N60028_000008
TREASURE ISLAND
SSIC NO. 5090.3.A

CLEAN

Contract No. N62474-88-D-5086

Contract Task Order 0015

Navy Engineer-in-Charge: Ernie M. Galang

PRC Project Manager: Emily Pimentel

NAVAL STATION TREASURE ISLAND
TREASURE ISLAND, CALIFORNIA

QUALITY ASSURANCE PROJECT PLAN
FINAL

Prepared By

PRC ENVIRONMENTAL MANAGEMENT, INC.
120 Howard Street, Suite 700
San Francisco, CA 94105
415/543-4880

September 8, 1991

CLEAN

Contract No. N62474-88-D-5086

Contract Task Order 0015

Navy Engineer-in-Charge: Ernie M. Galang

PRC Project Manager: Emily Pimentel

NAVAL STATION TREASURE ISLAND
TREASURE ISLAND, CALIFORNIA

QUALITY ASSURANCE PROJECT PLAN
FINAL

Emily Pimentel
PRC Project Manager

Santiago M. Lee
PRC Navy CLEAN Quality Assurance Officer

N60028_000008
TREASURE ISLAND
SSIC NO. 5090.3

QUALITY ASSURANCE PROJECT PLAN ADDENDUM IS APPENDIX B OF THE:

DRAFT BENCH SCALE SOIL BIOREMEDIATION TREATABILITY STUDY WORK PLAN

DATED 15 MARCH 1996

IS RECORD NO. N60028_000487

TABLE OF CONTENTS

SECTION		PAGE
1.0	INTRODUCTION	1
2.0	PROJECT ORGANIZATION AND RESPONSIBILITY	3
2.1	PROJECT ORGANIZATION	3
2.2	RESPONSIBILITIES	3
2.2.1	CLEAN Program Manager	3
2.2.2	Project Manager	4
2.2.3	Field Operations Manager	4
2.2.4	Quality Assurance Officer	5
2.2.5	CLEAN Health and Safety Program Manager	5
2.2.6	On-Site Health and Safety Coordinator	6
2.2.7	Laboratory Coordinator	6
2.2.8	Laboratory QA Manager	6
2.2.9	Feasibility Study Manager	7
2.2.10	Supervisory Geologists	7
2.3	TRAINING	7
3.0	DATA QUALITY OBJECTIVES FOR MEASUREMENT DATA	8
3.1	PRECISION	8
3.2	ACCURACY	9
3.3	REPRESENTATIVENESS	9
3.4	COMPLETENESS	10
3.5	COMPARABILITY	10
3.6	DETECTION/QUANTITATION LIMITS	10
4.0	SAMPLING PROCEDURES	11
5.0	SAMPLE CUSTODY	12
5.1	FIELD PROCEDURES	12
5.2	LABORATORY PROCEDURES	14
6.0	CALIBRATION PROCEDURES AND FREQUENCY	15
6.1	FIELD EQUIPMENT	15
6.2	LABORATORY EQUIPMENT	16
7.0	ANALYTICAL PROCEDURES AND DETECTION OR QUANTITATION LIMITS	17

TABLE OF CONTENTS
(Continued)

SECTION		PAGE
8.0	DATA REDUCTION AND VALIDATION	18
8.1	DATA REDUCTION	18
8.1.1	Field Data Reduction	18
8.1.2	Off-Site Laboratory Data Reduction	18
8.2	DATA VALIDATION	18
8.2.1	Field Data Review	19
8.2.2	Laboratory Data Validation	19
8.2.3	Field Data Reporting	20
8.2.4	Off-Site Laboratory Data Reporting	21
9.0	INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY	22
9.1	FIELD QUALITY CONTROL PROCEDURES	22
9.2	FIELD MEASUREMENTS	23
9.3	OFF-SITE LABORATORY	23
10.0	PERFORMANCE AND SYSTEM AUDITS	25
10.1	FIELD ACTIVITIES	25
10.2	OFF-SITE LABORATORY ACTIVITIES	26
11.0	PREVENTIVE MAINTENANCE	27
11.1	FIELD EQUIPMENT	27
11.2	LABORATORY EQUIPMENT	27
12.0	DATA ASSESSMENT PROCEDURES	28
12.1	PROJECT DATA MANAGEMENT SCHEME	28
12.2	STATISTICAL ASSESSMENT OF DATA QUALITY	28
13.0	CORRECTIVE ACTION PROCEDURES	30
13.1	FIELD ACTIVITIES	30
13.2	OFF-SITE LABORATORY ACTIVITIES	31
14.0	QUALITY ASSURANCE REPORTS TO MANAGEMENT	32

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

TABLE		PAGE
1	LABORATORY PRECISION AND ACCURACY GOALS FOR VOLATILE COMPOUNDS (SW-8240)	33
2	LABORATORY PRECISION AND ACCURACY GOALS FOR SEMIVOLATILE COMPOUNDS (SW-8270)	35
3	LABORATORY PRECISION AND ACCURACY GOALS FOR PESTICIDES/PCBs (SW-8080)2	38
4	LABORATORY PRECISION AND ACCURACY GOALS FOR PRIORITY POLLUTANT METALS (SW-3050/SW-6010)	40
5	PRECISION GOALS FOR MISCELLANEOUS FIELD PARAMETERS	42
6	PRECISION AND ACCURACY GOALS FOR MISCELLANEOUS LABORATORY PARAMETERS	43
7	TYPICAL FIELD MEASUREMENT AND TEST EQUIPMENT LIST	44
8	ANALYTICAL METHODS, DETECTION LIMITS AND REPORTING UNITS	45
9	PRACTICAL QUANTITATION LIMITS (PQL) FOR VOLATILE ORGANICS	47
10	PRACTICAL QUANTITATION LIMITS (PQL) FOR SEMI-VOLATILES	49
11	PRACTICAL QUANTITATION LIMITS (PQL) FOR PESTICIDES AND PCBs	52
12	INSTRUMENTAL DETECTION LIMITS FOR PRIORITY POLLUTANT METALS	54

LIST OF FIGURES

FIGURE		PAGE
1	ORGANIZATIONAL CHART	56
2	TYPICAL FIELD AND LABORATORY AUDIT PROCESS	57

N60028_000008
TREASURE ISLAND
SSIC NO. 5090.3

DRAFT
WORK PLAN
BENCH SCALE SOIL BIOREMEDIATION TREATABILITY STUDY

DATED 15 MAY 1996

IS RECORD NO. N60028_000487

FINAL
WORK PLAN
BENCH SCALE SOIL BIOREMEDIATION TREATABILITY STUDY

DATED 19 JULY 1996

IS RECORD NO. N60028_000551

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPjP) describes the policy, organization, functional activities, quality assurance (QA), and quality control (QC) protocols necessary to achieve the Data Quality Objectives (DQO) of the site Work Plan. The QAPjP represents the written result of initial planning for the Naval Station Treasure Island Remedial Investigation/Feasibility Study (RI/FS) measurement work. Its purpose is to provide project participants with the same goals and guidelines for the duration of the project. This plan follows U.S. EPA Region 9 Guidance for Preparing Quality Assurance Project Plan for Superfund Remedial Projects October, 1988. It contains the elements of the QAMS-005/80 guidance, and the products from the DQO process.

The QAPjP, along with the Field Sampling Plan (FSP), constitute the sampling and analysis plan for activities necessary to perform the RI/FS at the Naval Station Treasure Island. These documents have been prepared in conjunction with the workplan authorized under Contract Task Order 0015. This contract task order is authorized under the Comprehensive Long-Term Action Navy (CLEAN) Contract No. N6244-88-D-5086. The RI/FS will comply with CLEAN management plan, quality assurance program plan, health and safety plan, and community relations plan.

The proposed RI/FS is designed to characterize the nature of contamination at 22 sites at Naval Station Treasure Island. The field sampling plan describes the procedures to be used to collect soil, ground - water, surface water, sediment, and air samples. The data from the field program will be used to characterize Naval Station Treasure Island and support the FS.

Naval Station Treasure Island includes facilities on Treasure Island (TI) and Yerba Buena Island (YBI) in San Francisco Bay. Treasure Island is a man-made island composed of dredged material, primarily poorly graded fine sand placed over Yerba Buena Shoals. Yerba Buena Island is a natural rock island.

A preliminary assessment and site inspection (PA/SI) was conducted on 26 sites under the Navy Installation Restoration Program (IRP) in 1988. Those assessments of the naval station identified 22 sites to be further evaluated through a formal RI/FS. The sites to be studied in more detail through the RI/FS are:

Site No. 1	-	Medical Clinic
Site No. 3	-	PCB Equipment Storage Area
Site No. 4	-	Hydraulic Training School
Site No. 5	-	Old Boiler Plant
Site No. 6	-	Fire Training Annex
Site No. 7	-	Pesticide Storage Area
Site No. 8	-	Army Point Sludge Disposal Area
Site No. 9	-	Foundry
Site No. 10	-	Bus Painting Shop
Site No. 11	-	YBI Landfill
Site No. 12	-	Old Bunker Area
Site No. 13, 13A	-	Stormwater Outfalls TI/YBI
Site No. 14	-	New Tank Farm
Site No. 15	-	Old Fuel Tank Farm
Site No. 16	-	Clipper Cove Tank Farm
Site No. 17	-	Tank 103/104
Site No. 19	-	Refuse Transfer Area
Site No. 20	-	Auto Hobby Shop/Transportation Center
Site No. 21	-	Vessel Water Oil Recovery
Site No. 22	-	Navy Exchange Service Station
Site No. 24	-	5th Street Fuel Releases
Site No. 25	-	Seaplane Maintenance Area

These sites are described in detail in the RI/FS work plan.

