

Addendum to the Final Supplemental Work Plan

*Closure of Various Temporary Accumulation Areas and
RCRA Facility Assessment Sites
Marine Corps Air Station El Toro
Santa Ana, California*

SWDIV Contract No. N68711-93-D-1459, Delivery Order No. 0070

OHM Project No. 18609

Document Control No. SW8603

Revision 0

January 17, 2001



1230 Columbia Street, Suite 1200
San Diego, California 92101-8517

Prepared by:


Melanie Concepcion-Gonzalez
Chemist

Reviewed by:


Dwayne Ishida
Field Analytical Services Manager

Approved by:


Dhananjay Rawal
Project Manager

M60050.002453
MCAS EL TORO
SSIC NO. 5090.3

FINAL SUPPLEMENTAL WORK PLAN
CLOSURE OF VARIOUS TEMPORARY
ACCUMULATION AREAS AND RCRA FACILITY
ASSESSMENT SITES

DATED 26 SEPTEMBER 1997

IS ENTERED IN THE DATABASE AND FILED AT
ADMINISTRATIVE RECORD NO. M60050.002452

Table of Contents

<i>List of Figures</i>	<i>iv</i>
<i>List of Tables</i>	<i>iv</i>
<i>Abbreviations and Acronyms</i>	<i>v</i>
<i>Executive Summary</i>	<i>vi</i>
Section 1 Introduction	1-1
1.1 Site Location and Background.....	1-1
1.2 Objectives	1-1
1.3 Regulatory Background	1-1
1.4 Scope of Work and Assumptions.....	1-2
1.5 Project Schedule.....	1-2
1.6 Project Organization and Personnel.....	1-3
Section 2 Project Plan and Deliverables	2-1
Section 3 TAA and RFA Descriptions – MCAS El Toro	3-1
Section 4 Facility Decontamination Process	4-1
Section 5 Demolition and Dismantling of Facilities	5-1
Section 6 Sampling Strategy and Rationale	6-1
6.1 Cleanup Goals.....	6-2
6.2 Sampling Strategy	6-3
6.3 Sample Locations and Sampling Frequency	6-3
6.3.1 TAA Sites	6-3
6.3.1.1 Soil Samples	6-8
6.3.1.2 Rinsate Samples for TAA Decontamination Activities	6-8
6.3.2 RCRA Facility Assessment Sites	6-8
6.4 Analytical Requirements.....	6-8
6.4.1 Soil Sample Analysis.....	6-10
6.4.2 Waste Management	6-10
6.4.3 Analytical Methods	6-10
6.5 Sample Containers, Preservatives, and Holding Times	6-11
6.6 Field Quality Control Samples	6-12
6.6.1 Field Duplicates.....	6-13
6.6.2 Equipment Rinsate Samples.....	6-13
6.6.3 Trip Blanks.....	6-13
6.6.4 Laboratory Quality Control Samples	6-13

Table of Contents (Cont.)

6.7	Field Methods and Sampling Procedures	6-13
6.7.1	Sampling Procedures	6-13
6.7.2	Soil Sample Collection	6-14
6.7.3	Soil Sampling Procedures	6-14
6.7.4	Confirmation and Stockpile Sampling Procedures	6-15
6.7.5	Liquid Waste Sampling Procedures	6-15
6.7.6	Decontamination Procedures	6-16
6.7.7	Sample Numbering	6-16
6.7.8	Sample Labeling	6-16
6.7.9	Sample Packaging and Shipment	6-17
6.7.10	Field Documentation	6-17
6.7.10.1	Chain-of-Custody Record	6-18
6.7.10.2	Field Logbook	6-19
6.7.10.3	Document Corrections	6-19
6.8	Data Quality Objectives	6-20
Section 7 Sample Identification and Documentation		7-1
Section 8 Closure Certification		8-1
Section 9 Estimated Schedule for Closure		9-1
Section 10 Postclosure Plan		10-1
Section 11 Closure Cost Estimate		11-1
Section 12 Financial Responsibility		12-1
Section 13 Extensions for Closure Time		13-1
Section 14 References		14-1
Attachment 1 EnCore™ Sampling Procedures		
Attachment 2 Quality Assurance Project Plan		

Table of Contents (Cont.)

- Appendix A Health and Safety Plan Addendum (Appendix not modified)***
- Appendix B Contractor Quality Control Plan Addendum (Appendix not modified)***
- Appendix C Waste Management Plan Addendum (Appendix not modified)***
- Appendix D Quality Assurance Project Plan (Revised and included as Attachment 2)***
- Appendix E TAA and RFA Site-Specific (Appendix not modified)***
- Appendix F Site-Specific TAA and RFA Background Information (Appendix not modified)***
- Appendix G Detailed Plan for RCRA Clean Closure of Building 673-T3 MCAS El Toro and Building 248 MCAS Tustin (Appendix not modified)***

List of Figures

Figure 1-1	Project Organization Chart	1-4
Figure 6-1	Typical Site Layout and Proposed Soil Sampling Locations – Bermed TAA with Spill Containment Pump.....	6-4
Figure 6-2	Typical Site Layout and Proposed Soil Sampling Locations – Bermed TAA Without Spill Containment Pump.....	6-5
Figure 6-3	Typical Site Layout and Proposed Soil Sampling Locations – Unbermed, Fenced or Unfenced TAA	6-6
Figure 6-4	Typical Site Layout and Proposed Soil Sampling Locations – TAA Located Inside Building.....	6-7

List of Tables

Table 6-1	Soil Sample Locations for Each TAA Type	6-9
Table 6-2	Sample Locations for Rinsate Samples.....	6-9
Table 6-3	Summary of TAA Analytical Requirements for Rinsate Water and Soil Samples	6-9
Table 6-4	Soil Sample Analytes, Analytical Methods, Container Requirements, Preservatives, and Holding Times	6-11
Table 6-5	Aqueous Sample Analytes, Analytical Methods, Container Requirements, Preservatives, and Holding Times	6-12
Table 6-6	Field Quality Control Sample Frequency	6-12

Abbreviations and Acronyms

Bechtel	Bechtel National, Inc.
bgs	below ground surface
CA LUFT	California leaking underground fuel tank
CQC	contractor quality control
DCN	Document Control Number
DO	Delivery Order
ELAP	Environmental Laboratory Accreditation Program
EPA	U.S. Environmental Protection Agency
FSWP	final supplemental work plan
HCl	hydrochloric acid
HNO ₃	nitric acid
IRP	Installation Restoration Program
Jacobs	Jacobs Engineering Group Inc.
L	liters
MCAS	Marine Corps Air Station
mg/kg	milligrams per kilogram
mL	milliliters
MS/MSD	matrix spike/matrix spike duplicate
NFESC	Naval Facilities Engineering Service Center
OHM	OHM Remediation Services Corp.
oz	ounce
PCB	polychlorinated biphenyl
PRG	preliminary remediation goal
QAPP	quality assurance project plan
QC	quality control
RAC	Remedial Action Contract
RCRA	Resource Conservation and Recovery Act
RFA	RCRA facility assessment
SIM	selected ion monitoring
SOW	statement of work
SVOC	semivolatile organic compound
SWDIV	Southwest Division Naval Facilities Engineering Command
SWMU	solid waste management unit
TAA	temporary accumulation area
TPH	total petroleum hydrocarbons
VOA	volatile organic analysis
VOC	volatile organic compound

Executive Summary

This addendum documents changes to the *Final Supplemental Work Plan, Closure of Various Temporary Accumulation Areas and RCRA Facility Assessment Sites, Marine Corp Air Station Santa Ana, California*, dated September 26, 1997, Document Control No. SW4380. The final supplemental work plan was prepared by OHM Remediation Services Corp. under Southwest Division Naval Facilities Engineering Command Remedial Action Contract No. N68711-93-D-1459, Delivery Order No. 0070.

New subsections have been added to Sections 6.4, 6.6, and 6.7. Attachment 1 includes the EnCore™ sampling procedures. Section 5 has been deleted, and Appendix D, the quality assurance project plan, has been revised and is presented in Attachment 2.

Except as noted above, section (and subsection) numbers remain unchanged from those presented in the original document. Section 1.6, Project Organization and Personnel, has been modified to include new personnel. Section 6, Sampling Strategy and Rationale, has been modified to include new test methods such as EnCore™ sampling (U.S. Environmental Protection Agency Method 5035).

Section 1

Introduction

This addendum to the final supplemental work plan (FSWP) was prepared for the closure of various temporary accumulation area (TAA) sites and Resource Conservation and Recovery Act (RCRA) facility assessment (RFA) sites located at the Marine Corps Air Station (MCAS) El Toro in Santa Ana, California. This document was prepared by OHM Remediation Services Corp. (OHM) as an addendum to the FSWP dated September 26, 1997, Document Control No. (DCN) SW4380, which was prepared under Southwest Division Naval Facilities Engineering Command (SWDIV) Remedial Action Contract (RAC) No. N68711-93-D-1459, Delivery Order (DO) No. 0070 (OHM, 1997). The OHM project number is 18609. This addendum and the quality assurance project plan (QAPP) complete the project-specific sampling and analysis plan required for this project, as stipulated by U.S. Environmental Protection Agency (EPA) guidelines (EPA, 1993), and have been prepared in accordance with the *Navy Installation Restoration Chemical Data Quality Manual* (Naval Facilities Engineering Service Center [NFESC], 1999). The QAPP is presented in Attachment 2 of this addendum.

The structure of this document has been maintained to be consistent with the FSWP, as practicable. New subsections have been added to Sections 6.4, 6.6, and 6.7 and Sections 1.6 and 6 have been modified. Two attachments are included in this addendum: Attachment 1 – EnCore™ Sampling Procedures, and Attachment 2 – Quality Assurance Project Plan. The list of appendices was retained from the original FSWP; however, most appendices are not cited in this addendum. As a result, appendices are not called out sequentially. In addition, Appendix D has been modified and is included as Attachment 2.

1.1 Site Location and Background

Section not modified.

1.2 Objectives

Section not modified.

1.3 Regulatory Background

Section not modified.

1.4 Scope of Work and Assumptions

This addendum to the FSWP was prepared based on the statement of work (SOW) (revised June 16, 1996) and technical assumptions (revised June 20, 1996) included in DO No. 0070 (dated February 15, 1996) and the *Detailed Plans for RCRA Clean Closure of Building 637-3, MCAS El Toro, and Building 248, MCAS Tustin*, referred to hereinafter as the MCAS El Toro detailed plan, which is presented in Appendix G of this document. In addition to the assumptions presented in Appendix G, this addendum addresses subsurface soil contamination with the following closure activities:

- Sampling and analysis of soil at the TAA and RFA sites to evaluate whether contamination is present
- Excavation of contaminated soil (if required) and confirmation soil sampling
- Off-site disposal of contaminated soil
- Backfill and compaction of excavated areas.

This addendum addresses the following activities at TAA sites:

- Dry vacuuming of the TAA surface to collect dust and debris
- Decontamination of concrete floors, berms, and sumps only if required based on visual inspection
- Collection and laboratory analysis of soil samples obtained adjacent to the TAA sites, including rinsate samples
- Disposing of hazardous waste material off site.

This addendum addresses the following activities at RFA sites:

- Verification soil sampling at the RFA sites
- Excavation of contaminated soil based on the review of verification analytical results
- Confirmation soil sampling and laboratory analysis of soil samples collected from the excavated areas
- Stockpile sampling for waste disposal characterization purposes
- Backfill and compaction of excavated areas
- Off-site disposal of contaminated soil.

1.5 Project Schedule

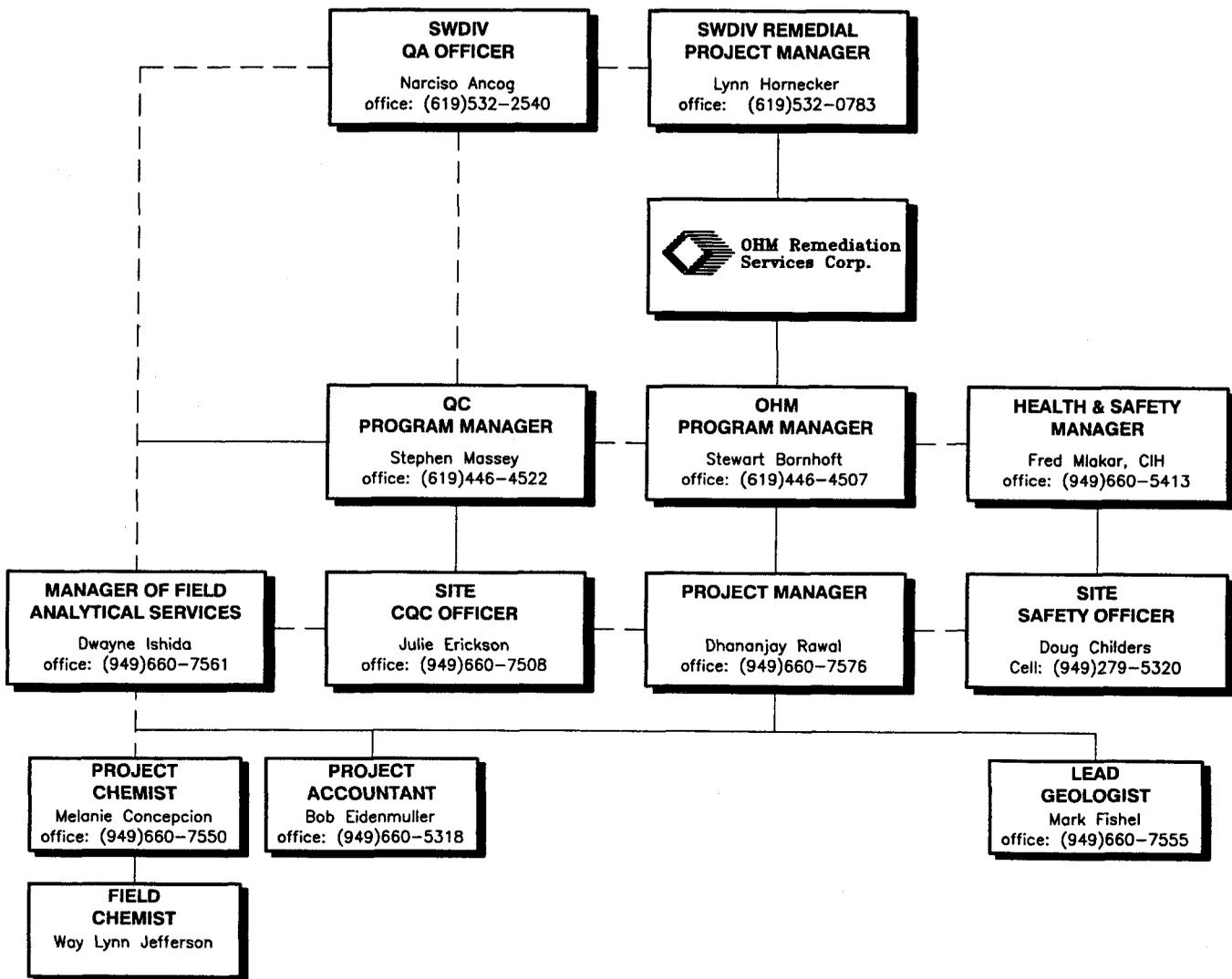
Section not modified.

1.6 Project Organization and Personnel

The OHM organizational chart for DO No. 0070 has been modified and is presented in Figure 1-1. Listed below are the key project personnel:

- MCAS El Toro Caretaker Site Office - Scott Kehe, El Toro (949) 726-2506
- SWDIV RAC Remedial Project Manager - Lynn Hornecker, San Diego (619) 532-0783
- OHM Project Manager - Dhananjay Rawal, Irvine (949) 660-7576
- OHM Site Contractor Quality Control (CQC) Officer – Julie Erickson (949) 451-7508.
- OHM Site Safety Officer - Doug Childers (949) 279-5320 (cell phone).

Project Organization Chart



NOTE:
ADDENDUM TO THE FINAL SUPPLEMENTAL WORK PLAN
(OHM, 1997)

Dec 20, 2000 11:02:16 I:\OHM CORP\PROJECTS\18609\18609318C.dwg

OHM Remediation Services Corp. <small>A Member of the IT Group SAN DIEGO, CA</small>				<small>DRAWN BY</small> R. FIRMORADIAN	<small>DATE</small> 12/20/00	PROJECT ORGANIZATION CHART MARINE CORPS AIR STATION EL TORO, CALIFORNIA			
				<small>CHECKED BY</small> 	<small>DATE</small> 1/18/01				
<small>CONTRACT NAME</small> SWDIV		<small>APPROVED BY</small> 	<small>DATE</small> 1/18/01	<small>PROJECT MANAGER</small> 	<small>DATE</small> 1/18/01				
<small>AUTOCAD FILE No.</small> 18609318C.DWG	<small>PLOT SCALE</small> 1=1	<small>SHEET</small> 1	<small>OF</small> 1	<small>SCALE</small> NONE	<small>DOCUMENT CONTROL No.</small> SW8603	<small>OHM PROJECT No.</small> 18609	<small>FIGURE No.</small> FIG 1-1	<small>REVISION</small> 0	

Section 2

Project Plan and Deliverables

Section not modified.

Section 3

TAA and RFA Descriptions – MCAS El Toro

Section not modified.

Section 4

Facility Decontamination Process

Section 5 of the MCAS El Toro detailed plan (Appendix G) provides information on the preconstruction meeting, mobilization, field setup, site management activities, and decontamination methods for facilities at MCAS El Toro. The TAA decontamination procedures described in Appendix G will be followed, with the following exception: RFA sites (solid waste management units [SWMUs]) will not require decontamination, but soil samples will be collected from these areas for laboratory analysis (Section 6). The following are changes to the FSWP:

Type 1 and 2 Facilities

Each bermed TAA site will be dry vacuumed to remove dust and debris within the interior portion of the structure unless evidence of spillage such as staining or obvious cracks on the surface of the concrete are apparent. In such an event, the paved area inside the bermed structure will be decontaminated with water as deemed necessary after visual inspection.

