

**COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN II)**  
Northern and Central California, Nevada, and Utah  
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**Prepared For**

**DEPARTMENT OF THE NAVY**  
Engineering Field Activity West  
Naval Facilities Engineering Command  
900 Commodore Drive  
San Bruno, California

**ECOLOGICAL RISK ASSESSMENT**  
**QUALITY ASSURANCE PROJECT PLAN**

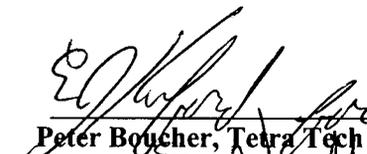
**FINAL**

**WEST BEACH LANDFILL, WEST BEACH**  
**LANDFILL WETLAND, AND RUNWAY WETLAND**  
**ALAMEDA POINT, ALAMEDA, CALIFORNIA**

**April 23, 1999**

**Prepared By**

**Tetra Tech EM Inc.**  
**10670 White Rock Road, Suite 100**  
**Rancho Cordova, CA 95670**  
**(916) 852-8330**

  
\_\_\_\_\_  
**Peter Boucher, Tetra Tech EM Inc. Project Manager**

  
\_\_\_\_\_  
**Ronald Riesing, Tetra Tech EM Inc. Quality Assurance Program Manager**

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## ABBREVIATIONS AND ACRONYMS

AWQC	Ambient water quality criteria
BERC	Berkeley Environmental Restoration Center
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLEAN II	Comprehensive Long-Term Environmental Action Navy II
CLP	Contract laboratory program
COC	Chain of custody
COPEC	Chemical of potential ecological concern
CRQL	Contract-required quantitation limit
CTO	Contract task order
CVAA	Cold-vapor atomic absorption spectroscopy
DQO	Data quality objective
EDD	Electronic data deliverable
EFA WEST	Naval Facilities Engineering Command, Engineering Field Activity West
EPA	U.S. Environmental Protection Agency
ERA	Ecological risk assessment
FOD	Frequency of detection
FTL	Field team leader
GC	Gas chromatograph
GC/MS	Gas chromatography/mass spectroscopy
GFAA	Graphite-furnace atomic absorption spectroscopy
GPC	Gel permeation chromatography
HQ	Hazard quotient
HSP	Health and Safety Plan
ICP	Inductive coupled plasma atomic emission spectroscopy
IR	Installation Restoration
LCS	Laboratory control sample
MS	Matrix spike
MSD	Matrix spike duplicate
NA	Not applicable
NAS	Naval Air Station
Navy	Department of the Navy
NOAA	National Oceanic and Atmospheric Administration
OCP	Organochlorine pesticide
OU	Operable unit
PAH	Polynuclear aromatic hydrocarbon
PARCC	Precision, accuracy, representativeness, completeness, and comparability
PCB	Polychlorinated biphenyl
PRC	PRC Environmental Management, Inc.
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
QCSR	Quality Control Summary Report
QMP	Quality Management Plan
RI	Remedial investigation
RPD	Relative percent difference
RPM	Remedial project manager

## ABBREVIATIONS AND ACRONYMS (Continued)

RW	Runway Wetland
RWQCB	Regional Water Quality Control Board
SDG	Sample delivery group
SIM	Selective ion monitoring
SOP	Standard Operating Procedure
SOW	Statement of work
SVOC	Semivolatile organic compound
TAL	Target analyte list
TRV	Toxicity reference value
TtEMI	Tetra Tech EM Inc.
WBL	West Beach Landfill
WBLW	West Beach Landfill Wetland
WESTDIV	Western Division Naval Engineering Facilities Command
WP/FSAP	Work Plan and Field Sampling and Analysis Plan

## 1.0 INTRODUCTION

The Department of the Navy (Navy), Naval Facilities Engineering Command, Engineering Field Activity West (EFA WEST) is conducting a remedial investigation (RI) at Alameda Point in Alameda, California. As part of the investigation, EFA WEST has authorized Tetra Tech EM Inc. (TtEMI), formerly PRC Environmental Management, Inc. (PRC), to develop ecological risk assessments (ERA) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62474-94-D-7609 (CLEAN II), Contract Task Order (CTO) No. 124, Modification 02. In partial fulfillment of this task order, TtEMI prepared the *Ecological Risk Assessment Work Plan and Field Sampling and Analysis Plan* for West Beach Landfill, West Beach Landfill Wetland, and Runway Wetland (TtEMI 1998a), hereinafter referred to as the *WP/FSAP* (TtEMI 1998a), which addresses Installation Restoration (IR) Site 2 and adjacent wetland areas of Operable Unit (OU) 2 of the former Naval Air Station (NAS) Alameda. This Ecological Risk Assessment Quality Assurance Project Plan, hereinafter referred to as the QAPP, along with the *Health and Safety Plan (HSP) Addendum* (TtEMI 1998b), hereinafter referred to as the *HSP Addendum*, are being submitted as companion documents to the *WP/FSAP* (TtEMI 1998a).

The *WP/FSAP* (TtEMI 1998a) describes sampling proposed for the following three areas within OU 2: IR Site 2, which is known as the West Beach Landfill (WBL); the West Beach Landfill Wetland (WBLW), which is adjacent to WBL; and the Runway Wetland (RW), which is geographically separated from the latter areas, but is considered to be ecologically contiguous. The sampling effort will include the collection of tissue samples from plants, aquatic invertebrates, and small mammals that serve as food sources for site ecological receptors. Tissue samples will be analyzed for various chemical parameters. Results of the sampling and analysis effort will be used to quantify chemical exposures for site-specific representative receptors evaluated as part of a baseline ERA, which will be documented in the OU 2 RI report. The *WP/FSAP* (TtEMI 1998a) proposed the collection of additional data in support of the ERA process being conducted at the subject sites.

This QAPP presents the quality assurance and quality control (QA/QC) procedures to be implemented during the field sampling and analyses and is organized as follows. Section 1.0 presents an introduction to the QAPP, including a description of the organization of the document. Section 2.0 presents the project management and personnel responsibilities. Section 3.0 outlines the quality objectives and criteria for measurement data including the project data quality objectives (DQO), data types and uses, quantitation limits, and data quality indicators. In Section 4.0, sampling procedures, documentation, and

records are discussed. Section 5.0 presents information on the analytical methodology for analyses. Section 6.0 discusses field and laboratory QC requirements, including requirements for testing, inspection, and maintenance of instrumentation and equipment. Section 7.0 presents data acquisition requirements, field and laboratory data management procedures, and criteria for data validation and usability. Section 8.0 addresses preventative maintenance procedures. Section 9.0 addresses assessment and oversight pertaining to evaluation and audits, appropriate response actions, and reports to management. Section 10.0 provides references for literature sources cited in this QAPP. Tables cited in the main body of text are included after Section 10.0.

## **2.0 PROJECT ORGANIZATION**

This section discusses the organizational structure for project management with the roles and responsibilities of each project team member. The project will be staffed by a team with the experience and training necessary to maintain consistent quality throughout the project. The project team for the field sampling and analysis activities comprises the following personnel:

- Ronald Yee, Navy remedial project manager (RPM)
- Steve Edde, Navy base realignment and closure environmental coordinator
- Gilbert Rivera, Navy QA officer
- Daniel Chow, TtEMI CLEAN II program manager
- Peter Boucher, TtEMI project manager and field team leader (FTL)
- Ron Reising, TtEMI QA program manager
- Ron Ohta, TtEMI project QA officer
- Conrad Sherman, TtEMI health and safety program manager
- Leslie Neudert, TtEMI project health and safety coordinator and on-site safety officer
- John Lane, TtEMI analytical coordinator

### **2.1 RESPONSIBILITIES**

The specific responsibilities of the team members listed previously are described in the following subsections.

#### **2.1.1 Navy Remedial Project Manager**

The Navy RPM is responsible for the following:

- Providing site information and history
- Providing logistical assistance
- Specifying sites requiring investigation
- Reviewing results and recommendations and providing management and technical oversight
- Ensuring proper review and distribution of documents
- Communicating comments from technical reviewers to contractors
- Ensuring that contractors address comments and take appropriate corrective actions
- Coordinating with regulatory agencies

### **2.1.2 Navy Base Realignment and Closure Environmental Coordinator**

The Navy base realignment and closure environmental coordinator is responsible for the following activities:

- Conduct reviews of the environmental cleanup programs
- Contact the appropriate agencies to form a base realignment and closure and cleanup team
- Implement environmental cleanup programs related to closure
- Negotiate appropriate cleanup and abatement actions
- Identify resource requirements for cleanup and abatement actions
- Act as the liaison and coordinator with appropriate installation and headquarter commanders with regard to closure-related environmental compliance matters
- Participate as a member of the community's Restoration Advisory Board
- Provide direction concerning the use of base realignment and closure environmental funds
- Propose and execute changes to existing cleanup agreements, orders, and decrees
- Provide input to the Finding of Suitability to Lease and Finding of Suitability to Transfer

- Maintain an awareness of the status of site activities and intervene as warranted to ensure that the project is completed expeditiously
- Integrate property transfer priorities into the cleanup program
- Certify that construction requested by lessee will not interfere with the environmental cleanup program

### **2.1.3 Navy Quality Assurance Officer**

The Navy QA officer is responsible for the review and approval of the QAPP and any subsequent addenda.

