluorescence (LIF) pushes and the collection of soil and groundwater samples.

Soil and groundwater samples will be analyzed by a fixed-base laboratory for total petroleum hydrocarbons as diesel (TPH-d); benzene, toluene, ethylbenzene, and xylene isomers (BTEX); naphthalene and polycyclic aromatic hydrocarbons (PAHs). A decision rule is proposed to determine if groundwater samples will be analyzed for methyl tertiary butyl ether (MTBE). The soil analytical results will be compared to the recommended soil cleanup levels stated in the Leaking Underground Fuel Tank (LUFT) manual (SWRCB, 1989) for TPH-d and to the levels in the U.S Environmental Protection Agency (EPA) Region 9 Preliminary Remediation Goals Soil Screening Levels for Protection of Groundwater with a Dilution Attenuation Factor of 1 (EPA, 2008). The groundwater analytical results will be compared to environmental screening levels (ESLs) to define the nature and extent of the plume (CRWQCB, 2008). Soil and groundwater sampling are planned to determine if the plume is stable, decreasing, or migrating. If this investigation defines the nature and extent of fuel-related contamination, and the plume is demonstrated to be stable or decreasing, a recommendation for site closure with NFA will be made and the soil data will be used to estimate the mass of petroleum hydrocarbons left in place at the site.

The overall quality of tasks performed for this site assessment will be assured by conformance to protocols established for sample collection, analytical procedures, and data management. This SAP provides details of the quality assurance/quality control protocols that will be implemented throughout the investigation.

SAP WORKSHEETS

Section Page

TABLES

FIGURES

ATTACHMENTS

ACRONYMS/ ABBREVIATIONS

AR	administrative records
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
°C	degrees Celsius
CA	Corrective Action
Cal EPA	California Environmental Protection Agency
CAS	Chemical Abstracts Service
CCC	criteria continuing concentration
CCV	continuous calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COC	Chain of Custody
COD	chemical oxygen demand
CPR	cardiopulmonary resuscitation
CPT	cone penetrometer test
CSM	conceptual site model
DCC	daily calibration check
DCN	document control number
DI	de-ionized
DO	dissolved oxygen
DON	Department of Navy
DQI	Data Quality Indicator
DQO	Data Quality Objective
DSITMS	Direct Sampling Ion Trap Mass Spectrometry
DTSC	Department of Toxic Substance Control
EPA	Environmental Protection Agency
EWI	Environmental Work Instruction
FCN	Field Change Notice
ft	feet
GC	gas chromatograph
GC/MS	gas chromatograph/mass spectrometer
Geotracker	geographical environmental information management system
GSU	Geological Service Unit
HAZWOPER	Hazardous Waste Operations and Emergency Response
HCl	hydrochloric acid
HSO	Health and Safety Officer
ICAL	initial calibration
ICV	initial calibration verification
ID	identification

IR	Installation Restoration
LCS	laboratory control spike
LDC	Laboratory Data Consultants
LIF	laser induced fluorescence
LQAP	Laboratory Quality Assurance Program
ug/kg	micrograms per kilogram
ug/L	micrograms per liter
MCL	Maximum Contaminant Level
MDL	method detection limit
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mL	milliliter
MS	matrix spike
MSD	matrix spike duplicate
NAVFAC	Naval Facilities Engineering Command
NAVFAC SW	Naval Facilities Engineering Command Southwest
NEDD	Navy Electronic Data Deliverable
NFESC	Naval Facilities Engineering Service Center
NIRIS	Naval Installation Restoration Information Solution
nm	nanometer
NTR	Navy Technical Representative
NTUs	nephlometric turbidity units
NAVWPNSTA	Naval Weapons Station
ORP	oxidation reduction potential
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
PAL	project action limits
PAH	polycyclic aromatic hydrocarbons
PG	Professional Geologist
pH	potential of hydrogen
PID	Photo Ionization Detector
PM	Program Manager
POC	Point of Contact
POL	Petroleum, Oil, and Lubricant
PT	proficiency testing (previously known as performance evaluation (PE) sample)
PVC	polyvinyl chloride
QA	Quality Assurance
QAO	Quality Assurance Officer
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QC	Quality Control
QL	quantitation limit
RBA	Richard Brady & Associates
RI	Remedial Investigation

RPD	relative percent difference
RPM	Remedial Project Manager
RTM	Remedial Technical Manager
%RSD	percent risk-specific dose
RSD	relative standard deviation
RWQCB	Regional Water Quality Control Board
Sample ID	sample identification
SAP	Sampling and Analysis Plan
SCAPS	Site Characterization and Analysis Penetrometer System
SHAW	Shaw Infrastructure, Inc
SOP	standard operating procedure
SPCC	spill prevention, containment, and counter measures
Station ID	station identification
SVOC	semi-volatile organic compounds
TBD	to be determined
TPH	total petroleum hydrocarbons
TPH-d	total petroleum hydrocarbon quantified as diesel
TSA	technical systems audit
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
USCS	Unified Soils Classification System
UST	underground storage tank
VOA	volatile organic analytes
VOC	volatile organic compounds
WP	work plan

2.0 SAP WORKSHEET #2 – SAP IDENTIFYING INFORMATION

Site Name/Number: Underground Storage Tank (UST) Site 229, Naval Weapons Station (NAVWPNSTA) Seal Beach, California

Operable Unit: N/A

Contractor Name: Richard Brady & Associates (RBA)

Contract Number: N68711-03-D-4302

Contract Title: San Diego Public Works Center (Shaw Infrastructure, Inc)

Work Assignment Number (optional): Task Order No. 0120

Document Control Number: RBAE-4302-0120-0028

2.1 Reference Documents

This Sampling and Analysis Plan (SAP) was prepared in accordance with the requirements of the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP) [U.S. Environmental Protection Agency (EPA) 2005] and EPA Guidance for QAPP, EPA QA/G-5, QAMS (U.S. EPA 2002), and with:

Naval Facilities Engineering Command (NAVFAC). 1999. Navy Installation Restoration Chemical Data Quality Manual. September.

Navy Facilities Engineering Command Southwest (NAVFAC SW). 2001. Environmental Work Instruction No. 1. Chemical Data Validation. November.

______. 2006. Environmental Work Instruction No. 2. Review, Approval, Revision and Amendment of SAPs. April.

______. 2001. Environmental Work Instruction No. 3. Laboratory Quality Assurance Program (LQAP). November.

______. 2007. Environmental Work Instruction No. 4. Implementing and Maintaining the Comprehensive Response, Compensation and Liability Act (CERCLA) Administrative Record and Compendium at NAVFAC Southwest. May.

______. 2005. Environmental Work Instruction No. 6. Environmental Data Management and Required Electronic Delivery Standards. April.

U.S. Environmental Protection Agency (EPA). 1992. Framework for Ecological Risk Assessment. EPA 630/R-92-001. Risk Assessment Forum, Washington DC.

______. 1997a. Test Methods for Evaluation of Solid Wastes, SW-846, Update III.

______. 1997b. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final. EPA/540/R-97/006, OSWER 9285.7-25. June.

______. 1999. Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA 540/R-99/008. October.

______. 2001. Requirements for Quality Assurance Project Plans, EPA QA/R-5, EPA/240/BB-01/003. March.

______. 2002. Guidance for Quality Assurance Project Plans, EPA QA/G-5. December.

______. 2004. Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540/R-94/012. February.

______. 2005. Uniform Federal Policy for Quality Assurance Project Plans, EPA-505-B-04-900A. March.

______. 2006. Guidance on Systematic Planning Using the Data Quality Objectives (DQO) Process EPA QA/G-4. Office of Environmental Information EPA/240/B-06/001. February.

______. 2008. "Regional Screening Levels for Chemical Contaminants at Superfund Sites" (formerly EPA Region 9 Preliminary Remeadiation Goals). September 12. Available online at http://www.epa.gov/region09/superfund/prg/index.html

______. 2008. RWQCB – San Francisco, 2008. Screening For Environmental Concerns at Sites with Contaminated Soil and Groundwater, Interim Final, May

2.2 Regulatory Program

The Navy conducts site investigations at NAVWPNSTA Seal Beach in the Installation Restoration (IR) Program in accordance with Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). For Petroleum sites such as UST Site 229 at NAVWPNSTA Seal Beach, the California Regional Water Quality Control Board – Santa Ana Region (RWQCB) is the lead regulatory agency.

2.3 Type of SAP

This SAP is a Project-Specific SAP.

2.4 Scoping Sessions

Scoping Sessions	Date
Initial Kickoff Meeting	August 22, 2008
Planning Meeting with California RWQCB-Santa Ana	September 9, 2008

2.5 Relevant SAP

List dates and titles of any SAP documents written for previous site work that are relevant to the current investigation.

Title	Date
No Previous SAP Applicability	

2.6 Project Stakeholders

- Department of the Navy (DON) – Lead Agency
- California RWQCB – Santa Ana Region – Lead Regulatory Agency for petroleum sites
- Orange County Health Care Agency – Local UST Regulatory Agency for UST closures and permitting

2.7 Lead organization

As lead agency, NAVFAC SW will be responsible for ensuring the collection of representative media samples, accurate analysis of samples, verification and independent third-party validation of data, and archival and reporting of data in accordance with this SAP (see Worksheet #7 for detailed list of data users).

2.8 Omitted SAP Elements

SAP elements or required information that has been omitted because they are either not applicable to this project or are provided elsewhere, are listed below:

No special training is required for this SAP (Worksheet #8).

2.9 Not Applicable SAP Worksheets

SAP elements and required information that are not applicable to the project are noted below. Further explanation is provided on the previous page and in the appropriate SAP worksheet(s).

UFP-QAPP Worksheet #	Required Information	Crosswalk to Related Information
A. Project Management		
Documentation		
1	Title and Approval Page	
2	Table of Contents SAP Identifying Information	
3	Distribution List	
4	Project Personnel Sign-Off Sheet	
Project Organization		
5	Project Organizational Chart	
6	Communication Pathways	
7	Personnel Responsibilities and Qualifications Table	
8	Special Personnel Training Requirements Table	Worksheet #2, Subsection 2.8
Project Planning/ Problem Definition		
9	Project Planning Session Documentation (including Data Needs tables) Project Scoping Session Participants Sheet	
10	Problem Definition, Site History, and Background. Site Maps (historical and present)	
11	Site-Specific Project Quality Objectives	
12	Measurement Performance Criteria Table	
13	Sources of Secondary Data and Information Secondary Data Criteria and Limitations Table	
14	Summary of Project Tasks	
15	Reference Limits and Evaluation Table	
16	Project Schedule/Timeline Table	
B. Measurement Data Acquisition		
Sampling Tasks		
17	Sampling Design and Rationale	
18	Sampling Locations and Methods/ SOP Requirements Table Sample Location Map(s)	
19	Analytical Methods/SOP Requirements Table	
20	Field QC Sample Summary Table	
21	Project Sampling SOP References Table Sampling SOPs	
22	Field Equipment Calibration, Maintenance, Testing, and Inspection Table	
Analytical Tasks		
23	Analytical SOPs Analytical SOP References Table	
24	Analytical Instrument Calibration Table	

Table Continues

UFP-QAPP Worksheet #	Required Information	Crosswalk to Related Information
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	
Sample Collection		
26	Sample Handling System, Documentation Collection, Tracking, Archiving and Disposal Sample Handling Flow Diagram	
27	Sample Custody Requirements, Procedures/SOPs Sample Container Identification Example COC Form and Seal	
QC Samples		
28	QC Samples Table Screening/Confirmatory Analysis Decision Tree	
Data Management Tasks		
29	Project Documents and Records Table	
30	Analytical Services Table Analytical and Data Management SOPs	
C. Assessment Oversight		
31	Planned Project Assessments Table Audit Checklists	
32	Assessment Findings and CA Responses Table	
33	QA Management Reports Table	
D. Data Review		
34	Verification (Step I) Process Table	
35	Validation (Steps Iia and Iib) Process Table	
36	Validation (Steps Iia and Iib) Summary Table	
37	Usability Assessment	

Acronyms:

CA Corrective Action
COC Chain of Custody
QA Quality Assurance
QC Quality Control
SAP Sampling and Analysis Plan
SOP Standard Operating Procedure

3.0 SAP WORKSHEET #3 – DISTRIBUTION LIST

Name of SAP Recipients	Title/Role	Organization	Telephone Number (Optional)	E-mail Address or Mailing Address	DCN (Optional)
Ms. Jennifer Sullivan	RPM	NAVFAC SW	619.532.3868	jennifer.a.sullivan1@navy.mil 1220 Pacific Highway Bldg. 128, Mail Room San Diego, CA 92132 ATTN.: Code OPDE.JS	
Mr. Rod Soule	Navy Technical Representative	NAVFAC SW	619.532.3176	roderick.soule@navy.mil 1220 Pacific Highway Bldg. 128, Mail Room San Diego, CA 92132 Attn.: Code EVR.RS	
Ms. Patricia Hannon	Agency Representative	RWQCB	951.782.4498	phannon@waterboards.ca.gov 3737 Main St., Suite 500 Riverside, CA 92501-3348	
Mr. Dwayne Ishida	PM	SHAW	949.660.7561	dwayne.ishida@shawgroup.com 3347 Michelson Drive, Suite 200 Irvine, CA 92612	
Mr. Jim Cirillo	POC	SHAW	949.660.5317	Jim.Cirillo@shawgrp.com 3347 Michelson Drive, Suite 200 Irvine, CA 92612	
Ms. Pei-Fen Tamashiro	IRP Coordinator	NAVWPNSTA Seal Beach	562.626.7897	pei-fen.tamashiro@navy.mil 800 Seal Beach Boulevard, Building 110 Seal Beach, CA 90740 Attn: Code N45W	

Table Continues

SAP WORKSHEET #3 – DISTRIBUTION LIST – CONTINUED

Name of SAP Recipients	Title/Role	Organization	Telephone Number (Optional)	E-mail Address or Mailing Address	DCN (Optional)
Mr. Narciso Ancog	QAO	NAVFAC SW	619.532.3046	narciso.ancog@navy.mil 1220 Pacific Highway Bldg. 128, Mail Room San Diego, CA 92132 ATTN.: Code EVR.NA	
Ms. Diane Silva	Administrative Record	NAVFAC SW	619.532.3676	diane.silva@navy.mil 1220 Pacific Highway Bldg. 128, Mail Room San Diego, CA 92132 ATTN.: Code EVR.DS FISC Bldg. 1, 3rd Floor	
Mr. Don McHugh	PM	RBA	858.634.4550	dmchugh@rbrady.net 3710 Ruffin Road San Diego, CA 92123	
Mr. Tim Shields	Program Manager	RBA	858.634.4514	tshields@rbrady.net 3710 Ruffin Road San Diego, CA 92123	
Mr. Jesse MacNeill	QAM	RBA	858.634.4549	jmacneill@rbrady.net 3710 Ruffin Road San Diego, CA 92123	

Acronyms:

DCN	Document Control Number
IRP	Installation Restoration Program
NAVFAC SW	Naval Facilities Engineering Command Southwest
PM	Project Manager
POC	Point of Contact
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
RBA	Richard Brady and Associates
RPM	Remedial Project Manager
RWQCB	Regional Water Quality Control Board

4.0 SAP WORKSHEET #4 – PROJECT PERSONNEL SIGN-OFF SHEET

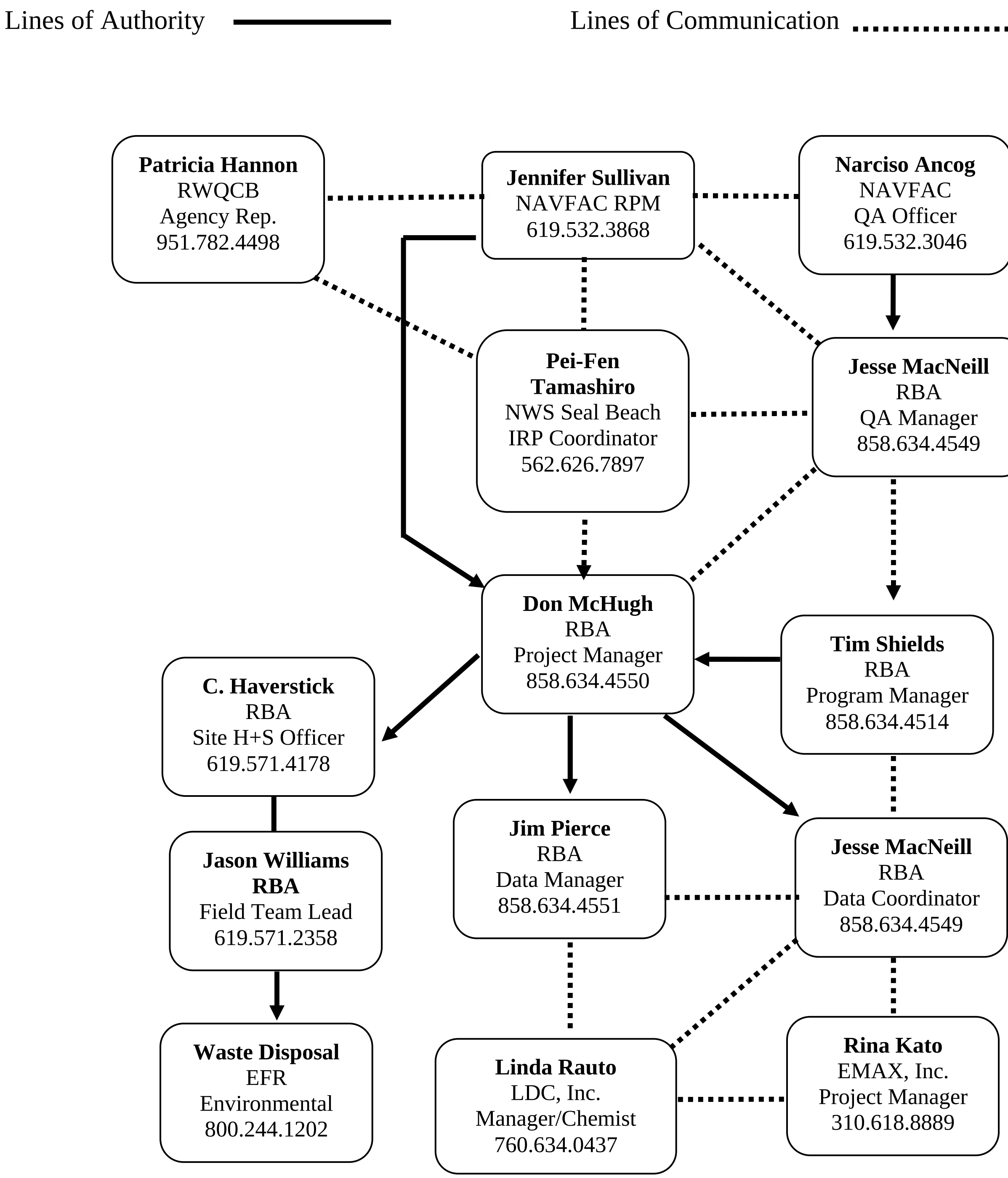
Key personnel will sign this sheet as part of the readiness review conducted prior to field work.

Name	Organization/Title/Role	Telephone Number (optional)	Signature/email receipt	SAP Section Reviewed	Date SAP Read
Craig Haverstick	RBA/HSO	619.571.4178		All Worksheets	
Fred Essig, PG	SCAPS Geologist/LIF Data Acquisition Specialist	619.571.2389		All Worksheets	
Jason Williams	RBA/Lead Sampling Technician	619.571.2358		All Worksheets	
Rina Kato	EMAX Laboratories, Inc. Project Manager	310.618.8889 x117		Worksheets 12, 13,15,19, 22,23, 24, 25, 26, 27, 30, 32,	
Linda Rauto	LDC, Manager/Chemist	760.634.0437		Worksheets 12, 13,15,19, 22,23, 24, 25, 26, 27, 30, 32,	

<u>Acronyms:</u>

HSO	Health and Safety Officer
LDC	Laboratory Data Consultants
PG	Professional Geologist
QAM	Quality Assurance Manager
RBA	Richard Brady & Associates
SCAPS	Site Characterization Analysis Penetrometer System

5.0 SAP WORKSHEET #5 – PROJECT ORGANIZATIONAL CHART



6.0 SAP WORKSHEET #6 – COMMUNICATION PATHWAYS

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
SAP Addendum	RBA PM	Don McHugh	858.634.4550 dmchugh@rbrady.net	RBA PM will review the SAP on an annual basis, in accordance with EWI #2, in order to determine if a revision or an amendment is required.
Lab Coordination	RBA QAM	Jesse MacNeill	858.634.4549 jmacneill@rbrady.net	RBA QAM will coordinate analytical laboratory services for the project. The selected laboratory will be certified by the California Department of Health Services Environmental Laboratory Accreditation Program for analysis of hazardous materials for each method specified in this SAP, and have received approval from the Naval Facilities Engineering Service Center in accordance with NAVFAC SW EWI #3.
Field Audit	RBA QAM	Jesse MacNeill	858.634.4549 jmacneill@rbrady.net	RBA QAM may conduct a field audit during project fieldwork. Audit results are maintained in RBA's project and QA files. Any issues requiring corrective action will be documented and assigned an appropriate response period.
Field & Analytical Corrective Actions	RBA PM RBA QAM	Don McHugh Jesse MacNeill	858.634.4550 dmchugh@rbrady.net 858.634.4549 jmacneill@rbrady.net	RBA PM will address all field corrective actions that result from field audits or field documentation reviews. RBA QAM will address all analytical corrective actions that result from a review of analytical results and lab reports. All corrective action forms will be maintained in the RBA project file.

Table Continues

SAP WORKSHEET #6 – COMMUNICATION PATHWAYS -- CONTINUED

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
FCN	RBA PM	Don McHugh	858.634.4550 dmchugh@rbrady.net	RBA PM will document any minor deviation from the SAP by notifying the RBA QAM and Program Manager by phone and e-mail within 24 hours and will submit a FCN within 48 hours. All completed FCNs will be included as an appendix in final report.
Release of Analytical Data	RBA QAM RBA DM	Jesse MacNeill Jim Pierce	858.634.4549 jmacneill@rbrady.net 858.634.4551 jpierce@rbrady.net	RBA QAM and DM will control access to the project database to ensure data integrity. The release of any analytical data will be at the direction of the RBA PM. RBA DM will manage the environmental data and submittals in accordance with NAVFAC SW EWI #6.
Stop Work	RBA QAM RBA PM RBA HSO NAVFAC SW RPM NAVFAC SW QAO	Jesse MacNeill Don McHugh Craig Haverstick Jennifer Sullivan Narciso Ancog	858.634.4549 jmacneill@rbrady.net 858.634.4550 dmchugh@rbrady.net 619.571.4178 chaverstick@rbrady.net 619.532.3868 jennifer.a.sullivan1@navy.mil 619.532.3046 narciso.ancog@navy.mil	RBA QAM, RBA PM, RBA HSO, NAVFAC SW RPM, or NAVFAC SW QAO may stop work in response to any serious quality- or safety-related issue if warranted. In this case, the issue and proposed corrective action will be documented with planned timing for implementation. The Stop Work Notice will be submitted to the NAVFAC SW QAO and RPM by e-mail within 24 hours.

Acronyms:

EWI	Environmental Work Instruction
FCN	Field Change Notice
HSO	Health and Safety Officer
NAVFAC SW	Naval Facilities Engineering Command Southwest
QA	Quality Assurance
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
RBA	Richard Brady and Associates
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan
TSA	Technical Systems Audit

7.0 SAP WORKSHEET #7 – PERSONNEL RESPONSIBILITIES AND QUALIFICATIONS TABLE

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
Don McHugh	PM	RBA	Responsible for implementing all activities specified in the Delivery Order. Supervises preparation of the WP and SAP by the RBA team. Monitors field activities to ensure compliance with SAP.	
Jesse MacNeill	QAM	RBA	Responsible for ensuring RBA team's programmatic and project-specific compliance with QA policies generally, and this SAP specifically. Ensures SAP conforms to current NAVFAC SW and UFP QAPP requirements. Ensures RBA team maintains proper training, certification, and experience to execute project-specified tasking. Responsible for RBA's environmental quality, including oversight of environmental program to ensure compliance with Federal, State, and local regulatory requirements and with Department of Navy policy; development of project plans; coordination of laboratory and data validation services; review of project-specific requirements as outlined in SAPs; and support to RBA PMs.	
Tim Shields	Environmental Program Manager	RBA	Responsible for providing technical direction and field oversight to RBA staff during SAP development and in execution of fieldwork.	
Craig Haverstick	H&S Manager/On-Site Safety Officer	RBA	Responsible for implementing the Health and Safety Plan, determining appropriate site control measures, and identifying personal protection levels. Leads daily safety briefings for the RBA Team, subcontractor personnel, and site visitors.	

Table Continues

SAP WORKSHEET # 7 – PERSONNEL RESPONSIBILITIES AND QUALIFICATIONS TABLE – CONTINUED

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
Jim Pierce	DM	RBA	Responsible for developing, monitoring, and maintaining the project database under guidance of RBA PM and QA Manager. Ensures timely and accurate upload of project data to NEDD/NIRIS and /or GeoTracker. Works with the QA Manager to resolve sample identification issues during preparation of the SAP and geospatial data issues during fieldwork execution.	
Narciso Ancog	QAO	NAVFAC SW	The QAO provides government oversight of the QA program, including review and approval of SAPs. The QAO has the authority to suspend affected projects or site activities if NAVFAC SW-approved quality requirements are not maintained.	
Jennifer Sullivan	RPM	NAVFAC SW	The RPM is the Navy manager directly responsible for project execution and coordination with base representatives, regulatory agencies and the NAVFAC SW management team.	
Rina Kato	PM	EMAX Laboratories, Inc.	Responsible for delivering analytical services that meet the requirements of this SAP. Reviews and understands all analytical requirements of this SAP. Works with the RBA QAM to confirm sample delivery schedules and ensure performance according to specifications. Reviews the laboratory data package before it is delivered to the RBA QAM.	
Linda Rauto	Manager/ Chemist	LDC	Conducts independent third-party validation of analytical data received from laboratory. Assures the data end user of known and documented data quality.	

Acronyms:

DM	Database Manager
H&S	Health and Safety
LDC	Laboratory Data Consultants
NAVFAC SW	Naval Facilities Engineering Command Southwest
NEDD/NIRIS	Naval Electronic Data Deliverable/Naval Installation Restoration Information Solution
PM	Project Manager
QA	Quality Assurance
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
RBA	Richard Brady & Associates
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan
UFP-QAPP	Uniform Policy for Quality Assurance Project Plans
WP	Work Plan

8.0 SAP WORKSHEET #8 – SPECIAL PERSONNEL TRAINING REQUIREMENTS TABLE

No specialized training is required for this project.

The Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) training requirements, as described in Title 29 Code of Federal Regulations (CFR) §1910.120, apply to those persons conducting field work. The regulation states that all personnel involved in characterization or remediation of an uncontrolled hazardous waste site shall be required to have 40 hours of certified training and three days of supervised field experience. In compliance with Title 29 CFR §1910.120, RBA's Environmental Department protocol requires "general site workers," those individuals performing field activities such as collecting media samples, to have completed the appropriate OSHA HAZWOPER training course.

Personnel who are on site to perform occasional inspection and sampling activities and are unlikely to experience exposure over the permissible exposure limit and published exposure limits may be considered "workers on site only occasionally for a specific limited task." These workers must have 24 hours of training and one day of actual field experience. Employees who have minimal (low risk) exposure or low probability of exposure to hazardous substances are covered by other OSHA standards, such as the Hazard Communication standard, Title 29 CFR §1910.120.

All RBA site workers will be 40-hour trained and will meet the minimum standard for supervised field experience. In compliance with regulatory procedures related to training, at least one RBA supervisor having received the OSHA 8-hr Hazardous Waste Supervisor training will be on-site at all times. All RBA employees have been trained in first aid, cardiopulmonary resuscitation (CPR), and blood borne pathogen awareness. At least two RBA personnel properly trained and certified in adult first aid and CPR and trained in the blood borne pathogens will be assigned and on-site at all times work is being performed.
All drilling and sampling activities will be supervised by a professional geologist or professional civil engineer licensed in California. Drilling will be conducted by a C-57 licensed driller.

9.0 SAP WORKSHEET #9 – PROJECT SCOPING SESSION PARTICIPANTS SHEET

9.1 Internal Project Kickoff Meeting with NAVFAC SW, NAVWPNSTA Seal Beach, and Contractor Team

Project Name: **UST Site 229 Site Characterization** Projected Date(s) of Sampling: **January 2009** Project Manager: **Jennifer Sullivan, NAVFAC SW**	**Site Name:** **UST Site 229** Site Location: **NAVWPNSTA Seal Beach, CA**
Date of Session: 22 August 2008 **Scoping Session Purpose: Internal Project Kickoff Meeting with NAVFAC and Contractor Team**	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Jennifer Sullivan	RPM	NAVFAC SW	619.532.3868	jennifer.a.sullivan1@navy.mil	RPM
Pei-Fen Tamashiro	IRP Coordinator	NAVWPNSTA Seal Beach	562.626.7897	pei-fen.tamashiro@navy.mil	POC
Paul Nguyen	POC	NAVWPNSTA Seal Beach	562.626.7655	Paul.d.nguyen@navy.mil	POC
Tim Shields	Program Manager	RBA	858.634.4514	tshields@rbrady.net	Program Manager
Don McHugh	PG	RBA	858.634.4550	dmchugh@rbrady.net	Project Manager

9.1.1 Comments/Decisions

Team developed preliminary technical strategy for the project and visited the site. The Team discussed the need for a separate planning meeting with agency partners.

9.1.2 Action Items

Continue development of technical strategy and proceed with development of Draft Work Plan (WP) presentation to NAVFAC SW and NAVWPNSTA Seal Beach. Schedule tentative field operations dates with NAVFAC SW and NAVWPNSTA Seal Beach. Schedule a planning meeting with the agency partners.

9.2 Planning Meeting with California RWQCB-Santa Ana Region

Project Name: **UST Site 229 Site Characterization** Projected Date(s) of Sampling: **January 2009** Project Manager: **Jennifer Sullivan, NAVFAC SW**	**Site Name:** **UST Site 229** Site Location: **NAVWPNSTA Seal Beach, CA**
Date of Session: 09 September 2008 **Scoping Session Purpose:**	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Jennifer Sullivan	RPM	NAVFAC SW	619.532.3868	jennifer.a.sullivan1@navy.mil	RPM
Ellen Graubard	Physical Scientist	NAVFAC SW	619.532.1850	ellen.graubard@navy.mil	POC
Pei-Fen Tamashiro	IRP Coordinator	NAVWPNSTA Seal Beach	562.626.7897	pei-fen.tamashiro@navy.mil	POC
Patricia Hannon	POC	Water Board	951.782.4498	phannon@waterboards.ca.gov	POC
Stephen Niou	POC	DTSC	714.484.5458	sniou@dtsc.ca.gov	POC
Tim Shields	Program Manager	RBA	858.634.4514	tshields@rbrady.net	Program Manager
Don McHugh	PG	RBA	858.634.4550	dmchugh@rbrady.net	Project Manager

9.2.1 Comments/Decisions

9.2.2 Team developed preliminary technical strategy and schedule for the project. They discussed the exit strategy for the site and screening criteria. Action Items

The project team will propose a soil screening level (SSL) for the migration of naphthalene to groundwater to the Water Board.

10.0 SAP WORKSHEET #10 – PROBLEM DEFINITION

This worksheet provides the first of seven steps of the Data Quality Objectives (DQO) process as detailed by the U.S. EPA (U.S. EPA, 2006). The process is used to determine the type, quantity, and quality of the data necessary to support decision-making regarding current site conditions and future site management decisions.

Inherent in the development of DQOs is a systematic and logical approach intended to yield an efficient sampling design based on accepted levels of potential decision errors. The conceptual site model (CSM) is the basis for Step 1 of the DQO process. The following subsections provide a site description of UST Site 229 developed to formulate the CSM presented in the WP and summarized in Section 10.2.

10.1 Site Description and History

The NAVWPNSTA Seal Beach is located in the Northwest corner of Orange County, approximately 20 miles south of Los Angeles, California (Figure 1). Comprised of 5,256 acres, NAVWPNSTA Seal Beach is a Navy weapons and munitions loading, storage, and maintenance facility. NAVWPNSTA Seal Beach consists of 230 buildings and 128 ammunition magazines providing over 500,000 square feet of ammunition storage space. NAVWPNSTA Seal Beach has been operated by the Navy and its contractors since its inception in 1944. NAVWPNSTA Seal Beach is located in the City of Seal Beach. Nearby communities include the Cites of Huntington Beach, Westminster, Los Alamitos, and Garden Grove.

10.1.1 Historical Property Use and Operations

UST Site 229 is located southwest of the intersection of Industrial Road and Kitts Highway adjacent to the eastern edge of former Building 229 (Figure 2). The former UST tank pit consists of an area of approximately 200 square feet. Building 229 was demolished in the 1990s and no surface expression of the building remains. Building 229 was the office of the NAVWPNSTA Seal Beach Comptroller/Controller and was used for accounting functions. The USTs were reportedly used to fuel a boiler that provided heat for the building.

Two 10,000-gallon steel USTs that formerly stored diesel fuel were removed from the site in 1991 by Riedel Environmental Services, Inc., (RES) (RES, 1991). RES collected four soil samples from the UST excavation for analysis of total petroleum hydrocarbon quantified as diesel (TPH-d) by U.S. EPA Method 8015; and benzene, toluene, ethylbenzene, and xylenes (BTEX) by EPA Method 8020. The laboratory reported the following range of concentrations:

Analyte	Total Number of Samples	Number of Detections	Range of Concentrations
TPH-d	4	3	770 to 3,500 mg/kg
Benzene	4	1	43 µg/kg
Toluene	4	2	29 and 34 µg/kg
Ethylbenzene	4	1	560 µg/kg
Total xylenes	4	4	18 to 920 µg/kg

Acronyms:
mg/lg milligrams per kilogram
µg/kg micrograms per kilogram

Upon completion of the excavation, UST removal, and sampling activities, RES backfilled the excavation with fill material. The concrete anchor pad for the two USTs was left in-place at a depth of approximately 11 feet below ground surface (bgs). Based on the TPH-d and BTEX concentrations reported in soil samples from the UST excavation, RES recommended further investigation of NAVWPNSTA Seal Beach UST Site 229 (RES, 1991).

In 1992, Jacobs Engineering Group (JEG) conducted a UST Study Site Assessment at NAVWPNSTA Seal Beach UST Site 229 (JEG, 1993). This UST Site Assessment consisted of a geophysical survey, a screening level soil gas study consisting of the collection of five soil gas samples, the advancement of seven soil borings, and the conversion of three of seven soil borings to groundwater monitoring wells. Eleven soil samples were analyzed for TPH-extractable as diesel by EPA Method 8015 and BTEX by EPA Method 8020. Soil boring, soil sampling points, and groundwater monitoring well locations are depicted on Figure 3. Five soil gas samples were analyzed for TPH by an unspecified method; and three groundwater samples collected from monitoring wells MW-1, MW-4, and MW-5 were analyzed for TPH-extractable as diesel by EPA Method 8015 and BTEX by EPA Method 8020 (JEG, 1993).

Hydrocarbon concentrations were not reported in any of the five soil gas samples. However, residual petroleum product was visible on temporary soil gas probes V-1 and V-4 upon removal of the probes (which were installed above the water table) indicating product had migrated away from the UST location (Figure 3).

Benzene and toluene were not reported in any of the 11 soil samples analyzed during the JEG assessment. Ethylbenezene and total xylenes were reported in the 11 foot bgs sample in soil boring MW1 at concentrations of 230 and 170 µg/kg, respectively (Figure 3). TPH-extractable as diesel was reported in 5 of the 11 soil samples analyzed with concentrations ranging from 53 mg/kg in the 5.5 foot bgs sample from MW3, to 2,600 mg/kg in the 11 foot bgs sample from MW4. TPH-extractable as diesel was also reported in soil samples collected from 8.5 feet bgs in soil borings SB6 and SB7 (Figure 3).

Soil borings MW1, MW4, and MW5 were advanced to a depth of 28 feet bgs and were converted to groundwater monitoring wells (Figure 3). Groundwater was encountered at approximately 8.5 feet bgs in each of the three monitoring wells which were generally screened from 5 to 28 ft bgs to the total depth drilled of 28 feet. The three monitoring wells were developed and sampled. TPH-extractable as diesel and BTEX were not reported in any of the three groundwater samples collected at NAVWPNSTA Seal Beach UST Site 229 (JEG, 1993).

JEG concluded that free product potentially exists on the groundwater above the in-place anchor pad from the former two 10,000-gallon USTs. In addition, JEG concluded that hydrocarbons in groundwater appeared to be confined within approximately 10 feet north of the former excavation, and the soil was impacted with hydrocarbons above the groundwater in the former excavation and approximately 25 feet northwest of the excavation beyond soil boring SB6 and monitoring well MW4 (Figure 3). JEG recommended that hydrocarbon impacted soil be removed and remediated, and that any free product be removed during excavation activities (JEG, 1993). At the conclusion of the JEG site assessment all three groundwater monitoring wells were properly destroyed.

No other additional work was conducted at the site after 1993 due to an experimental bioremediation study conducted at IR Site 14, located directly to the east of UST Site 229. To quantify degradation processes, the experimental study at IR Site 14 was conducted under controlled conditions. Given the close proximity of UST Site 229 to the bioremediation study area (approximately 100 feet), it would be reasonable to suspend investigation activities at UST 229 to prevent introducing additional potential factors that could compromise the study. The investigators of the study at IR Site 14 requested that no intrusive work be conducted at UST 229 during the bioremediation study. Additionally, IR Site 14 was recently granted no further action (NFA) status based on an assessment and ecological risk screening conducted by MARRS Services, Inc. The ecological risk assessment was conducted because IR Site 14 is located directly adjacent to the Seal Beach National Wildlife Refuge (MARRS, 2007). Groundwater isocontours for benzene and methyl tertiary butyl ether (MTBE) and the locations of UST Site 229, IR Site 14, and the Seal Beach National Wildlife Refuge are depicted on Figure 4.

On May 31, 2007, the Water Board issued *"Information Request for Underground Storage tank Site 229, U.S. Naval Weapons Station Seal Beach, Geotracker ID: T0605901373"* requesting any additional information pertaining to additional studies or remedial activities at UST Site 229. The letter also requested the above referenced information and a Work Plan for the site by July 31, 2007 however, based on funding prioritization, the investigation was delayed. (RWQCB, 2007).

In August 2008, NAVFAC SW authorized RBA through Shaw to complete a Site Characterization of NAVWPNSTA Seal Beach UST Site 229 using SCAPS. This Work Plan is designed to address the RWQCB's request and to investigation the site for further action.

10.1.2 Land Use

Since NAVWPNSTA Seal Beach was first commissioned in 1944, land use at the facility has been for weapons and munitions loading, storage, and maintenance. Prior to 1962 it was known as the Naval Ammunition and Net Depot and was used to service anti-submarine nets used to protect fleet bases and anchorages around the world. NAVWPNSTA Seal Beach has evolved into the Navy's primary West Coast ordinance storage, loading, and maintenance facility. All current facility operations are industrial, and the Navy's proposed future use for the entire facility will remain industrial, with controlled access restricted to authorized badged personnel.

As discussed above, former Building 229 was the offices of the NAVWPNSTA Seal Beach Comptroller/Controller and was used for accounting functions. The two former 10,000-gallon USTs were used to fuel a boiler that provided heat for former Building 229. In the Kickoff meeting for this project, held August 22, 2008 at NAVWPNSTA Seal Beach, the team discussed that the currently vacant and unpaved site is not planned for redevelopment. In addition, any potential site redevelopment would be industrial (RBA, 2008).

10.2 Conceptual Site Model

The initial CSM for the NAVWPNSTA Seal Beach UST Site 229 study area was compiled from historical research, site visits, and available hydrogeological and chemical data from previous investigations. A more refined CSM will be developed based on the results of this investigation. The initial CSM is presented in the following sections.

10.2.1 Potential Sources and Contaminants

A release of diesel fuel related to the former operations of the two 10,000-gallon USTs occurred within a limited area of the site. The area appears limited to the immediate vicinity of the former UST excavation. A three-dimensional depiction of the CSM is shown on Figure 5.

10.2.2 Pathways

The primary pathway for contaminant migration in the current CSM is infiltration of diesel in the vadose zone soil extending downward to groundwater. Free product is potentially present on the groundwater in the immediate vicinity of the former UST excavation. Dissolved-phase fuel has the potential to migrate away from the source area in the down-gradient direction, presumed to be towards the southeast.

10.2.3 Receptors

Shallow groundwater resources in the immediate vicinity of the former tank excavation are a potential receptor. No other current complete pathways have been identified for diesel to reach human or ecological receptors. The nearest edge of the Seal Beach National Wildlife Refuge to the site is located approximately 400 feet east southeast of the center of the former UST excavation at UST Site 229.

10.3 Step 1 – State the Problem

Laboratory analysis of soil samples collected from the former UST excavation and the area north and northwest of the former excavation in 1991 and 1992 indicates the release of diesel fuel.

The soil data suggests that the residual fuel contamination has likely caused a dissolved-phase impact to groundwater. Although TPH-extractable as diesel and BTEX were not reported in any of the three groundwater samples collected in 1992, the present nature (*i.e.* concentrations of fuel constituents relative to action levels protective of human health and the environment), extent, and stability (*i.e.* migration, if any) of the dissolved phase plume is not known.

Because nature, extent and stability of the plume are presently unknown, a decision whether or not a corrective action is warranted cannot be made with certainty. This investigation is designed to collect enough data to determine if corrective action is warranted.

11.0 SAP WORKSHEET #11 – PROJECT QUALITY OBJECTIVES/ SYSTEMATIC PLANNING PROCESS STATEMENTS

This worksheet includes steps 2 through 7 of the DQO process as detailed by the U.S. EPA (U.S. EPA, 2006). The process is used to determine the type, quantity, and quality of the data necessary to support decision-making regarding current site conditions and future site management decisions.

Inherent in the development of DQOs is a systematic and logical approach intended to yield an efficient sampling design based on accepted levels of potential decision errors. The following subsections provide the primary study goal of the proposed investigation, the information inputs, and analytical approach that will be used to achieve the study goal, as well as the performance criteria that will be used to assure that the data used to make project decisions is of sufficient quality.

11.1 Step 2 – Identify the Goals of the Study

Primary Goal: Determine if remedial action is required.

The primary goal will be achieved based on the answers to the following decision questions:

1. Is corrective action regarding free-phase petroleum hydrocarbons required?
2. Is corrective action regarding petroleum contamination of soil required?
3. Do groundwater samples need to be analyzed for MTBE?
4. Is corrective action regarding dissolved fuel-related constituents in groundwater required?

11.2 Step 3 – Identify Information Inputs

Inputs to project decisions include:

- Project action limits (Worksheet #15) (Also referred to as project screening criteria throughout this document.) ,
- decisions made in stakeholder planning meetings (Worksheet #9),
- information from historical record review,
- interviews and site reconnaissance; and
- existing soil and groundwater data.

Existing data inputs include:

- The UST Closure Report (RES, 1991) identifying the location of the diesel fuel release.
- The Site Assessment (JEG, 1993) presenting the soil, soil gas, and groundwater data for the site.

- Leaking Underground Fuel Tank (LUFT) Manual guidance for soil action levels.
- Maximum Contaminant Level (MCLs) for groundwater, which are project screening criteria.

New data inputs will consist of:

- SCAPS laser induced fluorescence (LIF) data and validated fixed-base laboratory analysis of soil samples.
- Validated fixed-base laboratory analytical from groundwater sampling of temporary and/or permanent monitoring wells located:
    - Adjacent to the buried concrete anchor pad for the former USTs
    - Up-gradient from the source area
    - At two locations down-gradient from the source area
- Free product measurements during groundwater sampling.

11.3 Step 4 – Define the Boundaries of the Study

The preliminary boundary for this investigation was developed based on a review of historical data from previous investigations. The preliminary vertical boundary is based on the data from the Site Assessment (JEG, 1993) suggesting a maximum depth of petroleum hydrocarbon impact at 11 feet bgs, the inferred depth of the left in-place concrete anchor pad. The final vertical boundary will be based on LIF data and will place the bottom of the small diameter groundwater monitoring wells at 5 to 10 feet below the water table elevation measured during the groundwater screening activities, or 18 feet bgs, whichever is deeper. Depth to groundwater is currently inferred to be approximately 11 feet bgs at the source area, and the vertical boundary is expected to be approximately 30 feet bgs at the source area.

The preliminary horizontal boundary has been determined based on previous field observations and laboratory analysis of soil samples. As indicated by the CSM, contamination at UST Site 229 is expected to be concentrated in the area of the former UST excavation.

The actual horizontal boundary will be determined by screening with SCAPS LIF and by collecting groundwater samples from temporary and/or permanent wells for TPH-d, BTEX, naphthalene and polycyclic aromatic hydrocarbons (PAH) analyses. Decision rules will be used to position the groundwater monitoring wells based on the LIF and soil analytical data. The potential SCAPS LIF locations are shown on Figure 4, the soil and groundwater decision trees are provided as Figures 7 and 8, respectively.

The SCAPS Investigation will proceed by pushing the LIF probe at the site. The LIF probe will initially be pushed to a minimum depth of 30 feet bgs at each location. The depth will yield continuous LIF and cone penetrometer test (CPT) data through approximately 19 feet of groundwater saturated lithology. The real-time LIF results will be distributed via daily field reports. The field team in coordination with DQO planning team will then add locations increase certainty regarding the extent of the free phase fuel product.

The following decision rules will apply to the dynamic work strategy of defining the lateral boundaries of the study.

Soils Investigation: Decision Rules to Define the Boundaries of the Study

- **If** elevated LIF intensity at a fuel-related wavelength at an intensity over 10,000 counts (which, in general, correlates to 0 – 100 parts per million TPH) is detected at a location, **then** petroleum contamination of soil is inferred, further study is recommended, and a new step-out LIF screening location will be selected and investigated during the initial deployment to determine the lateral extent of the plume.
- **If** elevated LIF intensity at a fuel-related wavelength is not detected at a location, **then** that location is outside of the screening-level boundary for petroleum contamination of soil, and the LIF screening investigation will proceed to an uninvestigated area of the plume during the initial deployment.
- **If**, based on LIF intensity, the lateral extent of petroleum contamination of soil is not considered defined by all of the proposed LIF locations shown on Figure 4, **then** the field team will identify additional LIF locations that will add resolution to the potential outer edge of the petroleum hydrocarbon plume. Additional LIF locations not previously cleared of utilities will be cleared prior to any subsurface work.
- **If**, based on LIF intensity, the lateral extent of petroleum contamination of soil is considered defined prior to the advancement of all proposed LIF locations shown on Figure 4, **then** the field team may eliminate proposed locations that are not required to determine lateral extent.
- **If**, based on LIF intensity the lateral extent of petroleum contamination of soil is considered defined, **then** the field team will propose soil sample locations for fixed-base laboratory analysis to confirm the boundary for petroleum contamination of soil. The LIF data and proposed soil sample locations will be distributed as a Field Memo to the Navy Project Team, and after the Navy's review and concurrence, to the Water Board point of contact (POC) with a request for concurrence to sample the proposed locations in accordance with this SAP. Five soil samples are planned, representing 10 percent of the anticipated maximum number of LIF screening locations. If more than 50 LIF screening locations are investigated, the number of samples for fixed-base laboratory analysis will be increased to be at least 10 percent of the LIF screening locations. Soil sampling is scheduled to occur during the initial deployment.

Schematic diagrams outlining the decision rules for the LIF and soil investigation are provided on Figure 6 and 7.

Groundwater Investigation: Decision Rules to Define the Boundaries of the Study

- **If** the lateral extent of petroleum contamination of soil is considered defined by pushes with LIF intensity counts below 10,000 which infers soil sample analytical results below project screening criteria (also referred to as project action limits (PALs) in Worksheet #15), **then** the field team will propose groundwater sample locations for fixed-base laboratory analysis to determine the boundary for petroleum contamination of groundwater. The field team will propose either temporary or permanent wells positioned with one located upgradient, one in the location of the highest LIF fluorescence (anticipated to be adjacent to the concrete anchor pad of the former UST), and two located downgradient, to evaluate the presence or absence of free-phase product and for groundwater sampling. If temporary wells are proposed, they may be installed and sampled either during the initial deployment or during a subsequent deployment. If permanent wells are proposed, they will be installed and sampled during a subsequent deployment. The proposed groundwater sample locations will be distributed as a Field Memo to the Navy Project Team, and after the Navy's review and concurrence, to the Water Board POC with a request for concurrence to sample the proposed locations in accordance with this SAP.
- **If** the fixed-base laboratory analysis of a groundwater sample from an upgradient or downgradient well reports concentrations of fuel-related BTEX, naphthalene and PAHs above ESLs, **then** further study is recommended and a new step-out groundwater sampling location will be proposed for investigation during a subsequent deployment to determine the lateral extent of the plume. The proposed groundwater sample locations will be distributed as a Field Memo to the Navy, and after the Navy's review and concurrence, to the Water Board POC with a request for concurrence to sample the proposed locations in accordance with this SAP.

