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COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN II)
Northern And Central California, Nevada, And Utah
Contract No. N62474-94-D-7609
Contract Task Order No. 200, Modification 01

Prepared for

DEPARTMENT OF THE NAVY
Scott Anderson, Remedial Project Manager
Naval Facilities Engineering Command
Southwest Division
San Diego, California

FINAL
QUALITY ASSURANCE PROJECT PLAN
ADDITIONAL INVESTIGATION OF ONSHORE
INSTALLATION RESTORATION SITE 21
VESSEL WASTE OIL RECOVERY AREA

NAVAL STATION TREASURE ISLAND
SAN FRANCISCO, CALIFORNIA

DS.0200.16911

August 2001

Prepared by

TETRA TECH EM INC.
135 Main Street, Suite 1800
San Francisco, California 94105
(415) 543-4880

David Donohue

David Donohue, Project Manager

TETRA TECH EM INC.

TRANSMITTAL/DELIVERABLE RECEIPT

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TO: Mr. Ron Fuller, Code 02R1.RF
Contracting Officer
Naval Facilities Engineering Command
Southwest Division
1230 Columbia Street, Suite 1100
San Diego, CA 92101-8517

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CTO: 0200
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NAVSTA Treasure Island, San Francisco

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Daniel Chow, Program Manager

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Tetra Tech EM Inc.

6th & Last Chance Gulch, Suite 612 ◆ Helena, MT 59601 ◆ (406) 442-5588 ◆ FAX (406) 442-7182

August 16, 2001

Mr. Scott Anderson
Remedial Project Manager
Southwest Division
Naval Facilities Engineering Command
1230 Columbia Street, Suite 1100
San Diego, CA 92101-8517

Subject: **Submittal of Final Quality Assurance Project Plan, Additional Investigation of Onshore Installation Restoration Site 21, Vessel Waste Oil Recovery Area, Naval Station Treasure Island, California**
CLEAN II Contract No. N62474-94-D-7609, Contract Task Order 200

Dear Mr. Anderson:

Enclosed please find four copies of the Final Quality Assurance Project Plan, Additional Investigation of Onshore Installation Restoration Site 21, Vessel Waste Oil Recovery Area, Naval Station Treasure Island, California. Please distribute one copy to Mr. Michael Bloom and one copy to Mr. Jim Sullivan. As you requested, copies of the report have been sent under separate cover to the BCT members listed below.

If you have any questions, please call me at (406) 442-5588.

Sincerely,

David Donohue
Project Manager

Enclosures

cc: Sarah Raker, Regional Water Quality Control Board
David Rist, Department of Toxic Substance and Control
Phillip Ramsey, United States Environmental Protection Agency, Region IX
Gary Foote, Geomatrix
Martha Walters, City of San Francisco
John Baur, IT Corporation
Nathan Brennan, RAB Co-Chair
Patricia Nelson, RAB Technical Chair
Dale Smith, RAB Member
Chris Shirley, ARC Ecology
Lew Schalit, RAB Member
Victor Early, TtEMI
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FINAL
QUALITY ASSURANCE PROJECT PLAN

ADDITIONAL INVESTIGATION OF ONSHORE INSTALLATION RESTORATION SITE 21 VESSEL WASTE OIL RECOVERY AREA

NAVAL STATION TREASURE ISLAND

SAN FRANCISCO, CALIFORNIA

DS.0200.16911

Prepared for:

DEPARTMENT OF THE NAVY

REVIEW AND APPROVALS

REGISTERED GEOLOGIST
JERRY T. WICKHAM
3766
STATE OF CALIFORNIA

TtEMI State of California
Registered Geologist: Jerry Wickham Date: 08/02/01

TtEMI Program
Quality Assurance Manager: Greg Swanson
TtEMI San Diego Date: 8/3/01

Navy Quality Assurance Officer: Narciso Ancog Date: 8/06/01

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ACRONYMS AND ABBREVIATIONS

A2LA	American Association for Laboratory Accreditation
ASTM	American Society for Testing and Materials
CDQM	Chemical data quality manual
CFR	Code of Federal Regulations
CLEAN II	Comprehensive Long-term Environmental Action Navy, Contract No. N62474-94-D-7609
CLP	Contract laboratory program
CPR	Cardiopulmonary resuscitation
CQI	Continuous quality improvement
CRQL	Contract-required quantitation limit
CTO	Contract task order
DHS	California Department of Health Services
DLC	Data life cycle
DNAPL	Dense nonaqueous phase liquid
DOT	U.S. Department of Transportation
DQA	Data Quality Assessment
DQO	Data quality objective
EDD	Electronic data deliverables
ELAP	Environmental Laboratory Accreditation Program
EPA	U.S. Environmental Protection Agency
EWI	Environmental work instruction
FS	Feasibility Study
FSP	Field sampling plan
GC	Gas chromatograph
GC/MS	Gas chromatography/mass spectroscopy
HCL	Hydrochloric acid
HSM	Health and safety manager
HSP	Health and safety plan
IC	Installation coordinator
IR	Installation restoration
IRP	Installation restoration program
LCS	Laboratory control sample
LIMS	Laboratory information management system
mg/L	Milligrams per liter
MDL	Method detection limit
MS	Matrix spike
MSD	Matrix spike duplicate

ACRONYMS AND ABBREVIATIONS
(Continued)

NAVSTA TI	Naval Station Treasure Island
NEDTS	Navy environmental data transfer standard
NFESC	Naval Facilities Engineering Service Center
OSHA	Occupational Safety and Health Administration
PARCC	Precision, accuracy, representativeness, completeness, and comparability
PE	Performance evaluation
PID	Photoionization detector
PPE	Personal protective equipment
ppm	Parts per million
PRG	Preliminary remediation goal
QA	Quality assurance
QAO	Quality assurance officer
QAPP	Quality assurance project plan
QC	Quality control
QCC	Quality control coordinator
QCSR	Quality control summary report
QMP	Quality management plan
RI	Remedial investigation
RPD	Relative percent difference
RPM	Remedial project manager
SDG	Sample delivery group
SOP	Standard operating procedures
SOW	Statement of work
SQL	Sample quantitation limit
SVOC	Semivolatile organic compound
SWDIV	Southwest Division, Naval Facilities Engineering Command
TCL	Target compound list
TI	Treasure Island
TIC	Tentatively identified compound
TtEMI	Tetra Tech EM Inc.
UV	Ultraviolet
VOC	Volatile organic compound
WP/CE	Work plan/cost estimate

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A1 INTRODUCTION

Tetra Tech EM Inc. (TtEMI) received Contract Task Order (CTO) No. 200 from the U.S. Department of the Navy, Naval Facilities Engineering Command, under Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62474-94-D-7609 (CLEAN II). The Navy originally issued CTO No. 200 for TtEMI to conduct a feasibility study (FS) report that included tasks to prepare a draft, draft final, and final FS report for onshore installation restoration (IR) sites 5, 9, 10, 11, 12, 21, 24, 28, and 29 at Naval Station Treasure Island (NAVSTA TI), San Francisco, California. These sites were investigated as part of the remedial investigation (RI) at NAVSTA TI (PRC 1997a).

TtEMI received a statement of work (SOW) dated August 14, 2000 for CTO No. 200, Modification 01 that reduced the scope of the CTO to include a draft, draft final, and final FS for IR Site 21 only. In November 2000, following discussion between the Navy and TtEMI, the Navy concluded that, prior to proceeding with the FS, additional investigation activities should be conducted at Site 21 to better define the contaminant source area and further characterize the magnitude and extent of volatile organic compound (VOC) contamination. Specifically, this investigation is designed to characterize soil contamination related to use of the former dip tank and to better define the extent of the groundwater contaminant plume.

This quality assurance project plan (QAPP) documents the data quality objectives, policies, project organization, and quality assurance and quality control (QA/QC) measures to be implemented for field activities at Site 21.

A1.1 DOCUMENT REQUIREMENTS AND FORMAT

This QAPP is based on Requirements for Quality Assurance Project Plans, EPA QA/R-5 (EPA 1999b). EPA QA/R-5 states that the requirements for QAPPs include (1) evaluating data quality objectives (DQO) for the project, (2) ensuring that intended measurements and data to be acquired are appropriate, (3) ensuring that QA/QC procedures are adequate for confirming the quality of data for the project, and (4) identifying limitations on the use of the data. Table A-1 provides a summary of the elements contained in this QAPP.

A1.2 USAGE OF THE DOCUMENT

Each element of the QAPP is discussed in this document as it pertains to the additional investigation at Site 21. The QAPP provides specific guidance and QA/QC criteria for collecting, evaluating, and submitting data while completing this project. All personnel working on the project are required to read and comply with the procedures defined in this document to ensure the quality and usability of the data collected.

A1.3 BACKGROUND

The background and history of Treasure Island (TI) and Site 21 are discussed in detail in Section 3.0 of the accompanying FSP (TtEMI 2001).

A1.4 DATA QUALITY OBJECTIVES

The data life cycle (DLC) process is being implemented to help ensure that the data collected are adequate to meet the objectives of this investigation. The three-step DLC process includes planning, implementation, and assessment. After the additional RI fieldwork is completed, the five-step data quality assessment (DQA) process (EPA 1996a) will be conducted to evaluate whether the data are of the right type, quantity, and quality to support the DQO.

DQOs are qualitative and quantitative goals developed to specify the quality of data needed to support specific decisions or regulatory actions for a particular data collection activity. The DQO process outlined by EPA guidance (EPA 1999a) includes the following seven steps to set the objectives for environmental investigations:

- Step 1 – State the Problem. Summarize the issues that require environmental data and identify resources available to resolve the problem.
- Step 2 – Identify the Decisions. Identify the decisions that require new environmental data to address the contamination problem.
- Step 3 – Identify Inputs to the Decisions. Identify the information needed to support the decisions and specify which inputs require new environmental measurements.
- Step 4 – Define the Study Boundaries. Specify the spatial and temporal aspects of the environmental media the data must represent to support the decisions.

- Step 5 – Develop Decision Rules. Develop logical "if . . . then" statements that define the conditions that would cause the decision-maker to choose among alternative actions.

- Step 6 – Specify Tolerable Limits on Decision Errors. Specify the decision-maker's acceptable limits on decision errors, which are used to establish performance goals for limiting uncertainty in the data.

- Step 7 – Optimize Sampling Design. Specify the sampling design, including locations and analysis, to meet the objectives of the RI.

The seven-step process for the IR Site 21 field activities is presented in the following subsections and is summarized in Table A-2.

A1.4.1 Step 1 - State the Problem

The results of the investigations conducted to date are not sufficient to determine the level of risk to human and ecological health presented by the potentially hazardous waste located within soil and groundwater at Site 21. Three main areas of uncertainty remain: (1) the nature and extent of soil contamination associated with the former dip tank, (2) the extent of VOC contamination in groundwater, and (3) the occurrence of natural VOC degradation in groundwater.

A1.4.2 Step 2 - Identify the Decisions

Following are the decisions associated with each problem:

<u>Nature and Extent of Soil Contamination Associated with the Former Dip Tank</u>

- Are the concentrations of soil contaminants at Site 21 attributable to releases associated with the former dip tank? Does Site 21 soil constitute a separate, significant risk to human and ecological health? Should soil at Site 21 be addressed through a removal action?

<u>Extent of Groundwater Contamination</u>

- Are the analytical results from the existing monitoring wells and monitoring wells installed during the additional investigation adequate to support the conclusion that little or no migration of contamination from the site to human or ecological receptors is occurring via groundwater, or does the variability in VOC concentrations in groundwater at the site indicate that groundwater sampling at additional locations is necessary?

Occurrence of Natural Attenuation

- Is natural attenuation of VOCs occurring within the soil/groundwater system at Site 21? If occurring, is the rate of natural attenuation sufficient to adequately mitigate VOC concentrations and prevent migration of contaminants to human or ecological receptors via groundwater?

A1.4.3 Step 3 - Identify Inputs to the Decision

The inputs to the decisions are from the following sources:

- Background information on historical operations at Site 21
- Data from previous investigations, including sampling and analysis, conducted at or near Site 21
- Data obtained from the soil and groundwater sampling and analysis outlined in the accompanying FSP
- Remediation goals and method detection limits for analytical methods

A1.4.4 Step 4 - Define the Study Boundaries

The spatial boundaries of the investigation cover the entire Site 21 area (see Figure 1 of the accompanying FSP). Initial sampling efforts will be focused in the area of the former dip tank, catch basins near the former dip tank, and areas directly downgradient of the dip tank. Soil sampling will be conducted within the upper ten feet but will not be collected below the water table. Groundwater sampling will be conducted from two depth intervals within the water table aquifer above the Young Bay Mud.

Temporal study boundaries include historic uses of the site dating back to the earliest Navy uses of Treasure Island, tidal influence on the site, seasonal groundwater elevation changes, and the degradation of VOCs over time. One round of subsurface soil sampling and four rounds of groundwater sampling are proposed. Any wells located within 100 feet of the shoreline will be sampled during low tide.

A1.4.5 Step 5 - Develop Decision Rules

The decision rule is an "if . . . then" statement that defines the conditions that will cause the decision-maker to choose among alternative actions.

For this QAPP, the decision rules are as follows:

Soil Contamination

- If the concentrations of soil contaminants at Site 21 are attributable to releases associated with the former dip tank and the soil constitutes a separate, significant risk (exceeding TI screening criteria) to human and ecological health, then soil at Site 21 will be addressed through a removal action; otherwise, no further action will be conducted.

Groundwater Contamination

- If the groundwater analytical results from the existing monitoring wells and monitoring wells installed during the additional investigation are adequate to support the conclusion that little or no migration of contamination via groundwater from the site to human or ecological receptors is occurring, then further investigation of groundwater contaminant concentrations and migration will not be necessary; otherwise, additional investigation or groundwater modeling may be necessary to complete the groundwater contaminant evaluation.

Natural Attenuation

- If VOC concentrations are shown to be decreasing through time at a favorable rate, then natural attenuation will be evaluated for effectiveness in degrading VOCs; otherwise, natural attenuation evaluation will be eliminated.

A1.4.6 Step 6 - Specify Tolerable Limits on Decision Errors

This step discusses the limits on decision errors for this investigation.

Background

The following two types of errors are associated with data collection and may lead to decision error:

- **Sampling error** occurs because it is impossible for a sampling effort to measure conditions at every point of a site or at every point in time. Sampling error occurs when the sample is not representative of the true state of the environment at a site.

- **Measurement error** occurs because of the random and systematic errors associated with sample collection, handling, preparation, analysis, data reduction, and data handling. These errors may lead to incorrect decisions or recommendations. In general, adopting a scientific approach that minimizes the potential for decision errors through the use of hypothesis testing controls decision errors. Measurement error is minimized by close adherence to sampling procedures and application of the QAPP (Appendix A).

EPA guidance (1994) suggests the following steps to identify and control decision errors:

- Define the possible range of the parameter of interest
- Define both types of decision error and the consequences of each
- Specify a range of parameter values for which the consequences of decision errors are relatively minor
- Check the limits on decision errors to ensure that they accurately reflect the decision-maker's concerns about the relative consequences for each type of decision error

Hypotheses and Types of Decision Errors

Decision errors are evaluated through hypothesis testing. The hypotheses are as follows:

Soil Contamination

Hypothesis 1: Activities related to the former dip tank have impacted the site soils with VOCs.
Hypothesis 2: Significant migration of VOCs has occurred in groundwater.
Hypothesis 3: Natural attenuation is occurring at a favorable rate.

The two types of decision error, false negative and false positive, are examined for each of the hypotheses.

- **A false negative decision error** occurs when the hypothesis is rejected although it is true. In the case of the soil in the vicinity of the dip tank, the hypothesis that there are elevated levels of VOCs resulting from the use of the dip tank would be rejected although it is true. The consequences of a false negative error would be that the potential source of soil contamination at Site 21 is not fully identified and ecological and human health risk may not be adequately addressed.

- **A false positive decision error** occurs when the hypothesis is not rejected although it is false. In the case of the soil in the vicinity of the dip tank, the hypothesis that there are elevated levels of VOCs resulting from the use of the dip tank would be accepted although it is false. The consequence of a false positive error would be that the soil around the former dip tank is considered as a potential source of contamination when in fact it is not. This decision may lead to an unnecessary removal action of the soil and unnecessary expenditure of cleanup funds.

Groundwater Contamination

- **A false negative decision error** occurs when the hypothesis is rejected although it is true. In the case of the groundwater contaminant migration at Site 21, the hypothesis that there is significant migration of VOCs via groundwater would be rejected although it is true. The consequences of a false negative error would be that the site may actually be a source of widespread contamination, potentially at levels posing significant risks to human or ecological health, and no further evaluation or cleanup would be pursued.

- **A false positive decision error** occurs when the hypothesis is not rejected although it is false. In the case of the groundwater contaminant migration at Site 21, the hypothesis that there is significant migration of VOCs via groundwater would be accepted although it is false. In this case, a false positive error would lead to additional but unnecessary investigations, studies, and possibly to remediation of incorrect or uncontaminated portions of the site.

Natural Attenuation

- **A false negative decision error** occurs when the hypothesis is rejected although it is true. In the case of the groundwater at Site 21, the hypothesis that natural attenuation of VOCs is occurring in groundwater would be rejected although it is true. In this case, a false negative error would lead to the decision that natural attenuation is not occurring. The consequences of a false negative error would be that additional but unnecessary investigations, studies, and possibly remedial action would be conducted.

- **A false positive decision error** occurs when the hypothesis is not rejected although it is false. In the case of the groundwater at Site 21, the hypothesis that natural attenuation of VOCs is occurring in groundwater would be accepted although it is false. The consequences of a false positive error would be that contaminant levels posing significant risks to human or ecological health may be left in place, and no further evaluation or cleanup would be pursued.

Range of Acceptable Error

The range of acceptable error for each decision and the factors affecting the range of error are discussed below.