Type 3 Facilities

In unbermed areas where metal lockers, bins, or other containers formerly used as TAA facilities are located, the metal lockers and/or bins will be removed and turned over to the base or disposed of off site, as appropriate.

No decontamination (with water) activities will be performed at Type 3 facilities. Only soil samples will be collected, as described in Section 6.

Type 4 Facilities

No decontamination (with water) activities will be performed at Type 4 facilities. Only soil samples will be collected, as described in Section 6.

Wastewater generated during decontamination activities will be transferred to 55-gallon drums or storage tanks for disposal in accordance with the waste handling and management options presented in Section 5.5 of Appendix G (MCAS El Toro detailed plan) and in Appendix C (waste management plan addendum).

Section 5

Demolition and Dismantling of Facilities

This section has been deleted.

Section 6

Sampling Strategy and Rationale

As stated in Section 6 of the MCAS El Toro detailed plan (Appendix G) the objective of sampling and analysis is to provide analytical data to support the successful closure of the TAA and RFA sites within MCAS El Toro.

Sampling strategies for the TAA and RFA sites are based on the following documents:

- MCAS El Toro detailed plan (Appendix G)
- Final RFA report (Jacobs Engineering Group Inc. [Jacobs], 1993)
- Final addendum to the RFA (Bechtel National, Inc. [Bechtel], 1996a)
- Draft final closure certification report (OHM, 1995)
- RCRA Part B Permit for MCAS El Toro
- Review of the soil analytical data from closure documents for actual field decontamination and soil sampling activities at 12 TAA and 5 RFA sites at MCAS El Toro.

Analytical test methods were selected based on the wastes that were potentially stored at each site.

Sampling activities at the TAA sites are as follows:

1. Soil samples will be collected at two depths (18 and 36 inches below ground surface) from four sides of the TAA containment pad. If (based on visual inspection) there are no significant cracks or stains on the surface of the concrete pad, a soil sample will not be collected from beneath the surface of the concrete pad. If there are significant cracks and heavy stains on the surface of the pad, additional soil samples will be collected beneath the cracks, as described in Section 6 of Appendix G. The TAA pad will be decontaminated, and rinsate water samples will be collected to verify the successful decontamination of the surface.
2. If any TAA site is located within an Installation Restoration Program (IRP) site boundary, OHM will use the nearby existing IRP soil data to the extent practicable.

The decontamination process presented in the MCAS El Toro detailed plan (Appendix G) will be followed. Soil and rinsate sample analytical methods are described in Section 6.3 of Appendix G.

Sampling at RFA sites will be based on the recommendations presented in the final addendum to the RFA (Bechtel, 1996a). OHM initially will collect and analyze verification soil samples at RFA sites. Based on the analytical data, the extent of excavation will be

determined, if necessary. If excavation is required, additional confirmation and stockpile soil samples will be collected. Soil samples will be analyzed based on the review of background information and contaminants of concern identified in the final RFA addendum (Bechtel, 1996a).

6.1 Cleanup Goals

Screening levels and cleanup goals for soil at TAA sites are as follows:

- EPA Region IX preliminary remediation goals (PRGs) (latest edition) listed for residential use with organic contaminants
- 5,000 milligrams per kilogram (mg/kg) for total petroleum hydrocarbons (TPH)-purgeable
- 10,000 mg/kg for TPH-extractable
- Background concentrations (Bechtel, 1996b) and/or EPA Region IX PRG values for residential land use for metal contaminants.

If soil analytical data from TAA sites suggest low concentration of organic compounds and background levels of metals in the vadose zone, screening-level risk assessment hazard index calculations will be performed to show that the remaining residual concentrations of organic and metal compounds do not pose a significant threat to human health or the environment.

If soil analytical data from TAA sites suggest high concentrations (obvious release) of organic compounds, contaminated soil will be excavated and additional soil samples will be collected.

The water (tap water) used for decontaminating the TAA pads will be sampled and analyzed for the full suite of organic and inorganic analyses. The analytical results will be used as "base levels" for comparison with the rinse water samples collected after decontamination. Cleanup goals for rinsate samples are as follows:

- Compare to base levels (less than base level plus 10 percent). If this limit is exceeded, compare contaminant concentrations with PRGs and perform a hazard index calculation (noncarcinogenic) or risk calculation (carcinogenic). Additional decontamination will be performed as necessary in accordance with the MCAS El Toro detailed plan (Appendix G).

Cleanup goals for RFA sites are as follows:

- Goals for polychlorinated biphenyls (PCBs) will be determined on a site-by-site basis, based on EPA guidance documents on presumptive remedies for PCB-contaminated sites, previous El Toro site cleanup goals, and/or EPA Region IX PRGs (latest edition).

- Goals for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and pesticides in soil will be EPA Region IX PRGs (latest edition) for residential land use.

6.2 Sampling Strategy

The sampling strategy for the closure of the TAA sites will be consistent with the strategy outlined in Section 6.1 of the MCAS El Toro detailed plan (Appendix G), with the following additions and/or clarifications:

- Prior to any soil sampling, Underground Services Alert will be notified at least 48 hours in advance and a comprehensive geophysical survey will be conducted in the areas of soil sampling and potential soil excavation to identify any subsurface utilities or obstructions.
- All sampling locations will be land-surveyed by a surveyor licensed by the State of California using the California State Plane Coordinate System. Northing and easting coordinates will be referenced to 1983 North American Datum. Elevations will be surveyed relative to the datum used by SWDIV (such as the 1929 U.S. Geological Survey mean lower low water datum).

6.3 Sample Locations and Sampling Frequency

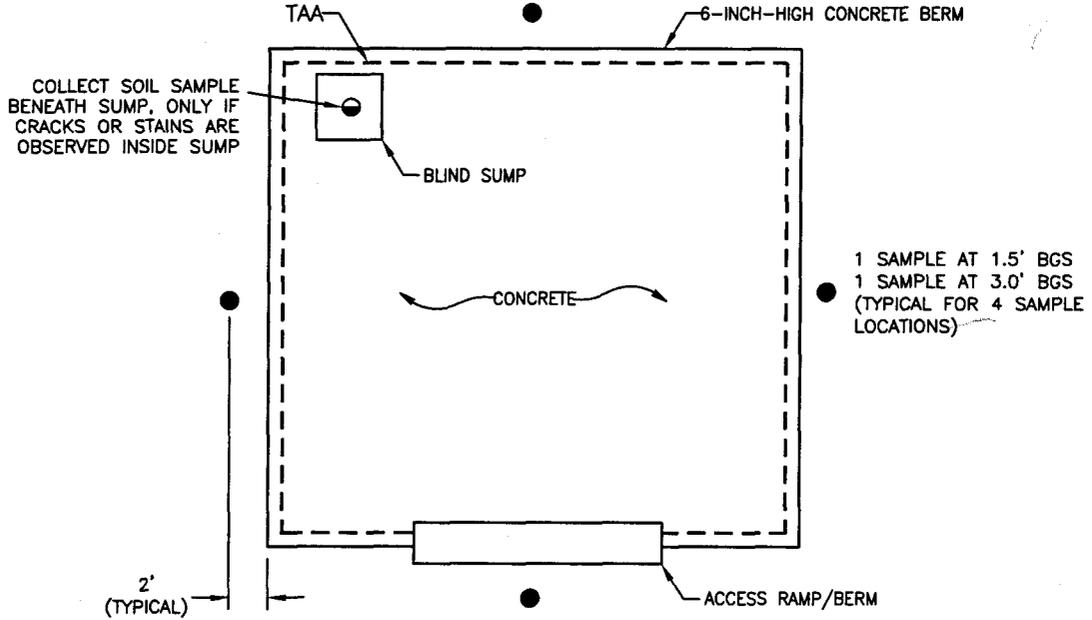
The following sections describe TAA sites and RFA sites.

6.3.1 TAA Sites

The four types of TAAs at MCAS El Toro are as follows:

- Type 1 – Bermed TAA with spill containment sump (approximately 2 by 2 by 2 feet)
- Type 2 – Bermed TAA without spill containment sump
- Type 3 – Unbermed TAA with or without fence
- Type 4 – Building with floor (concrete or asphalt).

The dimensions of the TAAs range from approximately 10 feet wide by 15 feet long to 20 feet wide by 30 feet long. Drawings of each TAA type, with proposed sample locations, are provided in Figures 6-1 through 6-4. These TAA types are generic classifications for future TAAs yet unassigned to DO No. 0070. Additional future TAA sites to be closed under this DO will be categorized as one of the above types. If any future TAAs assigned for closure cannot be categorized by the types listed above, sampling locations will be determined prior to entering the field and will be approved (via memorandum) by the Navy and/or appropriate regulatory agency.



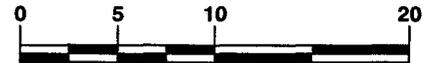
LEGEND:

- LIMIT OF TAA
- SOIL SAMPLE LOCATION
- TAA TEMPORARY ACCUMULATION AREA
- BGS BELOW GROUND SURFACE
- OPTIONAL SOIL SAMPLE

NOTES:

- 1- DRY VACUUM TAA GROUND/FLOOR SURFACE PER SUPPLEMENTAL WORK PLAN, SECTION 4, PRIOR TO COLLECTING SOIL SAMPLES.
- 2- COLLECT AND ANALYZE SOIL SAMPLES IN ACCORDANCE WITH SUPPLEMENTAL WORK PLAN, SECTIONS 6 AND 7.

GRAPHIC SCALE

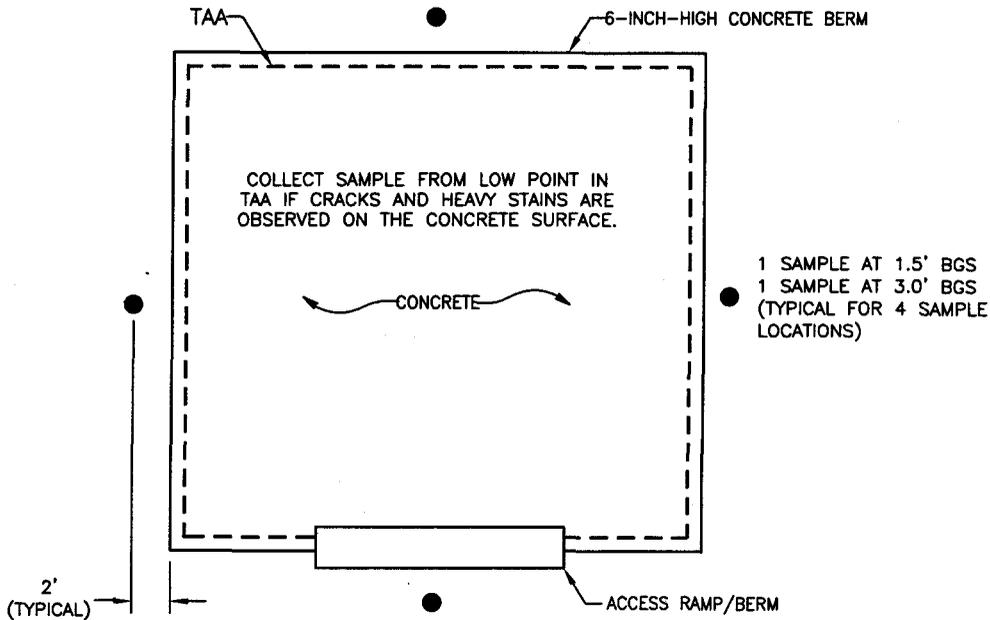


(IN FEET)

Dec 04, 2000 - 16:39:14 I:\OHM CORP\PROJECTS\18609\18609348.dwg

<p>OHM Remediation Services Corp. A Subsidiary of OHM Corporation IRVINE, CA</p>		DRAWN BY R. PARMORADIAN DATE 11/30/00	<p>TYPICAL SITE LAYOUT AND PROPOSED SOIL SAMPLING LOCATIONS BERMED TAA WITH SPILL CONTAINMENT SUMP MARINE CORPS AIR STATION EL TORO, CALIFORNIA</p>				
		CHECKED BY <i>[Signature]</i> DATE 1/18/01					
APPROVED BY <i>[Signature]</i> DATE 1/18/01	PROJECT MANAGER <i>[Signature]</i> DATE 1/18/01						
CONTRACT NAME SWDIV							
AUTOCAD FILE No.	PLOT SCALE	SHEET OF	SCALE	DOCUMENT CONTROL No.	OHM PROJECT No.	FIGURE No.	REVISION
18609348.DWG	1=1	1 OF 1	1"=10'	SW3169	18609	FIG 6-1	0

6-4



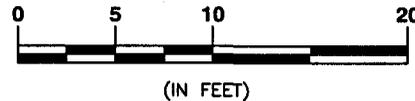
LEGEND:

- LIMIT OF TAA
- SOIL SAMPLE LOCATION
- TAA TEMPORARY ACCUMULATION AREA
- BGS BELOW GROUND SURFACE

NOTES:

- 1- DRY VACUUM TAA GROUND/FLOOR SURFACE PER SUPPLEMENTAL WORK PLAN, SECTION 4, PRIOR TO COLLECTING SOIL SAMPLES.
- 2- COLLECT AND ANALYZE SOIL SAMPLES IN ACCORDANCE WITH SUPPLEMENTAL WORK PLAN, SECTIONS 6 AND 7.

GRAPHIC SCALE



Dec 04, 2000 - 16:39:35 I:\OHM CORP\PROJECTS\18609\18609348A.dwg



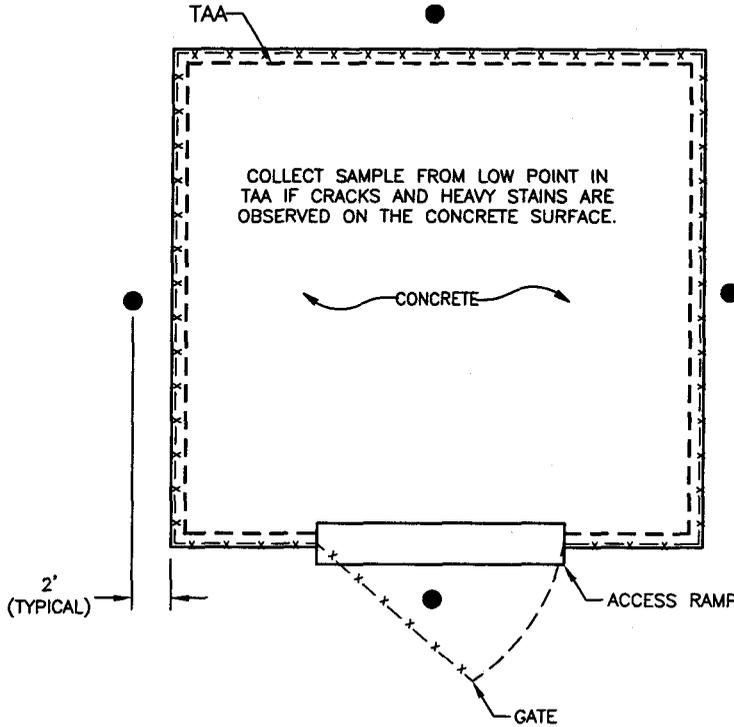
OHM Remediation Services Corp.
A Subsidiary of OHM Corporation
IRVINE, CA

DRAWN BY R. RIBORADIAN	DATE 11/30/00
CHECKED BY <i>[Signature]</i>	DATE 1/18/01
APPROVED BY	DATE
PROJECT MANAGER <i>[Signature]</i>	DATE 1/18/01

TYPICAL SITE LAYOUT AND PROPOSED SOIL SAMPLING LOCATIONS BERMED TAA WITHOUT SPILL CONTAINMENT SUMP MARINE CORPS AIR STATION EL TORO, CALIFORNIA

CONTRACT NAME
SWDIV

AUTOCAD FILE No. 18609348A.DWG	PLOT SCALE 1=1	SHEET 1	OF 1	SCALE 1"=10'	DOCUMENT CONTROL No. SW3169	OHM PROJECT No. 18609	FIGURE No. FIG 6-2	REVISION 0
--	--------------------------	-------------------	----------------	------------------------	---------------------------------------	---------------------------------	------------------------------	----------------------



1 SAMPLE AT 1.5' BGS
 1 SAMPLE AT 3.0' BGS
 (TYPICAL FOR 4 SAMPLE LOCATIONS)

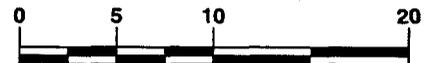
LEGEND:

- x-x- FENCE
- - - - LIMIT OF TAA
- SOIL SAMPLE LOCATION
- TAA TEMPORARY ACCUMULATION AREA
- BGS BELOW GROUND SURFACE

NOTES:

- 1- DRY VACUUM TAA GROUND/FLOOR SURFACE PER SUPPLEMENTAL WORK PLAN, SECTION 4, PRIOR TO COLLECTING SOIL SAMPLES.
- 2- COLLECT AND ANALYZE SOIL SAMPLES IN ACCORDANCE WITH SUPPLEMENTAL WORK PLAN, SECTIONS 6 AND 7.