A schematic diagram outlining the groundwater decision rules is provided in Figure 8.

The temporal boundary of the field investigation is defined by the completion of the of groundwater sampling. Although the funding for the groundwater sampling is currently not available, this SAP includes the planning for all sampling events so they can be executed as quickly and efficiently as possible as funding becomes available. When funding for the groundwater sampling becomes available, this SAP will be reviewed to determine if an addendum is necessary.

11.4 Step 5 – Develop the Analytical Approach

To assess impacts to soil and groundwater and establish the baseline quality of groundwater, screening activities will be performed to determine the locations of temporary monitoring wells. Field screening will be conducted as follows:

Analyte	Screening Method
Petroleum, Oils, and Lubricants in soil	SCAPS LIF (qualitative)

SCAPS LIF data will be reported as qualitative to semi-quantitative fluorescence intensity, and will not provide concentration data. SCAPS LIF data will be used to optimize soil sampling depths as noted in Worksheet #18. These soil samples are being collected and analyzed for the purpose of calculating the amount of contamination left in place and to confirm SCAPS LIF data in the event that a recommendation for site closure with no further action is made at the completion of this investigation.

Soil and groundwater collected from the site will be analyzed by a fixed-base laboratory for fuel-related constituents as follows:

Analyte	Analytical Method
Volatile organic compounds (VOC) in soil and groundwater	USEPA Method 8260B (BTEX & Naphthalene only)
VOC in groundwater (if supported by decision rule below)	USEPA Method 8260B (BTEX, Naphthalene & MTBE only)
(TPH-d	USEPA Method 8015 Modified
PAHs	USEPA Method 8270C-SIM

All groundwater samples will be collected using the methods described in Worksheets # 14 & 18 of this SAP.

Based on the analytical approach, the following decision rules addressing Step 2 Decision Questions 1 through 4 are proposed:

1. **If** free-phase petroleum hydrocarbons are measured or observed to be present at any level in a groundwater monitoring well, **then** corrective action will be recommended, otherwise NFA regarding free-phase petroleum hydrocarbons will be recommended.
2. **If** the former diesel fuel release area is bounded by SCAPS LIF locations with LIF intensity counts below 10,000, and the boundary is confirmed by soil sample data from the fixed-base laboratory reporting concentrations of fuel-related constituents below project screening criteria (Worksheet #15), **then** a recommendation of NFA regarding petroleum contamination of soil will be made for all areas outside the boundary, and the area within the boundary may require corrective action if the soil is causing a need for corrective action of groundwater, as determined in decision rules 4a through 4d and in Figures 6, 7, and 8.
3. **If** the validated fixed-base laboratory analysis by EPA Method 8260B of groundwater from a sampling event (from either temporary or permanent groundwater monitoring wells) reports concentrations of BTEX or naphthalene greater than the project screening criteria (Worksheet #15), **then,** per agreement at Planning Meeting with California RWQCB (Worksheet #9), analyses of

groundwater by EPA Method 8260B reporting also MTBE will be recommended for subsequent groundwater sampling events.

4a. **If** validated fixed-base laboratory analysis from the first groundwater sampling event of four temporary or permanent groundwater monitoring wells, positioned with one located upgradient, one in the location of the highest LIF fluorescence, and two located downgradient, reports concentrations of fuel-related constituents below project screening criteria (Worksheet #15), **then** NFA related to UST Site 229 will be recommended.

4b. **If** validated fixed-base laboratory analysis from the first groundwater sampling event of four temporary or permanent groundwater monitoring wells, positioned with one located upgradient, one in the location of the highest LIF fluorescence, and two located downgradient, reports any concentrations of fuel-related constituents above project screening criteria (Worksheet #15), **then** four quarters of sampling from permanent groundwater monitoring wells will be recommended to evaluate plume stability.

4c. Based on the LIF fluorescence results, four permanent groundwater monitoring wells will be installed, with one located upgradient, one in the location of the highest fluorescence, and two located downgradient. Groundwater monitoring will be conducted quarterly for one year. Chain of custody (COC) concentrations and groundwater elevations over time for each groundwater monitoring well will be plotted to evaluate the stability of the COCs in groundwater. **If** concentrations of fuel-related constituents detected above the MCLs are stable or decreasing or are below the Project Screening Criteria, **then** NFA will be recommended.

4d. **If** validated fixed-base laboratory analysis from four quarterly groundwater sampling events of four permanent groundwater monitoring wells, positioned with one located upgradient, one in the location of the highest LIF fluorescence, and two located downgradient, reports concentrations of fuel-related constituents are increasing, **then** additional investigation or corrective action will be recommended.

Primary Goal: If the nature and extent of the fuel release has been defined by the preceding decision rules, and the plume is stable or decreasing, **then** a recommendation will be made for site closure with NFA, otherwise recommendations for further action will be made based on the revised CSM.

11.5 Step 6 – Specify Performance or Acceptance Criteria

There are two types of decision errors: sampling design errors and measurement errors. Sampling design errors are a function of the selection of sample locations or analytical methods used to characterize the site to be studied. Measurement errors are a function of the procedures used to collect and analyze the samples.

In sampling designs that use a statistical approach to evaluate the data using decision rules, numerical limits on allowable error can be set and controlled by the sampling design (e.g., the number of samples). The use of classical statistics for this project would require a significant number of sampling locations to systematically examine the area potentially affected by the identified release. In this case, the source of the release and type of compounds of potential concern from that specific release has been identified, reducing the necessity for statistically derived broad-based plume mapping and constituent analysis.

In sampling designs that base the conclusions on the judgment of the decision makers, decision errors are reduced by subjective definition of the factual basis for the judgment. Based on the initial CSM for the site, the proposed sampling design is a fundamentally judgmental approach.

Measurement errors that arise during the various steps of the sample-measurement process (e.g., sample collection, sample handling, sample preparation, sample analysis, data reduction, and data handling) are possible regardless of the sampling design. Neither measurement errors nor variability can be eliminated, but they can be controlled by selecting appropriate procedures. The analytical methods and method reporting limits for soil and groundwater samples are listed in Worksheet 15.

Measurement error is further managed by using standard operating procedures (SOPs) and data quality management. Attachment 2 of this SAP presents SOPs that will be followed to minimize and control measurement error.

Decision uncertainty is managed by increasing the density of sampling points, especially in areas where there is high uncertainty about the correctness of a decision. This is cost-effectively accomplished by using tools such as the SCAPS LIF and CPT to build a detailed CSM in near real-time. By collecting and analyzing data in near real-time, critical data gaps are identified and filled, an accurate and complete CSM is developed, and field mobilizations and work plan cycles are reduced.

Table 11-1 presents possible decision error, identifies associated consequences, and addresses related uncertainties. The most severe error in judgmental sampling would be to conclude that action is not required when, in reality, an unacceptable risk to human-health risk and/or the environment exists. The judgmental sampling approach is designed to limit the probability of this error.

Table 11-1 Possible Decision Error

Possible Error	Associated Consequences	Uncertainty
Concluding that fuel constituents are present at a depth or in groundwater when it is not present.	Investigating or cleaning up a non-impacted site.	Low: Sufficient number of samples will be collected to differentiate "false positive" areas. See Decision Rules.
Concluding that fuel constituents are not present at a depth or in groundwater when it is present.	Not investigating or cleaning an impacted site.	Low: A sufficient number of locations will be screened, and then a sufficient number monitoring wells will be installed to define the plume. Quarterly sampling of the wells will resolve temporal uncertainty. See Decision Rules.

Decision uncertainty will be managed by specific targeting of initial sampling points, especially in areas where there is high uncertainty about the correctness of a decision. This is cost-effectively accomplished by targeting appropriate and discrete intervals and analytical methods, and using computer modeling capabilities to display integrated lithologic and contaminant data to build out a detailed CSM during the field deployment. By compiling and modeling data while still in the field, critical data gaps will be identified and filled, an accurate and complete CSM developed from supplemental sampling locations, and all critical data required to answer data quality objectives will be collected within one WP/field sampling/reporting cycle.

11.6 Step 7 – Develop the Detailed Plan for Obtaining Data

This investigation was designed using chemical and hydrogeologic data from previous investigations in the study area, and information from discussions with Navy and regulatory agency representatives. This investigation involves the collection of additional soil and groundwater samples for chemical analysis to determine the nature and extent of petroleum hydrocarbon impacts found at UST Site 229 during previous investigations. The new data from this investigation, along with the data from previous investigations, will be used to characterize the nature and extent of TPH-d, BTEX, Naphthalene, PAHs and, if applicable, MTBE.

This investigation is designed to use field methods, specifically SCAPS LIF, to delineate the nature and extent of petroleum hydrocarbon impacts to soil at UST Site 229. SCAPS LIF and CPT real-time data will be interpreted to identify the presence of petroleum hydrocarbons in the subsurface. Potential SCAPS LIF pushes locations are depicted on Figure 4. The LIF investigation will begin adjacent to the buried concrete anchor pad at the former UST location, and proceed at step-out locations using the decision rules in the SAP Worksheet #11.

Five soil samples, representing 10 percent of the SCAPS LIF locations, are planned to be collected for fixed-based laboratory analysis to address decision rule number 2. The soil samples are being collected and analyzed to evaluate SCAPS LIF data, to confirm the boundary of petroleum-contaminated soil (decision rule #2) and to estimate the mass of petroleum hydrocarbons left in place for input in the CSM. Soil samples will be collected at depths presented in Worksheet #18 for chemical analysis for TPH-d, BTEX, naphthalene and PAHs by a fixed-based analytical laboratory. Based on the LIF data, one soil sample will be proposed from the depth interval of the highest site-wide fluorescence. A second soil sample will be proposed from a depth interval of background fluorescence directly above sample with the highest fluorescence. A third soil sample will be proposed from an area where background fluorescence is measured through the entire push interval, (from a depth corresponding to the highest fuel fluorescence at an adjacent push location). Other soil samples will be proposed by SCAPS Field Team on judgmental basis with input from the DQO Planning Team. The LIF data and proposed soil sample locations will be distributed as a Field Memo to the Navy Project Team, and after the Navy's review and concurrence, to the Water Board POC with a request for concurrence to sample the proposed locations.

Groundwater samples will be collected to evaluate potential dissolved phase groundwater plumes at UST Site 229. The groundwater sampling may occur during a second field deployment to be scheduled by the Navy Remedial Project Manager (RPM). Groundwater samples will be collected for fixed-based laboratory analysis to evaluate site groundwater conditions. Groundwater samples may be collected from either temporary or permanent groundwater monitoring wells. Groundwater sampling locations will be optimized by the LIF data, and proposed groundwater sample locations will be distributed as a Field Memo to the Navy Project Team, and after the Navy's review and concurrence, to the Water Board POC with a request for concurrence to sample the proposed locations in accordance with the SAP (Appendix A). Decision rules regarding groundwater sampling are presented in the SAP Worksheet #11.

Data from LIF investigation will be used to position the small diameter monitoring wells just outside of the dissolved-phase plume in accordance with the decision rule in Step 4 above, thereby assuring that they will serve as useful down-gradient sentry wells and up-gradient background water quality wells.

The initial deployment is scoped only for SCAPS LIF and soil sampling. If the SCAPS LIF and soil sampling is completed under schedule, SCAPS may collect groundwater samples from temporary monitoring wells during the initial deployment. Otherwise, groundwater sampling will occur during a subsequent investigation using temporary and/or permanent monitoring wells to be scheduled by the Navy RPM.

For temporary monitoring wells, small diameter (¾-inch) 0.010-inch slotted well screen with a downhole pre-packed filter pack will be used (if subsurface conditions permit) in order to minimize the inclusion of contaminated soil in the water sample. Permanent monitoring wells will be installed with conventional rotary drilling equipment installing 2-inch poly-vinyl chloride (PVC) well casing to approximately 20 feet bgs.

Groundwater levels will be measured in each small diameter wells. An optical transit will be used to measure relative elevations to top of casings, and groundwater gradient and flow direction will be calculated in the field.

Representative groundwater samples will be collected from each well after completion using low flow methods described in Worksheet #14 and SOP T-002 (Attachment 2) for analysis of the same hydrocarbon based compounds at a fixed analytical laboratory. Groundwater samples for VOC analysis will be collected first using a bladder pump, and groundwater samples collected for TPH-d and PAH analyses will be collected last using a bladder or peristaltic pump. All soil and groundwater samples for off-site analysis will be handled in accordance with Worksheet #27.

12.0 SAP WORKSHEET #12 – MEASUREMENT PERFORMANCE CRITERIA

12.1 Measurement Performance Criteria Table – Field QC Samples (Water)

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Equipment Rinsate (Equipment Blank) (Rinsate Blank)	BTEX, Naphthalene, MTBE[a], TPH as diesel, PAH	1/day	Sensitivity/ Contamination (Accuracy/Bias)	Detections < QLs (Worksheet #15)	S
Field Duplicate	BTEX, Naphthalene, MTBE[a], TPH as diesel, PAHs	1/10 groundwater samples	Precision	RPD (Table 1)	S
Source Water Blank (Field Blank)	BTEX, Naphthalene, MTBE[a], TPH as diesel, PAHs	1/sampling event or source of water used for the final decontamination rinse	Sensitivity/ Contamination (Accuracy/Bias)	Detections < QLs (Worksheet #15)	S
Temperature Blank	BTEX, Naphthalene, MTBE[a], TPH as diesel, PAHs	1/shipping container	Representativeness	4°C (± 2°C)	S

Notes & Acronyms:
[a] If fixed-base laboratory analytical results from groundwater sampling exceed project screening criteria (PALs in Worksheet #15), then subsequent rounds of groundwater sampling may include the analysis of samples for MTBE by 8260B.

BTEX	benzene, toluene, ethylbenzene, and xylene	QC	quality control
˚C	degrees Celsius	QL	quantitation limit
MTBE	methyl tert-butyl ether	RPD	relative percent difference
PAH	polycyclic aromatic hydrocarbons	TPH	total petroleum hydrocarbon

12.2 Measurement Performance Criteria Table – Field QC Samples (Soil)

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
MS/MSD[1]	BTEX, Naphthalene, TPH as diesel, PAHs	1/20 soil samples	Interferences – Accuracy/Bias – Precision	%R / RPD (Table 1)	S&A

Notes & Acronyms:
[1] Matrix spike and matrix spike duplicate samples are considered lab QC samples, but are included here because they are collected in the field.

BTEX	benzene, toluene, ethylbenzene, and xylene
˚C	degrees Celsius
MS/MSS	matrix spike/matrix spike duplicate
PAH	polycyclic aromatic hydrocarbons
QC	quality control
QL	quantitation limit
RPD	relative percent difference
TPH	total petroleum hydrocarbon

13.0 SAP WORKSHEET #13 – SECONDARY DATA CRITERIA AND LIMITATIONS TABLE

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation / collection dates)	How Data Will Be Used	Limitations on Data Use
UST Removal Information, Soil Characterization data	Riedel Environmental Services, Inc.; Underground Storage Tank Closure Report, Naval Weapons Station, Seal Beach, California. July 1991	Soil Sampling; Collection Date: 1991.	A starting point to guide the investigation.	Analytical data was not validated.
Soil, Soil Gas, and Groundwater Characterization data	Jacobs Engineering Group, Inc., Underground Storage Tank Studies Site Assessment Report, Naval Weapons Station, Seal Beach, California, April 30, 1993	Soil, Soil Gas, and Groundwater Sampling; Collection Date: July 1992	A starting point to guide the investigation.	Analytical data was not validated.

Acronyms:
UST Underground Storage Tank

14.0 SAP WORKSHEET #14 – SUMMARY OF PROJECT TASKS

The scope of work for this project includes an initial phase of SCAPS LIF Investigation in which SCAPS will be deployed for 5 days to collect CPT/LIF data using dynamic work strategies, and to collect soil samples. If the schedule permits, groundwater samples may be collected during this initial SCAPS phase, otherwise, groundwater samples will be collected during a subsequent phase to be scheduled by the Navy RPM. This worksheet summarizes the tasks that will be performed as part of this investigation. SOPs for pertinent tasks are presented in Attachment 2.

14.1 Coordination and Notification

RBA will inform the Orange County Health Care Agency of the number and location of soil borings and well installations. A Subsurface Permits form shall be submitted to the Public Works Department of the NAVWPNSTA Seal Beach at least three weeks prior to any intrusive work at the station. Fieldwork will not proceed until an approved form is received. A copy of the approved form will be on hand during all field investigation activities.

14.2 Utility Clearance

Underground utility clearance will be coordinated through the Field Engineering Acquisition Department, and completed for each subsurface investigation location. The entire area within a 6-foot radius of each proposed subsurface sampling location will be cleared using the following protocol:

- Mark the proposed direct-push locations and the utility lines in the immediate vicinity using color-coded surveyor paint.
- Coordinate utility-locating activities with the utility locator service.
- Coordinate utility-locating activities with the Public Works Department.
- Coordinate utility-locating activities with Underground Service Alert.
- Use geophysical equipment and pipe locating procedures to ensure underground obstruction clearance.

Wherever possible, a transmitter/receiver unit will be attached to the exposed pipe or utility to trace metallic pipes or utilities that are either indicated on base utility maps or obvious via surface expression. The location of the utility will be marked on the ground using color-coded surveyor paint.

If a utility is identified within 3 feet of the proposed sampling/drilling location, the sampling/drilling point will be moved and the clearance procedures will be repeated.

14.3 SCAPS Investigation

14.3.1 CPT

Lithologic data will be collected using a CPT probe. The CPT is an instrumented probe that measures the tip resistance and sleeve friction of the probe penetration. Data for tip resistance and sleeve friction are simultaneously recorded in units of tons per square foot at approximately 1-inch vertical intervals. The data processing unit calculates the friction ratio (the ratio of sleeve friction to cone resistance) and then the friction ratio and tip resistance values are mapped to corresponding standardized soil behavior classifications using Robertson and Campanella's method (1988), providing continuous, real-time profiling of the subsurface lithology.

14.3.2 LIF

SCAPS uses a CPT probe with integrated LIF capabilities to detect subsurface petroleum hydrocarbons. SCAPS uses the LIF probe via the push-rod and probe fiber-optic cable system to detect relative subsurface soil Petroleum, Oil, and Lubricant (POL) concentrations. The LIF is advanced into the soils at the tip of case-hardened steel rods with a truck-mounted hydraulic ram assembly that generates the appropriate downward force to advance the probe into most types of unconsolidated soils. Probe wiring, fiber optic cable, and a grouting tube are run through a single umbilical cord at the center of the push rods from the probe directly to the analytical and support equipment located in the SCAPS truck.

As the LIF probe is pushed into the ground, laser light is transmitted via fiber optics within the rod-probe assembly. The laser light is transmitted to the soil through an optical window mounted in the side of the probe. As the laser light passes over the soil, the two-ring or greater polynuclear aromatics contained in the POL, if present, are induced to fluoresce at a specific wavelength. This fluorescence signal is carried back to the surface through a second optical fiber in the probe-rod assembly. The return signal is analyzed by a linear photodiode array spectrophotometer and recorded on the onboard computer. The LIF provides measurements of POL with a vertical resolution of approximately 2 inches as the probe is pushed into the ground at a rate of about 3 feet per minute.

As the probe is advanced, computer-generated real-time continuous logs of fluorescence intensity and wavelength are produced simultaneously with the CPT soil resistance, cone pressure and soil classification logs. Fluorescence intensity, wavelength logs, and spectral curves are used to evaluate the relative abundance of subsurface POL contaminants and to evaluate whether or not different types of POL are present.

14.3.3 Soil Sampling

Soil samples will be collected using 6-inch-long, stainless-steel or brass sleeves (Worksheet 18) and a direct-push drive sampling tool. Samples for VOC analysis will be immediately collected from the drive tube using three, 5-gram EnCore® devices in accordance with EPA Method 5035 and RBA SOP T-003 (Attachment 2). The stainless steel or brass sleeves will then either be capped at both ends with Teflon® swatches and polyurethane caps or the soil will be transferred into a glass jar with a Teflon® lined lid. Samples will be sent directly to the fixed-base lab for BTEX and Naphthalene, TPH-d and PAH analysis using EPA Methods 8260B, 8015M and 8270C-SIM, respectively. Fixed-base laboratory data will be submitted for third party data validation.

All direct-push data acquisition and sampling activities will be performed by experienced field personnel under the supervision of a California Professional Geologist (PG). The field staff will use their judgment to adjust the sampling depths or collect additional samples based on field observations of petroleum hydrocarbon impacts (mechanical, visual and/or olfactory) or changes in lithology. Lithologic descriptions of all the soil samples will be made in accordance with the Unified Soils Classification System (USCS); and descriptions of visible evidence of soil contamination (i.e., staining) and odor will be recorded on the location specific boring log and in the field notebook by the field staff during sampling activities.

14.4 Groundwater Sampling

If temporary groundwater monitoring wells are used for the first groundwater sampling event, small-diameter (¾-inch), direct push temporary wells will be installed at 4 locations to be determined based on the results of the SCAPS LIF Investigation using the decision rules in SAP Section 11.3 (DQO Step 4). Each temporary well will be constructed of manufacturer cleaned and wrapped, flush-threaded, 3/4-inch diameter, Schedule 40 PVC pipe with 10 ft of 0.010 slotted pipe placed to the bottom of the open test hole. A well screen with a down-hole pre-packed filter pack will be used (if subsurface conditions permit) in order to minimize the inclusion of contaminated soil in the water sample. Temporary direct push well installation will be conducted in accordance with the RBA SOP T-012 (Attachment 2).

If permanent groundwater monitoring wells are used (for initial or quarterly groundwater sampling as determined in decision rule 4b in SAP Section 11.4 (DQO Step 5), 2-inch-diameter groundwater monitoring wells will be installed with conventional rotary drilling equipment at locations to be determined based on the results of the SCAPS LIF Investigation using the decision rules in SAP Section 11.3 (DQO Step 4). Each monitoring well will be constructed of manufacturer cleaned and wrapped, flush-threaded, 2-inch diameter, Schedule 40 PVC pipe with 10 ft of 0.010 slotted pipe placed to the bottom of the open test hole. A filter pack will be installed. Monitoring well installation will be conducted in accordance with the RBA SOP T-004 (Attachment 2).

Screened intervals will likely be equal to or less than 10-feet and will target the upper portion of the saturated zone, capillary fringe, and some of the overlying vadose zone. Preliminary well construction logs will be completed in the field and well installation and sampling activities will be recorded in the field logbook.

All fluids and tools introduced into the subsurface will be free of petroleum-based materials including fuels, oils, grease, and/or solvents. Precipitation run-off will be prevented from entering the borehole during the investigation. Non-disposable field equipment will be decontaminated between sampling locations.

Depth to groundwater will be measured in each temporary well prior to collection of grab groundwater samples. The depth to groundwater will be measured using a Solinst water level indicator marked in 0.01-foot increments relative to a fixed point located at the top of each well casing. Well casing height above ground will also be recorded. These measurements will be recorded on the Low-Flow Well Purging Field Water Quality Measurements form (Attachment 1). The water level indicator will be decontaminated between wells in accordance with RBA SOP T-001.

Immediately following well installation and water level stabilization, all four monitoring wells will be micropurged with a QED Sample Pro portable low-flow bladder pump controlled by a MP15 Control/Power Pack, or equivalent. To assess stabilization, the groundwater depth, temperature, conductivity, dissolved oxygen (DO), turbidity, oxidation-reduction potential (ORP) and potential of hydrogen (pH) levels will be measured using a YSI multi-parameter meter with flow-through cell, or equivalent. Turbidity will be measured with a HF Scientific, Inc. Micro TPI portable turbidity meter, or equivalent. All wells will be purged until groundwater parameters stabilize, the well pumps dry, or three well volumes have been removed. Stabilization parameters will be recorded on the Low-Flow Well Purging Field Water Quality Measurements Form (Attachment 1) and in the field logbook. All down-hole purge equipment will be decontaminated between wells using RBA SOP T-001.

Groundwater samples will be collected from the wells in accordance RBA SOP T-002 for low-flow/low-stress sampling. Groundwater samples for VOC analysis will be collected first using a bladder pump; and groundwater samples collected for TPH-d and PAH analyses will be collected last using a bladder or peristaltic pump after the well has been adequately purged. Samples will be collected by directing the discharge from the sampling pump into the appropriate laboratory prepared and preserved sample containers. After sample collection, the containers will be labeled, prepared for shipment, placed in an insulated cooler with wet (double-bagged in re-sealable plastic bags) ice, and transported to the fixed-base laboratory. The groundwater samples will be analyzed for BTEX and naphthalene by EPA Method 8260B, TPH-diesel by EPA Method 8015 Modified and PAHs by EPA Method 8270C-SIM.

14.5 Quality Control Requirements

Quality Assurance (QA) is an integrated system of activities in the area of quality planning, assessment, and improvement to provide the project with a measurable assurance that the established standards of quality are met. Quality Control (QC) checks, including both field and laboratory, are specific operational techniques and activities used to fulfill the QA requirements. Worksheets #12 and #28 summarize the collection frequencies for the various field and laboratory QC samples, respectively.

14.5.1 Field Quality Control

The field QC samples will be assigned unique sample numbers and will be submitted blind to the analytical laboratory. If abnormalities are detected in field QC samples, the data associated with the QC samples will be flagged and appropriate actions will be taken to rectify issues.

14.5.2 Field Duplicate

Generally, one field duplicate sample would be collected for every 10 site samples. For groundwater, since only up to four locations are being sampled, only one duplicate sample will be collected. The duplicate sample will be collected by retaining a consecutive sample from the sampling device at one of the locations. Due to the large variability inherent in soils, a significantly large number of field duplicates would be necessary for an adequate assessment of sampling precision. Considering the limited number of confirmation samples planned, and the objectives of this investigation, there is greater value in the collection of additional site samples if needed. For this reason, field duplicate soil samples will not be collected during this investigation.

14.5.3 Equipment Rinsate Blanks

Equipment rinsate blanks will be collected daily during sampling to ensure that non-dedicated sampling devices have been decontaminated effectively. Equipment rinsate blanks will consist of the rinse water used in the final step of the decontamination procedure being poured over one of the pieces of sampling equipment, such as the stainless-steel pump, and into the sample containers. These samples may be collected at any time during the day after decontamination.

14.5.4 Source Blanks

Source blanks are collected to ensure that water used during decontamination is not a source of contamination. Source blank samples will be collected at a frequency of one for each source of water used for equipment rinsate blanks (for the duration of the sampling). If the source for decontamination water changes, additional source blank samples will be collected. To prepare source blanks, the sample containers will be filled with source water at the same time that it is used for decontamination.

14.5.5 Temperature Blanks

Temperature blank samples will accompany each cooler that contains samples with a temperature preservative requirement. The temperature blank will be prepared either by the analytical laboratory or the field sampling crew by filling volatile organic analytes (VOA) vials with de-ionized (DI) water. The temperature of the samples will be verified upon arrival at the analytical laboratory using the temperature blank.

14.5.6 Laboratory Quality Control

Laboratory QC is addressed through the analysis of laboratory QC samples, documented internal and external laboratory QC practices, and laboratory audits. The types of laboratory QC samples utilized will be project/chemical specific, but may include laboratory control samples, laboratory duplicates, matrix spikes (MSs), surrogate standards, internal standards, method blanks, and instrument blanks. MSs, matrix spike duplicates (MSDs), and laboratory controls samples (LCSs) are analyzed for every batch of up to 20 samples and serve as a measure of analytical accuracy. Surrogate standards are added to all samples, blanks, MSs, MSDs, and LCSs which are analyzed for organic compounds in order to evaluate the method's accuracy and to help determine matrix interferences. Definitions of each type of laboratory QC sample are listed in the following subsections. For laboratory measurements, if any of the QC checks are outside the acceptance criteria, corrective actions will be taken based on procedures in the Laboratory Quality Assurance Program (LQAP).

14.5.7 Laboratory Control Samples

LCSs include blank spikes and blank spike duplicates. Blank spike samples are designed to check the accuracy of the laboratory analytical procedures by measuring a known concentration of an analyte in the blank spike samples. Blank spike duplicate samples are designed to check laboratory accuracy and precision of the analytical procedures by measuring a known concentration of an analyte in the blank spike duplicate sample. Blank spike and blank spike duplicate samples are prepared by the laboratory using clean laboratory matrices spiked with the same spiking compounds used for MSs at levels approximately 10 times greater than the MDL. Laboratory control samples will be processed with each analytical batch consisting of 20 samples or less.

14.5.8 Laboratory Duplicates

Laboratory duplicates are two aliquots of a sample taken from the same sample container under laboratory conditions and analyzed independently. The analysis of laboratory duplicates allows the laboratory to measure the precision associated with laboratory procedures. Laboratory duplicate samples will be processed with each analytical batch consisting of 20 samples or less.

14.5.9 Matrix Spikes

MS and MSD samples are designed to check the precision and accuracy of the analytical methods through the analysis of a field sample with a known amount of analyte added. Additional sample volume for MS and MSD samples is collected in the field in the same manner as field duplicate samples. In the laboratory, two portions of the sample are spiked with a standard solution of target analytes. MS and MSD samples are analyzed for the same parameters as the field samples, and analytical results will be evaluated for precision and accuracy of the laboratory process and effects of the sample matrix. A minimum of one MS/MSD will be analyzed each day that field samples are analyzed, at a rate of one per 20 field samples or one per batch, whichever is more frequent.

14.5.10 Surrogate Standards

Surrogates are chemical compounds with properties that mimic analytes of interest, but that are unlikely to be found in environmental samples. Surrogates will be added to all field and QC samples analyzed for volatiles, analyzed by gas chromatography (GC) or GC/mass spectroscopy (GC/MS) to assess the recovery of the laboratory process, and to detect QC problems. The concentration and type of the surrogates used will be based on the LQAP.

14.5.11 Internal Standards

Like the surrogate standard, an internal standard is a chemical compound, unlikely to be found in environmental samples, that is added as a reference compound for sample quantification. Internal standard procedures are used for the analysis of volatile organics and extractable organics using GC/MS and also can be used for other GC and high-performance liquid chromatography (HPLC) analytical methods. The concentration and type of the internal standards used will be based on the LQAP.

14.5.12 Method Blanks

Method blanks are designed to detect contamination of field samples that may occur in the laboratory. Method blanks verify that method interference caused by contaminants in solvents, reagents, glassware, and other sample processing hardware are known and minimized. Method blanks are DI water for aqueous samples. A minimum of one method blank will be analyzed each day that field samples are analyzed at the rate of 1 per 20 field samples. A method blank must be analyzed daily. The concentration of the target compounds in the method blank sample must be less than five times the MDL. If the blank is not under the specified limit, the source contamination is to be identified and corrective actions taken.

14.6 Equipment Decontamination

Decontamination of non-disposable sampling equipment will be performed to prevent the introduction of extraneous material into samples and to prevent cross-contamination between samples. Equipment will be decontaminated in accordance with RBA SOP T-001.

In summary, decontamination of small non-disposable sample equipment will be conducted in the following steps:

1. Scrub the equipment with a brush, using laboratory grade detergent, such as Liquinox, and potable water solution, rinse with potable water, and rinse again with DI water. The equipment will be scrubbed and rinsed in three separate five-gallon buckets.
2. Reassemble the equipment and place it in a clean area on plastic or aluminum foil. If aluminum foil is used, wrap the equipment with the dull side toward the equipment.
3. Equipment rinsates will be collected from decontaminated equipment daily to provide a QC check on the decontamination procedure above. At least one field blank (source water used in the decontamination procedure) will be collected in the beginning of the investigation and analyzed for all target compounds.

14.7 Investigation Derived Waste Disposal

Wastes that are anticipated to be generated during the fieldwork include petroleum hydrocarbon impacted soil and groundwater, decontamination water, and personal protective equipment (PPE). These wastes will be containerized on site and stored temporarily in 55 gallon drums or other suitable containers for future disposal. Drums will be labeled and stored in a secure facility on pallets with spill control as appropriate.

Disposal of wastes will be determined based on the analytical results of the media in question. Contaminated wastes will be transported to an authorized disposal facility.

14.8 Data Management

All field observations and laboratory results will be linked to a unique sample location through the use of the Sample Identification (ID) system (described in Worksheet #27). Field observations and measurement data will be recorded on the field forms and in a field logbook to provide a permanent record of field activities. All data that are hand-entered will be subjected to a review by a second person to minimize data entry errors. A check for completeness of field records (logbooks, field forms, databases, electronic spreadsheets) will ensure that all requirements for field activities have been fulfilled, complete records exist for each activity, and the procedures specified in this SAP have been implemented. Field documentation will ensure sample integrity and provide sufficient technical information to recreate each field event.

Hard copies of the data reports received from the laboratories will be filed chronologically and will be stored separately from the electronic files. Hard copies of data signed by a representative of the analytical laboratory will be compared to any electronic versions of the data to confirm that the conversion process has not modified the reported results. Any additional reporting formats will be completed and electronic and hard copies will be stored in different locations at RBA facilities.

14.8.1 Third Party Data Validation

Data generated for this project will be reviewed and verified by the RBA QA Manager and validated by an independent outside reviewer. Only fixed-base laboratory samples will be validated. Data verification involves the process of generating qualitative and quantitative sample information through observations, field procedures, analytical measurements and calculations. The data verification and reporting process for the field data involves ensuring that blank samples and field duplicates defined in this SAP are within the acceptance criteria. The verification process for the laboratory data involves ensuring that the holding times, precision, accuracy, laboratory blanks, and detection limits are within the acceptance criteria outlined in this SAP.

The field and laboratory personnel will provide the RBA QA Manager with all the data. The RBA QA Manager will be responsible for overall review of the data verification results for compliance with the specified DQOs. Data verification tasks include confirmation that laboratory sample receipt forms match COC documentation and logbook entries. The sampling data will be validated by an independent third-party in accordance with NAVFAC SW Environmental Work Instruction (EWI) #1 (Chemical Data Validation). For this project, a 10% Level-IV and 90% Level-III data validation strategy will be implemented.

14.9 Level-III Validation

Level-III begins the process of data validation and includes the assessment of all the results reported in the standard data package. Qualifiers are issued at Level III and above. For level III data validation, the data values for routine and QC samples are generally assumed to be correctly reported by the laboratory. Data quality will be assessed by comparing the QC parameters to the appropriate criteria (or limits) as specified in this SAP, by Contract Laboratory Program (CLP) requirements, or by method-specific requirements (e.g., CLP, SW-846). If calculations for quantitation are verified, it is done on a limited basis and may require raw data in addition to the standard data forms normally present in a data package.

14.10 Level-IV Validation

Level-IV data validation constitutes the most extensive and exhaustive review and includes requantification of reported QC and field sample values using the raw data files. Level-IV data validation follows the EPA protocols and CLP criteria set forth in the functional guidelines for evaluating organic analyses (USEPA, 1999). These guidelines apply to analytical data packages that include the raw data (e.g., spectra and chromatograms) and backup documentation for calibration standards, analysis run logs, LCS, dilution factors, and other types of information. This additional information is utilized in the Level-IV data validation process for checking calculations of quantified analytical data. Calculations are checked for lab QC samples (e.g., MS/MSD and LCS data) and routine field samples (including field duplicates, field and equipment rinsate blanks, and VOC trip blanks). To ensure that detection limits and data values are accurate and appropriate, an evaluation is made of instrument performance, calibration methods, and the original data for calibration standards.

Analytical data may be qualified based on data validation reviews. Qualifiers will be consistent with the applicable EPA functional guidelines and will be used to provide data users with an estimate of the uncertainty level of associated with the “flagged” result.

Data validation results will be evaluated with respect to the attached qualifiers to determine data usability issues, if any. The following qualifiers may be assigned during the validation process:

- J – estimated concentration
- R – rejected value (unusable)
- U – not detected (e.g., not present based on blank contamination)
- UJ – sample detection limit is estimated.

For any instances where the validation qualifiers impact the overall data interpretation and project recommendations, the Data Quality Assessment will discuss the issue and the necessary corrective action.

14.11 NEDD/ NIRIS, GeoTracker, and Geographic Information System Submittal

Following the data validation process, RBA will enter the sample results into an electronic database. Data will be compiled with spatial and temporal qualifiers (location ID and sample date) so that it will be possible to rapidly plot or review changes in the concentration of target analytes at each sampling point over time. RBA will provide NAVFAC SW and NAVWPNSTA Seal Beach with Geographic Information System (GIS) management support for all data generated for this project. All analytical data generated during this investigation will be submitted via upload to the NIRIS portal in NEDD format in accordance with the most current version of the NAVFAC SW EWI #6.

In addition, the analytical data and all documents associated with this project will be submitted via upload to the California RWQCBs GeoTracker website in electronic data format.

15.0 SAP WORKSHEET #15 – REFERENCE LIMITS AND EVALUATION TABLES

15.1 TPH as diesel by EPA Method 8015M – Matrix: Soil

Analyte	Chemical Abstracts Service (CAS) Number	Project Action Limit[a] (mg/kg)	Project Action Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific	
					QLs (mg/kg)	MDLs (mg/kg)
TPH-diesel	-3527[b]	100	RCL	20	20	5

Notes and Acronyms:

[a] Soil samples are being collected and analyzed to help confirm the LIF results (decision rule #2) as well as calculate the amount of contamination left in place in the event that a recommendation for site closure with no further action is made.

[b] The NIRIS code for TPH (diesel range) has been used in place of the CAS number.

MDL	method detection limit
mg/kg	milligrams per kilogram
QL	quantitation limit
RCL	recommended soil cleanup level (LUFT Manual)
TPH	total petroleum hydrocarbons

15.2 TPH as diesel by EPA Method 8015M – Matrix: Water

Analyte	CAS Number	Project Action Limit (ug/L)	Project Action Limit Reference	Project Quantitation Limit Goal (ug/L)	Laboratory-specific	
					QLs (ug/L)	MDLs (ug/L)
TPH-diesel	-3527[b]	210	ESL	100[a]	500	100

Notes and Acronyms:

[a] The analytical method selected provides the lowest reporting limits available using routinely accepted methodology. Since the Project Action Limit (PAL) is less than the laboratory-specific Quantitation Limit (QL), the Method Detection Limit (MDL) will be used as the Project Quantitation Limit (PQL) for this analyte.

[b] The NIRIS code for TPH (diesel range) has been used in place of the CAS number.

ESL	environmental screening levels (SF Bay RWQCB, 2008)
MDL	method detection limit
ug/L	micrograms per liter
QL	quantitation limit

15.3 VOCs by EPA Method 8260B – Matrix: Soil

Analyte	CAS Number	Project Action Limit[a] (mg/kg)	Project Action Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific	
					QLs (mg/kg)	MDLs (mg/kg)
Benzene	71-43-2	0.0028	SSL	0.002[b]	0.005	0.002
Ethylbenzene	100-41-4	0.89	SSL	0.002[b]	0.005	0.002
Naphthalene	91-20-3	0.00055	SSL	0.002[b]	0.005	0.002
Toluene	108-88-3	0.76	SSL	0.005	0.005	0.002
o-Xylene	95-47-6	1.6	SSL	0.005	0.005	0.002
m,p-Xylene	7816-60-0	1.6	SSL	0.01	0.01	0.002

Notes and Acronyms:

[a] Soil samples are being collected and analyzed to help confirm the LIF results as well as calculate the amount of contamination left in place in the event that a recommendation for site closure with no further action is made.

[b] The analytical method selected provides the lowest reporting limits available using routinely accepted methodology. Since the Project Action Limit is less than the laboratory-specific Quantitation Limit (QL), the Method Detection Limit (MDL) will be used as the Project Quantitation Limit for this analyte.

MDL	method detection limit
mg/kg	milligrams per kilogram
QL	quantitation limit
SSL	soil screening level (US EPA, Region 9 PRGs, September 2008)

15.4 VOCs by EPA Method 8260B – Matrix: Water

Analyte	CAS Number	Project Action Limit (ug/L)	Project Action Limit Reference	Project Quantitation Limit Goal (ug/L)	Laboratory-specific	
					QLs (ug/L)	MDLs (ug/L)
Benzene	71-43-2	1[a]	MCL	1	5	1
Ethylbenzene	100-41-4	300	MCL	5	5	1
Naphthalene	91-20-3	24	ESL	2	2	0.5
Toluene	108-88-3	150	MCL	5	5	1
o-Xylene	95-47-6	1750[b]	MCL	5	5	1
m,p-Xylene	7816-60-0	1750[b]	MCL	10	10	2
MTBE[c]	1634-04-4	13	MCL	5	5	1

Notes and Acronyms:

[a] The analytical method selected provides the lowest reporting limits available using routinely accepted methodology. Since the Project Action Limit is less than the laboratory-specific Quantitation Limit (QL), the Method Detection Limit (MDL) will be used as the Project Quantitation Limit for this analyte.

[b] The MCL for Total Xylenes was used for this isomer.

[c] MTBE will be recommended for subsequent groundwater sampling events if the validated fixed-base laboratory data reports concentrations of BTEX or naphthalene greater than the project screening criteria (project action limits listed in this worksheet).

ESL	environmental screening levels (SF Bay RWQCB, 2008)
MCL	maximum contaminant level (EPA, 2008)
MDL	method detection limit
MTBE	methyl tert-butyl ether
ug/L	micrograms per liter
QL	quantitation limit

15.5 PAHs by EPA Method 8270C-SIM – Matrix: Soil

Analyte	CAS Number	Project Action Limit[a] (mg/Kg)	Project Action Limit Reference	Project Quantitation Limit Goal (mg/Kg)	Laboratory-specific	
					QLs (mg/Kg)	MDLs (mg/Kg)
Acenaphthene	83-32-9	27	SSL	0.03	0.03	0.01
Acenaphthylene	208-96-8	NA	NA	0.03	0.03	0.01
Anthracene	120-12-7	450	SSL	0.03	0.03	0.01
Benzo(a)anthracene	56-55-3	0.014	SSL	0.01[b]	0.03	0.01
Benzo(a)pyrene	50-32-8	0.31	SSL	0.01[b]	0.03	0.01
Benzo(b)fluoranthene	205-99-2	0.047	SSL	0.03	0.03	0.01
Benzo(g,h,i)perylene	191-24-2	NA	NA	0.03	0.03	0.01
Benzo(k)fluoranthene	207-08-9	0.46	SSL	0.03	0.03	0.01
Chrysene	218-01-9	1.4	SSL	0.03	0.03	0.01
Dibenzo(a,h)anthracene	53-70-3	0.015	SSL	0.01[b]	0.03	0.01
Fluoranthene	206-44-0	210	SSL	0.03	0.03	0.01
Fluorene	86-73-7	33	SSL	0.03	0.03	0.01
Indeno(1,2,3-cd)pyrene	193-39-5	0.16	SSL	0.03	0.03	0.01

Table Continues

SAP WORKSHEET #15 – PAHs by EPA Method 8270C-SIM (SOIL) – CONTINUED

Analyte	CAS Number	Project Action Limit[a] (mg/Kg)	Project Action Limit Reference	Project Quantitation Limit Goal (mg/Kg)	Laboratory-specific	
					QLs (mg/Kg)	MDLs (mg/Kg)
Naphthalene	91-20-3	0.00055	SSL	0.01[b]	0.03	0.01
Phenanthrene	85-01-8	NA	NA	0.03	0.03	0.01
Pyrene	129-00-0	150	SSL	0.03	0.03	0.01

Notes and Acronyms:
[a] Soil samples are being collected and analyzed to help confirm the LIF results (decision rule #2) as well as calculate the amount of contamination left in place in the event that a recommendation for site closure with no further action is made.
[b] The analytical method selected provides the lowest reporting limits available using routinely accepted methodology. Since the Project Action Limit is less than the laboratory-specific Quantitation Limit (QL), the Method Detection Limit (MDL) will be used as the Project Quantitation Limit for this analyte.

MDL	method detection limit
NA	not available (No SSL is available for this analyte)
PAH	polycyclic aromatic hydrocarbon
QL	quantitation limit
SSL	soil screening level (US EPA, Region 9 PRGs, September 2008)
mg/Kg	milligrams per kilogram

15.6 PAHs by EPA Method 8270C-SIM – Matrix: Water

Analyte	CAS Number	Project Action Limit (ug/L)	Project Action Limit Reference	Project Quantitation Limit Goal (ug/L)	Laboratory-specific	
					QLs (ug/L)	MDLs (ug/L)
Acenaphthene	83-32-9	23	ESL	0.03	0.03	0.01
Acenaphthylene	208-96-8	30	ESL	0.03	0.03	0.01
Anthracene	120-12-7	0.73	ESL	0.03	0.03	0.01
Benzo(a)anthracene	56-55-3	0.027	ESL	0.01[a]	0.03	0.01
Benzo(a)pyrene	50-32-8	0.2	MCL	0.03	0.03	0.01
Benzo(b)fluoranthene	205-99-2	0.029	ESL	0.01[a]	0.03	0.01
Benzo(g,h,i)perylene	191-24-2	0.1	ESL	0.03	0.03	0.01
Benzo(k)fluoranthene	207-08-9	3.7	ESL	0.03	0.03	0.01
Chrysene	218-01-9	0.35	ESL	0.03	0.03	0.01
Dibenzo(a,h)anthracene	53-70-3	7.5	ESL	0.03	0.03	0.01
Fluoranthene	206-44-0	8	ESL	0.03	0.03	0.01
Fluorene	86-73-7	3.9	ESL	0.03	0.03	0.01
Indeno(1,2,3-cd)pyrene	193-39-5	0.048	ESL	0.03	0.03	0.01

Table Continues

SAP WORKSHEET #15 – PAHs by EPA Method 8270C-SIM (WATER) – CONTINUED

Analyte	CAS Number	Project Action Limit (ug/L)	Project Action Limit Reference	Project Quantitation Limit Goal (ug/L)	Laboratory-specific	
					QLs (ug/L)	MDLs (ug/L)
Naphthalene	91-20-3	24	ESL	0.03	0.03	0.01
Phenanthrene	85-01-8	4.6	ESL	0.03	0.03	0.01
Pyrene	129-00-0	2	ESL	0.03	0.03	0.01

Notes & Acronyms:
[a] The analytical method selected provides the lowest reporting limits available using routinely accepted methodology. Since the Project Action Limit is less than the laboratory-specific Quantitation Limit (QL), the Method Detection Limit (MDL) will be used as the Project Quantitation Limit for this analyte.

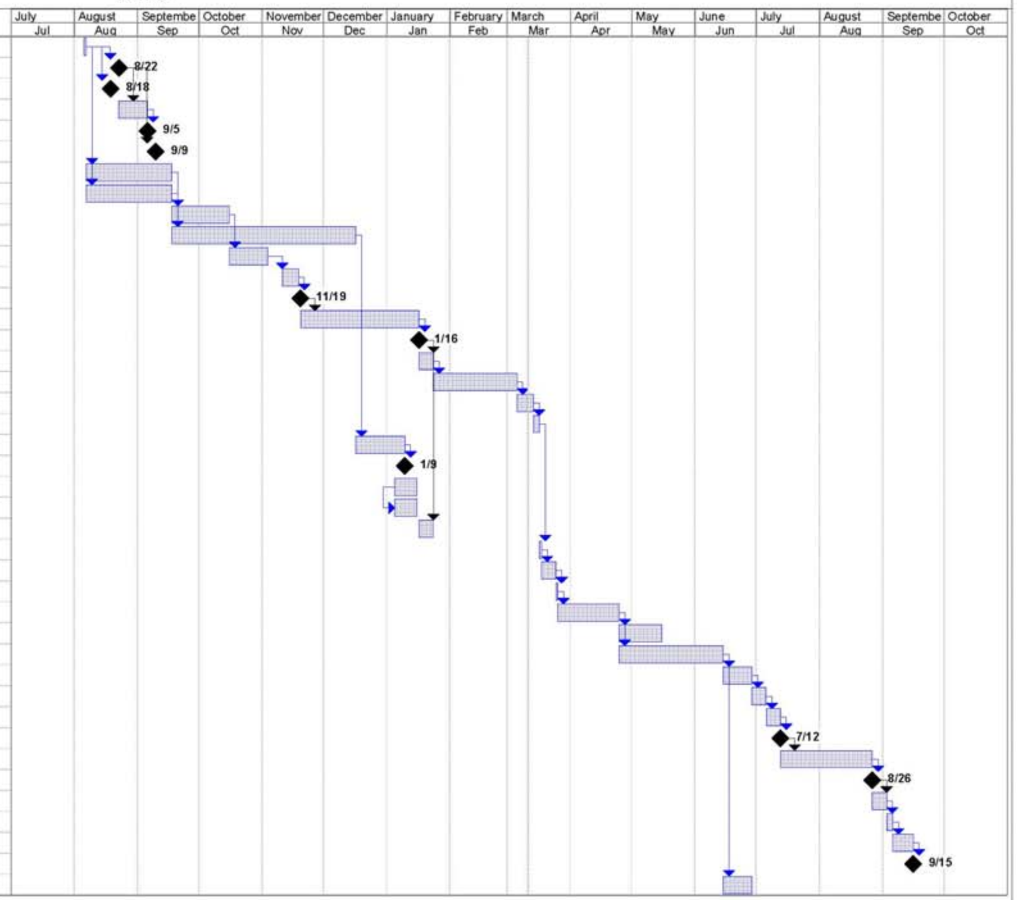
ESL environmental screening levels (SF Bay RWQCB, 2008)
MDL method detection limit
PAH polycyclic aromatic hydrocarbon
QL quantitation limit
ug/L micrograms per liter

NOTE: THIS LOW LEVEL SIM ANALYSIS REQUIRES ADVANCED NOTIFICATION TO THE LABORATORY SO THE PROPER CALIBRATION CAN BE PERFORMED.