The Navy QA Office is responsible for the following:

- Reviewing QC documentation, audits, and technical operations, as required
- Interacting with TtEMI's QA program manager about certification of laboratories, and coordinating QA and technical staff compliance with requirements
- Providing guidance to TtEMI's QA program manager in the correction of nonconformance issues
- Making recommendations to TtEMI's QA program manager regarding QA/QC topics and corrective action
- Serving as the main Navy contact for program QA matters, and providing guidance on appropriate procedures to TtEMI's QA program manager

### **2.1.4 Tetra Tech EM Inc. Navy CLEAN II Program Manager**

The program manager is responsible for the following activities:

- Ensuring that contract requirements are met
- Providing necessary resources to the project team to ensure adequate responses to requirements of the investigation
- Maintaining consistency in procedures and work products with other task orders

- Establishing and maintaining communication between the Navy RPM, QA program manager, health and safety program manager, and project manager
- Providing technical oversight, as necessary
- Providing guidance to the TtEMI project manager as needed

### **2.1.5 Tetra Tech EM Inc. Project Manager**

The project manager is ultimately responsible for the timely completion of the project. The responsibilities of the project manager include the following:

- Assigning technical staff
- Ensuring the completion of requirements by team members
- Supervising the document control process
- Approving deliverables and associated documents before transmittal
- Establishing and maintaining communication among technical staff, program managers, QA officer, the health and safety program manager, and regulatory agencies
- Implementing programs and protocols related to the project
- Coordinating with the Navy RPM

### **2.1.6 Tetra Tech EM Inc. Field Team Leader**

The FTL is responsible for the field program. The FTL will direct on-site activities, including those of subcontractors, and will ensure that procedures described in the *WP/FSAP* are followed in the field. The FTL will be responsible for ensuring that field equipment is properly calibrated and maintained and that individual samples are properly handled and documented to allow for tracing the possession and handling of samples from collection to laboratory receipt.

### **2.1.7 Tetra Tech EM Inc. Quality Assurance Program Manager**

The QA program manager is responsible for ensuring that the field sampling activities have appropriate QA. The QA program manager reviews contract laboratory QA plans and audits field and contract laboratory reports. Other responsibilities include the following:

- Meeting regularly with the program manager, project manager, and project QA officer
- Developing and revising the QA program, as required
- Supervising the QA responsibilities of the project QA officer
- Identifying nonconformance situations to management, as required
- Providing guidance in the correction of nonconformances
- Ensuring that deliverables meet the requirements of the *CLEAN II Quality Management Plan* (PRC 1996), hereinafter referred to as the *CLEAN II QMP*
- Making recommendations to the program manager, project manager or assistant project manager, and project QA officer regarding QA/QC topics and corrective action
- Conducting field and laboratory audits to ensure that sampling and analysis activities are performed in accordance with the QAPP

### **2.1.8 Tetra Tech EM Inc. Project Quality Assurance Officer**

Responsibilities of the project QA officer include, at a minimum, the following:

- Ensuring that protocols described in the QAPP are followed
- Providing guidance or assistance and resolving problems on QA/QC topics
- Verifying that the specified data collection methods comply with QA/QC requirements and will yield data of desired quality and integrity
- Reviewing and evaluating quality-related changes to the *WP/FSAP* (TtEMI 1998a) and QAPP
- Ensuring that nonconformances are identified and appropriate corrective actions are taken. Providing assistance to the project manager with regard to corrective action and, if necessary, soliciting involvement of the program manager

- Communicating regularly with the project manager, QA program manager, and analytical coordinator to ensure the progress of the QA tasks
- Acting as the main contact for project QA matters, and providing guidance on appropriate procedures to the project manager and support personnel

#### **2.1.9 Tetra Tech EM Inc. Health and Safety Program Manager**

The health and safety program manager is responsible for the following:

- Reviewing site-specific health and safety plans
- Ensuring that the *HSP Addendum* (TtEMI 1998b) meets the requirements of the *CLEAN II Program Health and Safety Plan* (PRC 1996b), hereinafter referred to as the *CLEAN II HSP*, and the *Base-wide Health and Safety Plan, NAS Alameda, Alameda, California* (PRC 1997b), hereinafter referred to as the *Base-wide HSP*
- Providing assistance and guidance to the project health and safety coordinator, as needed
- Maintaining communication with the program manager, project manager, and project health and safety coordinator
- Performing responsibilities specified in the *HSP Addendum* (TtEMI 1998b)

#### **2.1.10 Tetra Tech EM Inc. Project Health and Safety Coordinator**

The responsibilities of the project health and safety coordinator include the following:

- Preparing site-specific *HSP Addendum* (TtEMI 1998b)
- Ensuring that the *HSP Addendum* (TtEMI 1998b) complies with federal, state, and local health and safety requirements
- Establishing and maintaining communication between the on-site safety officer, project manager, and health and safety program manager
- Verifying that site personnel adhere to the site safety requirements
- Providing guidance to the project manager and support personnel on appropriate corrective action procedures

- Performing responsibilities specified in the *CLEAN II HSP* (PRC 1995b), *Base-wide HSP* (PRC 1997b), and site-specific *HSP Addendum* (TtEMI 1998b)
- Conducting field audits to ensure field compliance with the *CLEAN II HSP* (PRC 1995b), *Base-wide HSP* (PRC 1997b), and *HSP Addendum* (TtEMI 1998b)

#### **2.1.11 Tetra Tech EM Inc. On-Site Safety Officer**

The on-site safety officer; responsible for field implementation of the *HSP Addendum* (TtEMI 1998b), 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 for the policies and provisions of the *CLEAN II HSP* (PRC 1995b), *Base-wide HSP* (PRC 1997b), and *HSP Addendum* (TtEMI 1998b). Additional responsibilities are included in the site-specific *HSP Addendum* (TtEMI 1998b).

#### **2.1.12 Tetra Tech EM Inc. Analytical Coordinator**

The responsibilities of the analytical coordinator include the following:

- Ensuring that the contract laboratory implements the requirements of the QAPP and *WP/FSAP* (TtEMI 1998a)
- Coordinating with the contract laboratory on QA/QC matters
- Reviewing contract laboratory data before release
- Coordinating data validation activities
- Providing updates to the project manager with regard to QA/QC data

## **2.2 FIELD SAMPLING PERSONNEL TRAINING REQUIREMENTS**

All field personnel scheduled for field work at Alameda Point for the work described in the *WP/FSAP* (TtEMI 1998a) will be trained in compliance with the Occupational Safety and Health Administration requirements as specified in Title 29 of the Code of Federal Regulations 1910.120, and the CLEAN

Health and Safety Program, and will be experienced in hazardous waste site work, use of personal protective equipment, and emergency response procedures. At least one field team member will be current in cardiopulmonary resuscitation and first aid training. Special precautions for handling biological specimens during small mammal trapping activities will be implemented because of potential exposure to the hantaviruses. Health and safety policies and procedures specifically addressing hantavirus risks in the field are detailed in the *HSP Addendum* (TtEMI 1998b). All field personnel assigned to the project will receive the *WP/FSAP* (TtEMI 1998a), QAPP, and *HSP Addendum* (TtEMI 1998b) before commencement of field activities. All subcontractors will receive applicable information pertaining to field activities. As specified in the *HSP Addendum* (TtEMI 1998b), field staff orientation and briefing will be held before the initiation of field activities.

### **3.0 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA**

This section presents the DQOs, the proposed data quality needs, and the data quality indicators for the data to be collected under this QAPP.

#### **3.1 DATA QUALITY OBJECTIVES**

The DQO process presented in EPA guidance (1994a) has been used in planning this sampling effort. The process can be used to ensure that the collection of data of appropriate quality can be used to address specific problems. EPA (1994a) guidance outlines the following seven steps in setting DQOs for an investigation:

- State the problem
- Identify the decision
- Identify inputs to the decision
- Define the study boundaries
- Develop a decision rule
- Specify limits on errors
- Optimize the design for obtaining data

The following subsections describe the DQO for this investigation.

### **3.1.1 Problem Statement**

Based on the screening-level ERAs presented in Section 2.0 of the *WP/FSAP* (TtEMI 1998a), specific contaminants in surface soil and the rhizosphere (defined as 0 to 6 feet below ground surface) at WBL may pose risks to omnivorous small mammals and raptors. Chemicals of potential ecological concern (COPEC) in various media (for example, surface soil, the rhizosphere, sediment, and surface water) at WBL, WBLW, and RW may pose risks to terrestrial avian and mammalian species. These species represent several feeding guilds within the ecosystem and may be exposed in emergent wetland habitat and/or upland habitat at WBL, WBLW, and RW. The COPECs also may pose risks to the benthic invertebrate community in the ponds and to the pickleweed community, an important component of the emergent wetland habitat. Lastly, a subset of the COPECs in groundwater from WBL and WBLW may pose risks to marine organisms based on the potential for groundwater to migrate to the San Francisco Bay.

### **3.1.2 Identification of Decisions to be Supported**

The problem stated in Section 3.1.1 translates into several specific risk questions which the proposed field sampling and analyses intend to support. Table 10 of the *WP/FSAP* (TtEMI 1998a) provides additional documentation for the risk questions delineated below. Because the screening-level ERA for WBL relied on extensive modeling and the use of literature-derived values for the majority of exposure parameters, the first two questions presented in the following text require resolution before the remaining questions can be appropriately resolved.

1. Are COPECs in soil at WBL present in food items ingested by the representative receptors, which were evaluated in the screening-level ERA?
2. If those COPECs are in food items at WBL, are they present at concentrations sufficient to elicit adverse effects in omnivorous small mammals and raptors at WBL, as evaluated in the conservative screening-level ERA?
3. Are COPECs in media of concern at WBL, WBLW, and RW present at concentrations sufficient to elicit adverse effects in probing shorebirds, waterfowl, wading birds, passerines, raptors, and/or omnivorous mammalian predators, as evaluated in a quantitative baseline ERA?