Soil Contamination

- The horizontal distance separating the soil boreholes and vertical distance separating soil sample intervals governs the range of acceptable error in the investigation of this problem. Contamination of soil in a zone narrower than the distance separating boreholes (approximately 20 feet in source areas up to 100 feet in areas of lesser contamination) and soil sample intervals (approximately four feet within each soil borehole) is considered to fall within the range of acceptable error. Physical constraints of the site include the presence of Building 3. The foundation of the building may limit the amount of soil data collected beneath the building.

Possible error will be limited as the building is located in the assumed upgradient direction of the former dip tank.

Groundwater Contamination

- The horizontal distance separating monitoring wells governs the range of acceptable error in the investigation of this problem. Contamination of groundwater in a zone narrower than the distance separating downgradient monitoring wells (approximately 50 to 100 feet) is considered to fall within the range of acceptable error. The physical constraints of the site combined with data collected to date limit the extent of possible contamination and indicate a potential southeastward flow of groundwater towards the bay. The range of acceptable error for potentiometric gradients is determined by the attainable field measurement precision of ± 0.01 feet for water level measurement and ± 0.01 feet for top-of-casing-elevation measurement. EPA laboratory methods were chosen to provide acceptable data and method limitations are assumed to be within acceptable ranges of error.

Natural Attenuation

- Range of acceptable errors for natural attenuation parameters are similar to those of groundwater contamination for sample placement and laboratory reporting limits. Additionally, natural attenuation parameters are subject to errors resulting from the use of field monitoring equipment used to record parameters not being completed by a laboratory. Instrument detection limits and readings for natural attenuation parameters are assumed to be within the range of acceptable error.

A1.4.7 Step 7 - Optimize Sampling Design

The goal of this step is to identify a resource-effective design for generating environmental data that will satisfy the DQOs. The elements needed for effective design of the program are described below for each problem to be addressed by the FSP.

Soil Contamination

- To address the DQOs related to the soil contamination near the former dip tank, the following sampling scheme was designed: A total of 40 soil samples will be collected from 20 soil boreholes in the vicinity of the former dip tank. Initially, a minimum of six boreholes will be placed within ten feet of the former dip tank location in a radial pattern. Subsequent borehole sampling locations, if necessary, will be located based on visual observations and photoionization detector (PID) readings made at the initial borehole locations. Soil samples will be analyzed for VOCs only.

Groundwater Contamination

- To address DQOs related to groundwater contamination across the site, the following sampling scheme was designed: A total of 13 small-diameter (1-inch inside diameter) monitoring wells will be installed to supplement the existing monitoring wells. Well locations were selected to evaluate the horizontal and vertical extent of groundwater contamination. Eight of the

monitoring wells will be installed as "shallow" wells screened across the top of the water table and five of the wells will be installed as "intermediate" wells screened from 23 to 28 feet below ground surface. Groundwater contaminant samples will be analyzed for VOCs only. Groundwater samples will be collected from 13 new and 11 existing wells (24 total) for a period of four consecutive quarters to document seasonal changes in VOC concentrations.

Natural Attenuation

- To address DQOs related to the occurrence of natural attenuation across the site, the following sampling scheme was designed: 13 new small-diameter monitoring wells and 11 existing monitoring wells will be sampled for a period of four consecutive quarters to document natural attenuation parameters. Parameters to be monitored include: methane, ethane, and ethene, nitrate/nitrite, major anions, and alkalinity at an off-site laboratory and pH, temperature, conductivity, oxidation-reduction potential, dissolved oxygen, and iron and manganese in the field.

The design of the investigation described in this QAPP further relies on the following:

- Reporting field observations and collecting samples by qualified and trained field staff
- Use of reliable field tests and laboratory analytical methods
- Use of appropriate detection limits to control measurement error associated with selected field tests and laboratory analytical methods
- Review of test results for adherence to protocols

A2 PROJECT AND TASK ORGANIZATION

This section discusses management of the additional characterization at Site 21. A well-organized project team, combined with adequate experience and proper training, will promote consistent quality throughout the investigation. Sections A2.1 and A2.2 present the task organization for the project, including specific roles and responsibilities of project participants. Section A2.3 discusses training requirements for team members, and Section A2.4 lists the schedule for work to be conducted.

A2.1 PROJECT ORGANIZATION AND PERSONNEL

The following personnel have key roles related to the field efforts at Site 21.

Name	Role	Location	Telephone
Scott Anderson	Navy Remedial Project Manager	Naval Facilities Engineering Command, San Diego, CA	(619) 532-0938
Narciso A. Ancog	Navy QA Officer	Naval Facilities Engineering Command, San Diego, CA	(619) 532-2540
Greg Swanson	Program QA Manager	TtEMI, San Diego, CA	(312) 856-8722
Dave Donohue	Project Manager	TtEMI, Helena, MT	(406) 442-5588
Ron Ohta	Project QA Manager	TtEMI, Sacramento, CA	(916) 853-4506
Kevin Hoch	Project Chemist	TtEMI, San Francisco, CA	(415) 222-8304
Steve MacNeill	Field Team Leader	TtEMI, Helena, MT	(406) 442-5588
Dan Shaffer	On-site Safety Officer	TtEMI, Helena, MT	(406) 442-5588

A2.2 PROJECT TEAM RESPONSIBILITIES

The roles and key responsibilities of each project team member are described in the following subsections.

Navy Remedial Project Manager

The Navy remedial project manager (RPM) has overall responsibility for the Installation Restoration Program (IRP). The Navy RPM is directly responsible for project execution and coordination with base representatives, regulatory agencies, and the Southwest Division, Naval Facilities Engineering Command (SWDIV) management team.

The Navy RPM is responsible for the following:

- Providing site information and history
- Providing logistical assistance
- Specifying sites that require investigation
- Reviewing results and recommendations and providing management and technical oversight
- Verifying proper review and distribution of documents
- Communicating comments from technical reviewers to contractors

- Verifying that contractors address comments and take appropriate corrective actions
- Coordinating with regulatory agencies

Navy Quality Assurance Officer

The Navy Quality Assurance Officer (QAO) is responsible for QA issues for all Navy CLEAN II work. The Navy QAO provides government oversight of the QA program, including review and sign-off on QAPPs and FSPs. The QAO provides quality-related direction through the contracting officer's technical representative to the TtEMI QA Manager. The QAO has authority to suspend affected project or site activities if SWDIV-approved quality requirements are not adequately met.

TtEMI Project Manager

The project manager will work closely with the IC and Navy RPM. The project manager is responsible for overseeing project activities and coordinating with subcontractors. The project manager is ultimately responsible for timely completion of the field effort.

The responsibilities of the project manager are as follows:

- Verifying that QC requirements are fulfilled by team members
- Supervising the document quality control process
- Approving deliverables and associated documents before they are transmitted
- Establishing and maintaining communication among technical staff, program managers, QA officers, health and safety coordinators, and regulatory agencies
- Implementing programs and protocols related to the project
- Developing work plans that define the scope of major activities at the level of defensibility, documentation, and QC required for environmental measurements
- Developing specific QC procedures for major activities that produce or use environmental data
- Defining, reporting, and maintaining documentation of the precision, accuracy, representativeness, comparability, and completeness of data
- Working with program management, QC coordinators, and other CTO project managers to develop, revise, and implement mechanisms, as needed, to identify QA problems and expedite corrective actions

- Verifying that data processing procedures are documented, routinely reviewed, and revised
- Verifying that the CTO project team fulfills QC requirements of the work plan
- Maintaining and regularly reviewing QA records and forwarding copies to the QC coordinators and CLEAN II program QA manager
- Overseeing the technical review and QC check for deliverables and approving data, reports, specifications, drawings, and documentation before they are transmitted
- Establishing and maintaining communication among the CTO technical staff, the TtEMI QC coordinators, and CLEAN II program QA manager
- Preparing QAPPs for any CTO that involves field data collection, such as sample collection, including specifying acceptance criteria for the quality of data
- Verifying by personal observation that appropriate sampling, field testing, and field analysis procedures, as specified in the work plan and QAPP, are followed and that correct QC checks are made
- Working with QC coordinators to implement quality improvements identified during audit and review of ongoing work
- Implementing and following approved SOPs received from the TtEMI program manager
- Controlling the identification and handling of all documentation until it is turned over to designated document-control personnel

TtEMI Program QA Manager

The program QA manager is responsible for the quality of all work completed by TtEMI and its subcontractors under the Navy CLEAN II program. The program QA manager develops and maintains a comprehensive QA program and is responsible for audits, reviews of all work performed, and recommendations to technical staff and management regarding quality. The program QA manager has the following specific responsibilities:

- Developing and revising the TtEMI Navy CLEAN II QA program
- Assigning qualified personnel to serve as project QA managers
- Implementing and supervising the QA program with the assistance of QC coordinators and subcontractor project QA managers
- Coordinating and auditing the review of QC documentation and technical operations, as required

- Identifying nonconformance situations to the CLEAN II program manager and TtEMI corporate QA manager
- Providing guidance to CTO technical staff for QC program development and correcting nonconformance situations
- Preparing, revising, and providing SOPs to CTO project managers and technical staff
- Interacting with the Navy QAO about certification of laboratories and coordinating QA and technical staff compliance with requirements
- Ensuring compliance with orders and making recommendations to the CLEAN II program manager and CTO project managers regarding corrective action
- Approving the waiver of requirements for a written QC procedure when SOPs are specified by the Navy and are available for use
- Communicating regularly with the CLEAN II program manager and providing a summary of quality improvement opportunities to the CLEAN II program manager for further action
- Communicating regularly with and supervising QA responsibilities of QC coordinators and coordinating and compiling quality improvement opportunities identified by QC coordinators
- Updating the TtEMI corporate QA manager on newly identified, ongoing, and completed program-specific quality improvement opportunities
- Communicating TtEMI-identified quality improvement opportunities to subcontractor QA managers and assisting subcontractor QA managers in pursuing quality improvement opportunities that will benefit the overall program QA effort
- Meeting regularly with the program managers, project managers, and QA managers
- Reviewing and approving the QAPP
- Conducting field audits to ensure that sampling is performed in accordance with the QAPP

The program QA manager reports, as necessary, to the corporate QA manager and consults frequently with the program manager and the project QA manager. The program QA manager refers QA issues or disputes that cannot be resolved within the Navy CLEAN II program to the TtEMI corporate QA manager.

TtEMI Project QA Manager

A senior technical staff member will serve as project QA manager and will be responsible for review of work completed by TtEMI. The manager will provide recommendations about quality to the project

manager and technical staff. The project QA manager will also regularly communicate with the CLEAN II program QA manager to discuss QA problems and resolutions. Specific responsibilities of the project QA manager are:

- Meeting regularly with the CLEAN II program QA manager
- Reviewing all deliverables before they are released to ensure conformance with QA/QC procedures and the quality of the work product
- Providing recommendations to the program QA manager, as required, for corrective action regarding all aspects of work that do not meet program standards
- Providing guidance to project teams for QC program development and for correcting nonconformance situations
- Coordinating QC and technical staff compliance with specific QC requirements
- Ensuring compliance with orders and making recommendations to CTO project managers regarding corrective action
- Identifying quality improvement opportunities as part of the audit and review function
- Communicating quality improvement opportunities to the program QA manager or CTO project managers as appropriate
- Ensuring that the QAPP is prepared in accordance with EPA guidance documents
- Ensuring that all protocols described in the QAPP are met
- Providing guidance or assistance in resolving problems on QA/QC topics
- Verifying that the specified data collection methods comply with QA/QC requirements and will yield data of the desired quality and integrity
- Reviewing, evaluating, and approving quality-related changes to the FSP and project work plan
- Ensuring that all nonconformance's are identified and appropriate corrective actions are taken, providing assistance to the project managers with regard to corrective action, and, if necessary, soliciting involvement by the program manager and program QA manager
- Conducting laboratory evaluations and audits to ensure that analyses are performed in accordance with the QAPP
- Communicating regularly with the project manager, program QA manager, and project chemist to ensure the progress of QA tasks for the project
- Serving as the main contact for project QA matters and providing guidance on appropriate procedures to the project managers and support personnel

TtEMI Technical Staff

TtEMI technical staff will be responsible to the CTO project manager and project QA manager for completing project activities in compliance with approved SOPs, the QAPP, and other program and project QC guidelines and requirements. The technical staff has the following specific responsibilities:

- Collecting and generating field and laboratory data by carrying out activities consistent with the TtEMI quality management plan (QMP)
- Generating control and calibration data so that the quality and usability of field and laboratory data can be evaluated
- Documenting sample control and data management procedures
- Documenting the sources of all information acquired, including manual and computer calculations, engineering drawings, and equipment specifications

TtEMI On-Site Safety Officer

The on-site safety officer is responsible for field implementation of the HSP and has the authority to correct and change site control measures and the required health and safety protection. The on-site safety officer has primary on-site enforcement authority, as delegated by the project manager, for the policies and provisions of the health and safety program and the HSP. Responsibilities of the on-site safety officer are as follows:

- Serving as the initial contact for site-specific health and safety activities
- Conducting briefing sessions for and providing documentation to TtEMI and subcontractor personnel concerning site-specific hazards, emergency procedures, and symptoms associated with exposure to specific site contaminants
- Documenting health and safety briefings, meetings, and training that were completed in the field
- Selecting the required personal level of protection based on guidance in the facility-wide HSP and based on actual on-site operations
- Establishing, enforcing, and documenting decontamination operations for personnel and sampling equipment, sample containers, and heavy equipment
- Suspending any operation that threatens the health or safety of team members or the surrounding population and immediately notifying the project manager

- Determining and posting locations and routes to medical facilities, arranging for emergency transportation to medical facilities, and posting emergency service telephone numbers
- Assuming the lead role for TtEMI during a medical emergency
- Along with other TtEMI field personnel, providing on-site cardiopulmonary resuscitation (CPR) and first aid, as necessary

TtEMI Project Chemist

The TtEMI project chemist works with the task manager during preparation of the FSP and QAPP. These tasks include coordinating the analytical tests consistent with the type and quality of analytical data required for the project, setting up the contract analytical laboratories, coordinating validation of analytical results, and providing the procurement office with the information required to procure any special analysis. The responsibilities of the project chemist are:

- Verifying that the laboratory implements the requirements of the FSP and QAPP
- Coordinating with the contract laboratory on pickup and delivery schedules and QA/QC matters
- Conducting laboratory evaluations and audits
- Reviewing laboratory data prior to release
- Coordinating data validation activities
- Providing updates on the project to project QA officers and managers with regard to the QA/QC data

TtEMI Field Team Leader

The field team leader is responsible for field activities. The field team leader will direct all on-site activities, including those of subcontractors, and will ensure that the field team adheres to procedures described in the FSP.

A2.3 SPECIAL TRAINING AND CERTIFICATION

Personnel who work at a hazardous-waste project site are required to meet the health and safety training requirements of Title 29 Code of Federal Regulations (29 CFR) Part 1910.120(e), as described in the

following sections. Depending on individual responsibilities in the field and the complexity of a project, on-site personnel may be required to meet special training requirements defined in the FSP for the CTO. The following sections describe the training requirements for TtEMI personnel and subcontractors at TI.

A2.3.1 Personnel Health and Safety Training

TtEMI personnel working on hazardous-waste project sites who are responsible for the project or site activities are required to undergo specific training before participating in, managing, or supervising field activities. This training must thoroughly cover the following areas:

- Names of personnel and alternates responsible for health and safety at a hazardous-waste project site
- Health, safety, and hazards present on site
- Selection of the appropriate personal levels of protection
- Correct use of personal protective equipment (PPE)
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment on site
- Medical surveillance requirements, including recognition of symptoms and signs that might indicate overexposure to hazardous substances
- Contents of the basewide HSP

TtEMI personnel engaged in activities that may expose workers to hazardous substances and health hazards will receive a minimum of 40 hours of formal instruction off site and at least three days of actual field experience on site under the supervision of a trained, experienced field supervisor.

Field personnel directly responsible for, or who supervise employees engaged in, hazardous-waste operations also will also receive the 40 hours of initial training, three days of supervised on-site field experience under a trained supervisor, and at least eight additional hours of specialized supervisor training. The specialized training will include the requirements of the CLEAN II health and safety program, the PPE and personal level of protection programs, the spill containment program, and health-hazard monitoring procedures and techniques. TtEMI's on-site safety officer will receive an additional

eight hours of supervisor training. The on-site safety officer will also receive additional health and safety training, including training in operating monitoring instrumentation.

Written certificates will be presented to all employees who successfully complete this training. TtEMI employees engaged in work at hazardous-waste sites are required to undergo eight hours of annual refresher training to maintain certification.

The TtEMI field team leader, who is the on-site manager with authority delegated by the project manager to direct field operations, will be fully trained in hazardous-waste field operations and will ensure that all necessary preparation and coordination are complete before on-site work begins. This preparation generally consists of drafting project documents, such as the work plan, FSP, QAPP, and requests for bids, and assisting in preparation of the site-specific HSP under the guidance of the project manager. In some instances, a field team leader trains for this position by working on site as a team member before replacing the original field team leader.

At least one member of every TtEMI field team will maintain current certification in the American Red Cross "Multimedia First Aid" and "Cardiopulmonary Resuscitation Modular," or equivalent. The program HSM ensures that appropriate field personnel maintain current certification in both first aid and CPR.

Copies of TtEMI's health and safety training records, including course completion certifications for the initial health and safety training, first aid, CPR, and refresher training, will be maintained in project files. The program HSM implements the training requirements by notifying employees when they are due for recertification, disseminating information about appropriate courses, conducting or assisting in refresher training, and related tasks.

A2.3.2 Subcontractor Training

Subcontractors that work on site will certify that their employees have been trained for work on hazardous-waste project sites. The training will meet the Occupational Safety and Health Administration (OSHA) requirements at 29 CFR Part 1910.120(e). Before they begin work at the project site, subcontractors will submit to the program HSM certification of training for each employee who will be involved in fieldwork. Subcontractors also will ensure that these employees attend a pre-entry safety briefing.