16.0 SAP WORKSHEET #16 – PROJECT SCHEDULE / TIMELINE TABLE (OPTIONAL FORMAT)

Project Schedule
NWS Seal Beach SCAPS Investigation
UST 229

ID	Task Name	Duration	Start	Finish	Predecessors
1	Project Award	1 day?	Wed 8/6/08	Wed 8/6/08	
2	Kickoff Meeting	0 edays	Fri 8/22/08	Fri 8/22/08	1FS+16 edays
3	Draft Schedule	0 edays	Mon 8/18/08	Mon 8/18/08	1FS+12 edays
4	Kickoff Meeting Minutes	14 edays	Fri 8/22/08	Fri 9/5/08	2
5	Final Schedule	0 edays	Fri 9/5/08	Fri 9/5/08	4
6	Planning Meeting with Agencies	0 edays	Tue 9/9/08	Tue 9/9/08	2FS+18 edays
7	Pre-Draft WP and SAP Preparation	42 edays	Wed 8/6/08	Wed 9/17/08	1
8	Draft APP, SSHP, and AHA Preparation	42 edays	Wed 8/6/08	Wed 9/17/08	1
9	Navy Review of Pre-Draft WP and SAP	28 edays	Wed 9/17/08	Wed 10/15/08	7
10	Navy Review of Draft APP, SSHP, and AHA	90 edays	Wed 9/17/08	Tue 12/16/08	8
11	Response to Navy on Pre-Draft WP and SAP	19 edays	Wed 10/15/08	Mon 11/3/08	9
12	Draft WP and SAP Preparation	8 edays	Mon 11/10/08	Tue 11/18/08	11FS+7 edays
13	Submittal of Draft WP and SAP to Agencies	0 days	Wed 11/19/08	Wed 11/19/08	12FS+1 eday
14	Agency Review of Draft WP and SAP	58 edays	Wed 11/19/08	Fri 1/16/09	13
15	Submittal of Agency Comments on Draft WP & SAP	0 edays	Fri 1/16/09	Fri 1/16/09	14
16	Response to Agency Comments on Draft WP & SAP	7 edays	Fri 1/16/09	Fri 1/23/09	15
17	Comment Resolution on Draft WP and SAP	41 edays	Fri 1/23/09	Thu 3/5/09	16
18	Preparation of Final WP and SAP	8 edays	Thu 3/5/09	Fri 3/13/09	17
19	Submittal of Final WP and SAP	3 edays	Fri 3/13/09	Mon 3/16/09	18
20	Preparation of Final APP, SSHP, and AHA	24 edays	Tue 12/16/08	Fri 1/9/09	10
21	Submittal of Final APP, SSHP, and AHA	0 edays	Fri 1/9/09	Fri 1/9/09	20
22	Pre-Field Activities	11 edays	Mon 1/5/09	Fri 1/16/09	
23	Permitting	11 edays	Mon 1/5/09	Fri 1/16/09	22SS
24	Utility Clearance	7 edays	Fri 1/16/09	Fri 1/23/09	15
25	Mobilization	1 eday	Mon 3/16/09	Tue 3/17/09	19
26	Fieldwork	7 edays	Tue 3/17/09	Tue 3/24/09	25
27	Demobilization	1 eday	Tue 3/24/09	Wed 3/25/09	26
28	Laboratory Analysis of Samples	30 edays	Wed 3/25/09	Fri 4/24/09	27
29	Data Validation	21 edays	Fri 4/24/09	Fri 5/15/09	28
30	Preparation of Pre-Draft SC Report	51 edays	Fri 4/24/09	Sun 6/14/09	28
31	Navy Review of Pre-Draft SC Report	14 edays	Sun 6/14/09	Sun 6/28/09	30
32	Response to Navy on Pre-Draft SC Report	7 edays	Sun 6/28/09	Sun 7/5/09	31
33	Preparation of Draft SC Report	7 edays	Sun 7/5/09	Sun 7/12/09	32
34	Submittal of Draft SC Report	0 edays	Sun 7/12/09	Sun 7/12/09	33
35	Agency Review of Draft SC Report	45 edays	Sun 7/12/09	Wed 8/26/09	34
36	Submittal of Agency Comments on Draft SC Rpt	0 edays	Wed 8/26/09	Wed 8/26/09	35
37	Response to Agency Comments on Draft SC Rpt	7 edays	Wed 8/26/09	Wed 9/2/09	36
38	Comment Resolution on Draft SC Report	3 edays	Wed 9/2/09	Sat 9/5/09	37
39	Preparation of Final SC Report	10 edays	Sat 9/5/09	Tue 9/15/09	38
40	Submittal of Final SC Report	0 edays	Tue 9/15/09	Tue 9/15/09	39
41	NEDD/NIRIS, Geotracker, and GIS Submittal	14 edays	Sun 6/14/09	Sun 6/28/09	30



Project: NWS SB UST 229 Final ScheduleSAP
Date: Wed 3/11/09

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

Page 1

17.0 SAP WORKSHEET #17 – SAMPLING DESIGN AND RATIONALE

NAVFAC SW has identified NAVWPNSTA Seal Beach UST Site 229 as having a documented release of diesel fuel.

The Navy has identified the SCAPS LIF, and validated fixed-base laboratory analysis of soil and groundwater sampling as being appropriate to investigate the nature and extent of petroleum contamination at the area of the former excavation. Based on the initial CSM for the site, the proposed sampling design is a fundamentally judgmental approach, since the boundaries of the study area will be determined dynamically in the field based on screening data. The investigation will identify suitable locations for installation of four groundwater monitoring wells to perform an assessment of the condition of the groundwater beneath the site. Potential SCAPS LIF locations for the site are depicted on Figure 4.

The scope of work for this project includes the completion of up to 50 LIF test holes, the collection of up to five soil samples, and the installation of groundwater monitoring wells to assess if groundwater is affected by TPH–d, BTEX, naphthalene and PAH compounds associated with diesel fuel. Step-out locations and sampling will be guided by field screening as outlined in Worksheet #11 and the project decision trees (6, 7 and 8). The soil samples are being collected and analyzed to evaluate SCAPS LIF data, to confirm the boundary of petroleum-contaminated soil, to compare to the project screening criteria (Worksheet #15), and to estimate the mass of petroleum hydrocarbons left in place for input in the CSM. Groundwater samples will be collected to evaluate potential dissolved phase groundwater plumes at UST Site 229. The samples will be collected in accordance with RBA SOP T-002 (Attachment 2) and analyzed for BTEX & naphthalene by EPA Method 8260B, TPH-d by EPA Method 8015 Modified and PAHs by EPA Method 8270C-SIM.

18.0 SAP WORKSHEET #18 – SAMPLING LOCATIONS AND METHODS/SOP REQUIREMENTS TABLE

Sampling Location / ID Number	Matrix	Depth (ft bgs)	Analytical Group	Number of Samples (field duplicates)	Sampling SOP Reference[1]
Soil Sampling					
SB229-01-S-01	Soil	0-5[2]	TPH as diesel, BTEX, Naphthalene and PAHs	1	T-003, T-006
SB229-02-S-01	Soil	5-10[2]	TPH as diesel, BTEX, Naphthalene and PAHs	1	T-003, T-006
SB229-03-S-01	Soil	0-5[2]	TPH as diesel, BTEX, Naphthalene and PAHs	1	T-003, T-006
SB229-04-S-01	Soil	5-10[2]	TPH as diesel, BTEX, Naphthalene and PAHs	1	T-003, T-006
SB229-05-S-01	Soil	0-5[2]	TPH as diesel, BTEX, Naphthalene and PAHs	1	T-003, T-006
Groundwater Monitoring Well Sampling					
SB229-TW01-W-01	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1(1)	T-002
SB229-TW02-W-01	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1	T-002
SB229-TW03-W-01	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1	T-002
SB229-TW04-W-01	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1	T-002
Permanent Groundwater Monitoring Well Sampling (1st Quarter)					
SB229-MW01-W-01	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1(1)	T-002
SB229-MW02-W-01	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1	T-002
SB229-MW03-W-01	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1	T-002
SB229-MW04-W-01	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1	T-002

Table Continues

SAP WORKSHEET #18 - SAMPLING LOCATIONS AND METHODS/SOP REQUIREMENTS TABLE – CONTINUED

Sampling Location / ID Number	Matrix	Depth (ft bgs)	Analytical Group	Number of Samples (field duplicates)	Sampling SOP Reference[1]
Permanent Groundwater Monitoring Well Sampling (2nd Quarter)					
SB229-MW01-W-02	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1(1)	T-002
SB229-MW02-W-02	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1	T-002
SB229-MW03-W-02	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1	T-002
SB229-MW04-W-02	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1	T-002
Permanent Groundwater Monitoring Well Sampling (3rd Quarter)					
SB229-MW01-W-03	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1(1)	T-002
SB229-MW02-W-03	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1	T-002
SB229-MW03-W-03	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1	T-002
SB229-MW04-W-03	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1	T-002
Permanent Groundwater Monitoring Well Sampling (4th Quarter)					
SB229-MW01-W-04	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1(1)	T-002
SB229-MW02-W-04	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1	T-002
SB229-MW03-W-04	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1	T-002
SB229-MW04-W-04	Groundwater	12[3]	TPH as diesel, BTEX, Naphthalene and PAHs (MTBE)[4]	1	T-002

Table Continues

SAP WORKSHEET #18 - SAMPLING LOCATIONS AND METHODS/SOP REQUIREMENTS TABLE – CONTINUED

Notes:
[1] SOPs are available in Attachment 2.
[2] The soil sample depths are approximations which may vary slightly depending on the SCAPS LIF data collected during the investigation.
[3] The sample depth for all groundwater samples is an approximate value based on the anticipated placement of the pump intake. The pump intake will be placed at or near the mid-point of the well screen.
[4] If fixed-base laboratory analytical results from groundwater sampling exceed project screening criteria (worksheet #15), then subsequent rounds of groundwater sampling may include the analysis of samples for MTBE by 8260B

BTEX	benzene, toluene, ethylbenzene, and xylene isomers
MTBE	methyl tert-butyl ether
PAHs	polycyclic aromatic hydrocarbons
SOP	standard operating procedures
TPH	total petroleum hydrocarbon

.

19.0 SAP WORKSHEET #19 – ANALYTICAL SOP REQUIREMENTS TABLE

19.1 Matrix: Soil

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference[1]	Containers (number, size, and type)	Sample Volume[2] (units)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time[3] (preparation /analysis)
Soil	TPH as diesel	8015M/3520C/ EMAX-8015D	1 x 4 oz. glass jar or stainless steel or brass sleeve	30 g	4°C (±2°C)	7/40
Soil	BTEX & Naphthalene	8260B/5035/ EMAX-8260	3 x 5 gram EnCore® soil samplers	15 g	4°C (±2°C)	48 Hrs/14 days
Soil	PAHs	8270C-SIM/3520C/ EMAX-8270 SIM	1 x 4 oz. glass jar or stainless steel or brass sleeve	30 g	4°C (±2°C)	14/40

Notes:
[1] Analytical SOP Reference from Worksheet #23.
[2] Laboratory sample volume requirements.
[3] Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.

BTEX	benzene, toluene, ethylbenzene, and xylene isomers
PAHs	polycyclic aromatic hydrocarbons
SOP	standard operating procedures
TPH	total petroleum hydrocarbon

19.2 Matrix: Water

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference[1]	Containers (number, size, and type)	Sample Volume[2] (units)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time[3] (preparation /analysis)
Water	TPH as diesel	8015M/3520C/ EMAX-8015D	2 x 1 L Amber Glass	2 L	4°C (±2°C)	7/40
Water	BTEX & Naphthalene	8260B/5030/ EMAX-8260	3 x 40 mL VOA vials	120 mL	HCl, pH < 2 4°C (±2°C)	14 days
Water	PAHs	8270C-SIM/3520C/ EMAX-8270 SIM	2 x 1 L Amber Glass	2 L	4°C (±2°C)	7/40
Water	BTEX, Naphthalene & MTBE[4]	8260B/5030/ EMAX-8260	3 x 40 mL VOA vials	120 mL	HCl, pH < 2 4°C (±2°C)	14 days

Notes:
[1] Analytical SOP Reference from Worksheet #23.
[2] Laboratory sample volume requirements.
[3] Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.
[4] If fixed-base laboratory analytical results from groundwater sampling exceed project screening criteria (worksheet #15), then subsequent rounds of groundwater sampling may include the analysis of samples for MTBE by 8260B.

BTEX	benzene, toluene, ethylbenzene, and xylene isomers
MTBE	methyl tert-butyl ether
PAHs	polycyclic aromatic hydrocarbons
SOP	standard operating procedures
TPH	total petroleum hydrocarbon
VOA	

20.0 SAP WORKSHEET #20 – FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates[1]	No. of MS/MSDs	No. of Field Blanks	No. of Equip. Blanks	No. of Trip Blanks	No. of PT Samples[2]	Total No. of Samples to Lab
Soil	TPH as diesel	5	0	1/1	0	0	0	0	7
Soil	BTEX & Naphthalene	5	0	1/1	0	0	0	0	7
Soil	PAHs	5	0	1/1	0	0	0	0	7
Water	TPH as diesel	4	1	1/1	1	2	0	0	10
Water	BTEX & Naphthalene	4	1	1/1	1	2	2	0	12
Water	PAHs	4	1	1/1	1	2	0	0	10
Water	BTEX, Naphthalene & MTBE[3]	4	1	1/1	1	1	1	0	10

Notes and Acronyms:

[1] Soil duplicate samples will not be collected as part of the sampling efforts since assessment of spatial heterogeneity is not an objective of this project.

[2] PT samples will not be collected during this project.

[3] If fixed-base laboratory analytical results from groundwater sampling exceed project screening criteria (worksheet #15), then subsequent rounds of groundwater sampling may include the analysis of samples for MTBE by 8260B.

BTEX	benzene, toluene, ethylbenzene, and xylene isomers
MS/MSD	matrix spike/matrix spike duplicate
MTBE	methyl tert-butyl ether
PAHs	polycyclic aromatic hydrocarbons
PT	proficiency testing
TPH	total petroleum hydrocarbon

21.0 SAP Worksheet #21 – Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
T-001	Equipment Decontamination, 5/27/08	Richard Brady & Associates	Non-disposable drilling and sampling equipment	N	
T-002	Low-Flow Purging and Sampling Procedures for Groundwater Monitoring Wells, 5/29/08	Richard Brady & Associates	Water-level indicator, Portable or dedicated pump, In-line flow-through cell	N	
T-003	Soil Sampling Procedure For Volatile Organics Using The EnCore Sampler, 9/8/08	Richard Brady & Associates	EnCore Sampler T-Handle, Disposable EnCore Sampler	N	
T-005	SCAPS Data Acquisition Procedures For Laser-Induced Fluorescence, 9/8/08	Richard Brady & Associates	SCAPS Rig	N	
T-006	Environmental Soil Sampling, 9/8/08	Richard Brady & Associates	Soil Sampling Equipment	N	
T-012	Depth Discrete Direct Push Groundwater Sampling, 5/27/08	Richard Brady & Associates	SCAPS Rig, 1-inch diameter Schedule 40 PVC pipe	N	

Acronyms:

SOP	Standard Operating Procedure
RBA	Richard Brady & Associates

22.0 SAP WORKSHEET #22 – FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION TABLE

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference	Comments
Solinst Water Level Indicator	Maintenance	As needed. Decontaminate after each use.	Operational. Depress the battery test button to test the battery and circuitry.	In house repair/ Return to manufacturer	RBA Staff – Project Manager	RBA T-001 RBA T-002	Replace batteries as needed. Decontaminate after each well sampled.
YSI Meter (Model 556)	Maintenance	Rate of deposit build-up for anodes, cathodes, and surface of sensors. Check electrolyte solution and membrane cap every 30 Days.	Reports criteria per calibration ranges.	Return to manufacturer	RBA Staff – Project Manager	RBA T-002	Store probe in calibration cup filled with tap water and sealed to prevent evaporation when not in use. Replace batteries as needed.
	Calibration	Twice daily during sampling event (beginning and end of each day).	Per instrument specifications. Calibration ranges vary per parameter (D.O., pH, Specific Conductivity, and ORP).	Recalibrate until in acceptable range or return to manufacture for repair.	RBA Staff – Project Manager	RBA T-002	Replace batteries as needed.
QED Micro Purge Control and Power Pack	Maintenance	Check various components (valves, regulators, gauges, and controller) daily per sampling event.	Pumping at required flow pressure and rate for sample recovery.	Return to manufacturer	RBA Staff – Project Manager	RBA T-002	Replace batteries as needed. Air fittings must be in good condition and not leaking.

Table Continues

SAP WORKSHEET #22 – FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION TABLE – CONTINUED

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference	Comments
QED Sample Pro Portable Purge Pump	Maintenance	Check bladders and gaskets daily per sampling event and decontaminate after each use.	Pumping at required flow pressure and rate for sample recovery.	In house repair/ Return to manufacturer	RBA Staff – Project Manager	RBA T-001 RBA T-002	Various connecting parts and gaskets must fit and be in good working order. Inspect polyethylene tubing and bladders for leaks or wear. Decontaminate after each well sampled.
HF Scientific, Inc. Micro TRI Portable Turbidity Meter	Maintenance	As Needed	Per instrument specifications	In house repair/ Return to manufacturer	RBA Staff – Project Manager	RBA T-002	Replace batteries as needed.
	Calibration	Twice daily during sampling event (beginning and end of each day).	Per instrument specifications	Recalibrate until in acceptable range or return to manufacture for repair.	RBA Staff – Project Manager	RBA T-002	Replace batteries as needed.

Acronyms:

DO	dissolved oxygen
ORP	oxidation-reduction potential
SOP	standard operating procedures

23.0 SAP WORKSHEET #23 – ANALYTICAL SOP REFERENCES TABLE

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix/ Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
EMAX-8015D	Diesel Range Organics Rev.3	Definitive	Soil & Water/ TPH Extractable	GC	EMAX	N
EMAX-8260	Volatile Organics by GCMS Rev.4	Definitive	Soil & Water/ BTEX & Naphthalene	GCMS	EMAX	N
EMAX-8270 SIM	Semivolatile Organics by GCMS-SIM Rev.1	Definitive	Soil & Water/ SVOCs	GCMS	EMAX	N

Acronyms:

BTEX	benzene, toluene, ethylbenzene, and xylene isomers
GC	gas chromatography
GC/MS	gas chromatograph/mass spectrometry
SVOCs	semi-volatile organic compounds
TPH	total petroleum hydrocarbon
VOCs	volatile organic compounds

24.0 SAP WORKSHEET #24 – ANALYTICAL INSTRUMENT CALIBRATION TABLE

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/MS	ICAL	Initially; as needed	SPCCs average RF ± 0.050 and %RSD for RFs for CCCs < 30% and one option below: 1) linear- mean RSD for all analytes =/<15% 2) linear – least squares regression r =/> 0.995, when RSD >15% 3) non-linear – COD > 0.990 (6 points shall be used for second order, 7 points shall be used for third order)	Locate the source of the problem. If expected RFs are not met, check for standard degradation or perform instrument adjustment and/or maintenance to correct the problem then repeat initial calibration.	EMAX Chemist	EMAX-8260 EMAX-8270SIM
GC/MS	ICV	Every after ICAL	All analytes within ±25% of expected value [* within ±35% of expected value]	Prepare fresh standard and re-analyze ICV to rule out standard degradation or inaccurate injection. If problem persist perform instrument adjustment and/or maintenance to correct the problem then repeat ICAL and ICV.	EMAX Chemist	EMAX-8260 EMAX-8270SIM

Table Continues

SAP WORKSHEET #24 – ANALYTICAL INSTRUMENT CALIBRATION TABLE – CONTINUED

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/MS	DCC	Every 12 hrs.	SPCCs average RF > 0.050; and CCCs < 20% difference (when using RFs)or drift (when using least squares regression or non-linear calibration)	Prepare fresh standard and re-analyze CCV to rule out standard degradation or inaccurate injection. If problem persist perform instrument adjustment and/or maintenance to correct the problem and repeat ICAL.	EMAX Chemist	EMAX-8260 EMAX-8270SIM
GC	ICAL	Initially; as needed	1) RSD for all analytes ≤20% 2) linear – least squares regression r > 0.995 3) non-linear – COD > 0.990 (6 points shall be used for second order, 7 points shall be used for third order)	Locate the source of the problem. If expected RSD is not met, check for standard degradation or perform instrument adjustment and/or maintenance to correct the problem then repeat initial calibration	EMAX Chemist	EMAX-8015D

Table Continues

SAP WORKSHEET #24 – ANALYTICAL INSTRUMENT CALIBRATION TABLE – CONTINUED

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC	ICV	Every after ICAL	All analytes within ±15% of expected value	Prepare fresh standard and re-analyze ICV to rule out standard degradation or inaccurate injection. If problem persist perform instrument adjustment and/or maintenance to correct the problem and repeat ICAL.	EMAX Chemist	EMAX-8015D
GC	DCC	Every 12 hrs	All analytes within ±15% of expected value	Prepare fresh standard and re-analyze CCV to rule out standard degradation or inaccurate injection. If problem persist perform instrument adjustment and/or maintenance to correct the problem and repeat ICAL.	EMAX Chemist	EMAX-8015D

Table Continues

SAP WORKSHEET #24 – ANALYTICAL INSTRUMENT CALIBRATION TABLE – CONTINUED

Acronyms:

CCC	criteria continuing concentration
COD	chemical oxygen demand
CCV	continuous calibration verification
DCC	daily calibration check
GC	gas chromatography
GC/MS	gas chromatograph/mass spectrometry
ICAL	initial calibration
ICV	initial calibration verification
RPD	relative percent difference
SPCC	system performance check compound

25.0 SAP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
GCMS GC	Parameter Setup	Physical check	Physical check	Initiallly; prior to DCC	Predetermined optimum parameter settings	Reset if incorrect	EMAX Chemist	EMAX-8260 EMAX-8270SIM EMAX-8015D
GCMS	Tune Check	Instrument Performance	Conformance to instrument tuning.	Initially; prior to DCC	Compliance to ion abundance criteria as specified by the method.	Repeat tune check to rule out standard degradation or inaccurate injection. If problem persist troubleshoot instrument tuning and repeat tune check.	EMAX Chemist	EMAX-8260 EMAX-8270

Table Continues

SAP WORKSHEET #25 - ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING AND INSPECTION TABLE – CONTINUED

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
GCMS-8260	Instrument Maintenance	Parameter Check	Based on instrument Maintenance Log: Clean Purge Port, Bake Trap, Check Column Head Pressure, Set Injector Port Temperature, Check Interface Setting	Daily, Prior to use.	Predetermined Settings	Reset autosampler, if problem persist perform autosampler troubleshooting prior to instrument use. Reset to optimized temperature setup. Document actions in Instrument Maintenance Log.	EMAX Chemist	EMAX-8260
GCMS-8270	Instrument Maintenance	Parameter Check	Based on instrument Maintenance Log: Check Column Pressure, Check Column Temperature, Clean liner, Check septa, Check autosampler	Daily, Prior to use.	Predetermined Settings	Reset autosampler, if problem persist perform autosampler troubleshooting prior to instrument use. Reset to optimized temperature setup. Document actions in Instrument Maintenance Log.	EMAX Chemist	EMAX-8270SIM

Table Continues

SAP WORKSHEET #25 - ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING AND INSPECTION TABLE – CONTINUED

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
GC-8015D	Instrument Maintenance	Parameter Check	Based on instrument Maintenance Log: Check Column Head Pressure and Temperature, Check FID signal, Check Autosampler, Check gas flow	Daily, Prior to use.	Predetermined Settings	Reset autosampler, if problem persist perform autosampler troubleshooting prior to instrument use. Reset to optimized temperature setup. Document actions in Instrument Maintenance Log.	EMAX Chemist	EMAX-8015D

<u>Acronyms</u>

DCC	daily calibration check
FID	flame ionization detector
GC	gas chromatography
GCMS	gas chromatography mass spectrometry

26.0 SAP WORKSHEET #26 – SAMPLE HANDLING SYSTEM

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Field Sampling Personnel / Richard Brady & Associates
Sample Packaging (Personnel/Organization): Field Sampling Personnel / Richard Brady & Associates
Coordination of Shipment (Personnel/Organization): Quality Assurance Manager or Project Manager / Richard Brady & Associates
Type of Shipment/Carrier: Commercial shipment courier
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Custodian, EMAX Laboratories, Inc.
Sample Custody and Storage (Personnel/Organization): Sample Custodian, EMAX Laboratories, Inc.
Sample Preparation (Personnel/Organization): Various chemists and technicians, EMAX Laboratories, Inc.
Sample Determinative Analysis (Personnel/Organization): Various chemists and technicians, EMAX Laboratories, Inc.
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 30 days, or as required on a project specific basis
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 30 days, or as required on a project specific basis
Biological Sample Storage (No. of days from sample collection): NA
SAMPLE DISPOSAL
Personnel/Organization: Sample Custodian, EMAX Laboratories, Inc.
Number of Days from Analysis: 30 days, or as required on a project specific basis

Acronyms:

NA Not Applicable

27.0 SAP WORKSHEET #27 – SAMPLE CUSTODY REQUIREMENTS

27.1 Sample Identification

To provide a method of tracking each sample through collection, analysis, data review, and data reduction, a sample identification system has been established for sampling activities at NAVWPNSTA Seal Beach UST Site 229. The sample identification system is designed to be compatible with both the California State Water Resources Control Board's GeoTracker database requirements, as well as the NEDD standard. Sample number identification will be assigned in the field according to the following sample identification system:

- A ten-character or less designation of the Station ID. If a Location ID has already been established in NIRIS (i.e. permanent monitoring well), then it will be used as the Station ID.
- A one-character designation of the matrix type, i.e. "S" for soil or "W" for water.
- A two-character designation of the consecutive sample number from each matrix type collected at the location. Leading zeros are used as needed to create two characters.

For example, sample identification number SB229-03-S-01 refers to Station ID "SB229-03" (where "SB" refers to Seal Beach, "229" refers to UST 229, "03" refers to the third consecutive station), "S" refers to the soil matrix, and "01" refers to the first soil sample collected at the station.

For samples collected at the temporary monitoring well locations, the format of the Station ID would also incorporate the monitoring well number. For example, Sample ID number SB229-TW01-W-01 refers to Station ID "SB229-TW01" (where "SB" refers to Seal Beach, "229" refers to UST 229, "TW01" refers to that particular monitoring well), "W" refers to the water matrix, and "01" refers to the first groundwater sample collected at that monitoring well.

Field QC samples subjected to chemical analysis, such as equipment rinsate blanks, field blanks, and trip blanks will also be named this way; sequentially numbered as collected in the field with the site characterization samples. Field QC samples will be submitted to the laboratory under blind identification. Field QC samples will not be identified as QC samples in the sample name or on the COC (Attachment 1). Field QC samples will be labeled with a Sample ID comprised of the following sequential components, all separated by dashes:

- The Station ID of the preceding station sampled (i.e. the station sampled immediately prior to collecting the field QC sample).
- A one-character designation of the matrix type.
- A two-character designation of the consecutive sample number of each matrix type collected, continuing from the preceding station. Leading zeros are used as needed to create two characters.

In the following hypothetical example, the first samples collected at the site are from the station with the Station ID SB229-03, named in accordance with the protocol described above. In this hypothetical situation:

- one soil sample is collected.
- An MS/MSD is collected with the soil sample.
- Following the sampling, an equipment blank and a field blank are collected.

The samples would be named as follows:

The soil sample would be named SB229-03-S-01, referring to:

- o Station ID "SB229-03" (where "SB" refers to Seal Beach, "229" refers to UST 229, "03" refers to the third consecutive station).
- o Matrix type "S" (soil).
- o Consecutive sample "01".

The extra containers collected for the MS/MSD would also be labeled SB229-03-S-01 and the COC would identify this sample to the lab for use as an MS/MSD for lab QA/QC. The sample will be shown as a single line on the COC, with the total number of sample containers entered in the appropriate field.

The equipment blank would be named SB229-03-W-01, referring to:

- o Station ID SB229-03, representing the Field Point name of the preceding station where the sampling equipment was used.
- o Matrix type "W" (water sample).
- o Consecutive sample "01" refers to the first water sample related to the station.

Similarly, the field blank would be named SB229-03-W-02.

Temperature blanks will be labeled as temperature blanks. Temperature blanks are not subject to chemical analysis.

Cross-reference information regarding the Station ID, the assigned sample identification number, and whether the sample is a field quality control sample, will be documented on the Sample ID and Analysis Form (Attachment 1). These forms will be maintained in the bound project logbook.

27.2 Sample Custody

All samples will be recorded on COC forms (Attachment 1) using the sample ID described above. COCs will be completed using waterproof ink and in a manner to ensure entries are legible. Any errors made by the individual completing the COC shall be crossed out with a single line, initialed, and dated. The COC serves as the legal documentation of the sample custody since it records the transfer of the samples from field personnel to the laboratory to ensure that no tampering occurs.

The COC form will be signed by the individual responsible for custody of the sample containers, and the original will accompany the samples to the laboratory. One copy of the COC form will be kept by the project manager and/or the quality assurance manager and included in the project files. Information to be recorded on the COC form should include:

- Sample matrix,
- Sample collector's name,
- Dates/times of sample collection,
- Sample identification numbers,
- Number and type of containers for each sample aliquot,
- Type of preservation,
- Laboratory QC sample designation,
- Analysis method,
- Special handling instructions,
- Destination of samples,
- Name, date, time, and signature of each individual releasing the shipping container.

27.3 Sample Packaging and Shipment

Sample packaging will be conducted to ensure that samples arrive at the laboratory undisturbed and in good condition. The following packaging procedures are also designed to meet EPA and Department of Transportation regulations:

- Immediately after sample collection, a sample label will be completed with indelible ink and affixed to each sample container. Each sample will be placed in a re-sealable plastic bag to keep the sample container and label dry.
- Samples accumulated before transfer to the laboratory will be stored in an ice-filled chest and properly protected from breakage.
- A designated sample cooler will be filled with sample containers and properly protected from breakage. Sufficient packing material will be used to prevent sample containers from making contact during shipment. Enough wet ice will be added (double-bagged in re-sealable plastic bags) to maintain sample temperature requirements (4 ± 2°C). Field samples and ice will be collectively bagged in plastic trash bags, taped shut, and placed in the shipping container, to avoid water leakage. If the shipping container used is equipped with a drain plug, the plug will be taped shut both inside and outside to further ensure that there is no water leakage.
- The COC form will be completed and signed by RBA's field personnel and courier (if other than the sampler) for the samples transported to the laboratory. The COC

will be placed in a re-sealable plastic bag, and taped to the inside of the shipping container lid.

- The shipping container will be closed and taped shut with strapping tape (filament-type) completely around at both ends.
- Since the samples are to be delivered to the laboratory using a commercial shipment courier service, custody seals will be used on each container to provide tampering detection. The signed and dated custody seals will be placed on the front right and back left of the shipping container, and will be covered with wide, clear tape.

International Air Transportation Association regulations will be adhered to when shipping samples by air courier services. The package must be scheduled for priority overnight service to ensure that the temperature preservative requirement is not exceeded. Saturday deliveries will be coordinated with the laboratory.

27.4 Laboratory Receipt and Custody

The laboratory will designate a sample custodian. Upon receipt, this individual is responsible for inspecting the sample shipment, recording the temperature of the temperature blank and verifying the correctness of the COC records. The sample custodian will accept the samples by signing the COC form and noting the condition of the samples in the space provided on the COC form and on the Sample Receipt form. In case of breakage or discrepancies between the COC form, sample identification numbers, or requested analysis, the sample custodian will notify the RBA Quality Assurance Manager (QAM) as soon as possible. All discrepancies associated with COC forms or sample breakage will be relayed to RBA's QAM within 24-hours so corrective action can be implemented appropriately. The COC is generally considered to be a legal document and thus will be filled out legibly and as error free as possible.

Samples received by the laboratory will be entered into a sample management system, which must include:

- Laboratory sample number,
- Field sample designation,
- Analytical batch numbers,
- List of analyses requested for each sample container.

Immediately after receipt, the samples will be stored in an appropriate secure storage area. The laboratory will maintain custody of the samples as required by the contract or until further notification by the RBA PM or QAM. The analytical laboratory will maintain written records showing the chronology of sample handling during the analysis process by various individuals at the laboratory.

27.5 Field Documents and Records

A project-specific field logbook will be used to provide daily records of significant events, observations, and measurements during the field investigation. The field logbook also will be used to document all sampling activities. The logbooks will be kept in the possession of the field team leader during the on-site work and all members of the field team will have access to the logbook. The logbook will be maintained as a permanent record. Any errors found in the logbook will be verified, crossed-through, and initialed by the person discovering the error.

The field logbook is intended to provide sufficient data and observations to reconstruct events that occurred during field activities. The field logbook should be permanently bound and pre-paginated; the use of designated forms should be used whenever possible to ensure that field records are complete. The following items are examples of information that may be included in the field logbook:

- Name, date, and time of entry,
- Names and responsibilities of field crew members,
- Names and titles of any site visitors,
- Descriptions of field procedures, and problems encountered,
- Number and amount of samples taken at each location,
- Details of sampling location, including sampling coordinates,
- Sample identification numbers of all samples collected,
- Date and time of collection,
- Sample collector,
- Sample collection method,
- Decontamination procedures,
- Field instrument calibration and maintenance,
- Field measurements (e.g., organic vapor) and general observations.

Example forms are included as Attachment 1.

28.0 SAP Worksheet #28 – Laboratory QC Samples Table

28.1 TPH as diesel

Matrix	Soil
Analytical Group	TPH-d
Analytical Method / SOP Reference	8015M/ EMAX-8015D

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch	All analytes <1/2 QLs	Reprep and reanalyze LCS and all samples processed with the non-conforming LCS.	EMAX Chemist	Accuracy/Bias – Contamination	Detections < QLs (Worksheet #15)
Surrogate	Every analytical sample	Refer to QC Limit (Table 1)	Reprep and reanalyze LCS and all samples processed with the non-conforming LCS.	EMAX Chemist	Accuracy/Bias	%R (Table 1)
LCS	One per sample preparation batch	Refer to QC Limit (Table 1)	Reprep and reanalyze LCS and all samples processed with the non-conforming LCS.	EMAX Chemist	Accuracy/Bias	%R (Table 1)
MS/MSD	Project designated sample matrix QC.	Refer to QC Limit (Table 1)	If result is indicative of matrix interference, discuss in case narrative. Otherwise check for possible source of error, and extract / reanalyze the sample.	EMAX Chemist	Interferences – Accuracy/Bias – Precision	%R / RPD (Table 1)

Acronyms:

LCS	laboratory control sample	%R	percent recovery
MS/MSD	matrix spike/matrix spike duplicate	RSD	relative standard deviation
QC	quality control		
QL	quantitation limit		

28.2 TPH as diesel

Matrix	Groundwater
Analytical Group	TPH-d
Analytical Method / SOP Reference	8015M/ EMAX-8015D

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch	All analytes <1/2 QLs	Reprep and reanalyze LCS and all samples processed with the non-conforming LCS.	EMAX Chemist	Accuracy/Bias – Contamination	Detections < QLs (Worksheet #15)
Surrogate	Every analytical sample	Refer to QC Limit (Table 1)	Reprep and reanalyze LCS and all samples processed with the non-conforming LCS.	EMAX Chemist	Accuracy/Bias	%R (Table 1)
LCS	One per sample preparation batch	Refer to QC Limit (Table 1)	Reprep and reanalyze LCS and all samples processed with the non-conforming LCS.	EMAX Chemist	Accuracy/Bias	%R (Table 1)
MS/MSD	Project designated sample matrix QC.	Refer to QC Limit (Table 1)	If result is indicative of matrix interference, discuss in case narrative. Otherwise check for possible source of error, and extract / reanalyze the sample.	EMAX Chemist	Interferences – Accuracy/Bias – Precision	%R / RPD (Table 1)

Acronyms:

LCS	laboratory control sample
MS/MSD	matrix spike/matrix spike duplicate
QC	quality control
QL	quantitation limit
%R	percent recovery
RSD	relative standard deviation

28.3 BTEX & NAPHTHALENE

Matrix	Soil
Analytical Group	VOCs
Analytical Method / SOP Reference	8260B/ EMAX-8260

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch	All analytes <1/2 QLs	Reprep and reanalyze LCS and all samples processed with the non-conforming LCS.	EMAX Chemist	Accuracy/Bias – Contamination	Detections < QLs (Worksheet #15)
Surrogate	Every analytical sample	Refer to QC Limit (Table 1)	Reprep and reanalyze LCS and all samples processed with the non-conforming LCS.	EMAX Chemist	Accuracy/Bias	%R (Table 1)
LCS	One per sample preparation batch	Refer to QC Limit (Table 1)	Reprep and reanalyze LCS and all samples processed with the non-conforming LCS.	EMAX Chemist	Accuracy/Bias	%R (Table 1)
MS/MSD	Project designated sample matrix QC.	Refer to QC Limit (Table 1)	If result is indicative of matrix interference, discuss in case narrative. Otherwise check for possible source of error, and extract / reanalyze the sample.	EMAX Chemist	Interferences – Accuracy/Bias – Precision	%R / RPD (Table 1)

Acronyms:

LCS	laboratory control sample
MS/MSD	matrix spike/matrix spike duplicate
QC	quality control
QL	quantitation limit
%R	percent recovery
RSD	relative standard deviation

28.4 BTEX, NAPHTHALENE & MTBE

Matrix	Groundwater
Analytical Group	VOCs
Analytical Method / SOP Reference	8260B/ EMAX-8260

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch	All analytes <1/2 QLs	Reprep and reanalyze LCS and all samples processed with the non-conforming LCS.	EMAX Chemist	Accuracy/Bias – Contamination	Detections < QLs (Worksheet #15)
Surrogate	Every analytical sample	Refer to QC Limit (Table 1)	Reprep and reanalyze LCS and all samples processed with the non-conforming LCS.	EMAX Chemist	Accuracy/Bias	%R (Table 1)
LCS	One per sample preparation batch	Refer to QC Limit (Table 1)	Reprep and reanalyze LCS and all samples processed with the non-conforming LCS.	EMAX Chemist	Accuracy/Bias	%R (Table 1)
MS/MSD	Project designated sample matrix QC.	Refer to QC Limit (Table 1)	If result is indicative of matrix interference, discuss in case narrative. Otherwise check for possible source of error, and extract / reanalyze the sample.	EMAX Chemist	Interferences – Accuracy/Bias – Precision	%R / RPD (Table 1)

Acronyms:

LCS	laboratory control sample	%R	percent recovery
MS/MSD	matrix spike/matrix spike duplicate	RSD	relative standard deviation
QC	quality control		
QL	quantitation limit		

28.5 PAHs

Matrix	Soil
Analytical Group	PAHs
Analytical Method / SOP Reference	8270C-SIM EMAX-8270SIM

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch	All analytes <1/2 QLs	Reprep and reanalyze LCS and all samples processed with the non-conforming LCS.	EMAX Chemist	Accuracy/Bias - Contamination	Detections < QLs (Worksheet #15)
Surrogate	Every analytical sample	Refer to QC Limit (Table 1)	Reprep and reanalyze LCS and all samples processed with the non-conforming LCS.	EMAX Chemist	Accuracy/Bias	%R (Table 1)
LCS	One per sample preparation batch	Refer to QC Limit (Table 1)	Reprep and reanalyze LCS and all samples processed with the non-conforming LCS.	EMAX Chemist	Accuracy/Bias	%R (Table 1)
MS/MSD	Project designated sample matrix QC.	Refer to QC Limit (Table 1)	If result is indicative of matrix interference, discuss in case narrative. Otherwise check for possible source of error, and extract / reanalyze the sample.	EMAX Chemist	Interferences - Accuracy/Bias - Precision	%R / RPD (Table 1)

Acronyms:

LCS	laboratory control sample	%R	percent recovery
MS/MSD	matrix spike/matrix spike duplicate	RSD	relative standard deviation
QC	quality control		
QL	quantitation limit		

28.6 PAHs

Matrix	Groundwater
Analytical Group	PAHs
Analytical Method / SOP Reference	8270C-SIM EMAX-8270 SIM

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch	All analytes <1/2 QLs	Reprep and reanalyze LCS and all samples processed with the non-conforming LCS.	EMAX Chemist	Accuracy/Bias - Contamination	Detections < QLs (Worksheet #15)
Surrogate	Every analytical sample	Refer to QC Limit (Table 1)	Reprep and reanalyze LCS and all samples processed with the non-conforming LCS.	EMAX Chemist	Accuracy/Bias	%R (Table 1)
LCS	One per sample preparation batch	Refer to QC Limit (Table 1)	Reprep and reanalyze LCS and all samples processed with the non-conforming LCS.	EMAX Chemist	Accuracy/Bias	%R (Table 1)
MS/MSD	Project designated sample matrix QC.	Refer to QC Limit (Table 1)	If result is indicative of matrix interference, discuss in case narrative. Otherwise check for possible source of error, and extract / reanalyze the sample.	EMAX Chemist	Interferences - Accuracy/Bias - Precision	%R / RPD (Table 1)

Acronyms:

LCS	laboratory control sample	%R	percent recovery
MS/MSD	matrix spike/matrix spike duplicate	RSD	relative standard deviation
QC	quality control		
QL	quantitation limit		

29.0 SAP WORKSHEET #29 – PROJECT DOCUMENTS AND RECORDS TABLE

Document	Where Maintained
Draft SAP	RBA project file and NAVFAC SW Administrative Record
Final SAP	RBA project file and NAVFAC SW Administrative Record
Field notes/logbook	RBA project file
COC forms	RBA project file
Audit checklists/reports	RBA and laboratory project file
Corrective action forms/reports	RBA and laboratory project file
Laboratory data package (including raw data)	RBA, laboratory project file and NAVFAC SW Administrative Record
Laboratory equipment calibration logs	Laboratory project file
Sample preparation logs	Laboratory project file
Run logs	Laboratory project file
Sample disposal records	Laboratory project file
Validated data package	RBA, data validator project file, and NAVFAC SW Administrative Record

Acronyms:

COC	chain of custody
NAVFAC SW	Naval Facilities Engineering Command Southwest
RBA	Richard Brady and Associates
SAP	Sampling and Analysis Plan

30.0 SAP WORKSHEET #30 – ANALYTICAL SERVICES TABLE

For this project, analytical services will be provided by EMAX Laboratories, Inc. of Torrance, CA. Turnaround times for the laboratory data package will be based on the date in which the laboratory receives the samples. Preliminary results will be sent via email within 14 days, and the final data package will be sent in electronic and hardcopy formats to the RBA office in 30 days. The backup laboratory for this project is PACE Analytical Services of Seattle, WA. Both labs are currently certified by the California Department of Health Services (CDHS) Environmental Laboratory Accreditation Program (ELAP) for analysis of hazardous materials for each method specified in this SAP, and have received approval from the Naval Facilities Engineering Service Center (NFESC).

Matrix	Analytical Group	Sample Locations/ ID Number	Analytical Method	Data Package Turnaround Time	Laboratory / Organization (name and address, contact person and telephone number)	Backup Laboratory /Organization (name and address, contact person and telephone number)
Soil	TPH as diesel BTEX Naphthalene PAHs	All samples indicated in worksheet #18	8015M 8260B 8270C-SIM	14 Day Fax/ 30 Day Final	EMAX Laboratories, Inc. 1835 W. 205th St., Torrance, CA 90501 310.618.8889	PACE Analytical Services 940 South Harney Street Seattle, WA 98108 206.767.5060
Water	TPH as diesel BTEX Naphthalene PAHs MTBE	All samples indicated in worksheet #18	8015M 8260B 8270C-SIM	14 Day Fax/ 30 Day Final	EMAX Laboratories, Inc. 1835 W. 205th St., Torrance, CA 90501 310.618.8889	PACE Analytical Services 940 South Harney Street Seattle, WA 98108 206.767.5060

<u>Acronyms:</u>

BTEX	benzene, toluene, ethylbenzene and xylenes
MTBE	methyl tert-butyl ether
PAHs	polycyclic aromatic hydrocarbons

31.0 SAP WORKSHEET #31 -- PLANNED PROJECT ASSESSMENTS TABLE

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA)	Person(s) Responsible for Monitoring Effectiveness of CA
Readiness Review[1]	1/Prior to initiating fieldwork	Internal	RBA	Project Manager, RBA	Project team, RBA	Project Manager, RBA	Project Manager, RBA
Field Sampling TSA[1]	1/At start of field sampling activities	Internal	RBA	QA Manager, RBA	Project Manager, RBA	QA Manager, RBA	QA Manager, RBA Project Manager, RBA
Field Documentation Review[1]	Daily	Internal	RBA	QA Manager, RBA Project Manager, RBA	Project Manager, RBA	QA Manager, RBA	QA Manager, RBA Project Manager, RBA

Notes and Acronyms:
[1] Attachment 1 contains the examples of the review and audit forms.

CA	Corrective Action
QA	Quality Assurance
RBA	Richard Brady & Associates
TSA	technical systems audit

32.0 SAP WORKSHEET #32 -- ASSESSMENT FINDINGS AND CORRECTIVE ACTION RESPONSES

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response	Timeframe for Response
Readiness Review[1]	Written readiness review report	Jesse MacNeill, QA Manager, RBA	5 days after review	Completed Action Item List	Jesse MacNeill, QA Manager, RBA Tim Shields, Program Manager, RBA	5 days
Field Sampling TSA[1]	Written audit report	Don McHugh, Project Manager, RBA	5 days after audit	Corrective Action Form and/or Field Change Notice	Jesse MacNeill, QA Manager, RBA Tim Shields, Program Manager, RBA Jennifer Sullivan Lead RPM, NAVFAC SW (if FCN issued only)	Within 24 hours
Field Documentation Review[1]	Field Data Review Checklist	Don McHugh, Project Manager, RBA	Upon completion of the review	Corrective Action Form	Jesse MacNeill, QA Manager, RBA	2 days

Notes and Acronyms:
[1] Attachment 1 contains the examples of the review and audit forms.

CA	Corrective Action
NAVFAC SW	Naval Facilities Engineering Command Southwest
QA	Quality Assurance
RBA	Richard Brady & Associates
RPM	remedial project manager
TSA	technical systems audit

33.0 SAP WORKSHEET #33 -- QA MANAGEMENT REPORTS TABLE

Type of Report	Frequency	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation	Report Recipient(s)
Readiness Review[1]	1/Prior to initiating fieldwork	10 days prior to initiation of field activities	Don McHugh, Project Manager, RBA	Tim Shields, Program Manager, RBA; Jesse MacNeill, QA Manager, RBA
Field Sampling TSA[1]	1/At start of field sampling activities	5 days after initiation of sampling activities	Jesse MacNeill, QA Manager, RBA	Tim Shields, Program Manager, RBA; Don McHugh, Project Manager, RBA
Field Documentation Review[1]	Daily	5 days after completion of field activities	Jesse MacNeill, QA Manager, RBA	Tim Shields, Program Manager, RBA; Don McHugh, Project Manager, RBA

Notes and Acronyms:
[1] Attachment 1 contains the examples of the review and audit forms.

