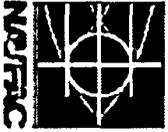




CTO 0101
DCN 8207
Revision:
August 6, 2004




Shaw® Shaw Environmental, Inc.
Contract Number N62474-98-D-2076
Document Control Number 8207
Contract Task Order 0101

Final Project Plans

Work Plan Addendum and SAP Addendum, Additional Corrective Action at
Corrective Action Area 11, Area 37, Alameda Point, Alameda, California



Revision 0 – August 6, 2004
**Work Plan Addendum and SAP Addendum
Additional Corrective Action at
Corrective Action Area 11, Area 37
Alameda Point, Alameda, California**

Final Project Plans

FINAL

WORK PLAN ADDENDUM

***Additional Corrective Action at Corrective Action Area 11, Area 37
Alameda Point, Alameda, California***

***Environmental Remedial Action
Contract Number N62474-98-D-2076
Contract Task Order 0101***

***Document Control Number 8207
Revision 0***

August 6, 2004

Submitted to:

US Department of the Navy
Southwest Division
Naval Facilities Engineering Command
Environmental Division
1220 Pacific Highway
San Diego, California 92132-5190

Submitted by:

Shaw Environmental, Inc.
4005 Port Chicago Highway
Concord, California 94520

FINAL

WORK PLAN ADDENDUM

***Additional Corrective Action at Corrective Action Area 11, Area 37
Alameda Point, Alameda, California***

***Environmental Remedial Action
Contract Number N62474-98-D-2076
Contract Task Order 0101***

***Document Control Number 8207
Revision 0***

August 6, 2004

Approved by: _____

John C. McMillan
John McMillan
Shaw Environmental, Inc.
Project Manager

Date: July 22, 2004

FINAL
CORRECTIVE ACTION WORK PLAN, HYDROCARBON PLUME
DELINEATION REMEDIATION, AND CLOSURE MEASURES,
CORRECTIVE ACTION AREAS 7, 11, AND 13

DATED 20 JULY 2001

THIS RECORD IS ENTERED IN THE DATABASE AND FILED
AS

RECORD NO. AR_N00236_000190

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Acronyms and Abbreviations

| | |
|-------|----------------------------------------|
| AST | aboveground storage tank |
| CAA | Corrective Action Area |
| EPA | Environmental Protection Agency |
| IT | IT Corporation |
| mg/kg | milligrams per kilogram |
| PRC | Preliminary Remediation Criteria |
| RCRA | Resource Conservation and Recovery Act |
| SAP | Sampling and Analysis Plan |

1.0 Introduction

Under Contract Task Order 0101, Shaw Environmental, Inc. is implementing remediation activities at Corrective Action Area (CAA) 11 at Alameda Point, Alameda, California (Figure 1). Remediation activities are being conducted in accordance with the following documents:

- *Final Corrective Action Work Plan, Hydrocarbon Plume Delineation, Remediation, and Site Closure Measures, Corrective Action Areas 7, 11, and 13, Alameda Point, Alameda California* (Work Plan) (IT Corporation [IT], 2001a)
- *Pilot-Scale Remediation System Description, Dissolved-Phase Fuel Hydrocarbons, Area 37, Alameda Point, Alameda, California* (IT, 2002a)
- *Remediation System Description, Separate Phase Hydrocarbons, Area 37, Alameda Point, Alameda, California* (IT, 2002b)
- *Technical Memorandum 2, Full-Scale Design System Description* (Shaw, 2003)

Corrective Action Area 11 contained 30 underground fuel storage tanks and conveyance piping for fuel distribution. A portion of Installation Restoration Program Site 11 and Resource Conservation and Recovery Act (RCRA) permitted Structure 598/HW04 are included in CAA-11. Structure 598/HW04 consists of three aboveground storage tanks (ASTs) and secondary containment (IT, 2001b; Tetra Tech Environmental Management, Inc., 1999a, 1999b). The ASTs identified as AST Nos. 598A, 598B, and 598C contained lube oil and have been out of service since at least 1995. Structure 598/HW04 was approved for closure by the Department of Toxic Substances Control in 1995 and it was not included in the RCRA Part B Permit for the Alameda Naval Air Station in 1996. Salient site features of CAA-11 are shown in Figure 2.

Previous fueling activities at CAA-11 resulted in petroleum release that impacted soil and groundwater beneath the site. Hydrocarbon impact to soil and groundwater is being addressed by a biosparging system and operational parameters are transmitted to the Navy and appropriate regulatory agencies in quarterly technical memorandums. The existing corrective action plans do not address small areas of elevated hydrocarbons in soil located outside of the biosparging treatment areas or groundwater impact adjacent to Building 14 (Shaw, 2003). This Work Plan Addendum to the Final Corrective Action Work Plan (IT, 2001a) describes excavation of small areas of shallow hydrocarbon-impacted soil, installation of groundwater monitoring wells to evaluate current subsurface conditions adjacent to Building 14, and removal of the three ASTs and ancillary fueling features.

1.1 Purpose and Scope

Three new corrective action elements are proposed to be conducted at CAA-11. These elements include excavation of hydrocarbon impacted soil in eight small localized areas, installation of four groundwater monitoring wells, and removal of various elements of Structure 589/HW04. Rational of each of these elements is described below.

1.1.1 Soil Excavation

Petroleum fuel hydrocarbon clean up at CAA-11 is being conducted in compliance with Preliminary Remediation Criteria (PRC) for Alameda Point (Navy, 2000). Previous investigations and work related to removal of subsurface fueling facilities found eight isolated areas of elevated fuel hydrocarbons exceeding PRC concentrations of 1,030 milligrams per kilogram (mg/kg) gasoline, 1,380 mg/kg diesel, and 1,900 mg/kg motor oil. The samples were collected at depths of seven feet below grade or less (Figure 3). Small excavations will be conducted at these locations to remove hydrocarbon-impacted soil.

1.1.2 Well Installation

Results of the environmental investigation described in the Final Corrective Action Work Plan (IT, 2001a) found two locations adjacent to the south side of Building 14 with dissolved total petroleum hydrocarbon concentrations exceeding 1.4 milligrams per liter (Figure 4). The investigative methods used included discrete groundwater samples using Hydropunch[®] technology and groundwater sampling from one-inch diameter piezometers. Most of the data used to characterize the plumes were obtained from August 2001 through January 2002. During the past two years, natural attenuation may have affected the extent and concentration of the dissolved hydrocarbon plumes and current data are necessary to evaluate possible remedial action. Five groundwater monitoring wells are proposed at the approximate locations shown on Figure 3 to provide current data on the dissolved hydrocarbons plumes.

1.1.3 Removal of ASTs and Ancillary Features

In addition to the two proposed remedial tasks described above, Shaw proposes to remove the ASTs of Structure 598/HW04, pump manifolds and containment pad, and loading platform. Possible petroleum releases during loading operations may have impacted the shallow soil in the vicinity of the load platform. The containment pad beneath the transfer pumps adjacent to Structure 598/HW04 and the concrete loading apron will be removed, and shallow soil investigated for petroleum hydrocarbons.

1.2 Project Planning Documents and Notifications

Project planning documents in support of this Work Plan Addendum include the following:

- The Sampling and Analysis Plan (SAP) Addendum (Appendix A)

- AST removal application to be submitted to the City of Alameda Fire Department
- Well Installation Permit Applications to be submitted to Alameda County Department of Health Services
- Notification to the Bay Area Air Management Control Board for an Excavation Permit in compliance with Rule 8, Regulation 40

1.3 Organization

John C. McMillan, P.E., will be the Shaw Project Manager for this project. The fieldwork will be performed under the direction of the Task Manager, Shelby Lathrop. James Perkins will act as Project Technical Lead. Eric Watabayashi will be the on-site Quality Control Manager. The Health and Safety Officer will be Jim Wright.

2.0 Specific Scope of Work

Details of the work scopes associated with each of the three elements of the Work Plan Addendum are described below.

2.1 Soil Excavation

Localized soil excavation will be conducted as described in the *Technical Memorandum 2, Full-Scale Design System Description, CAA-11, Alameda Point, Alameda California* (Shaw, 2003). The eight excavation locations are shown on Figure 3. Field preparations will begin with a licensed land surveyor re-establishing the exact locations of the eight soil samples shown on Figure 3. These locations will be marked and a utility locator will be contracted to clear any possible subsurface utilities in the vicinity of the proposed excavations. Underground Services Alert will be contacted 72 hours prior to any intrusive activity.

An excavation zone of approximately 4 feet by 4 feet will be marked on the surface and centered on the surveyed sample location. A backhoe will be employed to excavate the area to the targeted depth. The total depth of each excavation will initially terminate at 2 feet below the sampled depth (Table 1), but all excavation will terminate if groundwater is encountered. Excavated soil will be directly placed in storage bins. Upon completion of the initial excavation, the sidewalls and base of the excavation will be evaluated for subjective evidence of fuel hydrocarbons using visual staining and a photoionization detector. If field evidence suggests elevated petroleum hydrocarbons exist in the excavation sidewalls or base, the excavation will be expanded until the impacted soil, or a maximum of 5 cubic yards of soil, is removed.

Upon completion of excavation, soil samples will be collected from the sidewalls and base of the excavation (if groundwater is not present). The excavations will be backfilled with clean import soil or base rock. The extent and depth of the excavation will be measured for a documented reference of the soil sample locations. If any excavation remains open for more than one day, caution tape and barricades will be used to cordon off the area.

2.1.1 Soil Sampling Protocol

All soil samples will be collected and analyzed in accordance with the SAP. Samples will be collected using 6-inch brass sampling rings, cleaned with non-phosphate detergent and triple-rinsed with clean water prior to use. The samples will be collected in an undisturbed state using a hand-auger slide hammer sampling device, sealed with aluminum foil, capped with Teflon caps, further sealed on the outside of the cap with water-tight tape, placed inside sealed plastic bags, and deposited immediately on ice in a sealed container for delivery to a State of California-certified laboratory under legal chain of custody. The samples will be analyzed for

volatile organic total total petroleum hydrocarbons (C₆ to C₃₆) using U. S. Environmental Protection Agency (EPA) Method 8015. Total total petroleum hydrocarbons include total petroleum hydrocarbons as diesel and motor oil.

Surface restoration will consisted of matching surrounding grade conditions.

2.2 Well Installation

Five groundwater monitoring wells are proposed at the approximate locations shown in Figure 4. These wells will provide current data on the distribution of dissolved hydrocarbons along the south side of Building 14. Well permits will be obtained from Alameda County, Department of Health Services. Underground Services Alert will be contacted no later than 72 hours prior to intrusive work. Each proposed boring location will be cleared by a subcontracted utility locator. The upper 5 feet of each boring location will be hand-augured.

The groundwater monitoring wells will be installed using auger drilling to a total depth of approximately 15 feet below grade. The wells will be constructed of 4-inch-diameter polyvinyl chloride with a screened interval (0.010-inch slot size) from 1 foot above the groundwater surface (approximately 5 feet below grade) to total depth. The sand filter pack will consist of #2/12 sand. The sand pack will extend from the bottom of the borehole to 1 foot above the top of the screen. A 1-foot thick interval of bentonite will be placed above the sand pack and hydrated. The annulus will then be backfilled with neat cement containing 5 percent bentonite powder. Well constructions may be modified in the field based upon the type and depth of subsurface materials encountered during drilling.

Using a smear rig, the monitoring wells will be allowed to set for 72 hours prior to developing. A minimum of 50 gallons of groundwater will be extracted or until the well has been continuously bailed for one hour. Prior to collecting groundwater samples as described in the attached SAP Addendum, an interface probe will be used to check the wells for free product. If no product is detected each well will be sampled as described in the SAP.

2.3 AST Removal

The three ASTs and associated piping of Structure 598/HW04 will be removed, as will the concrete pad for the pumps, process manifolds, and the truck drive up apron (Figure 5). The ASTs are constructed of steel, and are approximately 25,000 gallons in capacity. Approximately 100 feet of process piping is associated with the AST and three pump stations. The pump stations rest on a 12-inch thick concrete pad that will be removed. A 30-foot by 50-foot concrete apron is found adjacent to the pump pad that will also be removed.

A subcontractor will be utilized to remove the targeted facilities of Structure 598/HW04. The primary tasks that will be conducted during the proposed work activity are as follows:

- Clean and rinse the ASTs and manifold interiors and exteriors.
- Containerize any resulting fluids for proper transport and disposal.
- Decommission the three pumping stations and remove all associated process piping.
- Inert and remove the ASTs.
- Dispose/recycle the ASTs and piping at an appropriate facility.
- Remove the concrete containment pad for the pump stations and the truck drive up apron.
- Containerize all decommissioning debris for proper off site disposal.
- Steam clean the double containment structure for the ASTs.
- Collect soil samples from beneath the concrete pads, and conduct limited over-excavation if necessary.

Prior to conducting any activity at Structure 598/HW04, a survey will be conducted to confirm all electrical connections are inactive. The interior of the ASTs and piping manifolds will be pressure cleaned and triple rinsed with non-phosphate detergent. The exterior of the ASTs and piping manifold will then be pressure washed. The piping manifolds will then be disconnected and removed. All decontamination fluids will be collected and stored on site.

The ASTs will then be detached from their mountings and inerted with dry ice prior to removal using a crane. The ASTs will be loaded onto trucks and transported to a licensed metal recycling facility. Piping manifold and the three pump stations will be similarly transported for disposal. No subsurface piping is anticipated to be removed.

The concrete pads associated with the pump stations and drive up apron will be broken and loaded into bins or directly into trucks. Once the pads are removed, the underlying soil will be checked for fuel hydrocarbons using visual staining and photoionization detector criteria. If no appreciable evidence of hydrocarbon impact exists, then surficial soil samples will be collected using a percussion soil sampler. Sampling protocol will be in accordance with Section 2.1.1. If areas present appreciable evidence of hydrocarbon impact, these areas will be excavated. The total volume of excavated soils will not exceed 20 cubic yards. Soil samples will be collected from the pads areas not requiring over-excavation, and from the base and sidewalls of any over-excavated area. Excavated areas will be backfilled with clean import material from the Dunbarton Quarry. Material from this quarry source has been previously chemically tested, and found to be acceptable.

If appreciable hydrocarbon impact remains after 20 cubic yards have been excavated, a study will be conducted to determine the extent of the remaining hydrocarbon impact. Appropriate corrective action will be evaluated and implemented.

3.0 Project Implementation

This section discusses the organization of the project staff and preparatory field activities.

3.1 Preconstruction Meeting

A preconstruction meeting will be held prior to implementation of field actions. The scope of work from utility survey through site restoration will be discussed, and any outstanding issues requiring resolution will be identified and addressed prior to initiation of field work.

3.2 Mobilization and Site Preparation

Initial activities will consist of mobilizing personnel and equipment to the site, clearing support areas, and performing a utility survey prior to subsurface activities.

Mobilization to the job site will occur within 1 to 3 working days following completion of the pre-construction meeting. Site preparation activities will include setting up staging areas for stockpiles, liquid containment drums/tanks, equipment, and debris bins.

3.2.1 Equipment and Materials

Construction equipment will be mobilized to the site and is expected to include pressure and non-pressure washing equipment, a backhoe or other excavator with a breaker, a water truck, pumping equipment, loader, field personnel trucks, and trucks sufficient to remove the ASTs and associated waste materials. Health and safety supplies will also be obtained prior to field actions and will be procured in accordance with the Health and Safety Plan included in the Work Plan (IT, 2001a). Other material and supplies will be mobilized on an as-needed basis during the project.

Soil and debris bins and liquid storage tanks will be staged as appropriate in an area with the least potential to impact vehicular and other access to the site area. Safety supplies and other small equipment will be housed at Shaw's site office. Temporary excavated soil stockpiles will be set up on an as-needed basis and will be removed as soon as possible. Storm water prevention measures will be implemented in accordance with the Appendix A of the Work Plan (IT, 2001a).

After completion of soil and liquids characterization, all resulting waste materials will be properly disposal, and the construction activities will be closed out.

3.3 Waste Transport and Disposal

Waste streams generated by project activities may include concrete, asphalt, and miscellaneous debris; Class II non-hazardous waste soil and debris; and waste water. Concrete and asphalt will

be segregated and placed in covered bins or placed directly onto trucks. It is anticipated that the concrete and any asphalt will be transported to a recycling facility.

Excavated soil will be profiled prior to disposal. Once profiled, soil will be transported for proper waste disposal by a licensed hazardous materials waste hauler. All soils will be disposed of in accordance with Federal, State, and local regulations at a designated, licensed waste facility or recycling location.

Decontamination and rinse water generated by the project will be stored in Department of Transportation-approved 55-gallon drums or Baker Tanks. Liquid sample(s) will be collected for characterization pending proper disposal. Once profiled, fluids will be transported for appropriate disposal by a licensed hazardous materials waste hauler

3.4 Construction Close Out

General site cleanup will commence concurrently with field operations and proceed on an as-needed basis until project completion. Heavy equipment will be demobilized as the project activities for which they were used are completed, and a final walkthrough with a Navy representative will be held prior to final construction close-out and acceptance of completion by the Navy and Shaw.

4.0 References

IT Corporation, 2001a, *Final Corrective Action Work Plan, Hydrocarbon Plume Delineation, Remediation, and Closure Measures, Corrective Action Areas 7, 11, and 13, Alameda Point, Alameda, California*, July 20.

IT Corporation, 2001b, *Final Comprehensive Guide to the Environmental Baseline Survey, Alameda Point, Alameda, California*, June 29.

IT Corporation, 2002a, *Pilot-Scale Remediation System Description, Dissolved-Phase Fuel Hydrocarbons, Area 37, Alameda Point, Alameda, California*,

IT Corporation, 2002b, *Remediation System Description, Separate Phase Hydrocarbons, Area 37, Alameda Point, Alameda, California*

Shaw Environmental, Inc., 2003, *Technical Memorandum 2, CAA-11 Full-Scale Design System Description*, July 24.

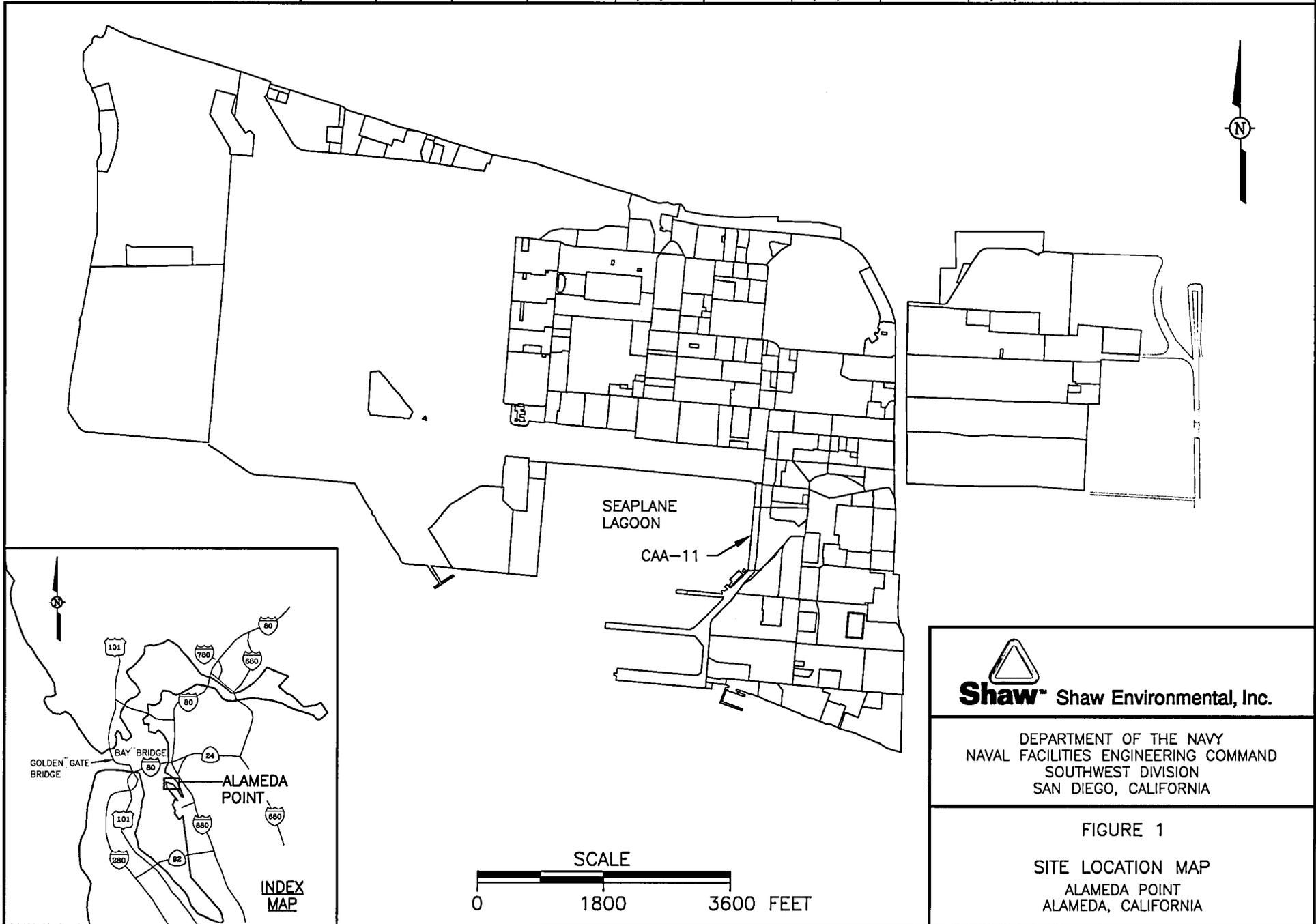
Tetra Tech Environmental Management, Inc., 1999a, *Final Summary Report USTs 37-1 through 3-8*.

Tetra Tech Environmental Management Inc., 1999b, *Final Summary Report USTs 37-13 through 37-20*.

U.S. Department of the Navy, 2000, *Letter from Andrew Dick to Brad Job, Regional Water Quality Control Board, San Francisco Bay Region, Oakland, California, Re: Preliminary Remediation Criteria and Closure Strategy for Petroleum-Contaminated Sites at Alameda Point, Alameda, California*, May 16.

Figures

| | | | | | | | | | |
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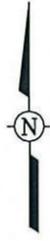


 **Shaw** Shaw Environmental, Inc.

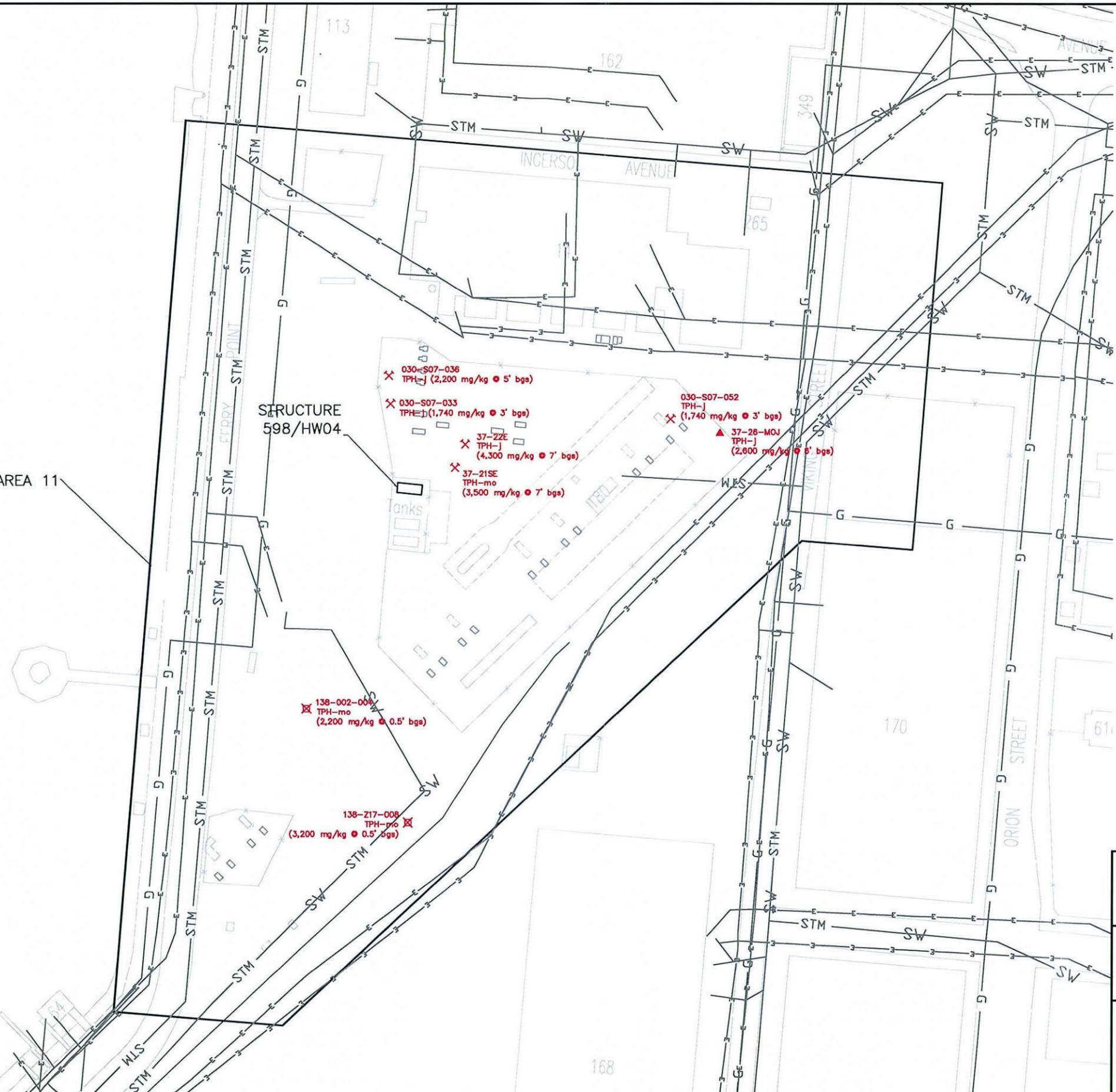
DEPARTMENT OF THE NAVY
 NAVAL FACILITIES ENGINEERING COMMAND
 SOUTHWEST DIVISION
 SAN DIEGO, CALIFORNIA