GRAPHIC SCALE

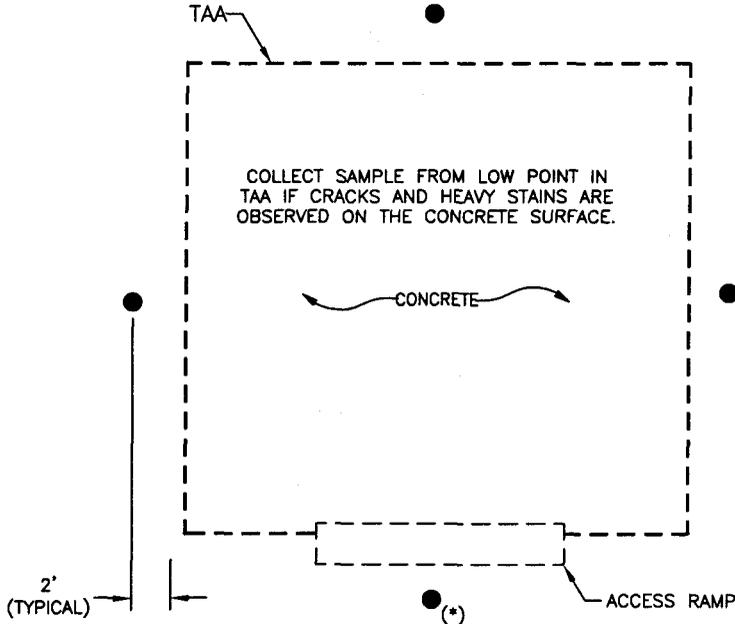


(IN FEET)

Dec 04, 2000 - 16:39:48 I:\OHM CORP\PROJECTS\18609\18609348B.dwg

<p>OHM Remediation Services Corp. A Subsidiary of OHM Corporation IRVINE, CA</p>				DRAWN BY R. PERFORADIAN DATE 12/4/00		<p>TYPICAL LAYOUT AND PROPOSED SOIL SAMPLING LOCATIONS UNBERMED, FENCED OR UNFENCED TAA</p> <p>MARINE CORPS AIR STATION EL TORO, CALIFORNIA</p>					
				CHECKED BY DATE 1/18/01					APPROVED BY DATE		
CONTRACT NAME <p style="text-align: center;">SWDIV</p>				PROJECT MANAGER DATE 1/18/01					OHM PROJECT No. 18609		
AUTOCAD FILE No. 18609348B.DWG		PLOT SCALE 1=1		SHEET 1	OF 1				SCALE 1"=10'		DOCUMENT CONTROL No. SW3169

6-6



1 SAMPLE AT 1.5' BGS
 1 SAMPLE AT 3.0' BGS
 (TYPICAL FOR 4 SAMPLE LOCATIONS)

LEGEND:

- LIMIT OF TAA
- SOIL SAMPLE LOCATION
- TAA TEMPORARY ACCUMULATION AREA
- BGS BELOW GROUND SURFACE
- (*) ADJUST BORING LOCATION TO BUILDING ENTRANCE/LOADING AREA

NOTES:

- 1- DRY VACUUM TAA GROUND/FLOOR SURFACE PER SUPPLEMENTAL WORK PLAN, SECTION 4, PRIOR TO COLLECTING SOIL SAMPLES.
- 2- COLLECT AND ANALYZE SOIL SAMPLES IN ACCORDANCE WITH SUPPLEMENTAL WORK PLAN, SECTIONS 6 AND 7.

GRAPHIC SCALE



(IN FEET)

Dec 20, 2000 - 17:04:54 I:\OHM CORP\PROJECTS\18609\18609348C.dwg

<p>OHM Remediation Services Corp. A Subsidiary of OHM Corporation IRVINE, CA</p>				DRAWN BY R. PIRMORADIAN		DATE 12/20/00		<p>TYPICAL LAYOUT AND PROPOSED SOIL SAMPLING LOCATIONS TAA LOCATED INSIDE BUILDING</p> <p>MARINE CORPS AIR STATION EL TORO, CALIFORNIA</p>							
				CHECKED BY <i>[Signature]</i>		DATE 1/18/01									
CONTRACT NAME <p style="text-align: center;">SWDIV</p>				APPROVED BY _____		DATE _____						PROJECT MANAGER <i>[Signature]</i>		DATE 1/18/01	
AUTOCAD FILE No. 18609348C.DWG		PLOT SCALE 1=1		SHEET OF 1 1		SCALE 1"=10'		DOCUMENT CONTROL No. SW3169		OHM PROJECT No. 18609		FIGURE No. FIG 6-4		REVISION 0	

6.3.1.1 Soil Samples

Soil samples will be collected at each TAA to determine whether contaminants of concern are present beneath and/or around the TAA. Soil samples will be collected using a hand-driven stainless steel splitspoon sampler. The boring locations will be located 2 to 5 feet outside the midway point of each side of the TAA. Borings will be completed to a maximum depth of 36 inches below ground surface. Soil samples will be collected at depths of 18 and 36 inches below ground surface. Table 6-1 indicates the sampling protocols for each type of TAA.

If the surface area of a TAA is observed to be damaged (i.e., cracked, heavy stains), an additional sample will be collected from the crack. Concrete and asphalt surfaces will be cored to provide access for boring and sampling equipment. If excavation of contaminated soil is required at a site, additional samples will be collected from the excavated areas and from the soil stockpiles for waste characterization.

6.3.1.2 Rinsate Samples for TAA Decontamination Activities

Based on visual inspection of TAA, if heavy stains and/or cracks on the surface of the pad are apparent, the TAA concrete surface will be decontaminated with water. Cleaning procedures are described in the MCAS El Toro detailed plan (Appendix G). Rinsate water samples will be collected at TAAs following cleaning. Table 6-2 indicates the protocols for the rinsate samples at each type of TAA.

6.3.2 RCRA Facility Assessment Sites

OHM will perform verification soil sampling at the RFA sites to assess the vertical and lateral extent of contamination. Based on the review of verification soil sample analytical results, decisions will be made regarding excavation at RFA sites.

If verification sampling results indicate that contaminants of concern exceed residential PRGs, excavation of the RFA site will be considered warranted. After the contaminated soil has been excavated, confirmation samples (from four sidewalls and the excavation floor, as deemed necessary) will be collected.

6.4 Analytical Requirements

All soil and water samples will be transported to a laboratory certified by the State of California Environmental Laboratory Accreditation Program (ELAP) and evaluated by NFESC for the specified analyses. The 18-inch-depth soil samples and all rinsate samples from TAAs will be analyzed for the full analytical suite listed in Table 6-3.

Table 6-1
Soil Sample Locations for Each TAA Type

TAA Types	No. of Samples	Locations
Type 1	Typical 4 Optional 2	Each of the four sides adjacent to the TAA One underneath the sump, but only if cracks, discoloration, or stains are apparent One underneath crack in the pavement area if necessary
Type 2	Typical 4 Optional 2	Each of the four sides adjacent to the TAA One beneath lowest point within the bermed area, but only if cracks, discoloration, stains are apparent One underneath crack in the pavement area if necessary
Type 3	Typical 4 Optional 2	Each of the four sides adjacent to the TAA One beneath lowest point within the TAA, but only if cracks, discoloration, stains are apparent One underneath crack in the pavement area if necessary
Type 4	Typical 4 Optional 2	Each of the four sides adjacent to building (near building entrance or loading/unloading area) One beneath lowest point within the building, but only if cracks, discoloration, stains are apparent One underneath crack in the pavement area if necessary

Table 6-2
Sample Locations for Rinsate Samples^a

TAA Types	No. of Samples	Locations
Type 1	One	Sump
Type 2	One	Low area of the containment pad
Type 3	None	Not applicable
Type 4	None	Not applicable

^aDecontamination with water will be performed only for Type 1 and 2 TAAs and only if the TAA structure has heavy stains, discoloration, and cracks on the surface of the concrete pad.

Table 6-3
Summary of TAA Analytical Requirements for Rinsate Water and Soil Samples

Analysis	Method	Sample Depth	
		18 inches	36 inches
Total Petroleum Hydrocarbons – Purgeable	Modified 8015 – Purgeable	X	
Total Petroleum Hydrocarbons – Extractable (C ₁₀ - C ₄₄)	Modified 8015 – extractable	X	
Pesticides	8081A	X	
Volatile Organic Compounds	8260B	X	
Semivolatile Organic Compounds	8270C	X	X
Selected Ion Monitoring	8270C	X	
Metals	6010/7000s	X	X

The 36-inch-depth soil sample will be analyzed for SVOCs and metals. In addition, if TPH, VOCs, or pesticides in the 18-inch-depth samples exceed detection limits, the 36-inch-depth samples will also be analyzed for the corresponding parameters. The analytical parameters have been or will be selected based on the hazardous waste inventories provided by MCAS El Toro and review of analytical data from past TAA decontamination sampling activities.

6.4.1 Soil Sample Analysis

The following analyses are required for TAA sites:

- TPH
- Pesticides
- VOCs
- SVOCs
- Metals.

Analyses required for RFA SWMU sites will be based on the recommendations presented in the RFA addendum (Bechtel, 1996a).

6.4.2 Waste Management

This section is included in Appendix C of the FSWP and will not be repeated here.

6.4.3 Analytical Methods

This section describes analytical methods that will be used, container and preservative requirements, and field and laboratory quality control (QC) samples that will be collected for this project.

The following analytical methods will be used for TAA sites:

- TPH-gasoline by California leaking underground fuel tank (CA LUFT) Method 8015M
- TPH-diesel and TPH-JP5 by CA LUFT Method 8015M
- Pesticides by EPA Method 8081A
- VOCs by EPA Method 8260
- SVOCs with selected ion monitoring (SIM) by EPA Method 8270
- Metals by EPA Method 6010/7000 series.

Analytical methods, calibration criteria, project-required reporting limits, and QC acceptance criteria are presented in detail in the QAPP (Attachment 2).

6.5 Sample Containers, Preservatives, and Holding Times

Tables 6-4 and 6-5 list the sample container, preservative, and holding time requirements for soil and water samples, respectively.

If the results of the first round of confirmation samples do not meet the cleanup goals, an additional 2 feet of soil will be excavated and another round of confirmation samples will be collected. Samples will also be collected from the soil stockpile, one representative sample per 500 cubic yards, and analyzed to characterize the stockpile soil prior to off-site disposal.

Table 6-4

Soil Sample Analytes, Analytical Methods, Container Requirements, Preservatives, and Holding Times

Analytes	Analytical Method	Matrix	Container	Preservative	Holding Time
TPH-Gasoline	CA LUFT 8015M	Soil	EnCore sample cartridge	Cool to 4 ± 2°C	48 hours until preservation, then 14 days from sampling
TPH-Diesel TPH-JP5	CA LUFT 8015M	Soil	One 8-oz jar	Cool to 4 ± 2°C	14 days
Pesticides	EPA 8081A	Soil	One 8-oz jar	Cool to 4 ± 2°C	14 days
VOCs	EPA 8260B	Soil	EnCore sample cartridge	Cool to 4 ± 2°C	14 days
SVOCs & SIM	EPA 8270C	Soil	One 8-oz jar	Cool to 4 ± 2°C	14 days
Metals (Title 22)	EPA 6010B/7000	Soil	One 8-oz jar	Cool to 4 ± 2°C	6 months, except 28 days for mercury

CA LUFT – California leaking underground fuel tank

EPA – U.S. Environmental Protection Agency

oz. – ounce

SIM – selected ion monitoring for semivolatiles

SVOCs – semivolatile organic compounds

TPH – total petroleum hydrocarbons

VOCs – volatile organic compounds

Table 6-5**Aqueous Sample Analytes, Analytical Methods, Container Requirements, Preservatives, and Holding Times**

Analytes	Analytical Method	Matrix	Container	Preservative	Holding Time
TPH-Gasoline	CA LUFT 8015M	Water	Three x 40-mL VOA vials	Cool to 4 ± 2°C, HCl, pH < 2	14 days
TPH-Diesel TPH-JP5	CA LUFT 8015M	Water	One 1-L amber glass bottle	Cool to 4 ± 2°C, HCl, pH < 2	7 days to extract 40 days to analyze
Pesticides	EPA 8081A	Water	One x 1-L amber glass bottle	Cool to 4 ± 2°C	7 days to extract 40 days to analyze
VOCs	EPA 8260B	Water	Three x 40-mL VOA vials	Cool to 4 ± 2°C, HCl, pH < 2	14 days
SVOCs & SIM	EPA 8270C	Water	One x 1-L amber glass bottle	Cool to 4 ± 2°C	7 days to extract 40 days to analyze
Metals (Title 22)	EPA 6010B/7000	Water	One x 500-mL polyethylene bottle	HNO ₃ , pH < 2	6 months, except 28 days for mercury

CA LUFT – California leaking underground fuel tank

EPA – U.S. Environmental Protection Agency

HCl – hydrochloric acid

HNO₃ – nitric acid

L – liter

mL – milliliter

TPH – total petroleum hydrocarbons

SIM – selected ion monitoring for semivolatiles

SVOCs – semivolatile organic compounds

VOA – volatile organic analysis

VOCs – volatile organic compounds

6.6 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 could include field duplicates, equipment rinsates, and trip blanks. Table 6-6 summarizes the field QC sample requirements.

Table 6-6**Field Quality Control Sample Frequency**

Type of Sample	Frequency
Trip Blank	1 per cooler containing VOC samples
Field Duplicate	1 per 10 samples

VOC – volatile organic compound

6.6.1 Field Duplicates

Field duplicates consist of two samples (an original and a duplicate) of the same matrix collected, to the extent possible, at the same time and location and using the same sampling techniques. Field duplicate samples are used to evaluate the precision of the overall sample collection and analysis process. Field duplicates will be collected at a frequency of 1 per 10 samples and will be analyzed in the same manner as the original sample. Field duplicates receive unique sample numbers; therefore, the identities of the duplicate samples are "blind" to the analytical laboratory. Exact locations of duplicate samples and the corresponding identifications will be recorded in the field logbook.

6.6.2 Equipment Rinsate Samples

Equipment rinsate samples will be collected only if nondisposable sampling equipment is used. Rinsate samples consist of reagent-grade water collected from the final rinse of the decontamination process. Rinsate samples will be collected from the sampling equipment and placed in appropriate precleaned containers supplied by the analytical laboratory and will be analyzed in the same manner as the field samples. Equipment rinsate samples are used to evaluate the effectiveness of the decontamination procedure and potential cross-contamination during sampling events. This project will use disposable sampling equipment whenever possible, thus minimizing the need for collection of equipment rinsate samples.

6.6.3 Trip Blanks

Trip blanks consist of hydrochloric acid (HCl)-preserved, organic-free water prepared by the laboratory in 40-milliliter volatile organic analysis (VOA) vials that will be carried into the field, stored with the project samples, and returned to the laboratory for analysis. Trip blanks are used to determine whether samples have been cross-contaminated with VOCs during sample collection and transportation. The trip blank vials must be free of any headspace. Trip blanks will be provided and analyzed for each VOC sampling and shipping event.

6.6.4 Laboratory Quality Control Samples

The laboratory will analyze a matrix spike/matrix spike duplicate (MS/MSD) for every 20 project samples. In order for the laboratory to prepare a project-specific MS/MSD, field personnel will collect triple the sample volume for water samples and double the sample volume for soil samples, at a minimum of 1 MS/MSD per 20 samples collected. Field personnel will designate 1 sample in 20 for MS/MSD analysis on the chain-of-custody form.

6.7 Field Methods and Sampling Procedures

This section presents sample collection, handling, and documentation procedures.

6.7.1 Sampling Procedures

The following sections present the procedures for collecting soil, stockpile, and liquid waste samples.

6.7.2 Soil Sample Collection

The following three types of soil sampling procedures will be used during this project:

- Hand augering at all TAAs
- Confirmation and stockpile soil sampling at RFA sites
- EnCore™ sampling for TPH-volatile and VOCs (Attachment 1).

6.7.3 Soil Sampling Procedures

Soil samples for TPH and VOC analysis will be collected using EnCore™ samplers. The standard operating procedure for using EnCore™ samplers is presented in Attachment 1. All other soil samples will be collected using a stainless steel splitspoon sampler fitted with brass sleeves. Each end of the brass sleeves will be capped with Teflon® sheets and plastic caps. The samples will be properly labeled, packaged in resealable plastic bags, and stored in a sample cooler containing resealable bagged ice pending transportation to the analytical laboratory. The following steps will be performed for field sampling:

1. Hand auger to sampling depth.
2. Decontaminate a hand-auger-driven stainless steel splitspoon sampler and load decontaminated brass sleeve.
3. Attach loaded splitspoon sampler to slide hammer.
4. Drive splitspoon sampler into sample point.
5. Remove sampler and retrieve brass sleeve.
6. Cap brass sleeve by placing a Teflon® sheet on each end and pushing a plastic cap over the Teflon® sheet.
7. Label the sleeve with a sample label completed with the information described in Section 6.7.8.
8. Use clear packing tape to secure the sample label to the container.
9. Place the sample in a resealable plastic bag.
10. Immediately place the plastic bag in a cooler with bagged ice.
11. Record the sample number, date, time, and a description of the sample on a chain-of-custody form and in the field logbook. Write all entries in indelible black ink.
12. Package and ship samples in accordance with the procedures outlined in Section 6.7.9.

6.7.4 Confirmation and Stockpile Sampling Procedures

Appropriate soil samples will be collected from stockpile soil generated during the course of the excavation activities using the following steps:

1. Determine the sample locations using a random number generator.
2. Use a backhoe bucket to access the random sample point, as required.
3. Collect soil samples in a precleaned, 8-ounce wide-mouth jar.
4. Label the jar with a sample label completed with the information described in Section 6.7.8.
5. Use clear packing tape to secure the sample label to the container.
6. Place the sample in a resealable plastic bag.
7. Immediately place the plastic bag in a cooler with bagged ice.
8. Record the sample number, date, time, and a description of the sample on a chain-of-custody form and in the field logbook. Write all entries in indelible black ink.
9. Package and ship samples in accordance with the procedures outlined in Section 6.7.9.

6.7.5 Liquid Waste Sampling Procedures

Liquid samples will be collected using a disposable bailer and then transferred into precleaned containers with the appropriate preservative provided by the analytical laboratory. The following steps will be used to collect liquid samples:

1. Obtain a new disposable bailer for each sample event.
2. Put on a new, clean, chemical-resistant pair of disposable gloves.
3. Lower the bailer into the drum or bin. Allow sufficient time for the bailer to fill with liquid.
4. Retrieve the bailer and fill the appropriate bottles for the analyses being requested.
5. Cap the bottles and wipe any moisture from the outside of the bottles.
6. Label each bottle with a sample label completed with the information described in Section 6.7.8.
7. Use clear packing tape to secure the sample label to the container.
8. Place the bottle in a resealable plastic bag.
9. Immediately place the plastic bag in a cooler with bagged ice.
10. Record the sample number, date, time, and a description of the sample on a chain-of-custody form and in the field logbook. Write all entries in indelible black ink.
11. Package and ship samples in accordance with the procedures outlined in Section 6.7.9.