QA	Quality Assurance
RBA	Richard Brady & Associates
TSA	technical systems audit

34.0 SAP WORKSHEET #34 -- VERIFICATION (STEP I) PROCESS TABLE

Verification Input	Description	Internal / External	Responsible for Verification
COC forms	COC forms will be reviewed internally upon their completion and verified against the packed sample containers they represent. The shipper's signature on the COC should be initialed by the reviewer, a copy of the COC retained in the project file, and the original and remaining copies taped inside the container for shipment.	Internal	Field Sampling Personnel (RBA)
Field notes/logbook	Field notes and/or entries into the field logbook will be reviewed internally and placed in the project file upon project completion.	Internal	Field Sampling Personnel (RBA) Quality Assurance Manager (RBA)
Audit reports	Upon report completion, a copy of all audit reports will be placed in the project file. If corrective actions are required, a copy of the documented corrective action taken will be attached to the appropriate audit report in the project file.	Internal	Project Manager (RBA) Quality Assurance Manager (RBA)
Laboratory data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal. All received data packages will be verified externally according to the data validation procedures specified in Worksheet # 36 of this SAP.	Internal/ External	EMAX Laboratories, Inc. LDC, Inc.
Electronic data deliverables	All EDDs will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal. All received EDDs will be verified externally against the hardcopy laboratory data packages.	Internal/ External	EMAX Laboratories, Inc. LDC, Inc.

Acronyms:

COC	Chain-of-custody
EDD	Electronic data deliverables
LDC	Laboratory Data Consultants
RBA	Richard Brady & Associates

35.0 SAP WORKSHEET #35 -- VALIDATION (STEPS IIA AND IIB) PROCESS TABLE

Step IIa / IIb[1]	Validation Input	Description	Responsible for Validation
IIa	Communication	Establish that required communication procedures were followed by field or laboratory personnel.	Project Manager (RBA) Quality Assurance Manager (RBA)
IIa	Sampling Methods and Procedures	Establish that the required sampling methods were used and that any deviations were noted. Ensure that the sampling procedures and field measurements met performance criteria and that any deviations were documented.	Quality Assurance Manager (RBA)
IIa	Holding Times	Ensure that samples were analyzed within holding times specified in method, procedure, or contract requirements. If holding times were not met, confirm that deviations were documented, that appropriate notifications were made as stated in RBA's Statement of Work to the laboratory.	Quality Assurance Manager (RBA) Data Validator (LDC)
IIa	Analytes	Ensure that required lists of analytes were reported as specified in governing documents (i.e., method, procedure, or contract).	Data Validator (LDC)
IIa	Analytical Methods and Procedures	Establish that the required analytical methods were used and that any deviations were noted. Ensure that the QC samples met performance criteria and that any deviations were documented.	Quality Assurance Manager (RBA) Data Validator (LDC)
IIa	Data Qualifiers	Determine that the laboratory data qualifiers were defined in the laboratory data package and applied as specified.	Quality Assurance Manager (RBA) Data Validator (LDC)
IIa	Field Transcription	Authenticate transcription accuracy of sampling data (i.e., from field logbook to report).	Project Manager (RBA) Quality Assurance Manager (RBA)
IIb	Sampling Plan	Determine whether the sampling plan was executed as specified (i.e., the number, location, and type of field samples were collected and analyzed as specified in the QAPP).	Project Manager (RBA) Quality Assurance Manager (RBA)
IIb	Sampling Procedures	Evaluate whether sampling procedures were followed with respect to equipment and proper sampling support (e.g., techniques, equipment, decontamination, volume, temperature, preservative, etc.).	Project Manager (RBA) Quality Assurance Manager (RBA)
IIb	Co-located Field Duplicates	Compare results of collocated field duplicates with criteria established in the QAPP.	Quality Assurance Manager (RBA) Data Validator (LDC)
IIb	Project Quantitation Limits	Determine that quantitation limits were achieved, as outlined in the QAPP and that the laboratory successfully analyzed a standard at the quantitation limit (QL).	Quality Assurance Manager (RBA) Data Validator (LDC)

Table Continues

SAP WORKSHEET #35 – VALIDATION (STEPS IIA AND IIB) PROCESS TABLE – CONTINUED

Step IIa / IIb1	Validation Input	Description	Responsible for Validation
IIb	Performance Criteria	Evaluate QC data against project-specific performance criteria in the QAPP (i.e., evaluate quality parameters beyond those outlined in the methods).	Quality Assurance Manager (RBA) Data Validator (LDC)

Notes and Acronyms:
[1] IIa=compliance with methods, procedures, and contracts [see Table 10, page 117, UFP-QAPP manual, V.1, March 2005.]
IIb=comparison with measurement performance criteria in the SAP [see Table 11, page 118, UFP-QAPP manual, V.1, March 2005]

COC	Chain of Custody
EDD	Electronic data deliverables
LDC	Laboratory Data Consultants
QA	Quality Assurance
QAM	Quality Assurance Officer
QAPP	Quality Assurance Project Plans

36.0 SAP WORKSHEET #36 -- ANALYTICAL DATA VALIDATION (STEPS IIA AND IIB) SUMMARY TABLE

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria[1]	Data Validator (title and organizational affiliation)
IIa	Soil	TPH-diesel	In accordance with EPA Contract Lab Program National Functional Guidelines, SW-846 Methods, NAVFAC SW EWI #1, and EPA Level III and IV guidelines.	Project Manager, LDC, Inc.
IIa	Soil	BTEX Naphthalene	In accordance with EPA Contract Lab Program National Functional Guidelines, SW-846 Methods, NAVFAC SW EWI #1, and EPA Level III and IV guidelines.	Project Manager, LDC, Inc.
IIa	Soil	PAHs	In accordance with EPA Contract Lab Program National Functional Guidelines, SW-846 Methods, NAVFAC SW EWI #1, and EPA Level III and IV guidelines.	Project Manager, LDC, Inc.
IIa	Groundwater	TPH-diesel	In accordance with EPA Contract Lab Program National Functional Guidelines, SW-846 Methods, NAVFAC SW EWI #1, and EPA Level III and IV guidelines.	Project Manager, LDC, Inc.
IIa	Groundwater	BTEX, Naphthalene & MTBE	In accordance with EPA Contract Lab Program National Functional Guidelines, SW-846 Methods, NAVFAC SW EWI #1, and EPA Level III and IV guidelines.	Project Manager, LDC, Inc.
IIa	Groundwater	PAHs	In accordance with EPA Contract Lab Program National Functional Guidelines, SW-846 Methods, NAVFAC SW EWI #1, and EPA Level III and IV guidelines.	Project Manager, LDC, Inc.

Table Continues

SAP WORKSHEET #36 – ANALYTICAL DATA VALIDATION (STEPS IIA AND IIB) SUMMARY TABLE – CONTINUED

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria[1]	Data Validator (title and organizational affiliation)
IIb	Soil	TPH-diesel	In accordance with EPA Contract Lab Program National Functional Guidelines, SW-846 Methods, NAVFAC SW EWI #1, and EPA Level III and IV guidelines.	Project Manager, LDC, Inc.
IIb	Soil	BTEX Naphthalene	In accordance with EPA Contract Lab Program National Functional Guidelines, SW-846 Methods, NAVFAC SW EWI #1, and EPA Level III and IV guidelines.	Project Manager, LDC, Inc.
IIb	Soil	PAHs	In accordance with EPA Contract Lab Program National Functional Guidelines, SW-846 Methods, NAVFAC SW EWI #1, and EPA Level III and IV guidelines.	Project Manager, LDC, Inc.
IIb	Groundwater	TPH-diesel	In accordance with EPA Contract Lab Program National Functional Guidelines, SW-846 Methods, NAVFAC SW EWI #1, and EPA Level III and IV guidelines.	Project Manager, LDC, Inc.
IIb	Groundwater	BTEX, Naphthalene & MTBE	In accordance with EPA Contract Lab Program National Functional Guidelines, SW-846 Methods, NAVFAC SW EWI #1, and EPA Level III and IV guidelines.	Project Manager, LDC, Inc.
IIb	Groundwater	PAHs	In accordance with EPA Contract Lab Program National Functional Guidelines, SW-846 Methods, NAVFAC SW EWI #1, and EPA Level III and IV guidelines.	Project Manager, LDC, Inc.

Notes and Acronyms:

[1]Validation shall be conducted in accordance with NFESC Special Publication SP-2056-ENV, Navy Installation Restoration Chemical Data Quality Manual, Naval Facilities Engineering Command, September 1999.

BTEX	benzene, toluene, ethylbenzene, and xylene isomers
LDC	Laboratory Data Consultants
MTBE	methyl tert-butyl ether
SVOC	semi-volatile organic compound
TPH	total petroleum hydrocarbon

37.0 SAP WORKSHEET #37 -- USABILITY ASSESSMENT

This section describes the QA/QC activities that occur after the data collection phase of the project has been completed to ensure that data conform to the specified criteria and thus are useful for their intended purpose.

37.1 Usability Assessment Objectives

The data quality is a function of the sampling plan rationale and the procedures used to collect the samples, as well as the analytical methods and instrumentation used. As discussed in the following sections, data collected during this extended site assessment will be evaluated for usability with respect to precision, accuracy, representativeness, completeness, comparability and sensitivity to determine whether the project DQOs have been met. All validated data will be identified and included in a data usability assessment. The data usability assessment will be completed by RBA personnel under the oversight of Tim Shields, RBA Program Manager. The RBA PM, Don McHugh, will be responsible for the coordination and performance of the usability assessment.

37.2 Precision

Precision quantifies the repeatability of a given measurement. Given the limited number of field and QC samples for this project, precision will be measured by the analyses of both field and laboratory duplicate samples, including MS/MSD. The laboratory will review the QC samples to ensure that internal QC data lies within the limits of acceptability. Any suspect trends will be investigated and corrective actions taken. The findings of the usability of the data relative to precision will be included in the report, including any limitations on the data set and/or individual analytical results. Precision is estimated by calculating the RPD of the duplicate samples, as shown in the following equation:

$$RPD\ (\%) = \frac{|A-B|}{(A+B)/2} \times 100$$

Where:

A = First duplicate concentration
B = Second duplicate concentration

37.3 Accuracy

Accuracy refers to the percentage of a known amount of analyte recovered from a given matrix. It measures the bias in a measurement system. A measurement is accurate when the value reported does not differ (by a specified amount) from the true value, or from the known concentration of a MS or standard. The accuracy of the analytical determinations will be evaluated based on the analyses of LCS, MS/MSD, and surrogate spikes (where applicable). If the percent recovery in these laboratory QC samples is below the accepted limits (Table 1), the associated project samples may be biased low. If the percent recovery is above the accepted limits, then the associated samples may be biased high. This means that the associated sample result is likely lower or higher than the actual laboratory result indicates. Comparisons to project screening criteria (worksheet #15) should be performed with consideration to these biases.

The findings of the usability of the data relative to accuracy will be included in the report, including any limitations on the data set and/or individual analytical results. Percent recoveries are estimated using the following equation:

$$Percent\ Recovery = \frac{S-C}{T} \times 100$$

Where:

S = Measured spike sample concentration
C = Sample concentration
T = True or actual concentration of the spike

37.4 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program. Sample representativeness will be assessed in terms of adherence to established sample collection procedures, required preservation, storage, and holding times. The findings of the usability of the data relative to representativeness will be included in the report, including any limitations on the data set and/or individual analytical results.

37.5 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount expected to be obtained under normal conditions. Completeness is determined based on the number of valid points (data not rejected) relative to the total number of validated data. In addition to validated results, broken, spilled samples, and any other problems that may compromise sample representativeness are included in the assessment of completeness.

$$\text{Completeness (\%)} = \frac{\text{Number of Valid Measurements}}{\text{Total Number of Measurements}} \times 100$$

A completeness standard of 90% has been established for this project. The findings of the usability of the data relative to completeness will be included in the report, including any limitations on the data set and/or individual analytical results.

37.6 Comparability

Comparability expresses the confidence with which one data set is compared with another. This evaluation criterion is critical for use in analyzing temporal trends in constituent variations within the sampling domain. Comparability will be achieved by using standard methods for sampling and analyses, presenting data in standard units, normalizing results to standard conditions, and using standard and comprehensive reporting formats. The findings of the usability of the data relative to comparability will be included in the report, including any limitations on the data set and/or individual analytical results.

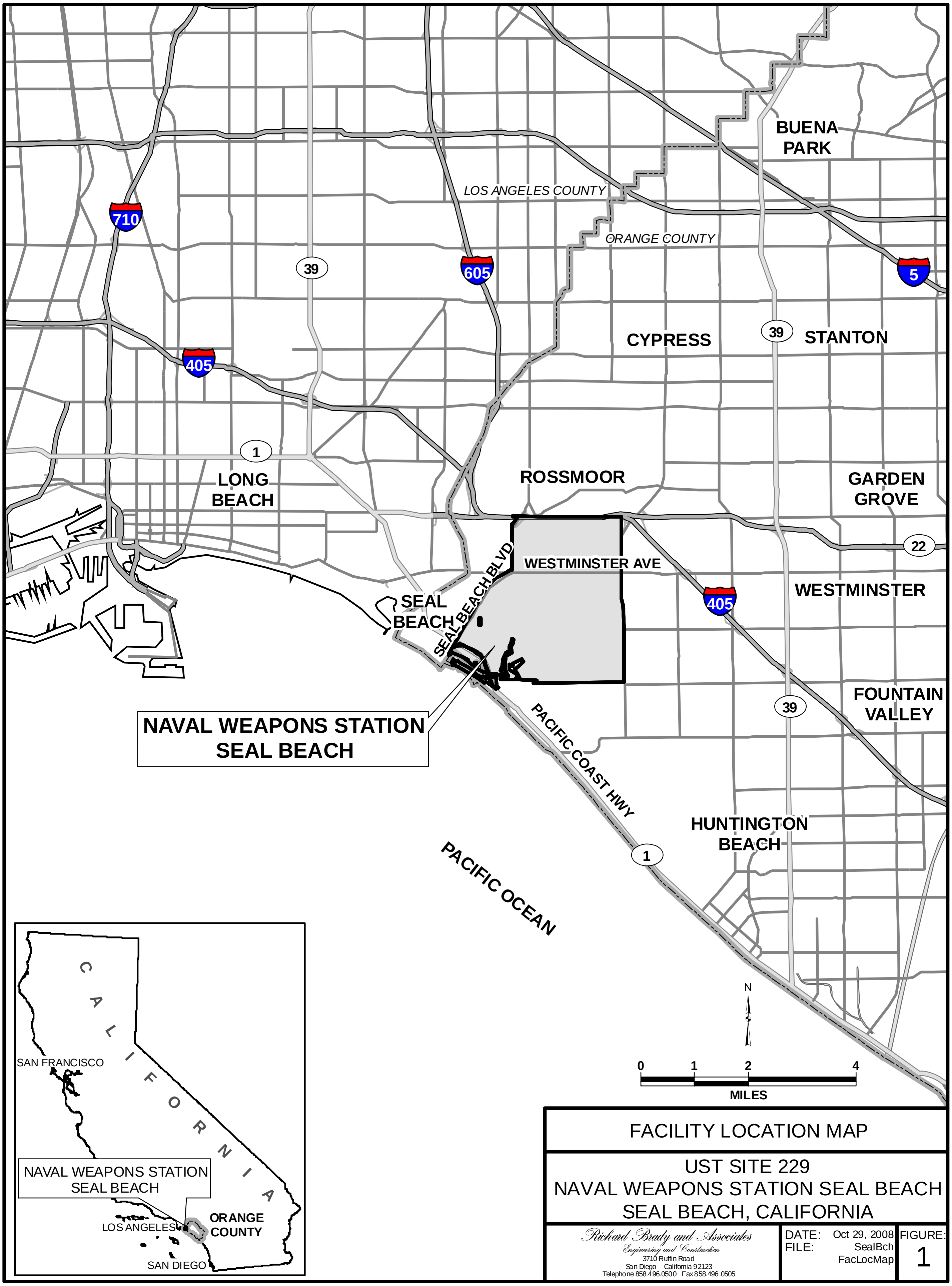
37.7 Sensitivity

Sensitivity is the ability of the analytical test method and/or instrumentation to differentiate between detector responses of varying concentrations of the target constituent. Methodology to establish sensitivity for a given analytical method or instrument includes examination of standardized blanks, instrument detection limit studies, and calibration of the quantitation limits (QL). The findings of the usability of the data relative to sensitivity will be included in the report, including any limitations on the data set and/or individual analytical results.

37.8 Usability Findings

The findings of the usability assessment will be presented in the site assessment report and will include, in addition to the criteria described above, an analysis of any discrepancies in the chain of custody, missed holding times for analysis, modifications to the scope of work, field changes, potential matrix interferences, and potential environmental impacts due to site conditions or meteorological effects.

FIGURES



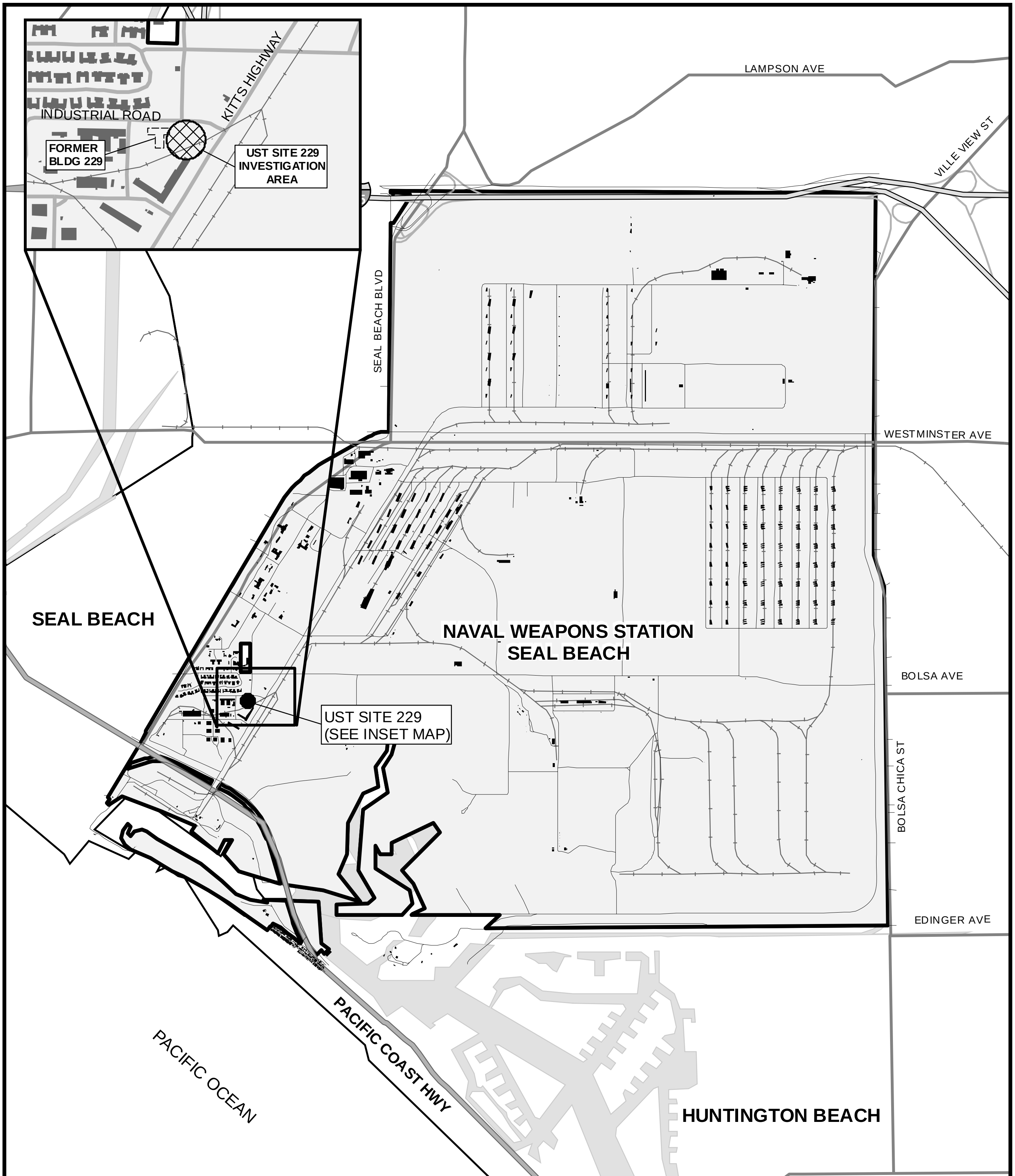
FACILITY LOCATION MAP

UST SITE 229
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

Richard Brady and Associates
Engineering and Construction
3710 Ruffin Road
San Diego California 92123
Telephone 858.496.0500 Fax 858.496.0505

DATE: Oct 29, 2008
FILE: SealBch FacLocMap

FIGURE: 1



N

0 0.25 0.5 1

MILES

SITE LOCATION MAP

UST SITE 229
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

Richard Brady and Associates
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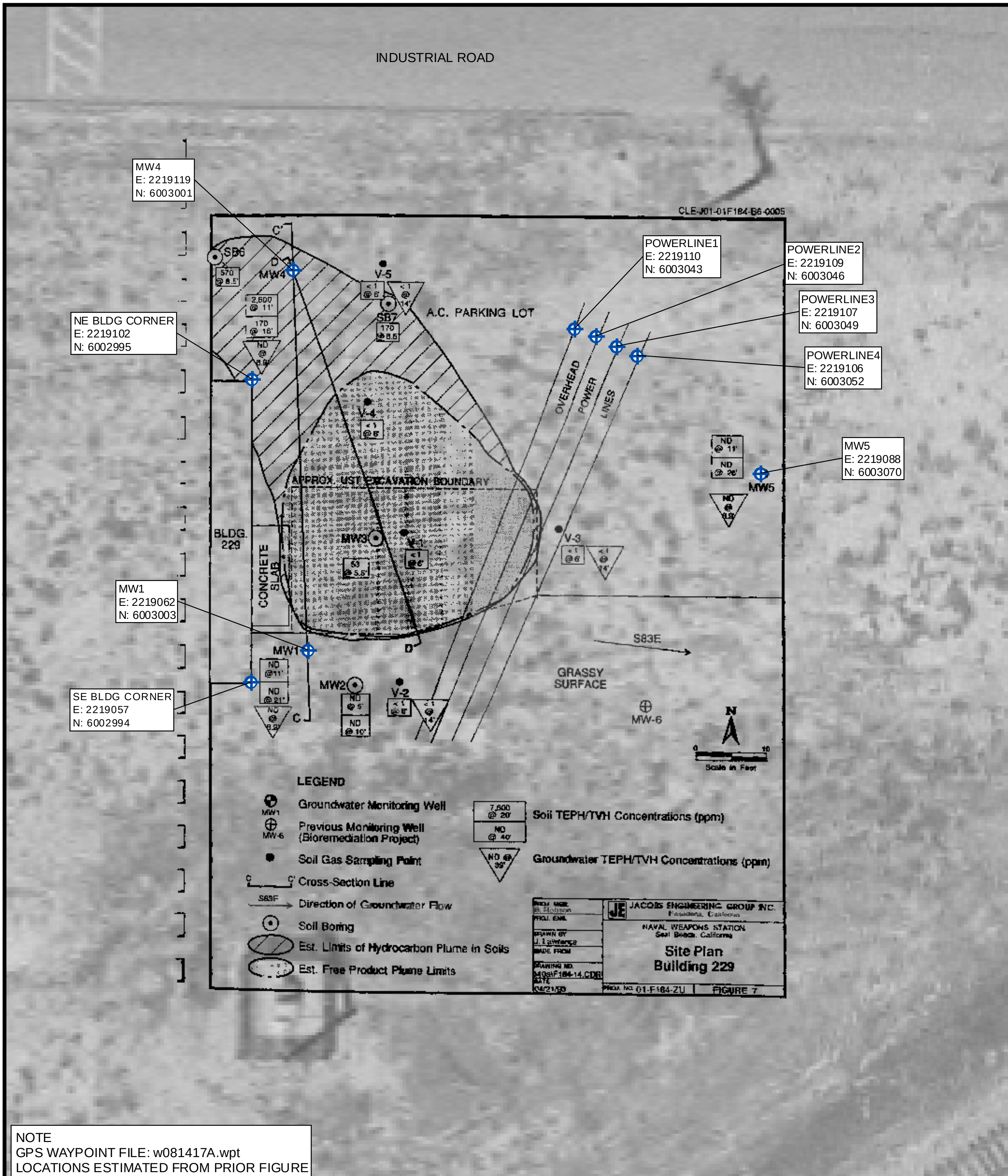
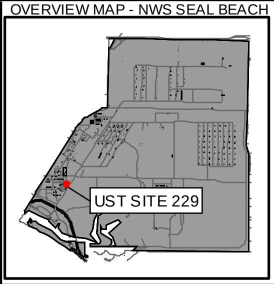
DATE: Oct 29, 2008
FILE: SealBch BaseMap2

FIGURE: 2



OVERVIEW MAP - NWS SEAL BEACH



N

0 20 40

FEET

MAP PROJECTION: NAD 83 CALIFORNIA STATE PLANE 6, SURVEY FEET

PREVIOUS INVESTIGATION

UST SITE 229
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

Richard Brady and Associates
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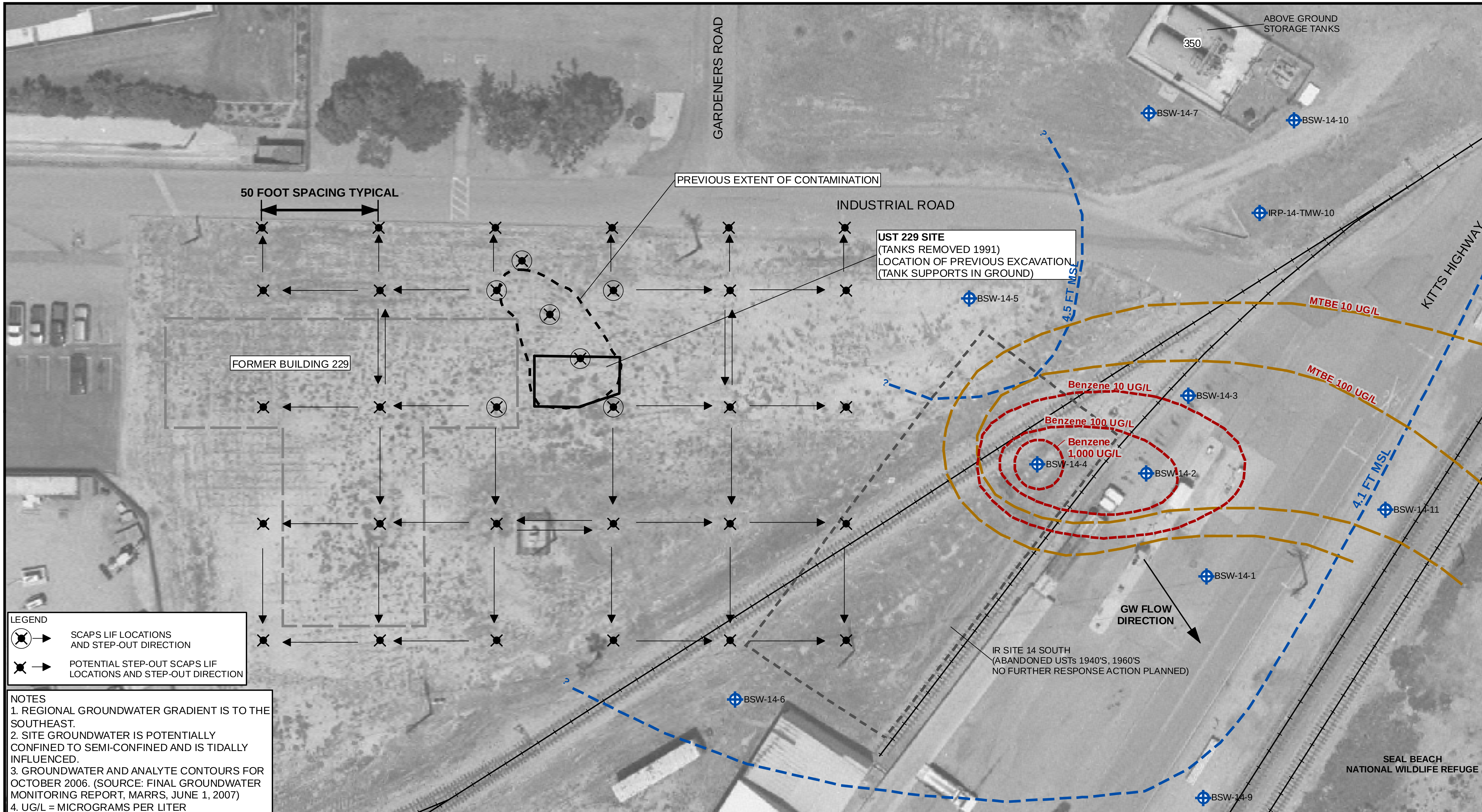
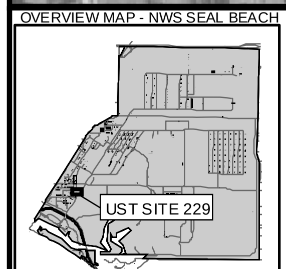
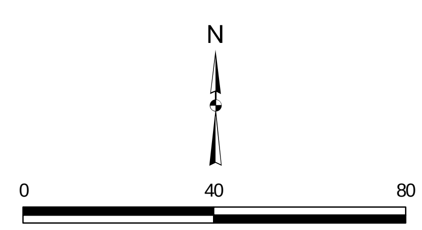
Telephone 858.496.0500 Fax 858.496.0505

DATE: Sep 15, 2008
FILE: UstSite229_080814

FIGURE: 3







MAP PROJECTION: NAD 83 CALIFORNIA STATE PLANE 6, SURVEY FEET

POTENTIAL SCAPS LIF LOCATIONS

UST SITE 229
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

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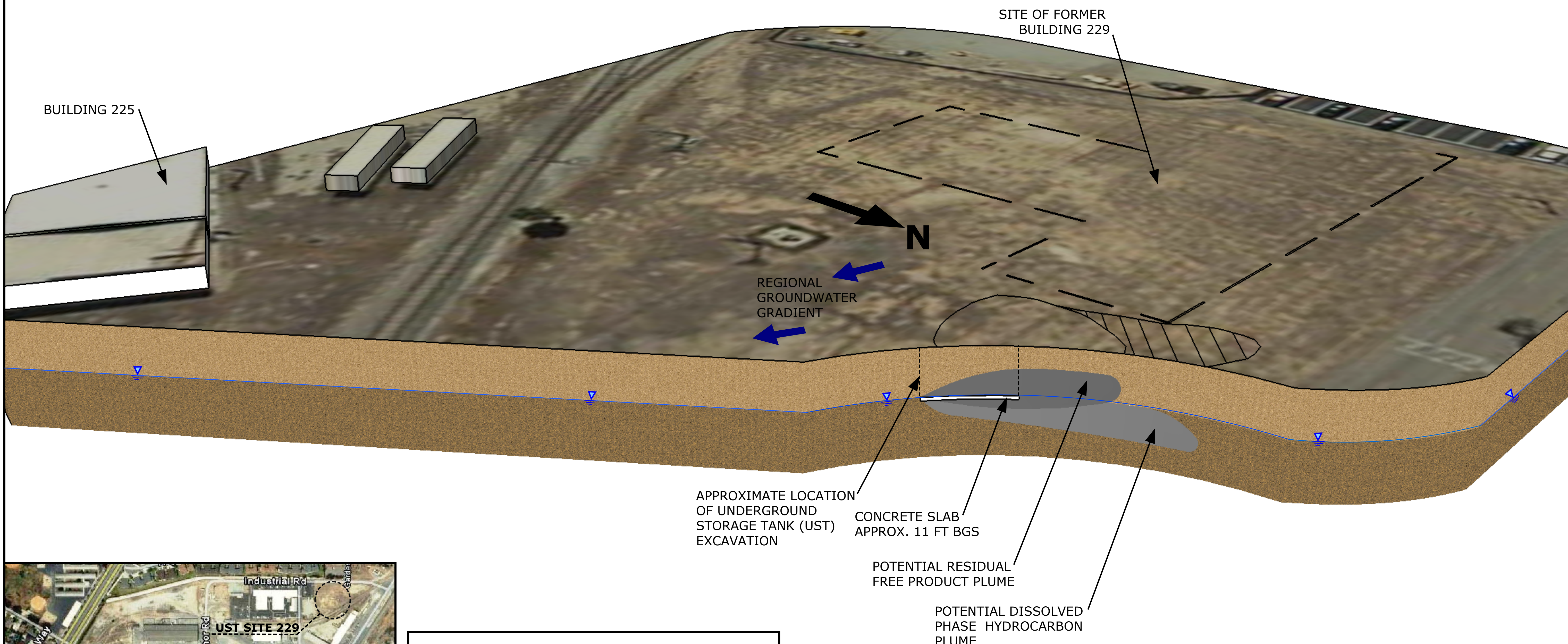
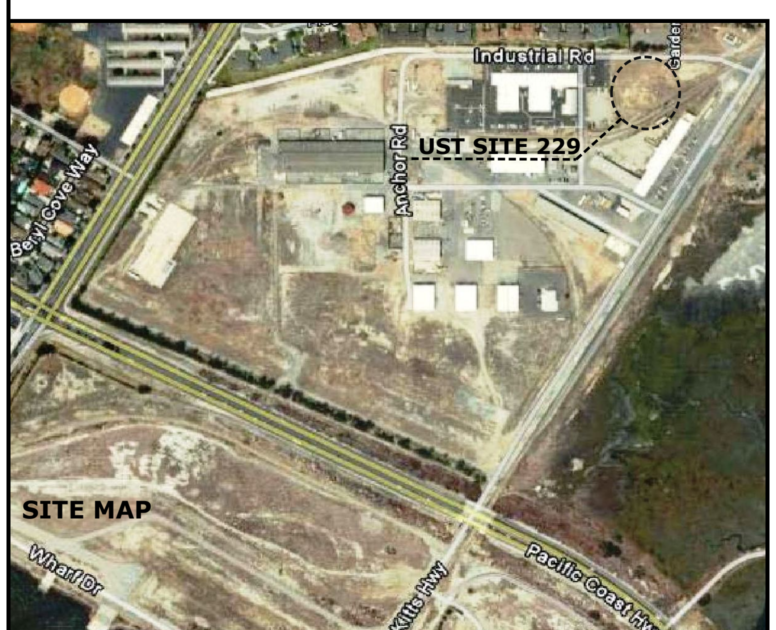
Telephone 858.496.0500 Fax 858.496.0505

DATE: Mar 26, 2009
FILE: UstSite229 PropLoc080825

FIGURE: 4





NOTES:

1. REGIONAL GROUNDWATER GRADIENT IS TO THE SOUTHEAST.
2. SITE GROUNDWATER IS POTENTIALLY CONFINED TO SEMI-CONFINED AND IS TIDALLY INFLUENCED.
3. MAP NOT TO SCALE.
4. THIS CONCEPTUAL SITE MODEL WAS DEVELOPED USING DATA PROVIDED IN THE 1993 SITE ASSESMENT REPORT BY JACOBS ENGINEERING GROUP, INC., ACTUAL SITE CONDITIONS MAY HAVE CHANGED.

LEGEND:

▽ GROUNDWATER TABLE (APPROX 8.5 FT BGS)

CONCEPTUAL SITE MODEL UST SITE 229		
NAVAL WEAPONS STATION SEAL BEACH SEAL BEACH, CALIFORNIA		
Richard Brady & Associates 3710 Ruffin Road San Diego California 92123 Telephone 858.496.0500 Fax 858.496.0505	DATE: SEPT 17 ,2008	
	FILE: CSM_skp	FIGURE 5

SCREENING LEVEL PETROLEUM IMPACTS IDENTIFICATION BY SCAPS LIF

Initiate the LIF screening pushes depicted on Figure 4.

↓

Complete LIF screening pushes depicted on Figure 4.

↓

Identify all of the initial pushes that reported elevated LIF petroleum response intensity above approximately 10,000 counts, indicating probable petroleum impacts.

↓

Initiate the LIF screening step-out sequence to define the extent of the petroleum impacts. Advance LIF screening step-out pushes at all grid points adjacent to any LIF locations that report potential petroleum fluorescence over approximately 10,000 counts.

↓

The step-out pushes will proceed as depicted on Figure 4 until LIF data from all perimeter step-out locations indicate petroleum fluorescence below approximately 10,000 counts throughout the entire depth.

↓

When all perimeter step-out locations indicate petroleum fluorescence below approximately 10,000 counts, soil sampling will be initiated (see soil sampling and analysis process schematic).

LIF SCHEMATIC DIAGRAM – PROJECT GOALS

UST SITE 229
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

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DATE: Nov 7, 2008
FILE: 081107_Fig6-8

FIGURE: 6

SOIL SAMPLING AND ANALYSIS

Determine the number of soil samples to collect. The number of soil samples will equal at least five samples or 10% of the total number of LIF pushes, whichever is greater.

↓

Collect one soil sample from the location with the highest fluorescence intensity interval. This will represent the maximum soil concentrations.

↓

Locate subsequent soil samples generally equidistant around the edge of the LIF push locations that have defined the petroleum impacts. Identify two adjacent locations:

1. **A location with an elevated LIF response above approximately 10,000 counts. Collect sample from the depth of the elevated LIF response.**
2. **One with LIF responses below approximately 10,000 counts. Collect sample from the same depth determined in the preceding step.**

These samples will be used to evaluate soil concentrations at the perimeter of petroleum impacts as defined by LIF screening.

↓

Additional sample locations may be selected to target a depth immediately overlying an LIF response above approximately 10,000 counts. These samples may be used to evaluate actual petroleum concentrations in soil where no petroleum fluorescence is detected.

↓

Use the soil analytical results to corroborate the LIF screening data and compare them to LUFT Manual values and Preliminary Remediation Goals for the protection of groundwater.

SOIL SCHEMATIC DIAGRAM – PROJECT GOALS

UST SITE 229
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

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DATE: Nov 7, 2008
FILE: 081107_Fig6-8

FIGURE: 7

WELL INSTALLATION GROUNDWATER SAMPLING AND ANALYSIS

Three groundwater monitoring wells will be installed for sampling and analysis based on the LIF screening and step-out data. Refer to SAP Sections 11.6 and 14.4 for a specific description of well installation and sampling.

↓

Install one of the groundwater monitoring wells adjacent to an upgradient LIF location that did not report petroleum impacts above approximately 10,000 counts. In addition, install two groundwater monitoring wells adjacent to downgradient LIF locations that did not report petroleum impacts above approximately 10,000 counts.

↓

Collect groundwater samples from the three groundwater monitoring wells and submit them for TPH, BTEX, and naphthalene analysis by EPA Methods 8015-modified and 8260B.

↓

Compare analytical results with San Francisco Bay RWQCB Environmental Screening Levels for Lowest Estuary Aquatic Habitat Goals.

↓

If the LIF data from the source area indicates the possibility of free product, an additional well may be installed adjacent the source area LIF push showing the greatest likelihood of free product within the source area. Using an interface probe, measure the source area well for the presence and thickness of free product.

↓

When all perimeter step-out locations indicate petroleum fluorescence below approximately 10,000 counts, soil sampling will be initiated (see soil sampling and analysis process schematic).

GROUNDWATER SCHEMATIC DIAGRAM – PROJECT GOALS		
UST SITE 229 NAVAL WEAPONS STATION SEAL BEACH SEAL BEACH, CALIFORNIA		
Richard Brady and Associates Engineering and Construction 3710 Ruffin Road San Diego California 92123 Telephone 858.496.0500 Fax 858.496.0505	DATE: Nov 7, 2008 FILE: 081107_Fig6-8	FIGURE: 8

TABLES

TABLE 1
PRECISION AND ACCURACY REQUIREMENTS

Analyte	Accuracy (% Recovery)		Precision (RPD)
	LCS	MS	
TPH-diesel by EPA Method 8015M - Soil			
TPH-diesel	60-140	40-150	50
Bromobenzene (Surr)	50-150	40-160	--
Hexacosane (Surr)	70-140	70-160	--
TPH-diesel by EPA Method 8015M - Groundwater			
TPH-diesel	70-140	60-140	30
Bromobenzene (Surr)	50-140	50-130	--
Hexacosane (Surr)	70-150	70-140	--
BTEX by EPA Method 8260B - Soil			
Benzene	70-130	60-150	50
Ethylbenzene	70-130	70-130	50
Naphthalene	70-130	70-130	50
Toluene	70-130	70-140	50
m,p-Xylene	70-140	70-130	50
o-Xylene	70-130	70-130	50
MTBE	60-150	60-150	50
1,2-Dichloroethane-d4 (Surr)	70-140	60-160	50
4-Bromofluorobenzene (Surr)	70-130	70-150	50
Toluene-d8 (Surr)	70-130	70-140	50
BTEX by EPA Method 8260B - Groundwater			
Benzene	70-130	60-140	30
Ethylbenzene	70-130	70-130	30
Naphthalene	70-130	70-130	30
Toluene	70-130	70-140	30
m,p-Xylene	70-130	70-140	30
o-Xylene	70-130	70-140	30
MTBE	70-140	60-140	30
1,2-Dichloroethane-d4 (Surr)	70-140	70-140	--
4-Bromofluorobenzene (Surr)	70-130	70-130	--
Toluene-d8 (Surr)	70-130	70-140	--
PAHs by EPA Method 8270C-SIM - Soil			
Acenaphthene	10-130	10-130	50
Acenaphthylene	20-130	20-130	50
Anthracene	20-130	20-130	50
Benzo(a)anthracene	30-130	30-130	50
Benzo(a)pyrene	30-130	30-130	50
Benzo(b)fluoranthene	40-130	40-130	50

Analyte	Accuracy (% Recovery)		Precision (RPD)
	LCS	MS	
Benzo(g,h,i)perylene	30-140	30-140	50
Benzo(k)fluoranthene	30-140	30-130	50
Chrysene	30-140	20-130	50
Dibenzo(a,h)anthracene	40-140	40-130	50
Fluoranthene	30-130	30-130	50
Fluorene	20-130	20-130	50
Indeno(1,2,3-cd)pyrene	20-160	20-160	50
Naphthalene	10-130	10-130	50
Phenanthrene	20-130	20-130	50
Pyrene	20-150	10-160	50
Terphenyl-d14 (Surr)	40-130	40-130	--
PAHs by EPA Method 8270C-SIM low - Groundwater			
Acenaphthene	10-130	20-130	30
Acenaphthylene	30-140	30-150	30
Anthracene	40-130	30-150	30
Benzo(a)anthracene	50-130	30-150	30
Benzo(a)pyrene	50-130	30-150	30
Benzo(b)fluoranthene	50-130	30-150	30
Benzo(g,h,i)perylene	30-150	30-150	30
Benzo(k)fluoranthene	50-130	30-150	30
Chrysene	50-130	30-150	30
Dibenzo(a,h)anthracene	40-140	30-150	30
Fluoranthene	40-130	30-150	30
Fluorene	10-150	30-150	30
Indeno(1,2,3-cd)pyrene	40-130	30-150	30
Naphthalene	20-130	30-150	30
Phenanthrene	40-130	30-150	30
Pyrene	40-130	30-150	30
Terphenyl-d14 (Surr)	50-130	30-130	--

Table 2

References

Author	Source
California Regional Water Quality Control Board – Santa Ana Region (Water Board), 2007.	Information Request for Underground Storage Tank Site 229, U.S. Naval Weapons Station Seal Beach, GeoTracker ID: T0605901373. May 31.
California Regional Water Quality Control Board – San Francisco Bay Region (Water Board), 2008.	Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, Table F-4a, Summary of Selected Aquatic Habitat Goals, May.
Jacobs Engineering Group (JEG), 1993.	Naval Weapons Station Seal Beach, California, Underground Storage Tank Studies Site Assessment Report. April 30.
MARRS Services, Inc. (MARRS), 2007.	Final Groundwater Monitoring Report, Installation Restoration Program (IRP) Site 14, Naval Weapons Station Seal Beach, Seal Beach, California. June 1.
Riedel Environmental Services, Inc. (RES), 1991.	Underground Storage Tank Closure Report, Contract # N6674-89-5323. July.
Richard Brady & Associates (RBA), 2008.	Final SCAPS Investigation Kickoff Meeting Minutes, Underground Storage Tank Site 229, Naval Weapons Station Seal Beach, California. September 11.
Robertson and Campanella, 1988	Guidelines for Use, Interpretation and Application of the CPT and CPTU, UBC, Soil Mechanics Series No. 105
U.S. Environmental Protection Agency (EPA), 2004	Region 9 Preliminary Remediation Goals (PRG) table. October 2004.

ATTACHMENT 1

FIELD FORMS

PRE-MOBILIZATION
READINESS REVIEW CHECKLIST

OVERVIEW, PLANNING, & PERSONNEL

	SAT	UNSAT	ACTION ITEM
1. Has the work scope been clearly defined for the site by the PM?			
2. Have data quality objectives (DQOs) been developed (as appropriate) using the U.S. EPA seven-step DQO process?			
3. Are objectives of work clearly understood by the team?			
4. Have appropriate personnel completed their training (e.g., QA orientation, Standard Operating Procedures [SOPs], technical specifications, Work Plan)?			
5. Are copies of training records for all field personnel available at the RR?			
6. Has Quality Management been notified?			
7. Has a quality representative been named and briefed by Quality Management regarding responsibilities?			
8. Have appropriate permits been obtained and regulatory compliance issues been addressed?			
9. Is field office space being provided and when will it be inspected for safety?			
10. Has a schedule been prepared, submitted, and approved by RBA, the Navy (including the Resident Officer in Charge of Construction), and other agencies as appropriate?			
11. Has the Work Plan been approved by the Navy and regulators (as appropriate)?			
12. Has a Registered Geologist been assigned to “responsibly direct” borehole logging and other geologic activities?			

SAFETY & HEALTH

	SAT	UNSAT	ACTION ITEM
1. Have provisions been made for fire extinguishers, first aid kits, mobile phones or radios, eye wash station, and other safety equipment at the site?			
2. Has the Site Safety Officer (SSO) reviewed the Site-Specific Accident Prevention Plan (APP) and/or Health and Safety Plan (HASP) and made arrangements for the required safety and health instrumentation?			
3. Have arrangements for emergency response contractors, local emergency services (police, fire, medical), or interface to base emergency plan been addressed?			
4. Has a contingency plan been prepared for emergencies?			
6. Has emergency coordinator been named?			
7. Have emergency procedures been discussed and understood by the field team?			
8. Does each subcontractor have an approved Activity Hazard Analysis (AHA)?			
9. Does each subcontractor have personnel that meet the appropriate S&H training for their respective tasks?			
10. Has the SSO reviewed with each subcontractor, the specific documentation required for work, including equipment certifications, material safety data sheets (MSDs), and the subcontractor's HASP/Injury and Illness Plan?			
11. Do program personnel meet training requirements (site-specific orientation, quality orientation, and training to appropriate S&H SOPs)?			
12. Is the APP/HASP complete and has it been approved by the Navy?			
14. Have subcontractors submitted a copy of their lock-out tag-out procedure (if applicable)?			

SITE ARRANGEMENT

	SAT	UNSAT	ACTION ITEM
1. Has base access been arranged for personnel and equipment, including subcontractors?			
2. Have appropriate arrangements been made with a local hospital?			
3. Have all required utility surveys been completed or have they been scheduled?			
4. Have appropriate federal, state, and local officials been notified for site entry?			
5. Have community relations activities been planned and has coordination been completed with NAVFAC SW and with local authorities/site owners, as required?			
6. Is there an internal communication system provided, if necessary/planned?			
7. Is there a means of contacting outside help?			
8. Have appropriate signs been procured? This would include Prop. 65 sign, OSHA Safety and Health Protection Poster, various types of caution signs (e.g., hearing protection required, eye protection required, authorized personnel only, waste storage).			

DOCUMENTATION PREPARED

	SAT	UNSAT	ACTION ITEM
1. Has the DQO plan been approved for the samples being taken?			
2. Has documentation (work plan, work-controlling documents, etc.) been completed and will copies be available for use on-site?			
3. Has the Sampling and Analysis Plan (SAP) been reviewed and approved by RBA Quality Assurance Manager (QAM) and the NAVFAC SW Quality Assurance Officer (QAO)?			
4. What is the name of the Data Manager for this project?			
5. Who is the contact person responsible for meeting NIRIS and/or GeoTracker requirements?			

INVESTIGATION-DERIVED WASTE (IDW)

	SAT	UNSAT	ACTION ITEM
1. Are waste-storage areas properly defined and is posting material available?			
2. Are proper waste container labels available?			
3. Are security measures available to prevent unauthorized entry into storage areas after mobilization?			
4. Will hazardous waste be stored in tanks?			
5. Is this hazardous waste addressed adequately in an IDW Plan?			
6. If hazardous waste is anticipated, are storage requirements (including 60- or 90-day limits) understood?			
7. Have provisions been made to remove waste within 60 or 90 days of generation?			
8. Is an IDW awareness sign available for IDW storage area?			
9. Has an IDW Plan been reviewed and approved by RBA and the Navy?			