FIGURE 1
 SITE LOCATION MAP
 ALAMEDA POINT
 ALAMEDA, CALIFORNIA

IMAGE X-REF ---
 OFFICE CONCORD
 DRAWN BY SCHAEFFER
 CHECKED BY JP
 APPROVED BY JM
 DRAWING NUMBER 843778-B105
 DATE 7/28/04



CORRECTIVE ACTION AREA 11



STRUCTURE 598/HW04

030-S07-036
TPH-J (2,200 mg/kg @ 5' bgs)

030-S07-033
TPH-J (1,740 mg/kg @ 3' bgs)

37-22E
TPH-J (4,300 mg/kg @ 7' bgs)

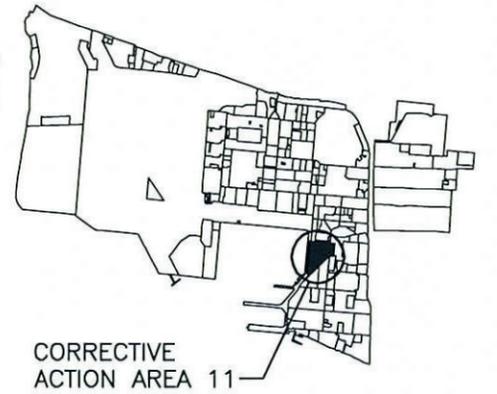
37-21SE
TPH-mo (3,500 mg/kg @ 7' bgs)

030-S07-052
TPH-J (1,740 mg/kg @ 3' bgs)

37-26-MOJ
TPH-J (2,800 mg/kg @ 6' bgs)

138-002-004
TPH-mo (2,200 mg/kg @ 0.5' bgs)

138-Z17-008
TPH-mo (3,200 mg/kg @ 0.5' bgs)



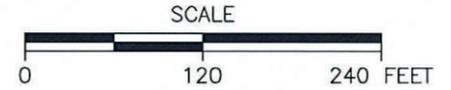
CORRECTIVE ACTION AREA 11
 KEY PLAN

LEGEND

- ⊗ SOIL SAMPLE LOCATION
- × SOIL SAMPLE FROM AN EXCAVATION
- ▲ GEOPROBE

NOTE:
 LOCATIONS WITH TPH CONCENTRATIONS EXCEEDING PRC DENOTED IN RED

- COMM — COMMUNICATION LINES
- E — ELECTRICAL LINES
- STM — STEAM LINES
- G — GAS LINES
- FUEL LINES
- SW — SANITARY SEWER LINE
- SS — STORM SEWER LINE
- IW — INDUSTRIAL WASTE LINE
- T — TELEPHONE LINE
- CTV — CABLE TV LINE



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DEPARTMENT OF THE NAVY
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 SOUTHWEST DIVISION
 SAN DIEGO, CALIFORNIA

FIGURE 3
 PROPOSED SOIL EXCAVATION LOCATIONS
 CAA-11, AREA 37
 ALAMEDA POINT
 ALAMEDA, CALIFORNIA

DRAWING NUMBER 843778-B106

APPROVED BY JM 7/20/04

CHECKED BY JP 7/20/04

DRAWN BY SCHAEFFER 7/20/04

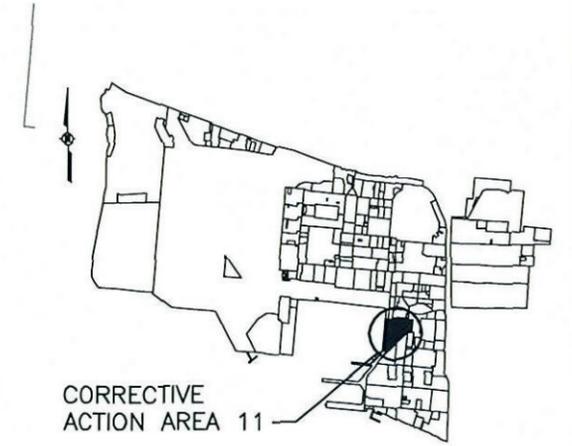
OFFICE CONCORD

X-REF

IMAGE



BUILDING 14



CORRECTIVE ACTION AREA 11

KEY PLAN

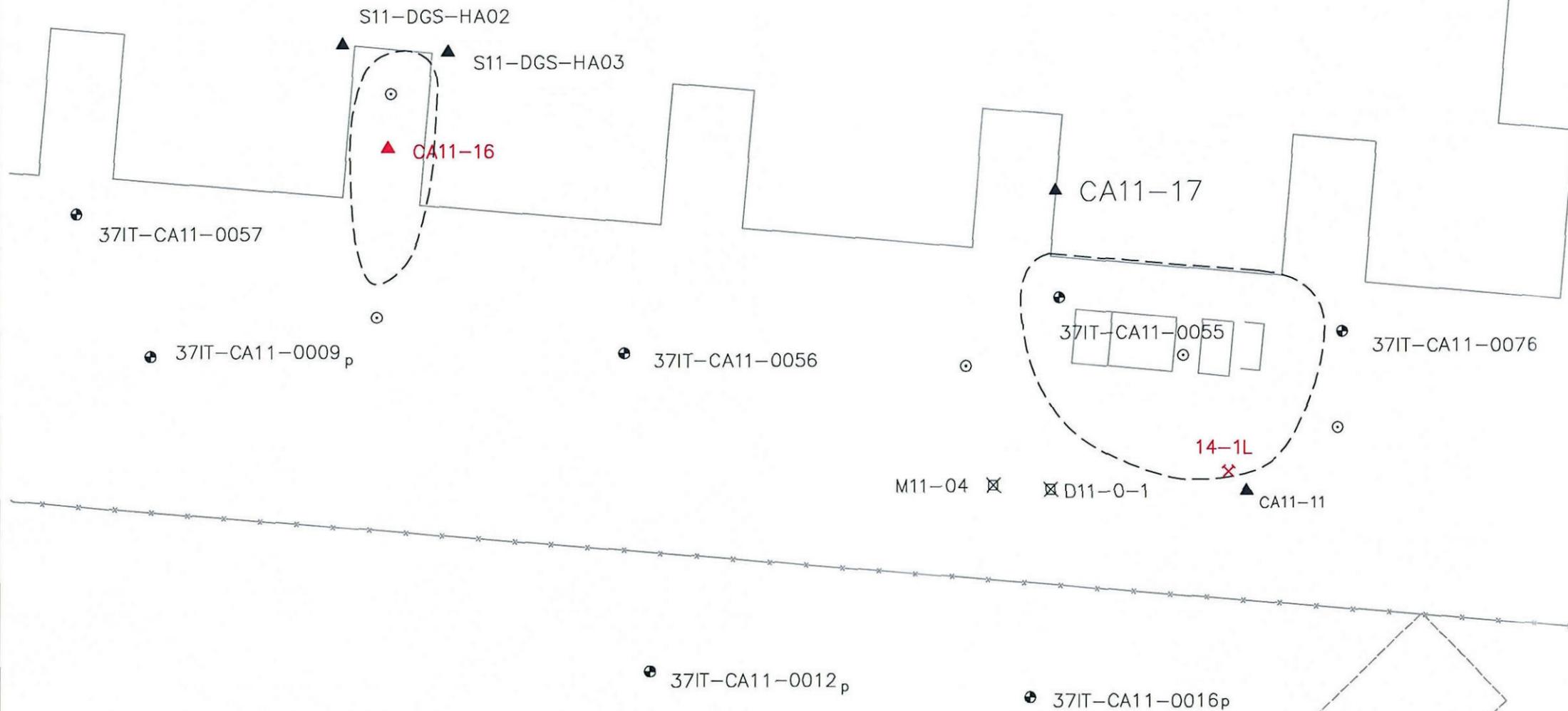
LEGEND

- ▲ GEOPROBE
- ⊗ SOIL SAMPLE FROM AN EXCAVATION
- - - GROUNDWATER TPH CONCENTRATION EXCEEDS 1.4 mg/L
- SOIL BORING LOCATION (P) PIEZOMETER INSTALLED AT LOCATION
- ⊗ EXISTING MONITORING WELL
- PROPOSED MONITORING WELL
- UST □ SUSPECTED PRIMARY FORMER POINT SOURCE
- * - FENCE



NOTES:

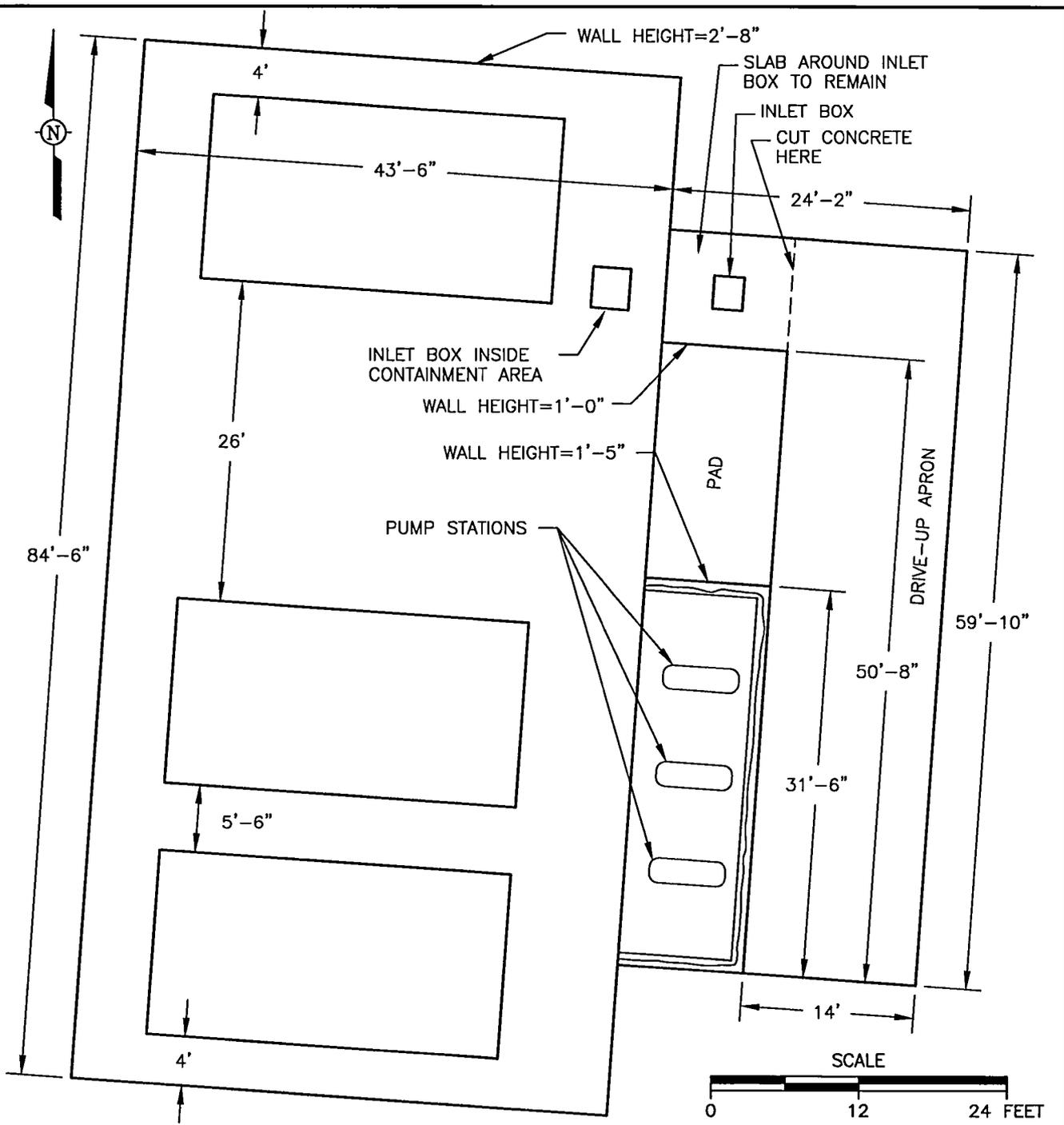
- TPH REPRESENTS SUM OF INDIVIDUAL TPH FRACTIONS AS DEFINED IN PETROLEUM STRATEGY MEMO (NAVY, 2001).
- LOCATIONS WITH TPH CONCENTRATIONS EXCEEDING PRC DENOTED IN RED



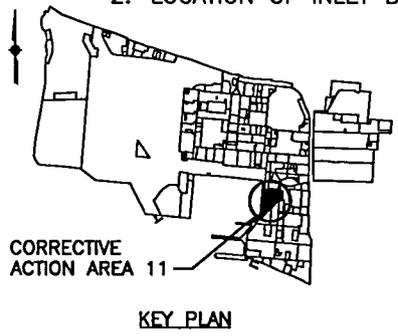
DEPARTMENT OF THE NAVY
 NAVAL FACILITIES ENGINEERING COMMAND
 SOUTHWEST DIVISION
 SAN DIEGO, CALIFORNIA

FIGURE 4
 PROPOSED MONITORING WELL LOCATIONS
 CAA-11, AREA 37
 ALAMEDA POINT
 ALAMEDA, CALIFORNIA

DRAWING NUMBER 843778-A25
 APPROVED BY JM 7/20/04
 CHECKED BY JP 7/20/04
 DRAWN BY SCHAEFFER 7/20/04
 OFFICE Concord
 X-REF ---
 IMAGE ---



- NOTE:
1. ALL MEASUREMENTS ARE APPROXIMATIONS AND ARE IN FEET AND INCHES.
 2. LOCATION OF INLET BOXES APPROXIMATE




Shaw Shaw Environmental, Inc.

DEPARTMENT OF THE NAVY
 NAVAL FACILITIES ENGINEERING COMMAND
 SOUTHWEST DIVISION
 SAN DIEGO, CALIFORNIA

FIGURE 5
 DETAILS OF STRUCTURE 598/HWO4
 CAA-11, AREA 37
 ALAMEDA POINT
 ALAMEDA, CALIFORNIA

Tables

Table 1
Summary of Shallow Soil Samples, CAA-11

| Sample Identification | Fuel Type | Concentration (mg/kg) | Depth of Sample (ft below grade) | Initial Depth of Excavation (ft below grade) |
|-----------------------|-----------|-----------------------|----------------------------------|----------------------------------------------|
| 030-S07-033 | Jet Fuel | 1,740 | 3 | 7 |
| 030-S07-36 | Jet Fuel | 2,200 | 5 | 7 |
| 030-S07-052 | Jet Fuel | 1,740 | 3 | 5 |
| 37-21SE | Motor Oil | 3,500 | 7 | Groundwater |
| 37-22E | Motor Oil | 4,300 | 7 | Groundwater |
| 37-26-MOJ | Jet Fuel | 2,600 | 5 | 7 |
| 138-002-004 | Motor Oil | 2,200 | 0.5 | 3 |
| 138-Z17-008 | Motor Oil | 3,200 | 0.5 | 3 |

ft denotes foot or feet.

mg/kg denotes milligrams per kilogram.

Appendix A
Sampling and Analysis Plan Addendum

FINAL

**SAMPLING AND ANALYSIS PLAN (FIELD SAMPLING
PLAN/QUALITY ASSURANCE PROJECT PLAN)**

***Additional Corrective Action at Corrective Action Area 11, Area 37
Alameda Point, Alameda, California***

***Contract No. N62474-98-D-2076
Contract Task Order 0101***

Document Control Number 8207

August 6, 2004

Submitted to:

Department of the Navy
Southwest Division
Naval Facilities Engineering Command
Environmental Division
1220 Pacific Highway
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Submitted by:

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Concord, California 94520-1120

FINAL

**SAMPLING AND ANALYSIS PLAN (FIELD SAMPLING
PLAN/QUALITY ASSURANCE PROJECT PLAN)
*Additional Corrective Action at Corrective Action Area 11, Area 37
Alameda Point, Alameda, California***

***Contract No. N62474-98-D-2076
Contract Task Order 0101***

Document Control Number 8207

August 6, 2004

Approved by: *John C. McMillan*
John McMillan
Shaw Environmental, Inc.
Project Manager

Date: July 22, 2004

Approved by: *Rose Condit*
Rose Condit
Shaw Environmental, Inc.
Program Chemist

Date: July 30, 2004

Approved by: *Nars Ancog*
Nars Ancog
U.S. Navy Quality Assurance Officer

Date: 8/3/04

FINAL
SAMPLING AND ANALYSIS PLAN ADDENDUM NO. 1
(FIELD SAMPLING PLAN/QUALITY ASSURANCE PROJECT
PLAN) VERIFICATION SOIL AND SOIL VAPOR SAMPLING AT
CORRECTIVE ACTION AREA 11

DATED 15 DECEMBER 2005

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Acronyms and Abbreviations

| | |
|---------|-------------------------------------------------------|
| °C | degrees Celsius |
| AST | aboveground storage tank |
| AWQC | ambient water quality criteria |
| bgs | below ground surface |
| CAA | Corrective Action Area |
| CCR | California Code of Regulations |
| COC | Chain of Custody |
| CTO | Contract Task Order |
| DO | dissolved oxygen |
| DOT | U.S. Department of Transportation |
| DQAR | Data Quality Assessment Report |
| DQO | data quality objective |
| DVE | dual vacuum extraction |
| EDD | Electronic Data Deliverable |
| EPA | U.S. Environmental Protection Agency |
| GC | gas chromatography |
| GC/MS | gas chromatography/mass spectrometry |
| IT | IT Corporation |
| LCD | laboratory control duplicate |
| LCS | laboratory control spike |
| LCS/LCD | laboratory control spike/laboratory control duplicate |
| MDL | Method Detection Limit |
| MER | marine ecological receptor |
| mg/L | milligrams per liter |
| mL | milliliter |
| mL/min | milliliter(s) per minute |
| MSA | Method of Standard Addition |
| MS | matrix spike |
| MSD | matrix spike duplicate |
| MS/MSD | matrix spike/matrix spike duplicate |
| NFESC | Naval Facilities Engineering Services Center |
| PQL | Practical Quantitation Limit |
| PRC | preliminary remediation criteria |
| QA | quality assurance |
| QAPP | Quality Assurance Project Plan |
| QC | quality control |
| RAC | Remedial Action Contract |
| RPD | relative percent difference |
| RPM | Remedial Project Manager |
| RWQCB | Regional Water Quality Control Board |
| SAP | Sampling and Analysis Plan |
| SDG | sample delivery group |
| SOP | Standard Operating Procedure |

Acronyms and Abbreviations (Continued)

| | |
|-------|-----------------------------|
| SWDiv | Southwest Division |
| T&D | Transportation and Disposal |
| TPH | total petroleum hydrocarbon |
| UST | underground storage tank |
| VOC | volatile organic compound |
| WET | Waste Extraction Test |

1.0 Introduction

Shaw Environmental, Inc., has prepared this Sampling and Analysis Plan (SAP) to support sampling and analysis activities associated with shallow soil excavations; a petroleum hydrocarbon plume evaluation; dual vacuum extraction (DVE) progress monitoring; and the removal of three aboveground storage tanks (ASTs), associated fixtures and pads within Corrective Action Area (CAA) 11, Alameda Point, Alameda, California.

This SAP is a combination of a Field Sampling Plan and a Quality Assurance Project Plan (QAPP). It provides complete guidance for all field and analytical activities performed for this project.

The objective of this project is to remove and evaluate petroleum hydrocarbons and associated constituents from the soil and shallow groundwater at CAA-11. The work will be conducted under Contract Task Order (CTO) 0101 of U.S. Department of the Navy, Southwest Division (SWDiv), Naval Facilities Engineering Command Remedial Action Contract (RAC) No. N62474-98-D-2076.

This SAP is based on the requirements of the following documents:

- *Navy Installation Restoration Chemical Data Quality Manual* (Naval Facilities Engineering Services Center [NFESC], 1999)
- *Data Quality Objectives Process for Hazardous Waste Site Investigations, EPA QA/G-4HW* (U.S. Environmental Protection Agency [EPA], 2000)
- *Requirements for Quality Assurance Projects Plans, EPA QA/R5* (EPA, 2001)
- *Environmental Work Instruction 3EN2.1—Chemical Data Validation* (SWDiv, 2001a)
- *Environmental Work Instruction 3EN2.2—Review, Approval, Revision, and Amendment of Field Sampling Plans and Quality Assurance Project Plans* (SWDiv, 2001b)
- *Environmental Work Instruction 3EN2.3—Laboratory Quality Assurance Program* (SWDiv, 2001c)
- *Quality Control Program Plan for Environmental Remedial Actions, Contract Number N62474-98-D-2076* (IT Corporation [IT], 2000)

The QAPP elements are organized into four groups that are addressed in various sections of this SAP as follows:

- **Group A—Project Management**
 - Title and approval sheet
 - Table of Contents
 - Project Organization – Section 1.3
 - Data Quality Objectives (DQOs) – Section 2.0
 - Documentation and records – Sections 5.1.5, 9.0, and 10.3
- **Group B—Measurement/Data Acquisition**
 - Sampling method requirements – Section 4.2
 - Sample handling and custody requirements – Section 5.0
 - Analytical method requirements – Section 4.1
 - Quality Control (QC) requirements – Section 7.2
 - Instrument/equipment testing, inspection, and maintenance requirements – Section 7.4
 - Instrument calibration and frequency – Section 7.3
 - Acceptance requirements for supplies and consumables –Section 7.6
- **Group C—Assessment/Oversight**
 - Assessments and response actions – Section 10.1
 - Reports to management – Section 10.2
- **Group D—Data Validation and Usability**
 - Data reduction, verification, and reporting requirements – Section 9.1
 - Validation methods – Section 9.2
 - Reconciliation with user requirements – Section 9.4

1.1 Site History and Background

Corrective Action Area 11 is located just east of the Seaplane Lagoon, Alameda Point, Alameda, California (Figure 1). Corrective Action Area 11, includes (1) the fuel loading station referred to as Area 37, (2) part of Installation Restoration Site 11 (Building 14), (3) a secondary containment structure (Structure 598/HW-04) for three large ASTs, and (4) a former fuel distribution line east of the Seaplane Lagoon and parallel to Ferry Point Road (*Environmental Baseline Survey, Phases 2A and 2B, Data Evaluation Summaries-Final Alameda Point, Alameda California, Vol. X, Zone 17* [IT, 2001a]). Thirty underground storage tanks (USTs) utilized for storage of aviation fuels and lubricants were previously located in CAA-11 with capacities

ranging from 1,500 gallons to 28,000 gallons. The layout and salient associated features of CAA-11 are shown in Figure 2.

Corrective Action Area 11 is in a location designated as part of the Inner Harbor land reuse area. Potential reuse may include offices, research and development areas, residential, and park areas. Groundwater beneath CAA-11 is part of the southeastern hydrologic region of Alameda Point and is also considered a potential drinking water source, according to the EPA's classification of groundwater aquifer use.

1.1.1 Localized Petroleum Hydrocarbon Contamination

An ongoing biosparge operation began within CAA-11 on March 17th, 2003, as described in the *Supplemental Field Sampling Plan Addendum, Evaluation of Biosparge Remedial Technology at Area 37 and Building 530, Alameda Point, Alameda, California*, dated February 3, 2003 (IT, 2003). This biosparge remedial action targets areas of dissolved-phase total petroleum hydrocarbon (TPH) contaminations greater than the preliminary remediation criteria (PRC) for the site. The TPH contamination associated with the results of eight shallow soil samples lay outside the treatment areas of biosparge system influence, will be addressed using localized excavations (Figure 3).

1.1.2 Petroleum Hydrocarbon Plume Associated with UST Cluster

From November 11th through November 22nd, 1994, a cluster of three USTs (No. 14-1, 14-2, and 14-3), reported to have contained lube oil, were removed from alongside the south-central portion of Building 14 and adjacent to the northern portion of Area 37 (Figure 4). In August 2001 through January 2002 hydropunch samples were collected from six locations around the UST cluster (Figure 4). The results of these hydropunch samples indicated dissolved-phase petroleum hydrocarbons above the ambient water quality criteria (AWQC) for marine ecological receptors (MERs) shown in Table 1. Biosparge is a reasonable technology for remediation of dissolved-phase petroleum hydrocarbons; however, it was not implemented at this location due to the close proximity of Building 14 and thus the potential for fugitive emissions to affect indoor air quality. Since the date of the hydropunch samples, no further evaluation of this plume has occurred.

1.1.3 Dual Vacuum Extraction Operations by Vacuum Truck

On November 22nd, 1994, a single UST (No. 14-4) was removed from the west end of Building 14 (Figure 5). In order to remediate the plume associated with this UST, a small excavation was performed and eight DVE wells were installed, extraction by vacuum truck was initiated in accordance with the *Final Remediation System Description, Separate Phase Hydrocarbons, Area 37, Alameda Point, Alameda, California*, (IT, 2002). Dual vacuum extraction at this location is ongoing.

1.1.4 Aboveground Storage Tanks, Associated Pads and Fixtures

Associated with structure 598/HW-04 are three large ASTs (No. 598A, 598B, and 598C) (Figure 6). Labeled for the containment of lube oil, all three tanks have been out of service since 1995. Structure 598/HW-04 was approved for closure by the Department of Toxic Substances Control in 1995 and was not included in the Resource Conservation and Recovery Act Part B Permit for the Alameda Naval Air Station in 1996. East of and adjacent to structure 598/HW-04 are pump manifolds atop a containment pad and a loading platform (Figure 6). With the exception of the tank pad and double containment wall associated with structure 598/HW-04, all ASTs, associated pump manifolds and slab, and the adjacent loading apron are scheduled to be removed under this CTO. Shallow soil showing evidence of petroleum impact below the slab and apron will also be removed.

1.2 Scope and Objectives

The scope of work for this project consists of the following tasks:

- Limited excavations of shallow petroleum hydrocarbon-impacted soil outside the area of biosparge operations at CAA-11
- Evaluation of groundwater associated with a localized petroleum hydrocarbon plume
- Evaluation of groundwater associated with an ongoing DVE treatment system
- Removal of three ASTs, adjacent pad and associated fixtures, loading apron, and removal of hydrocarbon-impacted soil beneath

This SAP has the following objectives:

- Providing a rationale for field sampling activities at CAA-11
- Describing the sampling strategy and design
- Describing and establishing consistent field sampling procedures
- Establishing data gathering, sample handling, and documentation methods that will be employed during field activities

The objective of this project is to achieve bulk removal of petroleum hydrocarbon-impacted soil via implementation of limited excavations; evaluate the groundwater associated with a localized petroleum hydrocarbon plume; evaluate the groundwater associated with an ongoing DVE treatment operation; and removal of three ASTs, adjacent pad, aprons, and associated fixtures at CAA-11. Soil and water will be sampled and analyzed to achieve the project objectives.