6.7.6 Decontamination Procedures

Nondisposable sampling equipment will be decontaminated to prevent the introduction of extraneous material into samples and to prevent cross-contamination between samples. All sampling equipment will be decontaminated by steam cleaning or by washing with a nonphosphate detergent such as Liquinox™ or equivalent. Decontamination water will be collected in 55-gallon drums.

The following steps will be followed for decontamination of nondisposable sampling equipment:

1. **Wash with Nonphosphate Detergent and Water Solution** — This step will remove visible contamination from the equipment. Use of a 5-gallon bucket approximately 75 percent full of solution and a long-handled brush is suggested for this step. Dilute the nonphosphate detergent as directed by the manufacturer.
2. **Rinse with Potable Water** — This step will rinse the detergent solution from the equipment. Use of a 5-gallon bucket approximately 75 percent full of water and a long-handled brush is suggested for this step. Periodic changing of this water is required.
3. **Rinse with Deionized Water** — This step will rinse remaining detergent solution and potable water residues from the equipment. For most effective rinsing, apply the deionized water from a stainless steel Hudson-type sprayer or Nalgene™ squeeze bottle while holding the equipment over a 5-gallon bucket.

6.7.7 Sample Numbering

All samples submitted to the analytical laboratory will be uniquely numbered according to the following format:

XXXXXX - YYY

Where “XXXXXX” is the five-digit OHM project number and “YYY” is a sequential number for this project. The project number is 18609. The sample number will be recorded in the field logbook and on the chain-of-custody form at the time of sample collection. A complete description of the sample and sampling circumstances will be recorded in the field logbook and referenced to the unique sample identification number.

6.7.8 Sample Labeling

Sample labels will be completed using indelible black ink and will be affixed to each sample container. Each sample label will be covered with clear tape. Sample containers will be placed in resealable plastic bags to protect the samples from moisture during transportation to the laboratory. Each sample container will be labeled with the following, at a minimum:

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

- Time of collection (24-hour clock)
- Project number (i.e., 18609)
- Sampler's initials
- Analyses to be performed
- Preservation (if any).

6.7.9 Sample Packaging and Shipment

Immediately after sample collection, each sample will be placed in a resealable plastic bag to keep the sample container and label dry. Glass sample containers will be protected with bubble wrap if transported by a commercial carrier.

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 temperature of the blank will be recorded by the laboratory immediately upon receipt of the samples.

Sample cooler drain spouts will be taped from the inside and outside of the cooler to prevent any leakage. Ice, sealed in plastic bags, 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.

A chain-of-custody form will be completed and then signed by the laboratory-assigned courier. The cooler can then be released to the courier for transportation to the laboratory.

If a commercial carrier is used, the chain-of-custody form 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 shipment. The samples will then be shipped to the analytical laboratory. A copy of the courier airbill will be retained for documentation.

6.7.10 Field Documentation

At a minimum, sampling information will be recorded on a chain-of-custody form and in the field logbook. Both documents will be completed in the field at the time of sample collection. All entries will be legibly recorded in indelible black ink.

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

6.7.10.1 Chain-of-Custody Record

The following will be recorded on the chain-of-custody form:

- Project name
- Project location
- Project number (OHM)
- Project contact (OHM)
- Client representative (SWDIV)
- Project manager (OHM)
- Sample numbers
- Date (of sample collection)
- Time (of sample collection to the nearest minute, military time)
- Sample type (composite or grab)
- Sample description (location and matrix)
- Number of sample containers
- Analysis required
- Remarks:
 - MS/MSD samples
 - Photoionization detector readings
 - Observations specific to sample
- Item numbers (to be relinquished)
- Transfer signature (to relinquish samples)
 - The sampler will be the first person to relinquish sample possession
- Courier/laboratory representative signature (for commercial carrier, record airbill number here)
- Date/time (of custody transfer)
- Additional remarks:
 - Transportation method
 - Laboratory name
 - Turnaround time requirement
 - Composting instructions (if needed)
- Sampler's signature.

6.7.10.2 Field Logbook

A permanently bound field logbook with consecutively numbered pages will be assigned to each project site. All entries will be written in indelible black ink. Corrections will be made by crossing out erroneous data with a single line and dating and initialing the entry. At the end of each workday, the logbook pages will be signed by the responsible sampler and any unused portions of logbook pages 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 document the following information:

- Project name and location
- Date and time
- Personnel in attendance
- General weather conditions
- Work performed
- Field observations
- Sampling performed, including specifics such as location, type of sample, type of analyses, and sample identification
- Field analyses performed, including results, instrument checks, problems, and calibration records for field instruments
- Descriptions of deviations from the field sampling plan
- Problems encountered and corrective actions taken
- Identification of field QC samples
- QC activities
- Verbal or written instructions
- Any other events that could affect the samples.

6.7.10.3 Document Corrections

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

6.8 Data Quality Objectives

This section is included in Section 3 of the QAPP (Attachment 2) and will not be repeated here.

Section 7

Sample Identification and Documentation

Section not modified.

Section 8

Closure Certification

Section not modified.

Section 9

Estimated Schedule for Closure

Section not modified.

Section 10

Postclosure Plan

Section not modified.

Section 11

Closure Cost Estimate

Section not modified.

Section 12

Financial Responsibility

Section not modified.

Section 13

Extensions for Closure Time

Section not modified.

Section 14

References

Bechtel, see Bechtel National, Inc.

Bechtel National, Incorporated, 1996a, *Final Addendum RCRA Facility Assessment Report, Marine Corps Air Station El Toro, California.*

Bechtel National, Incorporated, 1996b, *Final Technical Memorandum Background and Reference Levels Remedial Investigations, Marine Corps Air Station El Toro, California, October.*

EPA, see U.S. Environmental Protection Agency.

Jacobs Engineering Group Inc., 1993, *Final Resource Conservation and Recovery Act (RCRA) Facility Assessment Report, Marine Corps Air Station El Toro, California, 16 July.*

Jacobs, see Jacobs Engineering Group Inc.

Naval Facilities Engineering Service Center, 1999, *Navy Installation Restoration Chemical Data Quality Manual.*

NFESC, see Naval Facilities Engineering Service Center.

OHM, see OHM Remediation Services Corp.

OHM Remediation Services Corp., 1995, *Draft Final Closure Certification Report, Building 248, MCAS Tustin, October.*

OHM Remediation Services Corp., 1997, *Final Supplemental Work Plan, Closure of Various Temporary Accumulation Areas and RCRA Facility Assessment Sites, Marine Corps Air Station Santa Ana, California, September 26.*

U.S. Environmental Protection Agency, 1993, *Preparation of a U.S. EPA Region 9 Field Sample Plan for EPA-Lead Superfund Projects, August.*

Attachment 1
EnCore™ Sampling Procedures

SOIL SAMPLING WITH ENCORE™ SAMPLER FOR VOLATILE ORGANIC COMPOUND ANALYSIS

STANDARD OPERATING PROCEDURE

1.0 Purpose

1.1 This Standard Operating Procedure (SOP) establishes the protocol for EnCore™ soil sampling according to EPA Method 5035 for volatile organic compound (VOC) analyses. IT Corporation (IT) personnel will use this SOP for collection of soil and oily waste samples with low VOC concentrations as defined by the data quality objectives (DQOs). Low concentration samples are those ranging from 0.5 microgram/kilogram ($\mu\text{g}/\text{kg}$) to 200 $\mu\text{g}/\text{kg}$. Sample collected in Encore™ samplers will be analyzed by gas chromatography methods (EPA Methods 8015B, 8021B) or gas chromatography/mass spectrometry (EPA Method 8260B). Sample introduction techniques will be purge and trap technique. Additional sample aliquots will be collected into empty containers for dry weight determination.

2.0 References

- 2.1 Test Methods for Evaluating Solid Waste, USEPA Office of Solid Waste, SW-846, Final Update III, December 1996
- 2.2 USEPA Memorandum "Clarification Regarding Use of SW-846 Methods," August 7, 1998
- 2.3 IT SOP 3.1, Surface and Shallow Subsurface Soil Sampling
- 2.4 IT SOP 3.2, Subsurface Soil Sampling While Drilling
- 2.5 IT SOP 10.3, Split Spoon Sampling
- 2.6 IT SOP 1.1, Chain of Custody
- 2.7 IT SOP 2.1, Sample Handling, Packaging and Shipping
- 2.8 IT SQP 10.2, Corrective Action
- 2.9 IT SQP 4.2, Records Management

3.0 Definitions

3.1 EnCore™ Sampler

- 3.1.1 The EnCore™ sampler cartridge is a disposable volumetric sampling system designed to collect, store, and deliver soil samples hermetically. No chemical

preservation of the sample is performed in the field. Extrusion and extraction of the soil is done in the laboratory. Since the sample is never exposed to the atmosphere after sampling, the loss of the VOCs during sample transport, storage and analysis are negligible. The EnCore™ samplers come in two sizes for sample volumes of approximately 25 or 5 grams.

3.1.2 The associated device is the EnCore™ T-handle Sampling Tool, which is used with the EnCore™ cartridges.

3.1.3 The EnCore™ sampler is not designed to store solvent or free product. Soil conditions with heavy latent solvents may require different sampling techniques due to the potential interaction with the coring body.

3.2 Matrix Spike and Matrix Spike Duplicate

Matrix spike (MS) and matrix spike duplicate (MSD) are quality control (QC) check samples that measure matrix-specific effects and method performance. A matrix spike sample is prepared at the laboratory by adding a known quantity of target analytes to a sample prior to sample digestion or extraction.

3.3 Field Duplicate

Field duplicates are samples collected at the same time from the same source. They are used to evaluate the sampling precision and the overall quality of sample collection.

4.0 Supplies and Reagents

4.1.1 Supplies and reagents are the instruments, chemicals and other and materials necessary to perform analysis. The required list of supplies and reagents is as follows:

- EnCore™ sampler cartridge made by En Chem, Inc., 1795 Industrial Drive, Green Bay, WI 54302 or equivalent
- EnCore™ T-handle Sampling Tool made by En Chem, Inc., 1795 Industrial Drive, Green Bay, WI 54302 or equivalent
- Sample containers: pre-cleaned 40-milliliter (mL) vials with caps
- Plastic scoops, or stainless steel spatula, or wooden tongue depressors
- Chain of custody forms
- Disposable nitrile gloves
- Safety glasses
- Coolers for sample shipping

- Ice
- Packing material, such as absorbent pads
- Shipping tape
- Chain of custody seals
- Sample and shipping labels
- Paper towels or Kimwipes

5.0 Procedure

5.1 Responsibilities

5.1.1 The Project QC Manager is responsible for monitoring the sampling activities, assuring that the requirements of this SOP are met, and complete documentation of sampling activities.

5.1.2 The Project Manager is responsible for ensuring that proper supplies, reagents, and adequate space are available for sampling activities; for assigning qualified and trained personnel for sampling; and for integrating sampling activities into the project schedule.

5.1.3 The Project Chemist is responsible for laboratory selection and coordination, identification and preparation of field supplies, sampling per this SOP requirements, field quality control, sample handling in the field and shipping to the laboratory, and training and documentation of other project staff in the use of this SOP.

5.2 EnCore™ Assembly

5.2.1 Prior to taking the sample, test the plunger for free movement by pushing the plunger rod down until it rests against the tabs.

5.2.2 The locking lever on the EnCore™ T-handle must be depressed as the cartridge is inserted, and the slots on the cartridge with the locking pins in the T-handle must be lined up. Take a cartridge out of the bag and save the bag for future use. Plunger end first, insert the cartridge into T-handle with locking tabs aligned, and twist the cartridge clockwise to lock it in place.

5.2.3 If faulty components are detected during assembling process, discard the cartridge and assemble the device with a new cartridge.

5.3 Field Sampling

5.3.1 Collect soil samples one at a time using grab soil sample collection methods as defined in the project SAP. These methods may include surface and shallow subsurface sampling per IT SOP 3.1, subsurface sampling while drilling per IT SOP 3.2, split spoon sampling per IT SOP 10.3, or any other sampling procedure as defined in the project SAP.

5.3.2 Wear disposable gloves and safety glasses during sample collection activities. Apply EnCore™ to freshly exposed surface soil or to one end of a sleeve core as soon as it is brought to the surface. Holding the device with the T-handle up and the cartridge down, insert the sampling device into the soil. Look down the viewing hole to make sure the plunger o-ring is visible indicating that the cartridge is full. If the o-ring is not visible, apply more pressure to fill up the cartridge. Withdraw sampling device from soil and wipe of excess dirt from cartridge body.

5.3.3 Cap the cartridge core while it is still on the T-handle. Push or twist cap on until the grooves are seated over the ridge of the coring body.

5.3.4 Remove the capped sampler by pushing the locking lever down on T-handle, and twisting and pulling the sampler from T-handle. Lock the plunger by rotating plunger rod until the wings rest against the tabs. Attach the label and place the cartridge in the EnCore™ sampler bag.

5.3.5 Collect three EnCore™ samples for each location. In addition, collect 10-20g of soil into a clean, labeled vial for dry weight determination.

5.3.6 Store the EnCore™ sampler bag in a cooler with ice until it can be delivered to the laboratory or packaged for shipment.

5.3.8 Using the above-described procedure, collect two additional samples for MS/MSD analysis. In addition to the field sample ID, clearly identify these samples on the vial label as "MS" and "MSD."

5.3.9 Collect field duplicates as unhomogenized split samples obtained as two aliquots of the same soil in two EnCore™ sample cartridges.

5.3.10 During sampling follow the chain of custody procedures as required by IT SOP 1.1.

5.3.11 Package the samples per IT SOP 2.1; enclose the chain of custody form and ship the sample coolers as required by IT SOP 2.1.

5.3.12 Soil samples will be shipped to the laboratory for analysis or preservation within the 48 hour holding time unless otherwise specified in the SAP. Preserved samples can be held up to 14 days for analysis. The laboratory will keep samples in a secure refrigerator at $4 \pm 2^{\circ}\text{C}$ until the time of analysis. Analytical procedures will be according to EPA Method 5035 and laboratory SOP.

6.0 Quality Control

6.1 Unless otherwise required in the project SAP, a MS/MSD pair will be collected at a frequency of one pair for every 20 samples, and field duplicates will be collected at a 10% frequency.

7.0 Corrective Action

7.1 Corrective action for problems with sample collection may include re-sampling, preparation of new vials with methanol, and other actions as appropriate. Corrective action will be documented according to IT Standard Quality Procedure (SQP) 10.2.

8.0 Records

8.1 Records generated as a result of implementation of this SOP will be controlled and maintained in the project record files according to IT SQP 4.2

9.0 Attachments

None

Attachment 2

Quality Assurance Project Plan

Addendum to the Final Supplemental Work Plan (Quality Assurance Project Plan)

*Closure of Various Temporary Accumulation Areas and RCRA
Facility Assessment Sites*

*Marine Corps Air Station El Toro
Santa Ana, California*

SWDIV Contract No. N68711-93-D-1459, Delivery Order No. 0070

OHM Project No. 18609

Document Control No. SW8603

Revision 0

January 17, 2001



**OHM Remediation
Services Corp.**

1230 Columbia Street, Suite 1200P
San Diego, California 92101

Reviewed by:

A handwritten signature in black ink, appearing to read 'D. Ishida', written over a horizontal line.

Dwayne Ishida
Field Analytical Services Manager

Approved by:

A handwritten signature in black ink, appearing to read 'Narciso Ancog', written over a horizontal line.

Narciso Ancog
SWDIV, Quality Assurance Officer

Table of Contents

<i>List of Figures</i>	<i>iii</i>
<i>List of Tables</i>	<i>iii</i>
<i>Abbreviations and Acronyms</i>	<i>iv</i>
Section 1 Introduction	1-1
1.1 Objective.....	1-1
1.2 Background.....	1-1
Section 2 Project Organization	2-1
Section 3 Quality Assurance Objectives	3-1
3.1 Data Quality Objective.....	3-1
3.1.1 Stating the Problem.....	3-1
3.1.2 Identifying the Decisions.....	3-1
3.1.3 Identifying Inputs to the Decisions.....	3-1
3.1.4 Defining the Boundaries.....	3-1
3.1.5 Developing a Decision Rule.....	3-2
3.1.6 Specifying Limits on Decision Error.....	3-2
3.1.7 Optimizing the Design for Obtaining Data.....	3-2
3.2 Analytical Data Quality Objective.....	3-2
3.2.1 Quality Control Criteria.....	3-3
3.2.2 Analytical Methods.....	3-4
3.2.2.1 Project-Required Reporting Limits.....	3-4
3.2.2.2 Project Quality Control Limits.....	3-4
Section 4 Sample Collection	4-1
4.1 Sampling Locations.....	4-1
4.2 Sample Collection.....	4-1
4.3 Sample Containers, Preservatives, and Holding Times.....	4-1
4.4 Sample Packaging and Shipment.....	4-1
Section 5 Sample Custody and Documentation	5-1
5.1 Field Sample Custody and Documentation.....	5-1
5.1.1 Field Logbook.....	5-1
5.1.2 Sample Labeling.....	5-1
5.1.3 Custody Seals.....	5-1
5.1.4 Chain-of-Custody Records.....	5-2
5.2 Laboratory Sample Custody and Documentation.....	5-2
5.3 Corrections to Custody Documentation.....	5-2

Table of Contents (Cont.)