SECTION 3.1.3 – INPUTS TO THE DECISION

FINAL  
ECOLOGICAL RISK ASSESSMENT  
QUALITY ASSURANCE PROJECT PLAN  
WEST BEACH LANDFILL, WEST BEACH LANDFILL  
WETLAND, AND RUNWAY WETLAND

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**DIANE C. SILVA**  
**RECORDS MANAGEMENT SPECIALIST**  
**NAVAL FACILITIES ENGINEERING COMMAND**  
**SOUTHWEST**  
**1220 PACIFIC HIGHWAY**  
**SAN DIEGO, CA 92132**

**TELEPHONE: (619) 532-3676**

SECTION 3.1.4 – DEFINITION OF STUDY  
BOUNDARIES

FINAL  
ECOLOGICAL RISK ASSESSMENT  
QUALITY ASSURANCE PROJECT PLAN  
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**DIANE C. SILVA**  
**RECORDS MANAGEMENT SPECIALIST**  
**NAVAL FACILITIES ENGINEERING COMMAND**  
**SOUTHWEST**  
**1220 PACIFIC HIGHWAY**  
**SAN DIEGO, CA 92132**

**TELEPHONE: (619) 532-3676**

- Sampling matrix (for example, tissue residues for terrestrial, emergent wetland and submersed vegetation; soft-bodied invertebrates; fishes; small mammals)
- Preferred species for collection (for example, pickleweed for perennial emergent wetland vegetation and house mice for small mammals), the location of their preferred food sources, and their level of mobility
- Location of known contaminant sources and elevated concentrations of surface contaminants
- Potential for correlation with data collected from previous sample locations, including Berkeley Environmental Restoration Center (BERC) sediment sampling locations
- Necessary amount of data to increase statistical confidence during the baseline ERA

### 3.1.5 Decision Rules

Data to be collected include residue concentrations for metals, polynuclear aromatic hydrocarbons (PAH), organochlorine pesticides (OCP) and polychlorinated biphenyls (PCB), and organotins in tissue samples obtained from ruderal upland, emergent wetland, and submersed vegetation; aquatic invertebrates; fishes; and small mammals. The data generated from the field sampling and analyses will be used in combination with existing data in a weight-of-evidence approach to the baseline ERA. The study design for the baseline ERA is presented in Section 3.3 of the *WP/FSAP* (TtEMI 1998a).

Examples of the decision rules that will be used to resolve the risk questions are subsequently presented; they are following the questions that were previously presented in Section 3.1.2.

1. Are COPECs in soil at WBL present in food items ingested by the representative receptors, evaluated in the screening-level ERA?

If a chemical is detected in ruderal upland vegetation and/or small mammal tissue, the chemical will be further considered in the COPEC selection process. COPEC selection criteria include, but are not limited to frequency of detection (FOD), range and central tendency of concentration, bioaccumulation and biomagnification potential, other fate and transport characteristics, and toxicity.

2. If those COPECs are in food items at WBL, do the empirical data validate the risk estimates for omnivorous small mammals and raptors at WBL, as initially evaluated in the conservative screening-level ERA?

If a COPEC-specific hazard quotient (HQ) for the California ground squirrel and/or red-tailed hawk (based on the use of empirical residue data, screening-level ERA algorithms for WBL, and literature-derived toxicity reference values [TRV] [PRC 1997a]) is within the same order of magnitude as the original HQ estimate, then a higher level of confidence will be associated with the screening-level ERA model. Regardless, potential

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If bioassay data indicate chemical toxicity, then potential confounding factors (for example, grain size, organic content, and the use of standard laboratory organisms that are not present at the wetlands) will be evaluated.

7. Are COPECs in groundwater entering the San Francisco Bay and, if so, are they present at concentrations sufficient to elicit adverse effects in marine organisms?

If a COPEC-specific representative concentration in groundwater entering San Francisco Bay exceeds marine AWQC for chronic exposure, then potential risks to marine organisms associated with that COPEC will be further evaluated.

If a COPEC-specific representative concentration in the sediment pore water and/or at the sediment-surface water interface exceeds a literature value for effects in marine receptors (polychaetes, bivalves, and amphipods, with emphasis on species that occur in San Francisco Bay), then potential risks to marine organisms associated with that COPEC will be further evaluated.

### **3.1.6 Limits on Decision Error**

Because of the use of multiple lines of evidence or decision rules, which will be considered in a weight of evidence approach to the baseline ERA, a single error rate has not been assigned for the decisions. Generally, the intent will be to minimize the probability of making either false positive or false negative types of errors. Measurement objectives for precision, accuracy, representativeness, completeness, and comparability (PARCC) are discussed in Section 3.3.

### **3.1.7 Design Optimization**

Design optimization, as used in this section, primarily pertains to the design of the field sampling and analyses, but also pertains to the study design for the baseline ERA (see Section 3.0 of the *WP/FSAP* [TtEMI 1998a]). The field sampling and analysis design presented in Section 4.0 of the *WP/FSAP* was developed in consideration of a relatively large amount of site-specific data gathered during more than a dozen site visits ranging over several years. Previous site visits, delineated in Section 1.3 of the *WP/FSAP*, have resulted in the characterization of the types and distribution of habitats and associated plant, avian, and mammalian species at WBL, WBLW, and RW. The magnitude and distribution of chemicals within several media at all three areas have been characterized based on multiple field sampling efforts. Both spatial and temporal distributions of the previously listed characteristics (that is, habitats, species, and chemicals) have been observed. The field sampling design has taken into account

several other considerations, including intended data use, statistical confidence requirements, and sampling feasibility. Furthermore, the objectives of and approach to the field sampling and analyses were discussed during the March 16, 1998, meeting between the Navy and representatives of the regulatory agencies. It is anticipated that the comment and response process associated with the finalization of this draft QAPP and the draft *WP/FSAP* (TtEMI 1998a) and *HSP Addendum* (TtEMI 1998b) will result in optimization of the study design.

### **3.2 DATA QUALITY NEEDS**

Subsections 3.2.1 through 3.2.3 summarize the contaminants, definitive data, and appropriate analytical quantitation limits associated with the data needs for the project.

#### **3.2.1 Identification of Site Contaminants**

The COPECs in each applicable media of concern at each subject area have been identified and are presented in Tables 1 through 3, 6, and 7 of the *WP/FSAP* (TtEMI 1998a). In consideration of those COPECs and the results of the screening-level ERAs presented in Section 2.0 of the *WP/FSAP* (TtEMI 1998a), site contaminants of concern include metals, polynuclear aromatic hydrocarbons (PAHs), organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs), and organotins.

#### **3.2.2 Definitive Data**

Data generated under this field investigation will be subject to formal QC checks to support RI, remedial action, and risk assessment activities. All analytical data collected will be generated in accordance with Naval Facilities Engineering Support Center Level D QC protocols (equivalent to EPA definitive data). Definitive data, as defined by the *Guidance for the Data Quality Objectives Process for Superfund* (EPA 1994a) are data generated at the site or off-site in analytical laboratories using rigorous analytical methods, such as approved EPA reference methods. Samples selected for definitive data will be analyzed by Navy-approved, California-certified laboratories, following procedures specified in the *Statement of Work (SOW) for Analytical Laboratories* (PRC 1995a), hereinafter referred to as the *SOW for Analytical Laboratories*. Data are analyte-specific, with confirmation of analyte identity and concentration, and determination of analytical or total error. Methods will produce tangible raw data in

the form of paper printouts or computer-generated electronic files. QA/QC elements required for definitive data include the following:

- Sample documentation (such as location, date and time collected, and batch)
- Chain of custody (COC) (when appropriate)
- Sampling design approach (for example, systematic, simple or stratified random, or judgmental)
- Initial and continuing calibration
- Determination and documentation of quantitation limits
- Analyte identification
- Analyte qualification
- QC blanks (trip, method, and rinsate), as applicable
- Matrix spike (MS) recoveries, as applicable
- Performance evaluation samples (when specified)
- Matrix duplicate

### **3.2.3 Levels of Concern and Analytical Quantitation Limits**

The instrument detection limit is the minimum concentration of an analyte that can be distinguished from the normal random electronic "noise" of an analytical instrument. The quantitation limit is the lowest concentration at which an analyte can be accurately and reproducibly quantified. Quantitation limits will vary depending on the analyte, instrument sensitivity, and sample matrix effects. Usually, quantitation limits are equal to the instrument detection limits multiplied by a factor of 3 to 5. Because the data will be used in further ecological assessments, and potentially human health risk, there is a need for very low quantitation limits. Tables 1 through 4 describe the proposed contract-required quantitation limit (CRQL) goals for tissue.

SECTION 3.3 – DATA QUALITY INDICATORS

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SECTION 3.3.1 – PRECISION

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### 3.3.2 Accuracy

Accuracy refers to the degree to which a measurement agrees with the true value. The accuracy of a measurement system is impacted by errors potentially introduced through the sampling process, field contamination, sample preservation, sample handling, sample matrix, sample preparation, and analytical techniques. Analytical accuracy will be evaluated on the basis of MS samples, laboratory control samples (LCS) or blank spike samples, reference standards such as internal and surrogate standards, and method blank samples. MS samples and LCS or blank spike samples are analyzed at a frequency of one for every sample delivery group (SDG), or every 20 samples of a similar matrix, whichever is more frequent. Surrogate standards and internal calibration standards, where available, are added to every sample analyzed for organic constituents.