Analytical data collected under the provisions of this SAP will be used for the following purposes:

- Evaluate extent of limited excavations at CAA-11
- Evaluate groundwater associated with a former cluster of USTs at CAA-11
- Evaluate progress of ongoing DVE operation at CAA-11
- Identify the appropriate method to dispose of AST removal-derived and investigation-derived waste generated at CAA-11

1.3 Project Organization

The project organization consists of representatives from the Navy providing technical direction and quality assurance (QA) oversight, and the Shaw project team. The project organization consists of the following members:

- Navy Remedial Project Manager (RPM), SWDiv
- Navy QA Officer
- Program Manager
- Project Manager
- Program QC Manager
- Manager of Field Analytical Services
- Program Chemist
- Program Health and Safety Manager
- Site Health and Safety Specialist
- Cost Schedule Engineer
- Technical Lead
- Project Superintendent
- Project QC Manager
- Project Chemist
- Project Business Administrator

The Shaw team is shown in Figure 7.

The responsibilities of the team members associated with data acquisition activities are presented in Table 2.

2.0 Data Quality Objectives

The DQO process is a series of planning steps based on scientific methods that are designed to ensure that the type, quantity, and quality of environmental data used for decision-making are appropriate for the intended application. The DQO process, as defined by the EPA, consists of seven steps that are designed to provide a systematic approach to resolving issues that pertain to the site investigation and remediation (EPA, 2000). This section describes the outcome of the seven-step DQO process for data collection activities under this task.

2.1 Stating the Problem

Step 1: Identify the planning team members, including decision-makers, describe the problem, develop a conceptual model of the environmental hazard to be investigated, and determine resources such as budget, personnel, and schedule.

The planning team consists of representatives from the Navy and Shaw (the prime contractor for Navy RAC No. N6247-98-D-2076), with regulatory support and oversight from the Regional Water Quality Control Board (RWQCB). The Navy is the lead federal agency involved in the implementation of corrective action activities at CAA-11, and is the primary decision-maker. The work will be conducted according to the Navy-approved budget and schedule.

Leaking USTs and associated fuel distribution lines are believed to be the principal cause of petroleum hydrocarbon contamination to the subsurface soil and groundwater at CAA-11. Under CTO 0037 the Navy contracted IT (now Shaw Environmental, Inc.) to investigate the extent of this contamination and implement appropriate remediation technologies. The SAP, DQOs, and QAPP for this investigation are detailed in Part I and II of the *Final Corrective Action Work Plan, Hydrocarbon Plume Delineation, Remediation and Site Closure, Corrective Action Areas 7, 11 and 13, Alameda Point, Alameda, California*, (IT, 2001b). IT also initiated DVE operations at CAA-11 in accordance with the Final Remediation System Description (IT, 2002), and biosparge operations at CAA-11 in accordance with the *Supplemental Field Sampling Plan Addendum* (IT, 2003).

Under this CTO, Shaw Environmental Inc. is tasked to perform the following:

- Shallow soil excavation and associated confirmation activities to remove petroleum hydrocarbons within eight localized regions of CAA-11.
- Evaluate the groundwater near the location of the former UST cluster adjacent to the south-central portion of Building 14 for a period of one year.

- Evaluate the groundwater associated with the eight DVE wells adjacent to the west end of Building 14 for a period of one year.
- The removal of three ASTs, adjacent pads and associated fixtures of Structure 598/HW-04.

2.2 Identifying the Decisions

Step 2: Identify the principal study question, define alternative decisions, develop a decision statement, and organize multiple decisions.

The principal study questions are as follows:

- **Area 37 – Shallow Soil Excavations**
 - Are the soils of the shallow excavation sidewalls and/or bottom visually stained?
 - What are the concentrations of chemicals of concern in soil after limited excavation is performed?
- **Building 14 – Localized Plume Evaluation**
 - What are the current concentrations of chemicals of concern in the groundwater near the former cluster of USTs at CAA-11?
- **Building 14 – Progress Monitoring of DVE Operations**
 - Are free-phase petroleum hydrocarbons present in the DVE wells at CAA-11?
 - Do the concentrations of dissolved-phase petroleum hydrocarbons in the groundwater of the DVE wells at CAA-11 stay below the AWQC for MER for three consecutive months?
- **Structure 598/HW-04 – Removal of ASTs, Adjacent Pads and Associated Fixtures**
 - Are the soils beneath the removed pads visually stained?
 - Do the waste streams generated from the AST removals at CAA-11 meet selective criteria for cost-effective disposal?

2.3 Identifying Inputs to the Decisions

Step 3: Identify the information needed, determine sources for this information, determine the basis for determining the action level, and identify sampling and analysis methods that can meet the data requirements.

The decisions related to what remedial action to employ at CAA-11 were based on site information and the historical investigation data collected.

The majority of the petroleum fuel-impacted area at the site is being treated with biosparging. In the areas where biosparge treatment is deemed ineffective and cost-prohibitive, localized shallow soil excavations will be implemented. The decision whether or not to perform step-outs of the initial excavation boundaries will be based on the presence or absence of appreciable visual staining on the sidewall and/or bottom soils.

Data associated with the groundwater monitoring near the former cluster of USTs will be provided to the Navy to assist with the decision of what remedial action need take place to address any contamination issues present.

The decision of whether or not to sample a DVE well will be based upon the presence or absence of floating free-phase petroleum hydrocarbons within that well.

The decisions related to soil removal associated with three ASTs will be based on visual inspection of the area after the support pads and drive up apron are removed.

All remedial actions and/or systems will be evaluated on the merit of their respective technical practicality and cost-effectiveness.

2.3.1 Treatment Goals

The objective of this project is to reduce the concentrations of petroleum hydrocarbons and associated compounds (specifically jet fuel, diesel, and motor oil) to below the PRC. The PRC for free- and dissolved-phase petroleum hydrocarbons are outlined in a correspondence from the Navy to the RWQCB, entitled *Preliminary Remediation Criteria and Closure Strategy for Petroleum-Contaminated Sites at Alameda Point, Alameda, California*, (SWDiv, 2001d), and are shown in Table 1. The PRC for petroleum hydrocarbons in soil and groundwater at Alameda Point are dependent upon the anticipated reuse of the specific site in question, proximity of the site to ecological receptors (including potential groundwater conduits, such as storm drains) and the actual or potential beneficial uses of the groundwater. The PRCs were developed as cleanup goals for fuel release sites at Alameda Point to attain low-risk soil and groundwater status in compliance with the *Regional Board Supplemental Instructions to State Water Board December 8, 1995, Interim Guidance on Required Cleanup at Low-Risk Fuel Sites* (RWQCB, 1996).

The removal goal for free-phase fuel hydrocarbon is defined as a 1/8-inch thickness. Removal of free-phase product below 1/8-inch may not be technologically or economically feasible (this numerical criterion was established during a meeting with the Navy, Shaw, and the RWQCB on June 27, 2002). In addition, the MER PRC will be used as the guide for monitoring TPH removal at the site (see Table 1). The analytical methods for meeting the data requirements for

both free-phase and dissolved-phase petroleum hydrocarbons are outlined in Section 4.0 of this SAP.

Analytical results from waste material for off-site disposal (e.g., waste soil generated by excavation activities) will be compared to the requirements for defining hazardous waste described in the California Code of Regulation (CCR) *Title 22, Social Security, Division 4.5. Environmental Health Standards for the Management of Hazardous Waste, Chapter 11. Identification and Listing of Hazardous Waste, Article 3 Characteristics of Hazardous Waste, §66261.24 Characteristic of Toxicity, 40 CFR*, (CCR, 2002), and the disposal facility acceptance requirements.

2.4 Defining the Boundaries

Step 4: Define target population of interest, specify the spatial boundaries that clarify what the data must represent; determine the time frame for collecting data and making decisions, determine the practical constraints on collecting data.

The CAA-11 area is approximately two acres in size (Figure 2). Groundwater varies seasonally from approximately 4 to 8 feet below ground surface (bgs). Figure 3 shows the proposed limited excavation areas; Figure 4 shows the proposed monitoring well locations; Figure 5 shows the DVE well locations; and, Figure 6 shows the details of structure 598/HW04. There are no practical constraints to data collection.

2.5 Developing a Decision Rule

Step 5: Specify an appropriate population parameter (mean, median, percentile); confirm that the action level exceeds measurement detection limits, and develop a decision rule ("If...then" statements).

The following decisions may be made:

Area 37 – Shallow Soil Excavations

- If soil in shallow excavation sidewalls and/or bottom is not visually stained, then sidewall and bottom samples will be collected and the excavation will be backfilled.
- If soils in shallow excavation sidewalls and/or bottom samples are visually stained, then step-outs will occur in the direction of the staining until either visual staining ends or a total of 5 cubic yards of soil has been excavated.
- If excavated soil wastes are considered hazardous by law, then the waste will be transported for disposal at a state-approved hazardous waste disposal facility.
- If excavated soil wastes are considered nonhazardous by law, then the waste will be disposed of at a state-approved nonhazardous waste disposal/recycling facility.

Building 14 – Localized Plume Evaluation

- If the petroleum hydrocarbon concentrations in the groundwater near the former cluster of USTs are above the AWQC for MER (shown in Table 1), then one year of monthly groundwater monitoring will be performed.
- If the petroleum hydrocarbons concentrations in the groundwater near the former cluster of USTs are below the AWQC for MER (shown in Table 1), then no further action will be recommended to the Navy RPM.

Building 14 - Progress Monitoring of DVE Operations

- If free-phase petroleum hydrocarbons are present in a DVE well, then no sampling will occur and DVE operations will continue.
- If free-phase petroleum hydrocarbons are not present in the DVE well, then monthly groundwater monitoring will begin for three months.
- If the concentration of the dissolved-phase petroleum hydrocarbons in the groundwater stay below the AWQC for MER (shown in Table 1) for three consecutive months, then quarterly monitoring will begin for three quarters.
- If the concentration of the free-phase petroleum hydrocarbons in the groundwater rebound above the AWQC for MER after three months, then alternative remedial options will be recommended to the Navy RPM.

Structure 598/HW-04 – Removal of ASTs, Adjacent Pads and Associated Fixtures

- If soils beneath removed pads are not visually stained, then bottom samples will be collected.
- If soils beneath removed pads are visually stained, then stained soils will be excavated in the direction of the staining, until either visual staining ends or a total of 20 cubic yards of soil has been excavated.
- If the rinsate, soiled fixtures and/or excavated soil wastes are considered hazardous by law, then the wastes will be transported for disposal at a state-approved hazardous waste disposal facility.
- If the rinsate, soiled fixtures and/or excavated soil wastes are considered nonhazardous by law, then the wastes will be disposed of at a state-approved nonhazardous waste disposal/recycling facility.

2.6 Specifying Limits on Decision Error

Step 6: Determine the range of the parameter of interest, choose the null hypothesis, examine consequences of making an incorrect decision, specify a range of values where the consequences

are minor (gray region), and assign probability values to points above and below the action level that reflect tolerable probability for potential decision errors.

This step does not apply because the sampling approach is not based on probabilistic designs. The sampling approach is based on site knowledge. To limit uncertainty in obtained environmental data, criteria for the precision, accuracy, representativeness, completeness, comparability parameters, and reporting limits for the chemical constituents have been developed. The data that meet these criteria will be of definitive quality and of less uncertainty than the estimated data that do not meet the criteria.

2.7 Optimizing the Design for Obtaining Data

Step 7: Review the DQO outputs, develop data collection design alternatives, formulate mathematical expressions for each design, select sample size that satisfies the DQOs, decide on the most resource-effective design or agreed alternative, and document details in the SAP.

The sampling locations associated with the shallow soil excavations at CAA-11 will be based on the site information (Figure 3). The decision whether or not to perform step-outs of the initial excavations will be based on the presence or absence of visually contaminated sidewall and/or bottom soils. All shallow soil excavations will be limited to a maximum of 5 cubic yards per location.

The groundwater monitoring wells associated with the localized plume evaluation at CAA-11 will be placed so as to target the areas where maximum petroleum hydrocarbon contamination is expected.

The frequency for evaluation of the DVE treatment system is based on site information and previous experience on similar projects.

3.0 Sampling Strategy

This section discusses the sampling and analysis strategy for soil, water, and waste samples required to meet the project DQOs. Table 3 presents a summary of sampling and analysis for the project activities.

Procedures for sample collection and handling are discussed in Section 5.0 of this SAP. The Standard Operating Procedures (SOPs) referenced in these sections are part of the *Shaw Standard Quality Procedures and Standard Operating Procedures Manual* (Shaw, 2004) and are available for review at the project site.

3.1 Shallow Soil Excavations

Localized soil excavations will be conducted at eight locations throughout CAA-11 (Figure 3). Each excavation zone will be approximately 4 feet by 4 feet, centered on the surveyed sample location (Figure 3). The total depth of each excavation will initially terminate at 2 feet below the sample depth of the soil samples previously collected; an excavation will be terminated if groundwater is encountered.

3.1.1 Shallow Excavation Soil Sampling

Upon completion of each shallow excavation, the sidewall and bottom soils will be visually inspected for the presence or absence of staining (contamination). If no visual contamination is observed, then discrete sidewall and bottom samples will be collected. The sidewall samples will be collected at mid-depth of the excavation at a frequency of one per cardinal direction. If groundwater does not accumulate in the bottom of the excavation, a bottom sample will be collected from the approximate center of the excavation. Samples will be collected in accordance to the procedures described in Section 5.1.1.1 and will be analyzed for the following parameters:

- Total petroleum hydrocarbons as diesel and motor oil by EPA Method 8015B

If after the initial excavation, visual contamination is observed in the sidewall and/or bottom soils, then limited step-out excavation will be performed in the area of the visual contamination. Step-outs will continue until visually contaminated soil ceases to be seen or a total of 5 cubic yards of soil is removed. At termination of the step-outs, sidewall and bottom samples will be collected as described above. All shallow excavations will be backfilled following sidewall and bottom sampling.

3.2 Plume Evaluation Associated with Former Cluster of USTs

Five groundwater monitoring wells will be installed at the proposed locations shown in Figure 4. These wells will provide current data on the distribution and concentration of dissolved hydrocarbons along the south side of Building 14. Each groundwater monitoring well will be 4 inches in diameter and installed to a total depth of approximately 15 feet bgs.

3.2.1 Plume Evaluation Groundwater Samples

Following installation and development of the monitoring wells, baseline groundwater samples will be collected in accordance to the procedures described in Section 5.1.2.1 and will be analyzed for the following parameters:

- Total petroleum hydrocarbons as diesel, and motor oil by EPA Method 8015B
- Volatile organic compounds by EPA Method 8260B

Field measurements will include depth to water, dissolved oxygen (DO), temperature, pH, conductivity, and turbidity.

Following the initial round of baseline samples, groundwater samples will be collected monthly for three months, then quarterly for three quarters. Monthly and quarterly groundwater samples will be collected and analyzed as described above for the baseline samples.

3.3 Progress Monitoring of DVE Operations

Dual vacuum extraction operations have been underway along the west end of Building 14 (Figure 5) off and on since October 17, 2002 to present. In order to evaluate the progress of the DVE operation groundwater samples will be collected from each of the eight associated DVE wells (Figure 5).

3.3.1 Progress Monitoring Groundwater Samples

Before groundwater samples are collected, the presence or absence of free-phase petroleum hydrocarbons will be determined using an interface probe. Wells where no free-phase petroleum hydrocarbons are detected will be sampled monthly for three months, in accordance to the procedures described in Section 5.1.2.2 and analyzed for the following parameters:

- Total petroleum hydrocarbons as diesel and motor oil by EPA Method 8015B

Dual vacuum extraction wells with free-phase petroleum hydrocarbons present will not be sampled. If the concentrations of dissolved-phase petroleum hydrocarbons within a well stay below AWQC for MER (Table 1) for three consecutive months, then quarterly monitoring for up to three quarters will occur. Quarterly sampling will be performed in accordance with the same procedures and analyzed for the same parameters described above.

3.4 Removal of ASTs, Adjacent Pads and Associated Fixtures

Three ASTs and associated piping of Structure 598/HW04 will be removed, as will the concrete pad for the pump and process manifolds and the truck drive up apron (Figure 6). The ASTs are constructed of steel and each has approximately 25,000-gallons of capacity. Approximately 100 feet of process piping is associated with the ASTs, as is three pump stations, which include a pump, manifold, and meter. The pump stations rest on a 12-inch concrete pad, and will be removed. A 30-foot by 50-foot concrete apron is found adjacent to the pump pad, and will also be removed.

A subcontractor will be utilized to remove the targeted facilities of Structure 598/HW04. The primary tasks that will be conducted during the proposed work activity are as follows:

- Clean and rinse the ASTs and manifold interiors and exteriors.
- Containerize any resulting fluids for proper transport and disposal.
- Decommission the three pumping stations and remove all associated process piping.
- Inert and remove the ASTs.
- Dispose/recycle the ASTs and piping at an appropriate facility.
- Remove the concrete containment pad for the pump stations and the truck drive up apron.
- Containerize all decommissioning debris for proper off site disposal.
- Steam clean the double containment structure for the ASTs.
- Collect soil samples from beneath the removed concrete pad and apron, and conduct limited overexcavation if necessary.

3.4.1 Pad Removal Soil Sampling

After the concrete pad removals are complete, the soil beneath the pads will be inspected for the presence or absence of visually contaminated soils. If no appreciable visual evidence of contaminant impact is observed, then surface soil samples will be collected, approximately one per 30 feet x 30 feet area, in accordance to the procedures described in Section 5.1.1.1 and analyzed for the following parameters:

- Total petroleum hydrocarbons as diesel, and motor oil by EPA Method 8015B
- Volatile organic compounds by EPA Method 5035/8260B

If visual staining is observed, then areas exhibiting contaminant impact will be excavated a nominal 2 feet around the visually impacted soil, but will not exceed more than 1 foot beyond the

boundaries of the original concrete pad footprint. If after the initial excavation visual contamination is still present, then step-outs will be performed. Step-outs will continue until all visually contaminated soil is removed or, a maximum of 20 cubic yards of soil is removed.

At termination of the excavation, discrete sidewall and bottom samples will be collected. The sidewall samples will be collected at mid-depth of the excavation at a frequency of one per 20 feet of sidewall, but no less than one per cardinal direction. If groundwater does not accumulate in the bottom of the excavation, bottom samples will be taken at a rate of one per approximately 20 feet by 20 feet area, with no less than one sample being taken. Samples will be collected in accordance to the procedures described in Section 5.1.2.1 and will be analyzed for the following parameters:

- Total petroleum hydrocarbons as diesel, and motor oil by EPA Method 8015B
- Volatile organic compounds by EPA Method 5035/8260B

All shallow excavations will be backfilled following sidewall and bottom sampling.

3.5 Borrow Material Testing

Clean import material will be used to backfill the shallow excavations. On-site borrow material purchased from the Dunbarton Quarry as "clean" material for previous projects will be used. Samples results from the previous project will be used to certify the material as "clean." No additional samples of backfill material will be collected

3.6 Investigation Derived Waste

3.6.1 Waste Soil

Soil cuttings from drilling and well installation activities and excavated soil will be stored in U.S. Department of Transportation (DOT)-approved 55-gallon drums or roll-off bins. Based on the volume generated, one four-point composite soil sample will be collected and analyzed for the following parameters prior to off-site disposal:

- Total petroleum hydrocarbons as diesel, and motor oil by EPA Method 8015B
- Semivolatile organic compounds by EPA Method 8270C
- California Code of Regulations Title 22 Metals by EPA Methods 6010B/7000A

Samples will first be collected as grab samples and then composited by the laboratory for the analyses shown above. Additionally, one discrete soil sample will be collected using an EnCore® sampling device at a random location and will be analyzed for the following parameters:

- Total petroleum hydrocarbons as gasoline by EPA Method 5035/8015B

- Volatile organic compounds by EPA Methods 5035/8260B

If necessary, the following analyses will be performed to further characterize the waste classification of contaminated soil:

- Soluble Threshold Limit Concentrations by California Waste Extraction Test (WET) and EPA Method 6010B
- Toxicity Characteristic Leaching Procedure by EPA Methods 1311/6010B

The above analysis and sampling frequency may be changed at the request of the Shaw Transportation and Disposal (T&D) Coordinator or per the receiving facilities requirements.

3.6.1.1 Wastewater an Waste Product

Wastewater from decontamination or well sampling activities will initially be stored in temporary tankage. The wastewater will then either be treated through the on-site treatment system at Building 397, or combined and stored in a DOT-approved container.

If stored, the wastewater will be shipped off-site for proper disposal within 90 days of the accumulation start date. One wastewater sample will be collected and analyzed at a minimum for the following parameters to determine the disposal options:

- Total petroleum hydrocarbons as gasoline by EPA Method 8015B
- Total petroleum hydrocarbons as diesel, and motor oil by EPA Method 8015B
- Volatile organic compounds by EPA Method 8260B
- California Code of Regulations Title 22 Metals by EPA Methods 6010B/7000A

Any separate phase product will be removed and stored in a DOT-approved container. One waste product sample will be collected and analyzed at a minimum for the following parameters to determine the disposal or recycling options:

- Total petroleum hydrocarbons as gasoline by EPA Method 8015B
- Total petroleum hydrocarbons as diesel, and motor oil by EPA Method 8015B
- Semivolatile organic compounds by EPA Method 8270C
- Volatile organic compounds by EPA Method 8260B

The above analysis and sampling frequency may be changed at the request of the Shaw T&D Coordinator or per the receiving facilities requirements.

4.0 Analytical Requirements and Quality Control

This section describes analytical methods, container and preservative requirements, and field and laboratory QC samples.

4.1 Analytical Methods

The following chemical and biological analytical methods will be used in this project:

Soil and Groundwater Sampling:

- *Test Methods for Evaluating Solid Waste, Physical Chemical Methods, SW-846, Update III (EPA, 1996):*
 - Closed system purge and trap by EPA Method 5035
 - Total petroleum hydrocarbon as jet fuel, diesel and motor oil by EPA Method 8015B
 - Volatile organic compounds by EPA Method 8260B

Wastewater, Waste Soil, Sludge, or Product Sampling:

- *Test Methods for Evaluating Solid Waste, Physical Chemical Methods, SW-846, Update III (EPA, 1996):*
 - Total petroleum hydrocarbons as gasoline by EPA Method 8015B
 - Total petroleum hydrocarbons as diesel and motor oil by EPA Method 8015B
 - Volatile organic compounds by EPA Method 8260B
 - Semivolatile organic compounds by EPA Method 8270C
 - Metals by EPA Methods 6010B/7000A
- California Code of Regulations, *Title 22, Waste Soil & Sludge Samples Only, 1991:*
 - Soluble Threshold Limit Concentration by California WET and EPA Method 6010B
 - Toxicity Characteristic Leaching Procedure by California by EPA Method 1311/6010B

Detailed information on methods, calibration criteria, project-required reporting limits, and QC acceptance criteria are presented in Section 6.0.

4.2 Sample Containers, Preservatives, and Holding Times

Sample containers, preservation, and holding time requirements will be according to the EPA methods listed in Table 4. Sample containers for water will be certified pre-cleaned according to EPA protocols.

4.3 Field Quality Control Samples

Field QC samples will be collected and analyzed during the project to assess the consistency and performance of the sampling program. Field QC samples for this project will include field duplicates, equipment rinsate samples, trip blanks for water samples, and temperature blanks.

4.3.1 Field Duplicates

Field duplicate pairs consist of two samples of the same matrix (an original and a duplicate) collected at the same time and location to the extent possible, using the same sampling techniques. The purpose of field duplicate samples is to evaluate the variability of contaminant distribution in the sampled matrix. For groundwater, field duplicates serve as a measure of sampling precision. Field duplicate samples will be collected in the field at a frequency of 10 percent, and will be analyzed for the same analyses as their corresponding original samples. Field duplicates will be collected for groundwater samples only.

4.3.2 Equipment Rinsate Samples

Equipment rinsate samples are used to evaluate the effectiveness of the decontamination procedure and to identify potential cross-contamination during sampling events. Only disposable sampling equipment will be used to collect samples, therefore, equipment rinsate samples will not be collected. However, if non-disposable sampling equipment is used, equipment rinsate samples will be collected. Rinsate samples consist of analyte-free water collected from the final rinse of the decontamination process. Rinsate samples will be collected from the non-disposable sampling equipment, placed in appropriate pre-cleaned containers supplied by the analytical laboratory, and analyzed for the same analytes as the field samples.

4.3.3 Trip Blanks

Each cooler containing water samples for volatile organic compound (VOC) analysis will contain a trip blank. Trip blanks are 40-milliliter (mL) volatile organic analysis vials of analyte-free water, which are kept with the field sample containers from the time they leave the laboratory until the time they are returned to the laboratory. The purpose of trip blanks is to determine whether samples have been contaminated with VOCs during transportation or sample collection. One trip blank is needed for each day of sampling of groundwater samples for VOC analysis. Trip blanks will not be analyzed with wastewater samples or soil samples.

4.3.4 Temperature Blanks

Each cooler will be shipped with a temperature blank. A temperature blank is a sample container filled with tap water and stored in the cooler during sample collection and transportation. The laboratory will record the temperature of the temperature blank immediately upon receipt of the samples.

4.4 Matrix Spike and Matrix Spike Duplicate

The laboratory will analyze a matrix spike/matrix spike duplicate (MS/MSD) for every 20 water or soil project samples. Matrix spike/matrix spike duplicate analyses are not performed on waste samples. Field personnel will collect extra volumes for water and soil for MS/MSD analysis. Field personnel will designate 1 sample per every 20 for MS/MSD analysis on the Chain of Custody Form.

5.0 *Field Methods and Sampling Procedures*

5.1 *Introduction*

This section presents field methods and sampling procedures, including soil and water sampling, decontamination, sample handling, and documentation procedures.