Section 6 Analytical Quality Control Procedures	6-1
6.1 Laboratory Qualification.....	6-1
6.2 Laboratory Quality Control Procedures.....	6-1
6.3 Laboratory Quality Control Samples.....	6-10
6.3.1 Calibration.....	6-10
6.3.2 Instrument Blanks.....	6-10
6.3.3 Method Blanks	6-10
6.3.4 Laboratory Control Samples	6-11
6.3.5 Matrix Spike and Matrix Spike Duplicates	6-11
6.3.6 Duplicates.....	6-11
6.4 Preventive Maintenance.....	6-11
6.5 Data Review.....	6-12
6.6 Deliverables	6-12
6.6.1 Hard Copy Deliverables	6-12
6.6.2 Electronic Deliverables	6-13
Section 7 Data Quality Management.....	7-1
7.1 Data Management	7-1
7.1.1 Hard Copy Data.....	7-1
7.1.2 Electronic Data	7-1
7.2 Data Validation	7-1
7.3 Data Evaluation.....	7-2
Section 8 Quality Assurance Oversight	8-1
8.1 Field Audits.....	8-1
8.2 Laboratory Audits	8-1
8.3 Corrective Action Procedures	8-2
Section 9 References.....	9-1

Attachment 1 Sample Custody Seal

Attachment 2 Sample Chain-of-Custody Form

List of Figures

Figure 2-1 Project Organization Chart..... 2-2

List of Tables

Table 2-1 Personnel and Responsibilities 2-3
Table 3-1 Project-Required Reporting Limits 3-5
Table 3-2 QC Acceptance Criteria..... 3-10
Table 6-1 Summary of Calibration Criteria and Corrective Action Procedures..... 6-2

Abbreviations and Acronyms

BFB	bromofluorobenzene
CA LUFT	California leaking underground fuel tank
CCC	calibration check compound
CF	calibration factor
COPC	chemical of potential concern
CQC	contractor quality control
DCN	Document Control Number
DFTPP	decafluorotriphenylphosphine
DO	Delivery Order
DQO	data quality objective
EDD	electronic data deliverable
EICP	extracted ion current profile
ELAP	Environmental Laboratory Accreditation Program
EPA	U.S. Environmental Protection Agency
FSWP	final supplemental work plan
GC/MS	gas chromatograph/mass spectrometer
ICAP	inductively coupled argon plasma
ICP	inductively coupled plasma
ICS	interference check solution
LCS	laboratory control standard
MCAS	Marine Corps Air Station
MDL	method detection limit
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MS/MSD	matrix spike/matrix spike duplicate
NEDTS	Navy Environmental Data Transfer Standard
NFESC	Naval Facilities Engineering Service Center
OHM	OHM Remediation Services Corp.
PARCC	precision, accuracy, representativeness, completeness, and comparability
PCB	polychlorinated biphenyl
PRG	preliminary remediation goal
QA	quality assurance
QAPP	quality assurance project plan
QA/QC	quality assurance/quality control
QC	quality control
RAC	Remedial Action Contract
RCRA	Resource Conservation and Recovery Act
RF	response factor
RFA	RCRA facility assessment
RL	reporting limit
RPD	relative percent difference
RWQCB	California Regional Water Quality Control Board

Abbreviations and Acronyms (Cont.)

SIM	selected ion monitoring
SOP	standard operating procedure
SPCC	system performance check compound
SVOC	semivolatile organic compound
SWDIV	Southwest Division Naval Facilities Engineering Command
TAA	temporary accumulation area
TCLP	toxicity characteristic leaching procedure
TPH	total petroleum hydrocarbons
VOC	volatile organic compound
WET	waste extraction test
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
%R	percent recovery
%RSD	percent relative standard deviation

Section 1

Introduction

This quality assurance project plan (QAPP), Attachment 2 of the addendum to the final supplemental work plan (FSWP), was prepared in support of the remedial action at temporary accumulation area (TAA) sites and Resource Conservation and Recovery Act (RCRA) facility assessment (RFA) sites located at the Marine Corps Air Station (MCAS) El Toro in Santa Ana, California. This QAPP was prepared by OHM Remediation Services Corp. (OHM) as an addendum to the FSWP, dated September 26, 1997, Document Control Number (DCN) SW4380 (OHM, 1997), under Southwest Division Naval Facilities Engineering Command (SWDIV) Remedial Action Contract (RAC) No. N68711-93-D-1459, Delivery Order (DO) No. 00070.

This QAPP and Section 6 of the addendum to the FSWP (and Section 6 of the FSWP) complete the project-specific sampling and analysis plan required for this project, as stipulated by U.S. Environmental Protection Agency (EPA) guidelines (EPA, 1999a), and has been prepared in accordance with the *Navy Installation Restoration Chemical Data Quality Manual* (Naval Facilities Engineering Services Center [NFESC], 1999). This attachment brings the FSWP QAPP into compliance with current SWDIV QA/QC requirements.

1.1 Objective

This QAPP was prepared to ensure that the data collected during the investigative and possible removal activities are precise, accurate, representative, complete, and comparable and are suitable for the intended use of the data. This document describes quality assurance (QA) objectives and quality control (QC) requirements that will be used for this project. Some of the QC requirements associated with the sampling activities are presented in the FSWP and will not be repeated here.

The objectives of this project are to verify that all stored hazardous wastes, residues, and constituents that pose a potential health risk have been removed from the TAAs in accordance with the MCAS El Toro detailed plan (OHM, 1995a) and to perform verification soil sampling and other remedial measures to obtain closure of TAA and RFA sites.

The California Regional Water Quality Control Board (RWQCB) has regulatory oversight for these sites.

1.2 Background

Site locations and background, including site descriptions and previous investigative findings, are presented in the FSWP (OHM, 1997) and are not repeated here.

Section 2

Project Organization

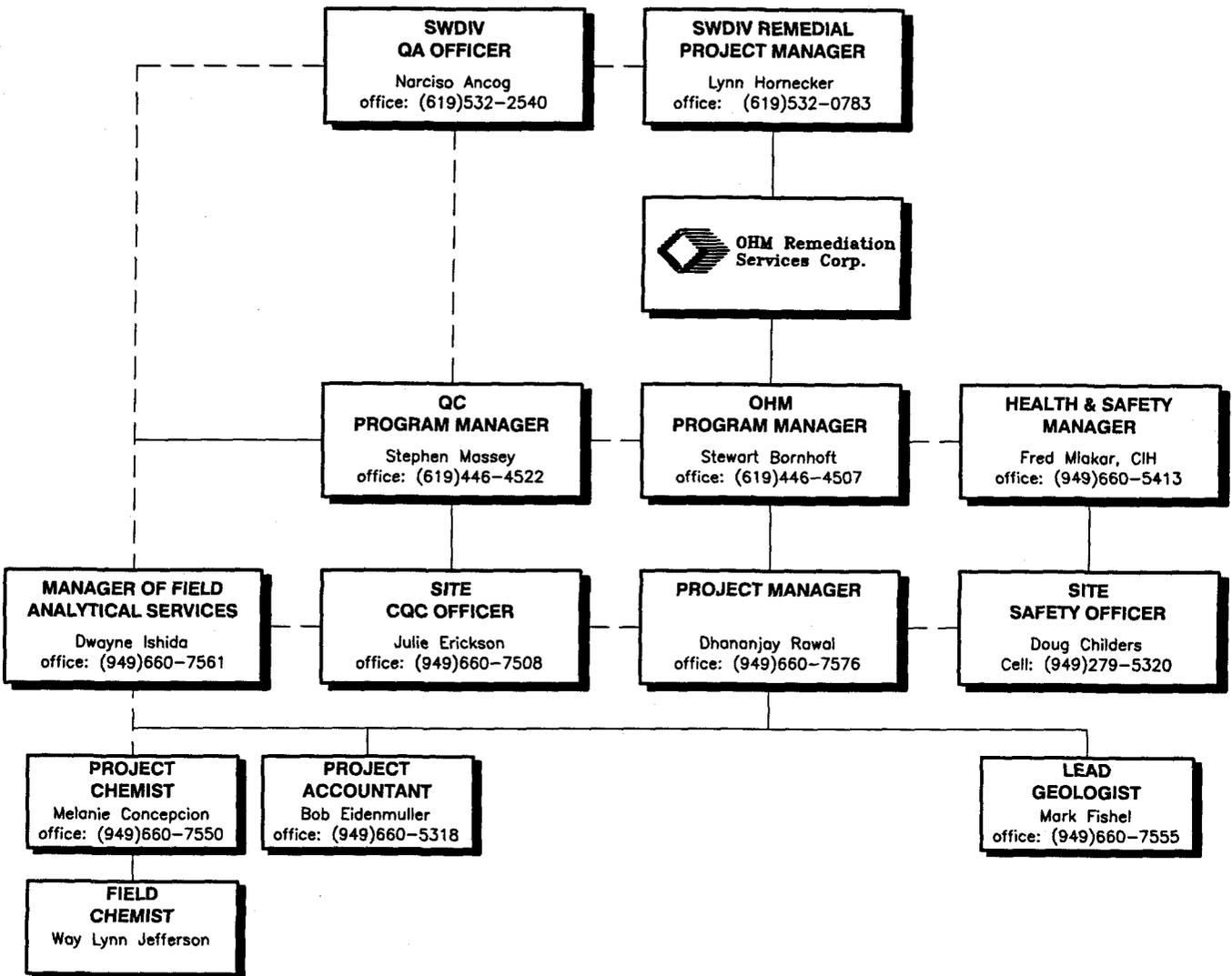
The project organization for this removal action consists of representatives from the Department of the Navy and the OHM team. The project organization is shown in Figure 2-1.

The project team consists of the following members:

- Remedial Project Manager, SWDIV
- Quality Assurance Officer, SWDIV
- Quality Control Program Manager, OHM
- Project Manager, OHM
- Health and Safety Manager, OHM
- Manager of Field Analytical Services, OHM
- Site Safety Officer, OHM
- Site Contractor Quality Control (CQC) Officer, OHM
- Project Chemist, OHM
- Field Chemist/Technologist, OHM
- Lead Geologist, OHM.

The responsibilities of the team members associated with the sampling activities are presented in Table 2-1.

Project Organization Chart



NOTE:
ADDENDUM TO THE FINAL SUPPLEMENTAL WORK PLAN
(OHM, 1997)

Dec 20, 2000 - 11:05:58 I:\DHM CORP\PROJECTS\18609\18609318D.dwg

OHM Remediation Services Corp. A Member of the IT Group SAN DIEGO, CA				DRAWN BY R. PIRMORADIAN		DATE 12/20/00		PROJECT ORGANIZATION CHART MARINE CORPS AIR STATION EL TORO, CALIFORNIA			
				CHECKED BY		DATE					
APPROVED BY		DATE									
CONTRACT NAME SWDIV				PROJECT MANAGER		DATE					
AUTOCAD FILE No.	PLOT SCALE	SHEET	OF	SCALE	DOCUMENT CONTROL No.	OHM PROJECT No.	FIGURE No.	REVISION			
18609318D.DWG	1=1	1	1	NONE	SW8603	18609	FIG 2-1	0			

**Table 2-1
Personnel and Responsibilities**

Key Position	Responsibility
SWDIV Quality Assurance Officer	<ul style="list-style-type: none"> • Provides governmental oversight of the OHM QA Program • Provides quality-related directives through Contracting Officer's Technical Representative • Provides technical and administrative oversight of OHM surveillance audit activities • Serves 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 OHM contracts • Coordinates training on matters pertaining to generation and maintenance of data quality • Has the authority to suspend project execution if QA requirements are not adequately followed
Project Chemist	<ul style="list-style-type: none"> • Develops the sampling and analysis plan and QAPP • Selects qualified subcontract laboratories • Implements chemical data QC procedures and audits field performance • Reviews laboratory data prior to use • Coordinates data validation of laboratory data • Reviews data validation report • Prepares and supports report preparation
Field Chemist/ Technologist	<ul style="list-style-type: none"> • Performs all sampling in accordance with approved Section 6 of the FSWP addendum and the QAPP • Ensures that field QA samples are collected as specified in Section 6 of the FSWP addendum • Completes sampling notes, forms, and sampling logs • Coordinates laboratory and field sampling activities • Implements corrective actions as required

OHM – OHM Remediation Services Corp.
QA – quality assurance
QAPP – quality assurance project plan
QC – quality control
SWDIV – Southwest Division Naval Facilities Engineering Command

Section 3

Quality Assurance Objectives

The overall objective of this QAPP is to outline procedures for the collection and assessment of data that are within acceptable ranges of precision, accuracy, representativeness, completeness, and comparability (PARCC) and meet the project data quality objectives (DQOs). The data quality associated with environmental data is a function of the sampling plan rationale and the procedures used to collect the samples, as well as the analytical methods and instrumentation used. However, uncertainty cannot be eliminated entirely from environmental data.

3.1 Data Quality Objective

The DQO process is a series of planning steps based on scientific methods that are designed to ensure that the types, 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 designed to provide a systematic approach to resolving all the issues that pertain to the site investigation and remediation (EPA, 1994a).

3.1.1 Stating the Problem

Based on previous investigations, hazardous materials were found or suspected to have been stored at the various sites. Table 1-2 of the FSWP lists the chemicals of potential concern (COPCs) for the TAA and RFA sites.

3.1.2 Identifying the Decisions

- Do these sites pose a risk to human health and environment?
- Are these sites suitable for closure?

3.1.3 Identifying Inputs to the Decisions

The following factors will be considered in the decision-making process:

- Previous background data collected by Jacobs Engineering (JEG) 1993, and Bechtel National, Inc. (BNI), 1996 during RFA field activities
- Analytical results for soil samples
- Field observations and field measurements.

3.1.4 Defining the Boundaries

TAAAs are located throughout the former MCAS El Toro. The dimensions of the TAAAs typically range from approximately 10 feet wide by 15 feet long to 20 feet wide by 30 feet

long. Soil that exceeds the screening criteria and/or presents a risk based on the streamlined risk evaluation will be excavated to meet cleanup goals (Section 6.1 of the FSWP addendum). The excavation will be sampled in conformance with Table 6-1 of the FSWP addendum. If confirmation samples indicate that cleanup goals have not been met, additional excavation and confirmation sampling will be conducted.

3.1.5 Developing a Decision Rule

- If a site is considered to pose a risk to human health or environment (based on the streamlined risk evaluation and cleanup goals), excavation of the contaminated area will be followed by confirmation soil sampling.
- If a site is not considered to pose a risk to human health or environment based on a streamlined risk evaluation, closure will be requested.

3.1.6 Specifying Limits on Decision Error

Statistically derived error limits cannot be established for this work. Sampling will be based on the judgment of field personnel. Samples will be collected from predetermined locations (at 5-foot intervals in the specified borings). In addition, potentially contaminated areas, as determined by visual inspection or by field instrumentation readings, will be sampled in order to evaluate the worst-case conditions at each site. Analytical results will be compared to agreed-upon action levels (most recent EPA Region IX PRGs for residential land use).

The sampling protocol focuses on the most likely areas of contamination and the most likely contaminants.

3.1.7 Optimizing the Design for Obtaining Data

Figures 6-1 through 6-4 and Tables 6-1 through 6-3 of the FSWP addendum provide sampling design and protocols for TAA and RFA sites. TAA sample locations focus on sumps, low areas, cracks, and access ramps. RFA sites focus on previously surveyed or sampled sites where results indicated the need for future remedial action (based on the RFA report) (Bechtel National, Inc., 1996). RFA site verification sampling, based on RFA findings, will be followed by excavation and confirmation sampling as outlined in the FSWP addendum.

3.2 Analytical Data Quality Objective

Analytical data will be obtained using standard EPA methods in a laboratory certified by the California Department of Health Services through the Environmental Laboratory Accreditation Program (ELAP). The laboratory will also be required to have successfully completed the NFESC laboratory evaluation process and to maintain this status throughout the project. The analytical DQOs will be assessed through measurement of PARCC parameters. These QC criteria are defined in this section, along with analytical methods used, project-required reporting limits, and QC criteria.

3.2.1 Quality Control Criteria

Definitions of QC criteria (PARCC parameters) are presented in this section.

- **Precision** — Precision is the measure of the reproducibility among a set of replicate results or the agreement among repeat observations made under the same conditions. Analytical precision is the measurement of the variability associated with duplicate or replicate analyses. For this project, a laboratory control standard (LCS) will be used to determine the precision of the analytical method. Total precision is the measurement of the variability associated with the entire sampling and analysis process. It is determined by analyzing duplicate field samples and measures variability introduced by both the laboratory and field operations. Field duplicate and matrix spike duplicate samples will be used to assess field and analytical precision. The precision measurement is expressed as the relative percent difference (RPD) between the duplicate sample results. RPD is calculated as follows:

$$\text{RPD} = 100 \times 2 \times (\text{result} - \text{duplicate result}) / (\text{result} + \text{duplicate result})$$

- **Accuracy** — Accuracy is the nearness of a result or the mean of a set of results to the true or accepted value. Analytical accuracy is measured by comparing the percent recovery (%R) of analytes spiked into an LCS to a control limit. Surrogate compound recoveries are also used to assess accuracy and method performance for each sample analyzed. The %R of specific analytes is calculated as follows:

$$\%R = 100 \times (\text{spiked sample result} - \text{unspiked sample result}) / \text{amount of spike added}$$

- **Representativeness** — Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program.
- **Completeness** — Completeness is the percentage of measurements made that are judged to be valid. The completeness goal is to generate sufficient valid data based on project needs. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not qualified with a “R” flag. The completeness requirement is 95 percent for aqueous samples and 90 percent for soil samples. Completeness is calculated as follows:

$$\text{Percent completeness} = 100 \times (\text{number of valid analyte results} / \text{number of possible results})$$

- **Comparability** — Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Sample data should be comparable with other measurements for similar samples and sample conditions. The objective for the quality assurance/quality control (QA/QC) program is to produce data with the greatest possible degree of comparability. The number of matrices

sampled and the range of field conditions encountered are considered in determining. Comparability is achieved by using standard methods for sampling and analysis, reporting data in standard units, normalizing results to standard conditions, and using standard and comprehensive reporting formats.

3.2.2 Analytical Methods

The following methods will be used during this project:

- Total petroleum hydrocarbons (TPH)-gasoline by California leaking underground fuel tank (CA LUFT) Method 8015M
- TPH-diesel by CA LUFT Method 8015M
- TPH-JP5 by CA LUFT Method 8015M
- Pesticides/PCBs by EPA Method 8081A/8082
- Volatile organic compounds (VOCs) by EPA Method 8260B
- Semivolatile organic compounds (SVOCs) with selected section listing selected ion monitoring (SIM) compounds and description of method by EPA Method 8270C
- Metals by EPA Method 6010B/7000 series.

The SIM technique is used on the following seven SVOCs in order to achieve detection limits lower than the Region IX PRGs (EPA, 2000):

- Benzo(a)pyrene
- Dibenzo(a,h)anthracene
- Hexachlorobenzene
- Indeno(1,2,3-cd)pyrene
- n-Nitrosodi-n-propylamine
- Pentachlorophenol
- bis(2-Chloroethyl)ether.