Accuracy is expressed in terms of percent recovery, which is calculated by the following equation:

$$\% \text{ Recovery} = \frac{\text{Measured Spike Value} - \text{Unspiked Value}}{\text{Known Spike Value}} \times 100$$

The results of blank samples will provide information on positive bias resulting from laboratory artifacts. The results of spiked samples and reference standards are expressed as percent recovery and provide information on positive and negative bias. Objectives for reference standards will be based on the employed method. Appropriate spike and reference standard compounds and concentration levels are specified in the analytical methods. When MS compounds are not specified, they will be selected such that the group of analytes is reasonably represented (chemical characteristics, retention times, and other appropriate criteria). If a surrogate is desired but not specified by the analytical methods, a nontarget analyte that is chemically similar to target analytes may be used. In cases where the spiking levels for MS and/or surrogate standards are not provided, the spiking will be conducted at a mid-calibration concentration level. Accuracy objectives for MS samples and surrogate compounds, expressed in percent recovery, are presented in Tables 5 through 8.

### 3.3.3 Representativeness

Representativeness is a qualitative expression of the degree to which sample data accurately represent the characteristics of a population, parameter variations at a sampling point, or an environmental

condition they are intended to represent. Representativeness is maximized by selecting the appropriate number of samples and sampling locations and using appropriate and established sample collection, handling, and analysis techniques to provide information that reflects "true" site conditions. For this field sampling effort, six vegetation samples and six small mammal samples will be collected from each study area (that is, WBL, WBLW, and RW) to achieve the minimum sample count (that is, six) required for calculation of a 95 percent upper confidence limit on an arithmetic mean concentration of a COPEC.

### **3.3.4 Completeness**

Completeness is defined as the percentage of measurements that are judged valid compared to the number of samples needed for the project. The project completeness value will be determined at the conclusion of the data validation phase and will be calculated by dividing the number of complete, valid sample results by the total number of sample analyses proposed in the *WP/FSAP* (TtEMI 1998a). As described in Section 7.3, the data validation process will determine whether a particular data point is a valid result that is acceptable for use, an estimated result that is acceptable for use, or a rejected result that is unacceptable for use. Complete results are defined as results that are considered acceptable and usable when compared to QC criteria. Sample results that are considered rejected, unacceptable, and unusable when compared to QC criteria are listed as incomplete and will not be used. The completeness objective for field samples is 90 percent for this project.

### **3.3.5 Comparability**

Comparability is a qualitative parameter that expresses the confidence that one data set may be compared to another. This goal is achieved through the use of standardized techniques to collect and analyze samples and report analytical results. These techniques are described in the *WP/FSAP* (TtEMI 1998a) and this QAPP.

## **4.0 SAMPLING PROCEDURES, DOCUMENTATION, AND RECORDS**

This section presents details on documentation and record keeping for the field sampling, including sample identification, sampling handling, sample documentation, laboratory documentation, data validation, and training requirements for field sampling personnel. Field sampling is scheduled to occur

during the summer of 1998, with a tentative start date of June 15, 1998. The final field schedule will be established once the *WP/FSAP*, this QAPP, and the *HSP Addendum* are finalized.

#### **4.1 SAMPLE COLLECTION PROCEDURES**

Standard procedures are to be followed for tissue sample collection activities performed at WBL, WBLW, and RW. The *WP/FSAP* (TtEMI 1998a) is to be used in conjunction with this QAPP; together, these documents describe the sample collection methods to be followed during the proposed field effort. The proposed sampling stations are presented in Figures 10 and 11 of the *WP/FSAP* and detailed sample collection procedures are presented in Section 4.0 of the *WP/FSAP* (TtEMI 1998a).

All analyses of samples to be collected will be performed by an off-site Navy-approved and California-certified laboratory. Samples will be handled in a manner appropriate for the intended analyses. Table 9 summarizes the analytical methods, sample containers, holding times, and preservation requirements for samples.

#### **4.2 SAMPLE IDENTIFICATION**

Samples will be uniquely identified to provide a means for tracking each sample from collection through analysis, data reduction, reporting, and validation. A sample identification system has been established for the proposed field activities to efficiently manage sample tracking and referencing.

The purpose of sample identification is to provide a consistent tracking record that designates specific information about each sample collected in the field. Each sample will be assigned a sample identification number.

The sample identification numbering system consists of four alphanumeric fields, which identify (1) the CTO number; (2) the sample station; (3) the sample matrix; and (4) the sample number. These four fields are described in the following text.

The CTO number is a field of three digits that identifies the project number for which a given sample is collected. For samples collected under this QAPP the CTO number is 124.

The sample station is a field of one alpha character followed by two sequential digits that identifies the sample station from which a sample is collected. Sample station selection rationale are described in Section 4.1 of the *WP/FSAP* and proposed sampling stations are presented on Figures 10 and 11 of the *WP/FSAP* (TtEMI 1998a). The alpha character corresponds to one of the following three areas, while the two digits correspond to sample stations within each area:

- West Beach Landfill – L
- West Beach Landfill Wetland – W
- Runway Wetland – R
- Reference Area (also known as the “Yellow Area”) – Y

The sample type is a field of two alpha characters that identifies the sampled matrix. The alpha characters correspond to one of the following five matrices:

- Terrestrial plant – TP
- Emergent wetland plant – EP
- Aquatic invertebrates – IN
- Fishes – FS
- Small mammals – SM

The sample number is a field of three sequential digits assigned to samples in the order in which they are proposed to be collected. For example, the first sample collected in the field, regardless of media, will be assigned a sample number of 001.

An example of these fields is “0124-W01-EP001.” This sample identification number represents a sample collected as part of CTO 0124, from sample station W01 (which is at WBLW), of emergent wetland vegetation, and designated 001.

The sample register will be the primary reference document for sample identification information. The sample register is a spreadsheet that lists the following information for each sample: the sample identification number; the sample matrix; the sample container types; and the laboratory analyses to be performed. Sample collection date and time are marked on the register. Consequently, the sample register serves as current record of sampling stations completed and yet to be sampled at any given time during the project. Table 15 of the *WP/FSAP* (TtEMI 1998a) presents the preliminary sample register.

Each sample will be assigned a unique laboratory identification to provide a means of submitting the samples blind to the laboratory. The laboratory identifications will be created prior to the sampling event and will be based on a three-part alpha/numeric code.

### **4.3 SAMPLE HANDLING**

Sample handling parameters and procedures described in this section include sample containers and labeling, custody seals, chain of custody, sample preservation and holding times, and sample packaging and shipping. Table 9 summarizes the containers, sample preservation, and holding time requirements for this project. The sample handling procedures discussed in Sections 4.3.1 through 4.3.5 are presented in detail in Standard Operating Procedure (SOP) No. 018 (PRC 1992). Special precautions will be used for handling small mammal samples received from the field because of the potential presence of the hantaviruses. Health and safety policies and procedures specifically addressing hantavirus risks in the field are detailed in the *HSP Addendum* (TtEMI 1998b).

Policies and procedures relevant to laboratory personnel will be supplied upon identification of the contract laboratory and the specific method to be used to remove potentially present hantaviruses from all received small mammal samples. Because the standard method for killing hantavirus (that is, autoclaving) is a temperature- and pressure-based process, organic target analytes potentially present in a sample could be “lost” during the autoclaving process. Consequently, gamma radiation will be used to effectively eliminate hantavirus risks and minimize the loss of organic target analytes.

#### **4.3.1 Sample Containers and Labels**

Plant and animal tissue samples will be collected in accordance with the procedures specified in Section 4.0 of the *WP/FSAP* (TtEMI 1998a). The contracted laboratory will provide clean sampling containers, which will meet EPA Contract Laboratory Program (CLP) container guidelines for CLP methods (EPA 1994b and 1994c) and will meet appropriate EPA method guidelines for non-CLP methods (National Oceanic and Atmospheric Administration [NOAA] 1993). Sample containers for each type of tissue sample to be collected are listed in Table 9.

A sample label will be affixed to each sample container sent to the contract laboratory. The sample label will be completed in indelible ink and include the following information:

- Project name and location (that is, Alameda Point)
- Site name (that is, L, W, R, or Y)
- Sample identification number
- Date of sample collection
- Preservative used (not applicable [NA] if none used)
- Sampler's initials
- Sample type (that is, plant, aquatic invertebrate, fish, or small mammal)
- Sample designation (that is, composite)
- Analyses requested

After the label has been affixed to the sample container, the label will be covered with a wide strip of clear strapping tape to protect it from moisture damage during sample shipment and storage.

#### **4.3.2 Custody Seals**

To ensure that no tampering occurs, custody seals will be placed on each cooler used to ship samples. Custody seals used during the course of the project will consist of two strips of security tape with the date and initials of the sampler, placed on each cooler so that they must be broken to gain access to the contents. Clear tape will be placed over the custody seals to protect them from accidental breakage.

#### **4.3.3 Chain of Custody**

COC procedures provide a written record tracing the possession of individual samples from the time of field collection through laboratory analysis. A sample is considered in custody if it meets one of the following criteria:

- In a person's possession
- In view after having been in physical custody
- In a secure area after having been in physical custody
- In a designated secure area to which access is restricted to authorized personnel

A COC record will be used to document information pertinent to the samples. Information to be recorded by the field personnel on the COC includes the following:

- Project name and number
- Name and signature of sampler(s)
- Destination of samples (that is, name of contract laboratory)
- Laboratory identification number

- Date and time of collection
- Sample designation (that is, composite)
- Sampling location
- Signatures of personnel involved in custody transfer (including date and time of transfer)
- Airbill number, if applicable
- Number and size of containers
- Preservatives used, if any
- Sample matrix
- Analyses required
- Contract number (in upper left corner)

Unused lines on the COC record will be lined out. COC records initiated in the field will be signed, placed in a plastic reusable bag and taped to the inside of the cooler. Signed airbills will serve as evidence of custody transfer between the field sampler and courier, and between the courier and the contract laboratory. Copies of the COC record and the airbill will be retained and filed by the sampler before shipment.