It is assumed that the 22 sites have unique conditions related to site characteristics and type of contamination anticipated. As a result, the RI/FS sampling program is designed to identify the wide range of conditions expected. Sites that are geographically interrelated, or that have similar conditions, will be sampled similarly, as described in the field sampling plan.

The site description and history are discussed in Section 2.0 of the RI/FS Field Sampling Plan for Naval Station Treasure Island.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The following subsections describe the project team organization and the responsibilities of key personnel who will be involved with the remedial investigation for the Naval Station Treasure Island.

2.1 PROJECT ORGANIZATION

The PRC team for this project consists of the following key personnel:

Program Manager:	Daniel Chow
Project Manager:	Emily Pimentel
Field Operations Manager:	Gary Miller
Quality Assurance Officer:	Santiago M. Lee
CLEAN Health and Safety Program Manager:	Fred Stanley
On-Site Health and Safety Coordinator:	Ksenija Mikulicic
Laboratory Coordinator:	Thorsten Anderson
Laboratory QA Manager:	To be determined
Feasibility Study Manager:	Alan Razavi
Supervisory Geologists:	Megan Donohue Tom Adkisson

An organizational chart for this project is presented in Figure 1.

2.2 RESPONSIBILITIES

The following subsections describe the responsibilities of the key personnel for this project.

2.2.1 CLEAN Program Manager

The responsibilities of the program manager include:

- Providing sufficient resources to the project team so it can respond fully to the requirements of the investigation.
- Providing direction and guidance to the project manager as appropriate.
- Reviewing the quality of data gathered during the course of the project and reviewing the final project report.

2.2.2 Project Manager

The project manager is responsible for technical, financial, and scheduling matters, including:

- Reviewing and approving the QAPjP, FSP, health and safety plan (HSP), and project work plan.
- Obtaining approval of the QA coordinator for proposed variances in any of the above documents.
- Supervising the performance of project team members.
- Ensuring and coordinating the availability of personnel, equipment, subcontractors, and services.
- Reviewing subcontractor work and approving subcontractor invoices.
- Monitoring project budget.
- Monitoring project schedule.
- Evaluating findings, developing conclusions and recommendations.
- Coordinating with the Navy to ensure that project goals are being met.

2.2.3 Field Operations Manager

The field operations manager is responsible for all field activity. His duties include:

- Providing oversight and any necessary site-specific information to field personnel, including subcontractors, about the requirements of the project Work Plan, QAPjP, and FSP before starting work.
- Providing direction and supervision of the drilling subcontractors.
- Monitoring drilling and sampling operations to ensure the drilling. subcontractor and sampling team members follow approved project work plans.

- Ensuring use of calibrated measurement and test equipment.
- Coordinating activities with project manager.
- Establishing and maintaining field records.

2.2.4 Quality Assurance Officer

Responsibilities of the project quality assurance officer include:

- Providing an official contact for quality assurance matters
- Identifying and responding to quality assurance and quality control (QA/QC) needs, resolving problems, and answering requests for guidance or assistance
- Reviewing, evaluating, and approving quality-related changes to the project Work Plan, QAPjP, and FSP
- Actively tracking the progress of quality tasks in this plan and consulting periodically with the project manager and program manager
- Preparing and submitting QA/QC reports to management
- Ensuring with the project manager that appropriate corrective actions are taken for all nonconformance
- Verifying that appropriate methods are specified for obtaining data of known quality and integrity
- Scheduling and verifying an appropriate quality assurance activity for each site to ensure compliance with requirements and procedures
- Actively tracking the progress of quality tasks in this plan and consulting periodically with the program manager and project manager
- Other responsibilities as requested by the project manager

2.2.5 CLEAN Health and Safety Program Manager

The health and safety manager approves the site-specific health and safety plan to ensure that it is consistent with the CLEAN Health and Safety Program.

2.2.6 On-Site Health and Safety Coordinator

The health and safety coordinator is responsible for reviewing and approving a site-specific health and safety plan and ensuring that site personnel adhere to the site safety requirements. Additional responsibilities are included in the TI HSP.

2.2.7 Laboratory Coordinator

The laboratory coordinator ensures that the laboratory implements the requirements of the QAPjP. The laboratory coordinator's responsibilities include:

- Coordinating with the laboratory on QA/QC matters
- Ensuring that sampling procedures comply with QA/QC requirements
- Reviewing laboratory QA/QC reports, and identifying potential or existing problems
- Reviewing laboratory data prior to release
- Ensuring proper use, maintenance, and storage of field and analytical equipment

2.2.8 Laboratory QA Manager

The responsibilities of the laboratory QA manager are as follows:

- Approving laboratory QA/QC documents
- Performing audits of the laboratory to verify compliance with the laboratory QA program
- Verifying completion of corrective action cited in audits
- Acting as the contact point for proposed changes in the laboratory's QA program and initiating changes in the program
- As necessary, discussing with the laboratory manager and the project manager unresolved nonconformance issues

2.2.9 Feasibility Study Manager

The FS manager is responsible for coordination of all remedial action evaluation and planning activities. Reporting to the project manager, he will ensure that FS activities are conducted in accordance with the project.

2.2.10 Supervisory Geologists

Supervisory geologists are responsible for the following:

- Overseeing drilling and sampling activities (including installation of wells and borings, soil sampling, logging, well development, and ground - water sampling
- Monitoring exposure levels of organic contaminants throughout drilling activities
- Handling and shipping samples to the designated laboratory

2.3 TRAINING

All field personnel scheduled to work at the Naval Station Treasure Island are trained in compliance with OSHA requirements, as found in 29 CFR 1910.120, and the CLEAN Health and Safety Program (April 5, 1991), and are experienced in hazardous waste site work, use of personal protective equipment, and emergency response procedures.

All field personnel assigned to the project will receive the Work Plan, QAPjP, and Health and Safety Plan (HSP) in a timely manner to allow for a sufficient review period. The drilling subcontractor will received information from the Work Plan pertaining to drilling/well installation operations and the HSP. A field staff orientation and briefing will be held prior to the initiation of site sampling to acquaint personnel with the site, assign field responsibilities, and provide training in the operation of any unusual field equipment.

3.0 DATA QUALITY OBJECTIVES FOR MEASUREMENT DATA

Data Quality Objectives (DQO) are qualitative and quantitative statements developed by data users to specify the quality of data needed from a particular data collection activity to support specific decisions or regulatory actions. The three-stage process for developing DQOs is described in EPA's Data Quality Objective for Remedial Activities, 1987. The results of this process are discussed in the RI/FS Work Plan.

The data gathered during the RI will be used to decide whether remediation measures are necessary, and if so, what measures are appropriate. To support this decision, the data must be scientifically sound, defensible, and of known, acceptable and documented quality. To provide data of this quality, the following will take place:

- Use standard operating procedures (SOPs) for sampling, chain-of-custody, calibration, preventive maintenance, laboratory analysis, reporting, validation, internal QC, audits, and corrective action.
- Set quantitative goals and units of expression for precision, accuracy, and completeness for each measurement parameter.
- Set qualitative goals for representativeness and comparability.

The specific SOPs to be used for the RI are described in detail in the FSP. Precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters are discussed below.

3.1 PRECISION

Precision refers to the reproducibility of measurements under a given set of conditions. Precision is expressed quantitatively as the measure of variability of a group of measurements compared to their average value. Analytical precision for a single analyte is expressed as a percentage of difference between results of duplicate samples for the analyte.

Precision of sample collection will be measured in the laboratory through the analysis of field duplicates. Precision of measurements taken in the field will be checked by reporting several measurements taken at one location and comparing the results.

Analytical precision will be assessed through the analysis of laboratory duplicates and matrix spike/matrix spike duplicates.

Precision and accuracy goals for each analyte are presented in Tables 1 through 6. Field and laboratory components are reported separately.

3.2 ACCURACY

Accuracy refers to the degree of agreement in a measurement with an accepted reference true value, or primary standard. Accuracy is a measure of bias in a measurement system. Sources of error that introduce bias are the sampling process, field contamination, preservation, sample handling, matrix, sample preparation, analysis techniques, laboratory contamination, and data reduction. Accuracy is expressed as the percent recovery of an analyte that has been added (spiked) to an environmental sample at a known concentration before analysis. Sampling accuracy can be maximized by adhering to the following:

- All procedures will be documented.
- All equipment and instrumentation will be properly calibrated and maintained.
- Trip blanks, field blanks, and equipment blanks will be included in all sample batches to identify contamination introduced by sampling activities or laboratory analyses.
- Frequent and thorough reviews of field procedures.

Analytical accuracy will be assessed using EPA or National Bureau of Standards (NBS) - approved standard reference materials (SRM), matrix spike, and surrogate spike recovery results.

3.3 REPRESENTATIVENESS

Representativeness is a qualitative parameter and is defined by the degree to which the data represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is maximized by ensuring that sampling locations are selected properly and samples are collected. The methods and protocols used to select samples that are representative of a particular sampling site are described in the FSP.

3.4 COMPLETENESS

Completeness is a measure of the percentage of valid data obtained from a sampling program. A certain amount and type of data must be collected for conclusions based on those data to be valid.