The pre-entry safety briefing is designed to inform subcontractor employees of the potential risks of working with hazardous materials, site-specific hazards, the required level of personal protection, and the correct use of PPE. This safety briefing is conducted by the on-site safety officer or other qualified person designated by the program HSM. Employees of associate and professional services firms and technical service subcontractors will attend a safety briefing before they conduct on-site work. Construction service subcontractors are responsible for conducting their own safety briefings. TtEMI personnel may audit these briefings.

Job hazards for most environmental investigation field tasks are described in the basewide HSP (PRC 1997b). Section 4.0 of the basewide HSP discusses hazard identification and analysis and describes physical, industrial, chemical, radiation, and biological hazards.

A2.4 PROJECT SCHEDULE

The implementation schedules for sampling, analysis, and associated reporting are presented in Section 8.0 of the accompanying FSP.

A3 SITE BACKGROUND AND PROBLEM DEFINITION

VOCs have been detected in soil and groundwater during previous investigations at Site 21. The purpose of this study is to identify the source of VOCs in groundwater at Site 21, evaluate natural attenuation parameters, and to assess whether a removal action is needed to address contaminated soil near the former dip tank. Further information on the history and previous investigations at Site 21 are presented in the accompanying FSP.

A4 PROJECT AND TASK DESCRIPTION

The following paragraphs summarize the objectives of and the tasks necessary to complete the additional investigation at Site 21. The primary objectives, types of data to be collected, data quality standards and criteria, and project documentation are discussed in the following sections. The DQO steps are presented in Section A1.4. A summary of the DQO steps is provided in Appendix A.

A4.1 PROJECT OBJECTIVES

The primary objectives of this investigation are to evaluate the extent of soil contamination associated with the former dip tank and assess whether a removal action is necessary for the soil, evaluate the extent of groundwater VOC contamination, and to evaluate the occurrence or absence of natural attenuation of the VOCs in soil and groundwater.

A4.2 PROJECT MEASUREMENTS

Analytical methods were selected to provide data of the necessary quality to meet the DQOs for this project and to maintain consistency and comparability of the current data with data collected previously.

A4.3 PROJECT QUALITY STANDARDS AND CRITERIA

To promote quality of, and consistency in, data acquisition and evaluation during this project, all project activities will be completed in accordance with the QAPP and the accompanying FSP. This document describes the technical and quality objectives for the project, the intended data collection methods that are appropriate for achieving project objectives, the assessment procedures adequate for confirming that data of the type and quality needed and expected are obtained, and any identified limitations on the use of these data.

Analytical data generated during this project will undergo validation and verification to ensure defensible and acceptable quality. Data validation and usability are further discussed in Section D1. An independent third-party contractor will validate data. At a minimum, ten percent of the analytical data will be randomly selected and fully validated. All remaining analytical data will undergo cursory validation.

The assessment tools needed to verify that data quality is maintained throughout the study include QC reviews on project documents such as technical, editorial, and QCC reviews; performance and system audits; and laboratory QA/QC procedures. Project audits are further described in Section C1.1. Laboratory QA/QC procedures are addressed in Section B6.

A4.4 PROJECT DOCUMENTATION

Field documentation and records maintenance are described fully in the following sections. Additional information on sample and location nomenclature is provided in the accompanying FSP. Sample documentation, such as sample labels, chain-of-custody procedures, and packaging and shipping, are discussed in Section B4.

Field Forms

The following field forms will be maintained as appropriate for this investigation at Site 21:

- Chain-of-custody form
- Daily quality control report

These forms are presented in Appendix B of this QAPP and will be used as source documents in support of the database for Treasure Island.

The following general guidelines for maintaining field documentation will be used:

- Documentation will be completed in permanent black ink.
- All entries will be legible.
- Errors will be corrected by crossing out with a single line by dating and initialing the lineout.

Field Logbooks

Field personnel will use permanently bound logbooks with sequentially numbered pages to maintain records. The front cover of the logbook will list the contract name and number, the CTO number, names of subcontractors, the client, and the name of the project manager. At a minimum, the following information will be recorded in the field logbook:

- Name and affiliation of all personnel or visitors on site
- Log and summary of daily activities and significant events
- Notes of conversations with coordinating officials

- Documentation of sampling activities
- Decontamination episodes
- References to other field logbooks or forms that contain specific information
- Discussion of problems encountered and their resolution
- Discussion of deviations from the FSP, QAPP, or other governing documents
- Description of all photographs taken

A5 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

Specific quality objectives and criteria for measurement data as they apply to this project are discussed in the following sections.

A5.1 PROJECT SCOPE AND ENVIRONMENTAL MEDIA

As noted in the FSP, samples will be analyzed for the following analytes: VOCs in soil samples and VOCs and natural attenuation parameters in groundwater samples.

A5.2 INTENDED DATA USERS AND USES

Data users include stakeholders, such as the regulatory agencies, the Navy, subcontractors to the Navy, and the public. Definitive data, as outlined in Section A5.3, will be required to allow for comparison to screening criteria.

A5.3 DATA TYPE AND QUANTITY

The data obtained from laboratory analysis can best be categorized as definitive. Definitive data are described in detail in the following subsection in order to establish that the data collected during this investigation will be of sufficient quality and quantity to meet the stated DQOs.

A5.3.1 Definitive Data

Definitive data will be generated off site. The subcontract laboratory will use EPA-approved methodologies for which it has been certified by the California Department of Health Services (DHS) through the Environmental Laboratory Accreditation Program (ELAP) and approved by the Navy. Definitive data will be obtained from the analysis of soil and groundwater samples. QA/QC elements required for definitive data are as follows:

- Sample documentation (location, date and time collected, and batch)
- Chain-of-custody forms
- Sampling design
- Initial and continuing calibration
- Determination and documentation of detection limits
- Analyte identification
- Analyte qualification
- QC blanks (trip, method, and rinsate)
- Matrix spike recoveries
- Performance evaluation (PE) samples
- Matrix duplicate or determination of analytical error
- Field duplicates or determination of total measurement error

QC samples are collected in addition to field samples and are used in conjunction with laboratory QC samples to evaluate the quality of the data produced from the field-sampling program. QC samples serve DQOs by meeting the established acceptance criteria specified in this QAPP for each analytical method. Results for QC samples that do not meet the criteria may indicate unacceptable data and may cause the laboratory to implement corrective action procedures or to qualify the data. The specific requirements for laboratory QC are provided in Section B6 of this QAPP.

A5.3.2 Screening Level Data

Screening level data will be collected on site. Portable analyzers will be used as a screening tool to aid in sample collection, selecting the proper level of PPE, and for monitoring air emissions during sampling activities. Data collected using portable analyzers will be recorded in the field logbook. A discussion of specific portable analyzers for this project is presented in Section B5.2.

A5.4 ACCEPTABLE LEVEL OF CONFIDENCE IN THE DATA

Determining acceptable limits on decision errors (DQO Step 6) will limit the uncertainty in the data set obtained from this project. Step 6 of the DQO process quantifies the acceptable limits on decision errors. These limits are needed to define the uncertainty that will be acceptable to all stakeholders (such as regulatory agencies, citizens, and site owners).

The quality of the analytical data will be assessed in terms of precision, accuracy, representativeness, completeness, and comparability (PARCC), as detailed in Section A5.5 of this QAPP. Additionally, professional judgment will be used to assess the practical versus statistical significance of the data collected. Decision errors based on sample design and data interpretation will be minimized through multiple internal and external reviews of project data and conclusions. Validation and verification of data generated during field activities are essential to obtaining data of defensible and acceptable quality. Verification methods for field and laboratory activities are presented in Section D1. Results of the data validation will play a major role in accepting or rejecting data.

A5.5 SPECIFYING PERFORMANCE CRITERIA: PARCC PARAMETERS

All analytical results will be assessed according to the PARCC parameters described in the following sections.

A5.5.1 Precision

Precision is the degree of mutual agreement between individual measurements of the same property under prescribed similar conditions. The precision of data is affected by precision in field sampling precision and in the laboratory analysis. It is evaluated by collecting and analyzing field duplicates at a

frequency of ten percent. Laboratory analytical precision is evaluated by analyzing matrix spike/matrix spike duplicates (MS/MSD) at a rate of five percent of the total number of samples collected. The results of the duplicate analysis are used to calculate the relative percent difference (RPD) used for evaluating precision.

The RPD is calculated using the following formula:

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

Where A = First duplicate concentration
B = Second duplicate concentration

Four factors may impair the precision of duplicate data: matrix interference, laboratory imprecision, sample heterogeneity, and the nature of the RPD calculation. Constituents present in the field sample may interfere with accurate quantification of the target analytes. Laboratory imprecision is a result of inconsistency in preparing and analyzing the samples. Heterogeneity in soil samples is inherent because of the varied composition of natural materials and the subsequent difficulty in collecting a homogenous sample. In cases where the duplicate samples contain extremely high or low concentrations of the target analyte, the RPD calculation may indicate high variances that do not reflect analytical precision. The data will be qualified as estimated in cases where the results for laboratory duplicates do not meet acceptance criteria and where matrix interference or laboratory imprecision is determined to be the cause.

A5.5.2 Accuracy

Accuracy is the degree of agreement between an analytical measurement and a reference accepted as a true value. The accuracy of a measurement system is affected by errors introduced through the sampling process by field contamination, sample preservation, and sample handling. Other factors that may affect accuracy are sample matrix, sample preparation, and analytical techniques. Sampling accuracy will be evaluated based on the results of the analysis of field blanks, trip blanks, and source-water blanks. The analytical laboratory will conduct a program of sample spiking to evaluate laboratory accuracy. This program includes analysis of the MS/MSD samples, laboratory control spikes (LCS) or blank spikes, surrogate standards, internal standards, and method blanks. MS and MSD samples are prepared and analyzed at a frequency of five percent, LCS or blank spikes are analyzed at a frequency of five percent, and surrogate standards and internal standards, where applicable, are added to every sample analyzed. The results of the spiked samples are used to calculate the percent recovery for evaluating accuracy.

Percent recovery is calculated using the following formula:

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

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

Results that fall outside of the acceptance range will be further evaluated.

A5.5.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent the characteristics of a population, parameter variations at a sampling point, or an environmental condition that they are intended to represent. Representativeness of data will be ensured using established field and laboratory procedures and their consistent application. To aid in the evaluation of the representativeness of the sample, field and laboratory blank samples and background samples will be evaluated for the presence of contaminants. Data deemed nonrepresentative, by comparison with the existing data, would be used only if accompanied by appropriate qualifiers and limits of uncertainty.

A5.5.4 Completeness

Completeness is a measure of the percentage of project-specific data that are useable and valid. Valid data are obtained when samples are collected and analyzed in accordance with QC procedures outlined in this QAPP, and when none of the QC criteria that affect data usability are exceeded. Other factors not related to the validity of the data can affect completeness, such as lost samples or broken sample containers. The project completeness value will be calculated when sampling is completely finished and all data are validated. Completeness will be calculated by dividing the number of useable sample results by the total number of planned sample results for this source removal. The completeness goal for this project is a 90 percent.

A5.5.5 Comparability

The comparability objective determines whether analytical conditions are sufficiently uniform for each analytical run to ensure that all of the reported data will be consistent. Comparability is ensured using similar analytical methods from one investigation to the next. Analytical techniques that will be used for this field investigation are comparable to techniques used by previous investigations at Treasure Island.

A5.6 DETECTION AND QUANTITATION LIMITS

The instrument detection limit is the minimum concentration of an analyte that can be distinguished from the normal electronic noise of an analytical instrument. The quantitation limit represents the lowest concentration at which an analyte can be accurately and reproducibly quantified. Contract-required quantitation limits (CRQL) are the minimums that are contractually required for analyses.
Samples analyzed for organic compounds will be reported as estimated values if concentrations are less than the CRQLs but greater than the method detection limit (MDL).

A6 DOCUMENTATION AND RECORDS

Documentation is critical for evaluating the success of any activity. The following sections discuss the requirements of laboratories for preparing definitive data packages. The electronic data delivered to the Navy at the conclusion of each sampling event will be in a format compatible with the Navy environmental data transfer standard (NEDTS).

A6.1 SUMMARY DATA PACKAGE

The contract laboratory program (CLP)-type summary data packages will be required for all analyses and will contain sample results (Form I) and all QA/QC summary forms (Forms II through X for organic compounds and Forms II through XIV for inorganic compounds) for all associated samples in one sample delivery group (SDG). Form I will include all sample results, corrected for dilution, as appropriate. If the client sample identification has been truncated because of software limitations, the complete sample identification will appear on Form I, either in the comments section or hand-printed after the truncated identification.

An SDG is a group of 20 or fewer samples for the same project received within a period of 14 days or less. An SDG is mainly a reporting format and is not limited to sample receipt groups or preparation or analytical batches. The SDG name will be a unique number that is not an actual or a part of an actual sample identification. Data for all samples in the SDG will be submitted concurrently. Partial submittals are unacceptable. The subcontractor will provide TtEMI with two copies of the summary data package within 35 days after receiving the last sample in the SDG. This package will be part of the standard analytical service.

The laboratory will prepare summary data packages in accordance with instructions provided in Section II.D, Exhibit B, in the CLP statement of work (SOW) for organics (EPA 1999c). For ease of use, summary data packages should not be bound and should be separated by analysis. The summary data package will consist of a case narrative, copies of all associated chain-of-custody forms, sample results, and QA/QC summaries. The case narrative will include the following information:

- Subcontractor name, project name, CTO (project) number, project order number, SDG number, and a table that cross-references client and laboratory sample identifications
- Detailed documentation of all sample shipping and receiving, preparation, analytical, and quality deficiencies, including analyses performed without an American Association for Laboratory Accreditation (A2LA) certified standard
- Thorough explanation of all instances of manual integration
- Copies of all associated nonconformance and corrective-action forms that will describe the nature of the deficiency and the corrective action taken
- Copies of all associated sample receipt notices

Organic Analysis

The following outline describes the format of the summary data package for organic analysis:

Section I - **Case Narrative**

1. Case narrative
2. Copies of nonconformance and corrective-action forms
3. Chain-of-custody forms
4. Copies of sample receipt notices
5. Internal tracking documents, as applicable

Section II - **Sample Results** - Form I for the following:

1. Environmental samples, including dilutions and reanalysis
2. Tentatively identified compounds (TIC) (VOC analyses only)

Section III - **QA/QC Summaries** - Forms II through VIII for the following:

1. System-monitoring compound and surrogate recoveries (Form II)
2. MS and MSD recoveries and RPDs (Forms I and III)
3. Blank spike or LCS recoveries (Forms I and III-Z)
4. Method blanks (Forms I and IV)
5. Performance check (Form V)
6. Initial calibrations with retention-time information (Form VI)
7. Continuing calibrations with retention-time information (Form VII)
8. Quantitation limit standard (Form VII-Z)
9. Internal standard areas and retention times (Form VIII)
10. Analytical sequence (Forms VIII-D and VIII-Z)
11. Gel permeation chromatography (GPC) calibration (Form IX)
12. Single component analyte identification (Form X)
13. Multicomponent analyte identification (Form X-Z)
14. Matrix-specific MDL (Form XI-Z)

A6.2 FULL DATA PACKAGE (CLP-TYPE)

Full data packages will contain all of the information from the summary data package and all associated raw data for samples in one SDG. The subcontractor will provide the full data package to TtEMI within 35 days after receiving the last sample in the SDG. Unless otherwise requested, the subcontractor will deliver one copy of the full data package; no more than two copies will be requested. For ease of use, the full data packages should be separated by analysis and should not be bound. The full data package will consist of a case narrative, copies of all associated chain-of-custody records, sample results, QA/QC summaries, and all associated raw data.

Organic Analysis

The following outline describes the format of the full data package for organic analysis:

Sections I, II, and III - **Summary Package**

Section IV - **Sample Raw Data** - indicated form, plus all associated raw data

1. Analytical results, including dilutions and reanalysis (Forms I and X)
2. TICs (Form I —semivolatile organic compounds [SVOC] and VOC only)

Section V - **QC Raw Data** - indicated form, plus all associated raw data

1. Method blanks (Form I)
2. MS and MSD samples (Form I)
3. Blank spikes or LCSs (Form I)

Section VI - **Standard Raw Data** - indicated form, plus all associated raw data

1. Performance check (Form V)
2. Initial calibrations, with retention-time information (Form VI)
3. Continuing calibrations, with retention-time information (Form VII)
4. Quantitation-limit standard (Form VII-Z)
5. GPC calibration (Form IX)

Section VII - **Other Raw Data**

1. Percent moisture for soil samples
2. Sample extraction and cleanup logs
3. Instrument analysis log for each instrument used (form VIII-Z)
4. Standard preparation logs, including initial and final concentrations for each standard used
5. Formula and a sample calculation for the initial calibration
6. Formula and a sample calculation for water and soil sample results

A6.3 DATA PACKAGE FORMAT

Electronic data deliverables (EDD) are required for all analytical results produced for Treasure Island. An automated laboratory information management system (LIMS) must be used to produce the EDD. Manual creation of the deliverable (data entry by hand) is unacceptable. The laboratory will verify EDDs internally before they are issued. The EDD will correspond exactly to the hardcopy data. No duplicate data will be submitted.

Results that should be included in all EDDs are as follows:

- Target analyte results for each sample and associated analytical methods requested on the chain-of-custody form
- TIC results reported for VOC analyses
- Method and instrument blanks and preparation and calibration blank results reported for the SDG
- Percent recoveries for the spike compounds in the MS, MSDs, blank spikes, or LCSs
- Matrix duplicate results reported for the SDG form

- All re-analyses, re-extractions, or dilutions reported for the SDG, including those associated with samples and the specified laboratory QC samples.

Data Storage and Disposal

Electronic and hardcopy data must be retained for a minimum of three and ten years, respectively, after final data have been submitted. The subcontractor will use a magnetic tape storage or other similar device that is capable of recording data for long-term, off-line storage. Raw data will also be retained on magnetic tape or other similar storage device. Communication with the laboratory will be initiated to ensure that suitable long-term data storage capabilities are available.

