Project file

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MOFFETT FIELD
SSIC NO. 5090.3

A Member of The IT Group

November 28, 2000

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C-8
CTO-18

Ms. Theodoris Broussard, Code 06B2.TB
Department of the Navy
BRAC Operations, Southwest Division
Naval Facilities Engineering Command
1220 Pacific Highway
San Diego, California 92132-5190

Addressee: Ms. Mary Parker, SWDiv RPM, Code 06CT.MP

Contract: N62474-98-D-2076, Environmental Remedial Action Contract
DCN 700.0

Contract Task Order: 0018

Subject: Sampling and Analysis Plan and Quality Assurance Project Plan, Sites 1 and 2 Monitoring and Landfill Maintenance, Moffett Federal Airfield, Moffett Field, California

Dear Ms. Parker:

Attached are three (3) copies of the Sampling and Analysis Plan and Quality Assurance Project Plan for Contract Task Order (CTO) No. 0018, Sites 1 and 2 Monitoring and Landfill Maintenance at Moffett Federal Airfield. These plans govern the current quarterly monitoring activities being performed at Sites 1 and 2 (continued from Delivery Order [DO] 0108). The approved Site Health and Safety Plan from DO 108 is still in use for this project. Once landfill maintenance activities are scheduled (and remaining funding is awarded), IT will prepare an updated Work Plan, Construction Quality Control Plan, and Site Health and Safety Plan package for these activities.

Should you have any questions or require additional information, please contact the undersigned at (925) 288-9898.

Sincerely,
IT CORPORATION

for Dennis R. Julio, P.E.
Project Manager
CTO 0018

Don Marini, P.E.
Deputy Program Manager
EFA-West PMO

Enclosures
cc: See attached Distribution List

DISTRIBUTION LIST FOR CTO 0018
SAP & QAPP
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Part II Quality Assurance Project Plan

SAMPLING AND ANALYSIS PLAN
POSTCLOSURE MONITORING (SITE 1) AND GROUNDWATER MONITORING (SITE 2) MOFFETT FEDERAL AIRFIELD MOFFETT FIELD, CALIFORNIA

Contract No. N62474-98-D-2076
Contract Task Order No. 0018

Submitted to:

Department of the Navy
Southwest Division
Naval Facilities Engineering Command
Environmental Division
1220 Pacific Highway
San Diego, California 92132-5181

Submitted by:

IT Corporation
4005 Port Chicago Highway
Concord, California 94520-1120

Revision 0

November 2000

Issued to: _____ Date: _____

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SAMPLING AND ANALYSIS PLAN
POSTCLOSURE MONITORING (SITE 1) AND GROUNDWATER MONITORING (SITE 2) MOFFETT FEDERAL AIRFIELD MOFFETT FIELD, CALIFORNIA

Contract No. N62474-98-D-2076
Contract Task Order No. 0018

Revision 0

November 2000

Approved by: _____ Date: 11.21.00
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Nars Ancog
U.S. Navy Quality Assurance Officer

Introduction

IT Corporation (IT) has prepared this Sampling and Analysis Plan (SAP) to address requirements for sampling and analysis in support of the post-closure monitoring of Operable Unit 1 (OU1) at Moffett Federal Airfield (MFA), Mountain View, California. OU1 consists of two capped landfills: Runway Landfill (Site 1) and the Former Golf Course Landfill (Site 2). Landfill refuse at Site 2 was excavated and consolidated into the Runway Landfill at Site 1.

Remedial actions at OU1 are conducted as part of the Installation Restoration Program (IRP) and under the authority of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The sampling and analysis described in this SAP are based on the following predecessor documents:

- Tetra Tech EMI (TtEMI), *Final Site 1 Post-Closure Monitoring Plan* (1998a)
- TtEMI, *Final Site 2 Groundwater Monitoring Plan* (1998b)
- IT, *Site 1 Post-Closure Monitoring Plan and Site 2 Groundwater Monitoring Plan*, (1999)

This work will be conducted under Contract Task Order No. 0018 of the Naval Facilities Engineering Command Engineering Field Activity – West (EFA–West) Remedial Action Contract No. N62474-98-D-2076.

The objective of this SAP is to address the requirements of Title 27, California Code of Regulations (CCR), Section 21830 for post-closure maintenance plans for solid waste landfills and Section 20380 for water quality monitoring and response programs for waste management units, and to provide the water quality protection standard for Site 2. The contaminants of concern at Site 1 and Site 2 are waste constituents and reaction products, such as landfill gas.

This SAP consists of two parts: Part I, Field Sampling Plan (FSP) and Part II, Quality Assurance Project Plan (QAPP). The FSP guides all field data collection work by defining in detail the field sampling activities that the IT Team will perform and the data gathering methods that the Team will use. The FSP addresses the following issues:

- Frequency of sample collection and the sampling locations
- Number and purpose of samples to be taken
- Number and type of field quality control (QC) samples
- Equipment decontamination procedures

- Disposal procedures for contaminated materials
- Analytical methods to be used
- Chain-of-custody (COC) procedures and field documentation
- Sample preservation, packaging, and shipment procedures

The QAPP defines the data quality objectives (DQOs), QC and quality assurance (QA) activities, and procedures that the IT Team, including subcontract laboratories, will follow to achieve project data quality goals. The quality-related issues are detailed in the following QAPP elements:

- Project management
- Measurement and data acquisition
- Assessment and oversight
- Data validation and usability

This SAP complies with the requirements of the following documents:

- *Guidance for Data Quality Objectives Process* (U.S. Environmental Protection Agency [EPA], 1994).
- *Requirements for Quality Assurance Project Plans* (EPA, 1997).
- *Navy Installation Restoration Chemical Data Quality Manual* (Naval Facilities Engineering Command, 1999).
- *Environmental Work Instruction 4EN.2* (Navy Southwest Division, 1999).
- *Quality Control Program Plan for Environmental Remedial Actions* (IT, 2000).

This SAP is a controlled document distributed by IT to all members of the project team. It is required reading for all staff participating in the data collection method, and it will be in the possession of the field teams and of the laboratories performing analytical work.

FIELD SAMPLING PLAN
POSTCLOSURE MONITORING (SITE 1) AND GROUNDWATER MONITORING (SITE 2) MOFFETT FEDERAL AIRFIELD MOFFETT FIELD, CALIFORNIA

Contract No. N62474-98-D-2076
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Revision 0

November 2000

Approved by: _____ Date: 11.21.00
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Acronyms and Abbreviations

°C	degrees Celsius
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
COC	chain of custody
CTO	Contract Task Order
DO	dissolved oxygen
DOT	U.S. Department of Transportation
DQOs	data quality objectives
EFA–West	Engineering Field Activity–West
EPA	U.S. Environmental Protection Agency
FSP	Field Sampling Plan
HCl	hydrogen chloride
HDPE	high-density polyethylene
IATA	International Air Transportation Association
IDW	investigation-derived waste
IRP	Installation Restoration Program
IT	IT Corporation
MFA	Moffett Federal Airfield
mL	milliliter
mL/min	milliliter(s) per minute
MS/MSD	matrix spike/matrix spike duplicate
mv	millivolts
NASA	National Aeronautics and Space Administration
ORP	oxidation-reduction potential
OU	Operable Unit
PCBs	polychlorinated biphenyls
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RL	reporting limit
SAP	Sampling and Analysis Plan
SOP	standard operating procedures
SOW	statement of work
SVOA	semivolatile organic analysis
TAL	Target Analyte List
TCL	Target Compound List
TOC	total organic carbon
TPH	total petroleum hydrocarbon
TtEMI	Tetra Tech EM, Inc.
UST	underground storage tank
VOA	volatile organic analysis

Acronyms and Abbreviations (continued)

VOC	volatile organic compound
VTSR	validated time of sample receipt
WATS	West Aquifer Treatment System

1.0 Introduction

IT Corporation (IT) has prepared this Field Sampling Plan (FSP) to address requirements for sampling and analysis in support of the post-closure monitoring of Operable Unit 1 (OU1) at Moffett Federal Airfield (MFA), Mountain View, California. OU1 consists of two capped landfills: Runway Landfill (Site 1) and the Former Golf Course Landfill (Site 2). Landfill refuse at Site 2 was excavated and consolidated into the Runway Landfill at Site 1.

The work will be conducted under Contract Task Order (CTO) No. 0018 of Naval Facilities Engineering Command Engineering Field Activity-West (EFA–West) Remedial Action Contract No. N62474-98-D-2076.

This FSP has been prepared as Part I of the Sampling and Analysis Plan (SAP) for the post-closure monitoring at Site 1 and Site 2 at MFA, California. The project data quality objectives (DQOs) are presented in the Quality Assurance Project Plan (QAPP), which constitutes Part II of the SAP.

1.1 Scope and Purpose

The purpose of this FSP is to define field sampling procedures and data gathering methods that will be used during the various remedial activities conducted at each site. Field personnel will use this FSP as a reference during sampling activities. This FSP summarizes the procedures to be followed to satisfy the following project objectives:

- Monitor groundwater and leachate at Sites 1 and 2 to detect any release of hazardous constituents
- Monitor methane concentrations in landfill gas for compliance with 27 Code of California Regulations (CCR) Section 20921

1.2 Objective

The FSP objectives of the FSP are to:

- Provide a rationale for field sampling activities
- Describe the sampling strategy and design
- Describe and establish consistent field sampling procedures
- Establish data gathering, sample handling, and documentation methods to be employed during field activities

Groundwater and landfill gas matrices will be sampled and analyzed to achieve project objectives. Sampling and analysis will be performed over the course of one year on a quarterly basis. Analytical data collected under the provisions of this FSP will be used to:

- Detect any hazardous contituents associated with landfills that have been relased into groundwater or landfill leachate
- Evaluate the decomposition process in the landfill based on methane generation

2.0 Site History and Background

2.1 Site Description

MFA is located near the southwestern edge of San Francisco Bay in Santa Clara County, California. MFA is bordered by salt evaporation ponds to the north, Stevens Creek to the west, U.S. Highway 101 to the south, and the Lockheed Aerospace Center to the east. MFA borders the cities of Mountain View and Sunnyvale, California. The National Aeronautics and Space Administration (NASA) Ames Research Center is located to the west and north of MFA. An industrial park is located south of U.S. Highway 101 and is hydraulically upgradient of MFA.

The Runway Landfill (Site 1) is located in the northernmost portion of MFA at the end of the runways between Zook Road and the Cargill Salt Company evaporation ponds. This site encompasses an area of approximately 12 acres. The landfill was operated from 1963 until the mid-1970s. The landfill received domestic refuse as well as waste from maintenance and military operations, such as scrap equipment, construction debris, paint and paint thinners, solvents, lacquer, asbestos, waste oil and transformer oil, jet fuel, fuel and transformer filters, and sawdust contaminated with polychlorinated biphenyls (PCBs).

The Former Golf Course Landfill (Site 2) is located in the northern portion of MFA, just west of the golf course and adjacent to a saltwater evaporation pond. Although Site 2 covers an area of approximately 5 acres, the buried waste was estimated to cover approximately 2 acres. The former landfill received domestic refuse as well as waste from maintenance and military operations.

2.2 Action Levels

The contaminants of concern for groundwater and leachate for Site 1 are the constituents for detection monitoring listed in Appendix I to Title 40 Code of Federal Regulations (CFR) Part 258: total organic carbon (TOC) and nitrite/nitrate. These contaminants of concern are listed in Table 1. Target analytes for Site 2 are total extractable petroleum hydrocarbons and volatile and semivolatile organic compounds per Contract Laboratory Program (CLP) Target Compound List (TCL) and metals per CLP Target Analyte Lists (TAL).

The purpose of the sampling efforts at Site 1 and Site 2 is data gathering. IT's scope of work does not include the comparison to the action levels.

2.3 Site Maps

A map showing gas vent and groundwater monitoring well locations is presented as Figure 1. Site 2 monitoring well locations are identified in Figure 2.

3.0 Sampling Strategy

The project DQOs and sampling design are presented in Section 3.1 of the QAPP. This FSP section discusses the sampling and analysis strategy for landfill gas, groundwater, and leachate samples required to meet the project DQO.

The following testing will be conducted at Site 1on a quarterly basis:

- Sampling and analysis of groundwater at selected wells
- Sampling and analysis of two leachate wells
- Landfill gas monitoring
- Water level monitoring

The following testing will be conducted at Site 2 on a quarterly basis:

- Sampling and analysis of groundwater at selected wells
- Water-level monitoring

Procedures for sample collection and handling are discussed in Section 5.0 of this FSP. The Standard Operating Procedures (SOPs) referenced in these sections are part of the *IT Standard Quality Procedures and Standard Operating Procedures Manual* (IT, 1999).