CONTRACTS/SUBCONTRACTS

	SAT	UNSAT	ACTION ITEM
1. Have target analyte detection limit requirements been determined, relative to appropriate regulatory action levels?			
2. Has the laboratory coordinator verified that the selected laboratory can meet required detection limits?			
3. Have equipment/materials/supply requirements been defined and arrangements made?			
4. Have vehicles for field transportation, equipment, and storage requirements been defined and have arrangements been made?			
5. Have emergency repair capabilities been identified and arranged prior to going out to the field (e.g., phone, gas, water, power, sewer)?			

CONTRACTS/SUBCONTRACTS (continued)

	SAT	UNSAT	ACTION ITEM
6. Have arrangements been made for chemical samples to be transported and processed by analytical laboratories?			

READINESS REVIEW ACTION ITEMS LIST

Item No.	Action Item	Responsible Person	Due Date	Date Completed
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				

Actions Completed

RBA Quality Assurance Manager　　　　Date

RBA Project Manager　　　　Date

POST-MOBILIZATION CHECKLIST

SAFETY & HEALTH

	SAT	UNSAT	ACTION ITEM
1. Are emergency planning requirements met?			
2. Are manifest records complete and correct?			
3. Have lost or missing shipments been traced?			
4. Are appropriate fire extinguishers provided at the site?			
5. Has a list of all required spill control, decontamination, safety, fire protection, and communication equipment specified for facility been made available?			
6. Does required equipment (e.g., fire extinguishers) have established test schedules, and are tests documented?			
7. Is the contingency plan maintained and kept up to date?			
8. Have appropriate arrangements been made with a local hospital?			
9. Is the APP/HASP current; has the SSO been identified and received training, and have all premobilization requirements been met?			
10. Do program personnel meet training requirements?			
11. Has compliance with medical surveillance program been achieved?			
12. Is monitoring equipment available and operational, and was it tested before field mobilization?			
13. Is PPE, site control, and decontamination equipment available and operational?			
14. Are appropriate calibration gases available?			
15. Are decontamination testing methods in place?			

SAFETY & HEALTH (continued)

	SAT	UNSAT	ACTION ITEM
16. Have emergency phone numbers been verified, made part of the site-specific training, and have they been tested, and are they posted?			
17. Are emergency supplies readily available?			
18. Does subcontractor(s) have all applicable safety and health records on-site?			
19. Are the Hazardous Communication training records and MSDs filed on-site?			
20. Have initial calibration records been maintained?			
21. Are samples expected to be contaminated with PCBs? If so, have arrangements been made with a carrier other than FedEx?			
22. Are samples expected to be contaminated with 20 ppm or greater of arsenic or PCBs? If so, have special training and shipping arrangements been made for these reportable quantities of hazardous substances?			
23. Are environmental samples (soil, waste, water) expected to meet any other contamination criteria that would require implementation of special training, packaging, and shipment requirements, in accordance with Department of Transportation requirements?			

SITE ARRANGEMENT

	SAT	UNSAT	ACTION ITEM
1. Was work scope reviewed with subcontractors at kickoff meeting?			
2. Has the subcontractor been made familiar with site contacts?			
3. Does the subcontractor have required materials, equipment, and personnel to perform assigned tasks?			
4. Did you check to see if the subcontractor has its AHA on-site?			

INVESTIGATION-DERIVED WASTE (IDW)

	SAT	UNSAT	ACTION ITEM
1. Has individual responsible for waste received training? Is it documented?			
2. Are records of storage time being maintained?			
3. Are warning signs posted at facility entrances and each side of storage areas?			
4. Is adequate aisle space maintained between containers in the storage area?			
5. Are storage areas posted with signs legible at 25 feet. Do these signs state, for example, “IDW Storage Area, Unauthorized Personnel Keep Out”?			
6. Are waste materials in storage, within the 60- or 90-day limit?			
7. Are containers maintained in good condition (no leaks; all contents of leaking containers are transferred to good containers)?			
8. Are containers compatible with waste?			
9. Are containers maintained closed except when adding waste?			
10. Does each container have a label with a start date on it? The start date is the first day that material is placed in container.			
11. Has the inspection schedule been developed and implemented?			

POST-MOBILIZATION ACTION ITEMS LIST

Item No.	Action Item	Responsible Person	Due Date	Date Completed
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				

Actions Completed

_______________________________________ ____________

RBA Quality Assurance Manager Date

_______________________________________ ____________

RBA Project Manager Date

Richard Brady & Associates

Engineering and Construction

Field Sampling Technical Systems Audit

Project Name: ____
Date of Audit: ____
Auditor: ____
Audit No: ____

General:

A. Has the site exclusion zone been defined and secured?
SAT ____ UNSAT ____ N/A ____

B. Is site access log available and in use?
SAT ____ UNSAT ____ N/A ____

C. Is the Work Plan, including the SAP, available onsite and are personnel complying?
SAT ____ UNSAT ____ N/A ____

D. Has the Project Personnel Sign-Off Sheet (SAP Table 1-3) been signed by all sampling personnel performing work on-site?
SAT ____ UNSAT ____ N/A ____

E. Are the appropriate and current SOPs available onsite?
SAT ____ UNSAT ____ N/A ____

F. Have the site emergency phone numbers and the medical facilities address and route map been posted?
SAT ____ UNSAT ____ N/A ____

LOGBOOKS

1) Are logbooks permanently bound and pre-paginated?
SAT ____ UNSAT ____ N/A ____

2) Are corrections to logbook entries made with a single line out of the incorrect entry, and has the correction been initialed by the person making the correction?
SAT ____ UNSAT ____ N/A ____

3) Is each sample or field measurement properly documented to facilitate timely, correct and complete analysis of data?
SAT ____ UNSAT ____ N/A ____

HEALTH & SAFETY

4) Has a daily Health & Safety meeting covering site-specific health hazards and required PPE been conducted?
SAT ____ UNSAT ____ N/A ____

5) Are there any visible Health & Safety concerns (ex. slips, trips, or falls)?
SAT ____ UNSAT ____ N/A ____

6) Have the utility & geophysical clearances been completed prior to the start of intrusive work?
SAT ____ UNSAT ____ N/A ____

7) Is an organic vapor meter, a PID/FID, being used to monitor organic vapors during direct push operations?

SAT ____ UNSAT ____ N/A ____

8) Are the field instruments being used calibrated, and is the calibration recorded? (Record instrument serial numbers.)

SAT ____ UNSAT ____ N/A ____

SCAPS

9) Was the SCAPS pre-push calibration of the laser performed and documented?

SAT ____ UNSAT ____ N/A ____

10) Was the SCAPS cone& sleeve strain gauge calibration performed and documented?

SAT ____ UNSAT ____ N/A ____

11) Are the site location names being used consistently with respect to the SCAPS WinOCPT data files and the sample identification numbers?

SAT ____ UNSAT ____ N/A ____

SAMPLING & ANALYSIS

12) Does the onsite mobile laboratory have current state certification? Current SOPs for methods they are performing? Qualification and certifications for the mobile lab operator?

SAT ____ UNSAT ____ N/A ____

13) Verify that the physical parameters for each groundwater sample collected are recorded and are in range. (include conductivity, pH, and temperature)

SAT ____ UNSAT ____ N/A ____

14) Verify that the soil or groundwater sample is transferred directly into the appropriate sample container, labeled, and placed into an ice chest.

SAT ____ UNSAT ____ N/A ____

15) Do the sample labels affixed to each sample container have the following information: project name and number, sample ID, analysis to be performed, type of preservative, sample collector's initials, collection date and time, and special instructions?

SAT ____ UNSAT ____ N/A ____

16) Are sampling equipment, materials, tools, and field measurement devices being decontaminated before each use, and in accordance with SOP T-001?

SAT ____ UNSAT ____ N/A ____

17) Are equipment rinsate blanks collected by pouring deionized water over or through the sampling equipment after decontamination and prior to taking the next sample?

SAT ____ UNSAT ____ N/A ____

18) Is one equipment rinsate sample (equipment blank) collected for each day that non-disposable sample equipment is used?

SAT ____ UNSAT ____ N/A ____

19) Is equipment rinsate documentation complete with detail of the equipment used and the source water description (ex. Arrowhead Distilled, Lot No., etc.)?

SAT ____ UNSAT ____ N/A ____

20) Is one MS/MSD sample collected for every 20 environmental samples collected?

SAT ____ UNSAT ____ N/A ____

21) Are source blanks being collected from the same source of water used for equipment decontamination?

SAT ____ UNSAT ____ N/A ____

22) Is one groundwater field duplicate sample collected for every 10 groundwater samples collected?

SAT ____ UNSAT ____ N/A ____

23) Does each shipping container being sent to the fixed-base laboratory contain a temperature blank?

SAT ____ UNSAT ____ N/A ____

24) Does each shipping container being sent to the fixed-base laboratory contain the appropriate number of trip blank samples?

SAT ____ UNSAT ____ N/A ____

25) Are soil and groundwater samples being sent to a fixed-base laboratory for the methods indicated in QAPP Worksheets 19, 20, and 28?

SAT ____ UNSAT ____ N/A ____

26) Are sample containers being placed in a cooler with wet or dry ice to maintain sample temperatures at 4°C?

SAT ____ UNSAT ____ N/A ____

27) Are glass sample containers being wrapped in foam or bubble wrap before being placed in a Ziploc style bag?

SAT ____ UNSAT ____ N/A ____

28) Are shipping containers being secured with two custody seals (front right & back left)?

SAT ____ UNSAT ____ N/A ____

29) Have all the appropriate sampling forms and sample decontamination been completed?

SAT ____ UNSAT ____ N/A ____

30) Is all applicable information recorded on the chain-of-custody (COC), including sample ID, ”relinquished/received by” signatures, and time and date of relinquishment?

SAT ____ UNSAT ____ N/A ____

31) Are samples requiring different QC levels or turn around times recorded on separate COCs?

SAT ____ UNSAT ____ N/A ____

32) If samples are to be delivered to the fixed-base laboratory by an overnight carrier, has the airbill number been recorded on the COC?

SAT ____ UNSAT ____ N/A ____

33) If samples are to be delivered to the fixed-base laboratory by an overnight carrier, has the COC been placed inside a plastic Ziploc style bag and taped to the inside of the sample container lid?

SAT ____ UNSAT ____ N/A ____

INVESTIGATION DERIVED WASTE

34) Is IDW being handled and stored appropriately? (i.e. soil being placed in covered portable roll-off bins lined with plastic sheeting or DOT approved drums (ex. 17H 55-gallon drum) and liquids in a separate 17H 55-gallon drum?)

SAT ____ UNSAT ____ N/A ____

35) Is each IDW container clearly marked with a label to indicate the waste source, date of generation, point of contact, etc.?

SAT ____ UNSAT ____ N/A ____

36) Is any IDW being stored over 90 days? If storage area is at Camp Pendleton, is any IDW being stored over 60 days?

SAT ____ UNSAT ____ N/A ____

COMMENTS:

LOW FLOW WELL PURGING-FIELD WATER QUALITY MEASUREMENTS FORM

Project Name: ______________________________
Project Number: ______________________________
Well Number: ______________________________
Date: ______________________________
Field Personnel: ______________________________
Weather ______________________________

Screen Interval (Depth in feet):__________________________
Pump Intake at (Depth in feet):__________________________
Purging Device:_______ Portable Bladder Pump
Total Depth (feet):____________________________________

Materials: [X] Dedicated Tubing [ ] Polyethylene [X] Teflon Lined [ ] Disposable [ ] Other______________

Clock Time 24 Hr:	Water Depth Below TOC (ft)	Pump Dial	Pumping Rate (L/min) <0.5	Cum. Volume Purged (liters)	Temp (°C)	Conductivity (µS/cm) (±3%)	pH (±0.2)	ORP/Eh (mV) (±10)	DO (mg/L) (±10%)	Turbidity (NTU) (±10%)	Comments

Sample ID:__________________________________
Sample Time:____________________________________

Comments:____
Sampler Signature:____

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Engineering and Construction

Field Documentation Review

Project: ______________________________

Date(s) of Fieldwork: ______________________________

Date of Review: ______________________________

Reviewer: ______________________________

Project Documents Reviewed: ______________________________

____

Field Logbook

Y N
- ☐ ☐ Was a Field Logbook used for this project?
- ☐ ☐ Are all entries to the Field Logbook complete?
- ☐ ☐ Are all entries legible and is the information consistent with other field documents?
- ☐ ☐ Were there entries or corrections made in the logbook that needed clarification?

Field Notebook

Y N
- ☐ ☐ Was a Field Notebook used for this project?
- ☐ ☐ Are all entries to the Field Notebook complete?
- ☐ ☐ Are all entries legible and is the information consistent with other field documents?
- ☐ ☐ Were there entries or corrections made in the notebook that needed clarification?

Chain-of-Custody

Y N
- ☐ ☐ Is all the project and contact information correct and complete?
- ☐ ☐ Are all Sample IDs and the additional sampling information correct?
- ☐ ☐ Does the Sample ID structure conform to the description in the planning document?
- ☐ ☐ Were the correct number and type of sample containers used?
- ☐ ☐ Do the requested analyses match the descriptions in the planning document?
- ☐ ☐ Was the correct TAT requested?
- ☐ ☐ Were the "comment" and "instruction" sections clear and complete?

SCAPS Profiles

Y N
- ☐ ☐ Were the push locations named in accordance with the planning document?
- ☐ ☐ Were the depths at each location consistent with the planning document?
- ☐ ☐ Were the three profiles collecting data down to the appropriate depth?

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Checklist Instructions

1. Field Logbook / Field Notebook

   - Read all daily entries in the logbook and/or notebook to verify the **completeness** of ideas and events. If any ideas or information looks incomplete, contact the appropriate person to make the corrections.

   - Make sure all entries are **legible** and information such as Station ID, Sample ID, collection time and date are **consistent** with other field documents. If any inconsistencies are found, try to resolve which entries are correct with the appropriate person and make all necessary corrections.

   * Initial and date all corrections, and always notify the QA Manager and Project Manger when corrections are needed.

2. COC

   - Verify that all project and contact information (client name, project name, project coordinator, address, phone number, etc.) is correct.

   - Cross-check all **Sample IDs** and **sampling information** (location, date & time) against the field logbook and/or field notebook. Verify that the **Sample IDs** conform to the description in the appropriate planning document (SAP, WP, etc).

   - Verify the **sample container information** and the **requested analyses** against the appropriate planning document.

   - Verify the **turnaround time (TAT)** for lab results against the laboratory Statement of Work (SOW). Look for instructions regarding both preliminary and final results.

   - Check the “comments” and “instructions” sections of the COC. Determine if any clarification is needed. MS/MSD should be listed in the comments, if applicable.

   * Report any changes or corrections immediately to the QA Manager or Project Manager so the correct information can be relayed to the lab in a timely matter.

3. SCAPS Profiles

   - Verify that the naming convention used for the push locations (ex. RBSD-01) and the depth of each push correlate with what is written in the planning document.

   - Verify that the three SCAPS profiles (Soil Class, Wavelength @ Peak, & Peak Intensity) collected data down to the appropriate depth.

INSTRUMENT CALIBRATION FORM

Project Name: ______________________________
Project Number: ______________________________
Project Location: ______________________________

Date	Time	Instrument Type	Model	Serial Number	Field Parameter	Measured Conc.	Final Calibrated Conc.	Accepted (Yes/No)	Initials	Comments

LABORATORY CHAIN-OF-CUSTODY

COC- ___ of ___

Richard Brady & Associates
Engineers & Constructors
4909 Murphy Canyon Road, Suite 220
San Diego, CA 92123
Phone: 858 / 496-0500 Fax: 858 / 496-0505

RESULTS DELIVERY:
☐ FAXED
☐ PICKED UP
☐ GUARD MAIL
☐ Other

CUSTOMER DUE DATE: ______
PROJECT NAME: ______
JOB ORDER #: ______
SAMPLED BY (PRINT): ______

CHECK REGULATORY PROGRAM
☐ HAZWASTE/GROUNDWATER/LUFT(RCRA)
☐ DRINKING WATER (SDWA)
☐ DISCHARGE (NPDES/CWA)
☐ ABATEMENT (HUD) ☐ OTHER

(LAB USE ONLY)
☐ RUSH SURCHARGE
PROJ. # ______
☐ NAVY IR
☐ OTHER

CONTACT: ______ PHONE: ______

ALT. CONTACT: ______ PHONE: ______

ACTIVITY: ______ FAX: ______

ADDRESS: ______

______

E-MAIL: ______

PRESERVATION CODE/BOTTLE CODE

ANALYSIS REQUESTED

LAB LOG NUMBER	SAMPLE IDENTIFICATION*	DATE COLLECTED	TIME COLLECTED	SAMPLE MATRIX	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	Number of Containers/Sample

RELINQUISHED BY: ______ (PRINT & SIGN) RECEIVED BY: ______ (PRINT & SIGN) DATE: ______ TIME: ______

RELINQUISHED BY: ______ (PRINT & SIGN) RECEIVED BY: ______ (PRINT & SIGN) DATE: ______ TIME: ______

RELINQUISHED BY: ______ (PRINT & SIGN) RECEIVED BY: ______ (PRINT & SIGN) DATE: ______ TIME: ______

COMMENTS: * = Location of where the samples(s) were collected. (Rvsd 06/11/03)

COOLER TEMP ______ degrees C (LAB USE ONLY)
RECEIVED ON ICE: Y ☐ N ☐
CORRECT CONTAINER: Y ☐ N ☐
PRESERVED: Y ☐ N ☐
SEAL INTACT: Y ☐ N ☐ N/A ☐
FED EX. TRACKING # ______

☐ BAC-T Form
☐ Field notes
☐ Scur Form
☐ SIF
☐ Others ______

COC2003.XLS

1 = Nitric Acid(HNO3) 2 = Hydrochloric Acid(HCl) 3 =Sulfuric Acid(H2SO4) 4 = Sodium Hydroxide(NaOH) 5 = Zinc Acetate(ZnC2H3O2)
6 = Sodium Thiosulfate(Na2S2O3) 7 = Ascorbic Acid(C6H8O6) 8 = Sodium Bisulfate(NaHSO4) 9= Monochloroacetic acid(C2H3O2Cl) NA = Not applicable 10 = Other ______

AIR MONITORING FORM

Monitoring Location:____________________ **Instrument Type:**____________________

Location POC:____________________ **Instrument Model:**____________________

Date:____________________ **Calibrated on:**____________________

Monitoring Crew:____________________ **Other Monitoring Equipment:**____________________

Monitoring Location	Activity Description (Drilling, sampling, excavating, etc.)	OVA Reading (ppm)	Monitored Zone *	Observations/Comments

* BZ = Breathing zone
BH = Borehole
EZ = Exclusion zone perimeter
Other - Please specify

SCAPS Soil Sample Description Form

SAMPLE ID: SAMPLED BY: DATE: TIME:

SAMPLE PUSH INTERVAL (AS PUSHED):
SAMPLE INTERVAL (CONVENTIONAL DRILLING):
RECOVERY (TUBES OR FOOTAGE):
0 ½ 1 1½ 2 2½ 3 3+

TUBE COLLECTED FOR SAMPLE: *TOP MIDDLE BOTTOM*
END OF TUBE MARKED FOR ANALYSIS: *TOP BOTTOM NA*
NOTES REGARDING SAMPLE DEPTH:

SOIL DESCRIPTION: COLOR (MUNSELL)

GRAIN SIZE / SOIL DESCRIPTION:

USCS CLASSIFICATION:

DENSITY DESCRIPTION:

MOISTURE DESCRIPTION:

STAIN AND ODOR DESCRIPTION:

NOTES REGARDING SOIL DESCRIPTION:

SAMPLE LOCATION RELATIVE TO CPT LOCATION

SAMPLE ID: SAMPLED BY: DATE: TIME:

SAMPLE PUSH INTERVAL (AS PUSHED):
SAMPLE INTERVAL (CONVENTIONAL DRILLING):
RECOVERY (TUBES OR FOOTAGE):
0 ½ 1 1½ 2 2½ 3 3+

TUBE COLLECTED FOR SAMPLE: *TOP MIDDLE BOTTOM*
END OF TUBE MARKED FOR ANALYSIS: *TOP BOTTOM NA*
NOTES REGARDING SAMPLE DEPTH:

SOIL DESCRIPTION: COLOR (MUNSELL)

GRAIN SIZE / SOIL DESCRIPTION:

USCS CLASSIFICATION:

DENSITY DESCRIPTION:

MOISTURE DESCRIPTION:

STAIN AND ODOR DESCRIPTION:

NOTES REGARDING SOIL DESCRIPTION:

SAMPLE LOCATION RELATIVE TO CPT LOCATION

FIELD NOTES CHECK OFF LIST

The following must be recorded in the Daily Field Notes:

- ☐ Project Name
- ☐ Project Number
- ☐ Date
- ☐ Weather
- ☐ Work Performed/Field Observations
- ☐ Field Personnel
- ☐ Health and Safety Briefing
- ☐ Incidents/ Corrective Actions
- ☐ Location and Type of Samples Collected
- ☐ Quality Control Activities
- ☐ Variation from Field Procedure/Reason

Daily Summary Report

Date:_______________

Project Name:
Project Number:

Weather	**Bright Sun**	**Clear**	**Overcast**	**Rain**	**Snow**
Temp (F)	**Under 32**	**32-50**	**51-70**	**71-85**	**Over 85**
Wind	**Still**	**Mod.**	**High**	**Report No.**	
Humidity	**Dry**	**Mod.**	**High**		

Field Personnel: ______________ ______________ ______________

______________ ______________ ______________

______________ ______________ ______________

______________ ______________ ______________

Project Name:	
Project No.	**Date:**

FIELD CHANGE FORM

Site Name/Project Title:____

Project Manager:_________________________ Date:____________________

Client:________________________________

SAP Approved by:________________________ SAP Date:________________

Field Change:

____

____

____

____

Reason for Field Change:

____

____

____

____

Overall Project Impact: ☐ Insignificant

☐ Significant (list below corrective action)

Corrective Action:

____

____

Requested by:__________________________________ Date:__________________

Approved by (PM) :_____________________________ Date:__________________

Approved by (QC Manager):_______________________ Date:__________________

ATTACHMENT 2

STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURE

EQUIPMENT DECONTAMINATION

SOP NUMBER: T-001

REVISION NUMBER: 1

REVISION DATE: May 27, 2008

Prepared by: ___________________________ *May 27, 2008*
Jason Williams *Date*

Approved by: ___________________________ *May 27, 2008*
Jesse MacNeill - Quality Assurance Manager *Date*

Approved by: ___________________________ *May 27, 2008*
Tim Shields - Program Manager *Date*

Richard Brady & Associates
Engineering and Construction

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San Diego, CA 92123

TABLE OF CONTENTS

RICHARD BRADY AND ASSOCIATES STANDARD OPERATING PROCEDURE

EQUIPMENT DECONTAMINATION PROCEDURES

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes procedures for field decontamination of drilling and sampling equipment. This SOP provides a description of methods used for preventing, minimizing, or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination. This SOP also provides general guidelines for developing decontamination procedures for sampling equipment to be used during hazardous waste operations. Implementation of this procedure will help protect site and community personnel by preventing removal of non-decontaminated equipment from a controlled area.

2.0 BACKGROUND

Samples of media such as soil and groundwater, collected during field investigations, are used to evaluate the presence and extent of potential contaminants. All equipment that comes in contact with the sampled material should be free of components that could influence (contaminate) the true physical or chemical composition of the material. Decontamination of the sampling equipment is required to minimize the risk of exposure to hazardous substances, prevent cross-contamination, and ensure the collection of representative samples. Disposable equipment or the use of dedicated equipment provides the most effective means of avoiding cross-contamination; however, the use of such equipment is not always practical. When non-dedicated equipment is used, physical and chemical steps shall be implemented to decontaminate or remove any chemical or material contamination from the sampling equipment.

Equipment shall be decontaminated to a level that meets the minimum requirements of the data collection effort. Decontamination steps (e.g., use of solvents versus use of only soap and water), should be selected based on the constituents present, their concentration levels in the waste or materials sampled, and their potential to introduce bias in the sample analysis results if not removed from the sampling equipment. Project-specific decontamination procedures shall be described in a work plan.

3.0 APPLICABILITY

This procedure is applicable for field decontamination of drilling, excavating, and/or sampling equipment that comes into contact with potentially contaminated soil, water, or other potentially hazardous materials. This procedure is applicable to drill rigs, backhoes, hand-augers, samplers, and other equipment or containers used in sampling.

This procedure may vary or change depending on site conditions, equipment limitations, or limitations imposed by the procedure. Use procedures specified in a site-specific work plan or Health and Safety Plan, where in conflict with or superior to this procedure. In all instances, document actual procedures used in the field log book.

4.0 DEFINITIONS

Decontamination – the removal of contamination from persons or objects.

Container – a portable device, in which a material is stored, transported, treated, disposed of, or otherwise handled.

Cross-Contamination – the inadvertent introduction of contaminated materials from one location to another.

HSP – Health & Safety Plan developed specific for a site or field activity that has been approved by the Site Safety and Health Representative. The HSP provides information specific to the project including relevant history, descriptions of hazards by activity associated with the project site(s), and techniques for exposure mitigation (e.g. personal protective equipment) and hazard mitigation.

IDW – Investigation Derived Waste.

Field Logbook – Permanent record of field activities. Must be bound. Off site personnel should be able to reconstruct all activities of the field investigation team using the field logbook.

PPE – Personal Protective Equipment.

Residual Contamination – Contamination residue that requires a detergent or solvent solution to remove from equipment, as in a wet decontamination area.

Gross Contamination – Contaminated matter that can be removed from equipment mechanically, as in the dry decontamination area.

Dry Decontamination Area – An optional division of the Decontamination Zone where gross decontamination is removed by physical means without water or solvents.

Wet Decontamination Area – Part of the Decontamination Zone where aqueous detergent and/or solvent solutions are used to remove contamination from equipment.

ACS - American Chemical Society, sets standards for the highest quality of chemical purity; publisher of Reagent Chemicals, 9th Edition, a guide to testing chemical purity.

5.0 REFERENCES

NIOSH/OSHA/USCG/EPA Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities [PB85-115/October 1985]

EPA, Office of Emergency and Remedial Response, Standard Operating Safety Guides, [PB9285.1-03/June 1992]

29 Code of Federal Regulations, 1910.132; Personal Protective Equipment Standard

Navy/Marine Corps Installation Restoration Manual, Naval Facilities Engineering Services Command (NFESC), February 1997

U.S. EPA, “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,” SW-846, 3rd edition, 1986.

U.S. EPA, “RCRA Waste Sampling Draft Technical Guidance, Planning, Implementation, and Assessment”, EPA530-D-02-002, August 2002.

U.S. EPA, “Sampling Equipment Decontamination,” SOP Number 2006, August 11, 1994.

California Department of Toxic Substances Control, Hazardous Materials Laboratory, User’s Manual, Revision 9, (October 1995).

6.0 APPARATUS AND MATERIALS

See attached equipment and material checklist for equipment and supplies for typical decontamination activities. Some equipment may not be applicable for some projects. Consider equipment based on availability, ease of decontaminating or disposing equipment, and type of contaminants encountered.

7.0 PROCEDURE

Use this procedure to remove or neutralize contaminants from equipment to minimize the likelihood of sample cross contamination, reduce or eliminate transfer of contaminants to clean areas, and prevent the mixing of incompatible substances.

7.1 Responsible Personnel

The following personnel are responsible for activities identified in this procedure.

Project Manager (PM) - is responsible for ensuring that field personnel have been trained in the use of this procedure. The PM is responsible for ensuring that field personnel have the proper equipment and decontamination line established prior to starting any invasive field activities. The PM is also responsible for making arrangements to dispose of all decontamination generated wastes (i.e., liquids and solids) and keeping documentation demonstrating proper disposal of such wastes.

Physical Science Technician (PST) – is responsible for conducting decontamination procedures. The PST is responsible for monitoring and aiding in the decontamination of personnel, PPE, and equipment. The PST must be appropriately protected to accomplish this task without exposure to the contamination. The PST is also responsible for communicating to the PM any problems encountered during the field activities.

7.2 Establish Decontamination Areas

Prior to starting field work, define geographic boundaries where contaminated equipment is restricted and where decontamination activities are performed:

- Exclusion Zone: The area where active and invasive activities (i.e. drilling, excavation, sampling, etc) will be undertaken. The zone of maximum hazard for exposure to contaminants.
- Contamination Reduction Zone: The decontamination station(s) are located here.
- Support Zone: The area that sits outside the Exclusion Zone and the Contamination Reduction Zone, which has minimal hazards from physical activities and chemical contaminants.

7.2.1 Dry Decontamination Area

Remove loose, contaminated soil adhering to the equipment in a dry decontamination area. Remove gross contamination physically without the use of water to reduce the amount of liquid waste. Separate “dry” and “wet” decontamination areas may not be applicable for all project sites. All excess water and loose soil on the drill rigs, augers, pipes, and other equipment should be removed to the maximum extent possible in the exclusion zone, prior to moving into the contamination reduction zone for more thorough cleaning. Using brushes, knock loose soil off flight augers or other sampling equipment onto plastic sheeting, into soil containment vessels, and/or back into the open boring.

7.2.2 Wet Decontamination Area

Remove residual contaminants in a wet decontamination area that were not removed during dry decontamination. For projects utilizing drilling or excavating equipment, use a liquid containment vessel in the wet decontamination area. Use a high-pressure steam cleaner, a pump to transfer liquid wastes, and drums or other containers with liners for storing liquid wastes, as needed. Use secondary containment with drums or containers containing liquid waste.

7.3 Generic Decontamination Procedures

Use these general guidelines for decontamination:

1. Decontaminate reusable equipment before use, between samples, and upon completion of field activities. Do not use/reuse a piece of equipment if it appears discolored or otherwise obviously contaminated.
2. Decontaminate the decontamination workers themselves before they enter a clean or Support Zone.
3. Use only labeled, dispensing devices to disperse water, alcohol, acid, and solvent rinses.
4. Do not clean rubber or plastic surfaces with hexane, methanol, or isopropyl alcohol.
5. Manage contamination wash and rinse solutions and contaminated articles as either hazardous waste or investigation-derived wastes.

Decontaminate equipment using these three general steps:

1. Remove gross contaminants.

2. Remove residual contaminants.
3. Prevent contamination.

7.3.1 Remove Gross Contamination

Remove gross contamination by:

- physical removal (dry decontamination) or
- steam or high-pressure hot water cleaning and/or vigorous brushing with a non-phosphate detergent or
- soaking and brushing.

Consider the type of equipment being decontaminated (e.g., drilling tolls or electronic equipment) and the contaminating medium.

7.3.2 Remove Residual Contamination

Use this generic procedure for removing residual contamination as recommended by U.S. EPA, Region IX.

Set up a decontamination line in sequential order, over a plastic drop cloth.

1. Wash equipment with a low or non-phosphate detergent.
2. Rinse with potable water.
3. Rinse with de-ionized or distilled water.

7.3.3 Prevent Recontamination after Decontamination

After decontamination, protect equipment from further contamination. Protection measures include wrapping with oil-free aluminum foil or plastic, and storing in Ziploc bags.

7.3.4 Disposal of Contaminants

Manage gross contamination and all washing and rinsing solutions as investigative derived waste (IDW). After use, manage gloves and other contaminated personal protective equipment as IDW.

8.0 Specific Decontamination Procedures

8.1 Decontamination of Field Instruments

Field instruments such as organic vapor monitors and gas analyzers are typically not constructed to allow immersion or aggressive scrubbing. Care should be taken to minimize the exposure to solid or liquid contaminants. In environments with high potential for contamination, instruments may be operated in plastic bags, allowing only detector assemblies to be exposed. Manufacturer instructions should be consulted. Probes of pH, temperature, and specific conductance meters should be thoroughly washed with deionized or distilled water then rinsed with deionized water.

8.2 Drilling/Excavation Equipment Decontamination

This section applies to drilling equipment and other hardware that goes down a borehole, including drill pipe, augers, drill bits. Decontaminate vehicles and downhole drilling equipment prior to moving to a site, between each drilling location, and prior to leaving the site. Decontamination of drilling equipment shall be performed by the drilling subcontractor.

Drill rig vehicle decontamination should be conducted on decontamination pads or in designated decontamination areas located close enough to the work site that contamination is not spread during the movement of the vehicle. Decontamination of drilling/excavating equipment shall be conducted in general accordance with the following steps:

1. Remove coarse soil adhered to equipment with a steel brush or equivalent instrument in dry decontamination area and/or in exclusion zone.
2. Move equipment to rack in the wet decontamination area (contaminant reduction zone).
3. Wash with a high pressure steam cleaner.
4. Air dry.
5. Protect decontaminated drilling and excavating equipment not in active use, such as hollow-stem auger sections, drill rods, down-hole hammers and bits, from dirt and dust until needed.
6. Remove soil from dry decontamination area and place in designated containers or disposal area.
7. Remove liquid from decontamination vessel and place in designated containers.
8. Dispose rags, plastic, PPE, etc., in designated container.
9. Secure decontamination area daily.

8.3 Decontamination of Soil and Sediment Sampling Equipment

Soil and sediment sampling equipment includes sample barrels, sleeves (i.e. tube, liners), retainers, hand augers, trowels, spoons, corers, grab samplers, dredges, and any other objects that might come into contact with a soil or sediment sample in the course of its collection and handling. Decontaminate before each use, and before departing the field. Decontaminate sample collection and sample preparation equipment used for soil sampling as follows:

1. Place equipment on a sawhorse or rack for inspection and decontamination in dry decontamination area and/or contaminant reduction zone.
2. Remove coarse soil adhered to equipment with a steel brush. Remove more cohesive material from equipment with a flat scraper such as a wooden spatula. A water spray bottle may be used to lightly moisten dry soil being removed from the equipment, if needed to control dust. Only the minimum amount of water spray should be used to keep the waste moisture content low.

3. Move equipment to wet decontamination area (if a separate dry decontamination area is used).
4. Scrub equipment in a containment vessel with a low or non-phosphate detergent.
5. Rinse in a containment vessel with potable tap water.
6. Rinse in a containment vessel with distilled or deionized water.
7. Air dry.
8. Protect decontaminated equipment from recontamination by dust, spray, and airborne contaminants by aluminum foil and/or plastic wrap and segregate from contaminated equipment until needed.
9. Sample preparation equipment used to collect sub-samples that will constitute a single composite sample does not need to be decontaminated between each sub-sample collection.
10. If the rinsate in the liquid containment vessel includes methanol, it should be kept separate from methanol-free waste to minimize cross-contamination and mixed waste. Do not overfill drums to allow for expansion. Methanol-soaked rags or towelettes should be bagged and placed into a separate lined drum.
11. Remove soil from dry decontamination area and place in designated containers or disposal area.
12. Remove liquid from decontamination vessel and place in designated containers.
13. Dispose rags, plastic, PPE, etc., in designated container.
14. Secure decontamination area daily.

8.4 Decontamination of Groundwater Sampling Equipment

Groundwater sampling equipment includes bailers, well sounder tapes, water level indicators, interface probes, pumps, hoses and wires introduced into the well, bailers, filters, and any other objects that might come into contact with groundwater that might be sampled. Gross contamination is typically not a problem unless viscous non-aqueous-phase liquids (NAPL) have accumulated.

Avoid introducing gross contaminants to wells. Tapes, hoses, and wires should not be permitted to lie on the ground or on contaminated surfaces. If such items become contaminated by ground contact, decontaminate prior to use. Equipment may be protected by hose reels, plastic sheeting, or plastic tubs.

Rinse or wipe equipment prior to inserting into wells, and when removed from wells. Manufactures instructions shall be consulted for decontamination of pumps and interface probes. NOTE: Certain materials may be susceptible to damage from organic solvents and/or acidic solutions.

Decontaminate water-sampling equipment by:

1. To decontaminate well casings/screens, prior to installation:
    - scrub with a laboratory grade detergent/water solution and
    - rinse with tap water or potable water.

    NOTE: In the case that the well casings/screens are obtained in a previously sealed plastic wrapping from the manufacturer, there is no need to decontaminate.
2. To decontaminate water level measurement devices:
    - scrub with a laboratory grade detergent/water solution and
    - rinse with tap water or potable water.
    - Avoid organic solvents which can remove the numbers from the tape.
3. To decontaminate well purging apparatus; bailers, pumps, and hand-held tools:
    - scrub with a laboratory-grade detergent/water solution,
    - rinse with tap or potable water, then
    - rinse with deionized-grade water, and
    - allow to air dry between uses.
4. Wrap hand-held equipment in aluminum foil or plastic to prevent contamination by airborne contaminants during transportation to the sampling site.

9.0 PERSONNEL PROTECTIVE EQUIPMENT

9.1 Personal Protective Equipment Requirements

Personnel in potential contact with known or suspected hazardous substances contamination must wear protective equipment. The types and levels of PPE and the procedures for decontaminating personnel upon leaving a contaminated zone are beyond the scope of this SOP. The purpose of PPE is to protect field personnel. PPE may be effective in protecting personnel from chemical hazards, but could compromise the usefulness of media samples if inadequately decontaminated between samples.

- Avoid contact with media samples.
- Use disposable gloves. Replace with fresh gloves for each sample.
- Decontaminate PPE using the same procedures for sampling equipment.

10.0 DOCUMENTATION

Record decontamination activities in the field logbook daily. Describe any deviations in procedures or conditions and/or problems that occur. The PST shall be responsible for submitting completed, legible copies of the field logbook to the Project Manager for review. The Project Manager shall be responsible for maintaining the logbook.

11.0 ATTACHMENTS

1. Equipment Supply Check List

RICHARD BRADY AND ASSOCIATES

STANDARD OPERATING PROCEDURE

EQUIPMENT DECONTAMINATION

ATTACHMENT 1

EQUIPMENT SUPPLY CHECKLIST

EQUIPMENT AND SUPPLY CHECKLIST

- ☐ Work Plan
- ☐ Sampling and Analysis Plan
- ☐ Low or non-phosphate laboratory detergent such as Alconox™ or Liquinox™ or equivalent. Liquinox is the preferred detergent.
- ☐ Sodium Hypochlorite, (bleach, i.e., Clorox).
- ☐ Disinfectant, (EPA registered biocide).
- ☐ Selected Rinses and Solvent Rinses (U.S. EPA, 1994)

Solvent	Examples of Solvent Rinse	Soluble Contaminant
Water	Deionized Water - Recommended maximum conductivity 1μS/cm. Tap Water - From an approved source with known chemistry	Low-chain hydrocarbons Inorganic compounds Salts Some organic acids and other polar compounds
Dilute Acids	1:1 Hydrochloric Acid - ACS trace element grade (5 percent by volume) 1:1 Nitric Acid - ACS trace element grade (10 percent by volume)	Nutrients Metals, Basic (caustic compounds (e.g., amines and hydrazines)
Organic Solvents	Hexane –pesticide grade	Organics (heavily contaminated), PCBs
Organic Solvents	Acetone - Pesticide-grade Isopropanol – Pesticide grade Methanol	Organics

Decontamination Tools and Supplies

- ☐ High-pressure portable steam cleaner.
- ☐ Liquid containment vessel and support rack.
- ☐ Solids containment vessel and support rack.
- ☐ Shovel.
- ☐ Electrical generator (if power source is not available) and fuel.
- ☐ Power cord (to connect steam cleaner to generator).
- ☐ Sturdy equipment table for tool assembly and disassembly.
- ☐ Stool or chair.
- ☐ Portable liquids pump and 10-foot (minimum) discharge hose.
- ☐ Bottlebrush.
- ☐ Long handled steel and soft bristled scrub brushes.
- ☐ Heavy plastic sheeting/drop cloths.
- ☐ Plastic or galvanized containers, buckets or tubs to hold wash and rinse solutions.
- ☐ Non-reactive solvent sprayers.
- ☐ Paper or clothe towels.

- ☐ Aluminum foil.
- ☐ Plastic wrap.
- ☐ Bound field logbook and ink pens.
- ☐ Labels and marking pens.
- ☐ Saw horses or racks for drill stem and other drilling hardware.

Waste Disposal

- ☐ Plastic trash bags.
- ☐ 55-gallon drums.
- ☐ Trash containers.
- ☐ Trash liners.
- ☐ Metal/plastic buckets/containers for storage and disposal of decontamination solutions.
- ☐ Wooden pallets (for drums).
- ☐ Secondary containment for drums containing liquid.

Health and Safety Equipment

- ☐ Chemical-resistant safety glasses, goggles, or splash shield.
- ☐ Chemical-resistant disposable clothing (i.e., Tyvek, coated-Tyvek, Saranex, etc.).
- ☐ Chemical-resistant gloves (i.e., natural rubber, nitrile, latex, etc.).
- ☐ Duct tape.
- ☐ Air Purifying Respirators, equipped with organic vapor cartridges.
- ☐ Any additional PPE, as required.
- ☐ Portable emergency eyewash station (if one is not available within 50 feet).
- ☐ First Aid Kit.

STANDARD OPERATING PROCEDURE

LOW-FLOW PURGING AND SAMPLING PROCEDURES FOR GROUNDWATER MONITORING WELLS

SOP NUMBER: T-002

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RICHARD BRADY AND ASSOCIATES STANDARD OPERATING PROCEDURE

LOW-FLOW PURGING AND SAMPLING PROCEDURES FOR GROUNDWATER MONITORING WELLS

1.0 PURPOSE

The primary objective of a groundwater sampling event is to obtain water quality data that is representative of the in-situ groundwater conditions and to minimize changes in groundwater chemistry during sample collection and handling. The purpose of this Standard Operating Procedure (SOP) is to provide direction on proper low-flow purging and sampling techniques. This SOP complements, and does not replace, site-specific Sampling and Analysis Plans (SAP) or Work Plans and implementation of quality assurance/quality control (QA/QC) measures.

2.0 BACKGROUND

Groundwater samples collected from monitoring wells are used to evaluate and monitor groundwater quality during site assessment and remediation activities. Collection of groundwater samples that are representative of actual chemical conditions of the aquifer is fundamental to evaluation and monitoring. Groundwater sample data quality is dependent on several factors including: well construction and development techniques, screen location and length, and the purging and sampling methods employed. High-flow purging and sampling of monitoring wells typically requires the removal of three to five well casing volumes prior to sampling to reduce bias associated with standing water in the well casing, and the use of bailers to collect the groundwater sample. This method can result in the collection of groundwater samples that may not be representative of ambient groundwater chemistry due to increased turbidity from stress on the formation and suspension of settled solids, aeration and volatilization, and altered ambient flow conditions. Additionally, this method may generate large volumes of water during purging activities that require proper handling and disposal.

Limitations created by high-flow well purging and sampling methods have contributed to the acceptance of low-flow purging and sampling methods. Low-flow purging and sampling is often a requirement in SAPs for samples to be analyzed for volatile organic compounds (VOCs) and purgeable total petroleum hydrocarbons (TPH) (such as gasoline). Low-flow purging and sampling uses dedicated or portable pumps to collect groundwater samples directly from the well screen interval at low-flow rates (< 1 Liter per minute [L/min]) with limited drawdown of the static water table. A water level meter is used to measure drawdown in the well concurrent with pumping. The low-flow method usually employs an in-line flow-through cell in which geochemical water-quality indicator parameters are continuously monitored. Samples are obtained when monitored chemical parameters have stabilized, thus demonstrating qualitatively that the groundwater being purged is in equilibrium. Samples are collected directly from the pumping mechanism with minimum disturbance to the aquifer groundwater. The placement of the pump within the screened interval and the use of low flow rates reduce turbidity and sample chemistry alteration, avoids disturbance to the water column in the well, and limits stress on the surrounding formation. Samples obtained in this manner better reflect the groundwater chemistry at ambient flow conditions and the true mobile load of any contaminants present. The low-flow purging method is designed to isolate the interval being sampled and limits vertical mixing, therefore reducing the volume of water purged in order to achieve stable water chemistry.

3.0 APPLICABILITY

Low-flow purging and sampling techniques are applicable for monitoring wells that can be continuously pumped at rates typically between 0.1 and 1.0 L/min without continuous static water level (SWL) drawdown. In general the SWL drawdown should not exceed 25% of the interval between the pump and the top of the saturated well screen. A more detailed discussion of pumping rates and drawdown is presented in Section 7.5. This technique is appropriate for sampling most groundwater contaminants, including inorganic compounds, metals, pesticides, polychlorinated biphenyls (PCBs), volatile and semi-volatile organic compounds (VOCs and SVOCs). This method may not be appropriate for sampling dense or light non-aqueous-phase liquids (DNAPL or LNAPL) and shall be evaluated on a case-by-case basis. Low-flow purging and sampling is best suited for wells with screen intervals less than 10 feet in length. Multiple pump intakes may be required for longer screen intervals or for aquifers screened across zones of contrasting permeability and/or multiple contaminant zones.

The low-flow method is not applicable for wells with sustainable flow rates less than 100 milliliters per minute (ml/min). Alternative purging and sampling approaches, such as "Passive Sampling" may be used for this condition (See Section 8.0).

Low-flow sampling may also not be appropriate for wells where contaminants are only detected using large volume purge sampling methods. Historic purge rates and volumes, and analytical data should be reviewed, if available, both before, as well as after sampling events, to evaluate if the low-flow sampling methodology is appropriate for a specific project site, or monitoring well(s). Since low-flow samples represent the contaminant concentrations in the vicinity of the pump intake, this sampling method may not be appropriate for wells where the highest concentrations of groundwater contaminants are above or below the screen, or absent from the sample intervals providing water to the pump intake.

4.0 DEFINITIONS

Analyte - A chemical component of a sample to be determined or measured.

Analytical (or Testing) Method - A specification for sample preparation and instrumentation procedures or steps that must be performed to estimate the quantity of analyte in a sample.

Bladder Pump – An air-driven device used to purge and sample groundwater. The pump uses a flexible membrane bag (e.g., the bladder) to prevent contact between the air and the sample, thus preventing cross-contamination or loss of volatile components. The bladder pump also has a stainless steel housing and may have a screen that filters out materials that might clog check valves. Water enters the housing through a check valve, while compressed gas (air) is injected at regulated intervals into the bladder. The bladder expands and contracts with air intake and escape, forcing the water to move into the discharge line to the wellhead.

Centrifugal Pump – A pump consisting of a fixed impeller on a rotating shaft, which has an inlet and discharge connection. The rotating impeller creates pressure in the liquid by the velocity derived from centrifugal force.

Drawdown – The lowering of the water level in a well from groundwater withdrawal.

Field Logbook – Includes records of Groundwater/Product Depths, Instrument Calibration Form, Sampling Identification and Analyses (cross reference), and Low Flow Well Purging-Field Data forms.

Flow Sample – A sample collected from a pump.

Heterogeneous – "Dissimilar." In the case of hydrologic units, heterogeneity refers to strata or geologic units that behave differently relative to water or contaminant transmission.

Homogeneous – "Similar." In the case of hydrologic units, homogeneity refers to strata or geologic units that behave similarly relative to water or contaminant transmission.

Interface Probe - Instrument capable of detecting and measuring the depth to the top and bottom of an immiscible organic layer floating on the surface of the water.

Inertial Lift Pump - A device used to purge and sample groundwater. The inertial pump operates by either moving sample tubing up and down in a well or by moving a rigid inner pump casing up and down. Both the sample tubing design and the rigid inner pump casing design are equipped with a check valve at the bottom. An electric or gasoline-powered motor can provide a continuous up and down motion for either design. The rapid up and down motion moves water up these pumps by lift and inertia. A rapid upstroke lifts the water in the tubing or casing. At the end of the upstroke the water in the tubing or casing continues to move slightly upward by inertia. On the down stroke, the check valve at the bottom of the tubing or casing opens, which allows additional water to enter the device. This cycle continues on each up and down movement until water moves up and out of the device. The up and down motion of this pump results in increased turbidity and volatilization of the sample, and is therefore, not appropriate for use in low-flow sampling.

Non-Aqueous Phase Liquid (NAPL) – Immiscible liquids that are found on the surface of the water table, at the base of the well or in the formation's interstitial pore space in both the saturated and unsaturated zones. When NAPL is observed in a well, it is commonly referred to as phase-separated product, free product, floating product, light non-aqueous phase liquid (LNAPL) or dense non-aqueous phase liquid (DNAPL).

Purge – The act of evacuation (removing) of stagnant water from a monitoring well that is not representative of formational water prior to groundwater sample collection.

Peristaltic Pump - A series of dividers or vanes fitted into a slotted rotor. The valves compress a flexible tube that contains the fluid. When rotated, these vanes move radially to conform to the contour of the pump housing such that, due to the creation of a partial vacuum, water is pushed from the pump in a continuous flow ahead of the vanes. Due to turbulence and volatilization, peristaltic pumps are not appropriate for collecting samples for VOCs or purgeable total petroleum hydrocarbon analysis.

Piston Pump - A stainless steel chamber between two pistons. By alternating chamber pressurization with compressed air, the pistons are activated, allowing water entry during the suction stroke and forcing water through the discharge line to the wellhead during the pressure stroke. Due to turbulence and volatilization, piston pumps are not appropriate for collecting samples for VOCs or purgeable total petroleum hydrocarbon analysis.