Upon receipt of an ice chest or shipping container, laboratory personnel will review the contents and will sign and retain the COC record and the airbill. Information that will be recorded on the COC record in the remarks column, or on another appropriate document, at the time of sample receipt will include the following, as appropriate:

- Status of custody seals
- Temperature of ice chest upon receipt
- Identification of number of broken sampling containers, if any
- Description of discrepancies between the COC record, sample labels, and requested analyses

Laboratory personnel will contact the TtEMI project chemist regarding discrepancies in paperwork and will document nonconformances and corrective actions in accordance with the contract laboratory's SOPs.

After samples have been accepted by the contract laboratory, checked, and logged in, they will be maintained in a manner consistent with custody and security requirements specified in the *EPA Statement of Work for Inorganic Analyses Multi-Media Multi-Concentration* (EPA 1994b), hereinafter referred to as the *Inorganic CLP SOW* and the *Statement of Work for Organic Analyses Multi-Media*

*Multi-Concentration* (EPA 1994c), hereinafter referred to as the *Organic CLP SOW*. Specific laboratory COC procedures are described in an SOP that is available in laboratory files, as required by the CLP.

#### **4.3.4 Sample Preservation and Holding Times**

Several of the chemical parameters to be measured in the plant and animal tissue samples are not chemically stable under some conditions and sample preservation (using refrigeration) will be required following collection of tissue samples. Refrigeration of samples is generally intended to retard biological and chemical degradation. Sample holding times and preservation methods are presented in Table 9.

#### **4.3.5 Sample Packaging and Shipping**

TtEMI SOP No. 019, "Packaging and Shipping Samples," (PRC 1994) will be followed for each laboratory sample shipment. During field sampling at WBL, WBLW, RW, and the reference area, all tissue samples collected during the field effort are expected to be classified as environmental samples. Environmental samples are defined as samples of matrices that are not saturated or mixed with product material. All U.S. Department of Transportation regulations will be followed during sample packaging and shipment.

### **4.4 SAMPLE DOCUMENTATION**

Sample documentation is presented in Section 4.5 of the *WP/FSAP* (TtEMI 1998a). Specifically, field logbooks are described in Section 4.5.1, daily field progress reports are described in Section 4.5.4, notification of field variance is described in Section 4.5.5.

### **4.5 LABORATORY DOCUMENTATION**

The contract laboratory will provide data packages in accordance with the *SOW for Analytical Laboratories* (PRC 1995a). The data package will include two copies of a summary data package containing the following:

- Case narrative
- Copies of nonconformance/corrective action forms
- COC forms
- Tracking documents
- Sample results
- QA/QC summaries

The data package will also include requirements for a full data package, which will include the following:

- Sample raw data
- QC raw data
- Standard raw data
- Instrument raw data
- Other raw data

#### **4.6 DATA VALIDATION AND QUALITY CONTROL SUMMARY**

Data validation is the process by which the contract laboratory data package for the sample delivery group (SDG) is technically evaluated by a validation reviewer independent of the contract laboratory and TtEMI. Section 7.3 of this QAPP includes a detailed description of the data validation procedures.

The contract laboratory will analyze SDGs that consist of no more than 20 samples each. The validation reviewer will prepare a validation narrative for each SDG. Each validation narrative will contain a list of the samples in the SDG, the analyses performed, the identity of the samples receiving full validation, and the results of validation for each methodology.

During data validation, the validation reviewer will complete worksheets that document the criteria reviewed. These worksheets will be used to generate the validation narrative. The worksheets are part of the complete data validation report that will be kept on file in TtEMI's Sacramento/Rancho Cordova office.

Once the analytical data have been received from the contract laboratory and the data validation has been performed, a quality control summary report (QCSR) in the form of a technical memorandum will be prepared.

The QCSR will summarize the data validation reports, the evaluation of PARCC criteria (discussed in Section 3.3), and the ability of the analytical data to support the project DQOs. The QCSR will also include tabulated validated data tables and data validation narratives.

The QCSR is intended to provide a general overview of data quality and the data validation reports. Specific details may be found in the data validation narratives, which are included in the appendix of the QCSR.

## **5.0 ANALYTICAL PROCEDURES**

All analyses will be performed by an off-site Navy-approved laboratory. Analysis of tissue residue will follow *Inorganic CLP SOW* (EPA 1994b), *Organic CLP SOW* (EPA 1994c), and the *Sampling and Analytical Methods for the National Status and Trends Program (NSTP) National Benthic and Surveillance and Mussel Watch Project* (NOAA 1993), hereinafter referred to as the *Sampling and Analytical Methods of the NSTP*. Tables 1 through 4 present the target analyte list (TAL) and CRQL goals that are discussed below. Appropriate cleanup will be done during preparation of the samples to remove interferences due to organic matter inherent in biological samples. The following subsections present a discussion of the methods for metals, PAHs, OCPs and PCBs, organotins, percent moisture, and percent lipids.

### **5.1 METHODS FOR METALS ANALYSES**

Depending on the particular sample matrix and the particular metal, several sample preparation methods and analytical methods will be performed by the contract laboratory. The following subsections present the sample preparation and analytical methods.

#### **5.1.1 Sample Preparation Methods**

Plant and animal tissue will be prepared in accordance with EPA methodology and applicable contract laboratory standard operating procedures (SOPs).

## **5.1.2 Analytical Methods**

Plant and animal tissue samples will be analyzed for metals in accordance with CLP procedures (EPA 1994b). For metals analysis, a measured aliquot of sample is digested in accordance with applicable contract laboratory SOPs. Digested samples are analyzed by using inductively coupled plasma atomic emission spectroscopy (ICP), graphite-furnace atomic absorption spectroscopy (GFAA), and cold-vapor atomic absorption spectroscopy (CVAA) depending on the exact analyte. Table 1 presents the TAL and CRQL goals for these methods.

Routine CLP methods for analyzing metals may be modified to achieve lower CRQLs or analyze individual metals. Additionally, ICP-trace analyzers may be used for the analysis of ICP and GFAA target elements. Any modifications will be made in accordance with the protocols specified in Subtasks 1.4.1 and 1.4.2 of the *SOW for Analytical Laboratories* (PRC 1995a).

Laboratories will comply with the QC requirements listed in the *Inorganic CLP SOW* (EPA 1994b) and Subtask 1.4 of the *SOW for Analytical Laboratories* (PRC 1995a). The following subsections describe the analytical instrumentation that may be used for the metals analyses.

### **5.1.2.1 Inductively-Coupled Plasma Atomic Emission Spectroscopy**

ICP analysis allows the simultaneous, multielemental determination of CLP metals by measuring element-specific light emissions by optical spectrometry. Element-specific atomic-line emission spectra are dispersed and the intensities of the lines are monitored by a photodiode array.

### **5.1.2.2 Graphite-Furnace Atomic Absorption Spectroscopy**

GFAA allows the individual analysis of arsenic, lead, selenium, and thallium to provide low CRQLs. In the furnace, the sample is evaporated to dryness, charred, and atomized. A light beam from a hollow cathode lamp or an electrodeless discharge lamp is directed through the tube into a monochromator and onto a detector that measures the amount of light. Because the wavelength of a light beam is characteristic of a single metal, the light energy absorbed at that wavelength is a measure of that metal's concentration.

### **5.1.2.3 Cold-Vapor Atomic Absorption Spectroscopy**

The CVAA technique is specified for mercury and is based on the absorption of light by mercury vapor at a wavelength of 253.7 nanometers. The mercury is reduced to the elemental state and aerated from solution in a closed system. The mercury vapor passes through a cell positioned in the light path of an atomic absorption spectrophotometer. Absorbance is measured as a function of mercury concentration.

## **5.2 METHODS FOR POLYNUCLEAR AROMATIC HYDROCARBON ANALYSES**

The following subsections present the sample preparation and analytical methods for PAH analyses.

### **5.2.1 Sample Preparation Methods**

Plant and animal tissue will be prepared in accordance with EPA methodology and applicable contract laboratory SOPs.

### **5.2.2 Analytical Methods**

Selective ion-monitoring (SIM) gas chromatography and mass spectroscopy (GC/MS) will be used to achieve low quantitation limits in the PAH analysis of tissue samples. The proposed protocol was developed for the NOAA NSTP (NOAA 1993). A measured amount of tissue sample is solvent-extracted by sonication. The extract is concentrated, processed through a gel permeation chromatography (GPC) cleanup, and analyzed by SIM GC/MS. The GC instrument is temperature programmed to separate the extractables, which are then detected by the mass spectrometer. The mass spectrometer is programmed to focus on a few selected mass ions instead of scanning the entire range of masses. The mass spectra and retention times are used to identify target compounds. Table 2 presents the target compound list and the required quantitation limits for PAHs. This method will target only PAHs and cannot detect any of the other semivolatile organic compounds (SVOC) (for example, phenols, and phthalates), but it is useful for achieving low quantitation limits.

Laboratories must meet the QC requirements specified in Subtask 1.3 of the *SOW for Analytical Laboratories* (PRC 1995a) in addition to the QC requirements listed in the *Sampling and Analytical Methods of the NSTP* (NOAA 1993).