3.1 Site 1

The Site 1 post-closure quarterly testing will be conducted from the following groundwater and leachate monitoring wells identified in Figure 1:

- Seven groundwater monitoring wells (W1-5, W1-8, W1-12, W1-14, W1-15, W1-16, and W1-19)
- Two leachate monitoring wells (W1-22 and W1-23)

There are five other wells (W1-6, W1-7, W1-20, PZ1-18, and PZ1-21) at Site 1, as shown in Figure 1, which are not part of this monitoring program and, therefore, will not be sampled; however, groundwater levels in these wells will be measured on a quarterly basis.

A total of seven groundwater and two leachate samples will be collected during each quarterly sampling event of the monitoring program. As specified in the *Final Site 1 Post-Closure Monitoring Plan*, (TtEMI, 1998a), the groundwater and leachate samples will be analyzed for the following constituents:

- Volatile organic compounds (VOCs) including ketones by EPA Method 8260B per Target Analyte List in Table 1
- Total and dissolved metals by EPA Methods 6010B/7000A per Target Analyte List in Table 1
- Organochlorine pesticides by EPA Method 8081A
- Polychlorinated biphenyls (PCBs) by EPA Method 8082
- Total organic carbon (TOC) by EPA Method 415.1
- Total nitrogen (nitrite/nitrate) by EPA Method 353.3

The TOC and total nitrogen will be also measured quarterly as indicator parameters that may be correlated with the metals concentrations in groundwater. Field parameters such as temperature, pH, specific conductance, oxidation-reduction potential (ORP), dissolved oxygen (DO), turbidity, and water levels will be measured and recorded as part of groundwater and leachate sampling.

Landfill gas will be measured quarterly for monitoring of methane concentrations at the wellheads of four landfill gas monitoring wells (LGMW1-1, LGMW1-2, LGMW1-3, and LGMW1-4) and 10 gas vents (GV-1 through GV-19) identified in Figure 1. IT field personnel will perform the measurements in the field using a field methane meter.

3.2 Site 2

As indicated in the *Final Site 2 Groundwater Monitoring Plan* (TtEMI, 1998b), the contaminants of concern at this site are VOCs, semivolatile organic compounds (SVOCs), pesticides, PCBs, and extractable petroleum fuels. The Site 2 post-closure quarterly samples will be collected from the following groundwater monitoring wells, which are identified in Figure 2:

- Six groundwater monitoring wells (W2-5, W2-6, W2-12, W2-14, W2-15, and W2-16)

Groundwater monitoring wells W2-3 and W2-13, which are also identified in Figure 2, are not part of the quarterly sampling; however, the water levels in these wells will be measured on a quarterly basis.

Six groundwater samples will be collected from Site 2 during each quarterly sampling event. According to the *Final Site 2 Groundwater Monitoring Plan*, (TtEMI, 1998b), these groundwater samples will be analyzed as follows:

- VOCs by CLP Statement of Work (SOW) low-level Volatile Organic Analysis (VOA)
- SVOCs by CLP SOW Semivolatile Organic Analysis (SVOA)
- Pesticides/PCBs by CLP SOW Pesticides/PCBs
- Total petroleum hydrocarbons (TPH) extractable as diesel and motor oil by EPA Method 8015B

These groundwater samples will not be analyzed for metals because of the high level of total dissolved solids previously found in groundwater at this section of the MFA.

Field parameters such as temperature, pH, specific conductance, oxidation-reduction potential, dissolved oxygen, turbidity and water levels will be measured and recorded as part of groundwater and leachate sampling. Oxidation-reduction potential and turbidity will not be used as stabilization parameters.

3.3 Investigation-Derived Waste

The project investigation-derived waste (IDW) will consist of the wastewater from well sampling and equipment decontamination.

The IDW will not be sampled or analyzed under the provisions of this CTO, as it will be disposed of at a groundwater West Aquifer Treatment System (WATS) currently operating at MFA.

4.0 Analytical Requirements and Quality Control

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

4.1 Analytical Methods

The following analytical methods will be used in this project:

- U.S. Environmental Protection Agency Test Methods for Evaluating Solid Waste, SW-846, Update III, 1996
  - TPH as diesel and motor oil by EPA Method 8015B
  - VOCs by EPA Method 8260B
  - Organochlorine pesticides by EPA Method 8081A
  - PCBs by EPA Method 8082
  - Metals by EPA 6010B/7000A
- U.S. Environmental Protection Agency Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, 1983
  - TOC by EPA Method 415.1
  - Total nitrogen (nitrite/nitrate) by EPA Method 353.1
- U.S. Environmental Protection Agency, CLP
  - SOW for Organic Analysis, OLM04.2, 1999

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

4.2 Sample Containers, Preservatives, and Holding Times

Sample containers, preservation, and holding time requirements will be specified and implemented according to the EPA requirements and Table 2. Sample containers for water will be certified precleaned according to EPA protocols. Table 2 lists the sample container, preservative, and holding time requirements for groundwater samples.

4.3 Field Quality Control Samples

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

4.3.1 Field Duplicates

Field duplicates are secondary samples of a matrix collected at the same time and location and using the same sampling techniques as their corresponding primary samples. The purpose of field duplicate samples is to evaluate the overall precision of the sample collection and analysis process. One field duplicate for each site at every sampling event will be collected, and analyzed for the same parameters as the corresponding primary sample. Field duplicates will be collected for groundwater samples only.

4.3.2 Trip Blanks

Each cooler containing water samples for VOC analysis will contain a trip blank. Trip blanks are 40-milliliter (mL) VOA vials of analyte-free water, which are kept with the field sample containers from the time they leave the laboratory until the time they are returned to the laboratory. The purpose of trip blanks is to determine if samples have been contaminated with VOCs during transportation or sample collection. One trip blank is needed for one-day sampling of groundwater for VOC analysis.

4.3.3 Temperature Blanks

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

4.4 Laboratory Quality Control Samples

The laboratory will analyze a matrix spike/matrix spike duplicate (MS/MSD) for every 20 field samples. To assist the laboratory in preparing a project-specific MS/MSD, field personnel will collect triple the sample volumes for groundwater samples. Field personnel will designate one sample of every 20 for MS/MSD analysis on the chain-of-custody (COC) form.

4.5 Summary of Field Sampling and Analysis

Table 3 presents a summary of field sampling and analysis for Site 1 and Site 2 post-closure monitoring.

5.0 Field Methods and Sampling Procedures

5.1 Introduction

This section presents field methods and sampling procedures for groundwater and leachate and for decontamination, sample handling, and documentation procedures.

5.1.1 Groundwater Sampling Procedures

Groundwater monitoring wells will be sampled in accordance with the procedures described in this section. The wells will be purged before sampling using a low-flow, micro-purging technique. Each monitoring well will be micro-purged (300 to 500 milliliter/minute [mL/min]) using a peristaltic pump or equivalent.

The following procedures will be followed when sampling a monitoring well:

1. Don appropriate personal protective equipment (PPE), following the site Health and Safety Plan guidance.
2. Confirm the well identification at each monitoring well. Preferentially collect samples from wells with the lowest expected contaminant concentrations to the highest expected concentrations to minimize the potential for cross-contamination.
3. Calibrate field instruments in accordance with the manufacturer's directions. Record all calibration documentation in the field log book or on the Groundwater Monitoring Data Form (found in Appendix A).
4. Measure the depth to water at each monitoring well using an electronic water level indicator probe. Record the water-level measurement to the nearest 0.01 of an inch on the Groundwater Monitoring Data Form. Decontaminate the water level indicator before each measurement according to the procedure in Section 5.3.
5. Carefully lower the tubing or the pump into the well with as little disturbance to the groundwater as possible. Place the intake to the pump at the middle of the screen interval. The pump speed will be set so that the water column in the well does not drop more than 0.2 feet below the initial water-level reading.
6. Purge the well at a flow rate of 300 to 500 mL/min. Monitor water quality parameters (turbidity, pH, temperature, conductivity, ORP and dissolved oxygen) every 3 to 5 minutes during purging, using in-line monitoring equipment to increase the reading stability. Record the water-quality parameters on the groundwater sampling log form. Stabilization is achieved if successive readings are within ± 0.1 pH units, ± 1 degree Celsius (°C) for temperature, ± 10 percent for conductivity, ± 10 percent for dissolved oxygen, and ±10 millivolts (mv) for ORP. Record turbidity measurements but do not use it as a stabilization parameter.

7. If the water quality parameters are stable for three consecutive readings, collect samples for chemical analysis. If the water quality parameters have not stabilized, continue purging until stabilization occurs or three calculated well volumes have been purged.

8. Reduce the pump flow to a rate of approximately 100mL/min, and collect samples for VOC analysis. Fill the containers so that no headspace exists.

9. Increase the flow rate to approximately 300 to 500 mL/min and collect the remaining samples. Fill the appropriate sample containers, identified in Table 2, from the pump discharge line. Collect field quality-control samples (e.g., field duplicates) as required.

10. Filter the samples for dissolved metal analysis through a 0.45 micron filter using an inline filtration apparatus, and preserve after filtering.

11. Label, package, and prepare the samples for shipment to the laboratory in accordance with IT SOPs 2.1 and 17.1. Transfer the samples to cold storage immediately after collection.

5.2 Landfill Gas Monitoring

If a field instrument specific to methane analysis is used for methane monitoring, sample collection will not be necessary. The instrument probe is lowered at least 2 feet into the well and a reading is taken. In the case of the gas vents, the meter tubing is firmly pressed to the screen inside the vent, and a reading is taken.

5.3 Decontamination Procedure

Dedicated sampling equipment will be used for the monitoring program since each well has a length of dedicated tubing for purging and sampling. The only equipment that will require decontamination is the water-level meter. Because the landfill sites have been monitored for a year and the well history is known, minimal decontamination will be sufficient to prevent cross-contamination between wells. The meter tip will be rinsed with deionized water and air-dried. This procedure has been proven to be adequate for these particular sites.

5.4 Sample Numbering

Samples will be uniquely designated using a numbering system that indicates the sampling point. For example, a leachate sample collected from well number W1-22 will be numbered W1-22.

Field duplicate samples will not be identified on the sample chain-of-custody as being duplicate samples. A duplicate sample for Site 1 will be identified as W00-1; a duplicate sample from

Site 2 will be identified as W00-2. The wells from which the duplicates have been collected will be recorded in the field log book and on the Groundwater Monitoring Data Form.

5.5 Sample Labeling

Sample labels will be filled out with indelible ink and affixed to each sample container. Nonwaterproof sample labels will be covered with clear tape according to IT SOP 17.1. Sample containers will be placed in resealable plastic bags to protect the sample from moisture during transportation to the laboratory. At minimum each sample container will be labeled with the following:

1. Sample identification number
2. Sample collection date (month/day/year)
3. Time of collection (24-hour clock)
4. Project number
5. Sampler's initials
6. Analyses to be performed
7. Preservation (if any)
8. Location (i.e., MFA)

5.6 Sample Packaging and Shipment

The shipping of samples to the analytical laboratory by land delivery services will be performed according to the U.S. Department of Transportation (DOT) regulations. The International Air Transportation Association (IATA) regulations will be adhered to when shipping samples by air courier services. Transportation methods will be selected to ensure that the samples arrive at the laboratory in time to allow testing according to established holding times and project schedules. No samples will be accepted by the receiving laboratory without a properly prepared COC record and properly labeled and sealed shipping container(s).

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

1. Type and composition of inner packing (e.g., plastic bags, metal cans, absorbent packing material, and ice for preservation)
2. Type and composition of overpacks (e.g., metal or plastic coolers, cardboard box, rock core box, and undisturbed tube rack)
3. Method of overpack sealing (e.g., strapping tape, custody seals)

4. Marking and labeling of overpacks (e.g., laboratory address, any appropriate DOT hazard class labels, and handling instructions)

Upon collection, samples will be handled according to IT SOP 2.1. Immediately after sample collection, sample labels will be affixed to each sample container. Each sample will be placed in a resealable plastic bag to keep the sample container and the label dry. All glass sample containers will be protected with bubble wrap. A temperature blank will be placed in every cooler with samples.

Samples to be shipped by commercial carrier will be packed in a sample cooler lined with a plastic bag. Ice, double bagged in resealable bags, will be added to the cooler in sufficient quantity to keep the samples cooled to 4±2°C for the duration of the shipment to the laboratory. Sample cooler drain spouts will be taped from the inside and outside of the cooler to prevent any leakage. Saturday deliveries will be coordinated with the laboratory.

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

If a commercial carrier is used, the COC form will include the airbill number in the "transfers accepted by" column and will be sealed in a resealable bag. The COC form 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 in the back. Clear tape will be affixed to the custody seals to prevent accidental breakage during shipping. The samples will then be shipped to the analytical laboratory. A copy of the courier airbill will be retained for documentation.