5.1.1 *Soil Sampling Procedures*

5.1.1.1 *Surface and Shallow Subsurface Soil Sampling*

Soil samples will be collected from excavation sidewalls and bottom using disposable sampling scoops. Samples will be collected either directly from shallow excavations using the general sampling technique described below:

- Obtain a new (unused) disposable sampling scoop (or other non-disposable decontaminated sampling equipment).
- Put on a new (unused) pair of sampling gloves and other appropriate personal protective equipment.
- Identify sampling locations according to Sections 3.1 and 3.4.
- If the excavation is less than 4 feet in depth or is sloped, the excavation may be entered for sample collection.
- If the excavation is greater than 4 feet and un-sloped, then the excavation will not be entered for sampling. Direct the backhoe operator to obtain a sample from the desired location.
- Collect sample for VOCs first following Shaw SOP-T-FS-104-5035, "Core Sampler," (Shaw, 2004), Attachment 1.
- Collect the sample for the remaining analysis into the appropriate sample containers using a disposable sampling scoop.
- Record sampling location (with maps) and field notes in the Field Logbook.
- Label, package, and prepare the samples for shipment to the laboratory in accordance with the procedures described in Section 5.1.4.3. Place the samples in cold storage after collection.

5.1.1.2 Waste Soil Sampling

Soil samples from drums or roll-off bins will be collected using a slide-hammer or a disposable scoop. One four point composite sample will be collected per waste stream or 500 cubic yards of waste soil using the general sampling technique describe below:

- Obtain brass sleeves or 8-ounce jars.
- Put on a new (unused) pair of sampling gloves and other appropriate personal protective equipment.
- Select sampling locations.
- Collect sample for VOCs and TPH as gasoline first, following Shaw SOP-T-FS-104-5035 (Shaw, 2004) (Attachment 1), using an EnCore[®] sampling device.
- Collect soil for remaining analysis by filling the sample sleeve or glass jar with soil.
- If using sampling sleeve, cover both ends of sleeves with Teflon[™] sheets and plastic caps.
- Record sampling location (with maps) and field notes in the Field Logbook.
- Label, package, and prepare the samples for shipment to the laboratory in accordance with the procedures described in Section 5.1.4. Place the samples in cold storage after collection.

5.1.2 Groundwater Sampling Procedures

5.1.2.1 Low-Flow Groundwater Sampling

Groundwater samples from monitoring wells (see Figure 4) will be collected by the low-flow sampling technique in accordance with the procedures described in this section. Wells will be micro-purged (300 to 500 milliliters per minute [mL/min]), using a peristaltic pump with dedicated tubing using the general sampling technique described below:

- Don appropriate personal protective equipment following the Site Health and Safety Plan procedures.
- Confirm the well identification at each monitoring well.
- Calibrate field instruments in accordance with the manufacturer's directions. Record all calibration documentation in the field logbook.
- Measure the depth to water at each monitoring well using an electronic water level indicator probe. Record the water level measurement to the nearest 0.01-inch in the field logbook. Decontaminate the water level indicator before each measurement according to the procedure in Section 5.1.3.

- **Carefully lower the sample tubing into the well with as little disturbance to the groundwater as possible.** Place the intake to the pump at the approximate middle of the screen interval. The pump speed will be set so that the water column in the well does not drop below the pump intake line. Monitor the water level and pump flow rate to stabilize the water level reading.
- Purge the well at a flow rate of 300 to 500 mL/min. Monitor water quality parameters (turbidity, pH, temperature, conductivity, and dissolved oxygen) every 3 to 5 minutes during purging, using in-line monitoring equipment. Record the water quality parameters in the Field Log Book. If the water quality parameters are stable for three consecutive readings, collect samples for chemical analysis. Stabilization is achieved if successive readings are within ± 0.1 pH units, ± 1 degree Celsius ($^{\circ}\text{C}$) for temperature, ± 3 percent for conductivity, and ± 10 percent for dissolved oxygen. **Since these wells are not equipped with permanent sampling pumps, turbidity measurements will be collected, but will not be used as a stabilization parameter.** If the water quality parameters have not stabilized, continue purging until stabilization occurs or three calculated well volumes have been purged. *If the total DO for the well is less than 1.0 milligrams per liter (mg/L), then the stabilization criteria is ± 0.3 mg/L.*
- After stabilization is achieved (do not stop the pump), collect samples into their appropriate sample containers, shown in Table 4, from the pump discharge line. Collect field quality control samples (e.g., field duplicates), as required. For VOC analysis, reduce the pump flow to a rate of less than 300 mL/min for sample collection.
- Even with low flow purging the well may fully de-water. If this occurs, the well will be allowed to recover to 80 percent and samples will be collected.
- Label, package, and prepare the samples for shipment to the laboratory in accordance with Section 5.1.4. Transfer the samples to cold storage after collection.

5.1.2.2 Grab Groundwater Sampling

Groundwater samples from DVE wells (see Figure 5) will be collected as “grab” samples without purging. Prior to sampling, stagnant or muddy water will be removed using a disposable bailer until three well volumes have been removed or the well is bailed dry. Sample bottles will then be filled from the discharge valve of the disposable bailer.

5.1.3 Decontamination Procedure

Decontamination of non-disposable sampling equipment that comes in contact with samples will be performed to prevent the introduction of extraneous material into samples, and to prevent cross contamination between samples. All sampling equipment will be decontaminated by washing with a non-phosphate detergent such as Liquinox™ or equivalent. Decontamination water will be collected in 55-gallon, DOT-approved drums or a poly-tank.

The following procedures will be used for decontamination of non-disposable sampling equipment:

- If gross contamination is present on the equipment (i.e., oil, mud or soil adhering to the equipment), first rinse with potable water. This step will decrease the gross contamination and reduce the frequency at which the non-phosphate detergent and water solution need to be changed. Change the water frequently.
- Wash with the non-phosphate detergent and water solution. This step will remove remaining contamination from the equipment. The non-phosphate detergent will be diluted as directed by the manufacturer.
- Rinse with potable water. This step will rinse the detergent solution away from the equipment. Change the water frequently.
- Rinse with deionized water. This step will rinse any detergent solution and potable water residues. Rinsing will be done by applying the deionized water from a Nalgene™ squeeze bottle (or equivalent) while holding equipment over a 5-gallon bucket.

5.1.4 Sample Management

The following sections describe sample numbering and labeling requirements.

5.1.4.1 Sample Numbering

All samples submitted to the analytical laboratory will be uniquely numbered. Water samples will be labeled in the following format:

101-CAA11-Y-ZZZ

Where “Y” is the system (DVE) or action (Soil Sample [SO] or Groundwater Monitoring Sample [GW]) identifier (Trip Blank will be used in space of the system identifier to denote trip blanks) and “ZZZ” is a sequential sample number for this project. The sample number will be recorded in the field logbook at the time of sample collection. A complete description of the sample and sampling circumstances will be recorded in the permanently bound field logbook, and referenced to the unique sample identification number.

5.1.4.2 Sample Labeling

Sample labels will be filled out with indelible ink and affixed to each sample container. If non-waterproof labels are used, the sample label will be covered with clear tape. Sample containers will be placed in resealable plastic bags to protect the sample from moisture during transportation to the laboratory. Each sample container will be labeled with the following information, at minimum:

- Sample ID number
- Sample collection date (month/day/year)

- Time of collection (24-hour clock)
- Project number (i.e., 843778)
- Sampler's initials
- Analyses to be performed
- Preservation (if any)
- Location (i.e., Alameda)

5.1.4.3 Sample Packaging and Shipment

Samples will be shipped to the analytical laboratory by land delivery services according to the DOT regulations. The International Air Transportation Association regulations will be adhered to when shipping samples by air courier services. Transportation methods will be selected to assure that the samples arrive at the laboratory in time to permit testing according to established holding times and project schedules. The receiving laboratory will only accept samples with a properly prepared chain of custody and properly labeled and sealed shipping container(s).

Packaging of sample containers will be based on the level of protection a sample will require during handling, shipping, and storage. Protection may vary according to sample type, sample media, suspected amount of hazardous substances, required testing, and handling and storage conditions. Proper packaging will be based on the following considerations:

- Type and composition of inner packing (e.g., plastic bags, metal cans, absorbent packing material, and ice for preservation)
- Type and composition of overpacks (e.g., metal or plastic coolers, cardboard box, rock core box, and undisturbed tube rack)
- Method of overpack sealing (e.g., strapping tape and custody seals)
- Mark and label of overpacks (e.g., laboratory address, any appropriate DOT Hazard Class Labels, and handling instructions)

Upon collection all glass sample containers will be protected with bubble wrap (or equivalent) to prevent breakage during shipment. A temperature blank will be placed in every cooler with samples.

Ice will be added to the cooler in sufficient quantity to keep the samples cooled to $4 \pm 2^{\circ}\text{C}$ for the duration of the shipment to the laboratory. Sample cooler drain spouts will be taped from the inside and outside of the cooler to prevent any leakage. Saturday deliveries will be coordinated with the laboratory.

If samples are picked up by a laboratory courier service, the chain of custody will be completed and signed by the laboratory courier. The cooler will then be released to the courier for transportation to the laboratory.

If a commercial carrier is used, the chain of custody will include the airbill number in the "transfers accepted by" column, and will be sealed in a resealable bag. The chain of custody will then be taped to the inside of the sample cooler lid. The cooler will be taped shut with strapping tape, and two custody seals will be taped across the cooler lid: one seal in the front and one seal in the back. Clear tape will be applied to the custody seals to prevent accidental breakage during shipping. The samples will then be shipped to the analytical laboratory. A copy of the courier airbill will be retained for documentation.

5.1.5 Sample Custody and Documentation

Sampling information will be recorded on a chain of custody and in a permanently bound field logbook. All entries will be legible and recorded in indelible ink.

5.1.5.1 Chain-of-Custody

Figure 8, "Chain of Custody," will be completed for each sample collected. In addition to providing a custody exchange record for the samples, the chain of custody form serves as a formal request for sample analyses. The Chain of Custody (COC) Form will be completed, signed, and distributed as follows:

- One copy retained by the sample coordinator for inclusion in the project files
- The original sent to the analytical laboratory with the sample shipment

After the laboratory receives the samples, the Sample Custodian will inventory each shipment before signing for it, and note on the original COC Form any discrepancy in the number of samples, temperature of the cooler, or broken samples. The Project Chemist will be notified immediately of any problems identified with shipped samples. The Project Chemist will in turn notify the Project QC Manager, and together they will determine the appropriate course of action. The Project Chemist will also notify the Project Manager if the project budget and schedule may be impacted.

The laboratory will initiate an internal COC that will track the sample within the various areas of the laboratory. The relinquishing signature of the Sample Custodian and the custody acceptance signature of the laboratory personnel transfer custody of the sample. This procedure is followed each time a sample changes hands. The laboratory will archive the samples and maintain their custody as required by the contract or until further notification from the Project Chemist, at which time the samples will either be returned to the project for disposal, or disposed by the laboratory.

5.1.5.2 Field Sample Custody

The COC Form will be the controlling document to assure that sample custody is maintained. Upon collecting a sample, sampling personnel will initiate the COC in the field. Each individual who has the sample(s) in his/her possession will sign the COC. Each time the sample custody is transferred, the former custodian will sign the COC on the "Relinquished by" line, and the new custodian will sign the COC on the "Received by" line. The date, time, and name of their project or company affiliation will accompany each signature.

The waybill number or courier name will be recorded on the COC when a commercial carrier is used. The shipping container will be secured with two custody seals, thereby allowing shipping personnel to maintain custody until receipt by the laboratory.

If the laboratory sample custodian judges sample custody to be invalid (e.g., custody seals have been broken), the laboratory will initiate a Nonconformance Report. The Project Chemist will be immediately notified. The Project Chemist will notify in turn, the Project Manager and the Project QC Manager. The Project Manager will make a decision, in consultation with the client, as to the fate of the sample(s) in question on a case-by-case basis. The sample(s) will either be processed "as-is" with custody failure noted along with the analytical data, or rejected with resampling scheduled, if necessary. The nonconformance associated with the samples will be noted on the appropriate certificate of analysis or case history.

5.1.5.3 Field Logbooks

A permanently bound field logbook with consecutively numbered pages will be assigned to this project. All entries will be recorded in indelible ink. Corrections will be made following the procedure described in Section 5.1.5.4, "Document Corrections." At the end of each workday, the responsible sampler will sign the logbook pages, and any unused portions of a logbook page will be crossed out, signed, and dated.

If it is necessary to transfer the logbook to another person, the person relinquishing the logbook will sign and date the last page used, and the person receiving the logbook will sign and date the next page to be used.

At a minimum, the logbook will contain the following information:

- Project name and location (on the front page of the log book)
- Date and time of collection for each sample (in the upper right corner of each page)
- Sample number
- Sample location (i.e., soil boring or sampling point)
- Sample type (i.e., soil and water)
- Composite or grab
- Composite type (the number of grab samples)

- Depth of sample
- Weather information (e.g., rain, sunny, approximate temperature, etc.)
- Containers used (e.g., metal liners, glass bottles, etc.)
- Requested analyses

In the graph paper portion of the field logbook, the sampler will fill in the following information:

- A map with sample locations (drawn or paste copy). Each sample location must be clearly identified on the map. Several sample locations may be presented on one map; however, the page with the map must be referred on each of the individual sample pages.
- Field analyses performed, including results, instrument checks, problems, and calibration records for field instruments.
- Descriptions of deviations from this SAP.
- Problems encountered and corrective action taken.
- Identification of field QC samples.
- List of QC activities.
- Verbal or written instructions from the Navy and Shaw Project QC Manager.
- Any other events that may affect the samples.

The sampler will cross out the unused portion and sign each page.

5.1.5.4 Document Corrections

Changes or corrections on any project documentation will be made by crossing out the item with a single line, initialing by the person performing the correction, and dating the correction. The original item, although erroneous, will remain legible beneath the cross out. The new information will be written above the crossed-out item. Corrections will be written clearly and legibly with indelible ink.

6.0 Laboratory Quality Control Program

This section describes analytical QC procedures, including laboratory qualifications, the QA program, and QC procedures associated with analytical methods.

6.1 Laboratory Quality Control Checks

The recovery of known additions is a part of laboratory analytical protocols. The use of additives at known concentrations allows detecting the matrix interferences and estimating the impact of these interferences when present. It also allows evaluating the efficiency of extraction procedures and overall accuracy of analysis. Laboratory internal QC checks will include:

- Laboratory control samples (LCS)
- Laboratory control duplicates (LCD)
- Matrix spikes (MS)
- Matrix spikes duplicates (MSD)
- Laboratory duplicates
- Surrogate standards
- Internal standards
- Method and instrument blanks
- Post-digestion spikes

6.1.1 Laboratory Control Samples

Laboratory control samples are matrix equivalent QC check samples (i.e., analyte-free water, laboratory sand, or sodium sulfate) spiked with a known quantity of specific analytes that are carried through the entire sample preparation and analysis process. The spiking solution used for laboratory control spike/laboratory control duplicate (LCS/LCD) preparation is of a source different from the stock that was used to prepare calibration standards.

6.1.2 Laboratory Duplicates

For laboratory sample duplicate analyses, a sample is prepared and analyzed twice. Laboratory sample duplicates are prepared and analyzed with each batch of samples for most inorganic analyses.

6.1.3 Matrix Spikes

Matrix spikes are QC check samples that measure matrix-specific method performance. An MS sample is prepared by adding a known quantity of target analytes to a sample prior to sample digestion or extraction. In general, for organic compound and metal analyses, an MS/MSD pair is prepared and analyzed with each preparation batch or for every 20 field samples. The frequency of MS/MSD analysis depends on the project DQOs. For inorganic compound analysis, a

single MS and a laboratory sample duplicate are often prepared and analyzed with each batch. The LCS results, together with MS results, allow verifying the presence of matrix effects.

6.1.4 Surrogate Standards

Organic compound analyses include the addition, quantitation, and recovery calculation of surrogate standards. Compounds selected to serve as surrogate standards must meet all of the following requirements:

- They are not the target analytes
- They do not interfere with the determination of target analytes
- They are not naturally occurring, yet are chemically similar to the target analytes
- They are compounds exhibiting similar response to target analytes

Surrogate standards are added to every analytical and QC check sample at the beginning of the sample preparation. The surrogate standard recovery is used to monitor matrix effects and losses during sample preparation. Surrogate standard control criteria are applied to all analytical and QC check samples, and if surrogate criteria are not met, re-extraction and re-analysis may be performed.

6.1.5 Internal Standards

Some organic compound analyses include the addition, quantitation, and recovery calculation of internal standards. Internal standards are usually synthetic compounds that are similar in chemical behavior to the target analytes. They are added to sample extracts at the time of instrument analysis, and are used to quantitate results through internal standard calibration procedures. Internal standard recoveries are used to correct for injection and detector variability. Gas chromatography/mass spectrometry (GC/MS) must use internal standards and have acceptability limits for internal standard areas. Use of internal standard quantitation for gas chromatography (GC) methods is optional.

6.1.6 Method Blanks

A method blank is used to monitor the laboratory preparation and analysis systems for interferences and contamination from glassware, reagents, sample manipulations, and the general laboratory environment. A method blank is carried through the entire sample preparation process, and is included with each batch of samples. Some methods of inorganic analysis do not have a distinctive preparation step. For these tests the instrument blank, which contains all reagents used with samples, is considered the method blank.

6.1.7 Instrument Blanks

An instrument blank is used to monitor the cleanliness of the instrument portion of a sample analysis process. Instrument blanks are usually just the solvent or acid solution of the standard used to

calibrate the instrument. During metals analyses one instrument blank is usually analyzed for every ten samples. For GC and GC/MS analysis, instrument blanks are analyzed on an as-needed basis for troubleshooting and chromatography column carryover determination purposes.

6.1.8 Post-Digestion Spikes and the Method of Standard Addition

A post-digestion spike is used during metal analysis to assess analytical interferences that may be caused by general matrix effects or high concentrations of analytes present in the sample. A digested sample is spiked with the analyte of interest at a known concentration, and the spike recovery is used to estimate the presence and magnitude of interferences.

If a post-digestion spike recovery fails to meet acceptance criteria, the Method of Standard Addition (MSA) will be used to quantitate the sample result. The MSA technique compensates for a sample constituent that enhances or depresses the analyte signal. To perform the MSA, known amounts of a standard at different concentrations are added to two to three aliquots of digested sample, and each spiked sample and the original unspiked sample are analyzed. The absorbance is then plotted against the concentration, and the resulting line is extrapolated to zero absorbance. The point of interception with the concentration axis is the indigenous concentration of the analyte in the sample.

6.2 Data Quality Indicators

This section defines the data quality indicators and their use for assessment of data quality.

6.2.1 Precision

Precision measures the reproducibility of measurements under a given set of conditions. The following equation illustrates the method for calculating relative percent difference (RPD) to assess a method's precision:

$$\text{Precision as RPD} = \frac{2 \times (\text{Result} - \text{Duplicate Result})}{\text{Result} + \text{Duplicate Result}} \times 100\%$$

The laboratory uses MS/MSD pairs to assess the precision of analytical procedures, with one MS/MSD pair analyzed for every batch of up to 20 samples. According to the Navy requirements, analytical laboratories perform MS/MSD on the Navy project samples. This allows determining whether matrix interferences may be present.

The laboratory uses LCS/LCD pairs when MSs are not practical due to the nature of sample or analytical method used, and they are prepared and analyzed with each batch of samples instead of MS/MSD. An LCS/LCD may also be prepared in place of an MS/MSD in the case that a sufficient sample volume was not obtained in the field to perform the MS/MSD analysis. For

inorganic analyses, analytical precision is usually calculated based on the sample and sample duplicate results.

The analytical laboratory will have statistically-based acceptability limits for RPDs established for each method of analysis and sample matrix. The laboratory will review the QC samples to ensure that internal QC data lie within the limits of acceptability. Any suspect trends will be investigated and corrective actions taken.

Field precision of sampling procedures is evaluated by collecting and analyzing "blind" field duplicate samples (field QC samples) at a rate of one for every ten samples. Sampling precision will be evaluated based on the RPD for field duplicate samples.

Field precision will be monitored for evaluation of the sampling techniques and sample handling procedures. Analytical data will not qualify during the data validation process, based on the field precision values.

6.2.2 Accuracy

Accuracy measures the bias of an analytical system by comparing the difference of a measurement with a reference value. The percent recovery of an analyte, which has been added to the environmental samples at a known concentration before extraction and analysis, provides a quantitation tool for analytical accuracy. The spiking solutions used for accuracy determinations are not used for instrument calibrations. The following equation illustrates how accuracy is evaluated:

$$\text{Accuracy as percent recovery} = \frac{\text{Spiked Sample Result} - \text{Sample Result}}{\text{Spiked Sample True Value}} \times 100\%$$

Percent recoveries for MS, MSD, and LCS that are analyzed for every batch of up to 20 samples serve as a measure of analytical accuracy. Surrogate standards are added to all samples, blanks, MS, MSD, and LCS analyzed for organic contaminants to evaluate accuracy of the method and help to determine matrix interferences.

As a general rule, the recovery of most compounds spiked into samples is expected to fall within a range of 70 to 130 percent. This range represents the EPA advisory acceptability limits for MS, MSD, and LCS for all organic analysis methods. The advisory control limits for metals analyses are 75 to 125 percent. The surrogate standard advisory acceptability limits are also 70 to 130 percent for all organic analyses with the exception of GC/MS methods, where these limits are specified in the methods for each matrix. Laboratories may use the advisory limits until the in-house statistically-based control limits are developed for each method of analysis and sample matrix.

Control limits are defined as the mean recovery, plus or minus three standard deviations, of the 20 data points, with the warning limits set as the mean, plus or minus two standard deviations. The laboratory will review the QC samples and surrogate standard recoveries for each analysis to ensure that internal QC data lay within the limits of acceptability. The laboratory will investigate any suspect trends and take appropriate corrective actions.

6.2.3 Representativeness

Unlike precision and accuracy, which can be expressed in quantitative terms, representativeness is a qualitative parameter. Representativeness is 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. A qualitative parameter depends on proper design of the sampling program.

Field personnel will be responsible for ensuring that samples are representative of field conditions by collecting and handling samples according to the approved SAP and field SOP. Errors in sample collection, packaging, preservation, or COC procedures may result in samples being judged non-representative and may form a basis for rejecting the data.

Data generated by the laboratory must be representative of the laboratory database of accuracy and precision measurements for analytes in different matrices. Laboratory procedures for sample preparation will ensure that aliquots used for analysis are representative of the whole sample. Aliquots to be analyzed for volatile parameters will be removed before the laboratory composites/homogenizes the samples, to avoid losing volatile compounds during mixing.

6.2.4 Comparability

Comparability is a qualitative parameter expressing the confidence where one data set can be compared with another, whether it was generated by a single laboratory or during inter-laboratory studies. The use of standardized field and analytical procedures ensures comparability of analytical data.

Sample collection and handling procedures will adhere to EPA-approved protocols. Laboratory procedures will follow standard analytical protocols, use standard units and standardized report formats, follow the calculations as referenced in approved analytical methods, and use a standard statistical approach for QC measurements.

6.2.5 Completeness

Completeness is a measure of whether all the data necessary to meet the project have been collected. Any data to be considered to be complete must meet all acceptance criteria including accuracy and precision and other criteria specified for an analytical method. The data will be reviewed and/or validated to keep invalid data from being processed through data collection.

Completeness is evaluated using the following equation:

$$\text{Completeness} = \frac{\text{Acceptable Results}}{\text{Total Results}} \times 100\%$$

The goal for completeness for all QC parameters, except holding times, will be 90 percent. The goal for holding times will be 100 percent. If these goals are not achieved, the sources of non-conformances will be evaluated to determine whether resampling and re-analysis is necessary.

6.3 Project-Required Reporting Limits

Following the Navy requirements (NFESC, 1999), the laboratory will determine the Method Detection Limits (MDLs) for each method, instrument, analyte, and matrix by using the procedure described in 40 Code of Federal Regulation Part 136B. The MDL is defined as the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero.

An MDL study involves preparation/digestion and analysis of seven replicates of a given matrix spiked with target analytes at concentrations two to five times greater than the estimated MDL. The MDLs for metals in soil will be derived from the MDLs for metals in water. At a minimum, the laboratory will conduct annual MDL studies. The laboratory will select the Practical Quantitation Limits (PQLs) for all analytes at concentration levels that exceed the calculated MDLs by a factor of two to ten.

Reporting limits for the project are presented in Tables 1 and 5 through 8. These limits may be elevated for individual samples if matrix interferences are encountered.

7.0 Laboratory Quality Assurance

The following sections describe the QC and QA procedures the analytical laboratory will follow to generate defensible data of known quality for the project.

7.1 Laboratory Qualifications

The analytical laboratories selected to analyze samples for this project will be certified by the California Department of Health Services through the Environmental Laboratory Accreditation Program for all analytical methods required for the project. In addition, the laboratory will successfully complete the NFESC's Laboratory Evaluation Program prior to sampling activities, and maintain that status throughout the project.

Laboratories selected for the project must be capable of providing the required turnaround times, project QC, and data deliverables required by this SAP.

7.2 Laboratory Quality Assurance and Quality Control Program

Quality assurance is a set of operating principles that, if strictly followed during sample collection and analysis, will produce defensible data of known quality. Included in QA are QC and quality assessments. Quality control is a set of measures within a sample analysis methodology to ensure that the process is in control. Quality assessment consists of procedures for determining the quality of laboratory measurements by use of data from internal and external QC measures.

A properly designed and executed QC program will result in a measurement system operating in a state of statistical control, which means that errors have been reduced to acceptable levels. An effective QA program includes the following elements:

- Certification of operator competence
- Internal QC checks, such as recovery of known additions through use of surrogate standards, MSs, and LCSs
- Analysis of externally supplied standards
- Analysis of reagent blanks
- Calibration with standards using internal or external standard procedures
- Calibration verification with second source standard
- Analysis of duplicates
- Maintenance of control charts

Strict adherence to Good Laboratory Practices and consistent use of SOPs are also essential for a successful QC program. The laboratory will have the current revisions of the SOPs readily available for all staff. At a minimum, SOPs will be written for the following procedures and methods:

- Sample receipt/control/disposal
- Sample preparation/extraction
- Sample analysis
- Results calculation
- Database management
- Health and safety
- Corrective action

The analytical laboratory will have written SOPs defining the instrument operation and maintenance, tuning, calibration, MDL determination, QC acceptance criteria, blank requirements, and stepwise procedures for each analytical method. The SOPs will be available to the analysts in the laboratory. Any method that is subcontracted by the laboratory to another laboratory, or sent to another facility of the same network of laboratories, will have a prior approval of the Shaw Project Chemist.