A6.4 DATA ARCHIVING AND RETRIEVAL

Field and analytical data collected for this project and other environmental investigations are critical to all site characterization efforts, development of the comprehensive conceptual model, risk assessments, and selection of remedial actions to protect human health and the environment. An information management system is needed to ensure efficient access to these data so that the goals of real-time and on-site decision-making can be achieved. Data collected during this investigation will be loaded into TtEMI's relational database.

A6.4.1 Data Management Scheme

To satisfy long-term data management goals, the data will be loaded into the database system at TtEMI for storage, further manipulation, and retrieval after review and validation of off-site laboratory and field reports. The database will be used to provide data for chemical and geologic analysis and for preparing reports and graphic representations of the data. Additional data acquired during field activities will be recorded on field forms. These forms are reviewed for completeness and accuracy by the project chemist or geologist. All field forms and related chain-of-custody forms are recorded in the database. Hard copies of field forms, data, and chain-of-custody records are filed in a secure storage area, according to project and document control numbers. Laboratory data packages and reports will be archived at TtEMI. The remaining data will be archived at the off-site laboratory for a minimum of ten years.

A6.4.2 Data Management Strategy

Short- and mid-term strategies for data management require that the Treasure Island data set be updated monthly and that EDDs should be compatible with the NEDTS as per SWDIV Environmental Work Instruction (EWI) #6 (SWDIV 1999a). The data set consists of chemical and field data from Navy contractors. Previous data for Treasure Island have been loaded into an Oracle database, which can generate reports using available computer-aided drafting and design and contouring software.

B1 MEASUREMENT AND DATA ACQUISITION

The following sections describe requirements for:

- Sampling design (Section B2)
- Sampling methods (Section B3)
- Sample collection, handling, and analysis (Sections B4, B5)
- QC samples and procedures (Section B6)
- Instrument and equipment testing, inspection, and maintenance (Section B7)
- Inspection and acceptance of supplies and consumables (Section B8)
- Nondirect measures (Section B9)

These sections provide adequate detail to evaluate whether the methods used for this project have been verified and documented.

B2 SAMPLING DESIGN (EXPERIMENTAL DESIGN)

The accompanying FSP describes the sampling design for the additional investigation. Methods that will be used to analyze samples are presented in Section B5. Sampling and analysis will be conducted in accordance with this document, the approved FSP, and the health and safety plan.

B3 SAMPLING METHODS

This discussion describes the procedures for collecting samples and includes:

- Identification of all sampling methods to be used
- Implementation requirements
- Decontamination procedures
- Materials required

B3.1 SAMPLE COLLECTION AND DECONTAMINATION

The following subsections describe procedures for sample collection, as well as decontamination and disposal of investigation-derived waste.

B3.1.1 Sample Collection Procedures

Standard procedures are to be followed for sampling and data collection at Treasure Island. The field team leader will define and use the specific sampling procedures presented in the accompanying FSP after approval by the project QA officer. TtEMI standard operating procedures for fieldwork, as amended in this QAPP or the FSP, will be used to collect the samples. Samples will be collected using the methods described in Section 4.0 of the accompanying FSP.

B3.1.2 Decontamination and Disposal Procedures

Equipment decontamination and waste disposal procedures are discussed in Sections 4.4 and 4.6 of the accompanying FSP.

B3.2 SAMPLE CONTAINERS AND HOLDING TIMES

The analytical methods, type of sample containers to be used for each analysis, sample volumes required, and maximum holding times for analysis are presented in Table B-1

B4 SAMPLE HANDLING, CUSTODY, AND SHIPPING PROCEDURES

Documentation and records, including field forms and field logbooks, are discussed in Section A4.4 of this QAPP. The sample handling and custody requirements are discussed in the following sections. The sections describe sample custody documentation and handling procedures to be followed while in the field, while transporting the samples to the laboratory, and at the laboratory.

B4.1 SAMPLE CUSTODY PROCEDURES

Documentation during sampling activities is essential to ensure proper sample identification. Standard sample custody procedures will be used to maintain and document the integrity of samples during collection, transportation, storage, and analysis. Sample custody documents must be written in indelible black ink. The documents will be corrected by drawing one line through the incorrect entry, entering the correct information, and initialing and dating the correction. A sample is considered to be in custody if one of the following statements applies:

- It is in a person's physical possession or view.
- It is in a secure area with restricted access.
- It is placed in a container and secured with an official custody seal such that the sample cannot be reached without breaking the seal.

Samples and documentation must be maintained in the custody of authorized personnel or under documented control in a secure area. The field team leaders are responsible for proper sample handling and documentation, so that the possession and handling of individual samples can be traced from the time of collection to laboratory receipt. The laboratory's QA manager is responsible for establishing a control system that will allow sample possession to be traced from laboratory receipt to final disposition.

B4.1.1 Sample Labels

A sample label will be affixed to all sample containers sent to the laboratory. This identification label will be completed with the following information written in indelible ink:

- Project name site number
- Sample identification number
- Date and time of sample collection
- Preservative used (if applicable)
- Sample collector's initials
- Filtering (if applicable)
- Analysis required

If a sample is split with another party, sample labels with identical information will be attached to each sample container. After labeling, each sample will be refrigerated or placed in a cooler that contains ice to maintain the sample temperature at 4°C (+/- 2°C).

B4.1.2 Custody Seals

Custody seals will be used on each sample transport container to ensure that no tampering occurs. Custody seals used during the project will consist of security tape with the date and initials of the sampler or field team leader. Sample transport containers will be sealed in this manner immediately after the samples are packaged. The tape will be placed such that the seal must be broken to gain access to the contents of the transport container.

B4.1.3 Chain-of-Custody Records

Chain-of-custody procedures provide an accurate written record that traces the possession of individual samples from the time of collection in the field until they are accepted at the laboratory. The chain-of-custody record will also be used as documentation of the samples collected and the analysis requested. Appendix B to this QAPP provides an example of a chain-of-custody record used by TtEMI. Laboratory-specific chain-of-custody records may also be used, depending on the site investigation. Information field personnel will record on the chain-of-custody record includes:

- Project name and number
- Name and signature of sampler
- Destination of samples (laboratory name)
- Sample identification number
- Sample location, description, and depth when applicable
- Date and time of collection
- Number and type of containers filled
- Analysis requested
- Preservatives used
- Pressure of stainless steel canisters

- Filtering (if applicable)
- Signatures of individuals involved in custody transfer (including date and time of transfer)
- Laboratory purchase order number
- Airbill number (if applicable)
- Relevant remarks related to sample analysis (such as samples selected for MS/MSD analysis)

Unused lines on the chain-of-custody record will be crossed out and initialed. Chain-of-custody records initiated in the field will be signed by the field personnel, the airbill number will be recorded, and the record will be placed in a plastic bag and taped to the inside of the lid of the shipping container used to transport the samples. Copies of the chain-of-custody record and the airbill will be retained and filed by field personnel before the containers are shipped. A copy of the chain-of-custody record will be delivered to the sample tracking coordinator as soon as possible after sampling. Multiple coolers may be sent in one shipment to the laboratory. Each cooler will contain a separate chain-of-custody record of the samples. The outside of the coolers will be marked to indicate the number of coolers in the shipment.

B4.1.4 Shipping Procedures

Samples collected during the field effort must be identified as environmental samples. Environmental samples are defined as samples of soil, groundwater, or other matrices that are not saturated or mixed with product material. U.S. Department of Transportation (DOT) regulations will be followed during sample packaging and shipment. The following procedures meet these requirements and are explained in EPA guidance on field-operations methods (EPA 1987):

- The cooler will be filled with sample bottles and packing material. Adequate packing material will be used to prevent sample containers from making contact during shipment. Wet ice will be added to maintain the sample temperature at 4 °C during shipment.
- The chain-of-custody records will be placed inside a plastic bag. The bag will be sealed and taped to the inside of the cooler lid. The Federal Express air bill, if required, will be filled out before the samples are handed over to the carrier. The laboratory will be notified if the sampler suspects that the sample contains any substance that would require laboratory personnel to take safety precautions.
- The cooler will be closed and taped shut with strapping tape around both ends. If the cooler has a drain, the drain will be taped shut both inside and outside of the cooler.
- Two signed custody seals will be placed on the cooler (one on the front and one on the back). Wide clear tape will be placed over the seals to prevent accidental breakage.

- The chain-of-custody record will be transported inside the sealed cooler. When the analytical laboratory receives the cooler, laboratory personnel will open it and sign the chain-of-custody record to document the transfer of samples.

Samples may be held on site for more than three days during weekend field activities if there is no threat that analytical holding times will be exceeded. Samples collected on the weekend will be stored under refrigeration and shipped the following Monday. Samples for analytes with extremely short holding times, such as 48 hours, will be shipped the day of sampling. Collection of these samples with extremely short holding times should not be scheduled for the weekend.

B4.1.5 Receipt of Cooler

When the laboratory receives a cooler, laboratory personnel will review the contents, sign the chain-of-custody form and airbill, and retain both documents for their records. Information that will be recorded on the chain-of-custody record or another appropriate document at the time of sample receipt will include the following:

- Status of the custody seals
- Temperature of the cooler
- Identification number of any broken sample containers
- Description of discrepancies between the chain-of-custody records, sample labels, and requested analyses
- Observations of visible headspace in vials of water destined for VOC analysis, indicating inadequate sample collection
- The pH of water samples received (the pH of water samples destined for VOC analysis will be documented at the time of analysis)
- Storage location of the sample and sample extracts

Laboratory personnel will contact the project chemist regarding discrepancies in paperwork and sample preservation. Nonconformance and corrective actions should be documented in accordance with laboratory SOPs. These procedures will be available on file at the laboratory. After samples have been accepted, checked, and logged in, the laboratory must maintain them in a manner consistent with the custody and security requirements specified in the laboratory QA plan.

Samples and sample extracts will be assigned to a specific refrigerator within the laboratory. Samples for analysis of VOCs will be maintained in a separate refrigerator in an organic-free atmosphere. All laboratory refrigerators will be assigned a number, and the refrigerator number will be recorded on a document that references the sample and extract locations. Only laboratory personnel will have access to the samples and will be required to sign a log sheet when removing samples and extracts from the refrigerators or replacing them. These log sheets will provide a chain-of-custody record as the sample moves within the laboratory. A chain-of-custody record, similar to the record used for sampling procedures, will be completed for samples removed from the laboratory for disposal or other purposes.

B5 ANALYTICAL METHODS

Analytical methods were selected to provide data of necessary quality to meet the DQOs for this project and to maintain consistency and comparability with existing site data. Table B-1 presents methods that will be used to analyze samples collected at Site 21. Chosen methods will be used because they are adequate to meet reporting limits required for comparison to screening criteria. The project-required reporting limits and a comparison to screening criteria are listed in Tables B-2 and B-3.

With approval from the Navy, including the SWDIV QAO, other EPA- and Navy-approved analytical methods may be selected. Any modifications to the analytical methods presented in this QAPP will be submitted for review by the Navy and regulatory agencies before they are used. Fixed-based laboratories to be used for this project must hold a current certification from the State of California through the Environmental Laboratory Accreditation Program (ELAP). In addition, the laboratory must successfully complete the laboratory evaluation process conducted by the Naval Facilities Engineering Center (NFESC) prior to performing sample analysis for this project.

The analytical, data reporting, and validation procedures will be carried out in accordance with the Navy Installation Restoration Chemical Data Quality Manual (NFESC 1999) and the protocols documented in this QAPP. A minimum of ten percent of all analytical data received from the off-site laboratory will be subjected to full validation as described in Section D1.2.3; the remaining data will undergo cursory validation, as described in Section D1.2.3. Off-site laboratories will retain a staff that possesses analytical expertise in (1) organic and inorganic analyses, (2) QA/QC procedures, (3) production of CLP-type data packages, and (4) operation and maintenance of the LIMS. The off-site laboratory will have

sufficient qualified personnel and appropriate analytical instrumentation available to technically and contractually carry out work required for this investigation. The following subsections provide details on the specific procedures that will be used to analyze samples.

B5.1 METHODS FOR SOIL AND GROUNDWATER ANALYSIS

The following subsections discuss preparation and analytical methods for analysis of soil and groundwater samples.

Analytical Methods

EPA 8260B – VOCs: EPA 8260B is a purge-and-trap GC/MS method that is applicable to the determination of purgeable organic compounds in solid or aqueous samples (EPA 1996b). The gas chromatograph is temperature programmed to separate the purgeables, which are then detected by the mass spectrometer. TCL components are identified by mass spectra and retention time. The TCL components will be quantified in all sample matrices. In addition to the TCL components, library searches will be undertaken to identify the 30 TICs detected at the highest-concentrations. Tables B-2 and B-3 present the TCL and project-required reporting limits for this method, along with a comparison with screening criteria for dense non-aqueous phase liquids (DNAPL) and preliminary remediation goals (PRG) for residential soil.

Groundwater samples will also be analyzed for the natural attenuation parameters methane, ethane, and ethene. The headspace analysis shall be performed in accordance with modified EPA Method 3810/American Society for Testing and Materials (ASTM) method D-3416. This is a gas chromatographic method using a hydrogen flame ionization detector. Table B-3 presents the project-required reporting limits for this method.

Other Parameters

Additional groundwater natural attenuation parameters to be assessed include nitrate/nitrite, major anions, and alkalinity. A summary of containers, holding times and preservation, and analytical method requirements is presented in Table B-1.

En Core Sampler

EPA Method 5035 recommends use of the EnCore sampler. The EnCore sampler is a sealed device used to transport solid samples from the field to laboratory, where they are preserved. Samples collected using the EnCore sampler must be preserved or analyzed by the laboratory within 48 hours after they are collected. Instructions for the use of the EnCore sampling device are presented in Appendix C.

B5.2 METHODS FOR FIELD ANALYTICAL SCREENING

This section includes brief descriptions of the methods commonly used for field procedures. The methods and QC procedures are detailed in the TtEMI field SOPs and are adapted from literature provided by the instrument manufacturer.

Monitoring Methods

PID Organic Vapor Monitor: The PID detects and measures total hydrocarbon vapors. The operating range of the instrument is 0 to 2,000 parts per million (ppm), and provides a nonspecific response to total hydrocarbons. This instrument is also highly sensitive to compounds such as benzene and acetone, but is less sensitive to alcohols and halogenated compounds.

During operation, a gas sample is drawn into the probe and past an ultraviolet (UV) light source by an internal pumping system. Hazardous substances in the sample are ionized, producing an instrument response if the ionization potentials are equal to or less than the ionizing energy supplied by the lamp. The radiation produces a free electron for each molecule of ionized contaminant, which generates a current directly proportional to the number of ions produced. This current is measured and displayed on the meter. The PID measures the total value for all species present with ionization potentials of less than or equal to the ionizing energy of the lamp.

In addition to the PID, other electronic devices will be used to measure field parameters. This equipment includes the QED Model FC-4000 multi-meter (or similar) that will be used to monitor pH, conductivity, temperature, oxidation-reduction potential, and dissolved oxygen in groundwater. Other field parameters will be measured using portable test kits. Ferrous iron will be analyzed in the field using a Hach Pocket Colorimeter (with ferrous iron reagent) test kit and manganese will be analyzed using the Hach MN-PAN

test kit. The iron test kit uses a colorimeter test method with a detection range of 0 to 3 milligrams per liter (mg/L) and incremental readings of 0.01 mg/L, and the manganese test kit uses a color disc method with a detection range of 0 to 0.7 mg/L and incremental readings of 0.05 mg/L.

B6 QUALITY CONTROL

The main functions of any sampling and analysis program are to obtain accurate, representative environmental samples and to provide defensible analytical data. A program to evaluate field and laboratory data was developed to achieve these goals. Quality of the field data will be assessed through collection and analysis of field QC samples on a regularly scheduled basis. Laboratory QC samples will also be analyzed in accordance with referenced analytical method protocols to ensure that laboratory procedures and analyses are conducted properly.

The following subsections discuss the types of QC samples to be collected and analyzed for the soil gas investigation and their role in the assurance of acceptable project data. Additional QC procedures are not limited to those discussed in this section. Field and laboratory personnel, in accordance with specific method protocols, may implement additional procedures. The following subsections discuss field QC samples, field measurement QC procedures, laboratory QC samples, and laboratory QC procedures.

B6.1 FIELD QUALITY CONTROL SAMPLES

QC samples are collected in the field and used to evaluate the validity of the field sampling effort. Field QC samples are collected for laboratory analysis to check sampling and analytical precision, accuracy, and representativeness. The following section discusses the types and purposes of field QC samples that will be collected for this project. Table B-4 provides a summary of the types and frequency of collection of field QC samples.

B6.1.1 Source-Water Blanks

Source-water blanks are used to evaluate the quality of the water used for the last rinse of the decontamination process. The source-water blank confirms that no contamination was added to the sampling tools that could originate in the rinsing water. The source-water blank consists of deionized water used for the final rinse, and is analyzed for the same analytical suite as the samples collected with

the equipment. Source-water blanks are collected at a frequency of one per sampling event provided the same source of water for the final rinse is used. Multiple containers of the same lot number of deionized or distilled water are considered the same source.

B6.1.2 Trip Blanks

A trip blank demonstrates that contamination is not originating from sample containers or from any factor during sample transport. A trip blank originates at the laboratory as a 40mL vial typically used for VOC analysis. The vial is filled at the laboratory with reagent-grade, organic-free water. The trip blanks are then transported to the site with the empty containers that will be used for sample collection. The trip blanks are stored at the site until the proposed field samples have been collected. One trip blank will accompany each sample transport container that holds water samples for analysis of VOCs back to the laboratory. The trip blank is not opened until it is returned to the laboratory. Trip blanks are analyzed for VOCs only.

B6.1.3 Equipment Rinsates

The equipment rinsate demonstrates whether the decontamination procedure is effective in removing contaminants from field equipment used to collect samples. An equipment rinsate is collected after a sampling device is subjected to standard decontamination procedures. Water for the intended analysis is poured over or through the sampling equipment, reserved in a sample container, and sent to the laboratory for analysis.