5.7 Field Documentation

Sampling information will be recorded on a COC form, in a permanently bound field logbook, and a groundwater sampling log. All entries will be legible and recorded in ink. Sampling location documentation will include:

- Vent well ID
- Groundwater monitoring well ID

5.7.1 Chain of Custody

The COC form will be completed according to the requirements of IT SOP 1.1.

5.7.2 Field Logbooks

A permanently bound field logbook with consecutively numbered pages will be assigned to this project. All entries will be recorded in indelible ink. Corrections will be made following the procedure described in Section 5.7.3. At the end of each workday, the logbook pages will be signed by the responsible sampler and any unused portions of a logbook page will be crossed out, signed, and dated.

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

The logbook will contain the following information related to landfill gas monitoring:

1. Project name and location (on the front page of the log book)
2. Date and time of collection for each sample
3. Sample location
4. Sample type
5. Weather information (rain, sunny, approximate temperature, etc.)
6. Methane concentration in percent or parts per million by volume.

Groundwater and leachate sampling will be recorded on the site-specific Groundwater Monitoring Data Forms.

5.7.3 Document Corrections

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

6.0 References

IT Corporation, July 1999, *Sampling and Analysis Plan, Post-Closure Monitoring (Site 1) and Groundwater Monitoring (Site 2), Moffett Federal Airfield*, Mountain View, California.

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Naval Facilities Engineering Command, September 1999, *Navy Installation Restoration Chemical Data Quality Manual.*

State of California, 1995, California Code of Regulations, Title 27, Environmental Health Standards for the Management of Hazardous Waste, San Francisco, CA

Tetra Tech EM, Inc., March 1998b, *Final Site 2 Groundwater Monitoring Plan, Moffet Federal Airfield.*

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

U.S. Environmental Protection Agency, September 1996, *Test Methods for Evaluating Solid Waste, Physical Chemical Methods, SW-846*, Update III.

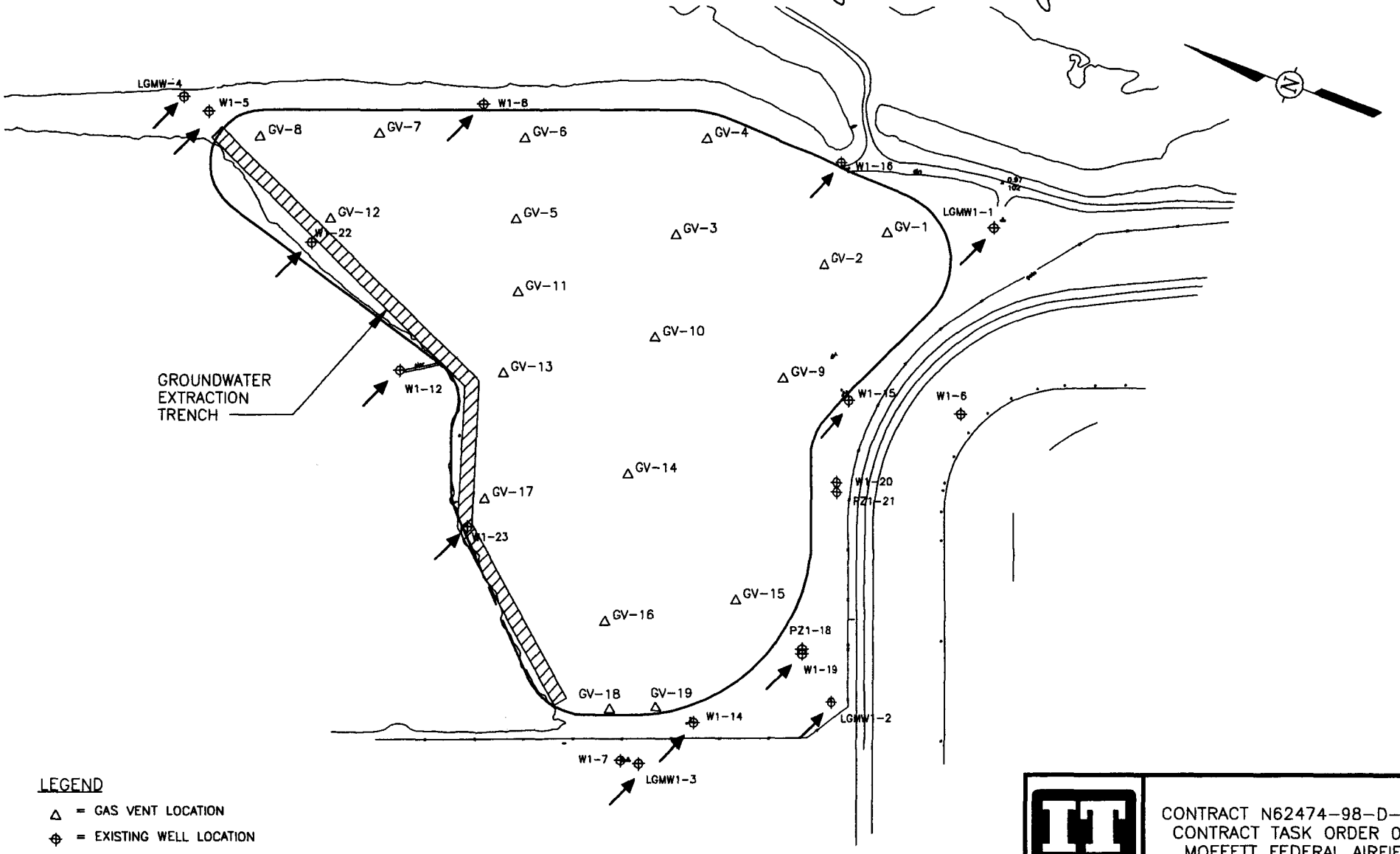
U.S. Environmental Protection Agency, November 1997, *Requirements for Quality Assurance Project Plans, EPA QA/R-5.*

U.S. Environmental Protection Agency, 1999, *Contract Laboratory Program Statement of Work for Organic Analysis, OLM04.2.*

U.S. Navy Southwest Division Naval Facilities Engineering Command, October 1999, *Environmental Work Instruction, 4EN.2.*

FIGURES

IMAGE	X-REF	OFFICE	DRAWN BY		CHECKED BY	APPROVED BY	DRAWING NUMBER
---	---	MTZ	SJZ	10/11/00	11.21.00	11.21.00	809616-A2



LEGEND

△ = GAS VENT LOCATION

⊕ = EXISTING WELL LOCATION

LGMW = LANDFILL GAS MONITORING WELL

W = GROUNDWATER MONITORING WELL
W1-22 AND W1-23 = GROUNDWATER EXTRACTION WELLS

PZ = PIEZOMETER WELL

↗ = WELLS TO BE MONITORED

—— APPROXIMATE SITE 1 BOUNDARY

SCALE

0 200 400 FEET

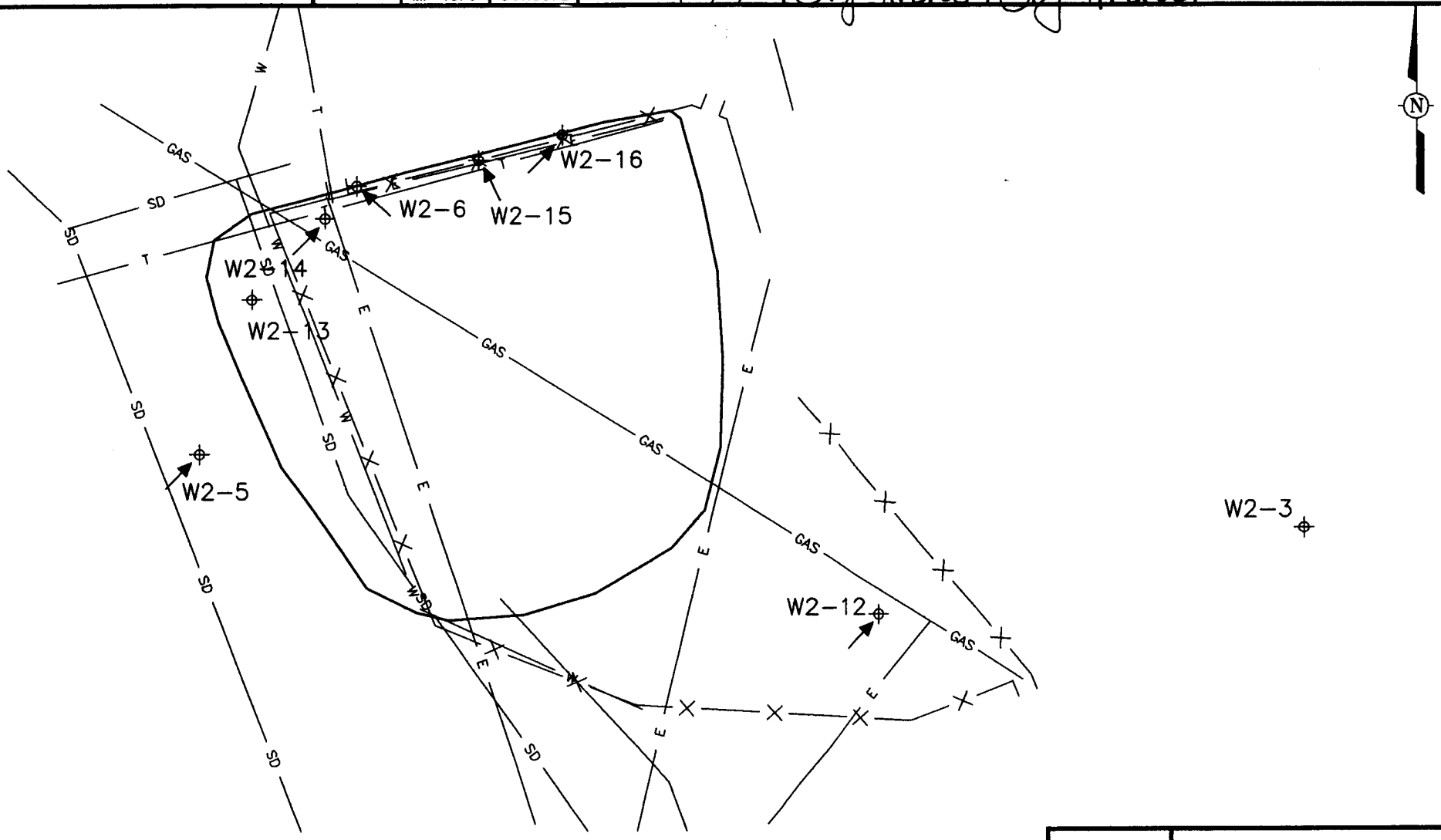
IT CORPORATION

CONTRACT N62474-98-D-2076
CONTRACT TASK ORDER 0018
MOFFETT FEDERAL AIRFIELD
MOFFETT FIELD, CALIFORNIA

FIGURE 1

MONITORING WELL AND
GAS VENT LOCATIONS
LANDFILL SITE 1

IMAGE	X-REF	OFFICE	DRAWN BY		CHECKED BY	APPROVED BY	DRAWING NUMBER
---	MF-TOPO	Concord	SJZ	10/11/00	11-21-00	11-21-00	809616-A1



LEGEND

- ⌖ EXISTING WELL LOCATION
- W = GROUNDWATER MONITORING WELL
- ↗ = WELLS TO BE MONITORED
- ——— APPROXIMATE SITE 2 BOUNDARY
- — GAS — EXISTING UNDERGROUND GAS LINE (PHOTO 4/26/96)
- — T — EXISTING UNDERGROUND TELEPHONE LINE
- — E — EXISTING UNDERGROUND ELECTRICAL LINE
- — W — EXISTING UNDERGROUND WATER LINE
- — SD — EXISTING UNDERGROUND STORM DRAIN

SCALE

0 150 300 FEET

IT CORPORATION

CONTRACT N62474-98-D-2076
CONTACT TASK ORDER 0018
MOFFETT FEDERAL AIRFIELD
MOFFETT FIELD, CALIFORNIA

FIGURE 2

MONITORING WELL LOCATIONS
LANDFILL SITE 2

TABLES

Table 1
Target Analytes for Landfill Site 1
Appendix I to Title 40 CFR Part 258
Constituents to Detection Monitoring