7.3 Calibration

All instruments will be calibrated and the calibration acceptance criteria met before samples are analyzed. Calibration standards will be prepared with National Institute for Standards and Testing-traceable standards and analyzed per method requirements. Initial calibration acceptance criteria documented in the laboratory SOPs will meet those of applicable guidance documents. The initial calibration will meet one of the following requirements:

- The lowest concentration of the calibration standard is less than or equal to the PQL based on the final volume of extract or sample
- For each target analyte, at least one of the calibration standards will be at or below the regulatory limit (action level) as defined by the DQOs

Before samples are analyzed, initial calibration will be verified with a second source standard prepared at the mid-point of the calibration curve. Initial calibration verification will meet the acceptance criteria, which are expressed in the laboratory SOPs (Shaw, 2004).

Daily calibration verification will be conducted at the method-prescribed frequencies, and will meet the acceptance criteria of applicable guidance documents. Daily calibration verification will not be used for quantifying target analytes.

Calibration data (calibration tables, chromatograms, instrument printouts, and laboratory logbooks) will be clearly labeled to identify the source and preparation of the calibration standard and, therefore, be traceable to the standard preparation records.

Calibration requirements and acceptance criteria for organic and inorganic analysis are summarized in Tables 9 through 13.

7.4 Preventive Maintenance

The primary objective of a preventive maintenance program is to help ensure the timely and effective completion of a measurement effort by minimizing the down time of crucial analytical equipment due to expected or unexpected component failure. In implementing this program, efforts are focused in three primary areas: maintenance responsibilities, maintenance schedules, and adequate inventory of critical spare parts and equipment.

Maintenance responsibilities for laboratory equipment are assigned to the respective laboratory managers. The laboratory managers then establish maintenance procedures and schedules for each major equipment item. These are contained in the maintenance logbooks assigned to each instrument.

The effectiveness of any maintenance program depends, to a large extent, on adherence to specific routine maintenance for each major equipment item. Other maintenance activities may also be identified as requiring attention on an as-needed basis. Manufacturers' recommendations and/or sample throughput provide the basis for the established maintenance schedules, and manufacturers' service contracts provide primary maintenance for many major instruments (e.g., GC/MS instruments, atomic absorption spectrometers, analytical balances, etc.). Maintenance activities for each instrument are documented in a maintenance log.

Along with a schedule for maintenance activities, an adequate inventory of spare parts is required to minimize equipment down time. This inventory emphasizes those parts (and supplies), which are subject to frequent failure, have limited useful lifetimes, or cannot be obtained in a timely manner should failure occur.

The respective laboratory managers are responsible for maintaining an adequate inventory of necessary spare parts. Sufficient equipment is on hand to continue analyses in the event that an instrument encounters problems. In addition to backup instrumentation, a supply of spare parts such as GC columns, fittings, and septa; atomic absorption lamps, mirrors, and diaphragms; graphite furnace tubes; and other ancillary equipment is maintained.

7.5 Training

The laboratory will have an established policy and procedure on training and documenting of the analyst's competency. Each staff member that performs sample preparation and analysis will

demonstrate their proficiency through preparation and analysis of four LCSs as described in the EPA SW-846 (EPA, 1996). An analyst will be considered proficient if the acceptance criteria for method accuracy and precision are met. The laboratory will maintain all training records on file.

7.6 Supplies and Consumables

The laboratory will inspect supplies and consumables prior to their use in analyses. The materials specifications in the analytical methods will be used as a guideline for establishing the acceptance criteria for these materials. Purity of reagents will be monitored by analysis of method blanks. An inventory and storage system for materials and supplies will assure use before manufacturers' expiration dates and storage under safe and chemically compatible conditions.

7.7 Software Quality Assurance

The generation, compilation, and reporting of electronic data are critical components of laboratory operations. To produce defensible data of known quality, the laboratory will develop a software QA plan or a SOP, which describe activities related to data generation, reduction, and transfer with modern tools of data acquisition, and the policies and procedures for procurement, modification, and use of computer software.

7.7.1 Software Validation

The laboratory will have procedures in place to ensure that all software for data reduction, reporting, and transfer adequately and correctly performs all intended functions, and does not perform any unintended functions.

The laboratory will verify, validate, and document the proper functioning of the software immediately after any new data acquisition and/or management systems have been installed at the laboratory. The baseline verification and validation may include the following actions:

- Comparison of the computer printouts with reduced data and the raw data
- Manual calculations to confirm correctness of all computer calculations
- Comparison of the analytical report to the electronic deliverable files

Baseline software validation will be documented in laboratory QA files. Continuing software verification will take place during sample analysis. To eliminate data entry errors during analytical sequence set-up, as part of data package review, the correctness of results will be checked by one manual calculation per QC batch during data review. This verification will be documented in the quality assurance/quality control checklist for each data file.

7.7.2 Software Security

Only authorized and trained laboratory personnel will have access to the operating and data management software. Each analyst will be trained in software use for operating different functional areas of the software systems and have a password that allows access to these areas.

7.7.3 Manual Integration

Manual integration is sometimes necessary for proper compound quantitation in cases when there are overlapping or tailing peaks, and sloping baselines. When justified, manual integration can be conducted for standards, samples, and QC check samples.

Manual integration may include valley-to-valley baselines, vertical peak separation, or slope integration. The type of manual integration is a judgment call of an analyst experienced in GC.

If a need for manual integration arises, the analysts performing analysis will select a proper approach based on their professional judgment. Manual integration will then be conducted and documented in the data file. Once an approach has been selected, it will be consistently used for the similarly affected peaks.

Manual integration documentation will include a copy of a computer-integrated chromatogram, a copy of a manually-integrated chromatogram, a brief justification description, and the name of the person who performed the manual integration. The Laboratory Manager will review and approve all manual-integrations performed by analysts.

8.0 *Laboratory Corrective Action*

Corrective action takes place when a circumstance arises that has a negative impact on the quality of the analytical data generated during sample analysis. For corrective action to be initiated, awareness of a problem must exist. In most instances, the individuals performing laboratory analyses are in the best position to recognize problems that will affect data quality. Keen awareness on their part can frequently detect minor instrument changes, drifts, or malfunctions, which can then be corrected, thus preventing a major breakdown in the QC system in place. If major problems arise, they are in the best position to recommend the proper corrective action and initiate it immediately, thus minimizing data loss. Therefore, the laboratory personnel will have a prime responsibility for recognizing a nonconformance and the need for implementing and documenting the corrective action. If a situation arises requiring corrective action, the following closed-loop corrective action process will be used:

1. Define the problem.
2. Assign responsibility for investigating the problem.
3. Investigate and determine the cause of the problem.
4. Determine corrective action course to eliminate the problem.
5. Assign responsibility for implementing the corrective action.
6. Determine the effectiveness of the corrective action and implement the correction.
7. Verify that the corrective action has eliminated the problem.
8. If not completely successful, return to Step 1.

The personnel identifying or originating a nonconformance will document it to include the following items:

- Identification of the individual(s) identifying or originating the nonconformance
- Description of the nonconformance
- Any required approval signatures
- Method(s) for corrective action or description of the variance granted
- Schedule for completing corrective action

All affected project samples will be listed on a Nonconformance/Corrective Action Report. The Laboratory Project Manager will notify the Shaw Project Chemist of any laboratory nonconformance affecting the samples. Nonconformance/Corrective Action Reports will be submitted to Shaw as part of data packages. Corrective Action procedures for different types of analysis are presented in Tables 9 through 13.

8.1 Batch Corrective Action

Analytical laboratory processes are batch processes, and the batch is a basic unit for the frequency of some QC elements. A batch is a group of samples of similar matrix that behave similarly with respect to the procedures being employed. The following three types of batches can be identified at the analytical laboratory:

- Preparation batch
- Instrument batch
- Sample delivery group (SDG)

A preparation batch is a group of up to 20 field samples, which are prepared (e.g., extracted or digested) simultaneously or sequentially without interruption. Samples in each batch are of similar matrix (e.g., soil, sludge, liquid waste, and water), are treated in a similar manner, and are processed with the same lots of reagents. For organic compound analyses, each batch will contain a method blank, an LCS, and an MS/MSD pair. For inorganic compound analyses, each batch will contain a method blank, an LCS, an MS, and a sample duplicate. These QC check samples are not counted into the maximum batch size of 20.

An instrument batch is a group of samples, which are analyzed within the same analytical run sequence. If the continuous operation of an instrument is interrupted (e.g., shut down for maintenance, etc.), a new instrument batch must be started. The instrument batch includes an instrument blank, calibration check standards, extracts/digestates of the field samples, and QC check samples. The number of samples in the analytical batch is not limited, but the frequency of the calibration check standard and instrument blank analysis is mandated in each particular method.

For VOC analyses by GC or GC/MS, the preparation and instrument batch are the same, since the sample preparation (purge and trap) is performed as part of the instrument analysis. For these analyses, a batch is defined as a group of up to 20 field samples that are sequentially loaded on the instrument and analyzed as a single analytical run sequence. Laboratory QC check samples (i.e., method blank, an LCS, and an MS/MSD pair) will be analyzed as part of the batch in addition to 20 field samples, as well as the calibration standard per method requirements.

For Contract Laboratory Program analyses, an SDG is defined as a group of 20 or fewer samples within a project that are received over a period of 14 days or less. An SDG is primarily a reporting format and is not limited to sample receipt groups, preparation batches, or analytical batches.

Method QC acceptance criteria determine whether a method is performing within acceptable limits of precision and accuracy. There is a method component and a "matrix" component to this determination. The method component measures the performance of the laboratory analytical

processes during the sample analyses. The matrix component measures the method performance on a specific matrix. Some QC elements uniquely measure the laboratory component of method performance, but all QC elements measuring the matrix component, contain the method component.

Method blanks and LCSs uniquely measure the method performance. Matrix spikes, MSDs, laboratory sample duplicates, surrogate standards, and post-digestion spikes measure the matrix component of method performance.

8.2 Method Blank

The method blank measures laboratory-introduced contamination for the sample batch and batch corrective action is initiated when contamination is found. It may include re-analysis of the blank; re-analysis of the samples; re-preparation and re-analysis of the blank, QC, and samples; and assessment of the impact of the contamination on batch sample data. Although it is a goal to have no detected target analytes in the method blanks, analytes may be periodically detected in blanks due to the nature of the analysis or the reporting limit for the analyte. For example, methylene chloride, acetone, and 2-butanone may sometimes be found in blanks for VOC analyses and the phthalate esters may sometimes be found in the blanks for semivolatile organic compound analyses.

A method blank will be considered acceptable where target analytes are present at concentrations where the conditions are less than the following:

- One half of the PQLs
- 5 percent of the regulatory limits for these analytes
- 5 percent of the sample results for these analytes

If the method blank results do not meet these acceptance criteria, the laboratory will initiate corrective action.

The first step of corrective action is to assess the effect on the samples. For example, if an analyte is found only in the blank, but not in any of the associated samples, or if the target analyte in the blank is less than one twentieth the value in the sample, no corrective action is necessary.

If corrective action is required, the method blank and any samples containing the same contaminant will be re-analyzed. If the contamination remains, the contaminated samples of the batch would be re-extracted and re-analyzed with a new method blank and QC check samples.

8.3 Laboratory Control Sample

An LCS must meet the accuracy acceptance criteria for target analytes for the batch to be considered acceptable. If the target analytes are outside of the acceptance limits, corrective

action will be initiated. Corrective action will include re-extraction and re-analysis of the whole batch, including method blanks, samples, and QC check samples.

If MSs are not conducted, an LCS/LCD pair will be analyzed with each batch of samples. If the LCS/LCD are outside method acceptance criteria for accuracy and precision, the whole batch will be re-extracted and re-analyzed, including method blanks, samples, and QC check samples.

8.4 Matrix Spike and Matrix Spike Duplicate

An MS/MSD pair is included with each batch of samples for organic compound analyses and MS and laboratory sample duplicates are included with each batch of samples for inorganic compound analysis. These QC check samples allow evaluating the accuracy and precision of analysis and the influence of matrix effects.

Matrix spike data evaluation is more complex than blank or LCS data evaluation since MSs measure matrix effects in addition to sample preparation and analysis effects. Sample heterogeneity, lithological composition of soil, and presence of interfering chemical compounds often negatively affect precision and accuracy of analysis. If the native concentration of target analytes in the sample chosen for spiking is high relative to the spiking concentration, the differences in the native concentration between the unspiked sample and the spiked samples may contribute a significant error in the precision and accuracy. The accuracy and precision in this case are not representative of the true method and matrix performance.

If the accuracy of MS/MSD analysis is outside the acceptability limits for any target analyte, the LCS will be evaluated. If the LCS accuracy limits are met, the MS/MSD recovery problem will be identified as matrix effect and no further action will be required. If the LCS accuracy limits are not met, corrective action will be implemented, and the affected samples and associated QC samples will be re-prepared and re-analyzed.

If the MS/MSD or sample/sample duplicate pair fail in precision due to observed matrix interferences, sample inhomogeneity or the nature of the contaminant, corrective action will not be required, and the laboratory will make an appropriate notation in the case narrative.

8.5 Individual Sample Corrective Action

In addition to batch corrective action, individual samples within a batch may also require corrective action.

Re-extraction and re-analysis of individual samples will take place in the following situations:

- Surrogate standard recoveries are outside acceptability limits.
- Internal standard areas for GC/MS analyses are outside acceptability limits.
- Errors have been made during sample preparation, and results of analysis are not conclusive.

9.0 Data Management

This section describes the data management procedures for data review, verification, reporting, and validation.

9.1 Data Reduction, Verification, and Reporting

All analytical data generated by the laboratory in support of the SWDiv RAC projects will be reviewed prior to reporting to assure the validity of reported data. This internal laboratory data review process will consist of data reduction, three levels of documented review, and reporting. Review processes will be documented using appropriate checklist forms, or logbooks, that will be signed and dated by the reviewer.

9.1.1 Data Reduction

Data reduction involves the mathematical or statistical calculations used by the laboratory to convert raw data to the reported data. The laboratory will perform reduction of analytical data as specified in each of the appropriate analytical methods and laboratory SOPs. For each method, all raw data results will be recorded using method-specific forms or a standardized output from each of the various instruments.

All data calculations will be verified and initialed by personnel both generating and approving them. All raw and electronic data, notebook references, supporting documentation, and correspondence will be assembled, packaged, and stored for a minimum of 10 years for future use. All reports will be held client confidential. If the laboratory is unable to store project-related data for 10 years, then it is the responsibility of the laboratory to contact Shaw to make alternative arrangements.

9.1.2 Laboratory Data Verification and Review

The laboratory analyst who generates the analytical data will have the primary responsibility for the correctness and completeness of data. Each step of this verification and review process will involve the evaluation of data quality based on both the results of the QC data and the professional judgment of those conducting the review. This application of technical knowledge and experience to the evaluation of data is essential in ensuring that data of known quality are generated consistently. All data generated and reduced will follow well-documented in-house protocols.

9.1.2.1 Level 1. Technical (Peer) Data Review

Analysts will review the quality of their work based on an established set of guidelines, including the QC criteria established in each method, in this SAP, and as stated within the laboratory QA Manual. This review will, at a minimum, ensure that the following conditions have been met:

- Sample preparation information is correct and complete.
- Analysis information is correct and complete.
- Appropriate SOPs have been followed.
- Calculations are verified.
- There are no data transposition errors.
- Analytical results are correct and complete.
- Quality Control samples are within established control limits.
- Blanks and LCSs are within appropriate QC limits.
- Special sample preparation and analytical requirements have been met.

Documentation is complete, for example, any anomalies and holding times have been documented and forms have been completed.

9.1.2.2 Level 2. Technical Data Review

A supervisor or data review specialist whose function is to provide an independent review of data packages will perform this review. This review will also be conducted according to an established set of guidelines and will be structured to verify the following findings of Level 1 data review:

- All appropriate laboratory SOPs have been followed.
- Calibration data are scientifically sound, appropriate to the method, and completely documented.
- Quality control samples are within established guidelines.
- Qualitative identification of contaminants is correct.
- Manual integrations are justified and properly documented.
- Quantitative results and calculations are correct.
- Data are qualified correctly.
- Documentation is complete, for example, any anomalies and holding times have been documented and appropriate forms have been completed.
- Data are ready for incorporation into the final report.
- The data package is complete and complies with contract requirements.

The Level 2 review will be structured so that all calibration data and QC sample results are reviewed and all of the analytical results from at least 10 percent of the samples are checked back to the sample preparation and analytical bench sheets. If no problems are found with the data package, the review will be considered complete.

If any problems are found with the data package, an additional 10 percent of the sample results will be checked back to the sample preparatory and analytical bench sheets. This cycle will then be repeated either until no errors are found in the checked data set or until all data has been checked. All errors and corrections noted will be documented.

9.1.2.3 Level 3. Administrative Quality Assurance Data Review

The Laboratory QA Manager will review 10 percent of all data packages. This review should be similar to the review as provided in Level 2, except that it will provide a total overview of the data package to ensure its consistency and compliance with project requirements. All errors noted will be corrected and documented.

9.1.3 Data Reporting

This section details the requirements for data reporting and data package formats that will be provided by the laboratory.

9.1.3.1 Hard Copy Deliverables

All relevant raw data and documentation, including (but not limited to) logbooks, data sheets, electronic files, and final reports, will be maintained by the laboratory for at least 10 years. The laboratory will notify Shaw 30 days before disposal of any relevant laboratory records.

Shaw will maintain copies of all COC until receipt of the laboratory report. Laboratory reports will be logged in upon receipt and filed in chronological order. If necessary, based on project DQOs, the second copy of the report will be sent for third-party data validation.

Data packages will be prepared to meet the requirements for data package contents that are presented in Tables 14 and 15. The data deliverable requirements for this project will be 90 percent EPA Level III and 10 percent EPA Level IV (SWDiv, 2001a) for all groundwater samples collected during rebound testing and soil confirmation samples. Groundwater samples collected during system operation will be delivered in EPA Level III only. Data packages for waste characterization and vapor samples will require a standard laboratory package.

9.1.3.2 Electronic Deliverables

The electronic data deliverable (EDD) will be in ASCII format. The analytical laboratory will follow the requirements stated in the Laboratory Interface Document for the Analytical

Laboratory EDD. At project closeout, Shaw will submit a Navy Electronic Data Transfer System compatible electronic file to the Navy.

The laboratory will certify that the EDD and the hard copy reports are identical. Both the EDD and the hard copy will present results to two or three significant figures. For inorganic results, two significant figures will be used for results that are less than 10, and three significant figures will be used for results that are greater than 10. For organic results, one significant figure will be used for results that are less than 10, and two significant figures will be used for results that are greater than 10. The EDD for each SDG will be due at the same time as the hard copy, 14 days after the last sample of the SDG has been delivered to the laboratory.

Field information (e.g., date and time collected, sample identification, etc.) will be entered directly into the main database from the chain-of-custody form or uploaded from electronic files generated in the field.

9.2 Data Validation

At the direction of the navy, groundwater monitoring samples may be validated by an independent third party validation company per the requirements of 3EN2.1 (SWDiv, 2001a).

Soil confirmation samples will be validated by an independent third party validation company per the requirements of 3EN2.1 (SWDiv, 2001a). Samples collected for waste characterization will not be validated but will be reviewed by a Shaw Project Chemist (see Section 9.3). Data will be validated at 90 percent EPA Level III and 10 percent EPA Level IV. The validation will be in accordance with the EPA *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA, 2002), *Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA, 1999), and the QC criteria specified in this document. Data will be validated and flagged with the following data qualifiers:

- *J qualifier* denotes the analyte was positively identified, but the associated numerical value is estimated.
- *U qualifier* denotes the analyte was analyzed for, but not detected. The associated numerical value is at or below the reporting limit.
- *R qualifier* denotes the data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria.

9.3 Data Review

The Project Chemist will review the laboratory data packages for, groundwater, soil, and waste samples to establish that holding times for extraction and analysis and internal QC check requirements have been met and to establish data usability.

9.4 Data Quality Assessment Report

Based on data validation/review, the Project Chemist will determine if the project DQOs have been met, and will calculate data completeness. To reconcile the collected data with project DQOs and to establish and document data usability, the Project Chemist will prepare a Data Quality Assessment Report (DQAR). The DQAR will cover the following topics:

- Implementation of sampling design and analysis according to the approved SAP (or sample completeness and representativeness)
- Proper frequency of field QC samples and the adequacy of field decontamination procedures
- Accuracy and precision of the data collected
- Data comparability, if appropriate
- Data usability for project decisions

The DQAR will be included in the Final Project Report.

10.0 Quality Assurance Oversight

The QA oversight for this project will include system audits of field activities and of the laboratory subcontracted by the Navy to perform the analyses.

10.1 Laboratory Assessment and Oversight

Systems and performance audits will be carried out by Shaw as independent assessments of sample collection and analysis procedures. The systems audit is a qualitative review of the overall sampling or measurement system, while the performance audit is a quantitative assessment of a measurement system.

Audit results are used to evaluate if the analytical laboratories are able to produce data that fulfill the objectives established for the program and identify any areas requiring corrective action.

10.1.1 Naval Facilities Engineering Service Center Laboratory Audits

The laboratories will successfully complete a NFESC laboratory audit. A NFESC audit conducted in the past for a different project is an acceptable qualification.

10.1.2 Technical Systems Audits

A technical systems audit is an on-site, qualitative review of the sampling or analytical system to ensure that the activity is being performed in compliance with the SAP specifications, and that the collected data fulfill the project DQOs.

Laboratories performing under this program may be required to have a pre-qualification (or periodic) systems audit performed by Shaw, depending on the scope of services to be provided, past performance, or other factors indicating a need to evaluate quality in this manner. Subsequently, the laboratories will respond to and address any project or technical concerns resulting from the audits. A follow-up audit may be performed to verify resolution of findings and observations, as well as review the corrective measures taken. Laboratories found deficient will not be used on a project until the deficiencies are corrected and the laboratory accepted. Laboratories previously qualified for the types of testing to be performed on the project will not require pre-qualification. That is, if pre-qualification has been within the past year and the work performed has been acceptable.

The laboratory systems audit results will be used to review laboratory operations and to ensure that any outstanding corrective actions have been addressed.

A laboratory systems audit will include the following critical areas:

- Sample custody procedures
- Calibration procedures and documentation
- Completeness of data forms, notebooks, and other reporting requirements
- Data review procedures
- Storage, filing, and record keeping procedures
- Quality control procedures and documentation
- Operating conditions of facilities and equipment
- Documentation of training and maintenance activities
- Systems and operations overview
- Security of laboratory automated systems

After the audit, a debriefing session will be held for all participants to discuss the preliminary audit results. The auditor will then complete the audit evaluation and submit to the Project Manager and the laboratory, an audit report including observations of the deficiencies and the necessary recommendations for corrective actions. Follow-up audits will be performed prior to completion of the project to ensure corrective actions have been taken.

10.1.3 Performance Evaluation Audits

Performance audits quantitatively assess the data produced by a measurement system. A performance audit involves submitting project-specific performance evaluation samples for analysis for each analytical method used in the project. The performance audit answers questions about whether the measurement system is operating within control limits and whether the data produced will meet the project DQOs. If there is a concern about the laboratory performance, or per the Navy request, Shaw will administer performance evaluation samples for the target analytes.

Review of performance evaluation results, include the following elements:

- Correct identification and quantitation of the performance evaluation sample analytes
- Accurate and complete reporting of the results
- Measurement system operation within established acceptance limits for accuracy

The concentrations reported for the performance evaluation samples will be compared to the known or expected concentrations spiked in the samples. The percent recovery will be calculated and the results assessed according to the acceptance limits, which are based on inter-laboratory studies. If the accuracy criteria are not met, the cause of the discrepancy will be investigated, and a second performance evaluation sample will be submitted. The performance evaluation sample results review will be documented in a report to the Project Manager.

10.1.3.1 Performance Evaluation Sample Programs

The off-site laboratory will participate in the EPA performance evaluation Water Supply and Water Pollution Studies programs or equivalent programs for state certifications. Satisfactory performance in these performance evaluation programs also demonstrates proficiency in methods used to analyze project samples. The laboratory will document the corrective actions to unacceptable performance evaluation results to demonstrate resolution of the problems.

10.1.3.2 Magnetic Tape Audits

Magnetic tape audits involve the examination of the electronic media used in the analytical laboratory to acquire, report, and store data. These audits are used to assess the authenticity of the data generated, and assess the implementation of good automated laboratory practices. Shaw may perform magnetic tape audits of the off-site laboratory when warranted by the project performance evaluation sample results, or by other circumstances.

10.2 Field Audits

The Shaw and the Navy QA Officers may schedule audits of field activities at any time to evaluate the execution of sample collection, identification, and control in the field. The audit will also include observations of COC procedures, field documentations, instrument calibrations, and field measurements.

Field documents and COCs will be reviewed to ensure that all entries are printed or written in indelible ink, dated, and signed.

Sampling operations will be reviewed and compared to this SAP and other applicable SOPs (IT, 2000b). The auditor will verify that the proper sample containers are used, the preservatives are added or are already present in the container, and the documentation of the sampling operation is adequate.

Field measurements will be reviewed by random spot-checking to determine that the instrument is within calibration, that the calibration is done at the appropriate frequency, and that the sensitivity range of the instrument is appropriate for the project.

Audit findings will be documented in a report to the Shaw Program QC Manager and the Project Manager. Corrective action will be implemented as necessary.

10.3 Sampling and Analysis Plan

When circumstances arise that impact the original project DQOs, such as a significant change in work scope, this SAP will be revised or amended according to the requirements specified in Environmental Work Instruction 3EN2.2 (SWDiv, 2001b). The modification process will be based on EPA guidelines (EPA, 2000) and direction from the Navy and QA Officer.

11.0 References

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U.S. Navy Southwest Division, 2001c, *Environmental Work Instruction 3EN2.3—Laboratory Quality Assurance Program*, November.

U.S. Navy Southwest Division, 2001d, *Preliminary Remediation Criteria and Closure Strategy for Petroleum-Contaminated Sites at Alameda Point*, Alameda, California, May 16th.