Field sampling conditions are often unpredictable and nonuniform. The objective of the FSP is to obtain representative samples for all required analyses at each site and to provide sufficient quantities of sample materials to complete those analyses. Project sampling design and rationale are discussed in detail in the FSP. It is anticipated that 95 percent laboratory completeness and 90 percent field completeness will be acceptable to attain DQOs.

3.5 COMPARABILITY

Comparability is a qualitative parameter and is defined by the confidence with which one data set can be compared to another data set. Comparability will be ensured through the use of SOPs for sampling and field operations. These SOPs are discussed in the FSP. In order to increase comparability of results, the same SOPs and types of sampling equipment will be used for all phases of this task

The analytical laboratories will use SOPs as described in their laboratory QA plans. EPA-approved methods will be used for all analyses. These methods are specified in EPA's Contract Laboratory Program (CLP) statements of work and Test Methods for Evaluating Solid Waste, SW-846. Identical analytical methods for given parameters will be used during all task phases to meet task objectives.

3.6 DETECTION/QUANTITATION LIMITS

Detection limit (DL) is the minimum concentration of an analyte that can be distinguished from the normal random noise of an analytical instrument or method. Quantitation limit (QL) is the lowest concentration at which an analyte can be accurately and reproducibly quantified. Usually, QLs are equal to the instrument detection limits multiplied by a factor of 3 or 5. The proposed detection limits and quantitation limits are listed in Table 9 through Table 12.

4.0 SAMPLING PROCEDURES

Objectives of the sampling activities for this project are to:

- Characterize hazardous constituents on site
- Identify and screen classes of compounds from subsequent sampling rounds
- Provide data for determining the risk to potential receptors
- Provide data for evaluating remedial alternatives

To ensure project objectives are met, a detailed FSP that documents all field and laboratory activities related to the sampling effort was prepared. Essential elements of the basis for the FSP are outlined below:

- Objectives of the sampling effort
- Historical account of site contamination
- Site reconnaissance
- Sampling strategy and rationale
- Field methods and procedures
    - sample collection
    - sample containerization
    - sample preservation
    - sample packaging and shipment
    - sample documentation
    - sample holding time
    - QC samples
    - disposal of contaminated materials
    - decontamination of field equipment
- Site safety plan
- Procedures for coordinating with analytical laboratories

A detailed discussion of each of these elements and a table summarizing the sampling methods and procedures are presented in the FSP.

5.0 SAMPLE CUSTODY

Standard sample custody procedures are used to maintain the quality of samples during collection, transportation, and storage for analysis. The following documents must be prepared to ensure proper sample identification:

- Sample identification label
- Custody seals
- Chain-of-custody (COC) records
- Organic and inorganic traffic reports
- Field note books

It is the field operations manager's responsibility to ensure that all samples are properly handled to maintain the integrity of the sampling and analysis process.

5.1 FIELD PROCEDURES

Each sample container sent to the laboratory must have its own sample identification label. The following information will be included on the sample label:

(1) Site name

(2) Field identification number

(3) Date and time of sample collection

(4) Type of sample matrix

(5) Name of sampler

(6) Sample preservative used

(7) Types of analyses to be conducted

If a sample is split with another party, sample labels with identical information will be attached to each of the sample containers. Prior to shipment, sample containers will be placed in an iced cooler and properly packed to eliminate the possibility of breakage and sample spoilage.

When samples are shipped to the laboratory, they will be placed in containers sealed with custody seals. If the custody seals are serially numbered, these numbers must be cross-referenced on both the field document and the COC report. Two seals are to be placed on each shipping container in a manner that indicates if the container were opened in transit. Wide clear tape should be placed over the seals to ensure that seals are not accidentally broken during shipment.

Possession of the samples must be traceable from the time each is collected until it is received by the laboratory for analysis. The COC record is used to record the custody of samples at all times. The following information will be supplied to complete the COC record:

(1) Project name

(2) Signatures of samplers

(3) Sample numbers

(4) Sample matrix

(5) Signatures of individuals involved in sample transfer (the initial transfer must involve one of the identified samplers)

Individuals receiving the samples will sign, date, and note the time they received the sample form. COC records initiated in the field will be placed in a plastic cover and taped to the inside of the shipping container used for sample transport from the field to the laboratory.

Samples will be kept at 4°C and will be shipped in insulated containers with either freezer forms or ice. If ice is used, it will be placed in a container so that the water will not fill the cooler as the ice melts. An appropriate absorbent material, such as vermiculite will be added to the cooler to absorb any water and act as cushioning material. The samples will be shipped within 24 hours of collection to allow the laboratory to meet holding times. Department of Transportation regulations will be used for packaging and shipment of samples. Each subcontractor responsible for sampling will be familiar with the regulations prior to sampling.

Bound field notebooks will be maintained by the sampling team leader to provide daily records of significant events, observations, and measurements during field investigations. All entries will be signed and dated. All members of the field investigation team will use these notebooks, which will be kept as permanent records of filed activities.

If observations or measurements are taken in an area where contamination of a field notebook may occur instead of recording it in the project notebook, the information may be recorded in a separate bound and numbered logbook before being transferred to the project notebook. The original records will be retained, and the delayed entry will be noted as such.

Field notebooks are intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during field activities and to refresh the memory of the field personnel if called upon to give testimony during legal proceedings. In a legal proceeding, notes, if referred to, are subject to cross-examination and are admissible as evidence. The field notebook entries must be factual, detailed, and objective.

5.2 LABORATORY PROCEDURES

Upon receipt, the laboratory will sign and keep copies of the bill of lading. The COC form will be signed. The temperature of the cooler will be documented. If any breakage or discrepancy arises between the COC form, sample labels, and requested analysis, the sample custodian will notify the laboratory coordinator. The pH of incoming samples will be checked upon receipt. Any discrepancy or improper preservation will be noted by the laboratory as an out-of-control event and will be documented on an out-of-control form with the corrective action taken.

The laboratory sample custodian will assign a unique laboratory number to each sample. The sample custodian will transfer the samples to the proper analyst or store them in the appropriate containers. The analysts will be responsible for the samples until they are returned to the sample custodian. A laboratory COC will be maintained during sample processing and data analysis.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

The following subsections discuss calibration procedures for field equipment used for on-site monitoring and testing for laboratory equipment used for sample analysis.

6.1 FIELD EQUIPMENT

Field monitoring equipment and test equipment will be calibrated at prescribed intervals and before use. Calibration frequency will be based on the analytical methods employed, the type of equipment, inherent stability, manufacturer's recommendations, values given in national standards, intended use, and user experience. A summary of typical field equipment calibration requirements and frequency is provided in Table 7.

In some cases, particularly for field equipment, scheduled periodic calibration will not be performed because the equipment is not continuously in use. However, such equipment will be fully tested and calibrated before use in the field, then at the required frequencies for the duration of the field activity. Calibrated equipment will be uniquely identified by using either the manufacturer's serial number or other means. A label with the identification number and the date when the next calibration is due will be attached to the equipment. If this identification is not possible, records traceable to the equipment will be readily available for reference.

If an equipment malfunction is suspected, the device will be removed from service and tagged so it is not inadvertently used. The field team leader or laboratory coordinator will be notified, as appropriate, so that service can be performed or substitute equipment can be obtained.

Equipment that can no longer be calibrated or becomes inoperable during use will be removed from service and either segregated to prevent inadvertent use or tagged to indicate that it is out-of-calibration. Such equipment will be repaired, recalibrated or replaced as appropriate. Any such action should be reported in the field activities daily log or appropriate laboratory log.

Records will be prepared and maintained for each piece of calibrated measuring and test equipment and each piece of reference equipment to indicate that established calibration procedures have been followed. Records for equipment used in the field will be kept in the project files. Off-site laboratories will keep calibration records for their own equipment.

6.2 LABORATORY EQUIPMENT

Laboratory measuring and testing equipment will be identified and calibrated in accordance with EPA guidance, laboratory QA plans, and manufacturer's recommendations. Measuring equipment, test equipment, and reference standards will be calibrated at prescribed intervals or daily before use.

In some cases, scheduled periodic calibration will not be performed because the equipment is not continuously in use. Such equipment will be calibrated on an "as needed" basis prior to use, and then at the required intervals for as long as its use continues.

Records will be prepared and maintained for each piece of calibrated equipment for measuring and testing purposes and for each piece of reference equipment to indicate that established procedures are followed. Records for equipment used will be kept in the project files.

Calibration will be performed by a California DHS-certified and Navy-approved laboratory. Procedures for this project will follow EPA-approved methods as reference in Test Methods for Evaluation Solid Waste (SW-846) and Code of Federal Regulations, Title 40, Part 136.

7.0 ANALYTICAL PROCEDURES AND DETECTION OR QUANTITATION LIMITS

During the Naval Station Treasure Island remedial investigation, chemical analyses and physical measurements will be performed by an on-site field screening and sampling team and an off-site analytical chemistry and geotechnical laboratory. An off-site laboratory that maintains appropriate California State Certification and is approved by the U.S. Department of Navy will be selected.

Personnel conducting field screening analyses will follow EPA-approved methods when available. Parameters for which approved EPA methods have not been established will be analyzed with a method that meets the objectives of the project. For the analysis of soil gas samples, a modified SW846 Method 8020 for field screening of benzene, toluene, ethylbenzene, and xylenes (BTEX) will be used. Table 8 summarizes analytical methods and detection limits for field screening activities.

When analyzing samples for this project, the off-site laboratory will follow EPA-approved analytical methods. Strict QA/QC protocols, as specified by the method, will be adhered to during all analyses. Based on procedures developed by the EPA for data quality objectives for remedial response activities (EPA, 1987), QC levels have been set for each parameter. Analytical methods and detection/quantitation limits for QC levels for the off-site laboratory are summarized in Tables 9 through 12.