Contamination in the equipment rinsate indicates that the cleaning procedure for field equipment is not effective, allowing for the possibility of cross contamination. The frequency of collection for equipment rinsates has been established based on the activity-specific requirements of this project. Criteria used to establish the frequency of collection for equipment rinsates include factors such as the type of sampling equipment being used and the expected level of contamination at the site. One equipment rinsate will be collected per day of sampling for the additional characterization at Site 21. The number of equipment rinsates will not exceed five percent of the total number of samples collected. Rinsate samples will be analyzed for VOCs only. During the data validation process, the results of equipment rinsate analysis will be used to qualify data or to evaluate the levels of analytes in the field samples.

B6.1.4 Field Duplicates

Field duplicates are taken to obtain precision data on handling, shipping, storage, preparation, and analysis of soil and groundwater samples at a frequency of one for every ten samples. Duplicate samples of groundwater will be obtained by collecting double volumes of the real sample and submitting the duplicate sample as a separate, discrete sample for VOC analysis.

B6.2 LABORATORY QUALITY CONTROL SAMPLES

Laboratory QC samples are analyzed to evaluate the quality of preparation and analysis of field samples. Laboratory QC samples are prepared and analyzed at the laboratory to assess analytical precision, accuracy, and representativeness. The types of laboratory QC samples that will be used are discussed in the following sections. Precision and accuracy goals for laboratory QC elements are presented in Table B-5.

B6.2.1 Method Blanks

Method blanks are prepared to determine whether contamination of the field sample is occurring in the laboratory during sample preparation or analysis. A method blank consists of laboratory organic-free water and is prepared and analyzed using the same methods and procedures and for the same parameters as the field samples. For EPA Method 8260 a method blank is prepared and analyzed using the same methods and procedures and for the same parameters as field samples. Method blanks are prepared at the frequency prescribed in the individual method.

B6.2.2 Laboratory Control Samples

An LCS is organic free water that has been spiked with standard reference materials of known concentration. An LCS is analyzed to verify the accuracy of the analytical system. LCSs are prepared and analyzed using the same procedures as field samples, at the frequency prescribed in the individual method.

B6.2.3 Matrix Spike and Matrix Spike Duplicates

MS and MSD samples are analyzed to evaluate the suitability of an analytical method for an environmental sample matrix. The MS sample is prepared using a known concentration of target analytes added to an aliquot of the field sample. To minimize errors, the field samples will not be spiked in the field. Instead, samples will be spiked when they are prepared for analysis at the laboratory. The MS and MSD measure the efficiency of all of the steps of the analytical method in recovering target analytes from an environmental sample matrix. The percent recoveries will be calculated for each of the spiked analytes and used to evaluate analytical accuracy. The RPD between spiked samples will be calculated to evaluate precision. For inorganic analyses, a matrix duplicate is analyzed in place of an MSD. Precision is calculated based on comparison of the results for duplicate and original analyses.

MS and MSD samples are collected at a frequency of five percent. If the percent recoveries for the MS and MSD used to assess accuracy or the RPD results used to assess precision are outside the established acceptance limits, laboratory protocols specific to the method will be followed to evaluate the usability of the data. The results for LCS or blank spikes, if available, will be examined to evaluate the effect of the out-of-control event on the reported results. Table B-5 provides control limits for the evaluation of accuracy and precision.

B6.2.4 Surrogate Standards

Surrogate standards consist of known concentrations of nontarget analytes that are added to each sample, method blank, LCS, and MS/MSD. The surrogate standard measures the efficiency of the analytical method in recovering target analytes from an environmental sample matrix.

Surrogate standards provide an indication of laboratory accuracy and matrix effects for every field and QC sample that is analyzed for volatile and extractable organic compounds. Surrogate compounds are used in the analysis of VOCs to monitor purge efficiency and analytical performance.

Percent recoveries for surrogate standards obtained from sample analysis are evaluated using laboratory-specific control limits. Factors such as matrix interference and high concentrations of analytes may affect the recovery of surrogate standards. The effects of the sample matrix are frequently outside the control of the laboratory and may present unique problems. Review and validation of data based on

specific sample results are frequently subjective and require analytical experience and professional judgment.

Laboratory personnel are required to re-extract (when applicable) and re-analyze samples when results for associated surrogate standards are outside control limits. Data from both analyses of the samples in question are reported. The data will be qualified during review. EPA guidelines for evaluating data for organic compounds provide additional criteria (EPA 1999c).

B6.2.5 Internal Standards

Internal standards are compounds that are added to every standard, method blank, LCS, and sample at a known concentration prior to analysis by GC/MS. They are used as the basis for quantification of target compounds. Internal standards ensure that the sensitivity and response of the GC/MS are stable during every analytical run. An internal standard is used to evaluate the efficiency of the sample introduction process and to monitor the efficiency of the analytical procedure for each sample matrix encountered. Data for internal standards data will be validated based on the EPA protocol presented in guidelines for evaluating data for organic compounds (EPA 1999c).

B6.3 LABORATORY CONTROL PROCEDURES

The laboratory will conduct the following quality control procedures in addition to analyzing laboratory quality control samples as described in Section B6.2.

B6.3.1 Method Detection Limit Studies

The MDL is a specified limit at which there is 99 percent confidence that the concentration of the analyte is greater than zero. The MDL takes into account sample matrix and preparation. The subcontract laboratory will demonstrate the MDLs for all analyses, except inorganic analyses and physical properties test methods.

MDL studies will be conducted annually for soil and water matrices or more frequently if any method or instrumentation changes. Each MDL study will consist of seven replicates spiked with all target analytes of interest at concentrations no greater than required quantitation limits. The replicates will be extracted

and analyzed in the same manner as routine samples. If multiple instruments are used, each will be included in the MDL study. The reported MDLs will be representative of the least-sensitive instrument. MDLs must meet the required quantitation limits. If MDLs do not meet the required quantitation limits, the situation is considered out of control and corrective action will be taken.

B6.3.2 Sample Quantitation Limits

Sample quantitation limits (SQL), also referred to as practical quantitation limits, are CRQLs adjusted for the characteristics of individual samples. The CRQL is a chemical-specific level that a laboratory should be able to routinely detect and quantitate for a given sample matrix. The CRQL is usually defined in the analytical method or in project-specific documentation. The SQL takes into account changes in preparation and analytical methodology that may alter the ability to detect an analyte, such as use of a smaller sample aliquot or dilution of the sample extract. Physical characteristics such as sample matrix and percent moisture that may alter the ability to detect the analyte are also considered. The laboratory will calculate and report SQLs for all environmental samples.

B6.3.3 Control Charts

Control charts document data quality in graphic form for specific method parameters such as surrogates and blank spike recoveries. A collection of data points for each parameter is used to statistically calculate means and control limits for a given analytical method. This information is useful in evaluating whether chemical measurement systems are in control. In addition, control charts provide information about trends over time in specific analytical and preparation methodologies. The Navy recommends that subcontract laboratories maintain control charts for organic and inorganic analyses. At a minimum, recoveries for method blanks surrogates and blank spikes should be charted for all organic methods. Blank spike recoveries should be charted for inorganic methods. Control charts should be updated monthly.

B7 INSTRUMENT AND EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

The following sections discuss regularly scheduled preventive maintenance and calibration procedures that are used to keep all field and laboratory equipment in good working condition.

B7.1 MAINTENANCE OF FIELD EQUIPMENT

Detailed information on maintenance and servicing of field equipment is available in the instruction manual of the specific instrument to be used. Field personnel will record service and maintenance information in field logbooks. Instrument problems encountered during fieldwork will be recorded and remedied in the field, if possible. Spare batteries, bulbs, probes, and other parts will be kept on hand for replacement. Specific preventive maintenance procedures will follow manufacturer recommendations.

B7.2 CALIBRATION OF FIELD ANALYTICAL EQUIPMENT

At a minimum, equipment used during field activities will be calibrated at the beginning of each day of sampling; however, some equipment may require calibration more often. The frequency of calibration depends on the type and stability of equipment, the analytical methods employed, the intended use of the equipment, and the recommendation of the manufacturer. More detailed calibration procedures for equipment are available from the specific manufacturer instruction manuals. All information on calibration will be recorded in a field logbook or on field forms. A label that specifies the scheduled date of the next calibration will be attached to the field equipment. If this identification is not feasible, calibration records for the equipment will be readily available for reference.

Should any of the field equipment become inoperable, it will be removed from service and tagged to indicate that repair, recalibration, or replacement is needed. The field team leader will be notified so that prompt service can be completed or substitute equipment can be obtained. Backup systems will be available for each instrument in use and will be calibrated prior to use in the field. Any action of this type will be reported in the daily field QC report. Corrective action measures are discussed in Section C1.2 of this QAPP.

B7.3 MAINTENANCE OF LABORATORY EQUIPMENT

The off-site subcontract laboratories will prepare and follow a maintenance schedule for each instrument used to analyze samples collected from Treasure Island. All instruments will be serviced at scheduled intervals necessary to optimize factory specifications. Routine preventive maintenance and major repairs will be documented in a maintenance logbook. An inventory of items to be kept ready for use in case of instrument failure will be maintained and restocked as needed. The list of spare parts will include

equipment replacement parts that subject to frequent failure, parts that have a limited lifetime of optimum performance, and parts that cannot be obtained in a timely manner.

As required by Navy IR chemical data quality manual (CDQM) guidelines (NFESC 1999), a description of specific preventive maintenance procedures for laboratory equipment is available in the laboratory's QA plan and in the written SOPs maintained by the laboratory. These documents identify the personnel responsible for major, preventive, and daily maintenance procedures, the frequency and type of maintenance, and maintenance documentation procedures.

B7.4 CALIBRATION OF LABORATORY ANALYTICAL EQUIPMENT

Laboratory instrument calibration procedures and frequencies will follow referenced analytical method requirements. Qualified analysts will calibrate the instrument and will document the procedure in an instrument logbook.

Laboratory calibration procedures and frequencies are listed in the subcontract laboratory's QA plan, the written SOPs maintained by the laboratory, and the analytical methods referenced in Section B5.1 of this QAPP. Laboratory instruments will be calibrated using the procedures and at the frequencies specified in QC requirements for EPA methods.

B7.4.1 Calibration Standards

Calibration standards will be obtained by the laboratory from the EPA repository or commercial vendors. Stock solutions for surrogate parameters and other inorganic mixes will be made from reagent-grade chemicals or as specified in the method SOP. Stock standards will also be used for intermediate standards used to make calibration standards. Special attention will be given to expiration dating, proper labeling, proper refrigeration, and freedom from contamination. Documentation relating to receipt, mixing, and use of standards will be recorded in the appropriate laboratory logbook. Logbooks must be permanently bound. Specific handling and documentation requirements for the use of standards will be provided in the selected laboratory's QA manual.

B7.4.2 Corrective Action Procedures

Instrument malfunctions will require immediate corrective action. Actions should be documented in field or laboratory logbooks. No other formal documentation is required unless data quality is adversely affected or further corrective action is necessary. On-the-spot corrective actions will be taken as necessary in accordance with the procedures described in the laboratory QA plan and SOPs.

B8 INSPECTION AND ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Analytical laboratories are required to provide certified clean containers for all analyses. The subcontract laboratory will maintain an inventory of analytical supplies required for analytical procedures, as described in Section B5.1.

Solvents and reagents used by the laboratories in all analytical procedures will be documented in a laboratory logbook. At a minimum, information regarding the manufacturer, lot number, date received, and date opened should be included. Solvents and reagents will be tested for contamination before use. The results of this procedure and any other quality inspections will be documented in a laboratory notebook.

Off-site laboratories will maintain and follow a written SOP for decontaminating glassware used in analytical procedures. Off-site laboratories will check the calibration of all analytical balances and automatic pipettes on a daily basis and will document the results in a laboratory logbook. Analytical balances will be recalibrated as necessary in accordance with the laboratory's written SOPs.

Subcontractor laboratories will check the temperature daily of all refrigerators used to store samples, standards, extracts, and other consumables, and will document measured temperatures in a laboratory logbook.

B9 NONDIRECT MEASURES

The following sections outline data management in the field and laboratory. Electronic data generated from this event will be delivered to the Navy in a format compatible with NEDTS.

B9.1 FIELD DATA MANAGEMENT

The TtEMI project manager will be responsible for review, transfer, and storage of all data collected in the field for the facility. The TtEMI field team leader will maintain documentation of sampling, logging, and field measurements. The TtEMI field team leader will also maintain daily field progress reports and will note any variance from standard operating procedures.

B9.2 LABORATORY DATA MANAGEMENT

When samples are received at the laboratory, the laboratory sample custodian will reconcile the information on the chain-of-custody forms with the sample bottles received. The sample custodian will document any anomalies and report them to the laboratory project manager (PM), who will contact the TtEMI project chemist. Anomalies will be resolved with the TtEMI project chemist. The information on the chain-of-custody forms will then be entered into the laboratory's information management system.

Samples will be tracked from the time of receipt through each stage of sample preparation, analysis, and final reporting using the laboratory's information management system. Either data will be transferred from the analytical instrument electronically to the laboratory's LIMS, or qualified personnel will enter the data through terminals. The laboratory will be responsible for tracking all QC parameters and sample results by SDG. Any data that exceed the specified QC limits specified for this project will be documented. QC anomalies that directly affect data quality will immediately be communicated to the TtEMI project chemist. The laboratory will implement and document any corrective actions that result from QC anomalies. The contract laboratory will generate the EDD and a CLP-like data package after all data have been reviewed and approved by the appropriate laboratory personnel. The EDD and data package will then be delivered to the TtEMI project chemist.

The laboratory PM will be responsible for proper sample handling and documentation from the time samples are received until the data package and EDD are submitted. The laboratory will use sample receipt forms and nonconformance memoranda to document and disseminate information on any nonconformance to the TtEMI project chemist.

B9.3 TETRA TECH EM INC. DATA MANAGEMENT

The laboratory will be responsible for sending a hard copy of the data package and the EDD on computer diskette to the TtEMI project chemist. The EDD and hardcopy data will be checked to ensure that their format and content comply with TtEMI specifications and with NEDTS per SWDIV EWI #6 (SWDIV 1999a). Any errors or missing information detected will be thoroughly investigated. The laboratory will be required to regenerate the EDD or data package if necessary.

A copy of the EDD and hardcopy data will be sent to an independent reviewer for data validation, as described in Section D1. The validator will assign qualifiers to the data as appropriate. The TtEMI project chemist will conduct a technical review of the data validation report, as described in Section D1. The validated data will be submitted to data entry staff for input into the database. The final version of the data validation report will be stored with the hardcopy analytical report.

C1 ASSESSMENTS AND RESPONSE ACTIONS

Oversight of QA activities will be completed using three types of audits (performance, system, and field), described in the following subsection. Any problems encountered during the field investigation will require appropriate corrective action procedures to ensure that they are resolved. This section describes the types of audits that may be completed, corrective action procedures that will be undertaken in the event of problems in the field or laboratory, and QA reports to management.

C1.1 PERFORMANCE, SYSTEM, AND FIELD AUDITS

An audit evaluates the capability and performance of a measurement system or its components and identifies problems that warrant correction. Three types of audits may be conducted during fieldwork for this project: performance, system, and field. The QA program manager, project QA officers, or senior technical staff will complete audits at scheduled intervals. Auditors will be independent of the activities audited and will be selected by the project QA manager. Technical expertise and experience in auditing will be considered in selecting an auditor or audit team. The Navy QAO may also complete an audit.

The auditor or audit team will develop an individual plan to provide a basis for each audit. Audits may include reviews of project plan adherence, training status, health and safety procedures, QC data, calibrations, and conformance to sampling and field SOPs. Audits may also review compliance with laws, regulations, policies, and procedures. After an audit is completed, the auditor or audit team will submit an audit report to the TtEMI project manager, program manager, installation coordinator, and ultimately the Navy QAO and Navy RPM. This report will also be included in the project summary report. The QA program manager will coordinate a management review if any deficiencies are noted.

The auditor or audit team can issue a corrective-action request form to identify and schedule specific corrective actions to be undertaken and completed by the project managers. The auditor or audit team verifies that corrective action has been completed. After corrective actions have been accepted and verified, the corrective-action request form will be used to close the audit.

C1.1.1 Performance Audits

A performance audit is a review of existing project and QC data to evaluate the accuracy of a total measurement system or a component of the system. The Navy will conduct laboratory performance audits before samples are submitted to the laboratory for analysis. TtEMI has contracts in place with several Navy-approved laboratories and conducts a laboratory audit as a condition of contract award. The performance of the laboratory is monitored through data validation and the quality of service. If problems with performance arise, the issues are evaluated to assess the need for additional performance audits of the laboratory. Internal audit routines for the laboratory are described in the laboratory QA plan and follow IR CDQM guidance (NFESC 1999).

C1.1.2 Field Audits

A field audit involves an on-site visit by the auditor or audit team. Items to be examined include the availability and implementation of approved field procedures, calibration and operation of equipment, chain-of-custody procedures, packaging, storage, and shipping of samples, health and safety procedures, documentation of procedures and instructions, and nonconformance documentation. Field audits are scheduled at the program level. It is unknown if this project will be subject to a field audit. Field schedules are provided to the program QA manager, who may select this project for a field audit.

C1.2 CORRECTIVE ACTION PROCEDURES

An effective QA program requires prompt and thorough correction of nonconformance conditions that affect quality. Rapid and effective corrective action minimizes the possibility of questionable data or documentation. Two types of corrective actions exist: immediate and long-term. Immediate corrective actions include correction of deficiencies or errors in documentation, repair of inaccurate instrumentation, or correction of inadequate procedures. The source of the problem is generally obvious and can be corrected at the time it is observed. Long-term corrective actions are designed to eliminate the sources of problems. Examples of long-term corrective actions are correction of systematic errors in sampling or analysis and correction of procedures that produce questionable results. Corrections can be made through additional personnel training, instrument replacement, or procedural improvements. One or more corrections may be necessary.

All QA problems and corrective actions will be documented to provide a complete record of QA activities and to help to identify long-term corrective actions needed. Defined responsibilities are required for scheduling, performing, documenting, and evaluating the effectiveness of the corrective action. This section describes the corrective action procedures to be followed in the field and laboratory. An example of a corrective action request form can be found in Appendix B.