Figures

| | | | | | | | | | |
|-------|----------|--------|-----------|---------|------------|---------|-------------|---------|---------------------------|
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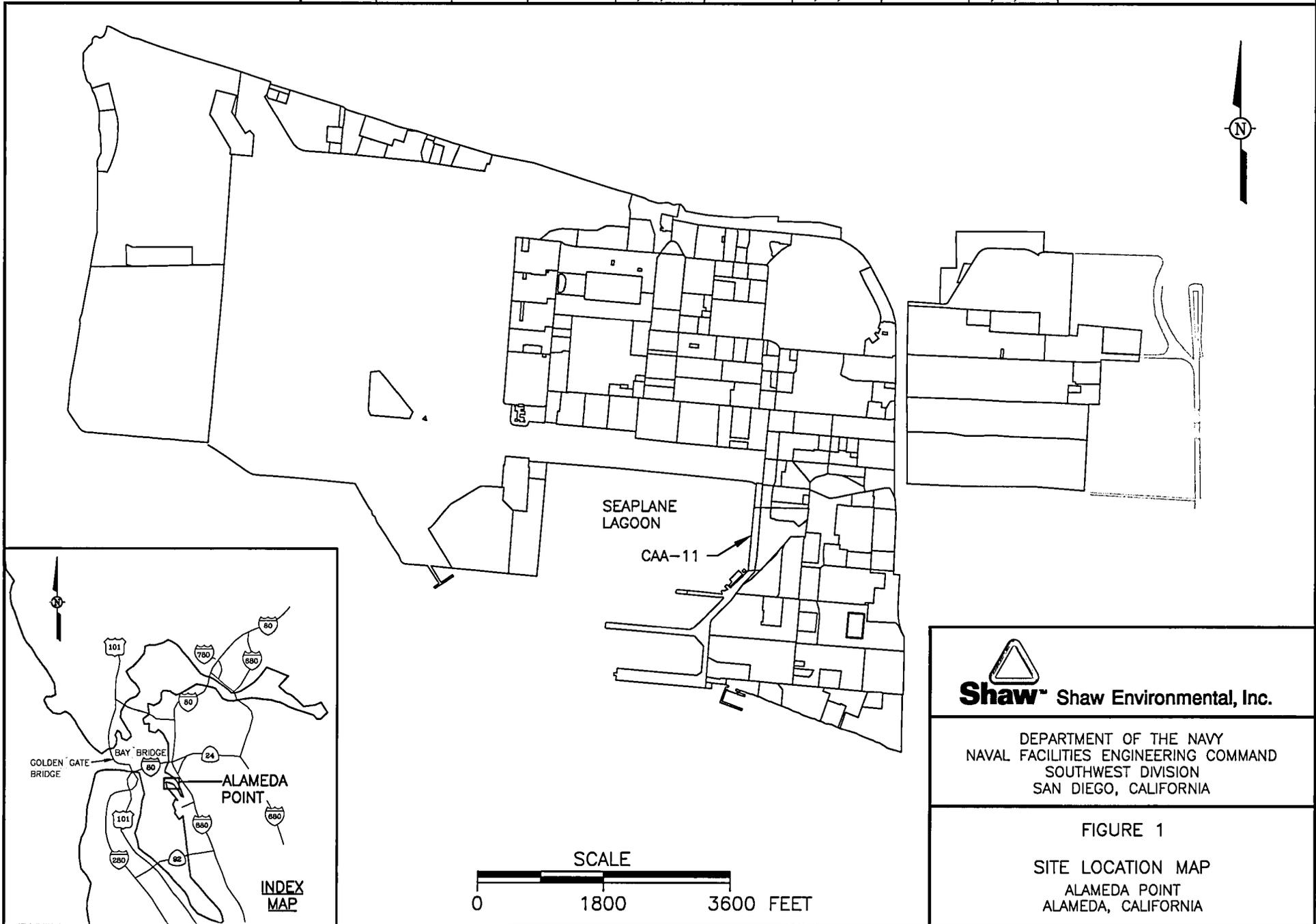
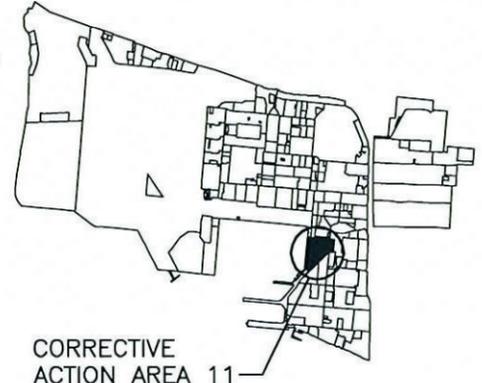
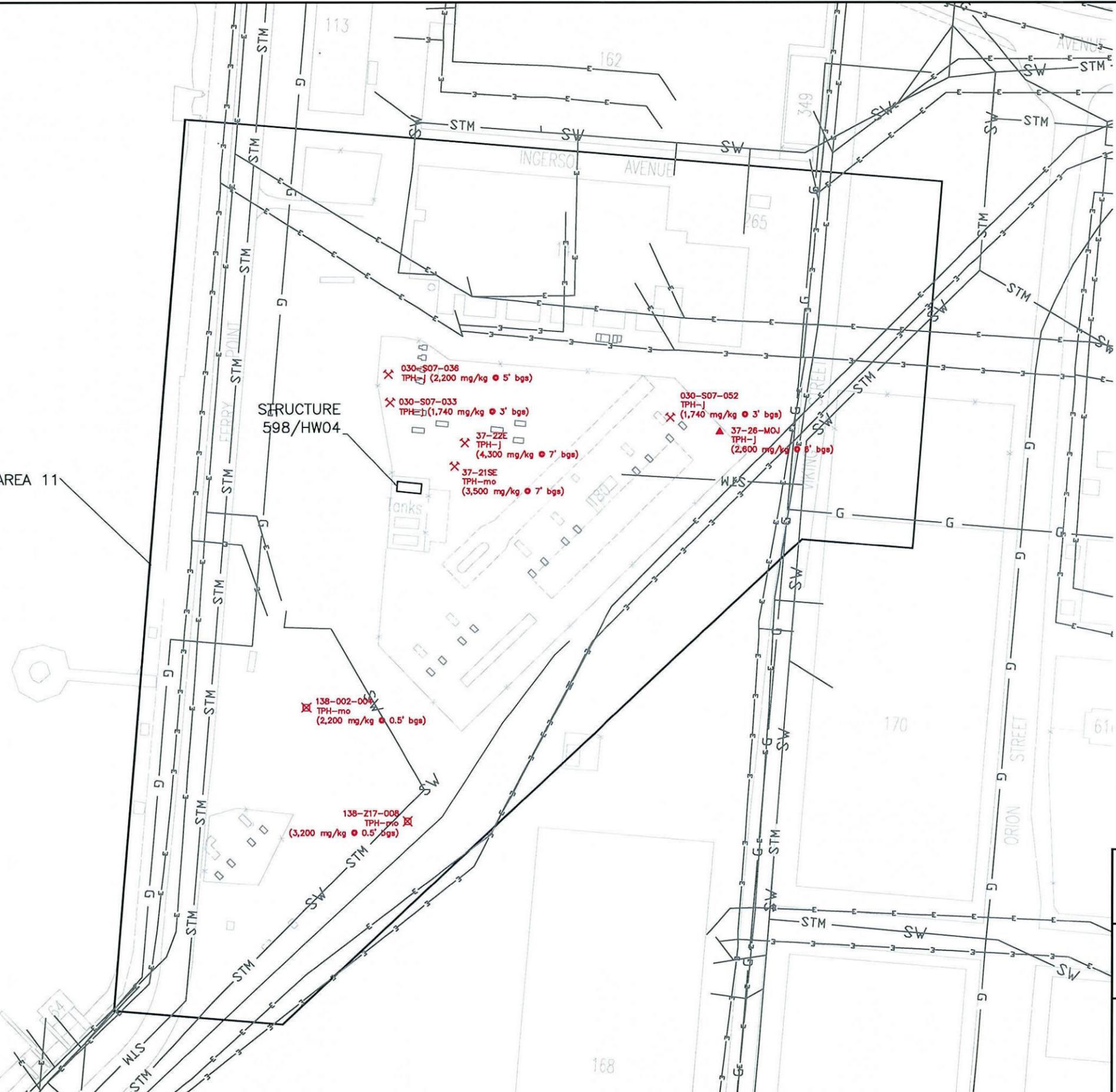


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CORRECTIVE ACTION AREA 11

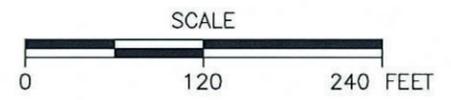


KEY PLAN

- LEGEND
- SOIL SAMPLE LOCATION
 - SOIL SAMPLE FROM AN EXCAVATION
 - GEOPROBE

NOTE:
 LOCATIONS WITH TPH CONCENTRATIONS EXCEEDING PRC DENOTED IN RED

- COMM --- COMMUNICATION LINES
- E --- ELECTRICAL LINES
- STM --- STEAM LINES
- G --- GAS LINES
- --- FUEL LINES
- SW --- SANITARY SEWER LINE
- SS --- STORM SEWER LINE
- IW --- INDUSTRIAL WASTE LINE
- T --- TELEPHONE LINE
- CTV --- CABLE TV LINE



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FIGURE 3
 PROPOSED SOIL EXCAVATION LOCATIONS
 CAA-11, AREA 37
 ALAMEDA POINT
 ALAMEDA, CALIFORNIA

DRAWING NUMBER 843778-B106

APPROVED BY JM 7/20/04

CHECKED BY JP 7/20/04

DRAWN BY SCHAEFFER 7/20/04

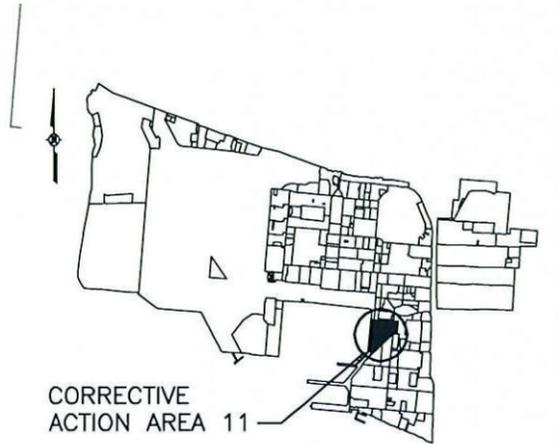
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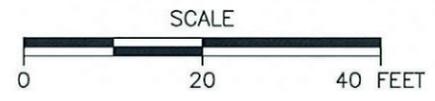


BUILDING 14



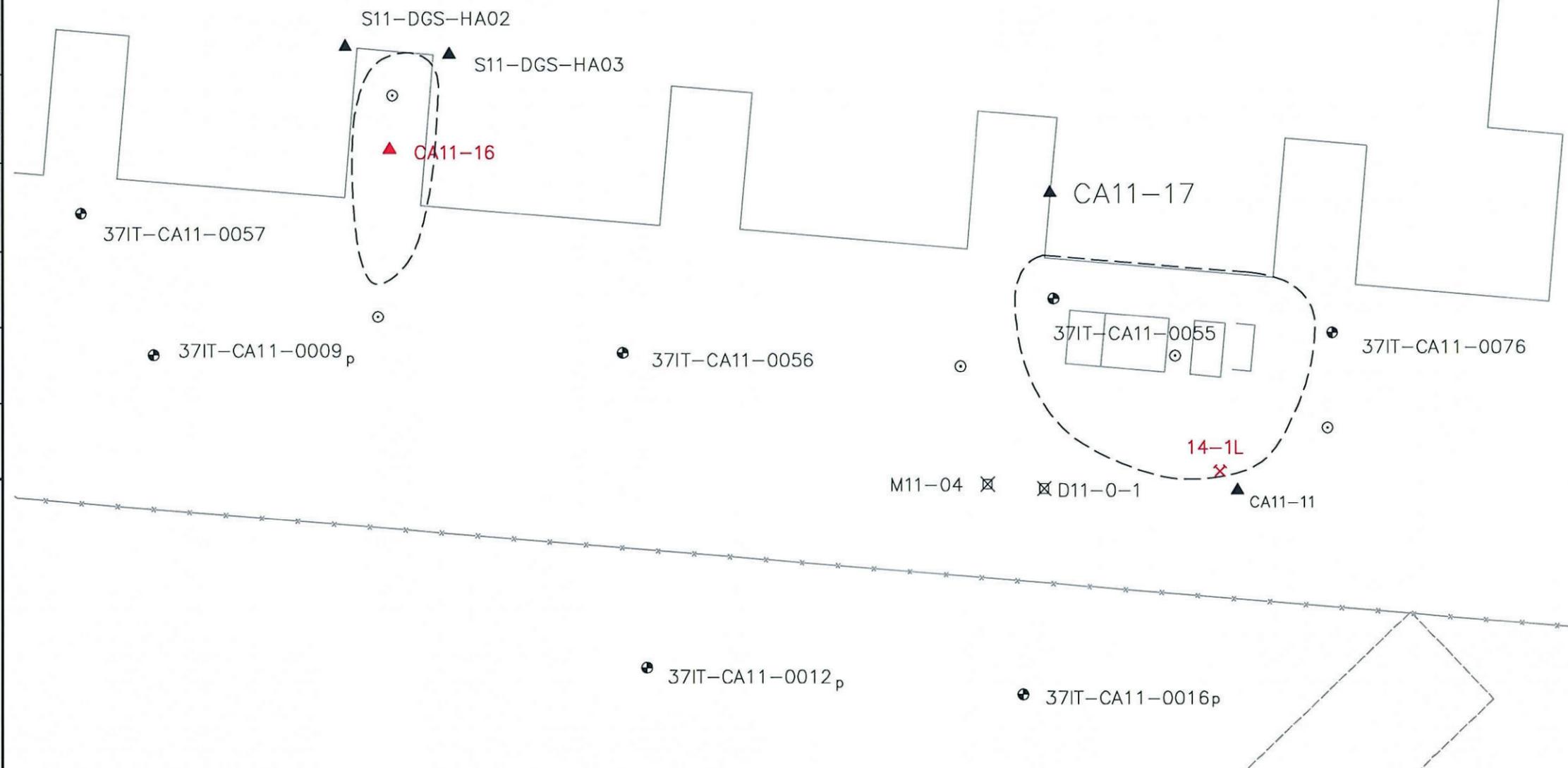
CORRECTIVE ACTION AREA 11
KEY PLAN

- LEGEND
- ▲ GEOPROBE
 - ⊗ SOIL SAMPLE FROM AN EXCAVATION
 - - - GROUNDWATER TPH CONCENTRATION EXCEEDS 1.4 mg/L
 - SOIL BORING LOCATION (P) PIEZOMETER INSTALLED AT LOCATION
 - ⊗ EXISTING MONITORING WELL
 - ⊙ PROPOSED MONITORING WELL
 - UST [] SUSPECTED PRIMARY FORMER POINT SOURCE
 - - - FENCE



NOTES:

- TPH REPRESENTS SUM OF INDIVIDUAL TPH FRACTIONS AS DEFINED IN PETROLEUM STRATEGY MEMO (NAVY, 2001).
- LOCATIONS WITH TPH CONCENTRATIONS EXCEEDING PRC DENOTED IN RED

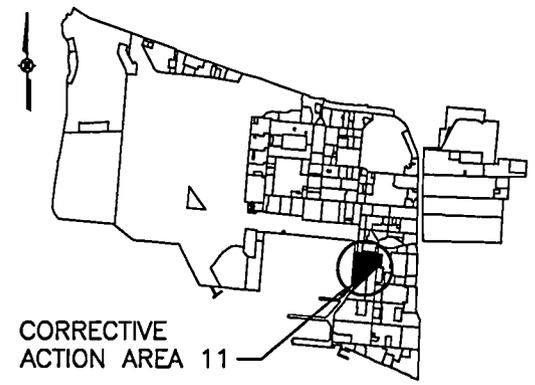
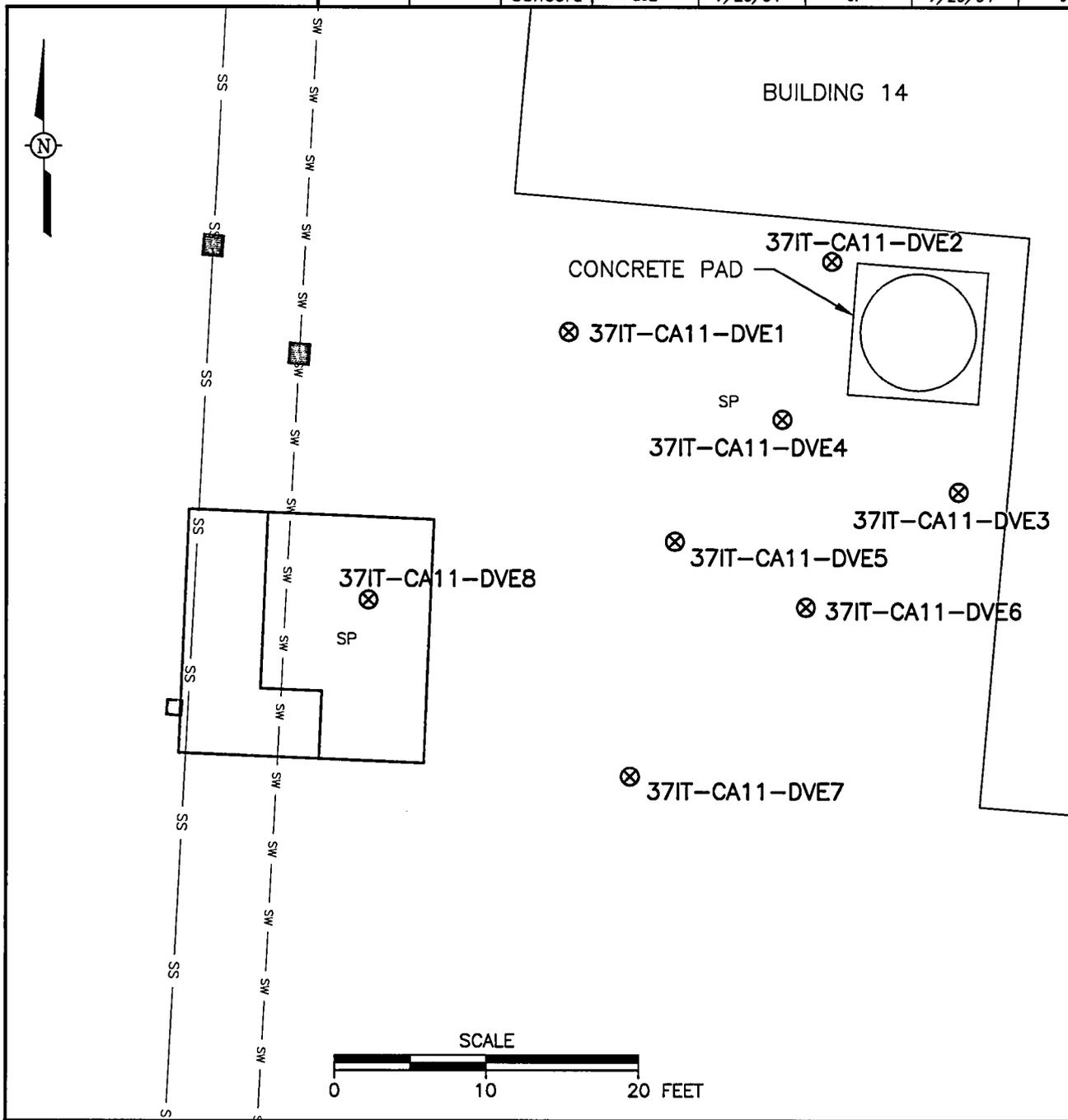


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FIGURE 4
PROPOSED MONITORING WELL LOCATIONS
CAA-11, AREA 37
ALAMEDA POINT
ALAMEDA, CALIFORNIA

| | | | | | | | | | |
|-------|-------|---------|----------|---------|------------|---------|-------------|---------|----------------|
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KEY PLAN

LEGEND

| | |
|--------|------------------------------|
| — SS — | SANITARY SEWER |
| — SW — | STORM SEWER |
| ⊗ | DVE WELL INSTALLED BY CTO-37 |
| SP | SEPARATE PHASE |

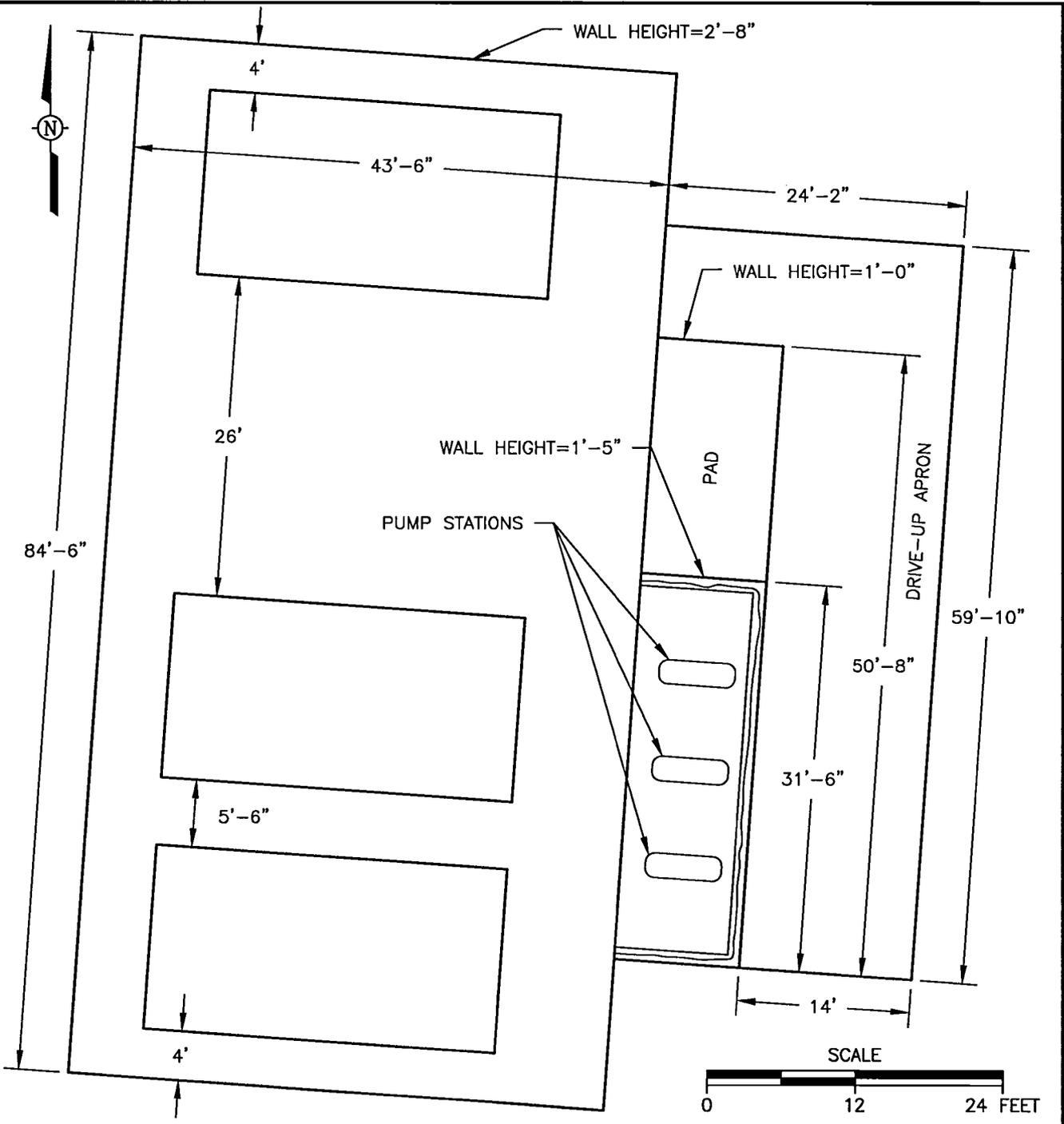
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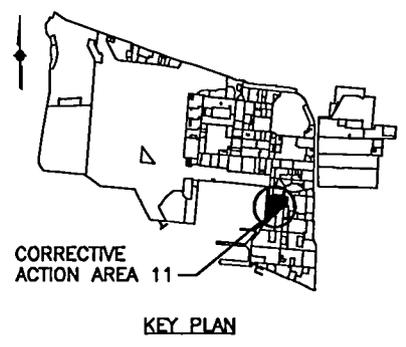
FIGURE 5

DVE WELL LOCATIONS
 CAA-11, BUILDING 14
 ALAMEDA POINT
 ALAMEDA, CALIFORNIA

| | | | | | | |
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| --- | --- | Concord | SCHAEFFER | JP | JM | 843778-A55 |
| | | | 7/20/04 | 7/20/04 | 7/20/04 | |



NOTE:
ALL MEASUREMENTS ARE APPROXIMATIONS AND
ARE IN FEET AND INCHES.