### **5.3 METHODS FOR ORGANOCHLORINE PESTICIDES AND POLYCHLORINATED BIPHENYLS ANALYSES**

The following subsections present the sample preparation and analytical methods for organochlorine pesticide and PCB analyses.

#### **5.3.1 Sample Preparation Methods**

Plant and animal tissue will be prepared in accordance with EPA methodology and applicable contract laboratory SOPs.

#### **5.3.2 Analytical Methods**

The NSTP protocol will be used for the analysis of OCPs and PCBs in tissue samples (NOAA 1993). A measured aliquot of tissue is solvent-extracted using sonication. The extract is solvent-exchanged, concentrated, and cleaned using column chromatography. The extract is directly injected onto a GC which is temperature programmed to separate the analytes and an electron capture detector is utilized for analyte detection. The GC analysis is performed using 2 dissimilar columns, which produce unique retention times for each analyte. A retention time match on both columns is used to identify target analytes.

The primary difference between the NSTP method and the CLP method is that, in the NSTP method, the PCBs are quantified as individual compounds (known as “congeners”) rather than by product mixture (that is, Aroclor group). Known concentrations of appropriate PCB standards will be analyzed by the NSTP method to determine the congener concentrations in the tissue samples. The laboratory will report concentrations for individual congeners, as well as for total PCBs. Then, the laboratory will use the congener concentrations from each sample to calculate total PCB concentrations in the tissue samples. Table 3 presents the low-level TAL and CRQL goals for this method.

Laboratories must meet the QC requirements specified in Subtask 1.3 of the *SOW for Analytical Laboratories* (PRC 1995a) in addition to the QC requirements listed in the *Sampling and Analytical Methods of the NSTP* (NOAA 1993).

#### **5.4 METHODS FOR ORGANOTIN ANALYSES**

The following subsections present the sample preparation and analytical methods for organotins.

##### **5.4.1 Sample Preparation Methods**

Plant and animal tissue will be prepared in accordance with EPA methodology and applicable contract laboratory SOPs.

##### **5.4.2 Analytical Methods**

The organotins method is a GC method developed by NOAA (1988). This GC method is applicable to the determination of organotins in soil, groundwater, and other matrices. A measured amount of sample is extracted with an organic solvent using an appropriate extraction technique described in accordance with applicable laboratory SOPs. The extract is derivitized using the Grignard reaction and cleaned using a florisil column. The GC is temperature programmed to separate the compounds, which are then detected by a flame photometric detector (FPD) with a 610-nanometer bandpass. The GC analysis is performed using 2 dissimilar columns, which produce unique retention times for each analyte. A retention time match on both columns is used to identify target analytes.

Laboratories must meet the QC requirements specified in Task 2 (non-CLP analyses, GC methods) and Subtask 2.8 of the TtEMI SOW for analytical laboratories (PRC 1995a). The TAL and CRQLs for this method are presented in Table 4.

#### **5.5 METHODS FOR PERCENT MOISTURE ANALYSES**

The following subsections present the sample preparation and analytical methods for percent moisture.

### **5.5.1 Sample Preparation Methods**

Plant and animal tissue will be prepared in accordance with EPA methodology and applicable contract laboratory SOPs.

### **5.5.2 Analytical Methods**

Percent moisture of the tissue samples shall be determined according to the methods described for soil in OLM03.1 (EPA 1994c).

## **5.6 METHODS FOR PERCENT LIPID ANALYSES**

The following subsections present the sample preparation and analytical methods for percent lipids.

### **5.6.1 Sample Preparation Methods**

Plant and animal tissue will be prepared in accordance with EPA methodology and applicable contract laboratory SOPs.

### **5.6.2 Analytical Methods**

Percent lipids shall be determined using the appropriate method as described in NOAA (1993).

## **6.0 QUALITY CONTROL REQUIREMENTS**

Internal quality control checks were developed to ensure accuracy and precision during field sampling and measurement as well as laboratory analysis. As described in the following text, field checks will be conducted on a regularly scheduled basis. Laboratory checks will be conducted according to referenced analytical method protocols. A discussion of measurements and procedures for internal QC is presented in this section.

## **6.1 FIELD QUALITY CONTROL SAMPLES**

Typically, field QC samples are collected for laboratory analysis to check sampling and analytical precision, accuracy, and representativeness. Because of the type of matrices being sampled during the field activities, no field duplicates, field blanks, or equipment rinsate blanks will be collected.

## **6.2 LABORATORY QUALITY CONTROL SAMPLES**

The contract laboratory will analyze QC samples that measure the contract laboratory's analytical accuracy, precision, and representativeness. Laboratory QC samples will be analyzed at the frequency specified in the analytical methods employed. The specific schedule for the analysis of laboratory QC samples are included in the contract laboratory's QA plan or SOPs. The following subsections describe method blanks, MS/MSD samples and matrix duplicate samples, and LCSs, respectively, which will be analyzed as appropriate.

### **6.2.1 Method Blanks**

Method blanks provide a measure of the combined contamination from the laboratory water, the instrument, the reagents, and the sample preparation steps. They are subjected to the entire preparation process. Method blanks will be analyzed at a frequency established by the referenced analytical methods. The method blanks aid in distinguishing between low-level field contamination and laboratory contamination. Concentrations that are suspected to be the result of laboratory contamination will be evaluated as part of the data validation process.

### **6.2.2 Matrix Spike, Matrix Spike Duplicate, and Matrix Duplicate Samples**

Before sample preparation at the contract laboratory, the organic MS/MSD samples will be spiked with appropriate analytes and analyzed in accordance with the referenced analytical method. Results from the analysis of the MSD and matrix duplicate samples are used to evaluate the effect of the matrix on precision and accuracy. The percent recoveries will be calculated for each of the spiked analytes detected and used to assess the analytical accuracy of the MS analysis. The relative percent difference (RPD) between MS and MSD samples or original and matrix duplicate samples will be calculated and

used to assess analytical precision. For inorganic analyses, a matrix duplicate will be analyzed instead of a MSD. Precision is measured by the RPD between this duplicate and the original analysis.

MS/MSD pairs for organic analysis or MS and matrix duplicate samples for inorganic analysis will be analyzed at a rate of 5 percent, or at a frequency of one for every SDG, or type of matrix, or 20 samples, whichever is more frequent (EPA 1987).

### **6.2.3 Laboratory Control Samples**

The LCSs or blank spike sample is spiked with a known concentration of target analytes added to a controlled interference-free matrix. The LCS is used to measure the laboratory accuracy in the absence of matrix interferences. In general, an LCS will accompany each MS/MSD (organic) or MS (inorganic) sample analysis.

## **7.0 DATA ACQUISITION, MANAGEMENT, VALIDITY, AND USABILITY**

This section describes the methods and requirements to be implemented for data acquisition, management, and validation before use of the data.

### **7.1 DATA ACQUISITION REQUIREMENTS**

Data acquired through the analyses of samples will be reported following formats established by the specific analytical method and the *SOW for Analytical Laboratories* (PRC 1995a) and within the required deliverable schedule. Data from analytical laboratories will be presented in a CLP hard copy or equivalent data package and in the electronic data deliverable (EDD) format detailed in the *SOW for Analytical Laboratories*.

The general EDD format is an ASCII file of the results and sample identification information downloaded into a specific file structure from the laboratory information management system. The EDD will be imported into the facility database. All data and QC information in the file must be within the limits established by the *SOW for Analytical Laboratories* (PRC 1995a) for correct transfer of the data from the contract laboratory. If the EDD is incorrectly structured, the contract laboratory is required to resubmit the data file in a timely manner.

SECTION 7.2 – DATA MANAGEMENT

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SECTION 7.2.1 – FIELD DATA MANAGEMENT

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SECTION 7.2.2 – LABORATORY DATA  
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SECTION 7.2.3 – TETRA TECH EM INC.  
DATA MANAGEMENT

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will prepare a data validation report and return the data package, marked tables, and data validation report to the TtEMI project chemist.

The TtEMI project chemist will perform a technical review of the data validation report as described in Section 7.3. The data tables will be submitted to a data entry person for input into the database. The final version of the data validation report will be generated complete with the analytical tables containing the appropriate qualifiers and comment codes. This complete data validation package will be stored with the raw analytical data.

The TtEMI project chemist will be responsible for the proper handling of the data. At the conclusion of the project, the TtEMI project chemist will prepare a technical memorandum that summarizes the overall quality of the data and also determines whether the DQOs were achieved. All hard copy data packages will be stored in an off-site storage facility, and the final version of the electronic data tables will be archived onto electronic data diskettes for permanent storage by TtEMI.

### **7.3 DATA VALIDATION AND USABILITY**

This section provides an overview of the data validation process and how data usability is documented. The data validation process ultimately enables the reconciliation of the data with the project objectives.

#### **7.3.1 Data Review, Validation, and Verification Requirements**

Throughout the data validation process, the data will be evaluated for acceptable quality and quantity, based on the critical PARCC indicator parameters (EPA 1987). These parameters are discussed in detail in Section 3.3.

All analytical methods for each SDG will be validated by a reviewer independent of the contract laboratory and TtEMI on the basis of the criteria listed in the *EPA National Functional Guidelines for Inorganic Data Review and for Organic Data Review* (EPA 1994d and 1994e, respectively). Table 10 identifies the data validation evaluation criteria. All samples in each SDG will receive a cursory validation review, and, initially, 10 percent of the samples for each of the analyses performed will receive a full validation review. If systematic errors are detected during the cursory and full validation, or if a review suggests thorough investigation is necessary, additional data may be designated for full

validation review. It is anticipated that greater than 10 percent of the data will ultimately receive full validation.