3.2.2.1 Project-Required Reporting Limits

Project-required reporting limits are identified in Table 3-1.

3.2.2.2 Project Quality Control Limits

Precision and accuracy QC limits are identified in Table 3-2.

Table 3-1
Project-Required Reporting Limits and Preliminary Remediation Goals

Parameter/ Method	Analyte	Reporting Limits				
		Water		Soil		
		RL	Unit	RL	Residential PRGs (Nov. 2000)	Unit
TPH-Purgeable CA LUFT 8015M	Gasoline	0.1	mg/L	10	NE	mg/kg
TPH-Extractable CA LUFT 8015M	Diesel	0.5	mg/L	10	NE	mg/kg
	Jet Fuel	0.5	mg/L	10	NE	mg/kg
	JP5	0.5	mg/L	10	NE	mg/kg
	Motor Oil	0.5	mg/L	10	NE	mg/kg
	Kerosene	0.5	mg/L	10	NE	mg/kg
	Crude Oil	0.5	mg/L	10	NE	mg/kg
	Waste Oil	0.5	mg/L	10	NE	mg/kg
Organochlorine Pesticides/ EPA 8081	alpha-BHC	0.35	µg/L	0.019	0.09	mg/kg
	beta-BHC	0.23	µg/L	0.033	0.32	mg/kg
	delta-BHC	0.24	µg/L	0.011	NE	mg/kg
	gamma-BHC	0.25	µg/L	0.02	0.44	mg/kg
	alpha-Chlordane	0.80	µg/L	0.015	1.6	mg/kg
	gamma-Chlordane	0.37	µg/L	0.015	1.6	mg/kg
	4,4'-DDD	0.50	µg/L	0.042	2.4	mg/kg
	4,4'-DDE	0.58	µg/L	0.025	1.7	mg/kg
	4,4'-DDT	0.81	µg/L	0.036	1.7	mg/kg
	Aldrin	0.34	µg/L	0.022	0.029	mg/kg
	Dieldrin	0.44	µg/L	0.035	0.03	mg/kg
	Endosulfan I	0.30	µg/L	0.021	370	mg/kg
	Endosulfan II	0.40	µg/L	0.024	370	mg/kg
	Endosulfan sulfate	0.35	µg/L	0.036	NE	mg/kg
	Endrin	0.39	µg/L	0.036	18	mg/kg
	Endrin aldehyde	0.50	µg/L	0.016	NE	mg/kg
	Heptachlor	0.40	µg/L	0.02	0.11	mg/kg
	Heptachlor epoxide	0.32	µg/L	0.021	0.053	mg/kg
	Methoxychlor	0.86	µg/L	0.057	310	mg/kg
	Toxaphene	0.50	µg/L	0.57	0.44	mg/kg
Polychlorinated Biphenyls/ EPA 8082	Aroclor-1016	1	µg/L	0.70	3.9	mg/kg
	Aroclor-1221	1	µg/L	0.05	0.22	mg/kg
	Aroclor-1232	1	µg/L	0.05	0.22	mg/kg
	Aroclor-1242	1	µg/L	0.05	0.22	mg/kg
	Aroclor-1248	1	µg/L	0.05	0.22	mg/kg
	Aroclor-1254	1	µg/L	0.05	0.22	mg/kg
	Aroclor-1260	1	µg/L	0.10	0.22	mg/kg

**Table 3-1
Project-Required Reporting Limits and Preliminary Remediation Goals**

Parameter/ Method	Analyte	Reporting Limits				
		Water		Soil		
		RL	Unit	RL	Residential PRGs (Nov. 2000)	Unit
Volatile Organic Compounds (VOCs)/ EPA 8260B	1,1,1-Trichloroethane	5	µg/L	5	770000	µg/kg
	1,1,2,2-Tetrachloroethane	5	µg/L	5	380	µg/kg
	1,1,2-Trichloroethane	5	µg/L	5	840	µg/kg
	1,1-Dichloroethane	5	µg/L	5	3300	µg/kg
	1,1-Dichloroethene	5	µg/L	5	54	µg/kg
	1,2-Dichloroethane	5	µg/L	5	350	µg/kg
	1,2-Dichloropropane	5	µg/L	5	350	µg/kg
	2-Butanone (MEK)	50	µg/L	50	7300000	µg/kg
	2-Chloroethyl vinyl ether	50	µg/L	50	NE	µg/kg
	2-Hexanone	50	µg/L	50	NE	µg/kg
	4-Methyl-2-pentanone (MIBK)	50	µg/L	50	790000	µg/kg
	Acetone	50	µg/L	50	1600000	µg/kg
	Benzene	5	µg/L	5	650	µg/kg
	Bromodichloromethane	5	µg/L	5	1000	µg/kg
	Bromoform	5	µg/L	5	62000	µg/kg
	Bromomethane	5	µg/L	5	3900	µg/kg
	Carbon disulfide	5	µg/L	5	360000	µg/kg
	Carbon tetrachloride	5	µg/L	5	240	µg/kg
	Chlorobenzene	5	µg/L	5	150000	µg/kg
	Chloroethane	5	µg/L	5	3000	µg/kg
	Chloroform	5	µg/L	5	240	µg/kg
	Chloromethane	5	µg/L	5	1200	µg/kg
	cis-1,2-Dichloroethene	5	µg/L	5	43000	µg/kg
	cis-1,3-Dichloropropene	5	µg/L	5	82	µg/kg
	Dibromochloromethane	5	µg/L	5	1100	µg/kg
	Ethylbenzene	5	µg/L	5	230000	µg/kg
	Methylene chloride	5	µg/L	5	8900	µg/kg
	Methyl tert-butyl ether (MTBE)	10	µg/L	10	17	µg/kg
	Styrene	5	µg/L	5	1700000	µg/kg
	Tetrachloroethene (PCE)	5	µg/L	5	5700	µg/kg
	Toluene	5	µg/L	5	520000	µg/kg
	trans-1,2-Dichloroethene	5	µg/L	5	63000	µg/kg
	trans-1,3-Dichloropropene	5	µg/L	5	82	µg/kg
Trichloroethene (TCE)	5	µg/L	5	2800	µg/kg	
Vinyl acetate	50	µg/L	50	430000	µg/kg	
Vinyl chloride	5	µg/L	5	150	µg/kg	
Xylenes (total)	5	µg/L	5	210000	µg/kg	
Ethyl tert-butyl ether (ETBE) a	10	µg/L	10	NE	µg/kg	
Tertiary amylmethyl ether (TAME)a	10	µg/L	10	NE	µg/kg	
Tertiary butyl alcohol (TBA) a	50	µg/L	50	NE	µg/kg	

**Table 3-1
Project-Required Reporting Limits and Preliminary Remediation Goals**

Parameter/ Method	Analyte	Reporting Limits				
		Water		Soil		
		RL	Unit	RL	Residential PRGs (Nov. 2000)	Unit
Semi-volatile Organic Compounds (SVOCs) Base/Neutral Extractables/ EPA 8270C	1,2,4-Trichlorobenzene	10	µg/L	330	650000	µg/kg
	1,2-Dichlorobenzene	10	µg/L	330	370000	µg/kg
	1,3-Dichlorobenzene	10	µg/L	330	13000	µg/kg
	1,4-Dichlorobenzene	10	µg/L	330	3400	µg/kg
	2,4,5-Trichlorophenol	25	µg/L	830	6100000	µg/kg
	2,4,6-Trichlorophenol	10	µg/L	330	44000	µg/kg
	2,4-Dichlorophenol	10	µg/L	330	180000	µg/kg
	2,4-Dimethylphenol	10	µg/L	330	1200000	µg/kg
	2,4-Dinitrophenol	25	µg/L	830	120000	µg/kg
	2,4-Dinitrotoluene	10	µg/L	330	120000	µg/kg
	2,6-Dinitrotoluene	10	µg/L	330	61000	µg/kg
	2-Chloronaphthalene	10	µg/L	330	4900000	µg/kg
	2-Chlorophenol	10	µg/L	330	63000	µg/kg
	2-Methylnaphthalene	10	µg/L	330	NE	µg/kg
	2-Methylphenol	10	µg/L	330	3100000	µg/kg
	2-Nitroaniline	25	µg/L	830	3500	µg/kg
	2-Nitrophenol	10	µg/L	330	NE	µg/kg
	3,3'-Dichlorobenzidine	10	µg/L	330	1100	µg/kg
	3-Nitroaniline	25	µg/L	830	NE	µg/kg
	4-Bromophenyl phenyl ether	10	µg/L	330	NE	µg/kg
	4-Chloroaniline	10	µg/L	330	240000	µg/kg
	4-Chlorophenyl phenyl ether	10	µg/L	330	NE	µg/kg
	4-Methylphenol	10	µg/L	330	310000	µg/kg
	4-Nitroaniline	25	µg/L	830	NE	µg/kg
	4-Nitrophenol	25	µg/L	830	490000	µg/kg
	Acenaphthene	10	µg/L	330	3700000	µg/kg
	Acenaphthylene	10	µg/L	330	NE	µg/kg
	Anthracene	10	µg/L	330	22000000	µg/kg
	Benzo[a]anthracene	10	µg/L	330	620	µg/kg
	Benzo[a]pyrene	10	µg/L	33 ^b	62	µg/kg
	Benzo[b]fluoranthene	10	µg/L	330	620	µg/kg
	Benzo[ghi]perylene	10	µg/L	330	NE	µg/kg
	Benzo[k]fluoranthene	10	µg/L	330	6200	µg/kg
Bis (2-chloroethoxy)methane	10	µg/L	330	NE	µg/kg	
Bis (2-chloroethyl)ether	10	µg/L	33 ^b	210	µg/kg	
Bis (2-chloroisopropyl)ether	10	µg/L	330	2900	µg/kg	
Bis (2-ethylhexyl)phthalate	10	µg/L	330	35000	µg/kg	
Butyl benzyl phthalate	10	µg/L	330	12000000	µg/kg	

**Table 3-1
Project-Required Reporting Limits and Preliminary Remediation Goals**

Parameter/ Method	Analyte	Reporting Limits				
		Water		Soil		
		RL	Unit	RL	Residential PRGs (Nov. 2000)	Unit
	Chrysene	10	µg/L	330	6100	µg/kg
	Di-n-butyl phthalate	10	µg/L	330	6100000	µg/kg
	Di-n-octyl phthalate	10	µg/L	330	1200000	µg/kg
	Dibenz[a,h]anthracene	10	µg/L	33 ^b	62	µg/kg
	Dibenzofuran	10	µg/L	330	290000	µg/kg
	Diethyl phthalate	10	µg/L	330	49000000	µg/kg
	Dimethyl phthalate	10	µg/L	330	100000000	µg/kg
	Fluoranthene	10	µg/L	330	2300000	µg/kg
	Fluorene	10	µg/L	330	2600000	µg/kg
	Hexachlorobenzene	10	µg/L	75 ^b	300	µg/kg
	Hexachlorobutadiene	10	µg/L	330	6200	µg/kg
	Hexachlorocyclopentadiene	10	µg/L	330	420000	µg/kg
	Hexachloroethane	10	µg/L	330	35000	µg/kg
	Indeno[1,2,3-cd]pyrene	10	µg/L	35 ^b	620	µg/kg
	N-Nitrosodi-n-propylamine	10	µg/L	33 ^b	69	µg/kg
	N-Nitrosodiphenylamine	10	µg/L	330	99000	µg/kg
	Naphthalene	10	µg/L	330	56000	µg/kg
	Nitrobenzene	10	µg/L	330	20000	µg/kg
	Pentachlorophenol	10	µg/L	200 ^b	3000	µg/kg
	Phenanthrene	10	µg/L	330	NE	µg/kg
	Phenol	10	µg/L	330	37000000	µg/kg
	Pyrene	10	µg/L	330	2300000	µg/kg
ICP Metals/ EPA 6010B EPA 7000	Aluminum	500	µg/L	50	76000	mg/kg
	Antimony	500	µg/L	5	31	mg/kg
	Arsenic	5	µg/L	0.5	0.39	mg/kg
	Barium	100	µg/L	1	5400	mg/kg
	Beryllium	10	µg/L	0.2	150	mg/kg
	Cadmium	5	µg/L	0.5	9.0	mg/kg
	Calcium	1,000	µg/L	100	NE	mg/kg
	Chromium	50	µg/L	1	210	mg/kg
	Cobalt	50	µg/L	1	4700	mg/kg
	Copper	50	µg/L	1	2900	mg/kg
	Iron	50	µg/L	5	23000	mg/kg
	Lead	5	µg/L	0.3	400	mg/kg
	Magnesium	1,000	µg/L	100	NE	mg/kg
	Manganese	20	µg/L	2	1800	mg/kg
	Molybdenum	100	µg/L	2	390	mg/kg
	Nickel	150	µg/L	2	150	mg/kg

Table 3-1
Project-Required Reporting Limits and Preliminary Remediation Goals

Parameter/ Method	Analyte	Reporting Limits				
		Water		Soil		
		RL	Unit	RL	Residential PRGs (Nov. 2000)	Unit
	Potassium	5,000	µg/L	100	NE	mg/kg
	Selenium	5	µg/L	0.5	390	mg/kg
	Silver	50	µg/L	1	390	mg/kg
	Sodium	1,000	µg/L	100	NE	mg/kg
	Thallium	10	µg/L	1	5.2	mg/kg
	Vanadium	100	µg/L	1	550	mg/kg
	Zinc	20	µg/L	1	23000	mg/kg
	Lead (for TCLP, WET)	50	µg/L	5	NA	mg/kg
	Mercury	0.2	µg/L	0.1	23	mg/kg

^aOxygenates

^bSelected Ion Monitoring (SIM) EPA 8270C

CA LUFT – California leaking underground fuel tank

EPA – U.S. Environmental Protection Agency

ICP – inductively coupled plasma

mg/kg – milligrams per kilogram

mg/L – milligrams per liter

NA – not applicable

NE – not established

PRGs – preliminary remediation goals for residential land use (EPA, 2000)

RL – reporting limit

SIM – selected ion monitoring

SVOCs – semivolatile organic compounds

TCLP – toxicity characteristic leaching procedure

TPH – total petroleum hydrocarbons

VOCs – volatile organic compounds

WET – waste extraction test

µg/kg – micrograms per kilogram

µg/L – micrograms per liter

Table 3-2
QC Acceptance Criteria

Method	Analyte	Accuracy Water (%R)	Precision Water (%RPD)	Accuracy Soil (%R)	Precision Soil (%RPD)
TPH-Purgeable CA LUFT 8015M	TPH-Gasoline	65-135	≤ 30	57-146	≤ 50
	<i>Surrogate:</i> Bromofluorobenzene	65-135		50-150	
TPH-Extractable CA LUFT 8015M	TPH-Diesel	65-135	≤ 30	65-135	≤ 50
	TPH-Jet Fuel	65-135	≤ 30	65-135	≤ 50
	JP5	65-135	≤ 30	65-135	≤ 50
	Motor Oil	65-135	≤ 30	65-135	≤ 50
	Kerosene	65-135	≤ 30	65-135	≤ 50
	Crude Oil	65-135	≤ 30	65-135	≤ 50
	Waste Oil	65-135	≤ 30	65-135	≤ 50
	<i>Surrogates (choose 2):</i> Bromobenzene	65-135		60-140	
Hexacosane	65-135		50-150		

Table 3-2 (Cont.)
QC Acceptance Criteria

Method	Analyte	Accuracy Water (%R)	Precision Water (%RPD)	Accuracy Soil (%R)	Precision Soil (%RPD)
EPA 8081A/ 8082	α -BHC	75-125	≤ 30	65-135	≤ 50
	β -BHC	51-125	≤ 30	41-133	≤ 50
	δ -BHC	75-126	≤ 30	65-136	≤ 50
	γ -BHC (Lindane)	73-125	≤ 30	63-130	≤ 50
	α -Chlordane	41-125	≤ 30	31-135	≤ 50
	γ -Chlordane	41-125	≤ 30	31-133	≤ 50
	4,4-DDD	48-136	≤ 30	38-146	≤ 50
	4,4-DDE	45-139	≤ 30	35-149	≤ 50
	4,4-DDT	34-143	≤ 30	25-153	≤ 50
	Aldrin	47-125	≤ 30	37-126	≤ 50
	Dieldrin	42-132	≤ 30	32-142	≤ 50
	Endosulfan I	49-143	≤ 30	39-153	≤ 50
	Endosulfan II	75-159	≤ 30	65-169	≤ 50
	Endosulfan Sulfate	46-141	≤ 30	36-151	≤ 50
	Endrin	43-134	≤ 30	33-144	≤ 50
	Endrin Aldehyde	75-150	≤ 30	65-160	≤ 50
	Endrin Ketone	75-150	≤ 30	65-160	≤ 50
	Heptachlor	45-128	≤ 30	35-138	≤ 50
	Heptachlor Epoxide	53-134	≤ 30	43-144	≤ 50
	Methoxychlor	73-142	≤ 30	63-152	≤ 50
	Toxaphene	41-126	≤ 30	31-136	≤ 50
	PCB	30-130	≤ 30	25-140	≤ 50
	Surrogates:				
	DCBP	34-133		25-143	
	TCMX	45-125		35-135	