Stability – Refers to the consistency of field water quality indicator parameters over a specified time interval. The most sensitive field parameters are dissolved oxygen, specific conductance, and temperature.

Static Water Level - The water level of a well that occurs when no water is withdrawn or added to the well.

Submersible Pump - A bowl assembly over an electric motor that is submersible. Water enters through an intake screen between the motor and the bowl assemblies, passes through the stages, and is discharged directly through the pump column to the wellhead. Due to turbulence and volatilization, submersible pumps are not appropriate for collecting samples for VOCs or purgeable total petroleum hydrocarbon by EPA method 8015M.

Turbidity - Refers to the decrease in transparency of the water due to suspended or colloidal particles.

Volatile Organic Compounds, (VOCs) - A class of chemical compounds, predominantly hydrocarbons and halogenated hydrocarbons, with low molecular weights and low boiling points that are insoluble or slightly soluble in water.

Well Casing - The rigid cylindrical material inserted into the well borehole.

Well Development – The process by which the hydraulic communication between the well and surrounding material is improved through the removal of fine-grained materials generated from drilling activities.

Well Screen - The perforated section of the well casing.

5.0 REFERENCES

ASTM International. D: 6771-02. 2002. Standard Practice for Low-Flow Purging and Sampling for Wells and Devices for Ground-Water Quality Investigations.

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Puls, R.W. and M.J. Barcelona. 1996. “Low Flow (Minimal Drawdown) Groundwater Sampling Procedures.” U.S. EPA, Ground Water Issue, Publication Number EPA/540/S-96/504, April 1996.

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6.0 Apparatus and Materials

The Project Manager and Field Technician shall plan for the purging and sampling event by assessing, selecting, and assembling the types of equipment, instruments, and supplies necessary to perform the scope of work. Prior to mobilizing, assemble, calibrate (if applicable), and test instruments. Decontaminate field and sampling equipment that will come in contact with the groundwater prior to use and between sample points. Procedures for instrument calibration and equipment decontamination are addressed in separate standard operating procedures. Apparatus and materials that may be required include the following:

- Water-level indicator capable of measurements within 0.01 feet (such as the Solinst, Keck, or equivalent QED drawdown meter).
- (Optional) Stainless steel tape and weight used for measuring total depth of well. Lead weights should not be used.
- (Optional) Continuous water-level indicator (pressure transducers, bubbler, or acoustic tools) may also be used during pumping activities to establish drawdown.
- (Optional) Flow meter to assist with pump placement.
- Portable or dedicated pump capable of pumping definable low-flow rates (<1.0 L/min) with adjustable flow rate controls (such as continuous discharge or cyclic discharge pumps). Pumps should be constructed of inert material, such as stainless steel or Teflon.
- In-line flow-through cell for continuous monitoring of indicator parameters (e.g. pH, specific conductivity, temperature, turbidity, dissolved oxygen [DO], and oxygen reduction potential [ORP]).
- (Optional) Field nephelometer to measure turbidity.
- Field instrument calibration equipment (e.g., pH buffer, conductivity standards, etc.).
- Volume measuring device for determining flow rate (e.g., graduated cylinder).
- Timepiece capable of measuring seconds for determining flow rate.
- Calculator.
- Decontamination supplies, including a reliable and documented source of distilled water and any solvents (if used), pressure sprayer, buckets, brushes, non-phosphate soap, and a plastic tarp. (See RBA SOP T-001)
- Sample bottles, sample preservation supplies, ice , and laboratory paperwork (chain-of-custody forms; sample labels, and custody seals).
- Coolers and sample packing supplies (absorbing packing material, plastic bags, etc.).

- Wellhead screening instruments such as (Photo Ionization Detector (PID), Flame Ionization Detector (FID), Oxygen Vapor Analyzer (OVA), combustible gas indicator).
- Approved plans and background documents – Approved SAP or Work Plan, Quality Assurance Project Plan (as appropriate), well construction data, well development information (such as pumping rates and drawdown), field and water-quality data from the previous sample collection event including depth-to-water levels, pumping rates, purged volumes, stability parameters, and elapsed time between purging and stabilization for the wells to be sampled.
- Site Health and Safety Plan and required equipment.
- Site Access/ Permission documentation for site entry.
- Well keys and map showing locations of wells.
- Field logbook including Groundwater Sample Collection forms.
- In-line 0.45-micron filters (as applicable).
- Tool box equipped with well maintenance equipment (e.g., wire brush, rubber gaskets, locking caps and keys).
- Containers (e.g., 55-gallon drums and/or portable tanks) for purged well water.

7.0 PROCEDURE

This procedure addresses the specific activities to be performed to accomplish a groundwater sampling event using low-flow purging and sampling techniques, including preparation, pump and tubing selection, pump placement and installation, well purging and measurement of water quality indicator parameters and turbidity, sample collection, and field documentation requirements.

7.1 Review SAP or Work Plan to Prepare for Low-Flow Purging and Sampling

In preparation for a low-flow purging sampling event at a given site, review the following information with the Project Manager:

- Access requirements (e.g., permission of owner, locked gates, road conditions).
- Identification number(s) of the well(s) to be sampled.
- Well locations.
- Well construction information (e.g., casing interval, screen interval, total depth, etc.).
- Pump information (dedicated or portable).
- Pump placement information.
- Anticipated pumping rates for purging and sampling.

- Procedures for measuring and recording flow rates, water-level measurements, field water-quality indicator parameters, and sample collection.
- Criteria for defining stabilization of water-quality parameters during purging.
- Criteria for defining recharge.
- Allowable drawdown during purging and sampling.
- Approximate minimal amount of time required to elapse between pump installation and start-up.
- Approximate maximum amount of time allowed to elapse between stabilization of water-quality indicator parameters and sample collection, based on recharge rates.
- Required Field logbook entries, any supporting documentation.
- Type of equipment needed for the scheduled sampling activity.
- Analytes requiring field filtration.

Record field information and data obtained during the purging and sampling event in the Field logbook. Record well sampling data on a Low Flow Well Purging and Field Water Quality Measurement Form (Low Flow Form), as provided in Attachment 1.

7.2 Pump and Tubing Selection

Select the type(s) of pumps for purging and sampling during field preparations, if not already specified in the SAP or Work Plan. Use adjustable rate pumps capable of consistent, continuous or semi-continuous (bladder pump) low flow-rates (<1.0 L/min). The pumping device should not cause undue pressure or temperature changes, change geochemical and physical parameters, or increase in turbidity. The pumping device must be appropriate to the analysis being performed (i.e. bladder pump for VOCs and purgeable TPH).

7.3 Well Inspection

Record the condition of each well prior to sampling. Use the "COMMENTS" section of the Low Flow Form (Attachment 1). Any signs of vandalism, unauthorized entry, or settlement and/or ponding around the well surface completion shall be noted, along with the well identification number and the date. Ensure that minor monitoring well maintenance is performed and recorded in the field logbook.

7.4 Pump Placement

Identify the placement of the pump intake. In typical wells, set the pump intake at least 2 feet from the top and bottom of the well screen. The following provides general guidelines for pump placement in different settings:

- **Well screened across a single zone of interest comprised of nearly homogeneous geologic materials, and the screen is not more than 20 feet in length –** position pump intake at or near the mid-point of the well screen or open zone, provided that this zone is fully submerged. This placement avoids mixing formation water with sediments in the well bottom or the overlying stagnant water within the well casing.

- **Well screened across a single zone of interest comprised of nearly homogeneous geologic materials, and the water column is less than 10 feet in length** – position pump intake in lower portion of screen, but at least 2 feet from the bottom to ensure adequate pump performance and avoid mobilization and entrainment of settled solids.
- **Well screened across a single zone of interest comprised of heterogeneous materials with layers of contrasting hydraulic conductivity** – position pump adjacent to the zone of highest hydraulic conductivity or adjacent to preferential flow pathways. A borehole flow meter may be used to identify zones of preferential flow pathways. Avoid placing the pump within 2 feet of the top or bottom of the screened interval, where possible.
- **Well screened across a single zone of interest comprised of heterogeneous or homogeneous materials, with a contaminant concentration zone** – position pump adjacent to zone of highest contaminant concentration. Avoid placing the pump within 2 feet of the top or bottom of the screened interval, where possible.
- **Well screen length >20 feet and no target zone identified** – use a sampling device with multi-level inlets to target individual zones or to collect equally spaced samples for composite sampling. Pump placement shall be at least 2 feet from the bottom and top of the well screen, where possible.
- **Dissolved phase contaminants of interest are known to concentrate near the top or bottom of the screened zone** – Where compounds of interest are known to concentrate near the top or the bottom of the screen zone, position pump intake in the upper one-third or lower one-third of the interval, respectively. The low-flow method may not be appropriate for sampling DNAPLs and LNAPLs. Evaluate well conditions on a case-by-case basis.

7.4.1 Pump Installation

Use dedicated pumps and tubing whenever possible. Carefully install portable pumps to avoid disturbing the water column. Use dedicated tubing with portable pumps to minimize the likelihood of cross-contamination. In general, stabilization of water-quality indicator parameters will take longer if a portable pump is used due to mixing of the water column during pump insertion.

Pumps selected for low-flow purging and sampling should be positive-displacement down-well pumps that can be placed with the pump intake within the well screen and that have adjustable flow rate control, such as bladder pumps or centrifugal pumps. Bladder pumps are recommended for collecting groundwater samples to be analyzed for VOCs and/or purgeable TPH. The QED MicroPurge bladder pump is currently being used by Richard Brady & Associates Field Technicians.

Peristaltic and other suction lift pumps should be used with caution because they may cause degassing, resulting in alteration of pH, alkalinity, and some volatilization, especially at lifts greater than 10 to 15 feet. Inertial lift pumps should not be used, since their operation requires continuous movement through the water column in the well, which can result in mixing and elevated turbidity levels. Vacuum trucks or bailers should not be used for VOC or TPH sample collection, or for well purging.

Small diameter tubing (1/4-inch to 3/8-inch diameter) should be used in order to minimize the purge volume. The SAP or Work Plan will identify specific tubing material requirements based on constituents of concern, well placement, regulatory requirements, and/or length of anticipated time tubing will be installed in a well. For example, Teflon® or Teflon-lined polyethylene tubing may be specified for wells with dedicated pumps and tubing. Teflon® or Teflon-lined polyethylene tubing may also be specified for wells with high concentrations of certain types of organic contaminants (e.g. trichloroethylene). Polyethylene tubing may be specified for wells where target analytes excludes organics, wells with low or no known contaminant concentrations, and/or for situations where the tubing will be installed in the well for a limited time period. The length of the discharge tubing used to convey water to sample containers should be minimized. Excess tubing length should be avoided to prevent changes in water temperature and to reduce the likelihood of aeration during sampling.

Install the pump using the following steps:

1. Decontaminate the pump and all tubing prior to use. To avoid cross contamination, use dedicated tubing in each well. When bladder pumps are used, install a new bladder for each well.
2. Label target depth on tubing taking care to not introduce any contamination to the tubing (i.e. sharpies and duct tape are not appropriate marking materials).
3. Note wind direction. Stand upwind from the well to avoid contact with gases/vapors emanating from the well.
4. Remove locking well cap and well casing cap.
5. If required by site-specific conditions, monitor headspace of well with appropriate air-monitoring equipment to determine presence of VOCs or other compounds of concern and record in field logbook.
6. Record the depth to water level from a referenced point prior to pump installation to within ±0.01 foot. When placing the probe in the water, take precautions to not disturb or agitate the water. Avoid measuring total depth of well prior to purging or sampling. When total well depth measurements are needed before sampling, allow sufficient time prior to sampling.
7. Lower the pump and tubing to the target depth location as slowly as possible to minimize mixing or mobilization of suspended or accumulated sediment. Keep equipment from contacting the ground and any material that is not decontaminated.
8. Avoid touching the bottom of the well or up-and-down motion of the pump apparatus during pump installation.

9. Allow sufficient time for suspended sediments to settle prior to starting the pump. Use previous sampling event logs to determine time requirements. Elapsed time between pump placement and start-up shall be determined on a well-specific basis. In general, install a portable pump approximately 1 hour or more prior to start-up to allow settling of solids and re-establishment of horizontal flow through the screen zone; however, in wells set in very fine-grained formations, use longer waiting periods.

7.5 Well Purging - Pumping Rate and Drawdown

The pumping rate used during well purging shall be determined based on the hydraulic performance of the well and ideally shall be established during well development, redevelopment, or prior to sampling. The goal of the low-flow purging method is to quickly establish an optimum pumping rate with minimal drawdown to avoid stressing the formation and mobilizing solids, and to obtain stabilized indicator parameters in the shortest time possible. Drawdown may vary from a few inches in high producing wells to several feet in lower producing wells. Use the following steps to establish the pumping rate (NOTE: Refer to Attachment 2 for manufacturer's guidance on establishing pumping rates for the QED MicroPurge sampling system):

1. Record the water level measurement to within ±0.01 foot, prior to starting the pump.
2. Start pump at a low rate (approximately 100 ml/min) or less, or lowest flow rate possible (< 1.0 L/min maximum). Typical purge rates for low-flow sampling are 0.1 to 0.5 L/min.
3. Obtain a turbidity measurement at the start of purging. If the initial turbidity reading is high (>50 NTU) and the second reading is not significantly lower, the pump rate should be lowered until turbidity decreases. If high turbidity rates persist after pumping rates are reduced, turn the pump off to allow turbidity to settle, and restart the purging process. If turbidity rates continue to be high, well maintenance, redevelopment or alternate sampling methods may be required.
4. Record water level measurements and flow rates at approximately 30-second to 5-minute intervals, depending on hydraulic conductivity of the aquifer, diameter of the well, and pumping rate, to establish the amount of drawdown caused by pumping.
5. Decrease the pumping rate if drawdown is rapid or continuous.
6. Slowly increase pumping rate if the drawdown is very slow or imperceptible until drawdown stabilizes. The maximum allowable pumping rate is 1.0 L/min. Change flow rates as little as possible.
7. When the final purge rate is achieved, initiate purging elapsed time at 00:00. Record pumping rate and time. If the QED MicroPurge Equipment is used, record key values identified in the manufacturer's instructions (e.g., ID value, pressure setting).
8. The allowable SWL drawdown shall not generally exceed 25% of the distance between the top of the saturated well screen (or the air-water interface in an unconfined aquifer) and the pump intake. This approach allows a factor of safety to ensure that water stored

in the well casing or water near the air-water interface is not drawn into the pump intake and collected as part of the sample (ASTM D: 6771, 2002).

9. The water level in the well should not be lowered below the top of the screen or, for wells screened across the water table, pumping should not result in the water level being lowered to the point of the pump's inlet, if at all possible.
10. Obtain a turbidity measurement any time the pumping rate is increased or the water level in the well drops noticeably.
11. Water-level measurements may be discontinued or reduced once drawdown has stabilized.
12. Record the turbidity measurement once the water level in the well has stabilized.
13. Containerize or discharge purged water in accordance with project requirements.

7.6 Measurement of Water Quality Indicator Parameters and Turbidity

Measure water-quality indicator parameters (e.g., pH, temperature, conductivity, dissolved oxygen and optionally oxidation-reduction potential [redox or ORP, also measured as Eh] using an in-line flow-through cell system attached directly to the pump discharge tubing during purging. Use these data to establish when representative formation water is being pumped from the well screen to determine when to collect samples. Measure turbidity using either an in-line flow-through cell or a field nephelometer to evaluate pumping stress on the formation and to establish the proper pumping rate. A minimum subset of monitoring parameters include: pH, temperature, conductivity, and either turbidity or DO.

1. Use an in-line flow-through cell to measure water-quality indicator parameters. Measure turbidity using either an in-line flow-through cell or a field nephelometer.
2. Calibrate all equipment used to measure water-quality indicator parameters and the nephelometer per manufacturer’s directions.
3. Determine measurement frequency. For in-line flow-through cells the frequency of measurement shall be based on the time required to completely evacuate one tubing volume (including pump and flow-through cell volume). Record a measurement in the field logbook after a minimum of one tubing volume has been purged from the well. Take subsequent readings at approximately three to five minute intervals, or at a frequency based on manufacturer recommendations.
4. Stabilization is achieved after all indicator parameters have stabilized within the predetermined range for each parameter of interest for three successive readings.
5. Criteria for stabilization are guidelines and may vary for specific wells.
    - pH – Three successive readings within ±0.1 units.
    - Specific conductance – Three successive readings within ±3%.
    - Redox Potential or ORP – Three successive readings within ±10 mV.

- Dissolved Oxygen – Three successive readings within ±10%.

6. Turbidity shall be measured at the same time that water-quality indicator parameters are measured and/or a minimum of three times during purging activities; once when purging is initiated (Section 7.5, Step 3); after the water level in the well has stabilized (Section 7.5, Step 11); and, after the water-quality indicator parameters have stabilized. Stabilization criteria for turbidity is:

   - Turbidity - ±10% of the prior reading or ±1.0 NTU, whichever is greater.

7. If water-quality indicator parameters have not stabilized to within each of their respective criteria after two hours of purging, proceed with sample collection and note lack of stabilization in field notebook.
8. The minimum purge volume should be the equivalent of at least twice the combined volumes of the sample pump and tubing.

7.7 Sample Collection Following Purging

After drawdown and chemical indicator parameters stabilize, or after two hours of purging, collect groundwater samples as soon as possible:

1. Use the same pumping device for sampling as purging. Do not move the pump or cause disturbance to the well prior to sampling.
2. Disconnect or bypass the in-line flow-through cell.
3. The pumping rate for sample collection should be the same or less than the purging rate and should be sufficiently low to minimize sample aeration, bubble formation, turbulent filling of sample bottles, or loss of volatiles due to extended residence time in tubing.
4. Pumping rates of less than 0.5 L/min are appropriate for most parameters. Water must enter sample container as a slow steady stream (Note: Bladder pumps will produce no flow during the chamber refill portion of the cycle.).
5. Pumping rates for VOC analysis should be operated at rates of less than 250 ml/min and the discharge from the pump should produce a thin, continuous stream of water when filling the sample vial. If cyclic-discharge pumps are used, vials should be completely filled from a minimum of discharge cycles.
6. Inspect discharge tubes for bubbles. If bubbles are observed, allow bubble to flow completely through discharge tube prior to sample collection.
7. Sample in order of least contaminated to the most contaminated well.
8. Collect samples for VOCs and other volatile organics (e.g., TPH –gasoline) first.
9. Collect samples that require filtration last. Use in-line filters.
10. Measure total depth of well upon completion of sampling activities and record in field notebook.
11. Handle, ship, and document samples per project requirements.

12. Secure the monitoring well.

7.8 Sample Filtration

Samples requiring filtration shall be collected as follows:

1. Following parameter stabilization (see Section 7.6), connect the in-line filter to the sample effluent line with the tubing adaptor.
2. Make sure the flow direction is correct as indicated on the filter.
3. Purge approximately 1500 mL (or volume recommended by the manufacturer) through the filter prior to sample collection.
4. Do not exceed a pumping rate of 500 mL/min.
5. Use a new dedicated filter for each well during each sampling event and properly dispose of the filter along with other waste generated during sampling.
6. Decontaminate the tubing adaptor between each use.

8.0 PASSIVE/MINIMAL PURGE METHOD

If a monitoring well cannot be pumped at low flow rates (less than 100 ml/min), without continuous drawdown, "passive" or minimal purge sampling may be implemented. The passive/minimal purge approach requires the removal of the smallest possible purge volume prior to sampling; generally limited to the volume of the sampling system. A dedicated pump is preferred. The pump selected must be capable of flow rates below 100 ml/min. The approach for pump placement and installation is generally the same as described above in Section 7.4 and 7.4.1. In general, the pump should be installed at least 24 hours prior to sampling. The selected tubing shall have sufficient wall thickness to limit oxygen transfer through the tubing when pumping at very low flow rates.

If it is decided to switch to passive/minimal sampling after initially trying to sample using low-flow sampling due to excessive drawdown rates, shut off the pump and leave in place for the well to recharge and stabilize. Allow 24 hours or more between turning the pump off and initiating passive/minimal purge sampling. Note the time, pumping rate, water level, and final recorded water quality parameters in the field notebook when pumping is terminated. Disconnect the pump from the sample tubing, ensuring that the tubing is adequately secured in place. After allowing suitable time for recharge and stabilization implement the procedures described below in Section 8.2.

8.1 Water Quality Parameters

If passive/minimal purge sampling is implemented, it is not necessary to track stabilization of water quality indicator parameters prior to passive/minimal purge sample collection. However, collect initial water-quality indicator parameters (e.g., temperature, pH, conductivity, dissolved oxygen and redox or ORP, and turbidity) using an in-line flow-through cell as described in Section 7.6, prior to sample collection. Compare these water quality indicator parameter values to measurements made during the initial attempt to sample well using low flow sampling and note variations in the field notebook or Low Flow Form. Where the total volume of water in the well is very small, field measurements can be accomplished with a very small volume flow cell (< 50 ml), or grab sampling and measurement can be used.

In situations where the appropriateness of passive sampling is being evaluated, measure water quality indicator parameters the first several times a particular well is sampled. If changes in parameter values are insignificant, then passive sampling is justifiable. If significant changes in the parameter readings do occur, evaluate which sampling methodology provides the most accurate values. A conservative approach is to choose the method that yields the higher contaminant values.

8.2 Passive/Minimal Purge Sample Collection Procedures

General procedures for passive/minimal purge sampling:

1. Record the water level measurement to within ±0.01 foot. Avoid agitating the water column.
2. Adjust the pump/controller to no more than the lowest pumping rate used during the initial low flow pumping (less than 100 ml/min), if appropriate. Typical flow rates for this sampling method are 10 to 100 ml/min.
3. Attach the pump/controller to the sample tubing and start the pump.
4. Purge one to three volumes of the sampling device (pump and tubing volume) prior to sample collection.
5. Record water quality parameters prior to sample collection (e.g. turbidity, temperature, pH, etc.) in the field notebook or Sample Collection form. Stabilization of water quality parameters is not required.
6. Collect the sample. Ensure that the discharge is a thin, continuous stream of water when filling the sample vial and no bubbles are present. It may be necessary to work with the analytical laboratory to reduce the sample volumes to the minimum possible to reduce the total volume of water removed. This is also useful from a practical standpoint, since the time required to fill larger sample containers may be lengthy at the very low flow rates used.
7. Record water level measurements and flow rate at the time of sample collection in the field logbook or Low Flow Form. Measure and record the water level measurement to within ±0.01 foot.
8. Sample in order of least contaminated to most contaminated well.
9. Collect samples for VOCs and other volatile organics (e.g., TPH –gasoline) first.
10. Collect samples that require filtration last. Use in-line filters.
11. Remove the sample tubing from the well.
12. Measure the total depth of the well upon completion of sampling activities and record in field logbook or Low Flow Form.

13. Handle, ship, and document samples per project requirements.
14. Secure the well.

9.0 DOCUMENTATION

Document all procedures and equipment used in the low-flow purging and sampling or the passive/minimal purge sampling in the Field logbook or Low Flow Form. Record all applicable field data including:

- Equipment calibration.
- Equipment decontamination.
- Equipment configuration for purging and sampling.
- Pump placement (relative to well screen and static water level).
- Procedures for determining and recording flow rates.
- Procedures of determining and recording volumes of water purged.
- Disposition of purged water.
- Initial, stabilized, and sample-collection pumping rates.
- Drawdown measurements.
- Stabilized pumping water level and water level during sample collection.
- Volume of water removed during purging and sampling.
- Water quality indicator-parameters and turbidity measurements during purging and sampling.
- Appearance of purged water (e.g., color, non-aqueous phase liquids, obvious odor, etc.).
- Times for all measurements, including start and end time for pump operation, purging and water-quality measurements, sampling, and stabilization of water-quality indicator parameters.

10.0 ATTACHMENTS

1. Low Flow Well Purging – Field Water Quality Measurement Form
2. QED Low-Flow Purging Procedure with MicroPurge basics Equipment

RICHARD BRADY AND ASSOCIATES

STANDARD OPERATING PROCEDURE

LOW-FLOW PURGING AND SAMPLING PROCEDURES FOR GROUNDWATER MONITORING WELLS

ATTACHMENT 1

LOW FLOW WELL PURGING – FIELD WATER QUALITY MEASUREMENT FORM

LOW FLOW WELL PURGING-FIELD WATER QUALITY MEASUREMENTS FORM

Project Name: ______________________
Project Number: ______________________
Well Number: ______________________
Date: ______________________
Field Personnel: ______________________
Weather ______________________

Screen Interval (Depth in feet): ______________________
Pump Intake at (Depth in feet): ______________________
Purging Device: ______________________
Total Depth (feet): ______________________

Materials: ☐ Dedicated Tubing ☐ Polyethylene ☐ Teflon Lined ☐ Disposable ☐ Other______

Clock Time 24 Hr:	Water Depth Below TOC (ft)	Pump Dial	Pumping Rate (mL/min) <500	Cum. Volume Purged (gallons)	Temp (°C) (± 3%)	Conductivity (μS/cm) (±3%)	pH (±0.1)	ORP/Eh (mV) (±10)	DO (mg/L) (±10%)	Turbidity (NTU) (±10%)	Comments

Sample ID:______________________
Sample Time:______________________

Comments:______________________
Sampler Signature:______________________

RICHARD BRADY AND ASSOCIATES

STANDARD OPERATING PROCEDURE

LOW-FLOW PURGING AND SAMPLING PROCEDURES FOR GROUNDWATER MONITORING WELLS

ATTACHMENT 2

QED LOW-FLOW PURGING PROCEDURE WITH MICROPURGE BASICS EQUIPMENT

MICRO PURGE basics QED

First in Control & Power
For Low-Flow Sampling

Low-Flow Purging Procedure with MicroPurge Basics Equipment

SEVERN TRENT SERVICES

QED ENVIRONMENTAL SYSTEMS
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(800) 624-2026 734-995-2547 Fax: 734-995-1170 info@qedenv.com

Part No. 2269 REV. # 5-21-01

CONTENTS

MICRO PURGE basics QED

MicroPurge® low-flow sampling offers important advantages over traditional purging and sampling methods, and can benefit many groundwater monitoring programs. It requires three basic steps:

1. Set the purge flow rate;
2. Control drawdown in the well;
3. Stabilize the purge water quality indicator parameters.

MicroPurge basics™ is a revolution in low-flow sampling control. The complete line of new MicroPurge basics products, combined with proven Well Wizard® pumps, will help you through all three steps with equipment that is easier to use, smaller, lighter, more powerful, and lower priced too!

MicroPurge basics™ means you can choose your own system - with the control and power to match your site requirements

Every MicroPurge basics component is complete, ready to use, and engineered for rugged field duty. The whole system is designed to let you choose the control and power options that fit your site needs now, with flexibility to meet future requirements.

Microprocessor-based control with water-level feedback and exclusive monitoring devices delivers the most accurate, precise samples you can get, assuring you consistent, repeatable data and eliminating most regulatory hassles.

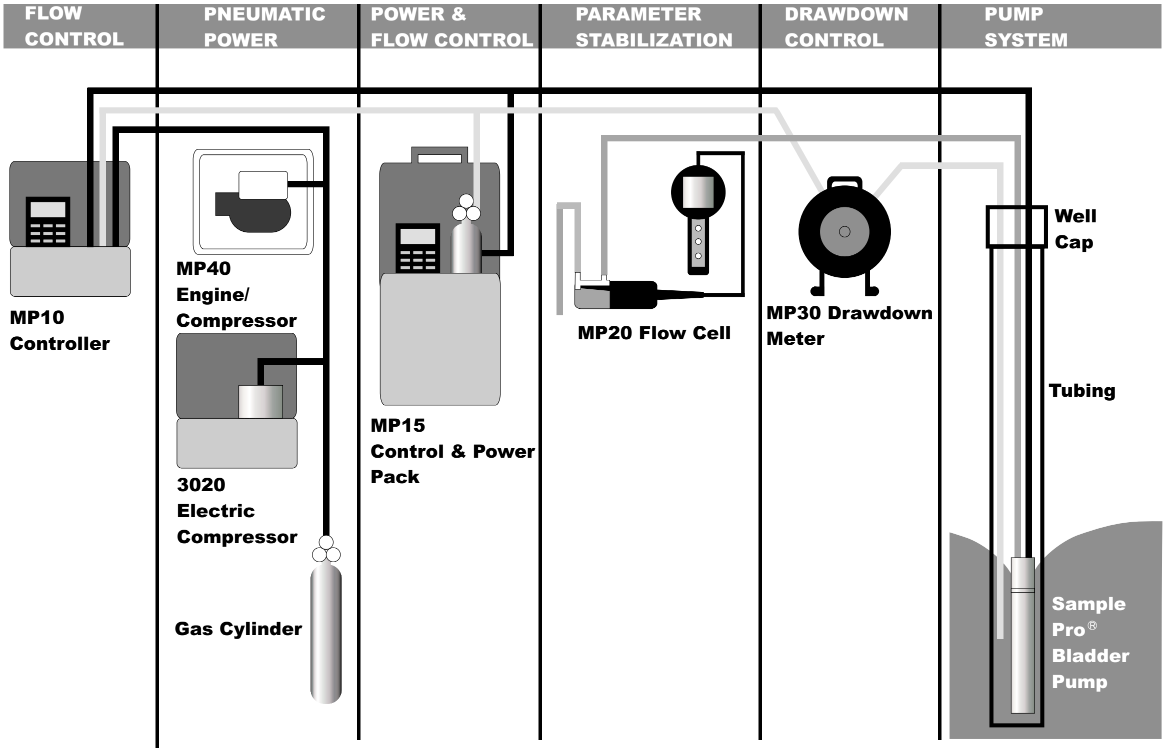
Low-flow Purging Procedure with MicroPurge basics Equipment

The following procedure is intended as an overview of typical operations at the well with MicroPurge **basics** equipment. This procedure assumes that all of the equipment is fully prepared with respect to battery condition, calibration and PurgeScan setup of the flow cell and charging of any compressed gas cylinders. Full detail is provided in the individual manuals for each product.

Summary:

1. Measure static water level with MP30 Drawdown meter.
2. Set MP30 probe at desired drawdown limit.
3. Connect compressed gas source (compressed gas cylinder or compressor) to MP10 or MP15 MicroPurge **basics** controller then connect controller to the pump supply fitting on the well cap.
4. Connect pump discharge tube to MP20 Flow Cell inlet tube, turn MP20 power ON, and verify that PurgeScan setup includes desired parameters and time interval.
5. Follow controller instructions to set desired flow rate; if drawdown limit is exceeded, reduce flow rate as needed to stay within limit.
6. Initiate PurgeScan on MP20 Flow Cell and write down data storage location #.
7. Watch for MP20 sound and flashing display indicators of stabilization, then begin sample collection.

MicroPurge Basics System Overview



Detailed Procedure:

Water Level

1. Determine static water level with MP30 Drawdown Control Meter power switched **"ON"** and Drawdown Control mode switched to **"OFF"** (**see Figure 1 below**).

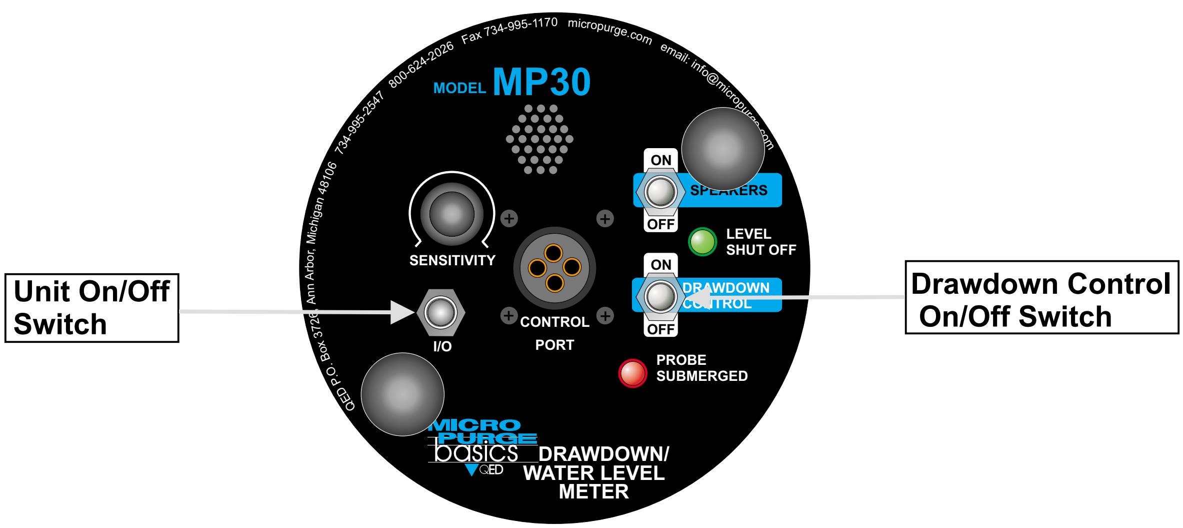


Figure 1
MP30 Control Panel

2. When well purging is to begin, switch the MP30 Drawdown Control switch to **"ON"** and lower the probe to desired drawdown control level.

Purge Flow

3. Connect the MP30 to the MicroPurge **basics** controller with the cable provided **(See Figure 2 below)**.
4. Connect MicroPurge **basics** controller (MP10 or MP15) to pump air supply fitting on the well cap **(See Figure 2 below)**.
5. Connect the pump discharge tube to the MP20 Flow Cell inlet tube **(See Figure 2 below)** and press the MP20 Power **"ON"** [O I] key.

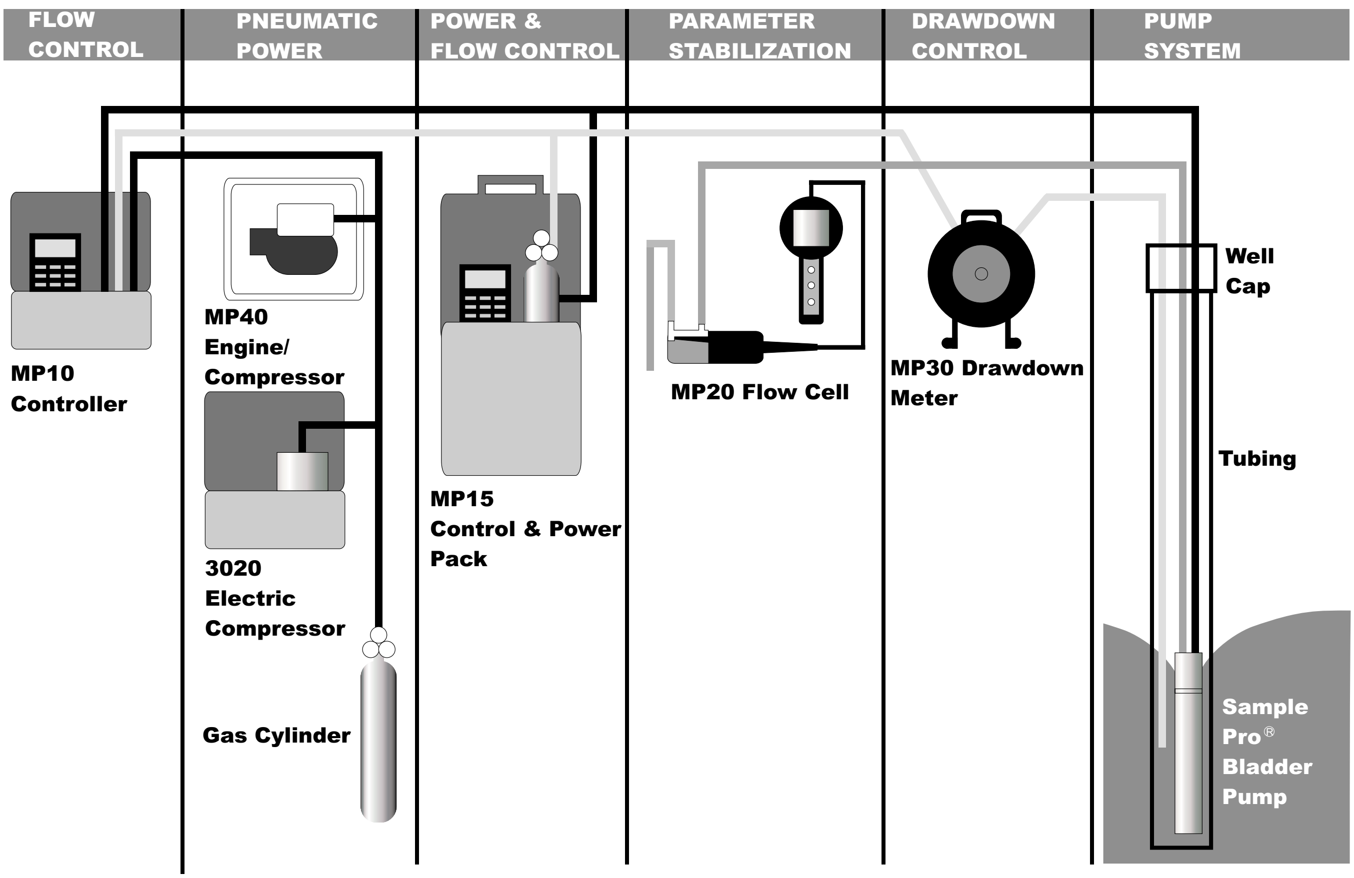


Figure 2
Basic System Diagram

6. Press **basics** controller power **"ON"** key (**see Figure 3 below**).
7. On **basics** controller, select desired Cycles Per Minute (CPM) with arrow key (default value is 4 CPM, lower CPM for deeper wells, higher CPM possible with shallow wells) (**see Figure 3 below**).

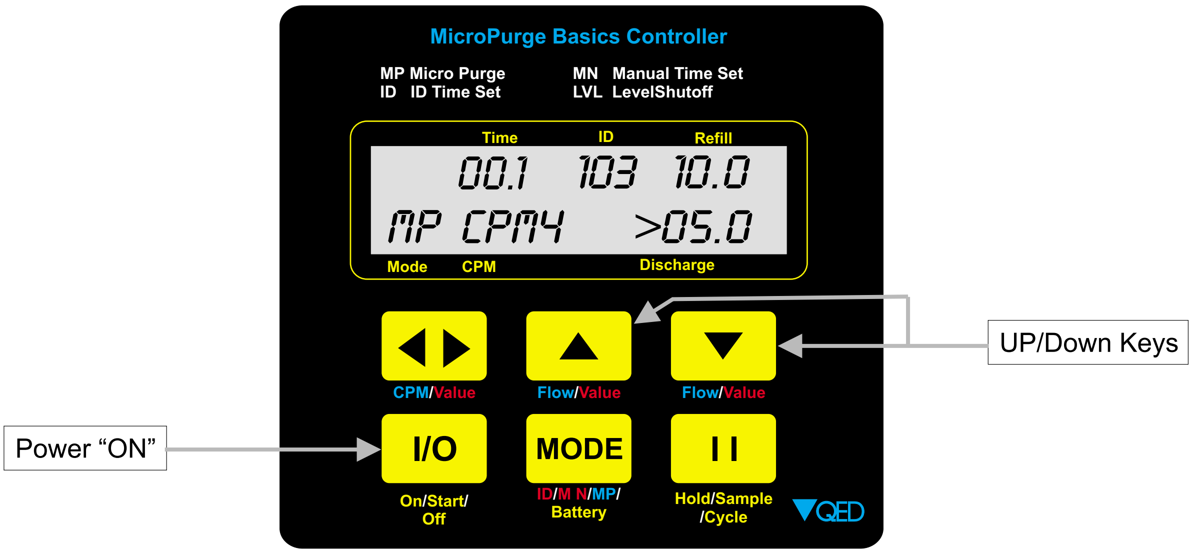


Figure 3
MP10 Keypad

8. Turn **basics** controller throttle to set depth on gauge to 10-20 feet deeper than the pump location in the well (**see Figure 4 below**).

Figure 4
MP10 Throttle and Gauge

9. Press **basics** controller **"ON"** key (**see Figure 3 above**) again to start pumping.
10. When water discharge begins, adjust throttle until a slow, steady flow-stream is achieved.
11. Press **basics** controller **"UP/DOWN"** keys (**see Figure 3 above**) to set the desired purge flow rate.

12. The MP30 Drawdown Meter will automatically signal the controller to pause pumping if the probe is no longer submerged, and will also activate the buzzer and the **"Level Shutoff"** (**see Figure 4 below**) light.

13. If the water level in the well recovers and reaches the probe, the **basics** controller will resume pump operation and the MP30 **"Probe Submerged"** light (**see Figure 4 below**) will activate

14. If the drawdown level exceeds the selected drawdown limit point too consistently, the flow purge flow rate can be further decreased with adjustment of the controller through one or more presses of the flow **"DOWN"** arrow key (**see Figure 5 below**). If the flow rate is already at or near a minimum desired rate, in some cases it may be also possible to lower the probe to a new, lower drawdown control point to increase the well recovery rate. Consult the site Sampling and Analysis Plan and regulatory guidance before adjusting purging protocols.

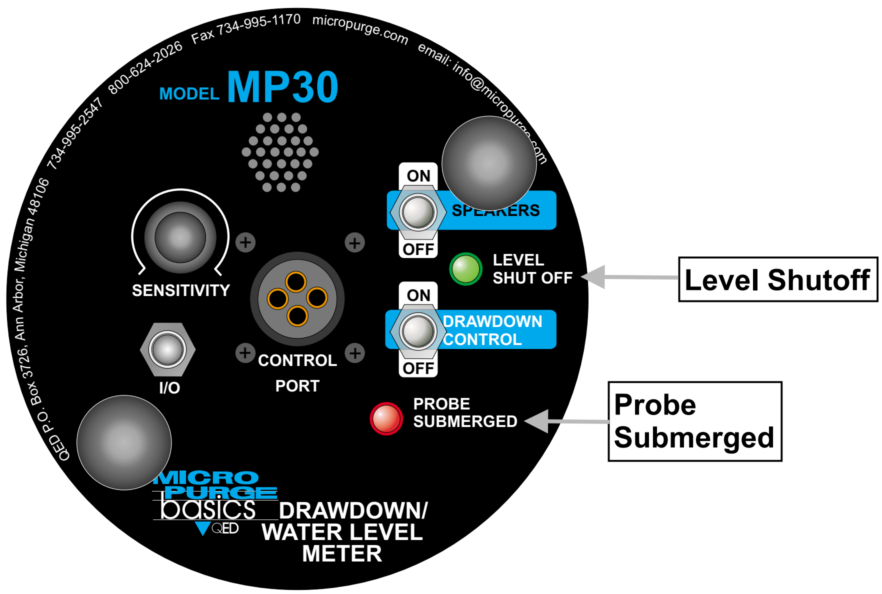


Figure 4
MP30 Control Panel

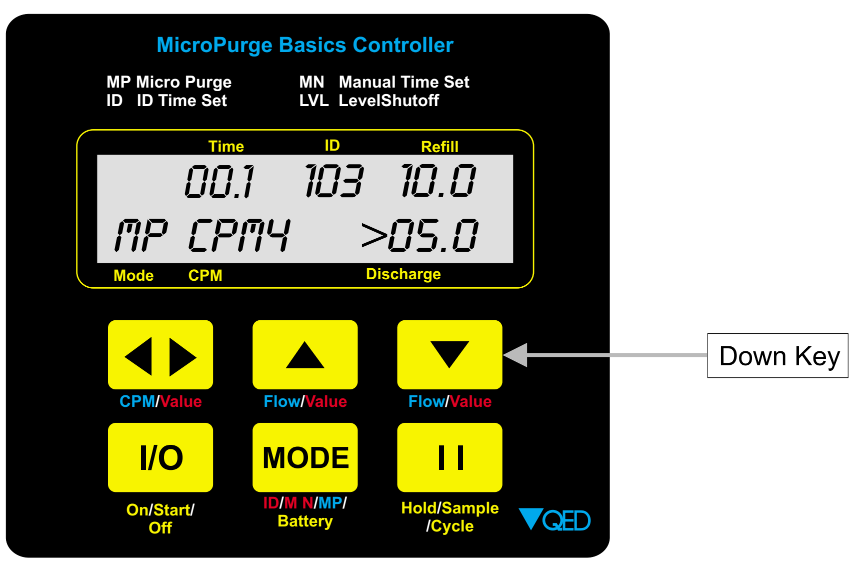


Figure 5
MP10 Keypad

Purge Water Quality Stabilization

15. When the final purge rate is achieved, record the ID value and pressure settings from the MP10/MP15 controller, then initiate PurgeScan on the MP20 Flow Cell by pressing the “**RIGHT**” arrow key once to highlight **"STORE"**, then pressing **"ENTER"**. This begins a PurgeScan stabilization cycle, starting at 00:00 elapsed time at the bottom **(See Figure 6 Below)** of the MP20 display, including automatic storage of key data frames. If it is desired to restart PurgeScan, press **“ESC"** ESC, then **"RIGHT"** arrow and **"ENTER"** again.

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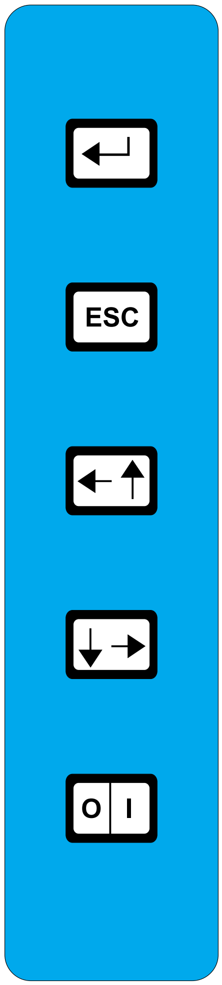
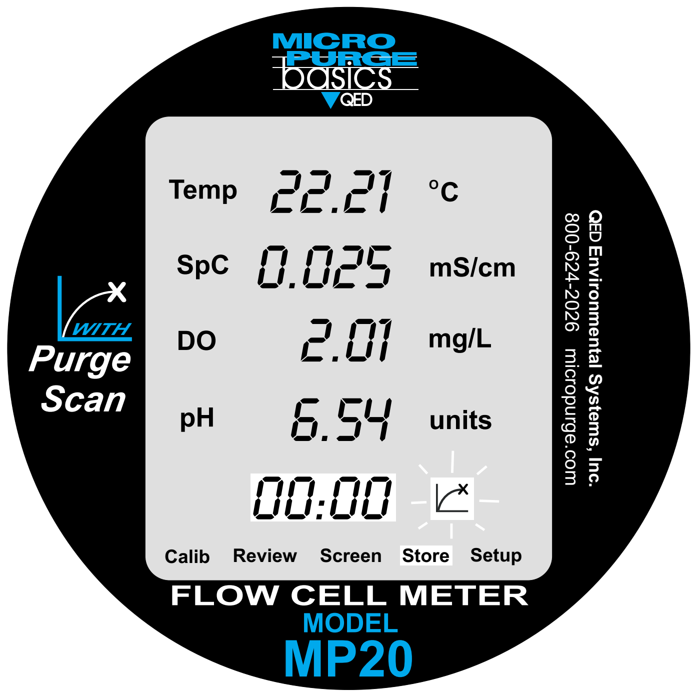


MP20 Keypad



MP20 LCD Display

Figure 6

16. Record the data frame Index value from the lower left corner of the MP20 display; this identifies the initial, **"TIME ZERO"** data set of each PurgeScan event, used for later review of stored data.

17. Monitor the MP20 display for the beeping and the flashing PurgeScan icon which signal that three successive readings at the selected time interval were within the stabilization range for selected parameters. Purging is complete and sampling can begin.

Overview on Drawdown, Purge Flow and Stabilization Settings

Drawdown Control Point Selection

The amount of drawdown permissible must be determined for each well on site, and may be affected by federal, state and local regulations or guidance applicable to the site. Once this is determined, the Drawdown Control probe can be positioned using several approaches. First, it can be lowered directly to the point of maximum desirable drawdown and kept in place. Secondly, it can be periodically raised from the set point to detect any changes in water level, then lowered again. Finally, it can positioned just part of the distance to the maximum drawdown point, for quicker feedback of the response between purge flow rate and drawdown. For example, if 10 inches of maximum drawdown is desired, the probe could be initially lowered to just 5" or less below the static water level. Then, if purge flow exceeds well recovery, this imbalance will be signaled more quickly than in waiting for the whole 10" to be drawn down, and purge flow can be reduced sooner to achieve equilibrium of purge flow with well recovery.

Flow Rate Selection

In general, the flow rate goal in low-flow rate sampling is a rate equal to or less than the well's recovery rate while staying within the drawdown limits. Minimizing drawdown reduces the impact of sampling on the aquifer, and helps minimize turbidity and drawing water from different zones than during undisturbed conditions. Actual flow rates typically range from 100ml/min to 1000ml/min. Within this range, if acceptable, higher flow rates allow faster filling of large volume sample containers. In all cases the flow rate should follow applicable regulations and existing sampling plans.