Analyte Name	
Volatile Organic Compounds	
1	Acetone
2	Acrylonitrile
3	Benzene
4	Bromochloromethane
5	Bromodichloromethane
6	Bromoform
7	Bromomethane
8	Carbon disulfide
10	Carbon tetrachloride
11	Chlorobenzene
12	Chloroethane
13	Chloroform
14	Chloromethane
15	Dibromochloropropane (DBCP)
16	Dibromomethane
17	Trans-1,4-Dichloro-butene
18	Dichloromethane (Methylene Chloride)
19	1,2-Dichlorobenzene
20	1,2-Dichloroethane
21	1,2-Dichloropropane
22	Cis-1,3-Dichloropropene
23	Trans-1,3-Dichloropropene
24	1,4-Dichlorobenzene
25	1,1-Dichloroethane
26	1,1-Dichloroethene
27	1,2-Dibromoethane (EDB)
28	Trans 1,2-Dichloroethene
29	Cis 1,2-Dichloroethene
30	Ethylbenzene
31	Styrene
32	Toluene
33	Trichloroethene (TCE)
34	Trichlorofluoromethane
35	1,1,1,2-Tetrachloroethane

Analyte Name	
36	1,1,1-Trichloroethane
37	1,1,2-Trichloroethane
38	1,1,2,2-Tetrachloroethane
39	Tetrachloroethene (PCE)
40	1,2,3-Trichloropropane
41	M&p-Xylenes
42	o-Xylene
43	Vinyl Chloride
44	Iodomethane
45	Vinyl acetate
46	2-Butanone (MEK)
47	4-Methyl-2-Pentanone (MIBK)
48	2-Hexanone
Metals	
49	Antimony (Sb)
50	Arsenic (As)
51	Barium (Ba)
52	Beryllium (Be)
53	Cadmium (Cd)
54	Chromium (Cr)
55	Cobalt (Co)
56	Copper (Cu)
57	Lead (Pb)
58	Nickel (Ni)
59	Selenium (Se)
60	Silver (Ag)
61	Thallium (Tl)
62	Vanadium (V)
63	Zinc (Zn)

Table 1 (continued)
Target Analytes for Landfill Site 1
Appendix I to Title 40 CFR Part 258 Constituents to Detection Monitoring

Analyte Name	
Pesticides	
64	Alpha-BHC
65	Beta-BHC
66	Delta-BHC
67	Gamma-BHC (Lindane)
68	Heptachlor
69	Aldrin
70	Heptachlor epoxide
71	Endosulfan I
72	Dieldrin
73	4,4'-DDE
74	Endrin
75	Endosulfan II
76	4,4'-DDD
77	Endosulfan sulfate
78	4,4'-DDT
79	Methoxychlor
80	Endrin aldehyde
81	Toxaphene
82	Alpha Chlordane
83	Gamma Chlordane
PCBs	
84	Aroclor-1016
85	Aroclor-1221
86	Aroclor-1232
87	Aroclor-1242
88	Aroclor-1248
89	Aroclor-1254
90	Aroclor-1260

Table 2
Analytical References, Containers, Preservation, and Holding Time for Groundwater Samples

Analysis	Analytical Methods	Container	Preservation	Holding Time
CLP Analyses				
VOCs	CLP SOW OLM04.2	Three glass 40-mL vials, Teflon®-lined septum	2-6°C, HCl to pH of 2 or less	14 days[1]
SVOCs	CLP SOW OLM04.2	1L amber glass, Teflon®-lined cap	2-6°C	7 days for extraction, 40 days for analysis [1]
Pesticides/PCBs	CLP SOW OLM04.2	1L amber glass, Teflon®-lined cap	2-6°C	7 days for extraction, 40 days for analysis [1]
SW-846, Update III, Organic Compounds				
TPH-Extractable fuels	EPA 3510C/8015B EPA 3520C/8015B	1L amber glass, Teflon®-lined cap	2-6°C	7 days for extraction, 40 days for analysis
VOCs	EPA 5030B/8260B	Three glass 40-mL vials, Teflon®-lined septum	2-6°C, HCl to pH<2	14 days
Organochlorine pesticides	EPA 3510C/8081A EPA 3520C/8081A	1L amber glass, Teflon®-lined cap	2-6°C	7 days for extraction, 40 days for analysis
PCBs	EPA 3510C/8082 EPA 3520C/8082	1L amber glass, Teflon®-lined cap	2-6°C	7 days for extraction, 40 days for analysis
Metals (except mercury)	EPA 3005A or EPA 3010A EPA 6010B, EPA 6020, EPA 7000A	HDPE or glass, 500 mL	HNO_3 to pH<2 For dissolved metals filter through a 0.45µm filter before adding acid	Six months
Mercury	EPA 7472			28 days
Inorganic Compounds				
TOC	EPA 415.1	HDPE or glass, 500 mL	2-6°C, H_2SO_4 or HCl to pH<2	28 days
Nitrite/Nitrate	EPA 353.3	HDPE or glass, 500 mL	2-6°C, H_2SO_4 to pH<2	28 days

°C – degrees Celsius
EPA – U.S. Environmental Protection Agency
PCBs – polychlorinated biphenyls
SVOCs – semivolatile organic compounds
TPH – total petroleum hydrocarbons
CLP – Contract Laboratory Program
HDPE – High-density polyethylene
SOW – Statement of Work
TOC – total organic carbon
VOCs – volatile organic compounds

[1] Although the CLP SOW specifies that the holding time is verified from validated time of sample receipt (VTSR), the holding time for CLP analysis will be verified from the date of sample collection.

Table 3
Summary of Quarterly Field Sampling and Analysis, Landfill Site 1 and Site 2

Matrix	Number of Field Samples	Number of QC Samples	Analysis	Description
Site 1 Monitoring: Wells W1-5, W1-8, W1-12, W1-14, W1-15, W1-16, W1-19; Leachate Wells W1-22 and W1-23				
Groundwater and Landfill Leachate	9	One field duplicate Trip blank 1 MS/MSD pair	VOCs (EPA 8260B) Organochlorine pesticides (EPA Method 8081A) PCBs (EPA Method 8082) Total and dissolved metals (EPA Method 6010B/7000A) TOC (EPA Method 415.1) Nitrite/Nitrate (EPA Method 353.3)	Quarterly monitoring
Site 1 Water Level Only: Wells W1-6, W1-7, W1-20, PZ1-18, PZ1-21				
Water	5	None	Water level meter	Quarterly measurements
Site 1 Landfill Gas Monitoring : Wells LGMW1-1, LGMW1-2, LGMW1-2, LGMW1-4, and GV1- through GV-19				
Methane	23	None	Field measurements with methane field analyzer	Quarterly measurements
Site 2 Monitoring: Wells W2-5, W2-6, W2-12, W2-14, W2-15, W2-16				
Water	6	One field duplicate Trip blank 1 MS/MSD pair	Low-level VOC (CLP SOW OLM04.2) SVOCs (CLP SOW OLM04.2) Pesticides/PCBs (CLP SOW OLM04.2) TPH as diesel and motor oil (EPA 8015B)	Quarterly monitoring
Site 2 Water Level Only: W2-3, W2-13				
Water	2	None	Water-level meter	Quarterly measurements

MS/MSD – matrix spike/matrix spike duplicate

APPENDIX A
GROUNDWATER MONITORING DATA FORM

GROUNDWATER MONITORING DATA FORM

PROJECT INFORMATION

Project Name: **Moffett FA– LF Site 2** Well ID:

Project Number: **809616** Date: _____

Project Location: **Mt. View, CA**

WELL MEASURMENTS

Depth to Water [ ] ft. Screen Depth:_____ft.

Purging Method= Low Flow Pumps
(Micro-Purge)

PURGE DATA

Time	Volume Purged	pH	Temp. (C)	Cond. (us)	ORP (mV)	D. O. (ppm)	Turbidity (NTU)
Stabilization criteria		*±0.1*	*±1℃*	*± 10%*	*None*	*± 10 %*	*None*

SAMPLING INFORMATION

Sample Number	
Sample Date/Time	
Sampler ID	
Weather Conditions	sunny rain overcast fog _____°F Temperature
Sample Collection Method	Low flow pump - ~ 100 mL/min
Volume Collected/Analyses	**CLP VOA (3 VOA Vials), CLP Pesticides/PCB (1 liter), CLP SVOC (1 liter), TPH- diesel/motor oil (1 liter)**

Comments:_____

QUALITY ASSURANCE PROJECT PLAN
POSTCLOSURE MONITORING (SITE 1) AND GROUNDWATER MONITORING (SITE 2) MOFFETT FEDERAL AIRFIELD MOFFETT FIELD, CALIFORNIA

Contract No. N62474-98-D-2076
Contract Task Order 0018

Submitted to:

Department of the Navy
Southwest Division
Naval Facilities Engineering Command
Environmental Division
1220 Pacific Highway
San Diego, California 92132-5181

Submitted by:

IT Corporation
4005 Port Chicago Highway
Concord, California 94520-1120

Revision 0

November 2000

Issued to: _____ Date: _____

☐ Controlled ☐ Uncontrolled

QUALITY ASSURANCE PROJECT PLAN
POSTCLOSURE MONITORING (SITE 1) AND GROUNDWATER MONITORING (SITE 2) MOFFETT FEDERAL AIRFIELD MOFFETT FIELD, CALIFORNIA

Contract No. N62474-98-D-2076
Contract Task Order No. 0018

Revision 0

November 2000

Approved by: _____ Date: 11·21·00
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U.S. Navy Quality Assurance Officer

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Acronyms and Abbreviations

°C	degrees Celsius
CCR	California Code of Regulations
CFR	Code of Federal Regulations
CDQM	Chemical Data Quality Manual
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-Term Environmental Action, Navy
CLP	Contract Laboratory Program
COC	chain of custody
CTO	Contract Task Order
DHS	Department of Health Services
DoD	Department of Defense
DQAR	Data Quality Assessment Report
DQO	data quality objective
EDD	electronic data deliverable
EFA–West	Engineering Field Activity–West
ELAP	Environmental Laboratory Accreditation Program
EPA	U.S. Environmental Protection Agency
FSP	Field Sampling Plan
GC	gas chromatography
GC/MS	gas chromatograph/mass spectrometer
GLP	Good Laboratory Practice
IDW	investigation-derived waste
IT	IT Corporation
ITEMS	IT Environmental Management System
IR	Installation Restoration
IRP	Installation Restoration Program
LCS	laboratory control sample
LCD	laboratory control duplicate
MEK	2-butanone
MFA	Moffett Federal Airfield
MS	matrix spike
MSA	Method of Standard Addition
MSD	matrix spike duplicate
NASA	National Aeronautics Space Administration
NCR	Nonconformance Report
NEDTS	Navy Electronic Data Transfer System
NFESC	Naval Facilities Engineering Service Center
NIST	National Institute for Standards and Testing
OU	Operable Unit

Acronyms and Abbreviations (continued)

PARCC	precision, accuracy, representativeness, completeness, and comparability
PCBs	polychlorinated biphenyls
PE	performance evaluation
PQL	practical quantitation limit
QA	quality assurance
QA/QC	quality assurance/quality control
TtEMI	Tetra Tech Environmental Management Incorporated
QAO	Quality Assurance Officer
QAPP	quality assurance project plan
QC	quality control
RAC	Remedial Action Contract
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SD	sample duplicate
SDG	sample delivery group
SOP	Standard Operating Procedure
SOW	statement of work
SVOA	semivolatile organic analysis
TAL	Target Analyte List
TCL	Target Compound List
TOC	total organic carbon
TPH	total petroleum hydrocarbons
VOA	volatile organic analysis
VOC	volatile organic compound

1.0 Introduction

IT Corporation (IT) has prepared this Quality Assurance Project Plan (QAPP) to address the requirements for sampling and analysis in support of the post-closure monitoring of Operable Unit 1 (OU1) at Moffett Federal Airfield (MFA), Mountain View, California. OU1 consists of two capped landfills: Runway Landfill (Site 1) and the Former Golf Course Landfill (Site 2). Landfill refuse at Site 2 was excavated and consolidated into the Runway Landfill at Site 1.

The work will be conducted under Contract Task Order (CTO) No. 0018 of Naval Facilities Engineering Command Engineering Field Activity-West (EFA–West) Remedial Action Contract No. N62474-98-D-2076.