8.0 DATA REDUCTION AND VALIDATION

To ensure that data management activities provide an accurate and controlled flow of data, it is important that data handling and reporting steps be defined and implemented. Data management procedures are applicable to field- and laboratory-generated data.

8.1 DATA REDUCTION

8.1.1 Field Data Reduction

Data generated in the field will be recorded in task-specific field notebooks or on customized data sheets. All calculations will be clearly recorded. The project manager will review all field documentation to ensure completeness and legibility.

The field data will be reduced using the following units:

- Water levels - Reported to the nearest 0.01 foot after two measurements agree
- pH - Digital reading rounded to 0.1 pH units
- Electrical conductivity - Reported to 100 micromhos per centimeter
- Survey Data - Well casing elevations surveyed to 0.01 foot, coordinates to 1.0 foot
- Water temperature - Degrees centigrade reported to 0.1 degree.

8.1.2 Off-Site Laboratory Data Reduction

Data generated by off-site laboratories will be reduced using the format specified in the EPA-approved method.

8.2 DATA VALIDATION

Data validation is the process of reviewing data and accepting, rejecting, or qualifying it on the basis of sound criteria. Laboratory data will be validated, as appropriate, based on holding times, initial calibration, continuing calibration, blank results, and other QC sample results. Data validation

will be performed by quality assurance chemists who are knowledgeable and experienced in data validation.

8.2.1 Field Data Review

Field data will be reviewed on two different levels. First, all data will be reviewed at the time of collection by following standard procedures and QC checks. Second, data will be reviewed by the supervisory geologist, who will review the data to ensure the correct codes and units were included. After data reduction into tables or arrays, the supervisory geologist will review data sets for anomalous values. Any inconsistencies will be resolved immediately, if possible, by seeking clarification from the field personnel responsible for data collection. The supervisory geologist is also responsible for ensuring that defensible and justifiable data were obtained by following the field objectives described below:

- Adherence to the work plan
- Equipment and instruments properly calibrated and in working order
- Sample collection according to standard operating procedures
- Sufficient sample volume collected to maintain sample integrity and all required analyses conducted
- All applicable blanks and field QC samples provided with each sample set
- Complete chain-of-custody documentation kept throughout the duration of the field effort and copies included with each sample shipment

Random checks of sampling and field conditions will be made by the supervisory geologist, who will check recorded data at the time to confirm observations. Whenever possible, peer review also will be incorporated into the data validation process in order to maximize consistency between field personnel.

8.2.2 Laboratory Data Validation

For this project, data validation guidelines required for Navy Level-D QC will be used. The data validation guidelines for benthic biota sampling will follow that required for Level C QC.

8.2.3 Field Data Reporting

Field documentation will be maintained in the following types of documents: field logbooks, sample tags, chain-of-custody forms, and field data sheets for recording sampling activities, geological operations, and field calibration and maintenance data. Examples of these forms are in the FSP. The following general guidelines for maintaining field documentation will be used:

- Documentation will be completed in permanent black ink.
- All entries will be legible.
- The recorder will be identified.
- Errors will be corrected by crossing out with a single line, dating, and initialing.
- Any serialized documents will be maintained on-site and referenced in the site logbook.

Field personnel will use bound field logbooks with sequentially numbered pages for the maintenance of field records. The front cover of the logbook will list the contract name and number, the task order number, the site name, names of subcontractors, the service 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
- Weather conditions during field activity
- Log and summary of daily activities and significant events
- Notes of conversations with coordinating officials
- Identification numbers of instruments used
- Results of calibrations and field measurements
- Documentation of sampling activities
- Decontamination episodes
- Reference to other field logbooks or forms that contain specific information
- Discussion of problems encountered and their resolution

- Discussion of deviations from the FSP, QAPjP, or other governing documents
- Description of all photographs

The field quality control data sheets will be maintained as appropriate for the following types of data:

- Soil boring log
- Monitoring well construction log
- Well development log
- Ground - water sampling log
- Surface water/sediment sampling form
- Field change request form

Examples of these data sheets are provided in the FSP.

8.2.4 Off-Site Laboratory Data Reporting

The off-site laboratory is required to report the data appropriate for Navy Level-D QC, as identified in the NEESA document Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program (NEESA 20.2-047B, June 1988) for RI/FS projects. Benthic biota sampling will be analyzed following Level E QC. Level B QC will be followed for the field (GC) gross chromatography analyses.

9.0 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

Internal quality control checks and frequency will be adopted for all field samples and measurements. The same approach will be adopted for laboratory analyses.

9.1 FIELD QUALITY CONTROL PROCEDURES

To check the quality of field data, quality control (QC) samples will be collected for laboratory analysis. Field QC sampling will be used to evaluate sampling and analytical accuracy and precision. The description and quantities of each QC sample type are specified in the Field Sampling Plan based on the frequencies listed below. All QC samples will be shipped according to the chain-of-custody procedures specified in Section 5.0. Field QC samples will include the following types of samples:

- A trip blank consisting of a sealed container of analyte-free water that travels from the field to the laboratory with the samples to be analyzed for volatile organic compounds (VOC) - the trip blank identifies contamination that may have been contributed to the field samples during transport (receives same treatment as sample containers). One trip blank will be included in each cooler containing VOC samples.

- A field rinsate blank consisting of final rinse water from the decontamination of field sampling equipment - the analysis of field rinsate determines if the decontamination procedure is adequate to avoid carry-over of contamination from one sampling location to another. One field rinsate sample will be collected during each day of field activities and analyzed for the same analytes as the samples collected that day.

- A field blank consisting of water used for rinse during decontamination -one field bank will be collected from each source of rinse water (distilled water) and each sampling event. Field blanks will be analyzed for all parameters of interest.

- A field duplicate consisting of a duplicate sample from one sampling location - duplicates will be collected from all matrices at a rate of 10 percent. Duplicates for water, soil, and sediment analyses, except VOCs, will be collected as described in the appropriate procedure, homogenized, then split and placed in identical sets of sample containers. The VOC soil samples will not be mixed, but select segments of soil will be taken from the length of the core and placed in replicate sets of 40-ml glass vials. Cores may be sealed and shipped to the laboratory for subsampling if appropriate. VOC duplicates for ground - water samples will be collected simultaneously with the original samples.

- A matrix spike/matrix spike duplicate (MS/MSD) to be collected at the same rate and in the same manner as the field duplicate - additional sample volume will be collected for the MS/MSD to allow the laboratory to estimate method precision and accuracy. MS/MSD samples will be identified as such on the chain-of-custody forms.

Field QC samples, except those collected as MS/MSD, will have discrete sample numbers and will be submitted "blind" to the laboratories. The quantities for each field QC sample type are specified in the FSP. These samples will be analyzed as if they were original field samples. Results for these samples will be included in the analytical report.

9.2 FIELD MEASUREMENTS

Field measurements will be performed as part of the field sampling. These field measurements and associated QC checks include:

- pH/conductivity/temperature - Ten percent will be measured in duplicate.
- Radioactivity - Ten percent will be measured in duplicate.
- Total organic vapor screening (Headspace using a HNu PID) - Ten percent will be measured in duplicate.
- Soil organic vapor (on-site gas chromatograph (GC)) - Ten percent will be duplicates. Method blanks consisting of helium injected from a syringe will be run at a minimum frequency of 10 percent. Probe blanks consisting of an inert gas introduced into sampling probe will be run at a frequency of 10 percent to check on possible probe contamination.
- Interference check samples consisting of helium injected from a decontaminated syringe will be run at a frequency of 10 percent to check on possible probe contamination. Interference check samples consisting of helium injected from a decontaminated syringe will be run at a frequency of 10 percent to determine if syringe cleaning is adequate.
- Background ambient air samples will be run at every third sampling location to monitor ambient conditions. A calibration check standard will be run after every 10 samples.

9.3 OFF-SITE LABORATORY

The number of QC samples specified in the EPA-approved methods will be utilized. The following QC samples will be analyzed, as appropriate:

- Method blanks
- Blank/spikes
- Surrogates
- Matrix spikes and matrix spike duplicates
- Laboratory duplicates
- Initial and continuing calibration checks

10.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits will be conducted on both field activities and laboratory analyses. The specifics are discussed below.

10.1 FIELD ACTIVITIES

QA audit procedures will be used during field activities to assess and document performance of technical operations. The QA audit pathway is presented as a flow chart on Figure 2. Audits will be performed once every 4 months by the program QA manager, QC coordinator, and senior technical staff. A copy of the audit results will be submitted to the Navy Resident Officer in Charge (ROIC).

Audits may include evaluating project plan adherence; training status; health and safety procedures; activity performance and records; budget status; QC data; calibrations; conformance to SOPs; and compliance with laws, regulations, policies, and procedures. An individual audit plan is developed for each audit.

All auditors will be independent of the activities audited. When an independent audit team is required, the auditor will be present during the activities to be audited. The selection process considers technical expertise and experience in auditing.

Following completion of an audit, the auditor or audit team will prepare and submit an audit report to corporate management and Navy ROIC. The corporate QA manager will coordinate a management review of any deficiencies that are noted. They will provide the program manager with any additional corporate resources necessary to correct such deficiencies.

The auditor can issue a corrective action request to identify and schedule specific corrective actions to be undertaken and completed by the project manager. Completion of corrective action is verified by the auditor or audit team. After acceptance and verification of all corrective actions, the corrective action request form will be used to close the audit.