A QCSR will be generated to summarize the project goals stated in the DQOs and the PARCC criteria. The technical memorandum will summarize how well the analytical data support the DQOs. The QCSR will include the following items:

- Reconciliation with DQOs
- Laboratory data validation summary
- Limitations on the applicability of the data
- Any plan modifications from the *WP/FSAP* (TtEMI 1998a)
- Field audit report (see Section 9.1.4)
- Any corrective actions performed

The data validation summary will include a brief description of the results of the data validation process for each analytical method; this description will consist of the assessment of data quality in terms of the PARCC criteria. The details of the data validation process for each SDG, along with the validated analytical results, will be included as data validation narratives in an appendix of the QCSR.

The contract laboratory will submit analytical reports in hard copy and electronic formats. Both hard copy reports and the electronic database reports will be submitted with laboratory qualifiers that are defined by either the EPA (1994d and 1994e) or the contract laboratory's SOPs. Table 11 presents the data validation qualifiers. Data submitted with EPA or laboratory-defined qualifiers will identify items such as (1) nondetected values, (2) values below the CRQL (considered estimated values), and (3) values with problems during the analysis. Through data validation, these CLP or laboratory-defined data qualifiers will be evaluated for appropriateness and replaced, as necessary, by the functional guidelines data validation qualifiers to notify the data user of the validity of the data. A database program created by TtEMI will be used to transfer data from the contract laboratory by an ASCII-formatted diskette. This database will allow (1) the data validation qualifiers to be substituted as necessary for the original laboratory qualifiers, (2) corrections of detected data errors, (3) other software to be interfaced, and (4) tables to be printed in various formats with the validated results.

In addition to the analytical results with the associated qualifiers, the printed tables will also include a comment column. The comment column will be used to provide an explanation for any assigned qualifiers. The letters "a" through "h" will be used to reference different QC issues that may have

SECTION 7.3.2 – DATA QUALITY ASSESSMENT

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**SAN DIEGO, CA 92132**

**TELEPHONE: (619) 532-3676**

SECTION 8.0 – PREVENTATIVE MAINTENANCE

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SECTION 9.0 – ASSESSMENT AND OVERSIGHT

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SECTION 9.1 – ASSESSMENT

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SECTION 9.1.1 – PERFORMANCE EVALUATIONS

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SECTION 9.1.2 – TECHNICAL SYSTEMS AUDIT

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SECTION 9.1.3 – TECHNICAL REVIEWS

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SECTION 9.1.4 – FIELD AUDITS

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## **9.2 RESPONSE ACTION**

An effective QA program requires prompt and thorough correction of nonconformances affecting quality. Rapid and effective corrective action minimizes the possibility of questionable data or documentation. All QA problems and corrective actions will be documented to provide a complete record of QA activities.

### **9.2.1 Field Corrective Action Procedures**

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

Nonconformances identified during an audit that have a substantial impact on data quality require the completion of a corrective action memorandum. This memorandum may be completed by an auditor or any individual who suspects that any aspect of data integrity is being affected by a field nonconformance. The memorandum shall include the description of the problem and the required corrective action.

Copies of the corrective action memorandum will be distributed to the TtEMI project manager, field team leader, the TtEMI project QA officer, and the project file. The project QA officer will forward the memorandum to the program manager and the QA program manager, as appropriate. Key personnel will meet to discuss the following:

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

The person identified as responsible for implementing the corrective action shall also be responsible for completing a follow-up memorandum documenting the completion of the corrective action. The follow-

up memorandum shall be submitted to the TtEMI project QA officer to evaluate that the solution has adequately and permanently corrected the problem. The TtEMI QA program manager can require data acquisition to be limited or discontinued until the corrective action is complete and the nonconformance eliminated. The TtEMI QA program manager can also request the reanalysis of any or all data acquired since the system was last in control.

### **9.2.2 Laboratory Corrective Action Procedures**

The internal laboratory corrective action procedures and a description of out-of-control situations requiring corrective action are contained in the contract laboratory QA plan. At a minimum, corrective action will be implemented when control chart warning or 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 TtEMI project chemist within 2 working days of identification. In addition, a corrective action report, signed by the contract laboratory director or contract laboratory project managers and the contract laboratory QC coordinator, will be provided to the TtEMI project chemist. The corrective action report shall include the description of the problem, the identification of the affected samples, and the required corrective action.

The corrective action procedures require that the contract laboratory identify all out-of-control situations that would effect significant amounts of qualified data and perform a corrective action designed to reduce the amount of qualified data. This corrective action is often the reanalysis of samples once the cause of the out-of-control situation has been identified and corrected.

### **9.3 REPORTS TO MANAGEMENT**

A summary progress report will be prepared on a monthly basis by the TtEMI project manager and submitted to the Navy. The report may include the following information:

- Audit results, if an audit was conducted during the reporting period
- 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 and objectives planned for the next month

This information will also be required from any subcontractors and will be included in the monthly status report.

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TABLES

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**TABLE 1**  
**CONTRACT-REQUIRED QUANTITATION LIMIT GOALS**  
**FOR METALS**  
**ALAMEDA POINT**

Analyte	Tissue* CRQL Goals (mg/kg)
Aluminum	10.0
Antimony	1.2
Arsenic	2.0
Barium	40.0
Beryllium	0.80
Cadmium	0.1
Calcium	1,000
Chromium	2.0
Cobalt	1.0
Copper	0.80
Iron	20.0
Lead	0.40
Magnesium	1,000
Manganese	3.0
Mercury	0.01
Molybdenum	1.0
Nickel	0.75
Potassium	1,000
Selenium	1.0
Silver	0.40
Sodium	1,000
Tin	2.0
Thallium	0.40
Vanadium	10.0
Zinc	4.0

Notes:

CRQL

Contract-required quantitation limit

mg/kg

Milligrams per kilogram

a

Quantitation limit goals listed for tissue are based on wet weight. The quantitation limits reported by the laboratory for tissue, calculated on a dry-weight basis as required by the contract, will be higher.

**TABLE 2**  
**CONTRACT-REQUIRED QUANTITATION LIMIT GOALS**  
**FOR POLYNUCLEAR AROMATIC HYDROCARBONS**  
**ALAMEDA POINT**

Analyte	Tissue <sup>a</sup> CRQL Goal (µg/kg)
Acenaphthene	10
Acenaphthylene	10
Anthracene	10
Benzo(a)anthracene	10
Benzo(a)pyrene	10
Benzo(e)pyrene	10
Benzo(b)fluoranthene	10
Benzo(k)fluoranthene	10
Benzo(g,h,i)perylene	10
Chrysene	10
Dibenzothiophene	10
Dibenzo(a,h)anthracene	10
2,6-Dimethylnaphthalene	10
Fluoranthene	10
Fluorene	10
Indeno(1,2,3-cd)pyrene	10
2-Methylnaphthalene	10
1-Methylnaphthalene	10
1-Methylphenanthrene	10
Naphthalene	10
Phenanthrene	10
Perylene	10
Pyrene	10
2,3,5-Trimethylnaphthalene	10

Notes:

CRQL                    Contact-required quantitation limit  
µg/kg                    Micrograms per kilogram  
a                            Quantitation limit goals listed for tissue  
are based on wet weight. The  
quantitation limits reported by the  
laboratory for tissue, calculated on a dry-  
weight basis as required by the contract,  
will be higher.

**TABLE 3**  
**CONTRACT-REQUIRED QUANTITATION LIMIT GOALS**  
**FOR ORGANOCHLORINE PESTICIDES AND POLYCHLORINATED BIPHENYLS**  
**ALAMEDA POINT**  
 (Page 1 of 2)

Analyte	Tissue* CRQL (µg/kg)
<i>Organochlorine Pesticides</i>	
alpha-BHC	0.1
beta-BHC	0.1
delta-BHC	0.1
gamma-BHC (Lindane)	0.1
Heptachlor	0.1
Aldrin	0.1
Heptachlor epoxide	0.1
Endosulfan I	0.1
Dieldrin	0.1
2,4'-DDE	0.1
4,4'-DDE	0.1
Endrin	0.1
Endosulfan II	0.1
2,4'-DDD	0.1
4,4'-DDD	0.1
Endosulfan sulfate	0.1
2,4'-DDT	0.1
4,4' DDT	0.1
Methoxychlor	0.1
Endrin ketone	0.1
Endrin aldehyde	0.1
alpha-Chlordane	0.1
gamma-Chlordane	0.1
Mirex	0.1
trans-Nonachlor	0.1
Technical chlordane	5
Hexachlorobenzene	0.1
Toxaphene	20
<i>PCB Congeners</i>	
BZ-8	0.1
BZ-18	0.1
BZ-28	0.1
BZ-44	0.1
BZ-52	0.1
BZ-66	0.1
BZ-101	0.1
BZ-105	0.1
BZ-118	0.1
BZ-128	0.1
BZ-138	0.1

**TABLE 3**  
**CONTRACT-REQUIRED QUANTITATION LIMIT GOALS**  
**FOR ORGANOCHLORINE PESTICIDES AND POLYCHLORINATED BIPHENYLS**  
**ALAMEDA POINT**  
**(Page 2 of 2)**

Analyte	Tissue <sup>a</sup> CRQL (µg/kg)
BZ-153	0.1
BZ-170	0.1
BZ-180	0.1
BZ-187	0.1
BZ-195	0.1
BZ-206	0.1
BZ-209	0.1

Notes:

BZ                    Ballschmiler and Zgil  
CRQL                Contract-required quantitation limit  
PCB                 Polychlorinated biphenyl  
µg/kg               Micrograms per kilogram  
a                      Quantitation limit goals listed for tissue are based on wet weight. The quantitation limits reported by the laboratory for tissue, calculated on a dry-weight basis as required by the contract, will be higher.