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

- *Navy Installation Restoration Chemical Data Quality Manual* (1999)
- U.S. Environmental Protection Agency (EPA), *Guidance for the Data Quality Objectives Process* (1994)
- EPA, *Guidance for the Data Quality Objectives Process for the Hazardous Waste Sites* (1997a)
- EPA, *Guidance for Quality Assurance Project Plans* (1997b)
- EPA, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846* (1996a)
- *EPA Contract Laboratory Program (CLP) Statement of Work (SOW) for Organic Analysis* (1999a)
- *EPA CLP National Functional Guidelines for Organic Data Review* (1999b)
- U.S. Department of Energy, *Hazardous Waste Remedial Action Program Requirements for Quality Control of Analytical Data* (1990)
- *EPA Requirements for QAPPs* (1999c)
- *EPA Guidance for Data Quality Assessment* (1996b)
- *EPA Guidance for Field Sampling Plan Preparation* (1993)
- U.S. Navy Southwest Division (SWDIV) *Environmental Work Instruction No. 1 - Chemical Data Validation* (1999a)

- U.S. Navy Southwest Division, *Environmental Work Instruction No. 2—Review, Approval, Revision, and Amendment of Field Sampling Plans (FSP) and Quality Assurance Project Plans* (1999b)
- U.S. Navy Southwest Division, *Environmental Work Instruction No. 3—Laboratory Quality Assurance Program* (1999c)

This QAPP and the preceding document, Field Sampling Plan (FSP), constitutes the Sampling and Analysis Plan (SAP). The FSP has the following objectives:

- Provide a rationale for field-sampling activities at Landfill Site 1 and Site 2
- Describe the sampling strategy and design
- Describe and establish consistent field sampling procedures
- Establish data gathering, sample handling, and documentation methods that will be used during field activities

Quality control (QC) requirements associated with the sampling activities are presented in the FSP and will not be repeated here.

In accordance with the U.S. Environmental Protection Agency (EPA), the QAPP elements are categorized into four groups that have been addressed in the SAP as follows:

Group A—Project Management

- Title and Approval Sheet
- Table of Contents
- Project/Task Organization—QAPP Section 2.0
- Data Quality Objectives—QAPP Section 3.0
- Documentation and Records—FSP Section 5.0, QAPP Section 5.0

Group B—Measurement/Data Acquisition

- Sampling Methods Requirements—FSP Section 5.0
- Sample Handling and Custody Requirements—FSP Section 5.0 and QAPP Section 5.0
- Analytical Method Requirements—QAPP Sections 3.2.7 and 3.2.8
- Quality Control Requirements—QAPP Sections 3.2 and 6.2

- Instrument/Equipment Testing, Inspection, and Maintenance Requirements—QAPP Section 6.2.2
- Instrument Calibration and Frequency—QAPP Section 6.2.1
- Acceptance Requirements for Supplies and Consumables—QAPP Section 6.2.4

Group C—Assessment/Oversight

- Assessments and Response Actions—QAPP Section 6.3 and 8.0
- Reports to Management—QAPP Section 8.0

Group D—Data Validation and Usability

- Data Review, Validation, and Verification Requirements—QAPP Section 7.1
- Validation and Verification Methods—QAPP Section 7.2 and 7.3
- Reconciliation with User Requirements—QAPP Section 7.4

1.1 Objective

This QAPP has been prepared to ensure that the data collected over the course of the project are of known quality to meet their intended use and that all components of data acquisition are thoroughly documented, verifiable, and defensible. This document describes the project data quality objectives (DQOs) and based on these DQOs derives appropriate quality assurance (QA) objectives and QC requirements to ensure that the acquired data are valid and usable. The QAPP outlines the criteria for data quality in terms of precision, accuracy, representativeness, completeness, and comparability, often referred to as the PARCC parameters.

1.2 Background

Background information is provided in Section 2.0 of the FSP.

2.0 Project Organization

The project organization consists of representatives from the Navy providing technical direction and QA oversight, and the IT Team. The project organization consists of the following members:

- Remedial Project Manager, Southwest Division
- U.S. Navy QA Officer (QAO)
- Project Manager, IT
- Program Quality Control (QC) Manager, IT
- Program Chemist, IT
- Program Health and Safety Manager, IT
- Site Health and Safety Officer, IT
- Technical Manager, IT
- Project QC Manager, IT
- Project Chemist, IT
- Field Technician, IT

The IT Team is identified in Figure 1.

The responsibilities of the Team members associated with data acquisition activities are listed in Table 1.

3.0 Quality Assurance Objectives

The DQOs are qualitative and quantitative statements that clarify the project objectives, specify the most appropriate type of data for the project decisions, determine the most appropriate conditions from which to collect data, and specify tolerable limits on decision errors. The DQOs are based on the end uses of the data and are determined through a seven-step process as described in QA/G-4 (EPA, 1994).

In addition to the project objectives, the DQOs specify data collection boundaries and limitations, the most appropriate type of data to collect, and the level of decision error that will be acceptable for the decision.

3.1 Data Quality Objectives

The DQO process is a series of planning steps based on scientific methods that are designed to ensure that the type, quantity, and quality of environmental data used for decision-making are appropriate for the intended application. The DQO process, as defined by EPA, consists of seven steps that are designed to provide a systematic approach to resolving issues that pertain to the site investigation and remediation (EPA, 1994). This section of the QAPP described the outcome of the seven-step DQO process for data collection activities under CTO 0004.

3.1.1 Stating the Problem

Step 1: Summarize the problem that requires environmental data acquisition and identify the resources available to resolve the problem. Operable Unit 1 (OU1) at Moffett Federal Airfield (MFA), Mountain View, California consists of two capped landfills: Runway Landfill (Site 1) and the Former Golf Course Landfill (Site 2). Landfill refuse at Site 2 was excavated and consolidated into the Runway Landfill at Site 1. Remedial actions at OU1 are conducted as part of the Installation Restoration Program (IRP) and under the authority of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

The Runway Landfill (Site 1) was operated from 1963 until the mid-1970s. The landfill received domestic refuse as well as waste from maintenance and military operations, such as scrap equipment, construction debris, paint and paint thinners, solvents, lacquer, asbestos, waste oil and transformer oil, jet fuel, fuel and transformer filters, and sawdust contaminated with polychlorinated biphenyls (PCBs). The target analytes for Landfill Site 1 are the constituents for detection monitoring according to Appendix I to Title 40 Code of Federal Regulations (CFR) Part 258. Methane concentrations in landfill gas will be monitored for compliance with

27 Code of California Regulations (CCR) Section 20921. In addition, total organic carbon (TOC) and nitrite/nitrate concentrations will be monitored as indicators of landfill activity.

The Former Golf Course Landfill (Site 2) is located in the northern portion of MFA, just west of the golf course and adjacent to a saltwater evaporation pond. Although Site 2 covers an area of approximately 5 acres, the buried waste was estimated to cover approximately 2 acres. The former landfill received domestic refuse as well as waste from maintenance and military operations.

Under the scope of this CTO, IT will provide the sampling and analysis of the existing groundwater and leachate monitoring well network to monitor the release of hazardous constituents into the groundwater at Sites 1 and 2. IT will also measure and document methane gas generation in the landfill gas monitoring wells and gas vents at Site 1. Target analytes for Site 2 are total extractable petroleum hydrocarbons, volatile and semivolatile organic compounds (VOCs and SVOCs), and pesticides/polychlorinated biphenyls (PCBs) of the Contract Laboratory Program (CLP) Target Compound List (TCL) and metals of the CLP Target Analyte List (TAL).

3.1.2 Identifying the Decisions

Step 2: Identify the decision that requires acquisition of environmental data. Identify the intended use of the data. The decision requiring acquisition of environmental data is to determine if chemical constituents hazardous to human health and the environment are being released by the landfills.

The data acquired over the course of the project activities will be used to answer the following questions:

- What are the current concentrations of contaminants in groundwater at the Site 1 and Site 2?
- What are the methane concentrations in landfill gas at Site 1?

3.1.3 Identifying Inputs to the Decisions

Step 3: Identify the information needed to support the decision and specify the inputs requiring environmental measurements. The information needed to support the decision consists of the concentrations of hazardous constituents in groundwater and methane in landfill gas. Specifically, groundwater samples at Site 1 will be analyzed for the following contaminants:

- VOCs, including ketones, by EPA Method 8260B
- Total and dissolved metals by EPA Methods 6010B/7000A
- Organochlorine pesticides by EPA Method 8081A
- PCBs by EPA Method 8082
- TOC by EPA Method 415.1
- Total nitrogen (nitrite/nitrate) by EPA Method 353.3

Groundwater at Site 2 will be analyzed for the following contaminants:

- VOCs by CLP Statement of Work (SOW) low-level volatile organic analysis (VOA)
- SVOCs by CLP SOW semivolatile organic analysis (SVOA)
- Pesticides/PCBs by CLP SOW Pesticides/PCBs
- Total petroleum hydrocarbons (TPH) extractable as diesel and motor oil by EPA Method 8015B

The groundwater concentrations will be compared with risk-based concentrations to determine if a risk to human health or the environment exists. Methane concentrations will be also compared with an action-level concentration allowable for landfill gas. Providing these comparisons is not in the scope of this CTO. The data will be transferred to Tetra Tech EM Inc., (TtEMI), a Navy contractor, who will be responsible for the decisions related to action levels.

3.1.4 Defining the Boundaries

Step 4: Specify the spatial and temporal aspects of the environmental media that the data must represent to support the decision. The Runway Landfill (Site 1) is located in the northernmost portion of MFA, at the end of the runways between Zook Road and the Cargill Salt Company evaporation ponds. This site encompasses an area of approximately 12 acres. The former Golf Course Landfill (Site 2) is located in the northern portion of MFA, just west of the golf course and adjacent to a saltwater evaporation pond. Although Site 2 covers an area of approximately 5 acres, the buried waste was estimated to cover approximately 2 acres. The former landfill received domestic refuse as well as waste from maintenance and military operations.

Under this CTO, IT will conduct groundwater and landfill gas monitoring on a quarterly basis over the course of one year.

3.1.5 Developing a Decision Rule

Step 5: Develop a logical statement "if...then" that defines the conditions that would cause the decision-maker to choose among alternative actions. Under the scope of this CTO, IT is not

tasked with making decisions about the hazardous or nonhazardous nature of the sampled matrices. However, IT will be making decisions related to the quality and usability of obtained data and will use the following logical statement:

- If the data quality indicators meet the acceptance criteria specified in this QAPP, then the data are valid and can be used for project decisions.

3.1.6 Specifying Limits on Decision Error

Step 6: Specify the decision-maker's acceptable limits on decision errors, which are used to establish appropriate performance goals for limiting uncertainty in environmental data. To limit uncertainty in obtained environmental data, criteria for the data quality indicators and reporting limits for the contaminants of concern have been developed. The data that meet these criteria will be of definitive quality and of less uncertainty than the estimated data that do not meet the criteria. Limits on decision errors are calculated for probabilistic sampling design and cannot be evaluated for this site for the following reasons:

- Methane gas measurements are considered screening, and the decision error cannot be quantified.
- Results from individual groundwater monitoring wells will be ultimately compared with the action levels and, therefore, statistical calculations are not applicable.

3.1.7 Optimizing the Design for Obtaining Data

Step 7: Identify the most resource-effective sampling and analysis design for generating data that are expected to satisfy project DQOs. This project has entered the second year of monitoring, and the sampling design has been optimized. Further optimization may take place during project execution if some of the exiting wells are considered superfluous and are eliminated from the groundwater well monitoring network.

3.2 Analytical Data Quality Objectives

A laboratory with appropriate capabilities and accreditation will produce analytical data required for the project using EPA methods of analysis. Analytical DQOs will be assessed through application of the PARCC parameters. Laboratory QC checks that allow derivation of the PARCC parameters and the applicable QC criteria are defined in this section. Because precision and accuracy information may be expressed in several ways, only the definitions for indicators provided in this section will be used for data quality assessment. This section also provides information on the analytical methods to be used and the project-required reporting limits for the target analytes.

3.2.1 Laboratory Quality Control Checks

The recovery of known additives is part of laboratory analytical protocols. The use of additives at known concentrations allows detection of matrix interferences and estimation of the impact of these interferences when present. It also allows evaluation of the efficiency of extraction procedures and overall accuracy of analysis. Internal laboratory QC checks will include:

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

3.2.2 Laboratory Control Samples

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

3.2.3 Laboratory Duplicates

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

3.2.4 Matrix Spikes

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

3.2.5 Surrogate Standards

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

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

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

3.2.6 Internal Standards

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

3.2.7 Method Blanks

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

3.2.8 Instrument Blanks

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

analyzed for every ten samples. For GC and GC/MS analysis, instrument blanks are analyzed on an as-needed basis to troubleshoot and to determine chromatography column carryover.

3.3 Data Quality Indicators

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

3.3.1 Post-Digestion Spikes and the Method of Standard Addition

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

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

3.3.2 Precision

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

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

The laboratory uses MS/MSD pairs to assess the precision of analytical procedures with one MS/MSD pair analyzed for every batch of up to 20 samples. In accordance with Navy requirements, analytical laboratories perform MS/MSD on Navy project samples. This makes it possible to determine whether or not matrix interferences are present.

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

sample volume was not obtained in the field to perform the MS/MSD analysis. For inorganic analyses, analytical precision is usually calculated based on the sample and sample duplicate results.