Purge Stabilization

The most common water quality parameters used to determine purging stabilization are dissolved oxygen (DO), specific conductance, and pH; ORP (redox) and turbidity are less commonly used, and arguments exist against their value for this purpose. The MP20 uses the following, fixed ranges as the basis for determining stabilization in the PurgeScan mode:

Stabilization Parameter	Stabilization Range
pH	.2 units
DO	0.2 mg/l
Conductivity	0.020 mS/cm
ORP (Redox)	20 millivolts

The time interval used to determine stabilization with PurgeScan should take the purge flow rate and purge cell volume into account. In general, the minimum PurgeScan time interval setting should be equal to or greater than the time required to replace the internal volume of the flow cell, 175 ml. On this basis, a one-minute or greater interval should be used with purge flow rates of 175 ml/min and higher. A purge flow rate of approximately 90 ml/min would require a time interval of 2 minutes or greater. A 50 ml/min flow rate would require use of a 4 minute interval. A more conservative approach would be to select an interval that allows two or three cell volumes to be purged between readings.

Low-flow Purging Procedure with Other Equipment

This procedure assumes use of a conventional water level meter, pump and control systems other than MicroPurge **basics**, and conventional flow cell instrumentation.

1. Measure static water level.
2. Select maximum drawdown level and lower probe to this level.
3. Adjust purge flow to initial target level, and monitor flow periodically to watch for changes in rate.
4. Begin purge flow, while monitoring continued alarm signals from water level meter to make sure drawdown level is not exceeded.
5. Begin to monitor purge water quality, watching for all stabilization parameter readings to stay within the selected limits for the required time period. Continue to observe the water level meter for excess drawdown.

CONTACT INFORMATION

For additional assistance contact QED Service at:

Phone:	1-800-624-2026 1-734-995-2547
Fax:	1-734-995-1170
E-mail:	service@qedenv.com
24-Hour Service Hot Line:	1-800-272-9559

STANDARD OPERATING PROCEDURE

SOIL SAMPLING PROCEDURE FOR VOLATILE ORGANICS USING THE EnCore® SAMPLER

SOP NUMBER: T-003

REVISION NUMBER: 02

REVISION DATE: September 8, 2008

Prepared by: ______________________________ *September 8, 2008*
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RICHARD BRADY AND ASSOCIATES STANDARD OPERATING PROCEDURE

SOIL SAMPLING PROCEDURE FOR VOLATILE ORGANICS USING THE En Core® SAMPLER

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes a procedure for collecting soil samples for volatile organic compounds (VOCs) using the En Core® Sampler. The outlined procedure is based on the EPA Method 5035 methodology presented in Update III of SW-846 promulgated in June 1997 and may be used in conjunction with analytical determinations of volatile organics including EPA Method 8015Modified (gasoline fraction only), 8021A, and 8260B.

EPA Method 5035 addresses four on-site handling options from which to select. This SOP focuses on the collection of soil samples for VOC analyses using a headspace-free, gas-tight sampler known as the En Core® Sampler. This SOP is not intended to replace thorough training and reading of reference materials

2.0 BACKGROUND

Collection and storage of soils for VOC analyses using previous EPA methodology (EPA Method 5030) has shown to be inadequate. The primary reasons are the loss of volatiles in the sampling and sub-sampling stages, and microbial degradation of aromatic volatiles. The methodology presented in EPA Method 5035 was designed to minimize VOC losses through volatilization and biodegradation. To address these problems and minimize the loss of VOCs during sample handling stages, EPA Method 5035 includes provisions such as field-preservation or the use of an En Core® Sampler designed to store and transfer soils (no field preservation required) with minimal loss of VOCs.

The En Core® Sampler can be used as applicable (cohesive granular soils) to collect and store samples without preservation for a maximum of 48 hours. A minimum of three En Core® Samplers per location is required to determine whether the concentration is high- or low-level, and to cover the potential for low-level and high-level contamination. Moisture content (so VOC results can be reported on a dry-weight basis) can be determined from unpreserved samples and may be collected from the conventional sample sleeve. The En Core® Sampler is a single use device.

3.0 APPLICABILITY

The procedures presented in this SOP are applicable to field investigation activities involving soil sample collection for VOC analyses. If needed, other methods of field preservation are covered under EPA method 5035. The other methods are not covered in this SOP.

Prior to determining the most appropriate VOC sample collection and preservation method, it is important to gather information regarding the type of soil to be sampled. If this information is not available, the project Sampling and Analysis Plan (SAP) should address all potential available methods of sample collection and preservation to minimize the loss of VOCs during sampling activities. In this case, field personnel should be prepared to perform any of the potential methods.

- Cohesive Granular Soils– The En Core® Sampler should be used on sites where cohesive soils are anticipated or known to occur. This sample collection and preservation method is preferable since it eliminates weighting and the addition of preservation in the field. In this case, samples must be stored at 4°C and prepared for analysis within 48 hours of sample collection.
- Non-cohesive Granular Soils– If gravel or a mixture of gravel and fines cannot be transferred using the En Core® Sampler, the soil may be quickly sampled using a stainless steel spatula or scoop and placed in a sealed VOC vial and analyzed as soon as possible. In this case, it is recommended to use a mobile laboratory to analyze samples as soon as they are collected. Caution should be taken in the interpretation of these results since loss of VOCs is likely due to the sampling method and the non-cohesive nature of the soil being sampled.
- Cemented Soil– If the soil requiring sampling is cemented in a manner that the En Core® Sampler can not be used, subsamples of the soil may be sampled by fragmenting a larger portion of the material using a clean spatula or chisel to generate a fragment that can be placed in a VOC vial. Care should be taken when transferring the aggregate to the sample container to prevent compromising the sealing surfaces and threads of the container. Caution should be taken in the interpretation of these results since loss of VOCs may occur during generation of the aggregate sample.

4.0 DEFINITIONS

Accuracy – The degree of agreement between an observed value and a true value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

Action Levels – The numerical value specified that causes the decision maker to choose one of the alternative actions (e.g., compliance or noncompliance). It may be a regulatory threshold standard, such as a Maximum Contamination Level, a risk-based concentration level, a technological limitation, or a reference-based standard. The action level is specified during the planning phase of a data collection activity.

Analyte - A chemical component of a sample to be determined or measured.

Bias – The systematic or persistent distortion of a measurement process which causes errors in one direction (i.e., the expected sample measurement is different than the sample's true value.

Cohesive Soil – Soil that possess some resistance to deformation because of the surface tension present in the water films. For example, wet clays can be molded into various shapes without breaking and will retain these shapes. Gravels or a mixture of gravel and fines that can not be easily obtained or transferred using coring tools are not cohesive and are called non-cohesive.

Contaminant of Potential Concern - Any physical, chemical, biological, or radiological substance or matter that has an adverse effect on air, water, or soil.

Data Quality Objectives – Qualitative and quantitative statements derived from the DQO process that clarify study objectives, define the appropriate type of data to collect, determine the most appropriate conditions from which to collect data, and specify the tolerable probabilities of making a decision error. These statements are used as the basis for establishing the type, quality, and quantity of data needed to support decisions.

Matrix Spike (MS) - An aliquot sample with known quantities of compounds (target analytes) that is mixed with a field sample and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery. The sample provides information on the target analyte stability and loss due to matrix interference and volatility after collection and during transport, storage, sample preparation and analysis.

Matrix Spike Duplicate (MSD) - A second aliquot of the same compounds as the matrix spike that is spiked into a duplicate field sample in order to verify the precision and accuracy of the results of the matrix spike.

Sampling – The process of obtaining samples and/or measurements of a subset of population units from the population. Proper sampling techniques must be employed to obtain samples that are representative of actual site conditions.

Target Analyte – The element, compound, or class of compounds detected and quantitated through the analytical measurement process.

Test Method – An adoption of a scientific technique for a specific measurement problem, as documented in a SOP.

Volatile Organic Compounds – Chemicals that have a low boiling point, evaporate easily, and contain hydrogen (H), carbon (C), and possibly other elements.

5.0 REFERENCES

Naval Facilities Engineering Service Center (NFESC), 1999, Navy Installation Restoration Chemical Data Quality Manual, September.

United States Environmental Protection Agency (EPA), 1997, Test Methods for Evaluation Solid Wastes, SW-846, Update III.

United States Environmental Protection Agency (EPA), 1999 Memorandum, Regional Interim Policy for Determination of Volatile Organic Compound (VOC) Concentrations in Soil and Solid Matrices.

United States Environmental Protection Agency (EPA), 1994, Guidance for The Data Quality Objectives Process, USEPA QA/G-4

6.0 APPARATUS AND MATERIALS

- Stainless steel spatula, scoop or knife.
- En Core® Sampler T-Handle and/or En Core® Sampler Extrusion Tool.
- Disposable En Core® Sampler and En Core® Sampler bag (labeled zipbag).
- Decontamination supplies, including a plastic tarp.
- Ice chest and wet ice (double bagged).
- Paper towel.
- Field Logbook.
- Soil Sample Collection Log forms.
- Chain-of-custody forms; sample labels, and custody seals.

7.0 PROCEDURE

This procedure addresses the specific activities to collect soil samples for VOC analyses (any volatile organic compound). The sampling protocol described below focuses on the use of a coring device (En Core® Sampler) that also serves as a shipping container.

7.1 Review of SAP or Work Plan

In preparation for a sampling effort involving the collection of soil samples for VOC analyses (TPH-gasoline and/or VOCs) at a given site, the Project Manager shall meet with the designated field personnel in charge of collecting the samples to review the site SAP and convey the following information:

- Access requirements (e.g., permission of owner, locked gates, road conditions).
- Identification number(s) of the areas to be sampled.
- Specific sample locations and sample identification strategy.
- Soil type being sampled, if known and any special considerations.
- Selected VOC sampling procedure (En Core® Sampler versus preservation).

- The potential use of a mobile lab (instant on-site analyses) and selection of confirmation samples using an En Core® Sampler to the fixed-based laboratory.
- Anticipated number of environmental samples and QC samples to meet project DQOs.
- Sample volume requirements (5 grams versus 25 grams) and/or En Core® Samplers needed by the contracted laboratory. The 25-gram sampler is typically used when Toxicity Characteristic Leaching Procedure (TCLP) and other leaching tests [i.e., synthetic precipitation leaching procedure (SPLP) and waste extraction test (WET)] are required.
- Required Field Logbook entries and any supporting documentation.
- Type of equipment needed for the scheduled sampling activity.

7.2 Sample Collection

The following procedure is designed to provide detailed information in the collection of soil samples using the En Core® Sampler. For a diagram of the sampling device, refer to the Manufacturer's Instructions (Attachment 1)

1. Label all sample pouches with the sample identification scheme indicated in the SAP.
2. Before taking the samples, hold coring device and push the plunger rod down until small o-ring rests against tabs. Depress the locking lever and place coring body plunger end first, into open end of T-handle, aligning the slots on the coring body with the locking pins in the T-handle. Twist coring body clockwise to lock pins in slots. Make sure sampler is locked in place.
3. Immediately before sampling, remove approximately half inch of soil from the exposed surface soil with a clean spatula, scoop, or knife. When inserting a clean coring tool into a fresh surface for sample collection, air should not be trapped behind the sample. This procedure will ensure that a fresh exposed surface is sampled.
4. Turn the T-Handle with the T up and coring down. Using the T-Handle, push sampler into soil until coring body is completely full. The coring body will be full when the small o-ring is centered in the T-Handle viewing hole. Remove sampler from soil sleeve and quickly wipe the coring body exterior to ensure a tight seal.
5. Cap the coring body while it is still on T-Handle. Push and twist cap over bottom until grooves on locking arms seat over ridge on coring body. Cap must be sealed to seal sampler.
6. Remove the capped sampler by depressing locking lever on the T-Handle while twisting and pulling sampler from T-Handle. Lock plunger by rotating extended plunger rod fully counterclockwise until wings rest firmly against tabs.
7. Insert the sampler into the sealable/labeled pouch and immediately place samples in a cooled (4°C) ice chest.

8. Collect field QC samples in accordance with the SAP requirements. A minimum of 3 En Core® Samplers are needed for each sample. A total of 9 En Core® Samplers are needed if collecting sample for MS/MSD.
9. Samples must be analyzed or frozen within 48 hours. Samples that are frozen shall be analyzed within 7 days to meet holding time requirements. Sampler should not be frozen below -20°C due to potential problems with tool seals and the loss of VOCs upon sample thawing.
10. Record laboratory and field identification numbers in the Soil Sample Collection form. Chain of custody forms will be completed with the laboratory identification number only so QC samples are submitted "blind" to the laboratory. .

8.0 DOCUMENTATION

Document all procedures and equipment used during soil sampling in the Field Logbook or appropriate soil sample collection form. Recorded field data shall include:

- Soil type and any relevant visual observations (i.e., stains).
- Inability to collect a representative sample.
- Sample collection date and times.
- Any observation that may impact data interpretation.

9.0 ATTACHMENTS

1. En Core® Sampler Manufacturer's Instructions

RICHARD BRADY AND ASSOCIATES

STANDARD OPERATING PROCEDURE

**SOIL SAMPLING PROCEDURE FOR VOLATILE ORGANICS
USING THE EnCore® SAMPLER**

ATTACHMENT 1

EnCore® SAMPLER MANUFACTURER'S INSTRUCTIONS

Disposable En Core® Sampler

En Novative Technologies, Inc.
1241 Bellevue Street
Green Bay, WI 54302
Phone: 920-465-3960 • Fax: 920-465-3963
Toll Free: 888-411-0757
www.ennovativetech.com

Sampling Procedures

Using The En Core® T-Handle

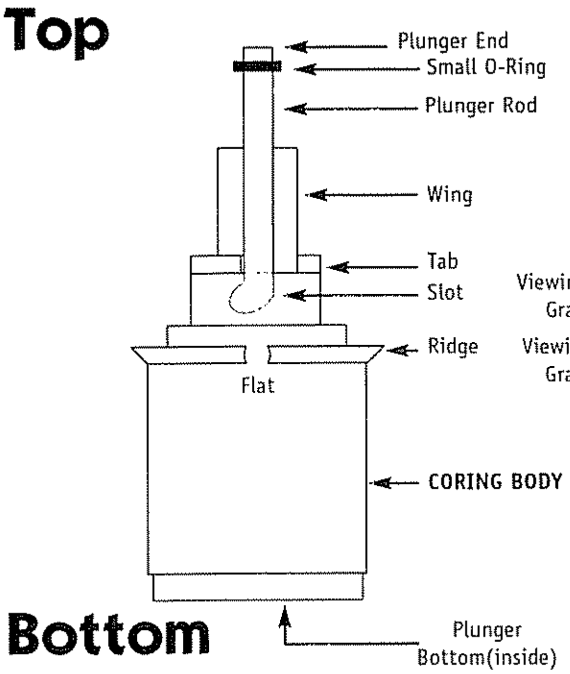
NOTE:

1. En Core® Sampler is a SINGLE USE device. It cannot be cleaned and/or reused.

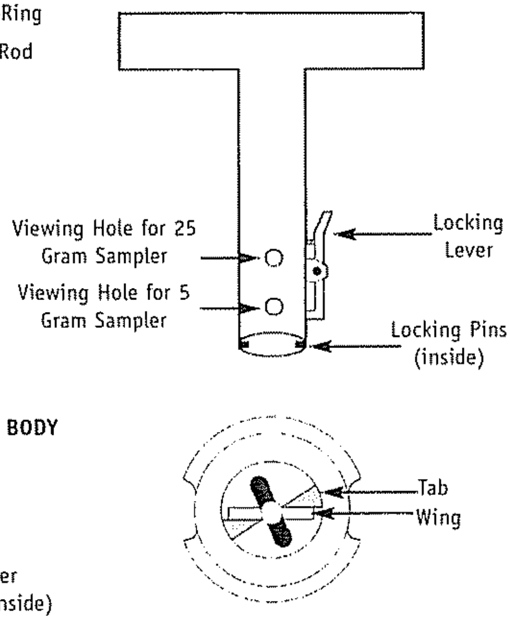
2. En Core® Sampler is designed to store soil. Do not use En Core Sampler to store solvent or free product!

3. En Core® Sampler must be used with En Core® T-Handle and/or En Core® Extrusion Tool exclusively. (These items are sold separately.)

En Core®

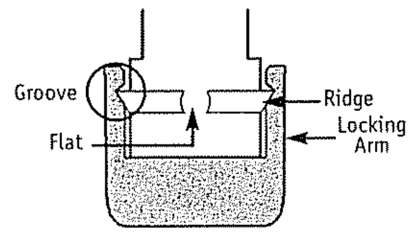


En Core® T-Handle



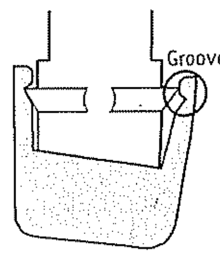
Sampler Correctly Capped

(Locking arm grooves seated over coring body ridge)



Sampler Incorrectly Capped

(Cap apperars crooked; locking arm grooves not fully seated over coring body ridge)



BEFORE TAKING SAMPLE:

1. Hold **coring body** and push **plunger rod** down until **small o-ring** rests against **tabs**. This will assure that plunger moves freely.

2. Depress **locking lever** on En Core T-Handle. Place coring body, **plunger end first,** into open end of T-Handle, *aligning the (2)* ***slots*** *on the coring body with the (2)* ***locking pins*** *in the T-Handle.* Twist coring body clockwise to lock pins in slots. Check to ensure Sampler is locked in place. Sampler is ready for use.

TAKING SAMPLE:

3. Turn T-Handle with T-up and coring body down. This positions plunger bottom flush with bottom of coring body (ensure that plunger bottom is in position). Using T-Handle, push Sampler into soil until coring body is completely full. When full, small o-ring will be centered in T-Handle **viewing hole**. Remove Sampler from soil. Wipe excess soil from coring body exterior.

4. Cap coring body while it is still on T-handle. *Push* **cap** over **flat** area of **ridge** *and twist* to lock **cap** in place. **CAP MUST BE SEATED TO SEAL SAMPLER (see diagram)**.

PREPARING SAMPLER FOR SHIPMENT:

5. Remove the capped Sampler by depressing locking lever on T-Handle while twisting and pulling Sampler from T-Handle.

6. Lock plunger by rotating extended plunger rod fully counter-clockwise until **wings** rest firmly against tabs (see plunger diagram).

7. Attach completed tear-off label (from En Core Sampler bag) to cap on coring body.

8. Return full En Core Sampler to zipper bag. Seal bag and put on ice.

Disposable En Core® Sampler

EXTRUSION PROCEDURES

USING THE En Core® EXTRUSION TOOL

CAUTION! Always use the Extrusion Tool to extrude soil from the En Core Sampler. If the Extrusion Tool is not used, the Sampler may fragment, causing injury.

1. Use a pliers to break locking arms on cap of En Core Sampler. Do not remove cap at this time. **(CAUTION: Broken edges will be sharp.)**

2. To attach En Core Sampler to En Core Extrusion Tool: Depress locking lever on Extrusion Tool and place Sampler, plunger end first, into open end of Extrusion Tool, aligning slots on coring body with pins in Extrusion Tool. Turn coring body clockwise until it locks into place. Release locking lever.

3. Rotate and gently push Extrusion Tool plunger knob clockwise until plunger slides over wings of coring body. (When properly positioned plunger will not rotate further.)

4. Hold Extrusion Tool with capped Sampler pointed upward so soil does not fall out when cap is removed. To release soil core, remove cap from Sampler and push down on plunger knob of En Core Extrusion Tool. Remove and properly dispose of En Core Sampler.

Warranty and Disclaimers

IMPORTANT: FAILURE TO USE THE EN CORE SAMPLER IN COMPLIANCE WITH THE WRITTEN INSTRUCTIONS PROVIDED HEREIN VOIDS ALL EXPRESS AND IMPLIED WARRANTIES, INCLUDING WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

PRINCIPLE OF USE. The En Core Sampler Cartridge System is a volumetric sampling system designed to collect. store and deliver a soil sample. The En Core Sampler comes in two sizes for sample volumes of approximately 25 or 5 grams. There are four components: the cartridge with a movable plunger; a cap with two locking arms; a T-handle (purchased separately); and an extrusion handle (purchased separately). NOTE: The En Core Sampler is designed to store soil. It is not designed to store solvent or free product.

The soil is stored in a sealed headspace-free state. The seals are achieved by three special Viton® * o-rings, two located on the plunger and one on the cap of the Sampler. At no time and under no condition should these o-rings be removed or disturbed.

QUALITY CONTROL. The cartridge is sealed in an airtight package to prevent contamination prior to use. Due to the stringent quality control requirements associated with the use of this system, the disposable cartridge is designed to be used only once.

WARRANTY. En Novative Technologies. Inc. ("En Novative Technologies") warrants that the En Core Sampler shall perform consistent with the research conducted under En Novative Technologies' approval, within thirty (30) days from the date of delivery, provided that the Customer gives En Novative Technologies prompt notice of any defect or failure to perform and satisfactory proof thereof. THIS WARRANTY DOES NOT APPLY TO THE FOLLOWING, AS SOLELY DETERMINED BY EN NOVATIVE TECHNOLOGIES: (a) Damage caused by accident, abuse. mishandling or dropping; (b)Samplers that have been opened, taken apart or mishandled; (c)Samplers not used in accordance with the directions; and (d)Damages exceeding the cost of the sampler. Seller warrants that all En Core Samplers shall be free from defects in title. THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES. WHETHER ORAL. WRITTEN, EXPRESSED. IMPLIED OR STATUTORY, INCLUDING ANY INFORMATION PROVIDED BY SALES REPRESENTATIVES OR IN MARKETING LITERATURE. IMPLIED WARRANTIES OF FITNESS AND MERCHANTABILITY SHALL NOT APPLY. En Novative Technologies' warranty obligations and Customer's remedies. except as to title, are solely and exclusively as stated herein.

LIMITATION OF LIABILITY. IN NO EVENT SHALL EN NOVATIVE TECHNOLOGIES BE LIABLE FOR ANTICIPATED PROFITS, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO. DAMAGES FOR LOSS OF REVENUE, DOWN TIME, REMEDIATION ACTIVITIES. REMOBILIZATION OR RESAMPLING, COST OF CAPITAL. SERVICE INTERRUPTION OR FAILURE OF SUPPLY. LIABILITY OF CUSTOMER TO A THIRD PARTY, OR FOR LABOR, OVERHEAD, TRANSPORTATION, SUBSTITUTE SUPPLY SOURCES OR ANY OTHER EXPENSE. DAMAGE OR LOSS, INCLUDING PERSONAL INJURY OR PROPERTY DAMAGE. En Novative Technologies' liability on any claim of any kind shall be replacement of the En Core Sampler or refund of the purchase price. En Novative Technologies shall not be liable for penalties of any description whatsoever. In the event the En Core Sampler will be utilized by Customer on behalf of a third party. such third party shall not occupy the position of a third-party beneficiary of the obligation or warranty provided by En Novative Technologies. and no such third party shall have the right to enforce same. All claims must be brought within one (1) year of shipment. regardless of their nature.

En Novative Technologies, Inc.
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www ennovativetech com

The En Core® Sampler is covered by One or More of the Following U.S. Patents: 5,343,771; 5.505.098; 5,517,868; 5,522,271. Other U.S. and Foreign Patents Pending

* Viton® is a registered trademark of DuPont Dow Elastomers.

STANDARD OPERATING PROCEDURE

HOLLOW STEM AUGER DRILLING

SOP NUMBER: T-004

REVISION NUMBER: 2

REVISION DATE: September 8, 2008

Prepared by: ________________________ *September 8, 2008*
Jason Williams *Date*

Approved by: ________________________ *September 8, 2008*
Jesse MacNeill - Quality Assurance Manager *Date*

Approved by: ________________________ *September 8, 2008*
Tim Shields - Program Manager *Date*

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RICHARD BRADY AND ASSOCIATES STANDARD OPERATING PROCEDURE

HOLLOW STEM AUGER DRILLING

1.0 PURPOSE

This Standard Operating Procedure (SOP) provides direction and establishes guidelines and procedures for field personnel during the supervision of hollow stem auger drilling operations. This SOP is not intended to apply to every situation that may be encountered, nor is intended to replace thorough training and reading of reference materials.

2.0 BACKGROUND

Subsurface activities may involve the use of drilling services. Drilling is recognized as one of the most hazardous construction operations. Health risks associated with drilling activities are due, in large part, to a failure in recognizing that the most serious accidents can occur.

3.0 APPLICABILITY

Drilling activities are applicable but not limited to activities associated with site construction, site demolition, underground storage tank removal, site investigations, and remedial activities. This SOP is applicable to hollow stem auger drilling.

4.0 DEFINITIONS

Auger – A device for sampling subsurface soil.

Hollow-stem auger – A small-diameter (typically 6- to 12-inch) drilling technique commonly used for environmental assessment of subsurface conditions and the installation of monitoring wells.

Split-barrel sampler – One of several specific types of sampling devices for retrieving representative soil samples from discrete depths. Where environmental samples are to be collected, use of these samplers requires the lining the interior of the sampler with appropriate sampling tubes, usually brass or stainless steel.

Field Log book – A project-specific bound record of information gathered by field personnel while logging borings.

Underground utilities - Include, but are not limited to, utilities (sewer, telephone, fuel, electric, water, and other product lines), tunnels, shafts, vaults, foundations, and other underground fixtures or equipment that may be encountered during drilling operations.

5.0 REFERENCES

ASTM Standard D 5784-95 Standard Guide for Use of Hollow-Stem Augers for Geoenvironmental Exploration and the Installation of Subsurface Water Quality Monitoring Devices.

ASTM Standard D 3550 Standard Method for Ring-Lined Barrel Sampling of Soils

ASTM Standard D 1587 Standard Method for Penetration Test and Split-Barrel Sampling of Soils.

Various auger sampling devices and their proper uses are discussed in ASTM Standard D 4700-91, Standard Guide for Soil Sampling from the Vadose Zone.

County of San Diego, Department of Environmental Health, Land & Water Quality Division, Site Assessment and Mitigation Program (SD DEH). Site Assessment and Mitigation Manual. http://www.sdcounty.ca.gov/deh/lwq/sam/manual_guidelines.html (This manual is updated yearly.)

State of California Department of Water Resource. Water Well Standards, Bulletins 74-81 and 74-90 (Latest editions September 1988 and June 1991, respectively).

6.0 APPARATUS AND MATERIALS

Select and assemble the types of equipment, instruments, and supplies necessary to perform the scope of work in accordance with the project specifications. A suggested checklist of apparatus and materials is included as Attachment A.

7.0 PROCEDURE

This procedure addresses the specific activities performed during hollow stem auger drilling activities. These procedures may vary based on site-specific conditions and requirements.

When preparing for the field investigation, review the planning documents (Work Plan, Sampling and Analysis Plan, Health and Safety Plan, etc.) for the following information:

- The purpose of each borehole (e.g., install monitoring well, collect soil samples, abandon a well, etc.)
- Specific methodology for drilling, including equipment and cuttings/fluid containment
- Specific locations, depths, and diameters of boreholes
- The types of sampling and/or logging of borehole
- Details of mobilization/demobilization and decontamination of equipment
- Appropriate health and safety guidelines and personnel protective equipment

7.1 Site Preparation

Determine the logistics of drilling, logging, sampling, cuttings/fluid containment, and/or well construction before mobilizing.

Assess the drilling site with the driller prior to mobilization. This assessment should identify potential hazards (slip/trip/fall, overhead power lines, etc.), and determine how drilling operations may affect the environment (dust, debris, noise). Evaluate and correct potential hazards. Shift or change borehole location, if necessary.

Ensure that all identifiable underground utilities around the drilling location have been marked, and the borehole location appropriately cleared. Keep copies of the site clearance documents on-site.

7.2 Health and Safety Requirements

Follow the approved site-specific health and safety plan. Check that all personnel conducting work at the site have appropriate training and qualifications.

Direct all personnel within the exclusion zone to pay close attention to rig operations. The rotating auger blades can snag or catch loose clothing and literally screw someone into the ground.

Establish clear communication signals with the drilling crew. Verbal signals may not be heard during the drilling process. Direct every member of the crew to inform the onsite RBA Project Manager of any unforeseen hazard, or when anyone approaches the exclusion zone.

7.3 Drilling Site Mobilization

Observe the drilling equipment for proper maintenance and appropriate decontamination prior to each time the rig is mobilized to a site.

Inspect for proper working order:

- Clutches
- Brakes
- Drive heads
- emergency shut down switches

Inspect for condition:

- cables
- hydraulic hoses
- auger joints
- auger bits

Any observed leakage of fluids from the rig should be immediately repaired and the rig decontaminated again before it is allowed to mobilize.

Mobilize rig over the borehole location.

- Secure exclusion zone with barricades

- Place plastic sheeting beneath rig or around borehole
- Level drill rig
- Raise mast slowly and avoid obstructions and hazards
- Prepare containment or set containers for investigation-derived waste

Calibrate safety, sampling, and monitoring equipment.

7.4 Breaking Ground

- Identify type of surface (e.g., asphalt, concrete, bare soil)
- Penetrate ground using appropriate equipment (e.g., cookie cutter).
- Inform driller of potential shallow hazards.
- Drill slowly to allow continuous visual inspection and/or monitoring
- Stop for probing or hand augering, if necessary.

7.5 Borehole Drilling

During drilling operations:

- Observe and monitor rig operations;
- Conduct health and safety monitoring and sampling
- Supervise health and safety compliance; and
- Prepare a lithologic log under the supervision of a Professional Geologist.

Observe and record drilling conditions. Communicate frequently with the driller. Log:

- relative rates of penetration (indicative of fast or slow drilling);
- chattering or bucking of the rig
- problems, including significant down time, and their causes

Direct driller to progress no faster than the onsite RBA Project Manager can adequately observe conditions, compile boring logs, and supervise safety and sampling activities.

Observe, supervise, and record quantities of cuttings and fluids contained during drilling.

All onsite personnel are to, at all times, be on the lookout for potentially unsafe conditions.

If any potentially unsafe conditions are evident from drilling observations and the health and safety sampling and monitoring, suspend drilling operations immediately and take appropriate actions. In the event suspension of drilling activities occur:

- Inform the onsite RBA Project Manager;
- Take corrective action before drilling may be continued; and

- Enter the observed problem, suspension, and corrective action in the Field Log book.

Log the boring. If total depth was reached prematurely due to refusal, note the cause of refusal on the field log.

7.6 Borehole Destruction

Follow local and state regulations for borehole destruction. In general, all boreholes should be destroyed by sealing from the bottom of the boring to ground surface with an approved sealing material such as a bentonite/cement slurry. Boreholes should be sealed the same day they are drilled. Sealing materials placed greater than 30 feet deep must be done using the tremie method.

7.7 Monitoring Well Completion

If a monitoring well is to be installed in the borehole, follow local and state regulations for the completion of the monitoring well. Supervise the placement of an adequate seal, the critical element of a monitoring well.

7.8 Demobilization/Site Restoration

After the drill rig is rigged down and removed from the borehole location:

- Clean surface to approximate pre-drilling conditions;
- Top off borings flush with surface;
- Finish monitoring well surface completions;
- Identify and isolate with barricades remaining hazards, if any;
- Containerize, label, and manage investigative derived waste,
- Inspect site condition for post-drilling compliance.

8.0 DOCUMENTATION

Document all procedures, observations, and equipment used during drilling activities in the Field Log book.

9.0 ATTACHMENTS

1. Equipment Supply Check List

RICHARD BRADY AND ASSOCIATES

STANDARD OPERATING PROCEDURE

HOLLOW STEM AUGER DRILLING

ATTACHMENT 1

EQUIPMENT AND SUPPLY CHECKLIST

EQUIPMENT AND SUPPLY CHECKLIST

- ☐ Work Plan
- ☐ Health and Safety Plan
- ☐ Underground Service Alert (USA) number
- ☐ Personal safety gear:
  - ☐ traffic vest,
  - ☐ steel toe shoes,
  - ☐ work gloves
  - ☐ earplugs,
  - ☐ sunscreen,
  - ☐ hardhat,
  - ☐ drinking water
- ☐ Gloves (e.g., powder-free nitrile)
- ☐ Warning signs, barricades, cones, and yellow caution tape
- ☐ Field log (notebook and forms)
- ☐ Log forms
- ☐ Pens
- ☐ Hand auger
- ☐ Shovel and other various hand tools
- ☐ Buckets
- ☐ Brushes
- ☐ Liquinox
- ☐ Deionized water
- ☐ Deionized water sprayer
- ☐ Gas and vapor monitoring equipment
- ☐ Utility mark out report
- ☐ Underground Locating Service (ULS)
- ☐ Drilling permit issued by local government agency
- ☐ Digging Permit issued by facility (e.g., Public Works Center)
- ☐ Safety fence and flashing lights for night-time vehicle or pedestrian traffic
- ☐ Soil logging equipment
- ☐ Chain of Custody forms
- ☐ Sample forms
- ☐ Sampling trowel, scoop, spoon, etc. (not too big, expect 4 oz jars)
- ☐ Soil or groundwater sampling equipment
- ☐ Teflon sheets for sample sleeves
- ☐ Sample jars
- ☐ Tool box
- ☐ Hammer
- ☐ Vise
- ☐ Baggies, large and small
- ☐ Sample labels
- ☐ Sharpie pens
- ☐ Plastic sheets for sample prep
- ☐ Soil classification chart

- ☐ Color chart
- ☐ Hand lens
- ☐ Ice Coolers for samples
- ☐ Ice
- ☐ Visqueen
- ☐ Drum labels
- ☐ Clipboards
- ☐ Paint for marking out auger locations
- ☐ Water level indicator
- ☐ Survey equipment (e.g., GPS unit)
- ☐ Camera
- ☐ Trash bags
- ☐ Dustpan foxtail
- ☐ Two tables: one for sampling, one for drying samplers
- ☐ Large paper clamps/clips for windy days
- ☐ Ice Coolers for drinks (must be marked FOOD ONLY)
- ☐ Shade
- ☐ Chairs

STANDARD OPERATING PROCEDURE

SCAPS DATA ACQUISITION PROCEDURES FOR LASER-INDUCED FLUORESCENCE

SOP NUMBER: T-005

REVISION NUMBER: 02

REVISION DATE: September 8, 2008

Prepared by: ________________________ *September 8, 2008*
Fred Essig *Date*

Approved by: ________________________ *September 8, 2008*
Jesse MacNeill - Quality Assurance Manager *Date*

Approved by: ________________________ *September 8, 2008*
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RICHARD BRADY AND ASSOCIATES STANDARD OPERATING PROCEDURE

SCAPS DATA ACQUISITION PROCEDURES FOR LASER-INDUCED FLUORESCENCE

1.0 PURPOSE

The primary objective of a SCAPS Laser Induced Fluorescence (LIF) push is to obtain high resolution vertical profile of contaminant and soil characteristics data in real time. The purpose of this Standard Operating Procedure (SOP) is to provide direction on proper data acquisition techniques through adherence to a site-specific Sampling and Analysis Plan (SAP) or Work Plan and implementation of quality assurance/quality control (QA/QC) measures.

2.0 BACKGROUND

SCAPS was developed as an alternative to collecting large numbers of soil samples using conventional drilling techniques and testing those samples at an off-site analytical laboratory. Conventional techniques provide assessment data following a delay of hours to days. Contaminated soil cuttings need to be disposed of and several deployments are typically required. SCAPS provides real time, high resolution assessment data using a direct-push probe based on Cone Penetrometer Test (CPT) technology that yields no soil cuttings. Time and expense of field deployments for contamination assessments are typically reduced using SCAPS.

3.0 APPLICABILITY

SCAPS LIF data acquisition techniques are applicable for assessing sites contaminated with petroleum, oils, and lubricants in soils of low to moderate density, and at locations and to depths accessible with a standard CPT rig. LIF and CPT soil classification data can be collected above and below the water table.

4.0 DEFINITIONS

SCAPS – Site Characterization and Analysis Penetrometer System. A system to obtain real time, subsurface assessment data on soil and chemical characteristics using a direct-push soil probe.

Clipping – Fluorescence intensity that exceeds the capability of the detector to quantitate, nominally greater than 250,000 counts.

CPT – Cone Penetrometer Testing relates cone pressure and sleeve resistance with soil types. Performed concurrently with LIF measurement while pushing the probe into the soil. CPT data can be used to objectively describe physical soil properties.

Data Acquisition Specialist – Person who operates the SCAPS laser and data acquisition system.

Field Log book – Contains records of Groundwater/Product Depths, Instrument Calibration Form, Sampling Identification and analyses (cross reference), Low Flow Well Purging-Field Data forms.

SCAPS Data Acquisition Logbook – A bound logbook dedicated to documenting the operation, maintenance, and quality assurance/quality control of the SCAPS system. The SCAPS Data Acquisition Logbook is system specific, and is separate from the project-specific field logbook

FSS – "Fischer Sea Sand" is a standard used as a system check for background fluorescence. A sample of washed sea sand, obtained from Fischer Scientific, is sieved and placed in a cuvette.

LIF – Laser Induced Fluorescence. The property of certain compounds to fluorescence in the presence of laser light. The character of the fluorescence can be related to petroleum and other compounds. Used as a primary tool in SCAPS assessment.

OMA – Optical multichannel analyzer spectrograph.

Pushroom Operator – The person who operates the direct-push hydraulic rams.

Push – The act of using the SCAPS rig to push an LIF probe into the soil. A push is the result of this action.

Qs10 – Quinine sulfate solution at 10 parts per million in a cuvette used as a fluorescence systems check before and after LIF pushes.

SAP – Sampling and Analysis Plan

Slit – A device that blocks incoming light, placed between the return fiber and the detector. Used to protect the detector from ambient light overload.

Window - Sapphire window mounted on a robe. Laser light and return fluorescence pass though the window.

WinOCPT – Software used to calibrate, control, and record LIF data.

5.0 REFERENCES

American Society for Testing Materials (ASTM). 1995, "Standard Test for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils". Designation D5778-95. Philadelphia, PA.

American Society for Testing and Materials, 1998, "Standard Test Method for Mechanical Cone Penetrometer Tests in Soil". Designation D3441-98. Philadelphia, PA.

6.0 APPARATUS AND MATERIALS

The Project Manager and SCAPS team shall plan for site assessment using LIF by reviewing the site-specific work plan. Prior to deploying, supplies shall be assembled, equipment shall be calibrated (if applicable), and tested. Procedures for equipment maintenance and calibration are addressed in separate standard operating procedures. Apparatus and materials that may be required include the following:

- SCAPS rig.
- SCAPS Data Acquisition Log book.
- Calibration and control standards.
- Paper towels.
- Methanol.
- Pen with indelible waterproof ink.
- Calibration standards.
- Approved plans and background documents – Approved SAP or Work Plan, Quality Assurance Project Plan (as appropriate).
- Site Health and Safety Plan and required equipment. The Site Health and Safety Plan, along with the site sign-in sheet should be on site and be presented by the site health and safety officer. Personnel-protective and air-monitoring equipment specified in the Site Health and Safety Plan should be demonstrated, present and in good working order on site at all times.
- Tool box equipped with maintenance supplies and equipment (e.g., replacement O-rings, rubber gaskets, expendable tips).

7.0 WARNINGS AND CAUTIONS

Laser light can cause eye and skin damage. The light is ultraviolet and invisible. Keep laser off unless the window is covered or below ground surface.

Keep the slit in to protect the detector from ambient light unless the window is covered or below ground surface or wear laser protective eyewear if working near exposed laser beam. **Ambient light can damage the detector, which is difficult or impossible to replace.**

When the slit that blocks ambient light to the detector is removed, the slit receptacle slot is covered using an abbreviated slit (short slit), shortened to allow light traveling in the fiber optic to reach the detector while blocking the light that could travel down the unoccupied slit receptacle potentially damaging the detector.

Use caution when the truck is in motion. When the ladder is up, the truck may move. Brace yourself and secure loose items when the truck is in motion. Do not leave or enter the truck if the ladder is up.

8.0 PROCEDURE

This procedure addresses the specific activities to be performed to acquire data during LIF pushes using SCAPS.

8.1 Review of SAP or Work Plan

To prepare for LIF pushes, the Project Manager shall meet with the designated Data Acquisition Specialist to review the site SAP or Work Plan and convey the following information:

- Identification number(s) of the pushes.
- Push locations.
- Data requirements, including total depths.
- Anticipated soil condition and depths, and depth(s) of contamination.
- Thickness of pavement cores, if applicable.
- Other SCAPS testing, in addition to LIF, that may be performed.

The Project manager shall record information obtained during LIF pushing in the Field Logbook that is dedicated to the project, as described in the SAP or Work Plan.

The SCAPS Data Acquisition Specialist shall record all SCAPS QA/QC systems checks and systems operation and maintenance notes in the separate SCAPS Data Acquisition Logbook.

8.2 Equipment Inspection

Prior to using LIF equipment:

- Make sure all necessary equipment and supplies are on board.
- Inspect equipment for dirt and damage.

8.3 Daily Equipment Initialization – Power Up Sequence

When the SCAPS rig has arrived at the site, the equipment may be powered up:

1. Lift the bench top to access the laser. Take care to avoid bumping fiber optics!
2. Check and record the xenon chloride gas pressure. The gauge is on the laser unit.
3. Turn the laser on, turning the the laser key ¼ turn to the right.
4. Verify the larger of the two slits is “in” place on the detector. It is Extremely Important to keep this slit in when the probe is exposed to ambient light (i.e., at all times the probe is out of the ground except when calibrating.)
5. Turn on the optical multichannel analyzer (OMA) unit.
6. Turn on the computer.
7. Initiate the pre-push calibration sequence as follows.
8. Open WinOCPT software.
9. Select the drop-down File menu, click New, enter a push name

10. Select Edit > Probe geometry, ensure that all values are correct for the probe in use. Measure probe with tape measure if necessary.
11. Place probe on metal supports, on the side of the bench.
12. Inspect the window or fogging, dirt, and damage.
13. Gently clean window with a drop of methanol on a laboratory tissue.
14. Carefully place the cuvettes of quinine sulfate (Qs10) calibration standard and Fischer Sea Sand (FSS) control standard on the probe with the Qs10 on the sapphire window and the FSS immediately next to it.
15. Remove the larger slit and replace with the short slit.
16. Make sure laser operation is external so that the computer controls laser firing by selecting the "EXT" switch position on the laser unit.
17. Select the Run dropdown menu, follow the single point measurement sequence, record the Maximum, Average, standard deviation, and wavelength in the SCAPS Data Acquisition Logbook laser statistics for QS10 and FSS.
18. Adjust laser power during the QS10 systems check, if necessary, to avoid clipping (>250,000 counts) and low response (<150,000 counts).
19. Repeat the QS10 systems check sequence a minimum of three times.
20. Turn laser off. Replace the larger light-blocking slit. Remove cuvettes.

8.4 SCAPS Push Sequence

When probe is clamped and ready:

1. In WinOCTP software, open a new push file. "File > New" (Insert a "0" to the automatic numbering if less than 10).
2. Click "Yes" (usually) to "preload documentation from WinOCPT?" For the first push of a project, insure accuracy of the data such as project name and personnel.
3. Minimize project information window.
4. "File > Load Views" and select "3+.vew" or another project specific view.
5. Initiate a scripted push, For the first of day, perform single-point pre-push measurements described above in "Daily Equipment Initialization".
6. Initiate the script sequence
7. Click Run then Script then press <enter> <enter> to accept defaults. (There is only one script, "SCAPS LIF collection sequence #1")
8. Record push filename in log book.
9. Window showing cone and sleeve readings appear. Record cone and sleeve readings in log book. Cone readings should be ±5, sleeve ±0.5.

10. Close cone/sleeve window
11. “Check sapphire window”
12. Put Qs cuvette on window.
13. Take slit out and replace with the short slit.
14. Turn the switch on the laser unit to “RUN”
15. Confirm trigger mode switch on the laser body is on external (EXT).
16. Press <enter> <enter> to accept defaults when asked to “Identify This Measurement”
17. Review the data graph. “Show Statistics” If acceptable “Script > Accept” and record data in log book.
18. Slide the cuvettes so the FSS cuvette covers the window. Allow no ambient light into the window.
19. Press <enter> <enter> to accept defaults.
20. Review the data graph. “Show Statistics” If acceptable “Script > Accept” and record data in log book.
21. Put the longer ambient light blocking slit in. Turn laser off. Remove cuvettes.
22. Verify tip is on probe.
23. Tell pushroom operator: “You may now lower probe to ground level.” Operator will lower the probe to ground surface then say “Depth Zero”.
24. Close graphs to clear the screen.
25. <Enter> when the probe is at ground level.
26. Record time in log book.
27. <Enter> <enter> to accept defaults.
28. Tell pushroom operator: “Begin the push”.
29. Turn laser on.
30. At 2.2 feet (or more if surface cored), remove slit. For a 6” core, allow laser to fire twice before lifting slit and replacing it with the shortened slit.
31. Observe data acquisition. Make depth is recorded consistently. Look for possible sensor failures in cone and sleeve. Note high LIF readings and wavelength changes. Tell project manager immediately of any noted observations.
32. At bottom of hole, “Run > Terminate”
33. Put the larger light blocking slit in.
34. Laser off
35. Suspend Script (defer system checks)

36. Record time in SCAPS Data Acquisition Log book.
37. Tell the pushroom operator to raise the probe to surface.
38. Wipe probe window first with paper towel, then with tissue moistened with methanol.
39. Inspect window for fogging, pitting, damage, etc.
40. Place Qs cuvette on probe window. Place FSS cuvette next to Qs cuvette.
41. remove the larger slit and replace it with the small slit
42. <enter> <enter> to accept defaults.
43. Review the data graph. “Show Statistics” If acceptable, “Script > Accept” and record data in SCAPS Data Acquisition Logbook.
44. Slide the cuvettes so the FSS cuvette covers the window. Allow no ambient light into the window.
45. Press <enter> <enter> to accept defaults.
46. Review the data graph. “Show Statistics” If acceptable, “Script > Accept” and record data in log book.
47. Put the larger light-blocking slit in.
48. If last push of the day, confirm the larger light blocking slit is in. Turn laser off. Remove cuvettes. Otherwise, repeat push sequence.
49. Copy push files to auxiliary computer.

8.5 Shut down – Power off

At the end of the day, the following steps shall be followed:

1. Copy remaining push files to auxiliary computer.
2. Copy the files on data acquisition computer to subdirectory.
3. Turn off equipment in reverse order:
4. Turn off computers.
5. Switch OMA off.
6. Switch off laser with key.
7. Secure computer monitor, log books, methanol bottles, and other loose objects.

9.0 DOCUMENTATION

Document all procedures and equipment used in data acquisition in the log book. Record all applicable data including:

- Equipment calibration.

- Equipment configuration.

10.0 ATTACHMENTS

Attachment 1: Example log book entry.

RICHARD BRADY AND ASSOCIATES

STANDARD OPERATING PROCEDURE

SCAPS DATA ACQUISITION PROCEDURES FOR LASER-INDUCED FLUORESCENCE

ATTACHMENT 1

SCAPS LIF LOG BOOK ENTRY

Project FAllon   Notebook No.

Continued from Page

1/25/07

Nitrogen Press. ______ Energy 8.7
Push Filename: FA02-38-LF PSH Cone: 0.312 Sleeve: -0.005
Qs10 Pre Push: 467 nm 202221 max 192872 X 2.55 sd
SS Pre Push: 478.7 nm 4761 max Start 9 :25
End: 9 :32 @ 17 /95 ' Cone: 0.243 Sleeve: -0.005
Qs10 Post Push: 468 nm 218240 max 194826 X 5.87 sd
SS Post Push: 471.2 nm 4686 max Spectra Depth ______ '

Nitrogen Press. ______ Energy ______
Push Filename: FA02-39-LF PSH Cone: 0.249 Sleeve: -0.001
Qs10 Pre Push: 468 nm ~~0.244~~ 200303 max ~~0.001~~ 187488 X 5.3 sd
SS Pre Push: 474 nm ~~200303~~ 481.8 max Start ____ : ____
End: 9 : 50 @ ____ / ____ ' Cone 0.251 Sleeve: -0.003
Qs10 Post Push: 467 nm 194329 max 178710 X 4.1 sd
SS Post Push: 472.6 nm 4438 max Spectra Depth ______ '

Nitrogen Press: ______ Energy 8.8
Push Filename: FA02-40-LF PSH Cone: 0.253 Sleeve: -0.005
Qs10 Pre Push: 468 nm 206192 max 192998 X 5.76 sd
SS Pre Push: 474 nm 4559 max Start ____ : ____
End: 10 :20 @ 17 /75 ' Cone 0.299 Sleeve: -0.002
Qs10 Post Push: 467.8 nm 178800 max 170536.3 X 2.494 sd
SS Post Push: 472.1 nm 4254 max Spectra Depth ______ '

Nitrogen Press. ______ Energy ______
Push Filename: FA02-41-LF PSH Cone: 0.280 Sleeve: -0.002
Qs10 Pre Push: 467.8 nm 207976 max 192904 X 3.993 sd
SS Pre Push: 471.0 nm 6232 max Start 10 :38
End: 10 :57 @ ____ / ____ ' Cone 0.274 Sleeve: -0.006
Qs10 Post Push: 467.7 nm 182675 max 165920 X 8.36 sd
SS Post Push: 474.9 nm 3839 max Spectra Depth ______ '

Systems Checks -
ran about 2 dozen systems check quickly. First checks had as 10 as low as 170k's, with distinct 3 cones (poor SD) - but the last half dozen or so were above 200 K w/ good SD. Immediately started pre-push script for FA02-41-LF. - T.S.