10.2 OFF-SITE LABORATORY ACTIVITIES

Performance audits of the off-site laboratory will be conducted routinely by the Navy. No other laboratory audits are planned for this project.

Internal audit routines are contained in the respective laboratory QA plans which adhere to the guidelines specified by the Navy.

11.0 PREVENTIVE MAINTENANCE

In order to keep all field and laboratory equipment in good working condition, regular preventive maintenance will be scheduled.

11.1 FIELD EQUIPMENT

Regular preventive maintenance checks of field equipment and instrumentation will be performed. All field monitoring and analytical equipment will be maintained in accordance with the manufacturers' recommended schedules and procedures. Field personnel will maintain records of service, calibration, and use as described in Section 6.0. Details of instrument problems encountered in the field will be described in the field sampling logbook and dealt with on-site if possible. Specific prevention maintenance practices will follow manufacturers' recommendations.

11.2 LABORATORY EQUIPMENT

A control system indicating the date of required maintenance, the person maintaining the equipment, and the next maintenance date will be used for laboratory equipment requiring routine maintenance. Information pertaining to histories of equipment maintenance will be kept in individual logs for each instrument.

Major instruments in the laboratories are usually covered by annual service contracts with manufacturers. Under these agreements, regular preventive maintenance visits are made by trained service personnel. Maintenance is documented and maintained in permanent records by the individual responsible for each instrument.

12.0 DATA ASSESSMENT PROCEDURES

12.1 PROJECT DATA MANAGEMENT SCHEME

The project data management scheme to be adopted conforms to the guidelines set for QAPjP data management as indicated in the guidance for conducting RI/FSs under Comprehensive Environmental Response, Compensation, and Liability Act (EPA Publication, 1988). Specific aspects of the data management scheme are discussed below.

12.2 STATISTICAL ASSESSMENT OF DATA QUALITY

A statistical evaluation of laboratory analytical results will apply precision, accuracy, completeness, and detection limit criteria for each parameter analyzed. When the analysis of a sample set is completed, the QC data generated will be reviewed and evaluated to validate the data set. The QC data will be reviewed for the following criteria:

Accuracy will be assessed by splitting a sample into two portions, spiking (by adding a known quantity of the constituents of interest to one of the portions, and then analyzing both portions for these parameters). The difference in the concentrations of the constituents of interest should be equal to the quantity of the spike added to one of the portions. The actual percent recovery is calculated as follows:

$$\% \text{ Recovery} = \frac{A_r - A_o}{A_t} \times 100\%$$

where A_r is the observed spiked sample concentration, A_o is the sample concentration, and A_t is the true or actual concentration of the spike. One hundred percent recovery is equivalent to 100 percent accuracy.

Precision will be assessed by conducting separate analyses of the duplicate spike samples or duplicate samples. A measure of the agreement in the reported values for the two portions is

obtained by calculating the relative percent difference (RPD) in the concentration level of each constituent, and is calculated as follows:

$$RPD = \frac{C_1 - C_2}{\frac{(C_1 + C_2)}{2}} \times 100\%$$

where C_1 is the concentration of analyte in the sample and C_2 is the concentration of the analyte in the duplicate/replicate.

In addition to evaluations of each set of data for accuracy and precision, an assessment will also be made of the completeness of the data. This assessment will involve computing the fraction of the reported values that remain valid after the sampling procedures have been reviewed and the results have been assessed for precision and accuracy. The quality assurance data objectives for the investigation relative to precision, accuracy, and completeness are described in Section 3.0.

13.0 CORRECTIVE ACTION PROCEDURES

Corrective action procedures after notice of an audit deficiency are discussed in this section.

13.1 FIELD ACTIVITIES

If an auditor identifies that any aspect of the integrity of the data is affected by nonconformance, the auditor will issue a corrective action request. Corrective action minimizes the possibility of questionable data or documentation. There are two types of corrective actions: immediate and long-term. Immediate corrective actions involve such things as the correction of procedures, repair of instrumentation that is working improperly, or correction of errors or deficiencies in documentation. Long-term corrective actions eliminate the source of problems by correcting systematic errors in sampling or analysis procedures that produce questionable results.

Copies of the corrective action request form will be given to the QA manager, the program manager, and subcontractor QA manager who will discuss each problem jointly to:

- Determine when the problem arose
- Assign responsibility for investigating and documenting the problem
- Determine the specific corrective action needed to eliminate the problem
- Set a time schedule and assign responsibility for implementing the required corrective action
- Verify and document that the corrective action has eliminated the problem
- Determine whether notification of the Navy is necessary

A corrective action status form is used to monitor the status of all corrective actions. Corrective action is not complete until the problem has been solved effectively and permanently. Follow-up action to ensure that the problem remains corrected is an important step in the corrective action procedure.

The program QA manager has the authority to require environmental measurements that are compromised to be discontinued or limited until corrective action is complete and data quality is no

longer questionable. The program QA manager also may order the reanalysis of samples or measurements occurring since the last documented evidence that the system was in control.

13.2 OFF-SITE LABORATORY ACTIVITIES

Internal corrective action procedures are contained in the laboratory QA plans.

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The final RI/FS report will contain a separate QA section summarizing data quality information collected during the RI/FS. The project-specific QA/QC effort will include:

- A system audit of the sampling plan during the first sampling effort - this will evaluate adherence to the work plan, sampling plan, and documentation of field activities and changes to the plan.
- Performance audits of selected field sampling operations - this will include evaluation of sampling methods, field documentation, field analyses, adherence to SOPs, and other issues pertaining to field activities.
- QA/QC of the validation of the site characterization data from the sampling operations - there will be an office review of data and field documentation.
- QA/QC review of the analysis of the data - this will evaluate the need for any additional sampling at the end of Phase I sampling operations and revisions of the sampling methods, parameters, or scope of sampling activities to address QC data gaps.

These QA/QC activities will be the responsibility of staff not directly involved with the project. For each audit, the findings, recommendations, and any corrective action will be identified in an internal QA/QC memorandum. Any need for corrective action will be communicated to the project manager.

The program QA manager will prepare a monthly report and may prepare reports to management that concern program and project QA. These reports may include the following:

- QA audit and other inspection results
- Instrument, equipment, or procedural problems that affect quality
- Past due corrective actions
- Objectives from the previous report that were achieved
- Objectives from the previous report that were not achieved
- Work planned for the next month

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

TABLES

TABLE 1
(Sheet 1 of 2)
LABORATORY PRECISION AND ACCURACY GOALS FOR VOLATILE COMPOUNDS (SW-8240)

	WATER		SOLID	
Method Blank Spike, Method Blank Spike Duplicate or Surrogate Compound	Acceptable % Recovery	Acceptable RPD[1]	Acceptable % Recovery	Acceptable RPD
Chloromethane	60-140	25	60-140	25
Bromomethane	60-140	25	60-140	25
Vinyl chloride	60-140	25	60-140	25
Chloroethane	60-140	25	60-140	25
Methylene chloride	--	--	--	--
Acetone	--	--	--	--
Carbon disulfide	60-140	25	60-140	25
1,1-Dichloroethene	60-140	25	60-140	25
* 1,1-Dichloroethane	61-145	14	59-172	22
1,1-Dichloroethane	60-140	25	60-140	25
1,2-Dichloroethene (total)	60-140	25	60-140	25
Chloroform	60-140	25	60-140	25
1,2-Dichloroethane	60-140	25	60-140	25
2-Butanone	60-140	25	60-140	25
1,1,1-Trichloroethane	60-140	25	60-140	25
Carbon Tetrachloride	60-140	25	60-140	25
Vinyl acetate	60-140	25	60-140	25
Bromodichloromethane	60-140	25	60-140	25
1,2-Dichloropropane	60-140	25	60-140	25
cis-1,3-Dichloropropene	60-140	25	60-140	25
* Trichloroethene	71-120	14	62-137	24
Dibromochloromethane	60-140	25	60-140	25
1,1,2-Trichloroethane	60-140	25	60-140	25
* Benzene	76-127	14	66-142	21
trans-1,3-Dichloropropene	60-140	25	60-140	25

TABLE 1
(Sheet 2 of 2)
LABORATORY PRECISION AND ACCURACY GOALS FOR VOLATILE COMPOUNDS (SW-8240)

Method Blank Spike, Method Blank Spike Duplicate or Surrogate Compound	WATER		SOLID	
	Acceptable % Recovery	Acceptable RPD[1]	Acceptable % Recovery	Acceptable RPD
Bromoform	60-140	25	60-140	25
4-methyl-2-pentanone	60-140	25	60-140	25
2-Hexanone	60-140	25	60-140	25
Tetrachloroethene	60-140	25	60-140	25
* Toluene	76-125	14	59-139	21
* Chlorobenzene	75-130	14	60-133	21
Ethylbenzene	60-140	25	60-140	25
Styrene	60-140	25	60-140	25
Xylene (Total)	60-140	25	60-140	25
Surrogates				
* Toluene-d_8	88-110	--	81-117	--
* Bromofluorobenzene	86-115	--	74-121	--
* 1,2-Dichloroethane-d_4	76-114	--	70-121	--

* These compounds are routinely spiked in the MBS and MBSD. The other compounds are spiked periodically to assess overall method performance.

[1] Relative percent difference

Precision and accuracy goals are approximate limits only. They will be refined when adequate data are available.