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

Water: 20% for all analyses

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

Water: 20% for all analyses

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

3.3.3 Accuracy

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

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

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

As a general rule, the recovery of most compounds spiked into samples is expected to fall within a range of 70 to 130 percent. This range represents the EPA advisory acceptability limits for MS, MSD, and LCS for all organic analytical methods. The surrogate standard advisory acceptability limits are also 70 percent to 130 percent for all organic analyses with the exception of GC/MS methods, where these limits are specified in the methods for each matrix. Laboratories may use the advisory limits until the in-house, statistically based control limits are developed for each method of organic analysis and sample matrix. The EPA SW-846 mandates the recovery acceptance limits for metal analysis at 75 percent to 125 percent.

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

3.3.4 Representativeness

Unlike precision and accuracy, which can be expressed in quantitative terms, representativeness is a qualitative parameter. Representativeness is the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. It is a qualitative parameter that depends on proper design of the sampling program.

Field personnel will be responsible for ensuring that samples are representative of field conditions by collecting and handling samples according to approved SAP and field Standard Operating Procedures (SOPs). Errors in sample collection, packaging, preservation, or chain-of-custody procedures may result in samples being judged nonrepresentative and may form a basis for rejecting the data.

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

3.3.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another, whether it was generated by a single laboratory or during

interlaboratory studies. The use of standardized field and analytical procedures ensures comparability of analytical data.

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

3.3.6 Completeness

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

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

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

3.4 Analytical Method Requirements

The following analytical methods will be used to obtain the data for this project:

- EPA Test Methods for Evaluating Solid Waste, SW-846, Update III (EPA, 1996)
  - TPH as diesel and motor oil by EPA Method 8015B
  - Volatile organic compounds VOCs by EPA Method 8260B
  - Organochlorine pesticides by EPA Method 8081A
  - PCBs by EPA Method 8082
  - Metals by EPA 6010B/7000A
- U.S. Environmental Protection Agency Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, 1983
  - TOC by EPA Method 415.1
  - Total nitrogen (nitrite/nitrate) by EPA Method 353.1

- U.S. Environmental Protection Agency, CLP
  - Statement of Work for Organic Analysis, OLM04.2, 1999

Laboratories will conduct these analyses according to the requirements of the method and the laboratory SOPs.

3.5 Project-Required Reporting Limits

Reporting limits for the project are presented in Tables 2 through 5. These limits may be elevated for individual samples if matrix interferences are encountered. The reporting limits for TOC and nitrite/nitrate will be specified according to the analytical laboratory QA Manual.

4.0 Sample Collection

4.1 Sample Locations

Sample locations and the number of samples to be collected are described in Section 3.0 of the FSP and are not repeated here.

4.2 Sample Collection

Sample collection procedures are described in Section 5.0 of the FSP and are not repeated here.

4.3 Sample Containers, Preservatives, and Holding Times

Sample containers, preservatives, and holding times are described in Section 5.0 of the FSP and are not repeated here.

4.4 Sample Packaging and Shipment

Sample packaging and shipping requirements are presented in Section 5.6 of the FSP and are not repeated here.

5.0 Sample Custody and Documentation

This section describes the sample custody and field documentation procedures that IT will follow at the project site.

5.1 Chain of Custody

An overriding consideration for data resulting from laboratory analyses is the ability to demonstrate that the data are legally defensible, i.e., that the samples were obtained from the locations stated and that they reached the laboratory without alteration. To accomplish this, evidence of collection, shipment, laboratory receipt, and laboratory custody until disposal will be documented through the chain-of-custody (COC) record. A sample is considered to be in custody if it is:

- In actual possession or in view of the person who collected the samples
- Locked in a secure area
- Placed in an area restricted to authorized personnel
- Placed in a container and secured with an official seal, such that the sample cannot be reached without breaking the seal

Figure 2 illustrates the COC record that will be used for the EFA–West Remedial Action Contract (RAC) projects. The COC record lists each sample and the individuals performing the sample collection, shipment, and receipt. The sample COC procedures will be implemented according to IT SOP 1.1. Figure 3 is an example of a custody seal that will seal a cooler with samples during transportation to the laboratory.

Sample custody will be the responsibility of the Project Chemist or an on-site designee from the time of sample collection until the samples are accepted by the courier service for delivery to the laboratory. Thereafter, the laboratory performing the analysis will maintain custody.

5.2 Analysis Request

In addition to providing a custody exchange record for the samples, the COC record serves as a formal request for sample analyses. The COC records will be completed, signed, and distributed as follows:

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

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

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

5.3 Field Sample Custody

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

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

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

5.4 Field Documentation

Field documentation procedures are described in Section 5.7 of the FSP.

6.0 Analytical Quality Control

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

6.1 Laboratory Qualifications

The analytical laboratories selected to analyze samples for this project will be certified by the California Department of Health Services (DHS) through the Environmental Laboratory Accreditation Program (ELAP) for all the analytical methods required for the project. In addition, the laboratory will successfully complete the Naval Facilities Engineering Service Center (NFESC) Laboratory Evaluation Program before sampling activities begin and maintain that status throughout the project.

Laboratories selected for the project must be able to provide the required turnaround times, project QC, and data deliverables required by this QAPP and the FSP.

6.2 Laboratory Quality Assurance and Quality Control Program

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

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

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

- Analysis of duplicates
- Maintenance of control charts

Strict adherence to Good Laboratory Practices (GLP) and consistent use of SOPs are also essential for a successful QC program. The laboratory will have the current revisions of the SOPs readily available for all staff. At a minimum, SOPs will be written for the following activities: sample receipt, control, and disposal; sample preparation and extraction; sample analysis; results calculation; database management; health and safety; and corrective action.

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

6.2.1 Calibration

Before samples are analyzed, all instruments will be calibrated and the calibration acceptance criteria will be met. Calibration standards will be prepared with National Institute for Standards and Testing (NIST)-traceable standards and analyzed according to methods requirements. Initial calibration acceptance criteria documented in the laboratory SOPs will meet those of applicable guidance documents. The initial calibration will meet one of the following requirements:

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

Before samples are analyzed, initial calibration will be verified with a second source standard prepared at the midpoint of the calibration curve. Initial calibration verification will meet the acceptance criteria in the laboratory SOPs.

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

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

Calibration requirements and acceptance criteria for organic and inorganic analysis are summarized in Tables 6 through 10.

6.2.2 Preventive Maintenance

The primary objective of a preventive maintenance program is to help ensure the timely and effective completion of a measurement effort by minimizing the down time of crucial analytical equipment due to expected or unexpected component failure. In implementing this program, efforts are focused in three primary areas: (1) maintenance responsibilities, (2) maintenance schedules, and (3) adequate inventory of critical spare parts and equipment.

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

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

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

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

6.2.3 Training

The laboratory will have an established policy and procedure on training and on documention of the analyst's competency. Each staff member who performs sample preparation and analysis will demonstrate his or her proficiency through preparation and analysis of four LCSs as described in the EPA SW-846. An analyst will be considered proficient if the acceptance criteria for method accuracy and precision are met. The laboratory will maintain all training records on file.

6.2.4 Supplies and Consumables

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

6.2.5 Software Quality Assurance

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

6.2.5.1 Software Validation

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

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

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

Baseline software validation will be documented in laboratory QA files. Continuing software verification will take place during sample analysis. To eliminate data entry errors during

analytical sequence setup, as part of data package review, the correctness of results will be checked by one manual calculation per QC batch during data review. This verification will be documented in the QA/QC checklist for each data file.

6.2.5.2 Software Security

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

6.2.5.3 Manual Integration

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

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

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

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

6.3 Laboratory Corrective Action

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

implementing and documenting the corrective action. If a situation arises requiring corrective action, the following closed-loop corrective action process will be used:

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

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

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

All affected project samples will be listed on the Nonconformance/Corrective Action Report. The laboratory Project Manager will notify the IT Project Chemist of any laboratory nonconformance affecting the samples. Nonconformance/Corrective Action Reports will be submitted to IT as part of data packages. Corrective action procedures for different types of analysis are presented in Tables 6 through 9.

6.3.1 Batch Corrective Action

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

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

A preparation batch is a group of up to 20 field samples that are prepared (e.g., extracted or digested) simultaneously or sequentially without interruption. Samples in each batch are of similar matrix (e.g., soil, sludge, liquid waste, and water), are treated in a similar manner, and are

processed with the same lots of reagents. For organic compound analyses, each batch will contain a method blank, an LCS, and an MS/MSD pair. For inorganic compound analyses, each batch will contain a method blank, an LCS, an MS, and an SD. These QC check samples are not counted into the maximum batch size of 20.

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

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

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

Method quality control acceptance criteria determine whether a method is performing within acceptable limits of precision and accuracy. This determination includes a method component and a "matrix" component. The method component measures the performance of the laboratory analytical processes during the sample analyses. The matrix component measures the method performance on a specific matrix. Some quality control elements uniquely measure the laboratory component of method performance but all QC elements measuring the matrix component contain the method component.

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

6.3.2 Method Blank

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

A method blank will be considered acceptable if the following conditions are met:

- Target analytes are present at concentrations less than one half of the PQLs
- Target analytes are present at concentrations less than 5 percent of the regulatory limits for these analytes
- Target analytes are present at concentrations less than 5 percent of the sample results for these analytes

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

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

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

6.3.3 Laboratory Control Sample

An LCS must meet the accuracy acceptance criteria for target analytes for the batch to be considered acceptable. If the target analytes are outside of the acceptance limits, corrective action will be initiated. Corrective action will include re-extraction and re-analysis of the whole batch, including method blank, samples, and QC check samples.

If matrix spikes are not conducted, an LCS/LCD pair will be analyzed with each batch of samples. If the LCS/LCD are outside method acceptance criteria for accuracy and precision, the

whole batch will be re-extracted and re-analyzed, including method blank, samples, and QC check samples.

6.3.4 Matrix Spike and Matrix Spike Duplicate

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

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

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

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

6.3.5 Individual Sample Corrective Action

In addition to batch corrective action, individual samples within a batch may also require corrective action. Re-extraction and re-analysis of individual samples will take place in the following situations:

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

7.0 Data Management

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

7.1 Data Reduction, Verification, and Reporting

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

7.1.1 Data Reduction

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

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

7.1.2 Laboratory Data Verification and Review

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

Level 1. Technical (Peer) Data Review—Analysts will review the quality of their work based on an established set of guidelines, including the QC criteria established in each method, in this QC Plan, and as stated within the laboratory QA Manual. This review will, at a minimum, ensure that the following conditions have been met:

- Sample preparation information is correct and complete
- Analysis information is correct and complete
- Appropriate SOPs have been followed
- Calculations are verified
- No data transposition errors exist
- Analytical results are correct and complete
- QC samples are within established control limits
- Blanks and laboratory control samples are within appropriate QC limits
- Special sample preparation and analytical requirements have been met
- Documentation is complete; for example, any anomalies and holding times have been documented and forms have been completed.

Level 2. Technical Data Review—The technical data review will be performed by a supervisor or data review specialist whose function is to provide an independent review of data packages. This review will also be conducted according to an established set of guidelines and will be structured to verify the following findings of a Level 1 data review:

- All appropriate laboratory SOPs have been followed
- Calibration data are scientifically sound, appropriate to the method, and completely documented
- QC samples are within established guidelines
- Qualitative identification of contaminants is correct
- Manual integrations are justified and properly documented
- Quantitative results and calculations are correct
- Data are qualified correctly
- Documentation is complete; for example, any anomalies and holding times have been documented and appropriate forms have been completed

- Data are ready for incorporation into the final report
- The data package is complete and is in compliance with contract requirements

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

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

Level 3. Administrative Quality Assurance Data Review—The Laboratory QA Manager will review 10 percent of all data packages. This review should be similar to the review as provided in Level 2 except that it will provide a total overview of the data package to ensure its consistency and compliance with project requirements. All errors noted will be corrected and documented.

7.1.3 Data Reporting

This section details the requirements for data reporting and data package formats that will be provided by the laboratory. Reporting units are presented in Table 11.

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

IT will maintain copies of all COC 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.

Data packages will be prepared to meet the requirements for data package contents that are presented in Tables 12 through 15. The data packages for all samples will meet the Level IV requirements.

7.1.4 Electronic Deliverables

The electronic data deliverable (EDD) will be in the IT Environmental Management System (ITEMS) Version 4.0 format delivered as ASCII text. The analytical laboratory will follow the requirements stated in the Laboratory Interface Document for the Analytical Laboratory Electronic Data Deliverable. At project closeout, IT will submit a Navy Electronic Data Transfer System (NEDTS) compatible electronic file to the Navy.