Table 3-2 (Cont.)
QC Acceptance Criteria

Method	Analyte	Accuracy Water (%R)	Precision Water (%RPD)	Accuracy Soil (%R)	Precision Soil (%RPD)
EPA 8260B	1,1-Dichloroethene	75-125	≤ 20	65-135	≤ 30
	Benzene	75-125	≤ 20	65-135	≤ 30
	Chlorobenzene	75-125	≤ 20	65-135	≤ 30
	Trichloroethene	71-125	≤ 20	61-135	≤ 30
	Toluene	74-125	≤ 20	64-135	≤ 30
	<i>Surrogates:</i>				
	Dibromofluoromethane	80-120		75-125	
	Toluene-D8	80-120		75-125	
	4-Bromofluorobenzene	80-120		75-125	
EPA 8270C	1,2,4-Trichlorobenzene	44-142	≤ 20	34-152	≤ 30
	1,4-Dichlorobenzene	30-125	≤ 20	25-135	≤ 30
	2,4-Dinitrotoluene	39-139	≤ 20	29-149	≤ 30
	Acenaphthene	49-125	≤ 20	39-135	≤ 30
	n-Nitrosodi-n-propylamine	37-125	≤ 20	27-135	≤ 30
	Pyrene	47-136	≤ 20	37-146	≤ 30
	2-Chlorophenol	41-125	≤ 20	31-135	≤ 30
	4-Chloro-3-Methyl Phenol	44-125	≤ 20	34-135	≤ 30
	4-Nitrophenol	25-131	≤ 20	25-141	≤ 30
	Pentachlorophenol	28-136	≤ 20	38-146	≤ 30
	Phenol	25-125	≤ 20	25-135	≤ 30
	<i>Surrogates:</i>				
	2,4,6-Tribromophenol	25-134		25-144	
	2-Fluorobiphenyl	43-125		34-135	
	2-Fluorophenol	25-125		25-135	
	Nitrobenzene-D5	32-125		25-135	
	Phenol-D5	25-125		25-135	
	Terphenyl-D14	42-126		32-136	

Table 3-2 (Cont.)
QC Acceptance Criteria

Method	Analyte	Accuracy Water (%R)	Precision Water (%RPD)	Accuracy Soil (%R)	Precision Soil (%RPD)
EPA 6010B	Aluminum	80-120	≤ 15	80-120	≤ 25
EPA 7000	Antimony	80-120	≤ 15	80-120	≤ 25
	Arsenic	80-120	≤ 15	80-120	≤ 25
	Barium	80-120	≤ 15	80-120	≤ 25
	Beryllium	80-120	≤ 15	80-120	≤ 25
	Cadmium	80-120	≤ 15	80-120	≤ 25
	Calcium	80-120	≤ 15	80-120	≤ 25
	Chromium	80-120	≤ 15	80-120	≤ 25
	Cobalt	80-120	≤ 15	80-120	≤ 25
	Copper	80-120	≤ 15	80-120	≤ 25
	Iron	80-120	≤ 15	80-120	≤ 25
	Lead	80-120	≤ 15	80-120	≤ 25
	Magnesium	80-120	≤ 15	80-120	≤ 25
	Manganese	80-120	≤ 15	80-120	≤ 25
	Molybdenum	80-120	≤ 15	80-120	≤ 25
	Nickel	80-120	≤ 15	80-120	≤ 25
	Potassium	80-120	≤ 15	80-120	≤ 25
	Selenium	80-120	≤ 15	80-120	≤ 25
	Silver	80-120	≤ 15	80-120	≤ 25
	Sodium	80-120	≤ 15	80-120	≤ 25
	Thallium	80-120	≤ 15	80-120	≤ 25
	Vanadium	80-120	≤ 15	80-120	≤ 25
	Zinc	80-120	≤ 15	80-120	≤ 25
	Mercury	75-125	≤ 15	75-125	≤ 25

CA LUFT – California leaking underground fuel tank

EPA – U.S. Environmental Protection Agency

TPH – total petroleum hydrocarbons

%R – percent recovery

% RPD – relative percent difference

Section 4

Sample Collection

Sampling procedures are described in Section 6 of the FSWP addendum.

4.1 Sampling Locations

Sample locations and the number of samples to be collected are described in Section 6 of the FSWP addendum and are not be repeated here.

4.2 Sample Collection

Sample collection procedures are described in Section 6 of the FSWP addendum and are not repeated here.

4.3 Sample Containers, Preservatives, and Holding Times

Proper sample containers, preservatives, and holding times are outlined in Tables 6-4 and 6-5 of the final supplemental work plan and are not be repeated here.

4.4 Sample Packaging and Shipment

Sample packaging and shipment procedures are described in Section 6.7.9 of the FSWP addendum and are not repeated here.

Section 5

Sample Custody and Documentation

In a sampling and analysis program, the integrity and traceability of the samples from the time they are collected through the time that data are reported are essential. Sample handling and custody transfer must be well documented because of the evidentiary nature of the data. A sample is considered to be in one's custody if it meets any of the following criteria:

1. The sample is in the actual possession or in the view of the person who collected the sample.
2. The sample is locked in a secure area.
3. The sample is placed in an area restricted to authorized personnel.

5.1 Field Sample Custody and Documentation

To maintain the integrity and traceability of the samples, all information pertinent to field sampling will be recorded in a field logbook. All samples will be properly labeled and custody sealed before they are transported to the laboratory and will be accompanied by completed chain-of-custody documentation. All documentation will be recorded in indelible black ink.

5.1.1 Field Logbook

Detailed information on documentation, including field logbooks and chain-of-custody forms, is presented in Section 6.7.10 of the FSWP addendum and is not repeated here.

5.1.2 Sample Labeling

Sample labels are used to prevent misidentification of samples. Labels will be filled out and affixed to sample containers at the time of sample collection. Detailed information on sample labeling is presented in Section 6.7.8 of the FSWP addendum and is not repeated here.

5.1.3 Custody Seals

Sample custody seals are used to detect unauthorized sample tampering from the time of sample collection to the time of analysis. The seals will be signed and dated by the sampler and then placed on the shipping containers in such a way that they must be broken in order to open the shipping containers. Seals will be affixed to shipping containers before the samples leave the custody of sampling personnel. A sample custody seal is presented in Attachment 1.

5.1.4 Chain-of-Custody Records

To establish the documentation necessary to trace sample possession from the time of collection, a chain-of-custody record will be completely filled out and accompany each sample. At a minimum, information presented in Section 6.7.10.1 of the FSWP addendum must be included on the chain-of-custody record. Samples will be delivered to the laboratory for analysis as soon as practicable. Chain-of-custody records will accompany all samples. A sample chain-of-custody form is presented in Attachment 2.

5.2 Laboratory Sample Custody and Documentation

Samples will be delivered to the laboratory personnel authorized to receive samples (also referred to as the sample custodian). Upon receipt of a sample, the custodian will inspect the condition of the sample (including temperature of the cooler) and the custody seal, reconcile the information on the sample label against that on the chain-of-custody record, assign a laboratory number, log the sample in the laboratory logbook, and store the sample in a secured sample storage room.

The IT project chemist will be informed immediately of any inconsistencies between the chain-of-custody record and the sample containers received. Any deviations from accepted sample handling procedures will be documented and the IT project chemist will be informed.

5.3 Corrections to Custody Documentation

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

Section 6

Analytical Quality Control Procedures

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

6.1 Laboratory Qualification

The analytical laboratories selected to analyze samples for this project will be certified by the California Department of Health Services through the ELAP for all the analytical methods required. In addition, the laboratories must successfully complete the NFESC laboratory evaluation program prior to sampling activities and must 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 QAPP and the FSWP addendum.

6.2 Laboratory Quality Control Procedures

The analytical laboratory must have written standard operating procedures (SOPs) defining the instrumentation, instrumentation maintenance, tuning, calibration, method detection limits, QC acceptance criteria, blank requirements, and stepwise procedures for each analytical method. The SOPs must be available to the analysts in the laboratory. The SOPs must meet or exceed the requirements of the methods cited in Section 3.2.2. The laboratory must maintain logs of all activities that have an impact on the quality of the laboratory results.

Approval of the OHM project chemist must be obtained prior to subcontracting any portion of the method to another laboratory or sending it to another facility of the same network of laboratories.

The laboratory must maintain the instruments required by the analytical methods specified. Sufficient redundancy of equipment must be available in the laboratory to provide adequate response in case of downtime.

Method substitution because of instrumental failure will not be permitted without the specific approval of the OHM project chemist.

Table 6-1 summarizes the QC requirements for each method.

**Table 6-1
Summary of Calibration Criteria and Corrective Action Procedures**

Method	Applicable Parameter	QC Function	Frequency	Acceptance Criteria	Corrective Action ^a
CA LUFT Method 8015M	TPH purgeable and extractable	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis; minimum once every 6 months	%RSD < 20%	Correct problem and then repeat initial calibration
		Initial calibration verification	Daily, before sample analysis	All concentrations within $\pm 15\%$ of expected value	Correct problem and then repeat initial calibration
		Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	All concentrations within $\pm 15\%$ of initial calibration	Correct problem and then repeat initial calibration verification and reanalyze all samples since last successful calibration verification
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analysis	QC acceptance criteria, Table 3-2	Recalculate results, locate and fix problem with system, and then rerun demonstration for all analytes that did not meet criteria
		Method blank	One per analytical batch	No TPH detected \geq RL	Correct problem and then reprepare and analyze method blank and all samples processed with the contaminated blank
		LCS for all analytes	One per analytical batch	QC acceptance criteria, Table 3-2	Correct problem and then reprepare and analyze the LCS and all samples in the affected analytical batch

**Table 6-1 (Cont.)
Summary of Calibration Criteria and Corrective Action Procedures**

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action*
CA LUFT Method 8015M	TPH	Surrogate Spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 3-2	Correct problem and then reextract and analyze sample
		MS/MSD	One per every 20 project samples per matrix	QC acceptance criteria, Table 3-2	None
		MDL study	Once per 12-month period	Detection limits established shall be less than the RLs in Table 3-1	None
		Results reported between MDL and RL	None	None	None

**Table 6-1 (Cont.)
Summary of Calibration Criteria and Corrective Action Procedures**

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action*
EPA Method 8081A/8082	Organochlorine pesticides/polychlorinated biphenyls	Five-point initial calibration for all analytes (and PCB 1016/1260 mix)	Initial calibration prior to sample analysis	%RSD < 20% for CFs or RFs	Correct problem and then repeat initial calibration
		Second-source calibration verification for all analytes (and PCB 1016/1260 mix)	Once per five-point initial calibration	All analytes within $\pm 15\%$ of expected value	Correct problem and then repeat initial calibration
		Retention time window calculated for each analyte (and PCB 1016/1260 mix)	Each initial calibration and calibration verifications	± 3 times standard deviation for each analyte retention time from 72-hour study	Correct problem and then reanalyze all samples analyzed since the last retention time check
		Initial calibration verification (for PCBs, only 1016/1260 mix)	Daily, before sample analysis	All analytes within $\pm 15\%$ of expected value	Correct problem and then repeat initial calibration
		Continuing calibration verification (for PCBs, only 1016/1260 mix)	After every 20 samples and at the end of the analysis sequence	All analytes within $\pm 15\%$ of expected value	Correct problem and then repeat initial calibration verification and reanalyze all samples since last successful calibration verification
		Breakdown check (Endrin and DDT pesticides analysis only)	Daily prior to analysis of samples	Degradation $\leq 15\%$	Repeat breakdown check
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 3-2	Recalculate results, locate and fix problem with system, and then rerun demonstration for those analytes that did not meet criteria
		Method blank	One per analytical batch	No analytes detected \geq RLs	Correct problem and then reprepare and analyze method blank and all samples processed with the contaminated blank
		LCS for all analytes (for PCBs, may only spike 1016/1260 mix)	One per analytical batch	QC acceptance criteria, Table 3-2	Correct problem and then reprepare and analyze the LCS and all samples in the affected analytical batch
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 3-2	Correct problem and then reextract and analyze sample
		MS/MSD (for PCBs, may only spike 1016/1260 mix)	One per every 20 project samples per matrix	QC acceptance criteria, Table 3-2	None
		Second-column confirmation (excluding PCBs, toxaphene and chlordane)	100% for all positive results	Same as for initial or primary column analysis	Same as for initial or primary column analysis
MDL study	Once per 12-month period	Detection limits established shall be less than the RLs in Table 3-1	None		

Table 6-1 (Cont.)
Summary of Calibration Criteria and Corrective Action Procedures

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action*
EPA Method 8260B	Volatile Organics	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	SPCCs average RF $\geq 0.30^b$; %RSD for CCCs <30%; and %RSD for all other calibration analytes $\leq 50\%$	Correct problem and then repeat initial calibration
		Second-source calibration verification	Once per five-point initial calibration	All analytes within $\pm 25\%$ of expected value	Correct problem and then repeat initial calibration
		Calibration verification	Daily, before sample analysis, and every 12 hours of analysis time	SPCCs average RF $\geq 0.30^b$; CCCs <25% drift; and all calibration analytes within $\pm 50\%$ of expected value	Correct problem and then repeat initial calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 3-2	Recalculate results, locate and fix problem with system, and then rerun demonstration for those analytes that did not meet criteria
		Internal standard retention time check	Immediately after or during data acquisition of calibration check standard	Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours)	Inspect mass spectrometer and gas chromatograph for malfunctions, and reanalyze samples analyzed while system was malfunctioning
		Check of mass spectral ion intensities using BFB	Prior to initial calibration and calibration verification	Refer to criteria listed in the EPA Method SW846 (EPA, 1994b)	Retune instrument and verify
		Method blank	One per analytical batch	No analytes detected \geq RLs except common laboratory contaminants (acetone and methylene chloride)	Correct problem and then reprepare and analyze method blank and all samples prepared with the contaminated blank
		LCS for all analytes	One per analytical batch	QC acceptance criteria, Table 3-2	Correct problem and then reprepare and analyze the LCS and all samples in the affected analytical batch
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 3-2	Correct problem and then reextract and analyze sample
		MS/MSD	One per every 20 project samples per matrix	QC acceptance criteria, Table 3-2	None
MDL study	Once per 12-month period	Detection limits established shall be less than the RLs in Table 3-1	None		

Table 6-1 (Cont.)
Summary of Calibration Criteria and Corrective Action Procedures

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action*
EPA Method 8270C	Semivolatile Organics	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	SPCCs average RF ≥ 0.30 ; %RSD for CCCs <30%; and %RSD for all other calibration analytes $\leq 50\%$	Correct problem and then repeat initial calibration
		Second-source calibration verification	Once per five-point initial calibration	All analytes within $\pm 25\%$ of expected value	Correct problem and then repeat initial calibration
		Calibration verification	Daily, before sample analysis, and every 12 hours of analysis time	SPCCs average RF ≥ 0.05 ; CCCs <30% difference; and all calibration analytes within $\pm 50\%$ of expected value	Correct problem and then repeat initial calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 3-2	Recalculate results, locate and fix problem with system, and then rerun demonstration for those analytes that did not meet criteria
		Check mass spectral ion intensities using DFTPP	Prior to initial calibration and calibration verification	Refer to criteria listed in the method description (EPA, 1994b)	Retune instrument and verify
		Internal standard retention time check	Immediately after or during data acquisition of calibration check standard	Retention time ± 30 seconds; EICP area within -50% to $+100\%$ of last calibration verification (12 hours) for each	Inspect mass spectrometer and gas chromatograph for malfunctions, and reanalyze samples analyzed while system was malfunctioning
		Method blank	One per analytical batch	No analytes detected \geq RLs except common laboratory contaminants (phthalates)	Correct problem and then reprepare and analyze method blank and all samples prepared with contaminated blank
		LCS for all analytes	One per analytical batch	QC acceptance criteria, Table 3-2	Correct problem and then reprepare and analyze the LCS and all samples in the affected batch
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 3-2	Correct problem and then reextract and analyze sample
		MS/MSD	One per every 20 project samples per matrix	QC acceptance criteria, Table 3-2	None
		MDL study	Once per 12-month period	Detection limits established shall be less than the RLs in Table 3-1	None

Table 6-1 (Cont.)
Summary of Calibration Criteria and Corrective Action Procedures

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action*
EPA Method 6010B	ICP Metals	Initial multipoint calibration (minimum 3 standards and 1 blank)	Daily initial calibration prior to sample analysis	Correlation coefficient ≥ 0.995 for linear regression	Correct problem and then repeat initial calibration
		Highest calibration standard	Before beginning a sample run	All analytes within $\pm 5\%$ of expected value	Correct problem and then repeat initial calibration
		Calibration blank	After every 10 samples and at end of analysis sequence	No analytes detected \geq RLs	Correct problem and then reanalyze calibration blank and previous 10 samples
		Continuing calibration verification (instrument check standard)	After every 10 samples and at the end of the analysis sequence	All analytes within $\pm 10\%$ of expected value	Repeat calibration and then reanalyze all samples since last successful calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 3-2	Recalculate results, locate and fix problem with system, and then rerun demonstration for those analytes that did not meet criteria
		Method blank	One per analytical batch	No analytes detected \geq RLs	Correct problem and then reprepare and analyze method blank and all samples prepared with the contaminated blank
		Interference check solution (ICS)	Beginning and end of an analytical run or twice during an 8-hour period, whichever is more frequent	Within $\pm 20\%$ of expected value	Terminate analysis, correct problem, reanalyze ICS, and then reanalyze all affected samples
		LCS for the analyte	One LCS per analytical batch	QC acceptance criteria, Table 3-2	Correct problem and then reprepare and analyze the LCS and all samples in the affected batch
		Dilution test	Each new sample matrix	1:4 dilution must agree within $\pm 10\%$ of the original determination	Perform postdigestion spike addition
		Postdigestion spike addition	When dilution test fails	Recovery within 75 to 125% of expected results	Correct problem and then reanalyze postdigestion spike addition
		MS/MSD	One per every 20 project samples per matrix	QC acceptance criteria, Table 3-2	None
MDL study	Once per 12-month period	Detection limits established shall be less than the RLs in Table 3-1	None		

**Table 6-1 (Cont.)
Summary of Calibration Criteria and Corrective Action Procedures**

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a
EPA Method 7000	Arsenic Lead Selenium Thallium	Initial multipoint calibration (minimum 3 standards and 1 blank)	Daily initial calibration prior to sample analysis	Correlation coefficient ≥ 0.995 for linear regression	Correct problem and then repeat initial calibration
		Second-source calibration check standard	Once per initial daily multipoint calibration	Analyte within $\pm 10\%$ of expected value	Correct problem and then repeat initial calibration
		Calibration blank	Once per initial daily multipoint calibration	No analytes detected \geq RLs	Correct problem and then reanalyze calibration blank and all samples associated with blank
		Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	Analytes within $\pm 20\%$ of expected value	Correct problem and then repeat calibration and reanalyze all samples since last successful calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 3-2	Recalculate results, locate and fix problem with system, and then rerun demonstration for those analytes that did not meet criteria
		Method blank	One per analytical batch	No analytes detected \geq RLs	Correct problem and then reprepare and analyze method blank and all samples processed with the contaminated blank
		LCS for the analyte	One per analytical batch	QC acceptance criteria, Table 3-2	Correct problem and then reprepare and analyze the LCS and all samples in the affected analytical batch
		New matrix check; five-fold dilution test	Each new sample matrix	Five times dilution sample result must be $\pm 10\%$ of the undiluted sample result	Perform recovery test
		Recovery test	When new matrix check fails	Recovery within 85 to 115% of expected results	Run all samples by the method of standard addition
		MS/MSD	One per every 20 project samples per matrix	QC acceptance criteria, Table 3-2	None
MDL study	Once per 12-month period	Detection limits established shall be less than the RLs in Table 3-1	None		

Table 6-1 (Cont.)
Summary of Calibration Criteria and Corrective Action Procedures

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a
EPA Method 7470A/7471A	Mercury	Initial multipoint calibration (minimum 5 standards and 1 blank)	Daily initial calibration prior to sample analysis	Correlation coefficient ≥ 0.995 for linear regression	Correct problem and then repeat initial calibration
		Second-source calibration check standard	Once per initial daily multipoint calibration	Analyte within $\pm 10\%$ of expected value	Correct problem and then repeat initial calibration
		Calibration blank	Once per initial daily multipoint calibration	No analyte detected $\geq RL$	Correct problem and then reanalyze calibration blank and all samples prepped with blank
		Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	Analyte within $\pm 20\%$ of expected value	Correct problem and then repeat calibration and reanalyze all samples since last successful calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table 3-2	Recalculate results, locate and fix problem with system, and then rerun demonstration for those analytes that did not meet criteria
		Method blank	One per analytical batch	No analyte detected $\geq RL$	Correct problem and then reprepare and analyze blank and all samples prepared with the contaminated blank
		LCS for the analyte	One per analytical batch	QC acceptance criteria, Table 3-2	Correct problem and then reprepare and analyze LCS and all samples in affected batch
		New matrix check; five-fold dilution test	Each new sample matrix	Five times dilution sample result must be $\pm 10\%$ of the undiluted sample result	Perform recovery test
		Recovery test	When new matrix check fails	Recovery within 85 to 115% of expected results	Run all samples by the method of standard addition
		MS/MSD	One per every 20 project samples per matrix	QC acceptance criteria, Table 3-2	None
		MDL study	Once per 12-month period	Detection limits established shall be less than the RLs in Table 3-1	None

^aAll corrective actions associated with the project work shall be documented, and all records shall be maintained by the laboratory.