C1.2.1 Field Procedures

Nonconformance conditions in the field are defined as occurrences or measurements that are either unexpected or that do not meet established acceptance criteria and will affect data quality if corrective action is not implemented. Examples of nonconformance are as follows:

- Incorrect use of field equipment
- Improper procedures for sample collection, preservation, and shipment
- Incomplete field documentation, including chain-of-custody records
- Incorrect decontamination procedures
- Incorrect collection of QC samples

Corrective action procedures will depend on the severity of the nonconformance. In cases where field personnel implement immediate and complete corrective action, the corrective action will be recorded in the field logbook and summarized in the daily field progress report.

Nonconformances that have a substantial impact on data quality require the completion of a corrective-action request form. This form may be filled out by an auditor or by any individual who suspects that any aspect of data integrity is being affected by a nonconformance in the field. Each form is limited to a single nonconformance. Multiple forms will be used for documentation if additional problems are identified.

Copies of the corrective-action request form will be distributed to the project managers, the field team leaders, the project QA manager, and the project file. The project QA manager will forward completed corrective-action forms to the program manager and the QA program manager. The project manager,

field team leader, and the project QA manager will meet to discuss the appropriate steps to resolve the problem, and will use the following list:

- Determine when and how the problem developed
- Assign responsibility for problem investigation and documentation
- Determine the corrective action to eliminate the problem
- Design a schedule for completing the corrective action
- Assign responsibility for implementing the corrective action
- Document and verify that the corrective action has eliminated the problem
- Notify the Navy of the problem and the corrective action taken

The project QA manager uses a corrective action status report to monitor the status of all corrective actions. The report will list a brief description of the problem, the individual who identified it, and the personnel responsible for selecting and implementing the corrective action. The report will also list completion dates for each phase of the corrective-action procedure and the due date for the QA program manager to review and check the effectiveness of the solution. Follow-up data will be listed to check that the problem has not reappeared. The follow-up review is conducted to ensure that the solution has adequately and permanently corrected the problem.

The QA program manager can require data acquisition to be limited or discontinued until the corrective action is complete and the nonconformance is eliminated. The QA program manager can also request the reanalysis of any or all data acquired since the system was last in control.

C1.2.2 Laboratory Procedures

The laboratory QA plan describes internal laboratory procedures for corrective action and out-of-control situations that require corrective action. At a minimum, corrective action will be implemented when any of the following three conditions occur: control limits are exceeded, method QC requirements are not met, or sample-holding times are exceeded. Out-of-control situations will be reported to the project chemist within two working days after they are identified. In addition, a corrective action report signed

by the laboratory director or project manager and the laboratory QC coordinator will be provided to the project chemists.

C1.3 REPORTS TO MANAGEMENT

Several reports will be prepared during fieldwork at TI to address QA issues. Each of these reports is summarized in this section.

C1.3.1 Daily Quality Control Reports

The daily QC report will summarize daily field activities throughout the field program. This report will include all work completed, including any QA/QC activities, health and safety activities, problems encountered, and corrective actions taken. The daily QC report is prepared by the field team leader and submitted to the project manager. The content of the reports will be summarized and included in the final report submitted for the field investigation.

C1.3.2 Project Monthly Progress Report

A summary report will be prepared by the project manager and project QA manager on a monthly basis and submitted to the program managers and QA program manager. This report will include the following:

- Status of the project
- Instrument, equipment, or procedural problems affecting QA and recommended solutions
- Objectives from the previous report that were achieved
- Objectives from the previous report that were not achieved
- Work planned for the next month

The aforementioned information will also be required from any subcontractors and will be included in the monthly progress report.

C1.3.3 Quality Control Summary Report

A QC summary report (QCSR) will be prepared by TtEMI and submitted to the Navy RPM with the final report for the activity. The QCSR will include a summary and evaluation of the QC completed during the task and will indicate the duration and location of storage for the complete data packages. Particular emphasis will be placed on the 5-step DQA process.

D1 DATA VALIDATION AND USABILITY

The following two sections discuss the requirements and methods for data review, verification, and validation. Section D2 discusses the process for reconciling the data generated with the DQOs for the task.

D1.1 DATA REVIEW, VERIFICATION, AND VALIDATION REQUIREMENTS

All data for this project will be reviewed and verified before they are input into the database. At a minimum, ten percent of the analytical data will be randomly selected and fully validated. The remaining 90 percent of the analytical data will undergo cursory validation. All data will be validated by an independent third-party validator according to the national functional guidelines for organic data review (EPA 1999c). All data review, verification, and validation will be performed in accordance with SWDIV EWI #1 and #3 (SWDIV 1999b and 1999c).

D1.2 VALIDATION AND VERIFICATION METHOD

Validation and verification of data generated during field activities are essential to obtaining data of defensible and acceptable quality. Verification methods for field and laboratory activities are presented in the following two sections; validation requirements are presented in Sections D1.2.3

D1.2.1 Verification of Field Data

Project team personnel will validate field data through reviews of data sets to identify inconsistencies or anomalous values. If possible, any inconsistencies discovered will be resolved immediately by seeking clarification from the field personnel responsible for data collection. In order to obtain defensible data, field personnel will be responsible for following the sampling and documentation procedures described in the accompanying FSP and this QAPP.

Data values that are significantly different from the population are called "outliers." A systematic effort will be made to identify any outliers or errors before field and laboratory personnel report the data. Outliers can result from improper sampling or analytical methodology, matrix interference, and errors in data transcription and calculation, or they may represent inherent variability in the sample. Outliers that result from errors found during data verification will be identified and corrected. Outliers that cannot be

attributed to analytical, calculation, or transcription errors will be reported in the case narrative section of the analytical report but will not necessarily be excluded from data analysis.

D1.2.2 Verification of Laboratory Data

Laboratory personnel will verify analytical data at the time of analysis and reporting through reviews of the raw data for any nonconformance with analytical method requirements. Detailed procedures for laboratory verification and corrective action will be provided in the laboratory's QA plan

D1.2.3 Validation of Analytical Data

The following four sections describe the validation requirements for analytical data.

Technical Requirements

Analytical data will be validated by an independent, third-party subcontractor, using the EPA national functional guidelines for organic data review (EPA 1999c).

Cursory Data Validation

Cursory validation will be completed on 90 percent of the data for all samples. The data reviewer is required to notify TtEMI and request any missing information needed from the laboratory. Elimination of data from the review process is not allowed. Data summary packages consist of sample results and QA/QC summaries (equivalent to CLP Forms I through X for organic analysis and Forms I through XIV for inorganic analysis), including calibration and internal standard data. No guaranteed minimum number of samples will be required for an SDG; however, the maximum number of samples will not exceed 20.

Full Data Validation

Full validation will be completed on a minimum of 10 percent of the data packages. The data reviewer is required to notify TtEMI and request any missing information needed from the laboratory. Elimination of data from the review process is not allowed. Data packages consist of sample results, QA/QC summaries (equivalent to CLP Forms I through X for organic analysis and Forms I through XIV for inorganic analysis), and raw data associated with the sample results and QA/QC summaries.

Criteria for Data Validation

The QC criteria to be reviewed for both cursory and full validations are identified as follows:

Cursory Data Validation

1. Organic Analyses

- Method compliance
- Holding times
- Calibration
- Blanks
- Surrogate recovery
- MS and MSD recovery
- Blank spike or LCS recovery
- Internal standard performance
- Other laboratory QC specified by the method
- Overall assessment of data for an SDG
- Field duplicate sample analysis

Full Data Validation

1. Organic Analyses

- Method compliance
- Holding times
- Calibration
- Blanks
- Surrogate recovery
- MS and MSD recovery
- LCS or blank spike
- Internal standard performance
- Field duplicate sample analysis
- Other laboratory QC specified by the method
- Detection limits
- Compound identification
- Compound quantitation
- Sample results verification
- Overall assessment of data for an SDG

D2 RECONCILIATION WITH USER REQUIREMENTS

The overall purpose of the work defined in this study is to identify the source of VOCs in groundwater at Site 21 and to help determine whether an interim action is needed to prevent these VOCs from migrating at concentrations that would pose unacceptable human health or ecological risk. The sampling and laboratory methods and procedures detailed throughout this QAPP should provide data of adequate quality to assess the concentrations and extent of VOCs throughout Site 21.

E1 REFERENCES

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SWDIV. 1999b. Environmental Work Instruction #1 – Chemical Data Validation. October 18.

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FIGURE

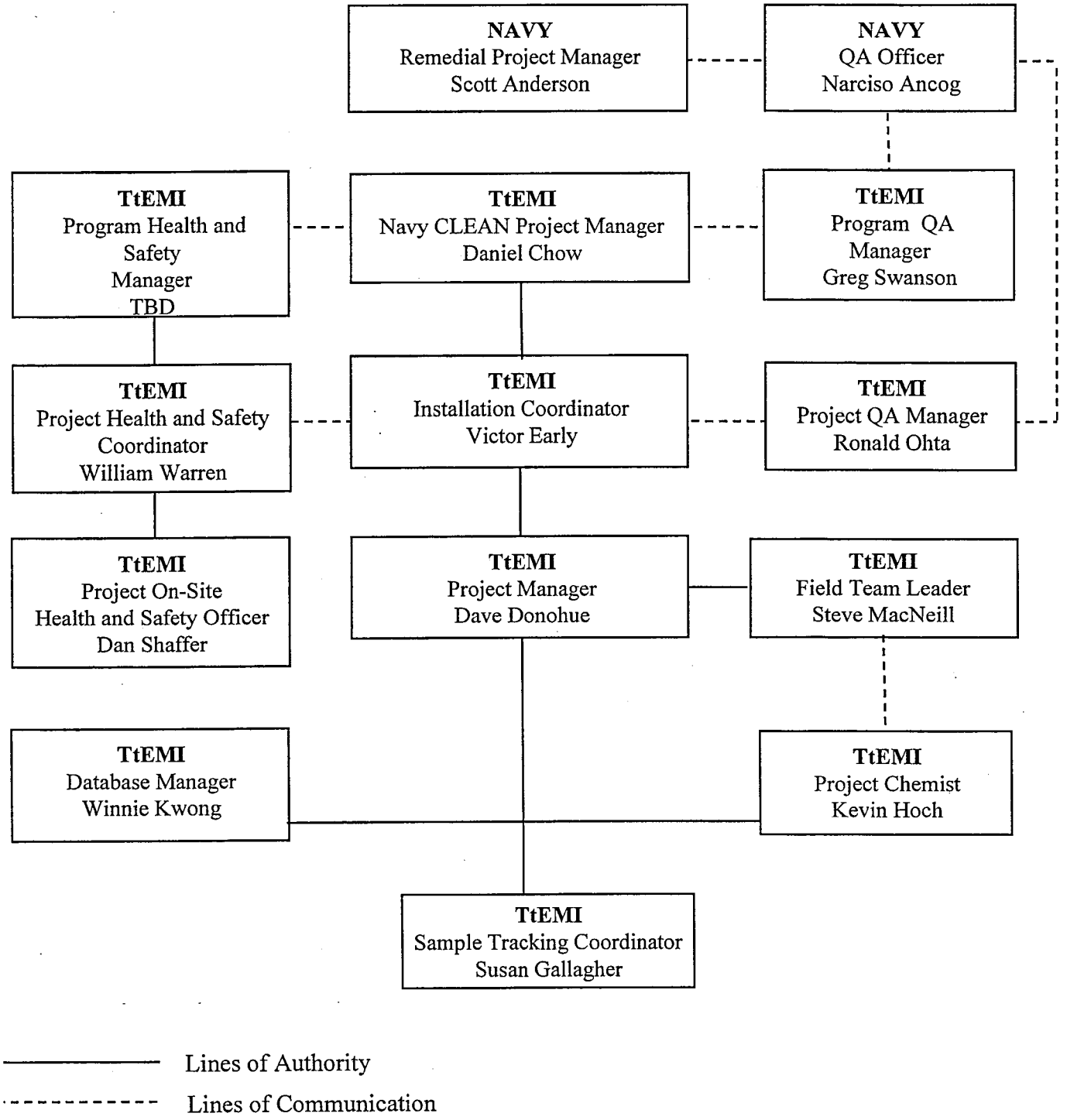

Figure A-1
Organization Flowchart

TABLES

TABLE A-1

QUALITY ASSURANCE PROJECT PLAN ELEMENTS
IR SITE 21 NAVAL STATION TREASURE ISLAND

A. Project Management	
Element/Content	**Report Section**
A1 Title and approval sheet	Not applicable
A2 Table of contents	Not applicable
A3 Distribution list	Not applicable
A4 Project/task organization	A2
A5 Problem definition/background	A3
A6 Project/task description	A4
A7 Quality objectives and criteria for measuring data	A5
A8 Special training and certification	A2.3
A9 Documentation and records	A6
B. Measurement/Data Acquisition	
Element/Content	**Report Section**
B1 Sampling process design (experimental design)	B2
B2 Sampling methods	B3
B3 Sample handling and custody	B4
B4 Analytical methods	B5
B5 Quality control	B6
B6 Instrument/equipment testing, inspection, and maintenance	B7
B7 Instrument calibration and frequency	B7
B8 Inspection/acceptance of supplies and consumables	B8
B9 Non-direct measurements	B9
B10 Data management	B9
C. Assessment/Oversight	
Element/Content	**Report Section**
C1 Assessments and response actions	C1
C2 Reports to management	C1.3
D. Data validation and usability	
Element/Content	**Report Section**
D1 Data review, validation, and verification	D1.1
D2 Validation and verification methods	D1.2
D3 Reconciliation with user requirements	D2

TABLE A-2
IDENTIFICATION OF THE SEVEN STEPS OF THE DQO PROCESS
IR SITE 21 NAVAL STATION TREASURE ISLAND

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
State the Problem	**Identify the Decisions**	**Identify Inputs to the Decisions**	**Define Study Boundaries**	**Develop Decision Rules**	**Specify Tolerable Limits on Error**	**Optimize Sampling Design**
• Data gaps exist at IRP Site 21 regarding the extent of contaminants in soil associated with the former dip tank. • Data gaps exist at IRP Site 21 regarding the extent of VOCs in groundwater. • Data gaps exist at IRP Site 21 regarding the existence or absence of natural degradation of VOCs in groundwater.	• Are the concentrations of soil contaminants at Site 21 attributable to releases associated with the former dip tank? Does Site 21 soil constitute a separate, significant risk to human and ecological health? Should soil at Site 21 be addressed through a removal action? • Are the analytical results from the existing monitoring wells adequate to support the conclusion that little or no migration of contamination from the site to human or ecological receptors is occurring via groundwater, or does the variability in VOC concentrations in groundwater at the site indicate that groundwater sampling at additional locations is necessary? • Is natural attenuation of VOCs occurring within the soil/groundwater system at Site 21? If occurring, is the rate of natural attenuation sufficient to adequately mitigate VOC concentrations and prevent migration of contaminants to human or ecological receptors via groundwater?	• Inputs to the decision to pursue these data gaps include historical information, analytical data, data quality objectives, and screening criteria.	• The horizontal extent of IRP Site 21 defines the horizontal study boundaries. The base of the shallow unconfined water-bearing zone defines the vertical boundaries. • Temporal study boundaries include historic uses of the site dating back to the earliest Navy uses of Treasure Island and tidal influence on the site.	• If the concentrations of soil contaminants at Site 21 are attributable to releases associated with the former dip tank and the soil constitutes a separate, significant risk to human and ecological health, then soil at Site 21 will be addressed through a removal action, otherwise, no further action will be conducted. • If the groundwater analytical results from the existing and newly installed monitoring wells are adequate to support the conclusion that little or no migration of contamination via groundwater from the site to human or ecological receptors is occurring, then further investigation of groundwater contaminant concentrations and migration will not be necessary, otherwise, additional investigation or groundwater modeling may be necessary to complete the groundwater contaminant evaluation. • If VOC concentrations are shown to be decreasing through time at a favorable rate, then natural attenuation will be evaluated for effectiveness in degrading VOCs, otherwise, natural attenuation evaluation will be eliminated .	• The limits on error for chemical data are defined within this QAPP (Section A1.4.6). • Range of acceptable error is addressed through sample design, selection of appropriate analytical methods and understanding of equipment error. • Data will be verified through the data validation process. • If false positive or false negative results are still suspected, additional analyses may be requested or confirmation sampling may be required.	• This QAPP was prepared to optimize the data collection for the investigation. • The sampling strategy in this QAPP was designed to fill data gaps identified in previous investigations. Up to 40 soil samples will be collected and four rounds of groundwater sampling from 24 wells will be conducted. • Investigation results will be used to assess the extent of identified constituents and to evaluate whether or not detected constituents are present above acceptable risk levels. Results will also be used to evaluate the need for a removal action. • Field procedures defined in this QAPP will be followed to ensure quality data collection.