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

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

Upon receipt by the IT ITEMS Data 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 reader 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 returned by the program, the file will be manually edited or regenerated by the laboratory. If no errors are returned, 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

All samples, with the exception of waste characterization samples, will be validated according to the requirements of Environmental Work Instruction 4EN.1, SWDIV EWI No. 1 (October, 1999). An independent data validation company will validate the data at 100 percent EPA Level IV. The validation will be in accordance with the CLP *National Functional Guidelines for Organic Data Review* (EPA, 1999b) and the QC criteria specified in this document. Data will be validated and flagged with data qualifiers shown in Table 16.

The data validation company will have the following qualifications:

- A minimum of five years of experience in environmental data validation for EPA and Department of Defense (DoD) programs
- Prior experience on Navy RAC or Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract projects
- Active peer review program

Personnel must have the following qualifications:

- Data Reviewer:
  - Bachelor of Science degree or higher in chemistry or physical science
  - Four years of combined experience with approximately two years in data validation and two years conducting laboratory analysis in an environmental laboratory using the EPA-approved methods being validated
- Peer Reviewer:
  - At a minimum, same as for the data reviewer

7.3 Data Review

The Project Chemist will review the standard laboratory data packages to establish that the holding times for extraction and analysis, the calibration, and internal QC check requirements have been met. The Project Chemist will review all vapor data and waste characterization data.

7.4 Data Quality Assessment Report

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

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

The DQAR will be included in the Quarterly Post-Closure Monitoring Report.

8.0 Quality Assurance Oversight

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

8.1 Laboratory Assessment and Oversight

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

Audit results are used to evaluate whether or not the analytical laboratories are able to produce data that fulfill the objectives established for the program and identify any areas requiring corrective action.

8.1.1 Naval Facilities Engineering Service Center Laboratory Audits

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

8.1.2 Technical Systems Audits

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

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

The laboratory systems audit results will be used to review laboratory operations and to ensure that any outstanding corrective actions have been addressed. A laboratory systems audit will include the following critical areas:

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

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

8.1.3 Performance Evaluation Audits

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

Review of PE results include the following elements:

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

The concentrations reported for the PE samples will be compared with the known or expected concentrations spiked in the samples. The percent recovery will be calculated and the results assessed according to the acceptance limits, which are based on inter-laboratory studies. If the

accuracy criteria are not met, the cause of the discrepancy will be investigated, and a second PE sample will be submitted. The PE sample results review will be documented in a report to the Project Manager.

8.1.4 Magnetic Tape Audits

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

8.1.5 Performance Evaluation Sample Programs

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

8.2 Field Audits

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

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

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

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

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

8.3 Quality Assurance Project Plan Revision or Amendment

When circumstances arise that impact the original project DQOs, such as a significant change in work scope, the QAPP document will be revised or amended. The modification process will be based on EPA guidelines and direction from the Navy and QA Officer.

9.0 References

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Naval Facilities Engineering Command, 1999, *Navy Installation Restoration Chemical Data Quality Manual (IR CDQM).*

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

U.S. Environmental Protection Agency, August 1993, *Guidance for Field Sampling Plan Preparation.*

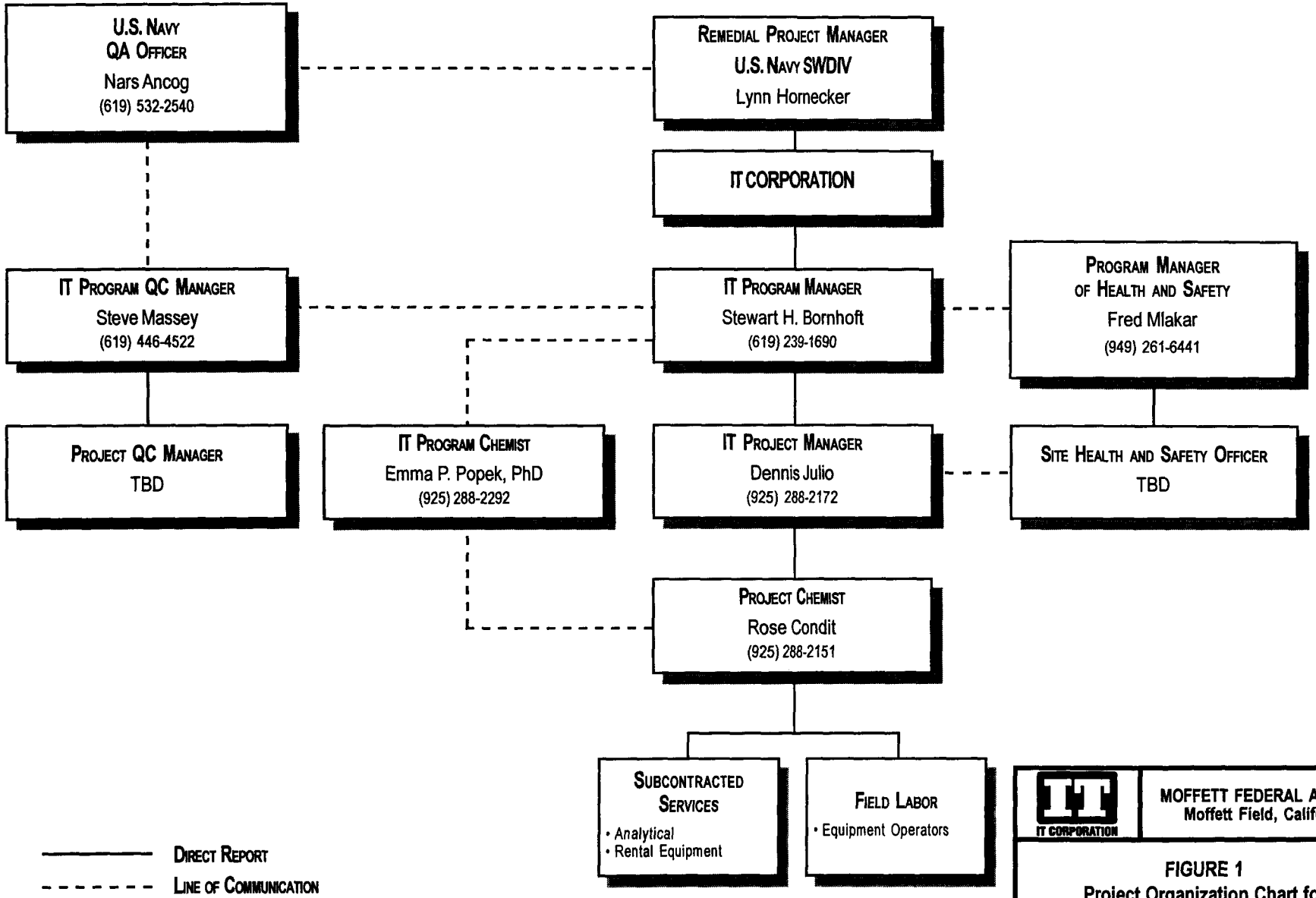
U.S. Navy Southwest Division, October 1999a, *Environmental Work Instruction No. 1 – Chemical Data Validation.*

U.S. Navy Southwest Division, October 1999b, *Environmental Work Instruction No. 2 – Review, Approval, Revision, and Amendment of Field Sampling Plans (FSP) and Quality Assurance Project Plans (QAPP).*

U.S. Navy Southwest Division, October 1999c, Environmental Work Instruction No. 3 – Laboratory Quality Assurance Program.

FIGURES

Drawn by		Checked by		Approved by	
DA	10/2/00				



IT CORPORATION

MOFFETT FEDERAL AIRFIELD
Moffett Field, California

FIGURE 1
Project Organization Chart for Postclosure Monitoring (Site 1) and Groundwater Monitoring (Site 2) Contract Task Order #0018

Prod 4:809616 Moffett Field CTO18:OrgChart.p65

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 545664
Page 1 of ____

Project Name/No. [1] _____
Sample Team Members [2] _____
Profit Center No. [3] _____
Project Manager [4] _____
Purchase Order No. [6] _____
Required Report Date [11] _____

Samples Shipment Date [7] _____
Lab Destination [8] _____
Lab Contact [9] _____
Project Contact/Phone [12] _____
Carrier/Waybill No. [13] _____

Bill to: [5] _____
Report to: [10] _____

ONE CONTAINER PER LINE

Sample Number [14]	Sample Description/Type [15]	Date/Time Collected [16]	Container Type [17]	Sample Volume [18]	Pre-servative [19]	Requested Testing Program [20]	Condition on Receipt [21]	Disposal Record No. [22]

FOR LAB USE ONLY

FOR LAB USE ONLY

Special Instructions: [23]

Possible Hazard Identification: [24]
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: [25]
Return to Client ☐ Disposal by Lab ☐ Archive _____ (mos.)

Turnaround Time Required: [26]
Normal ☐ Rush ☐

QC Level: [27]
I. ☐ II. ☐ III. ☐ Project Specific (specify): _____

1. Relinquished by [28] (Signature/Affiliation)	Date: _____ Time:	1. Received by [28] (Signature/Affiliation)	Date: _____ Time:
2. Relinquished by (Signature/Affiliation)	Date: _____ Time:	2. Received by (Signature/Affiliation)	Date: _____ Time:
3. Relinquished by (Signature/Affiliation)	Date: _____ Time:	3. Received by (Signature/Affiliation)	Date: _____ Time:

Comments: [29]

White: To accompany samples
Yellow: Field copy
*See back of form for special instructions.

FIGURE 2
Chain-of-Custody Record

Figure 3
Custody Seal

CUSTODY SEAL

Date:_____
Signature:_____

TABLES

Table 1
Project Personnel and Chemical Data Collection Responsibilities

Position	Responsibility
U.S. Navy QAO	Provides governmental oversight of the IT QA Program. Provides quality-related directives through Contracting Officer's Technical Representative. Provides technical and administrative oversight of IT surveillance audit activities. Acts as point of contact for all matters concerning QA and the Navy's Laboratory QA Program. Prepares governmental budget estimates for all QA functions included in IT contracts. Coordinates training on matters pertaining to generation and maintenance of quality of data. Authorized to suspend project execution if QA requirements are not adequately followed.
Program Chemist	Reviews and approves the SAP. Guides the selection of subcontract analytical laboratories. Conducts field and laboratory audits. Serves as a point of contact for the EFA–West QAO. Develops corrective action as required. Serves as a technical advisor to the project.
Project Chemist	Develops the project DQOs and prepares the SAP. Selects qualified subcontract laboratories. Implements chemical data QC procedures and performs auditing of field performance. Reviews laboratory data prior to use. Coordinates data validation of laboratory data. Reviews data validation report. Prepares the appropriate sections of the report summarizing the project activities.
Field Technician	Performs all sampling in accordance with approved SAP. Ensures that field QC samples are collected as specified in the FSP. Completes field documentation. Coordinates laboratory and field sampling activities. Implements field corrective actions as required.

Table 2
Reporting Limits–EPA Method 8015B (Nonhalogenated Organics Using GC/FID)

Compound name	Water, mg/L
TPH as diesel fuel, carbon range C_{12} to C_{24}	0.1
TPH as motor oil, carbon range C_{20} to C_{36}	0.1

Table 3
Reporting Limits–EPA Method 8260B and CLP SOW OLM04.2
(Volatile Organic Compounds)

Compound name	Water, µg/L
Acrylonitrile	2.0
Benzene	2.0 (0.5 for low-level CLP)
Bromobenzene	2.0
Bromochloromethane	2.0
Bromodichloromethane	2.0
Bromoform	2.0
Bromomethane	2.0
n-Butylbenzene	2.0
Sec-Butylbenzene	2.0
Tert-Butylbenzene	2.0
Carbon Tetrachloride	2.0 (0.5 for low-level CLP)
Chlorobenzene	2.0
Chloroethane	2.0
Chloroform	2.0
Chloromethane	2.0
2-Chlorotoluene	2.0
4-Chlorotoluene	2.0
Dibromochloromethane	2.0
Dibromochloropropane	2.0
Dibromomethane	2.0
Dichlorodifluoromethane	2.0
Dichloromethane (Methylene Chloride)	2.0
1,2-Dichlorobenzene	2.0 (0.5 for low-level CLP)
1,2-Dichloroethane	2.0 (0.5 for low-level CLP)
1,3-Dichlorobenzene	2.0 (0.5 for low-level CLP)
1,2-Dichloropropane	2.0
1,3-Dichloropropene	2.0 (0.5 for low-level CLP)
1,4-Dichlorobenzene	2.0 (0.5 for low-level CLP)
2,2-Dichloropropane	2.0
1,1-Dichloroethane	2.0
1,1-Dichloroethene	2.0
1,1-Dichloropropene	2.0
1,2-Dibromoethane	2.0