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FIGURE 6

DETAILS OF STRUCTURE 598/HW04
CAA-11, AREA 37
ALAMEDA POINT
ALAMEDA, CALIFORNIA

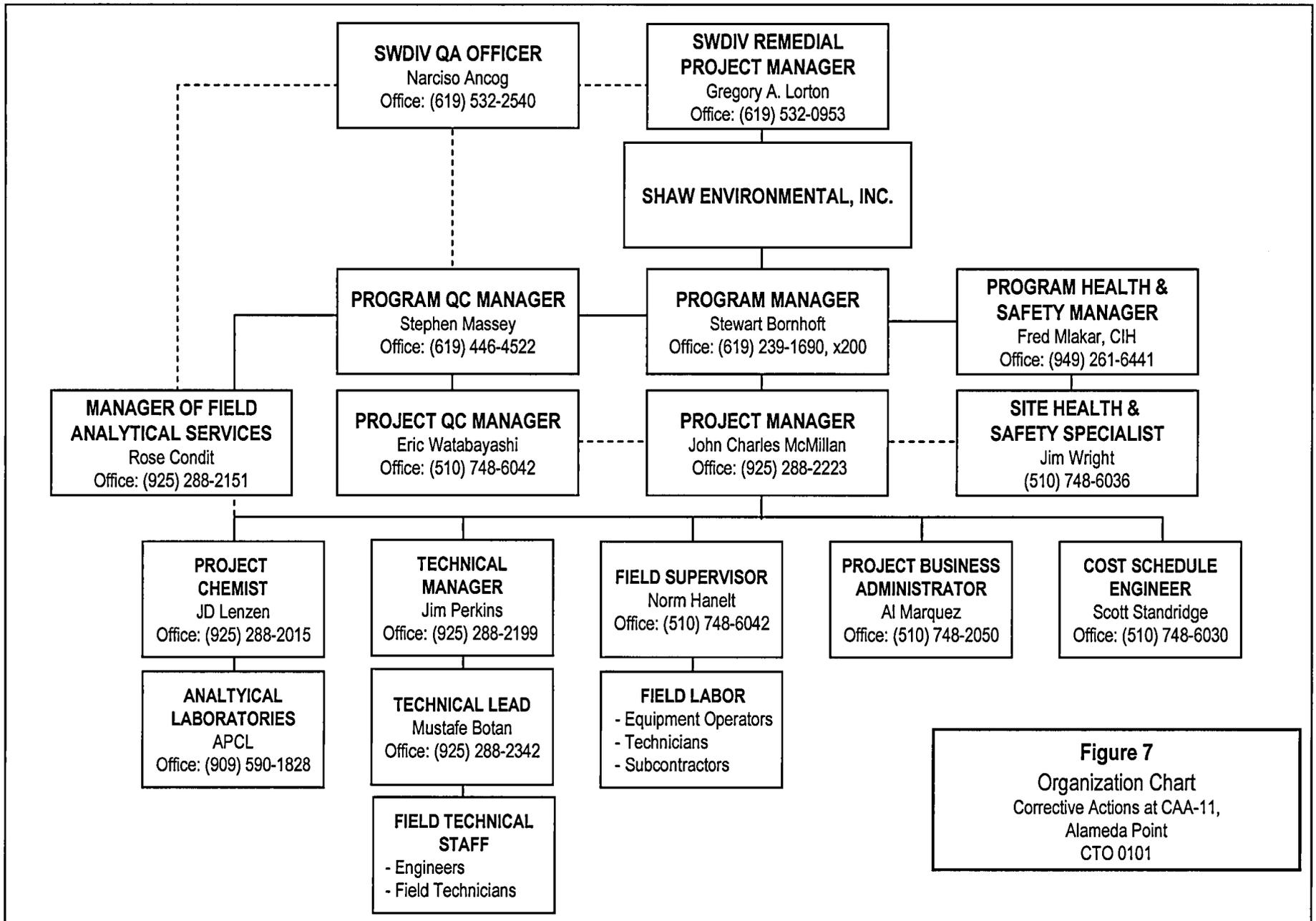


Figure 7
Organization Chart
Corrective Actions at CAA-11,
Alameda Point
CTO 0101

Tables

(Notes to Tables Follow Table 15)

Table 1
PRC for TPH and Associated Hydrocarbons for CAA-11

| Constituents of Concern | Soil | | Groundwater | | |
|--------------------------------------|-------------------------|-------------------------|------------------------|--------------------------------------------------------------------------------------|----------------------------------------------------------|
| | Reporting Limit (mg/kg) | Residential PRC (mg/kg) | Reporting Limit (mg/L) | (Marine Ecological Receptors) Storm Drain Exposure Pathway, AWQC (mg/L) ¹ | Potential Drinking Water Source, MCL (mg/L) ² |
| Total Petroleum Hydrocarbons | | | | | |
| TPH as gasoline (purgeable fuels) | 0.5 | 1030 | 0.05 | — | — |
| TPH as diesel (extractable fuels) | 10 | 1380 | 0.05 | — | — |
| TPH as motor oil (extractable fuels) | 100 | 1900 | 0.30 | — | — |
| Total Petroleum Hydrocarbons | 100 | — | 1.0 | 1.4 | — |
| Associated Constituent | | | | | |
| Benzene | 0.005 | 0.65 | 0.001 | 0.7 | 0.001 |
| Ethylbenzene | 0.005 | 230 | 0.001 | 0.43 | 0.7 |
| Toluene | 0.005 | 520 | 0.001 | 5 | 0.15 |
| Xylenes (Total) | 0.005 | 210 | 0.005 | — | 1.75 |
| Methyl-tertiary-butyl-ether (MtBE) | 0.05 | 17 | 0.005 | 8.0 | 0.013 |
| Lead | 1.0 | 221 | 0.005 | 0.0081 | 0.015 |

Source:

“—” Denotes that no value has been established for that chemical of concern.

AWQC = Ambient Water Quality Criteria

MCL = Maximum Contaminant Level

mg/kg = milligrams per kilogram

PRC = Preliminary Remediation Criteria

PRC for the soil and groundwater COC are in accordance with Tables 1 and 3 of the correspondence, dated May 16, 2001, from The Department of the Navy, Southwest Division to RWQCB, entitled “Preliminary Remediation Criteria and Closure Strategy for Petroleum-Contaminated Sites at Alameda Point, Alameda, California.”

Note:

¹AWQC will be used as the initial treatment goal for dissolved phase hydrocarbon removal at CAA-11.

²MCLs are the potential final remedial goals for the groundwater at CAA-11 due to its beneficial use as a potential drinking water source.

Table 2
Project Personnel and Chemical Data Collection Responsibilities

| Position | Responsibility |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| U.S. Navy QAO | <ul style="list-style-type: none"> • Reviews and approves SAPs and SAP Addendums. • Provides governmental oversight of the Shaw QA Program. • Provides quality-related directives through Contracting Officer's Technical Representative. • Provides technical and administrative oversight of Shaw surveillance audit activities. • Acts as point of contact for all matters concerning QA and the Navy's Laboratory QA Program. • Prepares governmental budget estimates for all QA functions included in Shaw contracts. • Coordinates training on matters pertaining to generation and maintenance of quality of data. • Authorized to suspend project execution if QA requirements are not adequately followed. |
| Program Chemist | <ul style="list-style-type: none"> • Reviews and approves the SAP. • Guides the selection of subcontract analytical laboratories. • Conducts field and laboratory audits. • Serves as a point of contact for the U.S. Navy QAO. • Develops corrective action as required. • Serves as a technical advisor to the project. |
| Project Chemist | <ul style="list-style-type: none"> • Develops the project data quality objectives and prepares the SAP. • Selects qualified subcontract laboratories. • Implements chemical data QC procedures and performs auditing of field performance. • Reviews laboratory data prior to use. • Coordinates data validation of laboratory data. • Reviews data validation report. • Prepares the appropriate sections of the report summarizing the project activities. |
| Field Technician | <ul style="list-style-type: none"> • Performs all sampling in accordance with approved SAP. • Ensures that field QC samples are collected as specified in this SAP. • Completes field documentation. • Coordinates laboratory and field sampling activities. • Implements field corrective actions as required. |

QA denotes quality assurance.

QAO denotes Quality Assurance Officer.

QC denotes quality control.

SAP denotes Sampling and Analysis Plan.

**Table 3
Summary of Field Sampling and Analysis**

| Location | Number of Field Samples | Number of QC Samples | Analysis | Description |
|-------------------------------------------------|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Shallow Excavation – Area 37 | | | | |
| Shallow Excavation Soil Sampling | 5 (4-sidewall & 1- bottom) | 1 field duplicate per 10 samples 1 MS/MSD pair per 20 samples | TPH as diesel and motor oil (EPA 8015B) | One sample will be taken per sidewall and bottom at each excavation location. |
| Plume Evaluation – Building 14 | | | | |
| Groundwater Sampling – New Wells - Baseline | 5 | 1 trip blank per sampling event 1 field duplicate per 10 samples 1 MS/MSD pair per 20 samples | TPH as diesel and motor oil (EPA 8015B) VOCs (EPA 8260B) | Baseline groundwater samples collected after development from 5 newly installed wells |
| Groundwater Sampling – One Year of Monitoring | 5 per event | 1 trip blank per sampling event 1 field duplicate per 10 samples 1 MS/MSD pair per 20 samples | TPH as diesel and motor oil (EPA 8015B) VOCs (EPA 8260B) | Samples will be collected from all 5 wells monthly for the first 3 months and quarterly for three quarters |
| DVE Progress Monitoring – Building 14 | | | | |
| Groundwater Sampling – Existing DVE Wells | To be determined | 1 trip blank per sampling event | TPH as diesel and motor oil (EPA 8015B) | Wells containing no free-phase petroleum hydrocarbons will be samples monthly for 3 months, then quarterly up to three quarters. |
| Pad Removals – Structure 598/HW-04 | | | | |
| Bottom Soil Sampling (If Necessary) | One per 20 feet x 20 feet area | 1 field duplicate per 10 samples 1 MS/MSD pair per 20 samples | TPH as diesel and motor oil (EPA 8015B) VOCs (EPA 5035/8260B) | One per 20 feet x 20 feet area of pad area or excavation bottom. |
| Shallow Excavation Soil Sampling (If Necessary) | One per 20 feet of sidewall, minimum one per sidewall | 1 field duplicate per 10 samples 1 MS/MSD pair per 20 samples | TPH as diesel and motor oil (EPA 8015B) VOCs (EPA 5035/8260B) | One sample will be taken per approximate 20 feet of sidewall, minimum of one per cardinal direction. |

Table 3 (Continued)
Summary of Field Sampling and Analysis

| Location | Number of Field Samples | Number of QC Samples | Analysis | Description |
|---------------------------|-------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Waste Sampling | | | | |
| Waste Soil/ Wastewater | As necessary | None | TPH as gasoline (EPA 8015B) TPH as diesel and motor oil (EPA 8015B) VOCs (EPA 8260B) CCR Title 22 Metals (EPA 6010B/700A) STLC (WET and EPA 6010B) TCLP (EPA 1311/6010B) | Analysis and frequency per the direction of the Transportation and Disposal Coordinator and receiving facility requirements. The analysis shown may change. |

DVE denotes dual vacuum extraction.

EPA denotes U.S. Environmental Protection Agency.

MS/MSD denotes matrix spike/matrix spike duplicate.

QC denotes quality control.

TPH denotes total petroleum hydrocarbon.

VOC denotes volatile organic compound.

CCR denotes California Code of Regulation.

STLC denotes soluble threshold limit concentration.

TCLP denotes toxicity characteristic leaching procedure.

WET denotes

Table 4
Sample Containers, Preservatives, and Holding Times

| Analytes | Method | Container ^(a) | Preservative | Holding Time |
|---------------------------------------|------------------------|------------------------------------------------------------------------|-------------------------------------------|---------------------------------------------------------------|
| Soil | | | | |
| VOCs | EPA 5035/8260B | 3 EnCore® devices or equivalent | Cool at 4±2°C | 48 hours for unpreserved 14 days for preserved |
| TPH as diesel and motor oil | EPA 8015B | 4 or 8 ounce glass jar with Teflon®-lined lid, or capped sample sleeve | Cool at 4±2°C | 14 days for extraction and 40 days for analysis |
| SVOCs | EPA 8270C | 4 or 8 ounce glass jar with Teflon®-lined lid, or capped sample sleeve | Cool at 4±2°C | 14 days for extraction and 40 days for analysis |
| Metals | EPA 6010B/7000A | 4 or 8 ounce glass jar with Teflon®-lined lid, or capped sample sleeve | Cool at 4±2°C | 180 days for all metals except mercury 28 days for mercury |
| Water | | | | |
| VOCs | EPA 8260B | Three 40-mL vials, Teflon™-lined septum | HCl to pH<2 Cool at 4±2°C | 14 days |
| TPH as gasoline | EPA 8015B | Two 40-mL vials, Teflon™-lined septum | HCl to pH<2 Cool at 4±2°C | 14 days |
| TPH as jet fuel, diesel and motor oil | EPA 8015B | Two 1-liter amber bottles, Teflon™-lined lid | Cool at 4±2°C | 7 days before extraction, 40 days after extraction |
| SVOCs | EPA 625/ 8270C | Two 1-liter amber bottles, Teflon™-lined lid | Cool at 4±2°C | 7 days before extraction, 40 days after extraction |
| Metals | EPA 6010B/7000A series | One 500-mL HDPE | HNO ₃ to pH<2 Cool at 4±2°C | 180 days for all metals except mercury 28 days for mercury |

(a) Additional sample containers will be provided for matrix spike/matrix spike duplicate analyses.

HCl - hydrochloric acid

HDPE - high-density polyethylene

HNO₃ - nitric acid

Table 5
Reporting Limits, EPA Method 8260B (Volatile Organic Compounds)

| Compound Name | Soil, µg/kg | Water, µg/L |
|--------------------------------------|-------------|--------------------|
| Benzene | 5.0 | 0.5 ^(a) |
| Bromobenzene | 5.0 | 0.5 |
| Bromochloromethane | 5.0 | 0.5 |
| Bromodichloromethane | 5.0 | 0.5 |
| Bromoform | 10 | 0.5 |
| Bromomethane | 5.0 | 0.5 |
| n-Butylbenzene | 5.0 | 0.5 |
| sec-Butylbenzene | 5.0 | 0.5 |
| tert-Butylbenzene | 5.0 | 0.5 |
| Carbon Tetrachloride | 5.0 | 0.5 |
| Chlorobenzene | 5.0 | 0.5 |
| Chloroethane | 10 | 0.5 |
| Chloroform | 5.0 | 0.5 |
| Chloromethane | 10 | 0.5 |
| 2-Chlorotoluene | 5.0 | 0.5 |
| 4-Chlorotoluene | 5.0 | 0.5 |
| Dibromochloromethane | 5.0 | 0.5 |
| Dibromo-3-chloropropane (DBCP) | 5.0 | 2.0 |
| Dibromomethane | 5.0 | 0.5 |
| Dichlorodifluoromethane | 10 | 0.5 |
| Dichloromethane (Methylene Chloride) | 5.0 | 5.0 |
| 1,2-Dichlorobenzene | 5.0 | 0.5 |
| 1,2-Dichloroethane | 5.0 | 0.5 |
| 1,3-Dichlorobenzene | 5.0 | 0.5 |
| 1,2-Dichloropropane | 5.0 | 0.5 |
| 1,3-Dichloropropane | 5.0 | 0.5 |
| 1,4-Dichlorobenzene | 5.0 | 0.5 |
| 2,2-Dichloropropane | 5.0 | 0.5 |
| 1,1-Dichloroethane | 5.0 | 0.5 |
| 1,1-Dichloroethene | 5.0 | 0.5 |
| 1,1-Dichloropropene | 5.0 | 0.5 |

Table 5 (Continued)
Reporting Limits, EPA Method 8260B (Volatile Organic Compounds)

| Compound Name | Soil, µg/kg | Water, µg/L |
|--------------------------------|-------------|-------------|
| 1,2-Dibromoethane (EDB) | 5.0 | 2.0 |
| trans 1,2-Dichloroethene | 5.0 | 0.5 |
| cis 1,2-Dichloroethene | 5.0 | 0.5 |
| Di-Isopropyl Ether (DIPE) | 5.0 | 0.5 |
| Ethylbenzene | 5.0 | 0.5 |
| Hexachlorobutadiene | 5.0 | 0.5 |
| Isopropylbenzene (cumene) | 5.0 | 0.5 |
| 4-Isopropyltoluene | 5.0 | 0.5 |
| Methyl-tert-butyl ether (MTBE) | 5.0 | 0.5 |
| Napthalene | 5.0 | 0.5 |
| n-Propylbenzene | 5.0 | 0.5 |
| Styrene | 5.0 | 0.5 |
| Tertiary Butyl Alcohol (TBA) | 50 | 50 |
| Toluene | 5.0 | 0.5 |
| Trichloroethene (TCE) | 5.0 | 0.5 |
| Trichlorofluoromethane | 5.0 | 0.5 |
| 1,1,1,2-Tetrachloroethane | 5.0 | 0.5 |
| 1,1,1-Trichloroethane | 5.0 | 0.5 |
| 1,1,2,2-Tetrachloroethane | 5.0 | 0.5 |
| Tetrachloroethene (PCE) | 5.0 | 0.5 |
| 1,1,2-Trichloroethane | 5.0 | 0.5 |
| 1,2,3-Trichlorobenzene | 5.0 | 0.5 |
| 1,2,3-Trichloropropane | 5.0 | 0.5 |
| 1,3,5-Trimethylbenzene | 5.0 | 0.5 |
| 1,2,4-Trichlorobenzene | 5.0 | 0.5 |
| 1,2,4-Trimethylbenzene | 5.0 | 0.5 |
| M&p-Xylenes, o-Xylene | 5.0 | 0.5 |
| Vinyl Chloride | 10 | 1.0 |
| Carbon Disulfide | 5.0 | 1.0 |
| Acetone | 50 | 50 |
| 2-Butanone (MEK) | 50 | 50 |
| 4-Methyl-2-Pentanone (MIBK) | 50 | 50 |
| 2-Hexanone | 50 | 50 |

(a) A lower reporting limit can be achieved if analyte concentration is reported to MDL.

Table 6
Reporting Limits, EPA Method 8015B (Nonhalogenated Organics Using GC/FID)

| Compound Name | Soil, mg/kg | Water, mg/L |
|----------------------------------------------------------------------------------------------------|--------------------|--------------------|
| Gasoline Range Organics, calculated as gasoline, carbon range C ₆ to C ₁₀ | 0.5 | 0.05 |
| Jet Fuel Range Organics, calculated as JP-4, carbon range C ₈ to C ₁₃ | 0.5 | 0.05 |
| Diesel Range Organics, calculated as diesel fuel, carbon range C ₁₀ to C ₂₄ | 10 | 0.05 |
| Motor Oil Range Organics, calculated as motor oil, carbon range C ₂₄ to C ₃₆ | 100 | 0.10 |

mg/kg denotes milligram per kilogram.
mg/L denotes milligram per liter.

Table 7
Reporting Limits, Metal Analyses

| Metal | Soil, mg/kg | Water, µg/L |
|----------------------------------------------|--------------------|--------------------|
| EPA Method 6010B (ICP) | | |
| Antimony (Sb) | 10 | 50 |
| Arsenic (As) | 10 | 50 |
| Barium (Ba) | 10 | 10 |
| Beryllium (Be) | 0.5 | 2.0 |
| Cadmium (Cd) | 0.5 | 2.0 |
| Chromium (Cr) | 5.0 | 5.0 |
| Cobalt (Co) | 5.0 | 10 |
| Copper (Cu) | 5.0 | 10 |
| Lead (Pb) | 1.0 | 10 |
| Manganese (Mn) | 2.0 | 10 |
| Molybdenum (Mo) | 5.0 | 50 |
| Nickel (Ni) | 5.0 | 20 |
| Selenium (Se) | 5.0 | 20 |
| Silver (Ag) | 5.0 | 10 |
| Thallium (Tl) | 10 | 2.0 |
| Vanadium (V) | 5.0 | 50 |
| Zinc (Zn) | 2.0 | 20 |
| EPA 7471A/7470 (Cold Vapor Technique) | | |
| Mercury (Hg) | 0.2 | 0.2 |

Table 8
Reporting Limits, EPA Method 8270C (Semivolatile Organic Compounds)

| Compound Name | Soil, µg/kg | Water, µg/L |
|------------------------------|-------------|-------------|
| Bis (2-chlorethyl)ether | 330 | 10 |
| 2-Chlorophenol | 330 | 10 |
| 1,3-Dichlorobenzene | 330 | 10 |
| 1,4-Dichlorobenzene | 330 | 10 |
| 1,2-Dichlorobenzene | 330 | 10 |
| 2-Methylphenol | 330 | 10 |
| Bis (2-chloroisopropyl)ether | 330 | 10 |
| 4-Methylphenol | 330 | 10 |
| N-Nitroso-di-n-Propylamine | 330 | 10 |
| Hexachloroethane | 330 | 10 |
| Nitrobenzene | 330 | 10 |
| Isophorone | 330 | 10 |
| 2-Nitrophenol | 330 | 10 |
| 2,4-Dimethylphenol | 330 | 10 |
| Bis (2-chlorethoxy) Methane | 330 | 10 |
| 2,4-Dichlorophenol | 330 | 10 |
| 1,2,4-Trichlorobenzene | 330 | 10 |
| Naphthalene | 330 | 10 |
| 4-Chloroaniline | 330 | 10 |
| Hexachlorobutadiene | 330 | 10 |
| 4-Chloro-3-Methylphenol | 330 | 10 |
| 2-Methylnaphthalene | 330 | 10 |
| Hexachlorocyclopentadiene | 330 | 10 |
| 2,4,6-Trichlorophenol | 330 | 10 |
| 2,4,5-Trichlorophenol | 1700 | 50 |
| 2-Chloronaphthalene | 330 | 10 |
| 2-Nitroaniline | 1700 | 50 |
| Dimethyl Phthalate | 330 | 10 |
| Acenaphthylene | 330 | 10 |
| 3-Nitroaniline | 1700 | 50 |
| Acenaphthene | 330 | 10 |
| 2,4-Dinitrophenol | 1700 | 50 |
| 4-Nitrophenol | 1700 | 50 |
| Dibenzofuran | 330 | 10 |

Table 8 (Continued)
Reporting Limits, EPA Method 8270C (Semivolatile Organic Compounds)

| Compound Name | Soil, $\mu\text{g}/\text{kg}$ | Water, $\mu\text{g}/\text{L}$ |
|-------------------------------------|-------------------------------|-------------------------------|
| 2,4-Dinitrotoluene | 330 | 10 |
| 2,6-Dinitrotoluene | 330 | 10 |
| Diethyl Phthalate | 330 | 10 |
| 4-Chlorophenyl Phenyl Ether | 330 | 10 |
| Fluorene | 330 | 10 |
| 4-Nitroaniline | 1700 | 50 |
| 2-Methyl-4,6-Dinitrophenol | 1700 | 50 |
| N-Nitrosodiphenylamine ¹ | 330 | 10 |
| 4-Bromophenyl Phenyl Ether | 330 | 10 |
| Hexachlorobenzene | 330 | 10 |
| Pentachlorophenol | 1700 | 50 |
| N-Nitrosodimethylamine | 330 | 10 |
| Phenol | 330 | 10 |
| Phenanthrene | 330 | 10 |
| Anthracene | 330 | 10 |
| Di-n-Butyl Phthalate | 330 | 10 |
| Fluoranthene | 330 | 10 |
| Pyrene | 330 | 10 |
| Butyl Benzyl Phthalate | 330 | 10 |
| 3,3'-Dichlorobenzidine | 660 | 20 |
| Benz(a)anthracene | 330 | 10 |
| Bis(2-ethylhexyl) Phthalate | 330 | 10 |
| Chrysene | 330 | 10 |
| Di-n-Octyl Phthalate | 330 | 10 |
| Benzo(b)fluoranthene | 330 | 10 |
| Benzo(k)fluoranthene | 330 | 10 |
| Benzo(a)pyrene | 330 | 10 |
| Indeno(1,2,3-cd)pyrene | 330 | 10 |
| Dibenz(a,h)anthracene | 330 | 10 |
| Benzo(ghi)perylene | 330 | 10 |
| Benzoic Acid | 1700 | 50 |

¹ N-Nitrosodiphenylamine subject to co-identification with diphenylamine.

² Analyte reported as a Tentatively Identified Compound (TIC) at an estimated concentration.

$\mu\text{g}/\text{kg}$ denotes microgram per kilogram.

$\mu\text{g}/\text{L}$ denotes microgram per liter.

Table 9
Summary of QC Requirements and Corrective Action for Gas Chromatography

| QC Check | Minimum Frequency | Acceptance Criteria | Corrective Action |
|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Five-point initial calibration for target analytes | Initial calibration prior to sample analysis | Target analyte CF or RF RSD less than or equal to 20% ¹ Mean CF or RF RSD less than or equal to 20% ¹ | Correct problem then repeat initial calibration. |
| Second-source calibration verification | Once per five-point initial calibration | Less than 20% difference for most target analytes, 25% for difficult compounds | Correct problem then repeat initial calibration. |
| Daily calibration verification | Before sample analysis and every 10 samples or every 12 hours, as specified by the method | Less than 15% difference for all target analytes | Correct problem then repeat initial calibration. |
| Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample | Once | QC acceptance criteria per method's requirements | Re-calculate results; locate and fix the problem, if exists, re-run demonstration of those analytes that did not meet acceptance criteria. |
| Retention time window study | Establish initially, verify during daily calibrations | Within ± 3 standard deviations of each analyte retention time from the initial study | Correct problem, re-evaluate analyte identification. |
| 8081A: DDT and Endrin breakdown check | Daily prior to analysis of samples and every 10 samples | Degradation $\leq 15\%$ | Clean the system, repeat breakdown check. |
| Internal standards (optional) | Every sample, spiked sample, standard, and method blank | Laboratory established QC acceptance criteria | Correct problem, re-extract and re-analyze affected samples. |
| Method blank | One per analytical batch (VOCs) and one per preparation batch (SVOCs) | No analytes detected above the RL | Correct problem, then re-extract and re-analyze method blank and all samples processed with the contaminated blank. |
| MS/MSD | One MS/MSD pair conducted on Navy samples per each analytical/preparation batch | Laboratory statistically derived control limits or Advisory recovery limits: 70-130% | Identify problem. If not related to matrix interference, re-extract and re-analyze MS/MSD and all associated batch samples. |
| LCS or LCS/LCD pair if there is not enough sample for MS/MSD | One LCS or LCS/LCD pair per analytical/preparation batch | Laboratory statistically derived control limits or Advisory recovery limits: 70-130% | Correct problem, then re-extract and re-analyze the LCS and all associated batch samples. |
| Surrogate standards | Every sample, spiked sample, standard, and method blank | Laboratory statistically derived control limits or Advisory recovery limits: 70-130% | Correct problem, then re-extract and re-analyze all affected samples. |
| MDL study | Once per 12-month period | Detection limits established will be below the RLs | Correct problem, repeat the MDL study. |

¹ If RSD for any analyte is > 20%, regression fit may be used for the calibration curve for that analyte. Acceptance criteria for first order regression is $r^2 \geq 0.99$

Table 10
Summary of QC Requirements and Corrective Action for EPA Methods 8260B and 8270C

| QC Check | Minimum Frequency | Acceptance Criteria | Corrective Action |
|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Five-point initial calibration for target analytes. | Initial calibration prior to sample analysis | <p><u>8260B</u>: The minimum average SPCC RF for Chloromethane, 1,1 Dichloroethane and Bromoform is 0.1; for Chlorobenzene and 1,1,2,2-Tetrachloroethane is 0.30.</p> <p><u>8270C</u>: The minimum average SPCC RF is 0.050.</p> <p><u>8260B and 8270C</u>: RSD average is less than or equal to 15% for target analytes, and is less than or equal to 30% for CCC¹</p> | Correct problem, then repeat initial calibration. |
| Second-source calibration verification | Once per five-point initial calibration | Less than 25% difference for all target analytes and CCCs | Correct problem, then repeat initial calibration. |
| Daily calibration verification | Before sample analysis and every 12 hours of analysis time | <p>Less than 20% difference for CCCs and specific target analytes</p> <p>Less than 30% difference for all other analytes</p> <p>Minimum RF for SPCCs per method specifications</p> | Correct problem, then repeat initial calibration. |
| Demonstrate ability to generate acceptable accuracy and precision using four replicate analytes of a QC check sample | Once | QC acceptance criteria per method's requirements | Re-calculate results; locate and fix the problem, if exists, re-run demonstration of those analytes that did not meet acceptance criteria. |
| Check of mass spectral ion intensities (tuning procedure) using BFB (8260B) and DFTPP (8270C) | Prior to initial calibration and calibration verification | Must meet the method's requirements before samples are analyzed | Re-tune instrument and verify the tune acceptability. |
| Internal Standards | During data acquisition of calibration standard, samples and QC check samples | Areas within -50% to +100% of last calibration verification (12 hours) for each | Inspect mass spectrometer and GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning. |
| Method blank | One per analytical batch (8260B) and one per preparation batch (8270C) | No analytes detected above the RL | Correct problem, then re-extract and re-analyze method blank and all samples processed with the contaminated blank. |
| MS/MSD | One MS/MSD pair conducted on Navy samples per analytical/preparation batch | Laboratory statistically established control limits; advisory recovery limits: accuracy - 70-130% precision - 30% | Identify problem. If not related to matrix interference, re-extract and re-analyze MS/MSD and all associated batch samples. |

Table 10 (Continued)
Summary of QC Requirements and Corrective Action for EPA Methods 8260B and 8270C

| QC Check | Minimum Frequency | Acceptance Criteria | Corrective Action |
|--------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| LCS or LCS/LCD pair if there is not enough sample for MS/MSD | One LCS or LCS/LCD per analytical/preparation batch | Laboratory statistically established control limits; advisory recovery limits: accuracy - 70-130% precision - 30% | Correct problem, then re-extract and re-analyze the LCS (LCS/LCD) and all associated batch samples. |
| Surrogate standards | Every sample, spiked sample, standard, and method blank | Advisory QC acceptance criteria per method specification or laboratory statistically established limits | Correct problem, then re-extract and re-analyze all affected samples. |
| MDL study | For each analytical system: once per 12-month period and after every major repair | Detection limits established will be at least two times below the RLs | Correct problem, repeat the MDL study. |

¹ If RSD for any analyte is >15%, regression fit should be used for the calibration curve for that analyte. Acceptance criteria for first order regression is a correlation coefficient $r \geq 0.99$.