Notes:
FSP Field sampling plan
IRP Installation Restoration Program RI Remedial Investigation
QAPP Quality assurance project plan

TABLE B-1

SAMPLE CONTAINER, HOLDING TIME, AND PRESERVATIVE REQUIREMENTS
IR SITE 21 NAVAL STATION TREASURE ISLAND

Parameter	Matrix	Analytical Method Number (as per SW-846)	Sample Container	Preservative	Holding Time[a]
Volatile Organic Compounds (VOC)	Soil	8260B	EnCore sampler (EPA Method 5035)	Cool, 4 °C / Sodium Bisulfate at lab	48 hours/14 days
	Water	8260B	3 x 40 mL VOA vial	HCl, pH < 2.0	14 days
Methane, ethane, ethane	Water	3810/ ASTM D-3416 Modified (RSK-175)	3 x 40 mL VOA vial	Cool, 4 °C	7 days
Nitrate/Nitrite	Water	300 Series	250-mL poly	H_2SO_4	14 days
Major Anions	Water	300 Series	250-mL poly	Cool, 4 °C	30 days
Alkalinity	Water	300 Series	250-ml poly	Cool, 4 °C	30 days
SVOC[b]	Soil	8270	1 x 8-ounce glass jar	Cool, 4 °C	14 days
	Water	8270	2 x 1-Liter amber glass jars	Cool, 4 °C	7 days
Metals[b]	Soil	6010	1 x 8-ounce glass jar	Cool, 4 °C	6 months; Mercury 28 days
	Water	6010	1 x 1-Liter poly container	HNO_3, Cool, 4°C	6 months; Mercury 28 days
Extractable Petroleum Hydrocarbon[b]	Soil	8015	1 x 8-ounce glass jar	Cool, 4 °C	14 days
	Water	8015	2 x 1-Liter amber glass jars	Cool, 4 °C	7 days
Purgeable Petroleum Hydrocarbons[b]	Soil	8015	1 x 8-ounce glass jar	Cool, 4 °C	14 days
	Water	8015	3 x 40 mL VOA vial	HCl, Cool, 4°C	14 days

Notes:
- HCl — Hydrochloric acid
- H_2SO_4 — Sulfuric acid
- RSK — Robert S. Kerr research laboratory
- [a] "x" days/"y" days refers to the maximum number of days from sampling to extraction (or preservation of EnCore samples) / the maximum number of days from extraction (or preservation of EnCore samples) to analysis
- [b] Parameters included for investigation-derived waste characterization.

TABLE B-2
COMPARISON OF PROJECT REQUIRED REPORTING LIMITS AND ANALYTE SCREENING CRITERIA FOR SOIL SAMPLES
IR SITE 21 NAVAL STATION TREASURE ISLAND

Compound	Units	Project Required Reporting Limit	Low Level Method Reporting Limit	PRG for Residential Soil	RL<PRG	Low Level RL < PRG
1,1,1-TRICHLOROETHANE	UG/KG	10	N/A	770000	YES	N/A
1,1,2,2-TETRACHLOROETHANE	UG/KG	10	N/A	380	YES	N/A
1,1,2-TRICHLOROETHANE	UG/KG	10	N/A	840	YES	N/A
1,1-DICHLOROETHANE	UG/KG	10	N/A	590000	YES	N/A
1,1-DICHLOROETHENE	UG/KG	10	N/A	540	YES	N/A
1,2-DICHLOROETHANE	UG/KG	10	N/A	350	YES	N/A
1,2-DICHLOROETHENE (TOTAL)	UG/KG	10	N/A	43000	YES	N/A
1,2-DICHLOROPROPANE	UG/KG	10	N/A	350	YES	N/A
2-BUTANONE	UG/KG	10	N/A	6900000	YES	N/A
2-HEXANONE	UG/KG	10	N/A	N/A	N/A	N/A
4-METHYL-2-PENTANONE	UG/KG	10	N/A	750000	YES	N/A
ACETONE	UG/KG	10	N/A	1600000	YES	N/A
BENZENE	UG/KG	10	N/A	670	YES	N/A
BROMODICHLOROMETHANE	UG/KG	10	N/A	1000	YES	N/A
BROMOFORM	UG/KG	10	N/A	62000	YES	N/A
BROMOMETHANE	UG/KG	10	N/A	3900	YES	N/A
CARBONDISULFIDE	UG/KG	10	N/A	360000	YES	N/A
CARBON TETRACHLORIDE	UG/KG	10	N/A	240	YES	N/A
CHLOROBENZENE	UG/KG	10	N/A	150000	YES	N/A
CHLOROETHANE	UG/KG	10	N/A	N/A	N/A	N/A
CHLOROFORM	UG/KG	10	N/A	240	YES	N/A
CHLOROMETHANE	UG/KG	10	N/A	1200	YES	N/A
CIS-1,3-DICHLOROPROPENE	UG/KG	10	N/A	82	YES	N/A
DIBROMOCHLOROMETHANE	UG/KG	10	N/A	1100	YES	N/A
ETHYLBENZENE	UG/KG	10	N/A	230000	YES	N/A
METHYLENECHLORIDE	UG/KG	10	N/A	8900	YES	N/A
STYRENE	UG/KG	10	N/A	1700000	YES	N/A
TETRACHLOROETHENE	UG/KG	10	N/A	5700	YES	N/A
TOLUENE	UG/KG	10	N/A	520000	YES	N/A
TRANS-1,3-DICHLOROPROPENE	UG/KG	10	N/A	82	YES	N/A
TRICHLOROETHENE	UG/KG	10	N/A	2800	YES	N/A
VINYL ACETATE	UG/KG	10	N/A	430000	YES	N/A
VINYL CHLORIDE	UG/KG	10	N/A	22	YES	N/A
XYLENE(TOTAL)	UG/KG	10	N/A	210000	YES	N/A

TABLE B-3

COMPARISON OF PROJECT REQUIRED REPORTING LIMITS AND ANALYTE SCREENING CRITERIA FOR WATER SAMPLES
IR SITE 21 NAVAL STATION TREASURE ISLAND

Compound	Project Required Reporting Limit (µg/L)	Laboratory Low Level Reporting Limit (µg/L)	Screening Criterion (µg/L)	PRRL Below Criterion?	LLLRL Below Criterion?
VOLATILE ORGANIC COMPOUNDS					
1,1,1-Trichloroethane	2.00	2.00	6,240	Yes	Yes
1,1,2,2-Tetrachloroethane	2.00	2.00	11	Yes	Yes
1,1,2-Trichloroethane	2.00	2.00	42	NA	NA
1,1-Dichloroethane	2.00	2.00	NE	NA	NA
1,1-Dichloroethene	2.00	2.00	3.2	Yes	Yes
1,2-Dichloroethane	0.50	0.50	99	Yes	Yes
1,2-Dichloroethene, Total	2.00	2.00	NE	NA	NA
cis-1,2-Dichloroethene	2.00	2.00	44,800	Yes	Yes
trans-1,2-Dichloroethene	2.00	2.00	140,000	Yes	Yes
1,2-Dichloropropane	2.00	2.00	39	Yes	Yes
2-Butanone	2.00	2.00	NE	NA	NA
2-Hexanone	2.00	2.00	NE	NA	NA
4-Methyl-2-Pentanone	2.00	2.00	NE	NA	NA
Acetone	2.00	2.00	NE	NA	NA
Benzene	0.50	0.50	71	Yes	Yes
Bromodichloromethane	2.00	2.00	46	Yes	Yes
Bromoform	2.00	2.00	360	Yes	Yes
Bromomethane	1.00	1.00	4,000	Yes	Yes
Carbon Disulfide	2.00	2.00	NE	NA	NA
Carbon Tetrachloride	0.50	0.50	4.4	Yes	Yes
Chlorobenzene	2.00	2.00	129	Yes	Yes
Chloroethane	2.00	2.00	NE	NA	NA

TABLE B-3

COMPARISON OF PROJECT REQUIRED REPORTING LIMITS AND ANALYTE SCREENING CRITERIA FOR WATER SAMPLES IR SITE 21 NAVAL STATION TREASURE ISLAND

Compound	Project Required Reporting Limit (µg/L)	Laboratory Low Level Reporting Limit (µg/L)	Screening Criterion (µg/L)	PRRL Below Criterion?	LLLRL Below Criterion?
VOLATILE ORGANIC COMPOUNDS (Continued)					
Chloroform	2.00	2.00	470	Yes	Yes
Chloromethane	2.00	2.00	6,400	Yes	Yes
cis-1,2-Dichloropropene	0.50	0.50	NE	NA	NA
Dibromochloromethane	2.00	2.00	34	Yes	Yes
Ethylbenzene	2.00	2.00	29,000	Yes	Yes
Methylene Chloride	2.00	2.00	1,600	Yes	Yes
Styrene	2.00	2.00	NE	NA	NA
Tetrachloroethene	2.00	2.00	8.85	Yes	Yes
Toluene	2.00	2.00	5,000	Yes	Yes
trans-1,3-Dichloropropene	0.50	0.50	NE	NA	NA
Trichloroethene	2.00	2.00	81	Yes	Yes
Vinyl Acetate	2.00	2.00	NE	NA	NA
Vinyl Chloride	0.50	0.50	525	Yes	Yes
Xylene (Total)	2.00	2.00	NE	NA	NA
METHANE, ETHANE, ETHENE					
Methane	10.00	NA	NE	NA	NA
Ethane	10.00	NA	NE	NA	NA
Ethene	10.00	NA	NE	NA	NA

Notes:

NA -- Not applicable
NE -- No criterion established
µg/L -- Micrograms per liter.

Notes - Screening Criteria:
Screening criteria type are provided in "Groundwater Screening Criteria for Naval Station Treasure Island," January 16, 2001.

TABLE B-4
FIELD QUALITY CONTROL SAMPLES

IR SITE 21 NAVAL STATION TREASURE ISLAND

Sample Type	Frequency of Analysis
Source water blank	1 per source of water per sampling event
Trip blank	1 per container of samples for aqueous VOC analysis
Equipment rinsate blank	1 per sampling device, day, or type of analysis
Field duplicate	1 per 10 water samples

TABLE B-5

PRECISION AND ACCURACY GOALS FOR SW-846 METHOD 8260B AND 3810/ASTM D-3416 MODIFIED ANALYSIS

IR SITE 21 NAVAL STATION TREASURE ISLAND

Matrix Spike Compound	Water		Soil	
	% Recovery	RPD	% Recovery	RPD
Method 8260B				
1,1-Dichloroethene	61-145	14	59-172	22
Trichlorethene	71-120	14	62-137	24
Chlorobenzene	75-130	13	60-133	21
Toluene	76-125	13	59-139	21
Benzene	76-127	11	66-142	21
Method 3810/ASTM D-3416 Modified (RSK-175)				
Methane, ethane, ethene	70-130	30	NA	NA

Surrogate Compound	Water % Recovery	Soil % Recovery
Toluene-d_8	88-110	84-138
4-Bromofluorobenzene	86-115	59-113
1,2-Dichloroethane-d_4	76-114	70-121

RPD Relative percent difference

NA Not applicable

RSK Robert S. Kerr research laboratory

APPENDIX A

FIELD FORMS

CHAIN OF CUSTODY RECORD

Tetra Tech EM Inc.
10670 White Rock Road, Suite 100
Rancho Cordova, CA 95670
(916) 852-8300 FAX (916) 852-8307

DATE	CHAIN OF CUSTODY NUMBER № 2814
LABORATORY NUMBER	PAGE ____ OF ____

PROJECT NAME	PROJECT MANAGER
PROJECT NUMBER	TELEPHONE NUMBER
PROJECT LOCATION	DESTINATION LABORATORY
SAMPLER(S)	ADDRESS
SAMPLER SIGNATURE(S)	CITY STATE ZIP
SITE CONTACT/ TELEPHONE NUMBER	LABORATORY TELEPHONE NUMBER

REQUESTED ANALYSES

SAMPLE IDENTIFICATION	DATE	TIME	MATRIX TYPE	NO./TYPE OF CONTAINERS	TURN AROUND TIME											REMARKS (GRAB, COMPOSITE, ETC.)

SHIPPED VIA: AIRBILL #: _____

SPECIAL INSTRUCTIONS:

RELINQUISHED BY (SIGNATURE)	PRINT NAME/ COMPANY	DATE	TIME	RECEIVED BY (SIGNATURE)	PRINT NAME/ COMPANY	DATE	TIME
				RECEIVED AT LAB BY (PRINT AND SIGN):			

DISTRIBUTION: WHITE = LABORATORY YELLOW = PROJECT MANAGER PINK = FILE

Tetra Tech EM Inc.

EXTENDED CHAIN-OF-CUSTODY #:

(FOR SOIL BORING AND GROUNDWATER SAMPLES)

DATE: Page of

PROJECT NAME	PROJECT #
SAMPLER(S) PRINTED NAME AND SIGNATURE	SAMPLING TEAM #

THIS FORM IS FOR INTERNAL USE ONLY
DO NOT SEND TO LABORATORY
SEND TO PROJECT CHEMIST

SAMPLE I.D.	FIELD I.D.	COLLECTION DATE	SAMPLE TYPE*	POINT TYPE*	MATRIX*	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	SAMPLER'S INITIALS	SAMPLER'S COMPANY

REMARKS:

INSTRUCTIONS: Complete all columns for each row you use. Enter only the codes listed below for columns containing and asterisk (*). Enter the three initials for the field sampler who collected the sample. Draw a vertical arrow down the column if an entry row applies to additional rows in the same column. Consult the project chemist for POINT NAMES prior to beginning field activities.

SAMPLE TYPE	POINT TYPE	MATRIX	
FB = Field Blank	MW = Monitoring Well	SOIL	TISSUE
TB = Trip Blank	SB = Soil Boring	WATER	PLANTS
ER = Equipment Rinsate	TANK = Underground storage tank	SEDIMENT	
DUP = Field Duplicate	EXCV = Excavation pit	SLUDGE	
WC = Waste characterization	MHSD = Storm drain manhole	AIR	
Real = Real Sample	MHSS = Sanitary sewer manhole	SOIL GAS	
(Note: For samples collected in triplicate for MS/MSD, place "Real/MS/MSD" in Sample Type)	MHI = Industrial waste manhole	PRODUCT	
	QC = QC sample		

TETRA TECH EM INC. DAILY QUALITY CONTROL REPORT		
NAVAL STATION TREASURE ISLAND SITE 21	DATE:	TEMPERATURE:
	DAY:	WIND:
	WEATHER:	HUMIDITY:

PROJECT: SITE 21 ADDITIONAL SOIL AND GROUNDWATER INVESTIGATION

CONTRACT NUMBER: N62474-94-D-7609 (Navy CLEAN II)

TtEMI PROJECT NUMBER: G0069-200BXXXX

SUBCONTRACTORS ON SITE:

PERSONNEL ON SITE:
From TtEMI:

EQUIPMENT ON SITE:

WORK PERFORMED (INCLUDING SAMPLING):

QUALITY CONTROL ACTIVITIES:
HEALTH AND SAFETY LEVELS AND ACTIVITIES:
PROBLEMS ENCOUNTERED/CORRECTIVE ACTION TAKEN:
DEVIATIONS FROM FIELD WORK PLAN:
SPECIAL NOTES:
TOMORROW'S EXPECTATIONS:
DISTRIBUTION: SUBMITTED BY:
Date:

APPENDIX B

ENCORE SAMPLER INSTRUCTIONS

Field Soil Sampling With EnCore™ Sampler for VOC Analysis

EnCore™ Sampler

The EnCore™ sampler system is a dedicated system designed to collect, store, and deliver approximately 5 or 35 gm of a soil sample in a zero headspace container. No chemicals for preservation are typically needed in the field. Extrusion and extraction of the whole sample in the core is done in the laboratory. No sub-sampling of the individual container is necessary. The EnCore™ sampling device was accepted in SW-846, 3rd update, and has been tested to deliver reliable data.

The Encore sampler is a single use device. It cannot be cleaned or re-used. It comes in two sizes for samples aliquots of 5 or 25 grams.

There are four components to the EnCore™ system:

1. Cartridge with moveable plunger
2. A cap with 2 locking arms
3. A T-handle to aid in sampling
4. An extrusion handle used in the laboratory

The soil collected by the sampler is stored in a sealed, headspace-free state. Three Viton o-rings achieve the seals; two located on the plunger and one on the cap of the sampler. At no time should these o-rings be removed or disturbed.

Soil Sampling with EnCore™ Samplers

Before taking the sample:

1. Hold coring body and push plunger rod down until small rod rests against tabs. This will ensure that the plunger moves freely.
2. Depress locking lever on EnCore™ T-handle. Place coring body, plunger end first, into the open end of the T-handle, aligning the two slots on the coring body with the two locking pins in the T-handle. Twist coring body clockwise to lock pins in the slot. Check to ensure sampler is locked in place. Sampler is now ready for use.

Taking the sample:

Turn T-handle with the "T" up and the coring body down. This positions the plunger body flush with the bottom of the coring body. Using the T-handle, push and twist the sampler into the soil until the coring body is completely full. When the EnCore™ sampler is full, the small o-ring on the plunger rod will be centered in the T-handle viewing hole (the upper hole for the 25g sampler and the lower hole for the 5g sampler). Remove the sampler from the soil. Before capping the sampler, wipe excess soil from

the coring body exterior, ridge area, and any soil that may protrude beyond the opening end of the coring body to ensure proper sealing. Cap the coring body while it is still on the T-handle. Continue as above until three samples are collected from the location. If only VOCs are to be analyzed for a given location, another 2oz. Jar of sample is required to allow for moisture content analysis.

(Note: The EnCore™ sampling system cannot be reliably used as stated above to sample sand, loose soil, or sediment since a cohesive plug will not be formed with these materials. Pull the plunger all the way back and lock it. Turn the sampler upside down and scoop the material into the coring body and cap it. Make a note of this method deviation in the field notebook.)

Surface Soil

Apply EnCore™ sampler to a freshly exposed soil surface and collect samples immediately as described above.

Deep Soil

EnCore™ samples must be sub-sampled from one of the open ends of a sleeve core, taken at the desirable depth as soon as it is brought to the surface, using the procedures described above.

Samples should be shipped to the laboratory immediately.

Sample shipment, preservation, and holding time:

Place the three co-located samples into one zipper bag. Seal the bag and place in a pre-chilled cooler maintained at 4°C and ship to the laboratory immediately for preservation and analysis.

The recommended holding time between sampling and preservation by the laboratory is 48 hours. The recommended holding time between preservation and analysis is 14 days.

The laboratory will preserve 2 aliquots of sample using sodium bisulfate and one aliquot of sample using methanol. This allows for both low-level and high-level analysis of the sample.