^bExcept >0.10 for bromoform and >0.01 for chloromethane and 1,1-dichloroethane.

BFB – bromofluorobenzene

CA LUFT – California leaking underground fuel tank

CCC – calibration check compound

CF – calibration factor

DFTPP – decafluorotriphenylphosphine

EICP – extracted ion current profile

EPA – U.S. Environmental Protection Agency

ICP – inductively coupled plasma

ICS – interference check solution

LCS – laboratory control standard

MDL – method detection limit

MS/MSD – matrix spike/matrix spike duplicate

PCB – polychlorinated biphenyl

QC – quality control

RF – response factor

RL – reporting limit

SPCC – system performance check compound

TPH – total petroleum hydrocarbon

%RSD – percent relative standard deviation

6.3 Laboratory Quality Control Samples

This section describes laboratory QC samples and calibration requirements.

6.3.1 Calibration

All instruments and equipment must be calibrated in accordance with the specified methods unless different instructions are included in this document.

Initial calibrations are performed when the method is first used and again whenever the continuing calibrations fail to meet the respective acceptance criteria. In addition, if the instrument undergoes significant maintenance, the initial calibration must be repeated.

Continuing calibrations are used to verify that the instrument performance has remained within the limits set at the time of the initial calibration. The frequency of continuing calibrations is method-dependent.

6.3.2 Instrument Blanks

Instrument blanks are analyzed to ensure that analytes from previous runs are no longer in the system and will not contaminate succeeding runs. Instrument blanks must be run following calibration runs, before sample analyses are performed, and after samples containing high concentrations of potentially interfering materials.

The instrument blanks must not contain target analytes at concentrations greater than the required quantitation limits. If the laboratory consistently observes contaminants in the instrument blanks, the laboratory must investigate the source of the contamination and eliminate it if possible.

6.3.3 Method Blanks

Method blanks are prepared in the same manner as the project samples and using the same reagents. The method blank is used to check that the equipment and reagents used in preparing the samples are free of contaminants that could interfere with the analysis.

The method blank must not contain analytes at concentrations greater than the required quantitation limits. If contaminants are found that either contribute to the apparent concentration of a particular target analyte or interfere with the analysis, the analysis sequence must be stopped, the source of contamination must be identified and corrected, and the analysis must be repeated. If contamination is detected in the method blank at concentrations exceeding reporting limits, the entire associated batch of extracts or digestates must be reprepared. Hence, it is very important to make sure that no such contamination is present.

6.3.4 Laboratory Control Samples

An LCS is a purchased sample containing known concentrations of specific target analytes. It can also be prepared by spiking known amounts of target analytes into a well-characterized blank matrix. The matrix will be laboratory reagent water for water samples and clean sand for soil samples.

The LCS is prepared and run with the associated samples, using the same reagents. All analytes in the LCS must meet recovery criteria. If the criteria are not met, the entire batch of samples must be reprepared, together with a new LCS, and reanalyzed.

6.3.5 Matrix Spike and Matrix Spike Duplicates

Matrix spike and matrix spike duplicate (MS/MSD) samples are used to determine whether matrix effects are affecting recoveries. For inorganic analyses, only a single matrix spike is performed per batch. An MS/MSD is prepared by spiking a known amount of a solution to two portions of a sample being analyzed in a batch. The recoveries are compared against each other and against the known amount of the spike. These data are used to determine both accuracy and precision.

6.3.6 Duplicates

Two types of duplicates, field and laboratory duplicates, will be analyzed. Field duplicates are two field-collected samples that are duplicates of each other. These samples are analyzed to measure the consistency of field sampling procedures. The field duplicate is treated as regular field sample and its identification is withheld from the laboratory.

The laboratory duplicate is created by the laboratory; two aliquots are intentionally taken from the same sample and are analyzed in parallel. This analysis serves to measure the precision of laboratory operations. Duplicate analyses will be used only for inorganic analyses.

6.4 Preventive Maintenance

All instruments must be maintained in accordance with the manufacturer's recommended procedures. The laboratory's quality assurance plan must define the frequency and type of instrument maintenance for each instrument. Laboratory personnel must also record all maintenance activities in an instrument logbook.

In addition to preventive maintenance, the laboratory must maintain a sufficient supply of replacement parts for parts that are known to require frequent changes due to wear and tear or due to contamination.

Whenever preventive or corrective maintenance is required for an instrument, the laboratory must demonstrate the return of the instrument to operating condition and must recalibrate the instrument prior to resumption of sample analyses.

6.5 Data Review

All data reported by the laboratory must be reviewed in accordance with the SOP. At a minimum, this written guidelines must meet the data review guidelines stated in the *Navy Installation Restoration Chemical Data Quality Manual* (NFESC, 1999).

6.6 Deliverables

The following sections describe the deliverable documents that will be submitted to OHM by the analytical laboratory.

6.6.1 Hard Copy Deliverables

Two hard copies of the data will be submitted to OHM by the laboratory. The report pages will be numbered. The report will contain a table of contents referencing individual sections in the data package, original chain-of-custody forms, a copy of all corrective action reports, and a case narrative documenting the resolution of all corrective actions and noncompliant events.

All project samples will be clearly referenced to the associated QC samples. Two types of data packages will be required for validation: EPA Level III and EPA Level IV packages.

For this project, 90 percent of the data shall be submitted in an EPA Level III equivalent data package and 10 percent shall be submitted in an EPA Level IV equivalent data package. All data packages will be assembled in the following sequence:

- Cover Page (with laboratory service identification number, OHM project name, and project number)
- Original Chain-of-Custody Form
- Sample Receipt Form (including cooler temperature)
- Cross-Reference Table
- Case Narrative
- Organic Raw Data Sequence (by test):
 - Sample result forms, including method blanks
 - Sample raw data after each result form (for EPA Level IV only)
 - Surrogate summaries (surrogates results can appear on the sample result forms)
 - QC summaries
 - Tune data (for gas chromatograph/mass spectrometer [GC/MS] only)
 - Initial calibration

- Daily calibration checks, including related continuing calibration verification
- Resolution check standards (GC/MS and pesticides)
- QC raw data (for EPA Level IV only)
- Instrument run log
- Sample preparation log
- Inorganic Raw Data Sequence (by metal):
 - Sample results forms, including method blanks
 - Sample raw data (for EPA Level IV only)
 - QC summaries
 - Initial calibration
 - Daily calibration checks, including related continuing calibration verification
 - Calibration blanks, including all related continuing calibration blanks
 - Interference check standards A and B for inductively coupled argon plasma (ICAP) only
 - Detection limit check standard (graphite furnace atomic absorption only)
 - QC raw data (for EPA Level IV only)
 - Postdigestion spike results
 - Analytical spike results
 - Method of standard additions
 - ICAP serial dilutions
 - Instrument run log
 - Sample preparation log.

6.6.2 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 Electronic Data Deliverable* (OHM, 1995b). At the closeout of this project, a file compatible with the Navy Environmental Data Transfer System (NEDTS) will be submitted 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 less than 10 and three significant figures will be used for results greater than 10. For organic results, one significant figure will be used for results less than 10 and two significant figures will be used for results greater than 10. The EDD for each sample delivery group is due at the same time as the hard copy (i.e., 14 days after the last sample of the sample delivery group has been delivered to the laboratory).

Section 7

Data Quality Management

This section describes data management, validation, and evaluation requirements.

7.1 Data Management

The following sections describe the requirements for the management of hard copy and electronic data.

7.1.1 Hard Copy Data

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 7 years. OHM will be notified 30 days before disposal of any relevant laboratory records.

OHM will maintain copies of all chain-of-custody forms until receipt of the laboratory report. Laboratory reports will be logged in upon receipt and filed in chronological order. The second copy of the report will be sent for third-party data validation.

7.1.2 Electronic Data

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

Upon receipt by the OHM database manager, electronic data will be uploaded into a temporary access database. The uploaded data will be printed and proofread relative to the hard copy submitted by the laboratory. The chemist will also check for irregularities in analyte identities, concentrations, and units. The uploaded data will also be processed to compare the fields against a list of required values. If any errors are identified, the file will be manually edited or regenerated by the laboratory. If no errors are identified, the data will be uploaded into the main database. The laboratory database will be merged with the field database and reports will be generated from the merged database.

7.2 Data Validation

Data from all samples except waste characterization samples will be independently validated. Data will be validated at 90 percent EPA Level III and 10 percent EPA Level IV. Data validation will be performed by an independent data validation company in accordance with the EPA's *Laboratory Data Validation Functional Guidelines* (EPA, 1994c and 1999c) and QC criteria specified in this document. Data not meeting method specifications will be flagged as estimated ("J") or rejected ("R").

The data validation company must have the following qualifications:

- A minimum of 5 years of experience in the environmental data validation business
- Prior experience with Navy RAC or Comprehensive Long-Term Environmental Action programs
- Navy data validation experience
- An active peer review program.

Personnel must have the following qualifications:

- Data Reviewer:
 - Bachelor of Science degree or higher in chemistry or related field
 - Combined experience of 5 years, with approximately 2 years in data validation and 3 years conducting laboratory analyses in an environmental laboratory that used the EPA-approved methods being validated.
- Peer Reviewer:
 - Bachelor of Science degree or higher in chemistry or related field.
 - Combined experience of 5 years, with approximately 2 years in data validation and 3 years conducting laboratory analyses in an environmental laboratory that used the EPA-approved methods being validated.

7.3 Data Evaluation

After validation, data will be further evaluated by the OHM project chemist. The project chemist will determine which of the advisory data qualifiers provided by the independent data validator will be retained or deleted. The evaluation of data will be based on the results of the QC samples, the level of contamination of samples indicated by the analysis of blanks, and the overall indication of interferences due to contamination. The following data qualifiers will be used in the report:

- J – Result is estimated
- U – Analyte is not detected at or above the stated reporting limit
- R – Result is rejected
- UJ – Analyte is not detected, but there is uncertainty about the reporting limits.

Data flags will be used to alert data users to uncertainties associated with the data. The evaluation flags will be entered in a special field in the electronic database. Thus, when data processing is complete, the data for each analyte will have the flag, if any, designated by the laboratory and the flag, if any, designated by the evaluator.

Section 8

Quality Assurance Oversight

QA oversight for this project will include system audits of field activities and the subcontract laboratory.

8.1 Field Audits

The OHM and SWDIV 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 chain-of-custody procedures, field documentation, instrument calibrations, and field measurements.

Field documents and chain-of-custody forms will be reviewed to ensure that all entries are printed or written in indelible ink and are dated and signed.

Sampling operations will be reviewed and compared against the FSWP addendum, the QAPP, and other applicable SOPs. The auditor will verify that the proper sample containers are used, appropriate preservatives are added or are already present in the container, and documentation of the sampling operation is adequate.

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

8.2 Laboratory Audits

The laboratory selected to perform the analyses must have successfully completed the NFESC laboratory evaluation process prior to sampling activities and must maintain that status throughout the project. This process will consist of a laboratory QA plan review, performance evaluation sample analysis, data package review, and on-site audit. OHM will not perform an on-site audit of the laboratory unless deemed necessary by the Navy.

Laboratory oversight by OHM will consist of reviewing the preliminary report and hard copy data packages. The following information can be obtained from the data packages:

- Correctness of chain-of-custody procedures
- Adherence to method or QAPP holding times
- Adequacy of method detection limits and reporting limits
- Correctness of spiking levels, frequency, and recovery
- Accuracy of analytical operations based on the LCS.

8.3 *Corrective Action Procedures*

The laboratory will have a QA/QC and corrective action program that addresses all out-of-control situations. Following completion of analyses, laboratory personnel will verify compliance with the QC requirements of the project and the laboratory QA/QC plan. If any of the parameters are outside the control limits, corrective action will be implemented.

Initial corrective action will be to verify that no obvious calculation errors have occurred. If appropriate, reanalysis will be performed. If the reanalysis confirms the initial out-of-control limit results, the chemist will notify the laboratory supervisor, who will then initiate the corrective action process. Corrective actions could include, but are not necessarily limited to, the following:

- Verification of dilution factors
- Examination of sample for nonhomogeneity
- Verification of sample preparation
- Checking of standard preparation logbook
- Verification of instrument performance
- Checking of reagent water purity
- Monitoring of chemist's method performance for procedure verification.

Notification and prompt involvement of the OHM project chemist in the corrective action process are absolutely necessary in determining an appropriate resolution. Corrective action records will document all steps taken in the corrective action process, beginning with a description of the problem and ending with the final resolution. A copy of the corrective action report will be sent to the OHM project chemist and will be maintained in the project file at OHM.

All corrective action reports will be maintained by the laboratory in a project file and delivered to OHM as part of the hard copy deliverable.

Section 9

References

Bechtel National, Inc., 1996, *Final Addendum to the RCRA Facility Assessment*, San Diego, California, May.

EPA, see U.S. Environmental Protection Agency.

Jacobs Engineering Group Inc., 1993, *Final Resource Conservation and Recovery Act (RCRA) Facility Assessment Report, Marine Corps Air Station El Toro, California*, 16 July.

Naval Facilities Engineering Service Center, 1999, *Navy Installation Restoration Chemical Data Quality Manual*.

NFESC, see Naval Facilities Engineering Service Center.

OHM Remediation Services Corp., 1995a, *Detailed Plan for RCRA Clean Closure of Building 673-T3, MCAS El Toro, and Building 248, MCAS Tustin*, June.

OHM Remediation Services Corp., 1995b, *Laboratory Interface Document for the Analytical Laboratory Electronic Data Deliverable*, September.

OHM Remediation Services Corp., 1977, *Final Supplemental Work Plan, Closure of Various Temporary Accumulation Areas and RCRA Facility Assessment Sites, Marine Corps Air Station Santa Ana, California*, September 26.

OHM, see OHM Remediation Services Corp.

U.S. Environmental Protection Agency, 1994a, *Guidance for the Data Quality Objectives Process*, EPA QA/G-4, QAMS.

U.S. Environmental Protection Agency, 1994b, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, EPA SW-846, 3rd edn., November.

U.S. Environmental Protection Agency, 1994c, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, OSWER 9420.1-05-1, EPA 540/R-94/013, Office of Emergency and Remedial Response, Washington, DC, February.

U.S. Environmental Protection Agency, 1999a, *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R5.

U.S. Environmental Protection Agency, 2000, *Region IX Preliminary Remediation Goals*, <http://www/EPA.gov/region09/waste/sfund/prg/index.htm>, prepared by Stanford J. Smucker, PhD., Regional Toxicologist, EPA Region IX, San Francisco, CA, November.

U.S. Environmental Protection Agency, 1999c, *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, OSWER 9420.1-05A-P1, EPA 540/R-90/008, Office of Emergency and Remedial Response, Washington, DC, October.

Attachment 1
Sample Custody Seal

CUSTODY SEAL

Person Collecting Sample _____ Sample No. _____
(signature)

Date Collected _____ Time Collected _____

Attachment 2

Sample Chain-of-Custody Form

Appendix A
Health and Safety Plan Addendum

(Appendix not modified)

Appendix B
Contractor Quality Control Plan Addendum

(Appendix not modified)

Appendix C
Waste Management Plan Addendum

(Appendix not modified)

Appendix D
Quality Assurance Project Plan

(Revised and included as Attachment 2)

Appendix E
TAA and RFA Site-Specific

(Appendix not modified)

Appendix F
Site-Specific TAA and RFA Background
Information

(Appendix not modified)

Appendix G

***Detailed Plan for RCRA Clean Closure of
Building 673-T3 MCAS El Toro and Building
248 MCAS Tustin***

(Appendix not modified)