Table 11
Summary of QC Requirements and Corrective Action for EPA Method 6010B

| QC Check | Minimum Frequency | Acceptance Criteria | Corrective Action |
|----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| IC per manufacturer's instructions with a minimum of one standard and a calibration blank | Initial calibration prior to sample analysis | Accepted if the ICV passes | Correct problem, repeat initial calibration. |
| Second-source ICV, prepared at the calibration mid-point | Once per initial calibration | Less than 10% difference from IC for all target analytes | Correct problem, repeat initial calibration. |
| CCV, same source as IC | Following IC, after every 10 samples and the end of the sequence | Less than 10% difference from IC for all target analytes; #%5 RSD for a minimum of two integrations | Correct problem, repeat initial calibration. |
| Calibration blank | After IC, before CCV calibration, after every 10 samples, and at the end of the sequence | All target analytes are within three times the IDLs | Prepare and analyze the blank again, re-calibrate the instrument. |
| Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample | Once | QC acceptance criteria per method's requirements | Re-calculate results; locate and fix the problem, if exists, re-run demonstration of those analytes that did not meet acceptance criteria. |
| IDL study | Once per 12 month period | IDLs will be below the MDLs | Correct problem, repeat the IDL study. |
| MDL study (water only) | Once per 12 month period | MDLs will be below the RLs | Correct problem, repeat the MDL study. |
| Method blank | One per digestion batch | No analytes detected above the RLs | Correct problem, then prepare and analyze again the method blank and all samples processed with the contaminated blank. |
| ICS | At the beginning of an analytical run | Within $\pm 20\%$ of expected value | Terminate analysis; correct problem; reanalyze ICS; reanalyze all affected samples. |
| MS/MSD for all analytes | One MS/MSD pair conducted on Navy samples per each preparation batch | Laboratory statistically derived control limits or Advisory Control limits of: 75% to 125% accuracy, 20% precision | Identify problem, re-prepare and re-analyze the MS/MSD pair and all samples in the associated batch. |
| LCS or LCS/LCD pair if there is not enough sample for MS/MSD | One LCS or LCS/LCD pair per each preparation batch | Laboratory statistically derived control limits or Advisory Control limits of: 75% to 125% accuracy, 20% precision | Terminate analysis, identify and correct the problem, prepare and analyze all affected samples and QC checks again. |
| Dilution test | Each new sample matrix | 1:5 dilution must agree within $\pm 10\%$ of the original determination | Perform post digestion spike addition. |
| MSA, single or multi-level | When interferences are suspected or and for new sample matrix | Linearity of a multi-level MSA | Correct problem, repeat MSA. |
| Post digestion spike addition | When dilution test fails | Recovery within 75% to 125% of expected results | Correct problem, reanalyze post digestion spike addition. |

Table 12
Summary of QC Requirements and Corrective Action for EPA Method 7000A

| QC Check | Minimum Frequency | Acceptance Criteria | Corrective Action |
|----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Initial multi-point calibration with a minimum of three standards and a calibration blank | Initial calibration prior to sample analysis | Correlation coefficient > 0.995; accepted if the ICV passes | Correct problem, repeat initial calibration. |
| Second-source ICV, prepared at the calibration mid-point | Once per initial calibration | Less than 10% difference from IC for all target analytes | Correct problem, repeat initial calibration. |
| CCV, same source as IC | After every 10 samples and at the end of the sequence | Less than 20% difference from IC for all target analytes | Correct problem, re-analyze previous 10 samples. |
| Calibration Blank | After IC, before CCV calibration, after every 10 samples, and at the end of the sequence | All target analytes not detected above the PQLs | Prepare and analyze the blank again, re-calibrate the instrument. |
| Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample | Once | QC acceptance criteria per method's requirements | Re-calculate results; locate and fix the problem, if exists, re-run demonstration of those analytes that did not meet acceptance criteria. |
| MDL study (water only) | Once per 12 month period | MDLs will be below the PQLs | Correct problem, repeat the MDL study. |
| Method blank | One per digestion batch | No analytes detected above the PQLs | Correct problem, then prepare and analyze again the method blank and all samples processed with the contaminated blank. |
| MS/MSD for all analytes | One MS/MSD pair conducted on Navy samples per each preparation batch | QC acceptance criteria: 80% to 120% accuracy, 20% precision | Identify problem. If not related to matrix interference, re-extract and re-analyze MS/MSD and all associated batch samples. |
| LCS or LCS/LCD pair if there is not enough sample for MS/MSD | One LCS or LCS/LCD pair per each preparation batch | QC acceptance criteria: 80% to 120% accuracy, 20% precision | Correct problem, re-digest and re-analyze LCS/LCD pair and the affected batch. |
| Dilution test | One sample per batch | 1:5 dilution must agree within $\pm 10\%$ of the original determination | Perform post digestion spike addition. |
| Post digestion spike addition (recovery test) | When dilution test fails | Recovery within 85% to 115% of expected results | Conduct MSA test. |
| MSA, single or multi-level | When post-digestion spike addition fails | Linearity of a multi-level MSA | Correct problem, repeat MSA. |

Table 13
Summary of QC Requirements and Corrective Action for Inorganic Analyses

| QC Check | Minimum Frequency | Acceptance Criteria | Corrective Action |
|----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Initial three-point calibration (IC) and a blank | Initial calibration prior to sample analysis | Correlation coefficient >0.99 | Correct problem, repeat initial calibration |
| Second-source ICV, prepared at the calibration mid-point | Once per initial calibration | Per method's requirements or laboratory established criteria | Correct problem, repeat initial calibration |
| Continuing calibration verification (CCV), same source as IC | After every 10 samples and at the end of the sequence | Per method's requirements or laboratory established criteria | Correct problem, re-analyze previous 10 samples |
| Calibration Blank | After IC, before CCV calibration, after every 10 samples, and at the end of the sequence | All target analytes not detected above the RL | Prepare and analyze the blank again, re-calibrate the instrument. |
| Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample | Once | QC acceptance criteria per method's requirements | Re-calculate results; locate and fix the problem, if exists, re-run demonstration of those analytes that did not meet acceptance criteria |
| MDL study (water only) | Once per 12 month period | MDL will be below the RL | Correct problem, repeat the MDL study |
| Method blank | One per preparation batch | No analytes detected above the RL | Correct problem, then prepare and analyze again the method blank and all samples processed with the contaminated blank |
| MS for all analytes | One MS conducted on Navy samples per each preparation batch | Advisory recovery limits 70-130% | Identify problem. If not related to matrix interference, re-extract and re-analyze MS/MSD and all associated batch samples. |
| Sample duplicate (SD) or MS/MSD pair | One SD or MS/MSD pair conducted on Navy samples per each preparation batch | 30% RPD for soil, 20% RPD for water Advisory recovery limits 70-130% | Identify problem. If not related to matrix interference, re-extract and re-analyze MS/MSD or SD and all associated batch samples. |
| LCS or LCS/LCD pair if there is not enough sample for MS/MSD or SD | One LCS or LCS/LCD pair per each preparation batch | 30% RPD for soil, 20% RPD for water Advisory recovery limits 70-130% | Correct problem, re-prepare and re-analyze LCS/LCD and the affected batch |

ICV = Initial Calibration Verification
 RL = Reporting Limit
 MDL = Method Detection Limit

Table 14
Gas Chromatography/Mass Spectrometry Data Deliverables Package Requirements

| Method | Deliverable Requirement | Equivalent EPA Form | CLP or CLP-like Package, Level IV | SW-846 Package, Level III | Standard Laboratory Report |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------------------|---------------------------|----------------------------|
| Organic Analysis by GC/MS | Case Narrative | | X | X | X |
| | Corrective Action Report(s) | | X | X | X |
| | Cross-reference of field sample numbers, laboratory IDs, and analytical QC batches | | X | X | X |
| | Chain-of-Custody Form, Cooler Receipt Form | | X | X | X |
| | Sample log-in sheet | DC-1 | X | | |
| | Complete SDG file inventory sheet | DC-2-1 | X | | |
| | Data summary for each blank and sample ¹ | I | X | X | X |
| | TICs for each sample (ten peaks) | I, TIC | X | | |
| | LCS/LCD report (including concentration spiked, percent recovered, percent recovery acceptance limits, RPD, and RPD acceptance limits) | III (modified) | X | X | X |
| | Surrogate recovery report (including concentration spiked, percent recovered, and percent recovery acceptance limits) | II | X | X | X |
| | MS/MSD report (including concentration spiked, percent recovered, percent recovery acceptance limits, RPD, and RPD acceptance limits) | III | X | X | X |
| | Instrument performance check (tuning) report | V | X | X | |
| | Initial calibration data (including acceptance limits) | VI | X | X (summary only) | |
| | Continuing calibration data (including acceptance limits) | VII | X | X (summary only) | |
| | Internal standard areas and retention time reports (including acceptance limits and out-of-control flags) | VIII | X | X | |
| | Reconstructed ion chromatogram for each sample and rerun, blank, spike, duplicate, and standard | | X | | |
| | Instrument quantitation report | | X | | |
| | Raw and background subtracted mass spectra for each target analyte found | | X | | |
| | Mass spectra of TICs with library spectra of five best-fit matches | | X | | |
| | Sample preparation bench sheets | | X | X | |
| | Gel permeation chromatography clean-up logs | | X | | |
| | Method blank summary | IV | X | | |
| | Standard preparation logs | | X | X | |
| Analysis run logs | VIII | X | X | | |
| Percent moisture | | X | X | X | |
| pH | | X ² | | | |

1 Must include field sample ID, laboratory ID, date/time sampled, date received, extracted/analyzed, PQLs, MDL, dilution factor(s), results, comments, and approval signature/date.

2 For water samples volatile analysis only.

**Table 15
Metals and Inorganic Deliverables Package Requirements**

| Method | Deliverable Requirement | Equivalent EPA Form | CLP or CLP-like Package, Level IV | SW-846 Package, Level III | Standard Laboratory Report |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------------------|---------------------------|----------------------------|
| Metals Analysis | Case Narrative | | X | X | X |
| | Corrective Action Report(s) | | X | X | X |
| | Cross-reference of field sample numbers, laboratory IDs, and analytical QC batches | | X | X | X |
| | Chain-of-Custody Form, Cooler Receipt Form | | X | X | X |
| | Sample log-in sheet | DC-1 | X | | |
| | Complete SDG file inventory sheet | DC-2-1 | X | | |
| | Data summary for each blank and sample ¹ | I-IN | X | X | X |
| | LCS/LCD report (including concentration spiked, percent recovered, percent recovery acceptance limits, RPD, and RPD acceptance limits) | VII-IN | X | X | X |
| | MS/MSD report (including concentration spiked, percent recovered, percent recovery acceptance limits, RPD, and RPD acceptance limits) | V (Part 1)-IN | X | X | X |
| | Post-digestion spike recovery | V (Part 2)-IN | X | X | X |
| | Duplicate sample report | VI-IN | X | X | X |
| | Blank results | III-IN | X | X | X |
| | Initial and continuing calibration data | II (Part I)-IN | X | X | |
| | ICP interference check sample report | IV-IN | X | X | |
| | Standard addition results | VIII-IN | X | X | |
| | ICP serial dilution results | IX-IN | X | | |
| | Preparation logs | XIII-IN | X | X | |
| | Analysis run logs | XIV-IN | X | X | |
| | Standard preparation logs | | | X | X |
| | Contract required detection limit standard report | II (Part 2)-IN | | X | |
| | Instrument detection limits | X-IN | | X | |
| ICP inter-element correction factors | XI-IN | | X | X | |
| Data and instrument printouts | | | X | | |
| Percent moisture | | | X | X | X |
| pH | | | X ² | | |

¹ Must include field sample ID, laboratory ID, date/time sampled, date received, extracted/analyzed, PQL, MDL, dilution factor(s), results, comments, and approval signature/date.

³ For water samples only.

General Notes to Tables

°C denotes degrees Celsius
BFB denotes Bromofluorobenzene
CCC denotes calibration check compounds
CCR denotes California Code of Regulations
CCV denotes continuing calibration verification
CF denotes calibration factor
CLP denotes Contract Laboratory Program
DFTPP denotes decafluorotriphenylphosphine
EPA denotes U.S. Environmental Protection Agency
FID denotes Flame Ionization Detector
ft bgs denotes feet below ground surface
GC denotes gas chromatography
HCl denotes hydrochloric acid
HDPE denotes high density polyethylene
HNO₃ denotes nitric acid
IC denotes ion chromatography
ICP denotes inductively coupled plasma
ICS denotes interference check standard
ICV denotes initial calibration verification
ICV denotes Initial Calibration Verification
IDL denotes instrument detection limit
IRP denotes Installation Restoration Program
IT denotes IT Corporation
JP-4 denotes Jet Propulsion Fuel, Grade 4
LCD denotes Laboratory Control Duplicate
LCS denotes Laboratory Control Standard
MDL denotes Method Detection Limit
MDL denotes method detection limit
mg/kg denotes milligram per kilogram.
mg/L denotes milligram per liter.
MS denotes matrix spike
MSD denotes matrix spike duplicate
MtBE denotes methyl tertiary butyl ether
NA denotes not applicable
PAH denotes polynuclear aromatic hydrocarbon(s)
PCB denotes polychlorinated biphenyl
pg/g denotes picogram per gram.
pg/L denotes picogram per liter.
ppb-v denotes part(s) per billion by volume
PQL denotes practical quantitation limit
QA denotes quality assurance
QAO denotes Quality Assurance Officer
QC denotes quality control
RL denotes reporting limit
RL denotes Reporting Limit
RPM denotes Remedial Project Manager
RSD denotes relative standard deviation
SAP denotes Sampling and Analysis Plan
SDG denotes sample delivery group
SIM denotes Selective ion monitoring
SVE denotes soil vapor extraction
SVOC denotes semivolatile organic compound
TBA denotes Tertiary Butyl Alcohol
TCDD denotes 2,3,7,8-Tetrachlorodibenzo-p-dioxin
TCLP denotes Toxicity Characteristic Leaching Procedure
TDS denotes total dissolved solids
TIC denotes tentatively identified compound
TO denotes toxic organic
TPH denotes total petroleum hydrocarbon(s)
TVPH denotes total volatile petroleum hydrocarbons
UST denotes underground storage tank
VOC denotes volatile organic compound
µg/kg denotes microgram per kilogram.
µg/L denotes microgram per liter.

***Attachment 1
Core Sampler SOP***

STANDARD OPERATING PROCEDURE

Subject: Sampling for VOCs in Soil—Sealed-Cap (EnCore®) Sampler

1. PURPOSE

The purpose of this procedure is to provide general information about the procedure for using the Disposable EnCore® Sampler or other similar sealed-cap soil VOC samplers. These samplers are used to obtain and ship soil and clay samples for volatile organic compound (VOC) analysis, including GRO, in accordance with SW-846 Method 5035A and other related protocols.

2. SCOPE

This procedure applies to all instances where soils require sampling and shipment for VOC analysis using no headspace methods, including samples collected from drilling cores.

This procedure should not be used if collecting samples for pre-weighed vial VOC methods.

This procedure and these types of samplers are not applicable to non-elastic soils and non-compactable materials, such as loose sand, rocky soils, and gravel. Such materials should be sampled using alternative methods.

3. REFERENCES

- 3.1 U.S. Environmental Protection Agency, 1996, Method 5035A "Closed-System Purge and Trap for Volatile Organics in Soil and Waste," *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Third Edition, Revised December, Update IV.
- 3.2 En Novative Technologies, Inc., "Disposable EnCore® Sampler Sampling Procedures—Using the EnCore® T-Handle," guide supplied with each case of samplers.

4. DEFINITIONS

- 4.1 **Sealed-Cap VOC Sampler**—A single-use volumetric sampling system designed to collect, store, and deliver soil samples for VOC methods that require no headspace.
- 4.2 **EnCore® Sampler**—A form of Sealed-Cap VOC Sampler designed and marketed by En Novative Technologies, Inc., of Green Bay, WI. The cartridges come in two sizes for sample volumes of approximately 25 or 5 grams.
- 4.3 **EnCore® T-Handle**—The specially machined holder for the EnCore® sampler sold separately by En Novative Technologies, Inc. The T-Handle provides the leverage needed to push the sampler into the soil, and should be used along with the sampler. In cases where a T-Handle is not available, it is possible though not recommended to grip the sampler by the sides, away from its sealing surfaces, with a pair of pliers or similar implement and push it into the soil.

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Field Sampling Discipline Lead is responsible for maintenance, management, and revision of this procedure. Questions, comments, or suggestions regarding this technical SOP should be sent to the Field Sampling Discipline Lead.

5.2 Project Responsibility

Shaw employees performing this task, or any portion thereof, are responsible for meeting the requirements of this procedure. Shaw employees conducting technical review of task performance are also responsible for following appropriate portions of this SOP.

For those projects where the activities of this SOP are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate procedures. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e. checkprints, calculations, reports, etc.) that the requirements of this SOP have been met. Such documentation shall be retained as project records.

6. PROCEDURE

For each sample location collected and for each applicable field or laboratory QC sample, a total of three samples will need to be obtained, as follows:

1. Open the sealed bag containing the sampler and, if using an EnCore®, push the plunger down until the small O-ring rests against the tabs.
2. If using an EnCore®, the locking lever on the T-Handle must be depressed as the cartridge is inserted. Line up the slots on the cartridge with the locking pins in the T-Handle. Plunger end first, insert cartridge into T-Handle with locking tabs aligned and twist the cartridge clockwise locking it in place.
3. Prepare the surface by removing grass, sticks, and other matter to allow the sampler to penetrate the intended location.
 - For hard pan soils and clays or excavations, scrape away the top few inches of the material to expose virgin and penetrable soil/clay for sampling.
 - When sampling subsurface cores, split the core cover lengthwise or push the core from the coring tube to expose the core and sample from points along the core.
4. Insert the cartridge device into the material being sampled with a downward twisting motion until full. If using the EnCore® system, observe the appropriate hole in the T-Handle and continue to push the sampler into the material being sampled until the small O-ring on the plunger is visible in the viewing hole (5g-bottom hole, 25g-top hole).
5. Withdraw sampling device from medium and use a fresh tissue to wipe off excess material from the outside of the cartridge body and especially the O-rings. If soil is protruding from the tube, carefully slice it off even with the open end using a clean knife or spatula.
6. For the EnCore® system, while the cartridge is still on the T-Handle, turn the T-Handle until the cartridge is facing upward and place the cap over the cartridge with the locking arms aligned with the flat surfaces of the locking ridge. Then gently push the cap onto the cartridge with even pressure, and twist the cap maintaining downward pressure until the arms lock against the ridge. Non-EnCore® systems must be sealed according to the manufacturer's instructions.

7. Inspect the cap and seal making sure that the cap is seated over the cartridge squarely and evenly. For the EnCore® system, both arms must be locked over the ridge or an imperfect seal will result, compromising the data.
8. Remove the capped sampler from its holder
9. For the EnCore® system, lock the plunger by rotating the plunger rod counterclockwise until the wings rest against the tabs
10. Complete and attach the label and seal the cartridge in the provided sampler bag.
11. Repeat steps 1-10 for the other two cartridges needed for the sample location, collecting each cartridge from undisturbed material as close as possible to the original location.
12. Place all three cartridges in the same bag and then label the outside of the bag per the project requirements
13. Place the labeled bag into a cooler with the project-required coolant (ice or dry ice).
14. Complete all required documentation and ship to the laboratory per the project plans

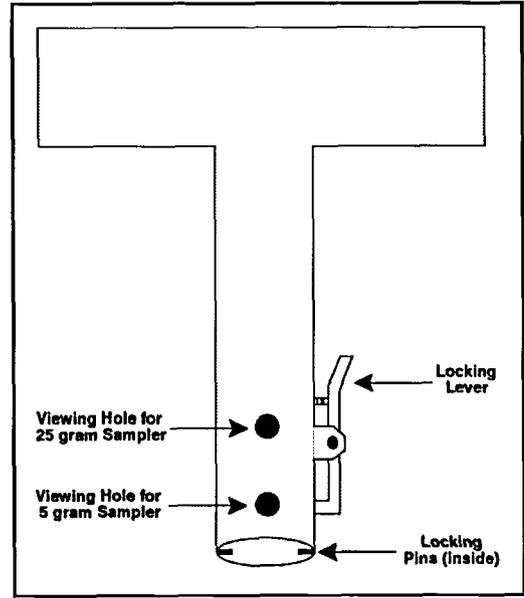
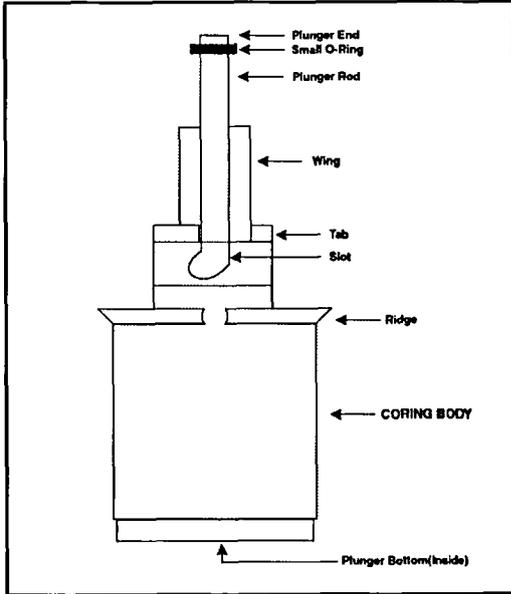
7. ATTACHMENTS

- **Attachment 1**—EnCore® Sampler Figures (from En Novative Technologies, Inc. web-site: <http://www.ennovativetech.com>).

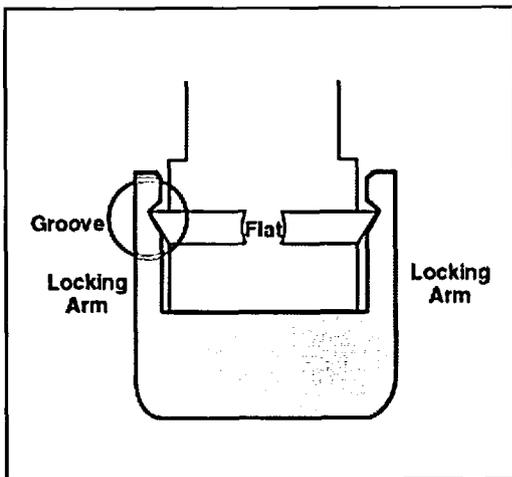
8. FORMS

None.

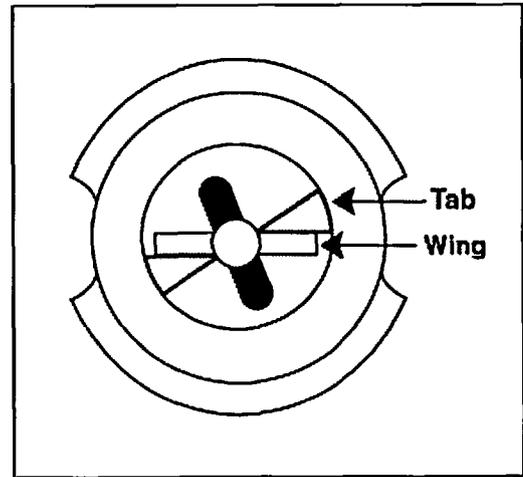
ATTACHMENT 1
 ENCORE® SAMPLER FIGURES



T-Handle



Sampler Properly Capped



Plunger Top view