Continued on Page

Read and Understood By

Signed ______ Date ______ Signed ______ Date ______

STANDARD OPERATING PROCEDURE

ENVIRONMENTAL SOIL SAMPLING

SOP NUMBER: T-006

REVISION NUMBER: 2

REVISION DATE: September 8, 2008

Prepared by: ______________________________ *September 8, 2008*
Jason Williams *Date*

Approved by: ______________________________ *September 8, 2008*
Jesse MacNeill - Quality Assurance Manager *Date*

Approved by: ______________________________ *September 8, 2008*
Tim Shields - Program Manager *Date*

Richard Brady & Associates
Engineering and Construction

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RICHARD BRADY AND ASSOCIATES STANDARD OPERATING PROCEDURE

ENVIRONMENTAL SOIL SAMPLING

1.0 PURPOSE

This Standard Operating Procedure (SOP) provides direction and establishes guidelines and procedures for field personnel collecting soil samples for environmental laboratory chemical analysis. This SOP is not intended to apply to every situation that may be encountered, nor is intended to replace thorough training and reading of reference materials.

2.0 BACKGROUND

Responsible parties and regulatory agencies make decisions about protecting human health and the environment from chemicals that may have been released during historic or current site activities. Chemical analysis of soil samples is often one source of information used in making environmental decisions. Soil sampling may be used in conjunction with various methods of subsurface investigations using various techniques.

3.0 APPLICABILITY

Soil sampling activities are applicable but not limited to activities associated with site construction, site demolition, underground storage tank removal, pipeline removal, site investigations, and remedial activities. This SOP is applicable to all soil sampling activities.

4.0 DEFINITIONS

Analyte - A chemical component of a sample to be determined or measured.

Analytical (or Testing) Method - A specification for sample preparation and instrumentation procedures or steps that must be performed to estimate the quantity of analyte in a sample.

Auger – A device for sampling subsurface soil.

Chain-of-custody - A protocol to insure the integrity of samples and resulting analytical results. Written forms indicating the date and time of transfer (e.g., from a sampler to the lab) are used. The procedure accounts for the whereabouts and handling of a sample and data from collection to final determination.

Drive sampler - A sample device that utilizes a hand held slide hammer to drive a six inch barrel to shallow subsurface depths. Typically used when collecting samples with a hand auger.

Encore sampler – One of several specific types of sampling devices for collecting samples for analysis for Volatile Organic compounds (VOCs) in accordance with EPA test method 5035/8260.

Field Log book – A project-specific record of information in a bound field notebook gathered by field personnel.

Hand auger – A small manual auger used fro shallow subsurface sample borings

Hollow-stem auger – A small-diameter (typically 6- to 12-inch) drilling technique commonly used for collecting soil samples and installing monitoring wells.

Matrix - The sample medium in which analytes of interest are tested. The media in which analytes are tested includes water, soil and solids.

Piston-type sampler - Sampling device used to collect soil samples at a discrete depth when a piston is released to allow soil to enter the sampler. The sampler is typically lined with 21” (three-6”, and one-3”) of brass or stainless steel tubing. It does not spilt or break apart, the soil sample, inside the tubing, is carefully extruded from the sampler. Piston-type samplers are typically used with direct-push technology.

SAP – Sampling and Analysis Plan

SCAPS – Site Characterization and Analysis Penetrometer System. A system to obtain real time, subsurface assessment data on soil and chemical characteristics using a direct-push soil probe. Soil samples can also be collected using a direct-push piston-type sampler.

Split-barrel/spoon sampler – One of several specific types of sampling devices for retrieving representative soil samples from discrete depths. Use of these samplers requires the lining the interior of the sampler with appropriate sampling tubes, usually brass or stainless steel.

VOC - (Volatile Organic Compound). Chemicals that have a low boiling point and evaporate easily containing hydrogen (H), carbon (C), and possibly other elements.

Underground utilities - Include, but are not limited to, utilities (sewer, telephone, fuel, electric, water, and other product lines), tunnels, shafts, vaults, foundations, and other underground fixtures or equipment that may be encountered during excavation operations.

5.0 REFERENCES

Navy Installation Restoration Laboratory Quality Assurance Guide, Naval Facilities Engineering Service Center (NFESC), Interim Guidance Document (Feb 1996).

Navy/Marine Corps Installation Restoration Manual, Naval Facilities Engineering Services Command (NFESC) (February 1997).

San Diego County, Department of Environmental Health (DEH), Site Assessment and Mitigation Program (DEH-SA/M), Site Assessment Manual (2004).

California Department of Toxic Substances Control, Hazardous Materials Laboratory, User’s Manual, Revision 12, January 2001.

CCR Title 22, Division 4.5, Chapter 11, Article 3, Section 66261.20(c).

EPA, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Revision 5, April 1998.

County of San Diego, Department of Environmental Health, Land & Water Quality Division, Site Assessment and Mitigation Program (SD DEH). Site Assessment and Mitigation Manual. http://www.sdcounty.ca.gov/deh/lwq/sam/manual_guidelines.html (This manual is updated yearly.)

6.0 APPARATUS AND MATERIALS

Select and assemble the types of equipment, instruments, and supplies necessary to perform the scope of work in accordance with the project specifications. A suggested checklist of apparatus and materials is included as Attachment A.

7.0 SOIL SAMPLE PROCEDURES

This procedure addresses the specific activities to be performed to accomplish a soil sampling event, including review of the Sampling and Analysis Plan (SAP), preparation for a sampling event by identifying necessary equipment and supplies, general sample collection procedures, including more details drilling activities and field documentation requirements.

7.1 Responsibilities

Project Manager (PM): The PM is responsible for ensuring that Richard Brady & Associates field personnel have been trained in the use of this procedure and for verification that soil sampling activities are performed in compliance with the Work Plan and this SOP.

Physical Science Technician (PST): The PST is responsible for compliance with this SOP including collection of samples, containerization of samples, and documentation.

7.2 Review of Sampling and Analysis Plan

In preparation for a soil sampling event at a given site, Richard Brady & Associates staff will review the site Sampling and Analysis Plan (SAP) and identify the following information:

- Identification number(s) of samples to be collected,
- Locations of the sample points,
- Location access requirements (e.g., permission of owner, locked gates, road conditions),
- Field and analytical parameters to be tested,
- Type and number of sample containers needed,
- Sample preservation methods,
- Volume of samples required for analysis,

- Type and number of QA/QC samples to be collected (e.g., duplicates, splits, and blanks), and
- Type of equipment needed for the scheduled sampling activity.

A location map shall be provided for use in the field. Copies of sampling specifications shall also be provided for field reference (if necessary).

Field information and data obtained during the sampling event shall be recorded in a logbook that is dedicated to the project.

7.3 Equipment and Supplies

Richard Brady & Associates staff shall plan for the sampling event by assessing, selecting, and assembling the types of equipment, instruments, and supplies necessary to perform the scope of work. Prior to going to the field, instrumentation shall be assembled, calibrated (if applicable), and tested. See Attachment 1.

7.4 General Soil Sampling Procedures

- Determine sampling locations and depths. Determining these locations depends on the nature of the sampling. In most cases, sample locations and depths will be determined prior to field mobilization and outlined in the site-specific SAP.
- After sample locations have been determined, penetrate the existing surface with sampling device; the depth will depend on the circumstances.
- When sample depth is attained, push/hammer sample (depending on sample method), until reaching undisturbed soil.
- If the soil is potentially impacted with hydrocarbons, it is usually desirable to obtain field organic vapor readings. After removing and breaking apart the sampler, collect a representative soil sample and place in a suitable container, such as a Ziplock bag, and record the result from the organic vapor analyzer (OVA).
- Collect representative soil samples in accordance with the SAP, ensuring correct sample container, preservation, labeling, storage, packing, and conveyance.
- Record the sampling information on the site plan, soil sample log, and a chain of custody form. Collect sample location information in accordance with the SAP, which may call for GPS or other location reference.
- Place the soil samples in a cooler packed with ice packets for cold storage pending transport to the environmental laboratory.
- The Project Manager is responsible for monitoring and documenting observations made during excavation activities in a field log. At a minimum the following information should be recorded prior to excavation activities: date, arrival time, site location, weather, onsite staff, any contractors (names and phone numbers), and the type and quantity of

equipment. During sampling activities the following information should be logged: start and stop time and location of all activities, blow counts performed to advance the sampler through each 6-inchinterval, description of the lithology encountered in accordance with the Unified Soil Classification System, odors and/or staining observed, depths and times which samples were taken, OVA readings (if taken), depth to water (if applicable), and problems causing delays during any activities.

- All sampling equipment should be decontaminated in accordance with the Richard Brady & Associates SOP T-001 Equipment Decontamination between all samples collected.

7.5 Subsurface Sampling Using a Spilt-barrel/spoon Sampler

Split-barrel/spoon samplers can be various lengths and are typically used for deeper samples with the hollow-stem auger. The following procedures provide directions for each step for this method of sampling.

- Decontaminate the split-barrel sampler and all other equipment.
- Begin augering to specified sample depths following SOP T-004 Hollow Stem Auger Drilling.
- After augering to a depth above the specified sample interval, stop augering and hammer the split-barrel sampler to the desired sample depth.
- Remove the sampler, break the sampler apart by unscrewing the ends and retrieve the tubing containing the sample.
- Collect the samples from the tubing depending on the preferred analysis. If the analysis is for VOCs, the SOP T-003 for Soil Sampling Procedure for Volatile Organics using the En Core® Sampler should be followed.
    - The stainless steel or brass tubing can be used for some other analysis or kept as a back-up sample. If this is the case, the tube ends should be wrapped in Teflon sheets and capped. Sealing the caps with silicon tape is optional. Do not use adhesive tape to seal the caps.
- The sampler and all equipment used to collect the sample should then be decontaminated following the SOP T-001 Equipment Decontamination.
- Repeat these steps until the specified number of samples have been collected from each boring.

7.6 Subsurface Sampling Using a Hand Auger (with drive sampler)

Hand augering may be used to collect soil samples from shallow depths when larger drilling equipment is not warranted. The collection of soil samples using a hand auger is typically used in conjunction with a drive sampler. The following procedures provide the minimum direction for each step of a soil sampling activity using hand auger equipment in conjunction with a drive sampler.

- Decontaminate the hand auger, drive sampler barrel and other equipment.
- Hold the auger vertical, apply pressure, and rotate in a clockwise direction through the soil.
- When the auger bucket is full of soil, remove it from the boring and transfer the contents to the plastic sheeting located around or next to the bore hole.
- Repeat previous two steps until achieving a depth above the desired sample depth.
- Using the drive sampler, hammer the sample barrel (loaded with specified tubing) until it has been driven to the desired depth.
- Remove the sample by gently tapping the hammer in an upwards motion as to not remove the soil sample from the sample barrel.
- Once the sample has been removed from the boring removed the tubing from the barrel by unscrewing the end and carefully extruding the sample.
- The hand auger, drive sampler, and all other equipment used to take the sample should then be decontaminated following the SOP T-100 Equipment Decontamination.
- Repeat these steps until the specified number of samples have been collected from the boring or until a depth is reached at which other means of collecting samples are necessary.

7.7 Subsurface Sampling Using SCAPS

Collecting soil samples using SCAPS utilizes a hydraulic press to push a piston-type sampler to the desired sample depth. This method is extremely precise in collecting samples from specific depths. The following procedure provides each step of a soil sampling activity using the SCAPS direct-push piston-type sampler.

- Decontaminate the piston-type sampler (must be taken apart) and all other equipment that comes in direct contact with the sample.
- The SCAPS unit is aligned above the specific sample location.
- The piston-type sampler is pushed to a depth above the desired sample depth.
- The piston is released using a wire cable, and the sampler is pushed to the desired sample depth. The typical sample interval is 18” (1.5’).
- Once the sample has been taken, the piston-type sampler is removed by retracting the hydraulic press.
- The sample is removed by carefully extruding the tubing from the sampler.

- The piston-type sampler and all other equipment used to take the sample should then be decontaminated following the SOP T-100 Equipment Decontamination.
- Repeat these steps until the specified number of samples have been collected from the push.

7.8 Subsurface Sampling during Trench Excavation Activities

Soil samples are collected from trench excavation sidewalls and bottom at a spatial intervals and depth specified in the project work plan or field sampling plan to accomplish specific project goals. The samples are collected by hand directly from excavation equipment. This is done specifically to eliminate hazards associated with having personnel enter potentially unstable excavations.

- Soil samples are immediately collected as soon as the excavation equipment is withdrawn from the hole. Soil is initially collected by placing approximately four cubic inches of soil from the excavator bucket into a decontaminated stainless steel bowl. The sample is then obtained by packing a laboratory-supplied sample container with soil, being careful to leave no headspace in the container. The soil in the bowl will not be mixed and as many soil horizons as possible will be sampled to obtain as representative a sample as possible. All soil sample containers are immediately sealed capped with the supplied lid, and are labeled with the project and sample number, collection depth, date, and time. This information is then entered on the chain of custody document. The sample is stored at the proper preservation temperature in an ice chest packed with double-bagged wet ice (4° C environment) until analysis. In the case of Encore samples, the sample is collected using the Encore sampling SOP T-003.
- Residual sample soil not placed in containers for laboratory analysis may be screened for combustible vapors using a combustible gas indicator (CGI) or equivalent instrument. For each vapor-screening event, soil is added to a 6-inch long by 2.5-inch diameter sample insert until it is approximately 1/3 full. The insert is capped, shaken, and penetrated with a probe inserted through a small opening in the cap. For hydrocarbon impacted soils, use an organic vapor analyzer (OVA) and place the probe inside the borehole and record the flame ionization detector (FID) reading taken after approximately 20 seconds and record the value in the boring logs.

7.9 Stockpile Soil Sampling

Generate a 2-dimensional grid to represent the stockpile, and select sample locations at random. Third dimension grid points (depths) are also randomly selected at each 2-dimensional grid location. Undisturbed samples are to be collected using a hand-auger / hammer driven system. A schematic of the contoured and gridded stockpiles with sample locations is shown in a figure in the final report.

7.10 Demobilization/Site Restoration

After the excavation has been backfilled:

- Repair surfaces to approximate pre-drilling conditions;
- Repair all surface structures as per the contract;
- Identify and isolate with barricades remaining hazards, if any;
- Containerize, label, and manage investigative derived waste,

8.0 DOCUMENTATION

Document all procedures, observations, and equipment used during excavation and sampling activities on the field log and forms related to the project.

9.0 ATTACHMENTS

1. Equipment Supply Checklist

RICHARD BRADY AND ASSOCIATES

STANDARD OPERATING PROCEDURE

ENVIRONMENTAL SOIL SAMPLING

ATTACHMENT 1

EQUIPMENT SUPPLY CHECKLIST

EQUIPMENT AND SUPPLY CHECKLIST

- ☐ Work Plan or Sampling and Analysis Plan
- ☐ Health and Safety Plan
- ☐ Underground Service Alert (USA) number
- ☐ Personal safety gear:
  - ☐ traffic vest,
  - ☐ steel toe shoes,
  - ☐ work gloves
  - ☐ earplugs,
  - ☐ sunscreen,
  - ☐ hardhat,
  - ☐ drinking water
  - ☐ Gloves (e.g., powder-free nitrile)
- ☐ Warning signs, barricades, cones, and yellow caution tape
- ☐ Field log (notebook and forms)
- ☐ Log forms
- ☐ Pens
- ☐ Hand auger
- ☐ Shovel and other various hand tools
- ☐ Buckets
- ☐ Brushes
- ☐ Liquinox
- ☐ Deionized water
- ☐ Deionized water sprayer
- ☐ Gas and vapor monitoring equipment
- ☐ Utility mark out report
- ☐ Underground Locating Service (ULS)
- ☐ Drilling permit issued by local government agency
- ☐ Digging Permit issued by facility (e.g., Public Works Center)
- ☐ Safety fence and flashing lights for night-time vehicle or pedestrian traffic
- ☐ Soil logging equipment
- ☐ Chain of Custody forms
- ☐ Sample forms
- ☐ Sampling trowel, scoop, spoon, etc. (not too big, expect 4 oz jars)
- ☐ Soil sampling equipment
- ☐ Teflon sheets for sample sleeves
- ☐ Sample jars
- ☐ Tool box
- ☐ Hammer
- ☐ Vise
- ☐ Baggies, large and small
- ☐ Sample labels
- ☐ Sharpie pens
- ☐ Plastic sheets for sample prep

- ☐ Plastic sheeting (6 mil. Min.)
- ☐ Soil classification chart
- ☐ Color chart
- ☐ Hand lens
- ☐ Ice Coolers for samples
- ☐ Ice
- ☐ Visqueen
- ☐ Drum labels
- ☐ Clipboards
- ☐ Paint for marking out auger locations
- ☐ Water level indicator
- ☐ Survey equipment (e.g., GPS unit)
- ☐ Camera
- ☐ Trash bags
- ☐ Dustpan foxtail
- ☐ Two tables: one for sampling, one for drying samplers
- ☐ Large paper clamps/clips for windy days
- ☐ Ice Coolers for drinks (must be marked FOOD ONLY)
- ☐ Shade
- ☐ Chairs
- ☐ EnCore® sampling devise extractor (if applicable),
- ☐ Instrument for measuring organic vapor concentrations such as a photoionization detector (PID) and/or a flame ionization detector (FID),

NOTE: The SCAPS truck and support trucks should be equipped with all SCAPS specific equipment for collecting soil samples.

STANDARD OPERATING PROCEDURE

DEPTH DISCRETE DIRECT PUSH GROUNDWATER SAMPLING

SOP NUMBER: T-012

REVISION NUMBER: 01

REVISION DATE: May 27, 2008

Prepared by: ________________________ May 27, 2008
Craig Haverstick Date

Approved by: ________________________ May 27, 2008
Fred Essig – Project Manager Date

Approved by: ________________________ May 27, 2008
Tim Shields - Program Manager Date

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RICHARD BRADY AND ASSOCIATES STANDARD OPERATING PROCEDURE

DEPTH DISCRETE DIRECT PUSH GROUNDWATER SAMPLING USING

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide direction and establish procedures for field personnel to use during collection of direct-push, discrete interval groundwater samples. This SOP is specific for the Site Characterization and Analysis Penetrometer System (SCAPS) however the following procedures are also intended to guide discrete interval sampling using direct push technology equivalent to the SCAPS. This SOP is not intended to replace thorough training and reading of reference materials.

2.0 BACKGROUND

SCAPS can collect discrete groundwater samples from targeted depth intervals. SCAPS uses a direct push tool that can install and isolate a ¾-inch diameter Schedule 40 polyvinyl chloride (PVC) screen within a selected interval.

3.0 APPLICABILITY

Direct push discrete sampling activities are applicable but not limited to activities associated with environmental site investigation and remedial activities.

Discrete interval sampling is indicated when there is a need to sample a specific vertical interval of the water column due to aquifer and geologic complexity in addition to migratory and dispersive behavior of a target analyte set.

4.0 DEFINITIONS

The following definitions are specific to the SCAPS direct push tools and techniques. Equivalent direct push sampling technology may differ.

Equivalent direct push technology – direct push platforms similar to the SCAPS marketed with different names, capable of allowing collection of a groundwater sample from a predetermined and isolated interval.

Discrete-interval groundwater sampling – refers to the tools and techniques necessary for collection of a groundwater sample from a subsurface interval, physically isolated so as to prevent, to the best extents practicable, mixing of groundwater from below and/or above the targeted interval.

Push (direct push context) – (noun) a type of soil boring where the ground is penetrated by a non-rotating probe pressed into the subsurface by mechanical pressure. (Verb) the application of mechanical pressure (typically hydraulic) to force a spear-shaped, metal probe into the ground.

Push rods – Hollow steel push rods approximately three feet long, sealed at the threaded joints with o-rings to prevent groundwater from entering. The push rods when connected in sequence effectively form a water tight, hollow tube.

Expendable drive point – becomes the bottom cap of the screened interval

Casing – Standard ¾ to 1-inch (nominal) flush-threaded PVC riser pipe

Screen – Standard ¾ to 1--inch (nominal) flush-threaded PVC 0.010-inch slotted wellscreen.

Underground utilities - Include, but are not limited to, utilities (sewer, telephone, fuel, electric, water, and other product lines), tunnels, shafts, vaults, foundations, and other underground fixtures or equipment that may be encountered during subsurface investigation.

5.0 REFERENCES

ASTM International. D:6771-02. 2002. Standard Practice for Low-Flow Purging and Sampling for Wells and Devices for Ground-Water Quality Investigations.

County of San Diego, Department of Environmental Health, Land & Water Quality Division, Site Assessment and Mitigation Program (SD DEH). Site Assessment and Mitigation Manual. Updated annually.

Yeskis, D. and B. Zavala. 2002. "Groundwater Sampling Guidelines for Superfund and RCRA Project Managers." U.S. EPA, Ground Water Forum Issue Paper, Publication Number EP542-S-02-001, May 2002.

6.0 DOCUMENTATION APPARATUS AND MATERIALS

Select and assemble the documentation, types of equipment, instruments, and supplies necessary to perform the scope of work in accordance with the project specifications. Documentation, apparatus and materials may include but is not limited to the following:

- Work Plan
- Statement of Work/Request for Quote
- Health and Safety Plan
- Underground Service Alert (USA) number
    - Personal safety gear:
    - traffic vest
    - steel toe shoes
    - work gloves
    - earplugs
    - sunscreen
    - hardhat
    - drinking water

- Gloves (e.g., powder-free nitrile)
- Warning signs, barricades, cones, and yellow caution tape
- Field log (notebook and forms)
- Log forms
- Pens
- Hand auger
- Shovel and other various hand tools
- Buckets
- Brushes
- Liquinox
- Deionized water
- Deionized water sprayer
- Gas and vapor monitoring equipment
- Utility mark out report
- Underground Locating Service (ULS) report
- Drilling permit issued by local government agency
- Digging Permit issued by facility (e.g., Public Works Center)
- Safety fence and flashing lights for night-time vehicle or pedestrian traffic
- Chain of Custody forms
- Sample forms
- Groundwater sampling equipment
- Sample containers
- Sample labels
- Sharpie pens
- Ice Coolers for samples
- Ice
- Visqueen
- Drum labels
- Clipboards

- Paint for marking out auger locations
- Water level indicator
- Survey equipment (e.g., GPS unit)
- Camera
- Trash bags
- Dustpan foxtail
- Work table: one for sampling, one for decontamination procedures
- Large paper clamps/clips for windy days
- Ice Coolers for drinks (must be marked FOOD ONLY)
- Shade
- Chairs

6.1 Site Preparation

Complete the following preparations prior to mobilization:

- Obtain site approval as required by the specific site.
- Post site notification at several locations in the site vicinity.
- Call all vendors involved to reconfirm commitments and start times.
- Check USA and update if needed.
- Visit the site.
- Confirm the internal and non-navy utilities mark out completed including a post mark out site walk with the utilities technician.
- Notify regulatory representatives.

6.2 Health and Safety Requirements

Follow the approved site-specific health and safety plan. Check that all personnel conducting work at the site have appropriate training and qualifications.

Topics included in the daily Health and Safety briefing conducted prior to the start of work each day include but are not limited to the following risks specific to the SCAPS rig or equivalent:

- falls
- underground and overhead utilities
- hearing
- traffic

- moving heavy equipment
- hydraulic jack deployment
- steep roads

Clarify that it is every crew member's responsibility to inform the rig geologist/engineer of any unforeseen hazard, or when anyone approaches the exclusion zone.

6.3 Site Mobilization

Inspect equipment for proper maintenance and appropriate decontamination prior to each time the rig is mobilized to a site. Following mobilization of the rig over the push location:

- Confirm utility clearance.
- Secure exclusion zone with barricades.
- During on-site location changes, either remain on board or stay clear of the SCAPS truck until the jacks are deployed and the truck is leveled.
- Understand that you need to see the driver to be in the driver's field of view.

6.4 Breaking Ground

During the initial ground penetration:

- Required is a dedicated observer to visually monitor the probe's movement within the first 2 feet of penetration.
- The operator will be immediately informed by the observer if there is sideway probe movement greater than approximately 1.5 inches.
- At the discretion of the operator and/or geologist, the push may be abandoned.

6.5 Push Advancement

During pushing operations:

- Observe and monitor rig operations.
- Conduct health and safety monitoring and sampling as dictated by site conditions.
- Supervise health and safety compliance.
- Suspend investigation operations immediately and take appropriate actions if any potentially unsafe conditions are evident from drilling observations and/or health and safety sampling and monitoring.

In the event suspension of direct push activities occur:

- Inform the Site Superintendent.
- Take corrective action prior to resumption.
- Enter the observed problem, suspension, and corrective action in the field log.

7.0 DISCRETE INTERVAL WELL SETTING PROCEDURE

The following sequence addresses the specific activities performed during discrete-interval direct push groundwater sampling activities. These procedures may vary based on site-specific conditions and requirements.

To acquire depth-discrete groundwater samples, screen intervals will likely be equal to or less than five feet long. SCAPS or equivalent direct push technology will to install a ¾ or 1-inch diameter Schedule 40 polyvinyl chloride (PVC) screen isolated at intervals selected following evaluation of the CPT data. The tool consists of:

- 2-inch outside diameter push rods that are sealed at the joints with o-rings to prevent groundwater from entering
- An expendable drive point that becomes the bottom cap of the screened interval
- Standard ¾-inch flush-threaded PVC riser pipe
- Standard ¾-inch flush-threaded PVC 0.010-inch slotted wellscreen.

An expendable drive point is attached to the bottom of a push-rod assembly. The SCAPS truck is used to push the assembly to a predetermined depth. Standard ¾-inch flush-threaded PVC screen and riser pipe are fed down through the push-rod assembly, and threaded onto the top of the drive point.

The push-rod assembly is pulled back toward the surface until the desired screened interval is exposed. The drive point, held in place by soil friction, anchors the screen at the desired depth.

To isolate a sampling interval targeted for below the water table, a foam bridge, installed on the casing at a predetermined depth and topped with approximately six inches of bentonite pellets, forms a seal around the exterior of the PVC riser pipe. The push rods and the exterior of the foam bridge are in contact with the soil, providing a tight annular seal above the screened interval.

Following well emplacement, groundwater samples will be collected in accordance with the project Sampling and Analysis Plan.

7.1 Well Destruction

After sampling, the PVC well materials are unthreaded from the expendable tip in preparation for destruction. SCAPS small-diameter wells are grouted, during destruction, using the well casing as it is being removed for a tremie pipe, effectively grouting the hole from bottom to top.

7.2 Demobilization/Site Restoration

After the direct push rig is has grouted the borehole and moved from the location:

- Remove and appropriately dispose of debris generated by direct push sampling operations.
- Clean surface to approximate pre-push conditions.
- Containerize, label, and manage any investigative derived waste.

- Inspect site for post-investigation restoration compliance.

8.0 DOCUMENTATION

Document all procedures, observations, and equipment used during subsurface activities on the field log and forms related to the project.

APPENDIX B

INVESTIGATION-DERIVED WASTE MANAGEMENT PLAN

FINAL

INVESTIGATION DERIVED WASTE PLAN

March 23, 2009

SCAPS LASER-INDUCED FLUORESCENCE INVESTIGATION
UNDERGROUND STORAGE TANK SITE 229,
NAVAL WEAPONS STATION SEAL BEACH, CALIFORNIA

Prepared for:
DEPARTMENT OF THE NAVY
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Engineering and Construction

Prepared under:
Contract No. N68711-03-D-4302
NAVFAC SW CTO 0120
DCN: RBAE-4302-0120-0028

Prepared by:

Date 3-23-09

Donald McHugh, P.G.
Project Manager

Reviewed by:

Date 3-23-2009

Timothy Shields
Program Manager

TABLE OF CONTENTS

FIGURES

ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
EPA	U.S. Environmental Protection Agency
IDW	Investigation-derived waste
IRP	Installation Restoration Program
LIF	Laser induced fluorescence
NAVWPNSTA Seal Beach	Naval Weapons Station Seal Beach, Seal Beach, CA
PPE	Personal protective equipment
RBA	Richard Brady & Associates
RCRA	Resource Conservation and Recovery Act
SCAPS	Site Characterization and Analysis Penetrometer System
TCLP	Toxicity characteristic leaching procedure
UST	Underground storage tank

B1.0 INTRODUCTION

Richard Brady & Associates (RBA) received under subcontract from Shaw Infrastructure, Inc., Contract Task Order 0120 from the U.S. Department of the Navy (Navy), Naval Facilities Engineering Command, Southwest under Contract Number N68711-03-D-5104. Under Contract Task Order 0120, RBA is conducting Extended Site Assessment activities at Underground Storage Tank (UST) Site 229 at Naval Weapons Station Seal Beach (NAVWPNSTA Seal Beach), Seal Beach, California. To guide the field, laboratory, and data reporting efforts associated with waste materials derived from the sampling activities, RBA prepared this investigation-derived waste (IDW) management plan.

Field activities at UST Site 229 will involve Site Characterization and Analysis Penetrometer System (SCAPS) laser induced fluorescence (LIF) technology combined with fixed-base laboratory testing of soil and groundwater samples. In performing sampling activities, RBA will generate IDW. This plan establishes standard waste management practices for addressing the IDW that will result from the field sampling activities at UST Site 229.

As directed by the U.S. Environmental Protection Agency (EPA) in Management of Investigation-Derived Wastes during Site Inspections (EPA 1991), this plan provides guidance for the characterization and management of IDW in a manner that is protective of human health and the environment and complies with applicable or relevant and appropriate requirements. This plan discusses the details of various management methods, including temporary on-site management and management at off-site treatment and disposal facilities, to address the types of IDW that will be generated during the field sampling activities.

The following sections of this document discuss IDW generated during sampling (Section B2.0), IDW characterization (Section B3.0), and management and disposal of IDW (Section B4.0).

B2.0 GENERATION OF INVESTIGATION-DERIVED WASTE

SCAPS direct-push technology is designed to minimize or eliminate the generation of IDW compared to conventional drilling. IDW at UST Site 229 may include soil cuttings, groundwater from well development and monitoring, decontamination fluids, equipment rinsate fluids, disposable equipment, and personal protective equipment (PPE). Each of these waste materials will be evaluated to determine whether it is regulated as hazardous or non-hazardous waste for the purposes of storage, treatment, or disposal. Following this evaluation, the proper arrangements will be made for disposal of each waste.

General refuse may include packaging materials generated during field activities. This refuse is typically managed as non-hazardous waste and disposed of in compliance with state solid waste regulations.

All soil and liquid wastes will be placed in properly labeled, closed containers such as 55-gallon drums and temporarily stored at UST Site 229 until appropriate arrangements can be made for its removal from the site. Liquid IDW, such as purge water and decontamination water, will be stored in 55-gallon drums at UST Site 229 until the contents of the drums can be characterized and transported for disposal.

From the time the IDW is produced, all containers will be properly labeled with "ANALYTICAL RESULTS ARE PENDING ON THE CONTENTS IN THIS CONTAINER." An example drum label is shown in Figure B-1. The label will include the following information:

- Type of IDW (soil, PPE/disposable equipment, purge water, decontamination fluids)
- Source site identification (UST Site 229)
- Location identification (i.e., S229MW01)
- Depth (if applicable)
- Date container sealed
- Drum number
- Contact information (i.e., RBA Project Manager, 858-496-0500)

Upon receipt of the soil and water analytical results, the most appropriate disposal option will be determined, and approval or concurrence will be requested on the IDW disposal activities from the Navy.

Disposable PPE will be managed according to the level of contamination encountered during field activities. In general, PPE will be managed as non-hazardous solid waste, particularly if little contact occurs with the sampling media and low levels of contaminants are involved. PPE will be placed in plastic bags and, if the results for IDW indicate that it is non-hazardous, the bags will transferred to an on-site industrial dumpster, whose contents are routinely disposed of in a municipal landfill.

An inventory of IDW generated from this site investigation activity and a weekly inspection log will be submitted to the Navy IRP Coordinator on a weekly basis until the wastes are shipped off site.

B3.0 INVESTIGATION-DERIVED WASTE CHARACTERIZATION

Characterizing IDW is necessary to determine whether IDW must be managed as hazardous waste, non-hazardous waste, or waste subject to other laws and regulations. Characterizing IDW is also required for purposes of determining proper storage, treatment, and disposal options.

Characterizing IDW is a multi-step process that involves determining the origin of the waste and then considering the chemical contaminants and their concentrations in the waste. Sampling and analysis of IDW will be conducted for soil cuttings, groundwater from well development and monitoring, and decontamination and equipment rinsate liquids generated during the field sampling activities at UST Site 229.

B3.1 Listed Hazardous Waste

The EPA provides guidance in the level of effort required to establish whether listed wastes are present at investigation sites (EPA 1991). This guidance will be used to identify, collect, and interpret the appropriate analytical data to determine whether the IDW contains any Resource Conservation and Recovery Act (RCRA)-listed hazardous waste. Contaminated media may be subject to RCRA hazardous waste regulations if the media contains a listed hazardous waste.

B3.2 Characteristic Hazardous Waste

Under Title 40 *Code of Federal Regulations* (CFR) 262.11, any waste that is not listed by the EPA (or mixed with or derived from a listed waste) must be examined to determine whether it exhibits any characteristics of hazardous waste. The EPA has established criteria for each characteristic to assist generators in determining whether a waste exhibits the characteristic. The regulations reference test methods for determining the presence of each characteristic. The characteristic of toxicity is tested using the toxicity characteristic leaching procedure (TCLP), and comparing the results of this procedure with preset concentrations for a number of specific toxic waste constituents. If the preset concentration for any constituent is exceeded, the corresponding waste is considered to be characteristically hazardous. However, the EPA does not require the TCLP for individual constituents that are not present in the waste being evaluated or for constituents that are present below total concentrations that are specified for each constituent (Title 40 CFR Part 261, Appendix II). The EPA typically uses a rule of thumb of 20 times the TCLP concentration to estimate the total concentration limit above which the TCLP is required.

B3.3 California Regulations for Identifying Hazardous Waste

California regulations for identifying hazardous wastes pursuant to RCRA (Title 22, California Code of Regulations, Section 66261.20) are broader and more stringent than federal RCRA requirements. Therefore, solid waste excluded from the definition of hazardous waste under the federal RCRA regulations (Title 40 CFR 261.4[b]) may be regulated as hazardous waste under California regulations. Federal and California regulations will be compared, and the more stringent California regulations will be used for identifying the hazardous waste.

B4.0 MANAGEMENT AND DISPOSAL OF INVESTIGATION-DERIVED WASTE

The project IDW coordinator or the project manager will decide when sufficient quantities of IDW have been accumulated for shipment off site. In accordance with federal regulations (Title 40 CFR 262.34), IDW that has been identified as hazardous waste will be stored at UST Site 229 for no more than 90 days from the date the waste was first generated. Once the IDW is classified as hazardous waste, a hazardous waste label will be placed on the hazardous waste container, replacing the IDW drum label. The project IDW coordinator will complete any work orders for the proper disposal of the IDW.

B4.1 Shipping Investigation-Derived Soil Waste to Off-Site Facilities

If any of the soil samples collected and analyzed during this investigation are classified as hazardous waste, then composite soil characterization samples will be collected from the 55-gallon drums that will be used at NAVWPNSTA Seal Beach for temporary storage of IDW from drilling activities at UST Site 229. After the analytical data are received, the solid waste will be disposed of at either a hazardous or nonhazardous off-site disposal facility, as applicable. If all of the analytical results for soil samples are classified as non-hazardous waste, then composite samples will not be needed for waste characterization.

Upon receipt of a work order, the waste management subcontractor is responsible for scheduling the shipment with the project manager or IDW coordinator. The subcontractor is also responsible for preparing a waste profile, uniform hazardous waste manifest, non-hazardous waste manifest, and/or land disposal restriction notification, as applicable to the shipment. The project manager or IDW coordinator will coordinate with the Navy IRP coordinator to obtain signatures for the waste profile, manifests, and/or land disposal restriction notification prior to shipping the waste for off site disposal.

B4.2 Management of Liquid Investigation-Derived Waste

If any of the water samples collected and analyzed during this investigation are classified as hazardous waste, then composite water samples will be collected from the 55-gallon drums that will be used at NAVWPNSTA Seal Beach for temporary storage of liquid IDW generated from field activities at UST Site 229. After the analytical data from the samples are received, the project manager or IDW coordinator will arrange to have the liquid IDW picked up and disposed of in an appropriate manner at an off-site facility. A certificate of disposal or other acknowledgement of receipt will be filed with a waste profile. If all of the analytical results for water samples are classified as non-hazardous waste, then composite samples will not be needed for waste characterization.

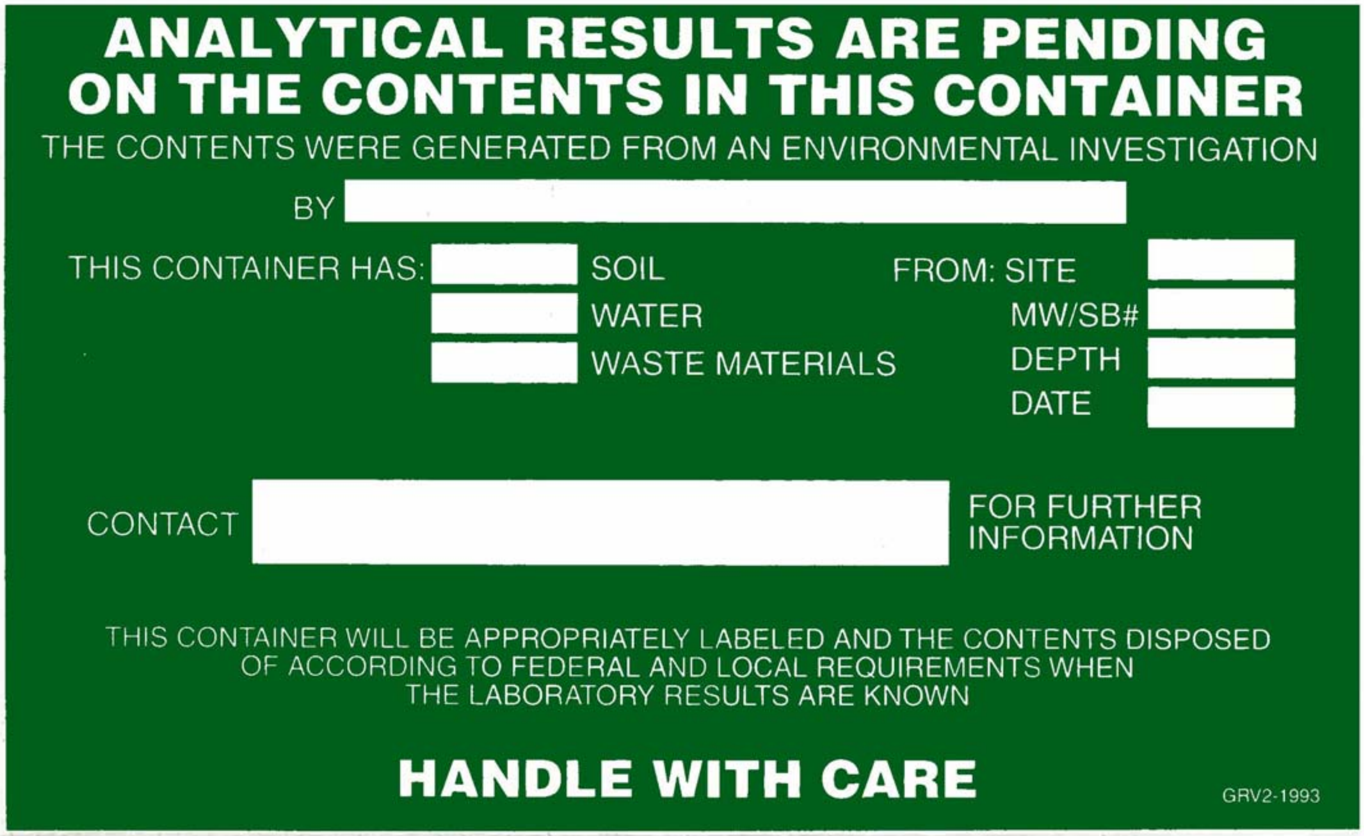
B5.0 REFERENCES

Title 22, California Code of Regulations, section 66261.20. 1999.

U.S. Environmental Protection Agency (EPA). 1991. Management of Investigation-Derived Wastes during Site Inspections. EPA/540/G-91/009. Office of Emergency and Remedial Response (OERR) Directive 9345.3-02. May.

FIGURES

Figure B-1. Example Drum Label



APPENDIX C

REGULATORY CORRESPONDENCE

Revised Response to Comments

Draft Work Plan,
Extended Site Assessment of Former UST Site 229,
Naval Weapons Station Seal Beach, California
Dated November 18, 2008

Comments of Patricia Hannon, Site Cleanup/DoD Section California Regional Water Quality Control Board, Santa Ana Region ***General Comments on Work Plan***	**Navy Responses**
1) Page 8 Section 3.1.3 Receptors Please revise this section to include groundwater as a receptor.	**1)** Section 3.1.3 has been revised as follows: "Shallow groundwater resources in the immediate vicinity of the former tank excavation are a potential receptor. No other current complete pathways have been identified for diesel to reach human or ecological receptors. The nearest edge…"
Comments of Patricia Hannon, Site Cleanup/DoD Section California Regional Water Quality Control Board, Santa Ana Region ***Specific Comments on Appendix A, Sampling and Analysis Plan***	**Navy Responses**
2) Page 2 *U.S. EPA Region 9 Preliminary Remediation Goals Soil Screening Levels for Protection of Groundwater, 2004* has been updated and replaced. Please see U.S. EPA's website for the updated version at http://www.epa.gov/region09/superfund/prg/index/html	**2)** The screening criteria have been updated as requested.
3) Page 14 Section 3.0 SAP Worksheet #3 – Distribution List Please correct my email address in this section to : phannon@waterboards.ca.gov, and update the email addresse(es) listed in other sections of this document	**3)** The email address has been corrected on Worksheet #3 and in Section 9.2 of the SAP.

Revised Response to Comments

Draft Work Plan,
Extended Site Assessment of Former UST Site 229,
Naval Weapons Station Seal Beach, California
Dated November 18, 2008

Comments of Patricia Hannon, Site Cleanup/DoD Section California Regional Water Quality Control Board, Santa Ana Region **Specific Comments on Appendix A, Sampling and Analysis Plan**	**Navy Responses**
4) Page 28 Worksheet 10 section 10.2.3 Receptors Please revise this section to include groundwater as a receptor	**4)** Section 10.2.3 has been revised as follows: "Shallow groundwater resources in the immediate vicinity of the former tank excavation are a potential receptor. No other current complete pathways have been identified for diesel to reach human or ecological receptors. The nearest edge…"
5) Page 32, Section 11.3 Step 4 – Define the Boundaries of the Study Please specify the range of petroleum hydrocarbon concentrations that is represented by a "count of 10,000"	**5)** Section 11.3 has been revised as follows: "**If** elevated LIF intensity at a fuel-related wavelength at an intensity over 10,000 counts (which, in general, correlates to 0 – 100 parts per million TPH) is detected at a location, **then** petroleum contamination of soil is inferred …"
6) Page 32, Last paragraph Please define the terms "project action levels" and "project action limits"	**6)** The term "Project Action Limits", presented in Worksheet #15, has been replaced with the term "Project Screening Criteria" throughout the document. The term "Project Action Levels" has been deleted from the text. Potential petroleum impacts to groundwater will need to be delineated to the "Low Risk" thresholds identified in the "*Santa Ana Regional Board Supplemental Guidance, Clarification of Low-Risk Designation of Fuel Contaminated Sites, dated September 4, 1996."* Former UST Site 229 lies seaward of the Eastern Branch of the Newport-Inglewood and meets the definition of a low risk groundwater case. Any potential

Comments of Patricia Hannon, Site Cleanup/DoD Section California Regional Water Quality Control Board, Santa Ana Region **Specific Comments on Appendix A, Sampling and Analysis Plan**	**Navy Responses**
	clean up goals would be negotiated in a Corrective Action Plan, if necessary.
7) Page 34 Last paragraph The "Project Action Limits" presented in Worksheet #15 were not discussed at the planning meeting. Please revise this section to accurately reflect the topics that were discussed at the meeting.	**7)** Please see to Response to Comment 6.
8) Page 35 First paragraph A single sampling event will not show whether or not the plume is stable. Please revise the monitoring plan to allow for an appropriate dataset for review and interpretation of the magnitude of the plume.	**8)** The SAP currently allows up to four quarters of monitoring. See Worksheet 11, page 35, Section 4C.
9) Page 35 Section 4c According to this section: "If…concentrations of fuel related constituents detected above the method detection limit (MDL) are stable (defined as within 30 percent per Table 1) or decreasing, then the plume is considered to be stable or receding and no further action will be recommended." This paragraph is unclear as written, please clarify. Note that the MDLs are not listed in Table 1 at all.	**9)** Page 35 Section 4c has been revised as follows: "Based on the LIF fluorescence results, four permanent groundwater monitoring wells will be installed, with one located upgradient, one in the location of the highest LIF fluorescence, and two located downgradient. Groundwater monitoring will be conducted quarterly for one year. COC concentrations and groundwater elevations overtime for each groundwater monitoring well will be plotted to evaluate the stability of the COCs in groundwater.

Revised Response to Comments
Draft Work Plan,
Extended Site Assessment of Former UST Site 229,
Naval Weapons Station Seal Beach, California
Dated November 18, 2008

Comments of Patricia Hannon, Site Cleanup/DoD Section California Regional Water Quality Control Board, Santa Ana Region Specific Comments on Appendix A, Sampling and Analysis Plan	Navy Responses
	If concentrations of fuel-related constituents detected above the MCLs are stable or decreasing or are below the Project Screening Criteria, no further action will be recommended."
10) Page 38 If groundwater monitoring wells are installed, we recommend that the well screens be no more than 15 feet long, with the top of the screen at an anticipated or known high groundwater elevation, and extending downward across the water table or predicted or known low groundwater elevation. If this recommended interval exceeds 15 feet of screen, a nested, multi-completion well (well pair) should be considered. In addition, all groundwater monitoring well locations must be surveyed. In order to be consistent with the data requirements in GeoTracker database, the locational data for the groundwater monitoring wells must be provided as latitude and longitude measurements in decimal degrees, and elevation data must be in feet above mean seal level. Attached for your reference is copy of the GeoTracker Reporting Requirements for electronic submittal of information	**10)** If permanent groundwater monitoring wells are installed, well screens will be no longer than 15 feet as recommended. All data collected during the Extended Site Assessment at Former UST Site 229 will be consistent with GeoTracker database reporting requirements.

Revised Response to Comments
Draft Work Plan,
Extended Site Assessment of Former UST Site 229,
Naval Weapons Station Seal Beach, California
Dated November 18, 2008

Comments of Patricia Hannon, Site Cleanup/DoD Section California Regional Water Quality Control Board, Santa Ana Region **Specific Comments on Appendix A, Sampling and Analysis Plan**	**Navy Responses**
11) Page 52 SAP Worksheet #15 Reference Limits and Evaluation Tables Please define the term "Project Action Limit". Please also provide justification for use of the proposed chemical concentrations for determining no further action at the site. At a minimum, you should provide a discussion as to how these concentrations will be protective of the water resource and its beneficial uses.	**11)** Please see Response to Comment 6.
12) Page 54 Section 15.4 The proposed Project Quantitation Limit Goal is unacceptable, because it exceeds the California Maximum Contaminant Level (MCL) of 1 microgram per liter (µg/l) for benzene.	**12)** At a minimum, the Project Team will use the California MCLs as the Project Quantitation Limit Goal. Worksheet 15 has been updated to reflect this. However, groundwater will be delineated to the Project Screening Criteria identified in Response to Comment 6.

Reference:

California Regional Water Quality Control Board – Santa Ana Region (1996). Santa Ana Regional Board Supplemental Guidance, Clarification of Low-Risk Designation of Fuel Contaminated Site. September 4.