TABLE 2

(Sheet 1 of 3)

LABORATORY PRECISION AND ACCURACY GOALS FOR SEMIVOLATILE COMPOUNDS (SW-8270)

	WATER		SOLID	
Method Blank Spike, Method Blank Spike Duplicate or Surrogate Compound	Acceptable % Recovery	Acceptable RPD[1]	Acceptable % Recovery	Acceptable RPD
* Phenol	12-89	42	26-90	35
bis(2-chloroethyl)ether	10-150	50	10-150	50
* 2-Chlorophenol	27-123	40	25-102	50
1,3-Dichlorobenzene	10-150	50	10-150	50
* 1,4-Dichlorobenzene	36-97	28	28-104	27
1,2-Dichlorobenzene	10-150	50	10-150	50
Benzyl alcohol	10-150	50	10-150	50
bis(2-Chloroisopropyl)ether	10-150	50	10-150	50
* N-Nitroso-di-n-propylamine	41-116	38	41-126	38
Hexachloroethane	10-150	50	10-150	50
Nitrobenzene	10-150	50	10-150	50
Isophorone	10-150	50	10-150	50
2-Nitrophenol	10-150	50	10-150	50
2,4-Dimethylphenol	10-150	50	10-150	50
* 1,2,4-Trichlorobenzene	39-98	28	38-107	23
Naphthalene	10-150	50	10-150	50
Hexachlorobutadiene	10-150	50	10-150	50
Hexachlorocyclopentadiene	10-150	50	10-150	50
* 4-Chloro-3-methylphenol	23-97	42	26-103	33
2,4,6-Trichlorophenol	10-150	50	10-150	50
2-Chloronaphthalene	10-150	50	10-150	50
Dimethylphthalate	10-150	50	10-150	50
Acenaphthylene	10-150	50	10-150	50
* 2,6-Dinitrotoluene	46-118	31	31-137	19
Acenaphthene	10-150	50	10-150	50

TABLE 2
(Sheet 2 of 3)
LABORATORY PRECISION AND ACCURACY GOALS FOR SEMIVOLATILE COMPOUNDS (SW-8270)

Method Blank Spike, Method Blank Spike Duplicate or Surrogate Compound	WATER		SOLID	
	Acceptable % Recovery	Acceptable RPD[1]	Acceptable % Recovery	Acceptable RPD
* 4-Nitrophenol	10-80	50	11-114	50
* 2,4-Dinitrotoluene	24-96	38	28-89	47
Diethylphthalate	10-150	50	10-150	50
4-Chlorophenyl-phenylether	10-150	50	10-150	50
Fluorene	10-150	50	10-150	50
4,6-Dinitro-2-methylphenol	10-150	50	10-150	50
N-Nitrosodiphenylamine	10-150	50	10-150	50
4-Bromophenyl-phenylether	10-150	50	10-150	50
Hexachlorobenzene	10-150	50	10-150	50
* Pentachlorophenol	9-103	50	17-109	47
Phenanthrene	10-150	50	10-150	50
Anthracene	10-150	50	10-150	50
Di-n-butylphthalate	10-150	50	10-150	50
Fluoranthene	10-150	50	10-150	50
* Pyrene	26-127	31	35-142	36
Butylbenzylphthalate	10-150	50	10-150	50
3,3'-Dichlorobenzidine	10-150	50	10-150	50
Benzo(a)anthracene	10-150	50	10-150	50
Chrysene	10-150	50	10-150	50
Di-n-octylphthalate	10-150	50	10-150	50
Benzo(b)fluoranthene	10-150	50	10-150	50
Benzo(k)fluoranthene	10-150	50	10-150	50
Benzo(a)pyrene	10-150	50	10-150	50
Indeno(1,2,3-cd)pyrene	10-150	50	10-150	50
Dibenz(a,h)anthracene	10-150	50	10-150	50

TABLE 2
(Sheet 3 of 3)
LABORATORY PRECISION AND ACCURACY GOALS FOR SEMIVOLATILE COMPOUNDS (SW-8270)

Method Blank Spike, Method Blank Spike Duplicate or Surrogate Compound	WATER		SOLID	
	Acceptable % Recovery	Acceptable RPD[1]	Acceptable % Recovery	Acceptable RPD
Benzo(g,h,i)perylene	10-150	50	10-150	50
Surrogates				
* Nitrobenzene-d_5	35-114	--	23-129	--
* 2-Flurobiphenyl	43-116	--	30-115	--
* Terphenyl-d_{14}	33-141	--	18-137	--
* Phenol-d_6	10-94	--	24-113	--
* 2-Fluorophenol	21-100	--	25-121	--
* 2,4,6-Tribromophenol	10-123	--	19-122	--

* These compounds are routinely spiked in the MBS and MBSD; the other compounds are spiked periodically to assess overall method performance.

[1] Relative percent difference

Precision and accuracy goals are approximate limits only. They will be refined when adequate data are available.

TABLE 3
(Sheet 1 of 2)
LABORATORY PRECISION AND ACCURACY GOALS FOR PESTICIDES/PCBs (SW-8080)

Method Blank Spike, Method Blank Spike Duplicate or Surrogate Compound	WATER		SOLID	
	Acceptable % Recovery	Acceptable RPD[1]	Acceptable % Recovery	Acceptable RPD
alpha-BHC	25-175	50	25-175	50
beta-BHC	25-175	50	25-175	50
delta-BHC	25-175	50	25-175	50
* gamma-BHC (Lindane)	56-123	15	46-127	50
* Heptachlor	40-131	20	35-130	31
* Aldrin	40-120	22	34-132	43
Heptachlor epoxide	25-175	50	25-175	50
Endosulfan I	25-175	50	25-175	50
* Dieldrin	52-126	18	31-134	38
4,4'-DDE	25-175	50	25-175	50
* Endrin	56-121	21	42-139	45
Endosulfan I	25-175	50	25-175	50
4,4'-DDD	25-175	50	25-175	50
Endosulfan sulfate	25-175	50	25-175	50
* 4,4'-DDT	38-127	27	23-134	50
Methoxychlor	25-175	50	25-175	50
Endrin ketone	25-175	50	25-175	50
alpha-Chlordane	25-175	50	25-175	50
gamma-Chlordane	25-175	50	25-175	50
Toxaphene	25-175	50	25-175	50
Aroclor 1016	25-175	50	25-175	50
Aroclor 1221	25-175	50	25-175	50
Aroclor 1232	25-175	50	25-175	50
Aroclor 1242	25-175	50	25-175	50
Aroclor 1248	25-175	50	25-175	50

TABLE 3
(Sheet 2 of 2)
LABORATORY PRECISION AND ACCURACY GOALS FOR PESTICIDES/PCBs (SW-8080)

	WATER		SOLID	
Method Blank Spike, Method Blank Spike Duplicate or Surrogate Compound	Acceptable % Recovery	Acceptable RPD[1]	Acceptable % Recovery	Acceptable RPD
Aroclor 1254	25-175	50	25-175	50
Surrogate				
* Dibutylchlorendate (DBC)	38-127	--	23-134	--

* These compounds are routinely spiked in the MBS and MBSD; the other compounds are spiked periodically to assess overall method performance.

[1] Relative percent difference

Precision and accuracy goals are approximate limits only. They will be refined when adequate data are available.

TABLE 4

(Sheet 1 of 2)

LABORATORY PRECISION AND ACCURACY GOALS FOR PRIORITY POLLUTANT METALS (SW-3050/SW-6010)

	WATER[1]		SOLID[2]	
Method Blank Spike, Method Blank Spike Duplicate or Surrogate Compound	Acceptable % Recovery	Acceptable RPD [1]	Acceptable % Recovery	Acceptable RPD [1]
Aluminum	75-125	20	75-125	35
Antinomy	75-125	20	75-125	35
Arsenic	75-125	20	75-125	35
Barium	75-125	20	75-125	35
Barium	75-125	20	75-125	35
Beryllium	75-125	20	75-125	35
Cadmium	75-125	20	75-125	35
Calcium	75-125	20	75-125	35
Chromium	75-125	20	75-125	35
Cobalt	75-125	20	75-125	35
Copper	75-125	20	75-125	35
Iron	75-125	20	75-125	35
Lead	75-125	20	75-125	35
Magnesium	75-125	20	75-125	35
Manganese	75-125	20	75-125	35
Mercury	75-125	20	75-125	35
Nickel	75-125	20	75-125	35
Potassium	75-125	20	75-125	35
Selenium	75-125	20	75-125	35
Sodium	75-125	20	75-125	35
Thallium	75-125	20	75-125	35
Vanadium	75-125	20	75-125	35
Zinc	75-125	20	75-125	35

TABLE 4
(Sheet 2 of 2)
LABORATORY PRECISION AND ACCURACY GOALS FOR PRIORITY POLLUTANT METALS (SW-3050/SW-6010)

1 Relative percent difference is for duplicate analyses only.

2 Percent recoveries are matrix dependent and may not always be achievable.

Precision and accuracy goals are approximate limits only. They will be refined when adequate data are available.