Compound name	Water, µg/L
Trans 1,2-Dichloroethene	2.0
Cis 1,2-Dichloroethene	2.0
Ethylbenzene	2.0
Hexachlorobutadiene	2.0
Isopropylbenzene	2.0
4-Isopropyltoluene	2.0
Napthalene	2.0
n-Propylbenzene	2.0
Styrene	2.0
Toluene	2.0
Trichloroethene	2.0
Trichlorofluoromethane	2.0
1,1,1,2-Tetrachloroethane	2.0
1,1,1-Trichloroethane	2.0
1,1,2,2-Tetrachloroethane	2.0
Tetrachloroethene	2.0
1,1,2-Trichloroethane	2.0
1,2,3-Trichlorobenzene	2.0
1,2,3-Trichloropropane	2.0
1,3,5-Trimethylbenzene	2.0
1,2,4-Trichlorobenzene	2.0
1,2,4-Trimethylbenzene	2.0
M&p-Xylenes	2.0
o-Xylene	2.0
Vinyl Chloride	2.0 (0.5 for low-level CLP)
Acetone	100
Carbon Disulfide	100
2-Butanone	100
4-Methyl-2-Pentanone	50
2-Hexanone	50

Table 4
Reporting Limits–Metal Analyses

Metal	Water, µg/L
EPA Method 6010B (ICP)	
Antimony (Sb)	50
Arsenic (As)	50
Barium (Ba)	100
Beryllium (Be)	2.0
Cadmium (Cd)	2.0
Chromium (Cr)	10
Cobalt (Co)	10
Copper (Cu)	10
Lead (Pb)	5.0
Nickel (Ni)	40
Selenium (Se)	20
Silver (Ag)	5.0
Thallium (Tl)	10
Vanadium (V)	10
Zinc (Zn)	20

Table 5
Reporting Limits–EPA Methods 8081A/8082 and CLP SOW OLM04.2 (Organochlorine Pesticides/PCBs)

Compound name	Water, µg/L
Alpha-BHC	0.05
Beta-BHC	0.05
Delta-BHC	0.05
Gamma-BHC (Lindane)	0.05
Heptachlor	0.05
Aldrin	0.05
Heptachlor Epoxide	0.01 (for CLP)
Endosulfan I	0.05
Dieldrin	0.10
4,4'-DDE	0.10
Endrin	0.10
Endosulfan II	0.10
4,4'-DDD	0.10
Endosulfan Sulfate	0.10
4,4'-DDT	0.10
Endrin Ketone	0.10
Methoxychlor	0.5
Endrin Aldehyde	0.10
Chlordane (alpha, gamma isomers)	0.05
Chlordane (technical)	5.0
Toxaphene	2.0 (for CLP)
Aroclor-1016	0.5 (for CLP)
Aroclor-1221	0.5 (for CLP)
Aroclor-1232	0.5 (for CLP)
Aroclor-1242	0.5 (for CLP)
Aroclor-1248	0.5 (for CLP)
Aroclor-1254	0.5 (for CLP)
Aroclor-1260	0.5 (for CLP)

Table 6
Summary of QC Requirements and Corrective Action for EPA Methods 8260B and 8270C

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

Table 6 (Continued)
Summary of QC Requirements and Corrective Action for EPA Methods 8260B and 8270C

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Surrogate standards	Every sample, spiked sample, standard, and method blank	QC acceptance criteria per method's requirements (per Method 8260B Table 8 and Method 8270A Table 8[b])	Correct problem, then re-extract and re-analyze all affected samples.
MDL study	Once per 12-month period	Detection limits established will be below the RLs	Correct problem, repeat the MDL study.

[a] If RSD for any analyte is less than 15%, regression fit may be used for the calibration curve for that analyte. Acceptance criteria for first order regression is $r^2 \geq 0.99$.

[b] For Method 8270C, use the surrogate standard acceptance criteria of Method 8270A, Revision 1, July 1992.

Table 7
Summary of QC Requirements and Corrective Action for Chromatography Methods

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

[a] *If RSD for any analyte is less than 20%, regression fit may be used for the calibration curve for that analyte. Acceptance criteria for first-order regression is $r^2 \geq 0.995$.*

Table 8
Summary of QC Requirements and Corrective Action for EPA Method 6010B

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

Table 9
Summary of QC Requirements and Corrective Action for EPA Method 7000A

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

Table 10
Summary of QC Requirements and Corrective Action for Inorganic Analyses

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

Table 11
Reporting Units

Description	Aqueous Samples
Organic parameters, explosives	µg/L
Total petroleum hydrocarbons (TPH)	mg/L
Inorganic parameters	mg/L
Metals	µg/L

Table 12
GC/MS Data Deliverables Package Requirements

Method	Deliverable Requirement	Equivalent EPA Form	CLP or CLP-like Package Level IV	SW-846 Package, Level III	Standard Laboratory Report
Organic Analysis by GC/MS	Case Narrative		X	X	X
	Corrective Action Report(s)		X	X	X
	Cross-reference of field sample numbers, laboratory IDs, and analytical QC batches		X	X	X
	COC Form, Cooler Receipt Form		X	X	X
	Sample log-in sheet	DC-1	X		
	Complete SDG file inventory sheet	DC-2-1	X		
	Data summary for each blank and sample [a]	I	X	X	X
	TICs for each sample (ten peaks)	I,TIC	X	X	
	LCS/LCD report (including concentration spiked, percent recovered, percent recovery acceptance limits, RPD, and RPD acceptance limits)	III (modified)	X	X	X
	Surrogate recovery report (including concentration spiked, percent recovered, and percent recovery acceptance limits)	II	X	X	X
	MS/MSD report (including concentration spiked, percent recovered, percent recovery acceptance limits, RPD, and RPD acceptance limits)	III	X	X	X
	Instrument performance check (tuning) report	V	X	X	
	Initial calibrating data (including acceptance limits)	VI	X	X (summary only)	
	Continuing calibration data (including acceptance limits)	VII	X	X (summary only)	
	Internal standard areas and retention time reports (including acceptance limits and out-of-control flags)	VIII	X	X	
	Reconstructed ion chromatogram for each sample and rerun, blank, spike, duplicate, and standard		X		
	Instrument quantitation report		X		
	Raw and background subtracted mass spectra for each target analyte found		X		
	Mass spectra of TICs with library spectra of 5 best-fit matches		X		
	Sample preparation bench sheets		X	X	
	Gel permeation chromatography clean-up logs		X		
	Method blank summary	IV	X		
	Standard preparation logs		X	X	
	Analysis run logs	VIII	X	X	
	Percent moisture		X	X	X
	PH		X [b]		

[a] *Must include field sample ID, laboratory ID, date/time sampled, date received, extracted/analyzed, Practical Quantitation Limits, Method Detection Limit, dilution factor(s), results, comments, approval signature/date.*

[b] *For water samples volatile analysis only.*

Table 13
GC or HPLC Data Deliverables Package Requirements

GC/HPLC	Deliverable Requirement	Equivalent EPA Form	CLP or CLP-like Package, Level IV	SW-846 Package, Level III	Standard Laboratory Report
Organic Analysis by GC or HPLC	Case Narrative		X	X	X
	Corrective Action Report(s)		X	X	X
	Cross-reference of field sample numbers, laboratory IDs, and analytical QC batches		X	X	X
	Chain-of-Custody Form, Cooler Receipt form		X	X	X
	Sample log-in sheet	DC-1	X		
	Complete SDG file inventory sheet	DC-2-1	X		
	Data summary for each blank and sample [a]	I	X	X	X
	LCS/LCD report (including concentration spiked, percent recovered, percent recovery acceptance limits, RPD, and RPD acceptance limits)	III (modified)	X	X	X
	Surrogate recovery report (including concentration spiked, percent recovered, and percent recovery acceptance limits)	II	X	X	X
	MS/MSD report (including concentration spiked, percent recovered, percent recovery acceptance limits, RPD, and RPD acceptance limits)	III	X	X	X
	Initial calibration data for each column (indicate which column was used for quantitation)	VI	X	X (summary data)	
	Continuing calibration data (indicate which column was used for quantitation) and calibration verification data	VII	X	X (summary data)	
	Chromatograms for each sample (and reruns), confirmation runs, blank, spike, duplicate, and standards		X	X [b]	
	Instrument quantitation report		X		
	Method blank summary	IV	X		
	Pesticide identification summary	X	X		
	Sample preparation bench sheets		X	X	
	Gel permeation chromatography clean-up logs		X		
	Standard preparation logs		X	X	
	Analysis run logs	VIII	X	X	
	Percent moisture		X	X	X

[a] *Must include field sample ID, laboratory ID, date/time sampled, date received, extracted/analyzed, Practical Quantitation Limit, Method Detection Limit, dilution factor(s), comments, approval signature/date. Results from the primary and secondary columns/detector must be reported.*

[b] *For petroleum fuels or PCB analyses chromatograms for samples with compound detection only.*

Table 14
Metals Data Deliverables Package Requirements

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

[a] *Must include field sample ID, laboratory ID, date/time sampled, date received, extracted/analyzed, Practical Quantitation Limit, Method Detection Limit, dilution factor(s), results, comments, approval signature/date.*

[b] *For water samples only.*

Table 15
Inorganic Data Deliverables Package Requirements

Method	Deliverable Requirement	Equivalent EPA Form	CLP or CLP-like Package	SW-846 Package	Standard Laboratory Report
Inorganic Chemistry	Case narrative		x	x	x
	Corrective action report(s)		x	x	x
	Cross-reference of field sample numbers, laboratory IDs, and analytical QC batches		x	x	x
	COC Form, Cooler Receipt Form		x	x	x
	Sample log-in sheet	DC-1	x		
	Complete SDG file inventory sheet	DC-2-1	x		
	Data summary for each blank and sample [a]	I-IN	x	x	x
	LCS/LCD report (concentration spiked, percent recovered, percent recovery acceptance limits, RPD, and RPD acceptance limits)	VII-IN	x	x	x
	MS report (concentration spiked, percent recovered, percent recovery acceptance limits)	V(PART1)-IN	x	x	x
	Duplicate sample report	VI-IN	x	x	x
	Calibrations, initial and vertification	II(PART1)-IN	x	x	
	Copies of sample preparation logs	XIII	x	x	
	Copies of analysis run logs	XIV	x	x	
	Raw data and instrument printouts		x		
	Copies of standard preparation logs		x	x	
	Percent moisture		x	x	x

[a] *Must include field sample ID, laboratory ID, date/time sampled, date received, Extracted/Analyzed, Analytical Results, Dilution Factors, PQLs, MDLs, comments, approval signature/date.*

Table 16
Data Qualifiers

Qualifier	Description
J	The analyte was positively identified, the quantitation is an estimation. The analyte was positively identified but the associated numerical value is an estimated value above the MDL and below the PQL.
U	The analyte was analyzed for, but not detected. The associated numerical value is at or below the PQL.
R	The data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria.
B	The analyte was found in an associated blank as well as in the sample.

Notes to Tables

µg/kg – microgram per kilogram

µg/L – microgram per liter

BFB – Bromofluorobenzene

CC – continuing calibration

CCC – Calibration Check Compounds

CCV – continuing calibration verification

CF – Calibration Factor

CLP – Contract Laboratory Program; these limits must be observed for CLP analysis, all other CLP compounds per CLP Contract Required Quantitation Limit

COC – chain of custody

CRDL – contract required detection limits

DBCP – dibromochloropropane

DDT – Dichlorodiphenyltrichloroethane

DFTPP – Decafluorotriphenylphosphine

DQO – data quality objectives

EFA–West – Engineering Field Activity–West

EPA – U.S. Environmental Protection Agency

FSP – Field Sampling Plan

GC – gas chromotography

GC/FID – gas chromotography/flame ionization detector

GC/MS – gas chromatography/mass spectometry

HPLC – high-performance liquid chromatography

IC – initial calibration

ICP – Inductively Coupled Plasma

ICS – interference check solution

ICV – initial calibration verification

ID – identification

IDL – instrument detection limit

LCS/LCD – laboratory control sample/laboratory control duplicate

MDL – method detection limit

MEK – 2-Butanone

mg/kg – milligram per kilogram

mg/L – milligram per liter

MIBK – 4-methyl-2-pentanone

MS – matrix spike

MS/MSD – matrix spike/matrix spike duplicate

MSA – method of standard addition

PCBs – polychlorinated biphenyls

PCE – tetrachloroethene

ppb-V – parts per billion-volume

PQL – practical quantification limit

QA – quality assurance

QAO – Quality Assurance Officer

QC – quality control

RF – Response Factor

RL – reporting limit

Notes to Tables (Continued)

RPD – relative percent difference
RSD – Relative Standard Deviation
SAP – Sampling and Analysis Plan
SD – sample duplicate
SDG – sample delivery group
SPCC – System Performance Check Compounds
SVOC – semivolatile organic compounds
TCE – trichloroethene
TIC – tentatively identified compounds
TPH – total petroleum hydrocarbons
VOC – volatile organic compounds