ATTACHMENT

ATTACHMENT 1

RESPONSE TO COMMENTS ON THE DRAFT FIELD SAMPLING PLAN AND QUALITY ASSURANCE PROJECT PLAN

RESPONSE TO COMMENTS ON THE DRAFT FIELD SAMPLING PLAN (FSP) AND QUALITY ASSURANCE PROJECT PLAN (QAPP), ADDITIONAL INVESTIGATION OF ONSHORE INSTALLATION RESTORATION SITE 21, VESSEL WASTE OIL RECOVERY AREA, DATED FEBRUARY 26, 2001
NAVAL STATION TREASURE ISLAND, SAN FRANCISCO

This document presents the Navy's responses to comments from 1) the California Regional Water Quality Control Board (RWQCB), 2) the City of San Francisco (submitted by Geomatrix Consultants), and 3) Ms. Dale Smith RAB member, on the *Draft Field Sampling Plan (FSP) and Draft Quality Assurance Project Plan (QAPP), Additional Investigation of Onshore Installation Restoration Site 21, Vessel Waste Oil Recovery Area, Naval Station Treasure Island, San Francisco,* dated February 26, 2001, and prepared by Tetra Tech EM Inc. (TtEMI). The RWQCB comments were received on April 5, 2001 via electronic mail. The City of San Francisco comments were received on April 11, 2001 via electronic mail and the comments from Ms. Dale Smith were received on April 17, 2001 via electronic mail.

RESPONSES TO RWQCB COMMENTS

The following comments were received from the California Regional Water Quality Control Board (RWQCB) Associate Engineering Geologist, Ms. Sarah Raker, on April 5, 2001.

Specific Comments

1a. **Comment:** **Identify data gaps from previous soil and groundwater investigations that are needed to further evaluate the extent of TPH around the former oil recovery system and VOCs in groundwater downgradient from the suspected source areas (the former dip tank). As stated in the Draft Final RI, the primary objective of the RI at Site 21 is to assess the nature and extent of petroleum hydrocarbon contamination around the oil recovery system and the chlorinated solvent contamination near the pipeline and Building 3. The draft FSP and QAPP should be updated to address these objectives by providing rationale for the additional data needed to fill the data gaps.**

Response: The purpose of the proposed additional investigation at Site 21 is to complete a focused field effort to delineate volatile organic compound (VOC) contamination associated with the suspected source of the contamination (the former dip tank) and to delineate the extent of contamination. No data gaps have been identified for TPH. The FSP was developed and presents background information essential to the understanding of the proposed tasks. Contaminant concentration and monitored natural attenuation data will be collected in order to provide information for use in evaluating remedial alternatives.

1b. Comment: **The following additional items should be provided: Summarize the status of the pipeline investigation conducted at Site 21 since the RI was conducted in 1995. Include a description of the fuel pipeline removal and abandonment, results of soil and groundwater samples collected for the pipeline investigation, and rationale why no further investigation of TPH at Site 21 is needed.**

Response: The purpose of this additional investigation is to focus on the VOC contamination. The pipeline investigation conducted under the petroleum program is summarized in the RI Report and the CAP pipeline work plan. All groundwater samples collected during the pipeline investigation within Site 21 contained less than the groundwater criteria of 1.4 milligrams per liter (mg/L) of total petroleum hydrocarbons, therefore, no further investigation of petroleum hydrocarbons is proposed at this time.

1c. Comment: **Describe the additional data that were obtained or reviewed since the RI was conducted that identified the former use of the dip tank near Building 3. Are historical drawings of Building 3 available to identify other possible sources of VOC inside Building 3, such as pipelines, sumps, or drainage basins?**

Response: Since the draft RI Report was completed in 1997, basewide groundwater-monitoring program data collected in 1998 and 2000 have been reviewed. The RI hydropunch data, along with the groundwater monitoring data, were used to help focus the VOC investigation. Evaluation of Site 21 data indicates that VOCs detected in groundwater originate from (or near) the area of the former dip tank location. No other VOC sources were identified inside Building 3 from the review of historical drawings for Site 21 during the RI.

1d. Comment: **Update the soil and groundwater sample location map to include the known extent of VOCs in groundwater.**

Response: Figure 1 was modified to include the current extent of VOC contamination.

1e. Comment: **The locations of the proposed upgradient monitoring wells may need to be adjusted after the extent of VOCs in soil has been delineated.**

Response: Comment noted. Well locations provided on Figure 1 are proposed only and are subject to relocation based on field data and utility clearance issues.

1f. Comment: **Based on the distribution of tetrachloroethene (PCE), trichloroethene (TCE), and 1,2-dichloroethene (1,2-DCE) detected in the shallow and intermediate groundwater, the proposed monitoring well locations should be adjusted closer to the various VOC plumes. Let's discuss the rationale for the well locations before the next draft FSP is submitted.**

Response: Monitoring well locations are proposed so that the horizontal boundaries (non-detect) of the plume can be positively identified. However, the location of the monitoring wells has been adjusted to be within the suspected plume boundary based on RWQCB's written and verbal comments. The location of the monitoring wells is shown on Figure 1.

1g. **Comment:** **Based on the current site data, it is unclear why aquifer tests are being proposed. The need to conduct aquifer tests and the number and location of tests should be evaluated after the extent of VOCs in groundwater has been delineated.**

Response: To complete groundwater natural attenuation modeling efforts, the collection of aquifer-testing data will be necessary. Wells to be used for aquifer testing will be selected after the first round of groundwater sampling is completed so that pumping tests will not impact areas of groundwater contamination. Aquifer testing rationale is provided in Section 4.3.

2a. **Comment:** **Provide additional figures to depict the site conceptual model to support the proposed additional investigation. The site conceptual model for Site 21 contained in the draft final RI is a generic flow chart showing various release mechanisms, pathways, exposure routes, and possible receptors. Please update the site-specific conceptual model on a figure to show the suspected sources of contaminants in the soil and groundwater and their possible migration to the bay.**

Response: A site conceptual model is typically not included in a FSP. The model presented in the RI report (PRC 1997) is of sufficient detail for the purposes of this investigation. Additional text was added to Section 3.0 to further describe the suspected source of contamination and potential contaminant pathways.

2b. **Comment:** **Additional figures should also include:**

Location of suspected or known buried utilities and the location of the former waste oil recovery area

Response: A figure showing proposed well locations and buried utilities has been added to Attachment 2 of the FSP.

2c. **Comment:** **Additional figures should also include:**

Water level elevations and the direction of groundwater flow

Response: Groundwater flow direction is presented in the text of the FSP. Detailed site maps showing water table elevations and contours provided in the RI Report are included in Attachment 2.

2d. **Comment:** **Additional figures should also include:**

Cross section showing shallow and deeper water bearing units and the distribution of VOCs in groundwater (see Figure 14-10 of the draft final RI)

Response: Figure 14-10 of the draft final RI report has been included in Attachment 2.

2e. Comment: **Additional figures should also include:**

Location of fuel pipeline investigation samples and results of total petroleum hydrocarbons (TPH) analyses

Response: TPH is not the subject of this investigation. The pipeline investigation conducted under the petroleum program is summarized in the RI Report and the CAP pipeline work plan.

2f. Comment: **Additional figures should also include:**

Results of previous soil and groundwater samples to indicate the known extent of VOCs at the site (see Figures 14-6 through 14-9 of the draft final RI). "Dot" maps, similar to those prepared for the Corrective Action Plan (CAP) sites, can be used to show the extent of TPH and VOCs at various concentration ranges.

Response: Concentration maps of all VOC data (from the RI report) were reviewed during the evaluation and placement of proposed sampling locations. No "Dot" maps are currently available for the VOC data. The proposed fieldwork is focused on soil sampling locations near an assumed source area and defining the horizontal extent of VOC contamination in groundwater.

3. Comment: **The data quality objectives (DQOs) for this additional investigation are not consistent with the stated purpose of the investigation. The purpose of the additional investigation is 1) to locate and better define the suspected source of VOCs near the former dip tank and 2) to evaluate the magnitude and extent of volatile organic compounds (VOCs) in groundwater. The assessment of whether these contaminants pose risk to ecological or human receptors or whether a removal action is needed at Site 21 will be made after this additional investigation is completed. Please refer to the DQOs presented in the FSP and QAPP for the additional investigation proposed at Site 24 for an example.**

Response: The text of the FSP has been revised to better address the purpose of the additional investigation. The text in Section 2.0 has been revised and includes the following: 1) conduct additional field investigation at Site 21 to locate and better define the suspected source of VOCs in the area of the former dip tank, 2) evaluate the magnitude and extent of VOCs in groundwater, and 3) evaluate the occurrence of natural attenuation.

The Navy agrees that the assessment of whether these contaminants pose risk to human receptors or whether a removal action is needed at Site 21 will be made after this investigation is complete. However, the Navy believes that these points are important to help establish sampling locations and protocol and should remain in the DQO text.

RESPONSES TO GEOMATRIX CONSULTANTS COMMENTS

The following comments were received from Peggy Peischel of Geomatrix Consultants on April 11, 2001. Geomatrix Consultants for the City of San Francisco submitted the comments.

General Comment

Comment: **The redevelopment plans and schedule for Site 21 should be compared with the likely investigation and remediation activities and timeframe to identify potential conflicts. The City would like to meet with the Navy to discuss the duration of the planned investigations and remediation within context of the City's redevelopment plans.**

Response: The current schedule calls for the initial round of fieldwork at Site 21 to be performed during the summer of 2001 (completed by September). Subsequent quarterly sampling rounds would be completed by May 2002. The RI Report is currently scheduled for completion in June 2002.

Comments on the Draft Field Sampling Plan (FSP)

1. **Comment:** **Section 2.0: Stated objectives do not match those presented in the draft QAPP.**

   Response: The text has been modified so that the stated objectives match in both documents.

2. **Comment:** **Section 4.1: Since groundwater may be present at about 6 feet below ground surface (bgs), the FSP should clarify that the proposed 4-6 foot depth and 6-8 foot depth samples will be adjusted upwards so both are collected above the water table. We suggest that the six initial boring locations be shown on Figure 1, along with an indication of potential subsequent step-out locations. Other investigative methods, such as a soil gas investigation, may also be a cost-effective alternative to the collection of soil samples.**

   Response: Comment noted. As stated in the text (Section 4.1) all soil samples will be collected above the water table. The text has been clarified to state that sample intervals will be adjusted as necessary to ensure that samples are collected above the water table.

   Although soil gas investigations are a cost-effective alternative to soil sampling, the proposed soil samples are targeted in a well-defined area suspected of being the source of VOC contamination.

3. **Comment:** **Sections 4.1.1: The draft FSP references a soil sampling standard operation procedure (SOP No. 005, included in Appendix A). This SOP does not include or reference procedures for the EnCore sampler. The SOP should be updated—it specifies that VOA vials should be filled directly from the split-spoon sampler or tube sampler in the field.**

Response: Directions for the collection of soil samples using the EnCore sampler has been added to Section 4.1.1 of the FSP in order to update the existing standard operating procedure (SOP). Complete EnCore sampling directions are included in Attachment 2.

4. **Comment:** **Section 4.2: The purpose of some of the proposed wells is unclear. Specific rationale for the placement of each proposed well should be added to the FSP.**

Response: Table 4-3 has been added to the FSP that details the placement and rationale for each proposed well. A copy of the table has been attached to these responses to comments.

5. **Comment:** **Section 4.2.1: One intermediate-depth well is proposed within area of the former dip tank, a suspected source area for VOC contamination. An option to install surface conductor casing through the shallow groundwater zone, depending on field observations during drilling, should be considered for the FSP.**

Response: The intermediate-depth well proposed immediately downgradient of the former dip tank area will be installed within the same water-bearing zone as the adjacent shallow well and will not penetrate any confining units. The well will be installed through a large bore Geoprobe drive pipe that effectively seals off all potential contamination from potentially contaminated shallow zones above the proposed screened interval. As the well is constructed within the drive pipe, a bentonite seal will be installed above the filter pack of the screened interval.

6. **Comment:** **Section 4.2.3: Numerous groundwater-monitoring wells are present in this area of Treasure Island. Therefore, the "11 existing monitoring wells" referenced in the third paragraph of this section should be specifically listed for clarification.**

Response: The text has been modified to state that 11 of the 12 existing monitoring wells (well 21MW-07A2 not included) will be sampled. All 12 of the existing wells are presented in Figure 1.

7. **Comment:** **Section 4.3: The FSP should identify which two wells will have pumping tests and which nine wells will have slug tests. An apparent inconsistency should be resolved—this section specifies that slug tests will be performed on nine wells, instead of the seven wells referenced in Section 4.3.2.**

Response: Slug tests will be completed on nine wells and pumping tests will be completed on two additional wells for a total of eleven aquifer tests. Wells to be tested by pumping will be chosen based on discharge rates noted during groundwater sampling activities. Additionally, areas of obvious groundwater contamination noted during sampling will be avoided. No changes were made to the text.

8. **Comment:** **Sections 4.3.1 and 4.3.2: The selected observation wells should also be identified.**

Response: See response to comment 7. Pumping wells and observation wells will be identified at the completion of groundwater sampling activities.

9. **Comment:** **Section 4.3.2: Reliable information from a slug test is greatly dependent on well construction and test procedures. Has each well been evaluated to determine whether the construction is suitable for a slug test? For instance, meaningful slug test results are dependent on low borehole storage capacity and the well screen being submerged below the groundwater level. How many cycles of slug placement, removal and recovery will be performed? Typically three cycles are performed on each well to reduce variability in results.**

We strongly recommend that transducers be used on <u>all</u> wells, especially on the faster recharging wells. Using a well probe and stopwatch for fast recovery wells is likely to result in missed data during the early part of recovery.

Response: Existing wells have been evaluated for aquifer testing. Slug test and pumping test results from the existing wells at Site 21 will provide sufficient data for use in evaluating the hydrogeologic environment at the site. The number of times a slug test will be repeated per monitoring well will depend upon the recovery time of the tested well and the assessment of the data as it is obtained during the test.

Transducers and a data logger will be used to collect data during the pumping tests. However, the slug test data will be recorded with a well probe and stopwatch. The Navy agrees that early time data are difficult to collect in small-diameter wells. A transducer cable installed in a 2.0-inch diameter well with a 1.5-inch diameter slug typically moves upward when the slug is removed providing a loss of early time data. However, early time data usually represents drainage from the borehole and is typically ignored during data evaluation.

10. **Comment:** **Section 5.0: Table 5-1 is missing from the draft FSP**

Response: Table 5-1 was inadvertently omitted from some of the draft FSP copies. Table 5-1 is attached to these responses to comments and will be included in the final FSP.

11. **Comment:** **Section 5.6: Consistent with the draft QAPP, the source water blank should be analyzed for the same parameters as the soil samples <u>and</u> the groundwater samples, not just for VOCs.**

Response: Source water blanks will be analyzed for contaminants (VOCs) and for monitored natural attenuation (MNA) parameters. The text and Table 5-1 has been modified.

12. **Comment:** **Table 4-2: An apparent inconsistency should be resolved—the hold time for nitrate/nitrite is shown as 14 days in Table 4-2 and as 48 hours in Table 4-3. (Note: Table 4-3 has been renumbered Table 4-4 in the Final FSP).**

Response: The hold time for preserved nitrate/nitrite is 14 days and for unpreserved nitrate/nitrite is 48 hours. Both hold times (preserved and unpreserved) were added to both tables to clarify the existing inconsistency.

13. **Comment:** **Table 4-2: It would be helpful if the major anions were listed, perhaps in a footnote to the table.**

Response: Comment noted. The major anions were added as a footnote to Table 4-2.

<u>Comments on the Draft Quality Assurance Project Plan (QAPP)</u>

1. **Comment:** **Section A1.4.2 and Table A-2: The decision point for groundwater appears to be based solely on the evaluation of data from existing wells to determine whether or not "sampling at additional locations is necessary". This is inconsistent with the draft FSP, which begins with the installation of new groundwater monitoring wells. The draft FSP appears to already assume that existing monitoring well data are inadequate and then proposes additional sampling locations.**

Response: The QAPP text in Section A1.4.2 and Table A-2 refers to all wells (existing and proposed) as if they are already present. Therefore, the decision point is based on the evaluation to be performed after the installation and sampling of the new wells. Section A1.4.2 has been modified to clarify this point.

2. **Comment:** **Section A1.4.5 and Table A-2: Generally, the same comment as for Section A1.4.2 above. An alternative action resulting from the groundwater contamination "if . . . then" statement already appears to have been selected and presented in the draft FSP**

Response: Please see response to comment 1.

3. **Comment:** **Section A1.4.5: The natural attenuation decision rule relies on VOC concentrations "decreasing through time at a favorable rate". The expected or acceptable time period and rate of decrease, or other appropriate measure of effectiveness, should be included in the decision rule.**

Response: At this time, acceptable natural VOC degradation rates have not been established. Following completion of the additional investigation, review of data, and evaluation of the hydrogeologic conditions to conclude if conditions are favorable for MNA, the Navy (in conjunction with other Base Closure Team members) will make a decision regarding the acceptability of the reported natural VOC degradation rates.

RESPONSES TO MS. DALE SMITH (RAB MEMBER) COMMENTS

The following comments were received via electronic mail from Paul Rosenfeld on April 17, 2001. The comments were submitted by RAB member Ms. Dale Smith.

1. **Comment:** **The rationale for utilizing natural attenuation as the preferred remediation procedure does not appear to have been discussed in this document. Why was it chosen?**

   Response: At this time, natural attenuation has not been chosen as the preferred remediation procedure at Site 21. Review of groundwater data collected during previous sampling events at Site 21 indicates that natural attenuation may be occurring. The investigation proposed in the FSP calls for collecting additional natural attenuation data that will verify if natural attenuation is a viable site closure alternative.

2. **Comment:** **Was there not a COC plume cross-section map developed for this area in the past? Has it been updated and why was it not included?**

   Response: A contaminant of concern (COC) plume cross-section map was developed for the RI report. VOC concentration maps were updated in the 1999 groundwater status report (TtEMI 1999). The figures have been included in Attachment 2 of the FSP.

REFERENCES

PRC. 1997. "Draft Final Onshore RI Report, NAVSTA TI, California." Prepared for the Department of the Navy, Western Division. Naval Facilities Engineering Command, San Bruno, California. September.

Tetra Tech EM Inc (TtEMI). 1999. "Groundwater Status Report, Summary of Groundwater Monitoring from January to November 1998, Naval Station Treasure Island, San Francisco, California." May 7.