TABLE 5
PRECISION GOALS FOR
MISCELLANEOUS FIELD PARAMETERS

Parameter	Method	RPD[1]
Radioactivity	Geiger-Mueller Counter	±1 mR/hr
VOC screen	HNu PID	25 units
pH	EPA 150.1	±0.1 unit
Specific Conductance	EPA 120.1	±50μmhos
Temperature	EPA 170.1	±1°C
Water Level	Electric Sounder	±0.01 foot
Visual Classification	ASTM D-2488	--
OVA/GC - Soil Gas	TBD	--

[1] Relative percent difference

TABLE 6
PRECISION AND ACCURACY GOALS
FOR MISCELLANEOUS LABORATORY PARAMETERS

Parameter	Method	RPD[1]
Cyanide	SW-7010	TBD[2]
Asbestos	EPA BULK	--
Soil pH	SW-9045	0.2
Grain size	ASTM D-422	--
Specific gravity	ASTM D-854	--
Atterberg limits	ASTM D-4318	--
Moisture	ASTM D-2216	--
Cation exchange	SW-9080/9081	--
Total petroleum hydrocarbon	EPA-418.1	50
Organophosphorus pesticides	SW-8140	50
Chlorinated herbicides	SW-8150	50

[1] Relative percent difference

[2] To be determined by subcontractor

Precision and accuracy goals are approximate limits only. They will be refined when adequate data are available.

TABLE 7

TYPICAL FIELD MEASUREMENT AND TEST EQUIPMENT LIST

Instrument to be Calibrated	Standard Reference	Calibration Technique/ Frequency	Acceptance Specifications
Conductivity meter	Buffer solution of known conductivity (1,000 mhos)	Manufacturer's users manual; Calibrate daily	Standard solution value
pH/temperature meter	Two buffer	Manufacturer's users manual; Calibrate daily	Buffer solution values
HNu photoionization detector	Gas standard kit	Manufacturer's users manual; Calibrate daily	Meter indicates standard ppm concentrations and zero setting
Geiger Mueller Counter	Secondary Standard of known exposure vote from radiation source	Manufacturer's uses manual; Calibrate daily	Span gas concentration value

Note: Field instruments are calibrated daily or before use.

TABLE 8

(Sheet 1 of 2)

ANALYTICAL METHODS, DETECTION LIMITS AND REPORTING UNITS

PARAMETER	MATRIX	ANALYTICAL METHOD	DETECTION LIMIT	REPORTING UNITS
Radioactivity	soils			
VOC Screen (HNu)	soils		1 ppm	ppm
pH	water	E150.1	--	pH units
Specific conductance	water	E120.1	--	µmhos/cm
Temperature	water	E170.1	--	°C
Water level	water			feet
Visual classification	soils/ sediment	ASTM[3] D-2488		
OVA (GC)	soil gas			

TABLE 8

(Sheet 2 of 2)

ANALYTICAL METHODS, DETECTION LIMITS AND REPORTING UNITS

Notes:

1 Water parameters (Specific Conductance, pH, and Temperature) will be analyzed after purging of each casing volume. Each well will be purged of 3 casing volumes of water or until water parameters stabilize.

2 All water levels will be measured in the same 24 hour period before purging of sampling of any wells. All water levels will be measured again just before purging and just after sampling.

3 American Society of Testing and Materials (ASTM)

TABLE 9
(Sheet 1 of 2)
PRACTICAL QUANTITATION LIMITS (PQL) FOR VOLATILE ORGANICS
(SW-8240)

Volatiles	Ground Water µg/L	Low Soil/Sediment µg/Kg
1. Chloromethane	10	10
2. Bromomethane	10	10
3. Vinyl Chloride	10	10
4. Chloroethane	10	10
5. Methylene Chloride	5	5
6. Acetone	100	100
7. Carbon Disulfide	5	5
8. 1,1 - Dichloroethene	5	5
9. 1,1 - Dichloroethene	5	5
10. trans-1,2-Dichloroethene	5	5
11. Chloroform	5	5
12. 1,2-Dichloroethane	5	5
13. 2-Butanone	100	100
14. 1,1,1,- Trichloroethane	5	5
15. Carbon Tetrachloride	5	5
16. Vinyl Acetate	50	50
17. Bromodichloromethane	5	5
18. 1,1,1 -Tetrachloride	5	5
19. 1,2-Dichloropropane	5	5
20. trans-1,3-Dichloropropene	5	5
21. Trichloroethene	5	5
22. Dibromochloromethane	5	5
23. 1,1,2-Trichloroethane	5	5
24. Benzene	5	5
25. bis-1,3-Dichloropropene	5	5
26. 2-Chloroethyl Vinyl Ether	10	10

TABLE 9
(Sheet 2 of 2)
PRACTICAL QUANTITATION LIMITS (PQL) FOR VOLATILE ORGANICS
(SW-8240)

	Volatiles	Ground Water µg/L	Low Soil/Sediment µg/Kg
27.	Bromoform	5	5
28.	2-Hexanone	50	50
29.	4-Methyl-2-pentanone	50	50
30.	Tetrachloroethene	5	5
31.	Toluene	5	5
32.	Chlorobenzene	5	5
33.	Ethyl Benzene	5	5
34.	Styrene	5	5
35.	Total Xylenes	5	5

PQLs listed for soil/sediments are based on wet weight. Normally, data is reported on a dry weight basis; therefore, PQLs will be higher, based on the percent moisture in each sample.

TABLE 10
(Sheet 1 of 3)
PRACTICAL QUANTITATION LIMITS (PQL) FOR SEMI-VOLATILES (SW-8270)

Semi-Volatiles	Ground Water µg/L	Low Soil/Sediment µg/Kg
Phenol	10	660
bis(2-Chloroethyl) ether	10	660
2-Chlorophenol	10	660
1,3-Dichlorobenzene	10	660
1,4-Dichlorobenzene	10	660
Benzyl Alcohol	20	1300
1,2-Dichlorobenzene	10	660
2-Methylphenol	10	660
bis(2-2-Chloroisopropyl) ether	10	660
4-Methylphenol	10	660
N-Nitroso-Di-N-propylamine	10	660
Hexachloroethane	10	660
Nitrobenzene	10	660
Isophorone	10	660
2-Nitrophenol	10	660
2,4-Dimethylphenol	10	660
Benzoic Acid	50	3300
bis(2-Cholroethoxy) methane	10	660
2,4-Dichlorophenol	10	660
1,2,4-Trichlorobenzene	10	660
Naphthalene	10	660
4-Chloroaniline	20	1300
Hexachlorobutadiene	10	660
4-Chloro-3-methylphenol	20	1300

TABLE 10
(Sheet 2 of 3)
PRACTICAL QUANTITATION LIMITS (PQL) FOR SEMI-VOLATILES (SW-8270)

Semi-Volatiles	Ground Water µg/L	Low Soil/Sediment µg/Kg
2-Methylnapthalene	10	660
Hexachlorocyclopentadiene	10	660
2,4,6-Trichlorophenol	10	660
2,4,5-Trichlorophenol	10	660
2-Chloronaphthalene	10	660
2-Nitroaniline	50	3300
Dimethyl phthalate	10	660
Acenaphthylene	10	660
3-Nitroaniline	50	3300
Acenaphthene	10	660
2,4-Dinitrophenol	50	3300
4-Nitrophenol	50	3300
Dibenzofuran	10	660
2,4-Dinitrotoluene	10	660
2,6-Dinitrotoluene	10	660
Diethylphthalate	10	660
4-Chlorophenyl phenyl ether	10	660
Fluorene	10	660
4-Nitroaniline	50	3300
4,6-Dinitro-2-methylphenol	50	3300
N-Nitrosodiphenylamine	10	660
4-Bromophenyl phenyl ether	10	660
Hexachlorobenzene	10	660
Pentachlorophenol	50	3300
Phenanthrene	10	660
Anthracene	10	660

TABLE 10
(Sheet 3 of 3)
PRACTICAL QUANTITATION LIMITS (PQL) FOR SEMI-VOLATILES (SW-8270)

Semi-Volatiles	Ground Water µg/L	Low Soil/Sediment µg/Kg
Di-n-butylphthalate	10	660
Fluoranthene	10	660
Pyrene	10	660
Butyl benzyl phthalate	10	660
3,3'-Dichlorobenzidine	20	1300
Benzo(a)anthracene	10	660
bis(2-ethylhexyl)phthalate	10	660
Chrysene	10	660
Di-n-octyl phthalate	10	660
Benzo(b)fluoranthene	10	660
Benzo(k)fluoranthene	10	660
Benzo (a)pyrene	10	660
Indeno(1,2,3-cd)pyrene	10	660
Dibenz(a,h)anthracene	10	660
Benzo(g,h,i)perylene	10	660

PQLs listed for soil/sediment are based on wet weight. Normally, data is reported on a dry weight basis; therefore, PQLs will be higher based on the % moisture in each sample. This is based on a 30-g sample and gel permeation chromatography cleanup.

TABLE 11
(Sheet 1 of 2)
PRACTICAL QUANTITATION LIMITS (PQL) FOR PESTICIDES AND PCBs
(SW-8080)

Pesticides/PCBs	Ground Water µg/L	Low Soil/Sediment µg/Kg
Aldrin	0.05	8.0
α-BHC	0.05	8.0
ß-BHC	0.05	8.0
δ-BHC	0.05	8.0
Gamma-BHC (Lindane)	0.05	8.0
Chlordane (technical)	0.50	80
4,4'-DDD	0.10	16
4,4'-DDE	0.10	16
4,4'-DDT	0.10	16
Dieldrin	0.10	16
Endosulfan I	0.05	8.0
Endosulfan II	0.10	16
Endosulfan sulfate	0.10	16
Endrin	0.10	16
Endrin ketone	0.10	16
Heptachlor	0.05	8.0
Heptachlor epoxide	0.05	8.0
Methoxychlor	0.50	80
Toxaphene	1.0	160
Aroclor-1016	0.50	80
Aroclor-1221	0.50	80
Aroclor-1232	0.50	80
Aroclor-1242	0.50	80
Aroclor-1248	0.50	80
Aroclor-1254	1.0	160
Aroclor-1260	1.0	160

TABLE 11
(Sheet 2 of 2)
PRACTICAL QUANTITATION LIMITS (PQL) FOR PESTICIDES AND PCBs
(SW-8080)

PQLs listed for soil/sediment are based on wet weight. Normally data is reported on a dry weight basis; therefore, PQLs will be higher based on the percent moisture in each sample. This is based on a 30-g sample and gel permeation chromatography cleanup.