TABLE 4

CONTRACT-REQUIRED QUANTITATION LIMIT GOALS FOR ORGANOTINS  
ALAMEDA POINT

Analyte	Tissue <sup>a</sup> CRQL (µg/kg)
<i>Organotins</i>	
Tetrabutyltin	5
Tributyltin	5
Dibutyltin	5
Monobutyltin	5

Notes:

CRQL Contract-required quantitation limit

µg/kg Micrograms per kilogram

a Quantitation limit goals listed for tissue are based on wet weight. The quantitation limits reported by the laboratory for tissue, calculated on a dry-weight basis as required by the contract, will be higher.

**TABLE 5**

**PRECISION AND ACCURACY GOALS FOR METALS  
ALAMEDA POINT**

<b>Analyses</b>	<b>Method <sup>a</sup></b>	<b>Tissue <sup>b</sup></b>	
		<b>Percent Recovery</b>	<b>RPD</b>
Metals	CLP	75 - 125	35

Notes:

CLP            Contract Laboratory Program

RPD           Relative percent difference

a              Method references are provided in Section 5.0

b              Percent recovery and relative percent difference control limits are based on laboratory matrix spiked samples and duplicate samples, respectively.

TABLE 6

PRECISION AND ACCURACY GOALS FOR POLYNUCLEAR AROMATIC HYDROCARBONS  
ALAMEDA POINT

Fraction	Matrix Spike Compound	Tissue	
		Percent Recovery	RPD
Base/Neutral	Acenaphthene	31 to 137	19
Base/Neutral	Pyrene	35 to 142	36

Fraction	Surrogate Compound	Tissue
		Percent Recovery
Base/Neutral	Nitrobenzene-d <sup>5</sup>	23 to 120
Base/Neutral	2-Fluorobiphenyl	30 to 115
Base/Neutral	p-Terphenyl-d <sup>14</sup>	18 to 137
Base/Neutral	1,2-Dichlorobenzene-d <sup>4</sup>	20 to 130

Notes:

RPD

Relative percent difference

TABLE 7

PRECISION AND ACCURACY GOALS FOR ORGANOCHLORINE PESTICIDES AND  
POLYCHLORINATED BIPHENYLS  
ALAMEDA POINT

Fraction	Matrix Spike Compound	Tissue	
		Percent Recovery	RPD
OCP/PCB	gamma-BHC (Lindane)	46 to 127	50
OCP/PCB	Heptachlor	35 to 130	31
OCP/PCB	Aldrin	34 to 132	43
OCP/PCB	Dieldrin	31 to 134	38
OCP/PCB	Endrin	42 to 139	45
OCP/PCB	4,4'DDT	23 to 134	50

Fraction	Surrogate Compound	Tissue
		Percent Recovery
OCP/PCB	Tetrachloro-m-xylene	30 to 150
OCP/PCB	BZ #121	30 to 150
OCP/PCB	BZ #204	30 to 150

Notes:

- BHC Benzene hexachloride
- BZ Ballschmiler and Zgil
- DDT Dichlorodiphenyltrichloroethane
- OCP Organochlorine pesticide
- PCB Polychlorinated biphenyl
- RPD Relative percent difference

a The matrix spike compound list may vary depending on the contract laboratory's Standard Operating Procedure. At a minimum, the listed compounds must be used.

**TABLE 8**

**PRECISION AND ACCURACY GOALS FOR ORGANOTINS  
ALAMEDA POINT**

Fraction	Matrix Spike Compound <sup>a</sup>	Tissue	
		Percent Recovery	RPD
Organotins	Tetrabutyltin	30 to 130	50
Organotins	Tributyltin	30 to 130	50
Organotins	Dibutyltin	30 to 130	50
Organotins	Monobutyltin	30 to 130	50

Fraction	Surrogate Compound	Tissue
		Percent Recovery
Organotins	Tripentyltin	40 to 140

Notes:

RPD

Relative percent difference

a

The matrix spike compound list may vary depending on the contract laboratory's Standard Operating Procedure. At a minimum, the listed compounds must be used.

TABLE 9

**ANALYTICAL METHODS AND HOLDING TIME REQUIREMENTS FOR TISSUE SAMPLES  
ALAMEDA POINT**

Parameter	Tissue Type	Sample Container <sup>d</sup>	Method Number <sup>a</sup>	Volume <sup>e</sup>	Preservative	Holding Time <sup>b</sup>
Metals	Vegetation <sup>c</sup>	Appropriate laboratory-issued sample container	CLP	100 g	Cool, 4 °C	Mercury 28 days, all other metals 6 months
	Aquatic invertebrates, fishes, small mammals	Appropriate laboratory-issued sample container	CLP	100 g	Cool, 4 °C	Mercury 28 days, all other metals 6 months
PAHs	Vegetation <sup>c</sup>	Appropriate laboratory-issued sample container	NOAA	100 g	Cool, 4 °C	14 days/40 days
	Aquatic invertebrates, fishes, small mammals	Appropriate laboratory-issued sample container	NOAA	100 g	Cool, 4 °C	14 days/40 days
OCPs/PCBs	Vegetation <sup>c</sup>	Appropriate laboratory-issued sample container	NOAA	100 g	Cool, 4 °C	14 days/40 days
	Aquatic invertebrates, fishes, small mammals	Appropriate laboratory-issued sample container	NOAA	100 g	Cool, 4 °C	14 days/7 days/2 days <sup>f</sup>
Organotins	Vegetation <sup>c</sup>	Appropriate laboratory-issued sample container	NOAA	100 g	Cool, 4 °C	14 days/40 days
	Aquatic invertebrates, fishes, small mammals	Appropriate laboratory-issued sample container	NOAA	100 g	Cool, 4 °C	14 days/40 days

Notes:

°C            Degrees centigrade

CLP           Contract Laboratory Program

g             Grams

NOAA        National Oceanic and Atmospheric Administration

OCP          Organochlorine pesticide

PAH          Polynuclear aromatic hydrocarbons

PCB          Polychlorinated biphenyl

a             Complete method references are presented in Section 5.0.

b             For PAHs and OCP/PCBs, the first time period refers to the maximum number of days from sampling to extraction and the second time period refers to the maximum number of days from extraction to analysis.

c             Ruderal upland, emergent wetland, and submersed vegetation

d             Appropriate laboratory-issued sample containers will be used for all tissue samples and could be one of the following: plastic freezer bags; foil wrap, and glass or polyethylene jar. Sample containers will be selected to avoid possible cross contamination (for example, plastic bags will not be used for samples analyzed for organics due to presence of phthalates in plastic and foil wrap will not be used for samples analyzed for metals due to the presence of aluminum in foil.

TABLE 10

DATA VALIDATION EVALUATION CRITERIA  
ALAMEDA POINT

**CLP Inorganics (EPA 1994d)**

- \*Holding times
- \*Calibration (initial and continuing)
- \*Blanks (method, instrument, and preparation blanks)  
Inductively coupled plasma interference check sample (ICS)
- \*Laboratory control sample (LCS)
- \*Duplicate sample analysis
- \*Matrix spike (MS) sample analysis  
Graphite furnace atomic absorption (GFAA) quality control (QC)  
ICP serial dilution  
Sample result verification
- \*Field duplicates
- \*Overall assessment of data for a sample delivery group (SDG)

**CLP Organics (EPA 1994e)**

- \*Holding times  
Gas chromatograph/mass spectrometer (GC/MS) tuning
- \*Calibration (initial and continuing)
- \*Blanks (method, instrument, and preparation blanks)
- \*Surrogate recovery
- \*Matrix spike/matrix spike duplicate (MS/MSD)
- \*Field duplicates
- \*Internal standard performance  
Target compound identification  
Tentatively identified compounds  
System performance
- \*Overall assessment of data for an SDG

**Non-CLP Organics and Inorganics Parameters**

- \*Method compliance
- \*Holding times
- \*Calibration (initial and continuing)
- \*Blanks (method, instrument, and preparation blanks)
- \*Surrogate recovery
- \*Sample duplicates, MSs, MSDs, blank spikes
- \*Other laboratory QC specified by the method
- \*Field duplicates  
Detection limits  
Compound identification  
Compound quantitation  
Sample result verification
- \*Overall assessment of data for an SDG

**TABLE 11**  
**DATA VALIDATION QUALIFIERS AND COMMENT CODES**  
**ALAMEDA POINT**

<b>Data Qualifier<sup>a</sup></b>	<b>Definition</b>
U	Compound was analyzed for, but was not detected above the concentration listed; the value listed is the sample quantitation limit.
J	Estimated concentration value; the result is considered qualitatively acceptable but quantitatively unreliable.
UJ	Estimated quantitation limit; the compound was analyzed for but was considered nondetected.
JN	An analyte has been tentatively identified; the associated numerical value represents its approximate concentration.
R	The data are unusable (compound may or may not be present). Resampling and reanalysis are necessary for verification.
No qualifier	The data are acceptable qualitatively and quantitatively.
<b>Comment Code</b>	<b>Definition</b>
a	Surrogate spike recovery problems
b	Blank contamination problems
c	Matrix spike recovery problems
d	Duplicate (precision) problems
e	Internal standard problems
f	Calibration problems
g	Quantification below the reporting limit
h	Other problems; refer to data validation narrative

Notes:

a EPA 1994d and 1994e