TABLE 12
(Sheet 1 of 2)
INSTRUMENTAL DETECTION LIMITS FOR PRIORITY POLLUTANT METALS (SW-6010)

Element	Instrumental Detection Limit (μg/L)*
Aluminum	45
Antimony	32
Arsenic	53
Barium	2
Beryllium	0.3
Boron	5
Cadmium	4
Calcium	10
Chromium	7
Cobalt	7
Copper	6
Iron	7
Lead	42
Magnesium	30
Manganese	2
Molybdenum	8
Nickel	15
Potassium	(See note a)
Selenium	75
Silicon	58
Silver	7
Sodium	29
Thallium	40
Vanadium	8
Zinc	2

TABLE 12

(Sheet 2 of 2)

INSTRUMENTAL DETECTION LIMITS FOR PRIORITY POLLUTANT METALS (SW-6010)

---

* The estimated instrumental detection limits shown are taken from EPA SW-846. They are given as a guide for an instrumental limit. The actual method detection limits are sample dependent and may vary as the sample matrix varies.

a Highly dependent on operating conditions and plasma position.

FIGURES

FIGURE 1 TREASURE ISLAND
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
PROJECT ORGANIZATION

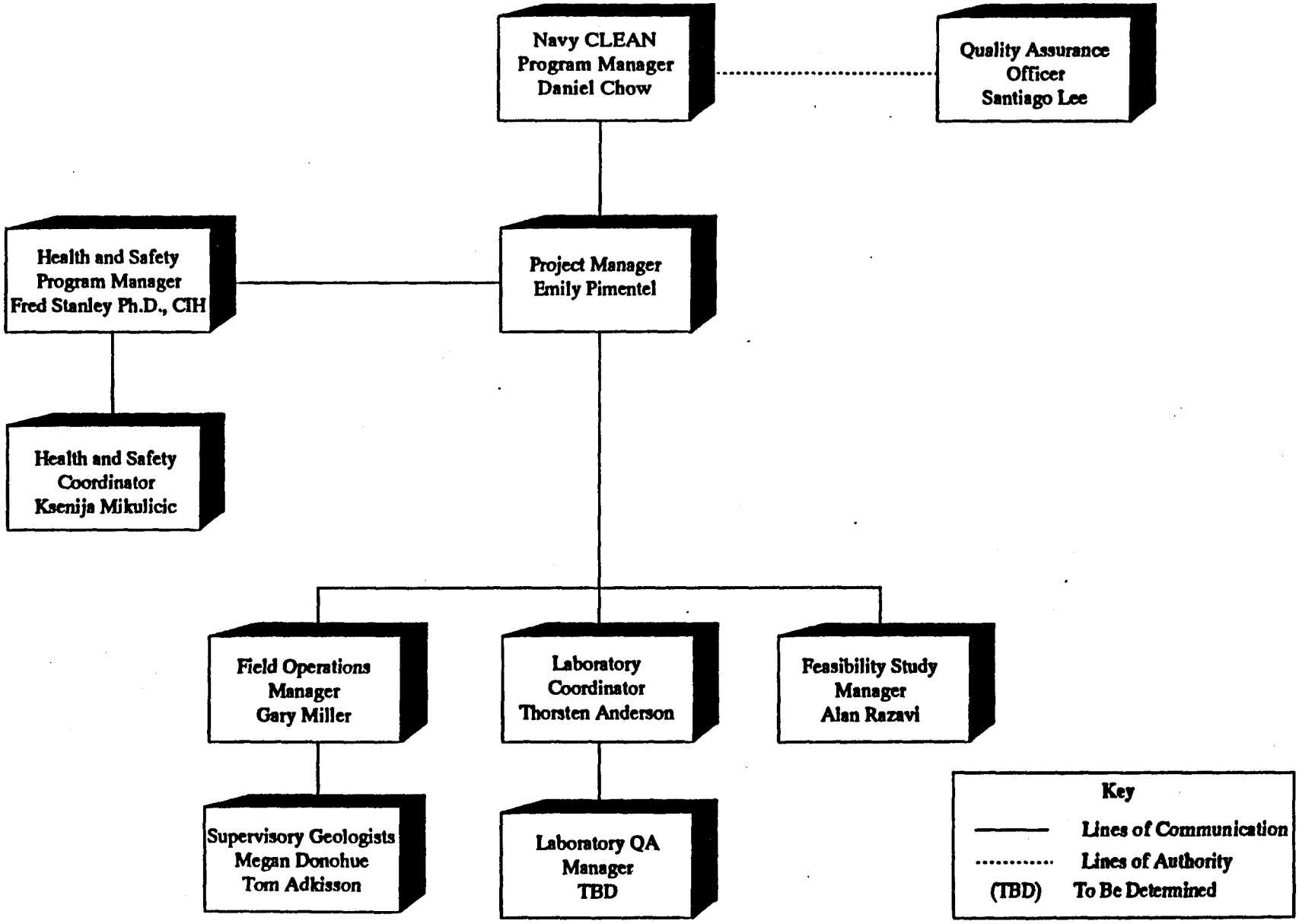
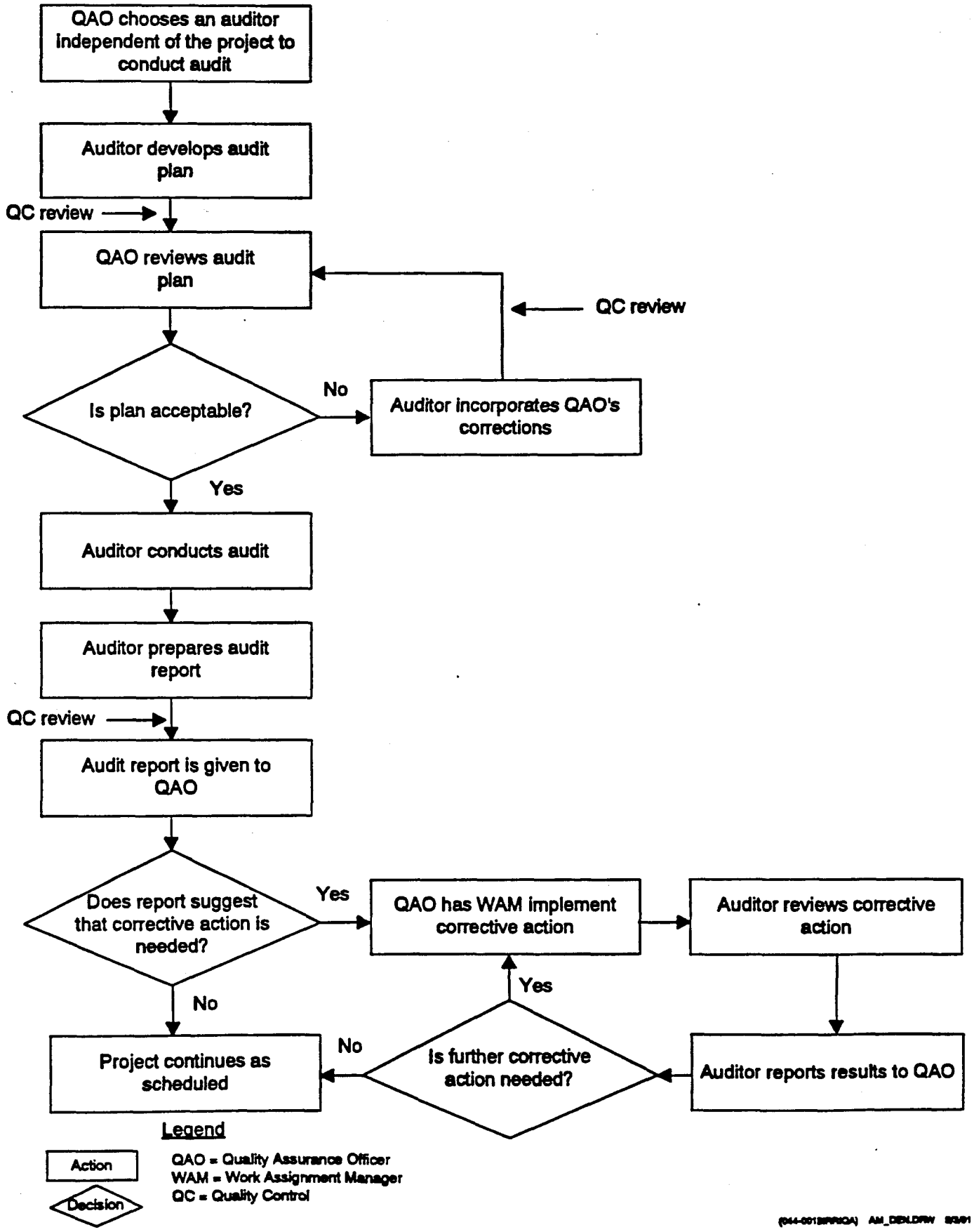
FIGURE 2
TYPICAL FIELD AND LABORATORY AUDIT PROCESS