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REPORTS

DATE:

April 1990

Quality Assurance Project Plan

Work Copy

Mercury Meter Site Investigation/Remediation Farmington, New Mexico

Prepared for

El Paso Natural Gas Company
El Paso, Texas

April 1990

EPNG File No. 10014.A.2

Volume 1 of 2

WCC File No. 90H3012C

Woodward-Clyde Consultants

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MERCURY METER SITE INVESTIGATION/REMEDIATION QUALITY ASSURANCE PROJECT PLAN

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1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

El Paso Natural Gas Co. (EPNG) operations are divided into two regions, North and South. The North region consists of Farmington and Albuquerque Divisions and include operations in Texas, New Mexico, Oklahoma, Arizona, Utah and Colorado. The South Region consists of the Midland and El Paso Divisions and include operations in Texas, New Mexico, Arizona and California. The majority of the Farmington Division operations are located in the San Juan Basin and there are approximately 10,000 well sites over a 32,000 sq. mi. area. In late 1987, EPNG became aware of the potential mercury contamination in the soil at their flow meter sites within their operations.

EPNG recognized the need to determine the magnitude of mercury contamination and hired a consulting firm to investigate. John Mathes & Associates, Inc. (JMAI) of Pittsburgh, PA., concluded that 86% to 88% of all the sites which have or had mercury meter stations (8700) in the Farmington Division were potentially contaminated. EPNG is concerned for its' employees health and exposure to mercury and developed "The Mercury Protocol". The Mercury Protocol document addressed the procedures for mercury handling, vehicle decontamination and meter house cleanup. EPNG has conducted the cleanup of approximately 340 mercury contaminated metering facilities as of February 1990, in the Farmington Division. EPNG met with the Oil Conservation Division (OCD) of New Mexico in November of 1988 to discuss their experience, findings and proposed a basic program to address the past and future use of

the mercury flow meters and the potential soil contamination and discuss their intent to expand the mercury site remediation program.

The cleanup will be conducted by EPNG personnel assisted by contract labor. This Quality Assurance Project Plan (QAPP), the Work Plan and the Field Sampling Plan (FSP) developed by Woodward-Clyde Consultants (WCC) will be implemented by EPNG personnel. Oversight Quality Assurance and Quality Control (QA/QC) for mercury remediation will be provided by WCC. This program will be extended outside the Farmington Division once experience has been gained and revisions to the protocol, if any, are complete.

1.2 STATISTICAL REPORT

In January of 1989, JMAI was contracted by EPNG to determine the number of mercury meter stations with potential health hazards due to mercury contaminated soil. Based on a binomial distribution it was estimated that 68 out of 8500 sites would determine within a 90% accuracy, the number of potential mercury contaminated sites. To eliminate unknown sources of bias in the selection process and obtain a representative sampling of the sites to be tested, the sites were selected randomly. JMAI commenced field sampling and analysis of 68 randomly selected sites in the Farmington Division in New Mexico in late January of 1989. Field testing was completed in early February of 1989 and a report issued on March 27, 1989. The report, titled "Pipeline Metering Station, Mercury Assessment Report", concluded that between 7,312 and 7,438 out of 8500 (86%-88%) sites in New Mexico, Arizona, Utah and Colorado had a potential mercury contamination problem.

The presence of mercury contamination within the meter hut was defined using three different criteria. The first criteria was based on EP TOX mercury concentration results of the underlying soil equal to or greater than 0.2 mg/L representing an environmental hazard considered to be a characteristic waste to be disposed of as a hazardous waste. The second criteria concentrated on the visual location of free mercury within the meter hut and/or beneath the meter station after the soil was stirred. The third criteria was based on measuring mercury vapor concentrations greater than 0.05 mg/m3.

Of particular interest in the report, JMAI studied the relationship between each type of EP Tox, total mercury, and headspace mercury measurements. The study could not demonstrate the relationship between the results of the three types of measurements.

1.3 PROJECT OBJECTIVE AND SCOPE OF WORK

The primary objectives of the Mercury Meter Investigation/ Remediation project are:

* Maintain the health and safety of EPNG personnel

* Maintain the metering station site environmental conditions

* Reconstruct the meter house for reducing the release of mercury into the environment

These objectives will be accomplished by the following site activities:

* Screening the air within the meter house for the presence of combustible gases and mercury vapors

* Visually inspecting for indications of mercury contamination

* Removing the meter house

* Excavating the soil suspected to be contaminated with mercury

* Verification sampling of the soil after soil removal

* Reconstructing the meter house with a device to catch and contain mercury

EPNG's objective is to review and improve existing investigation/ remediation procedures. EPNG is concerned over the workers' safety, health risk and had oriented the mercury protocol toward workers' safety. There are presently three criteria which define mercury soil contamination. These 3 criteria include:

1. Visible mercury

2. Presence of mercury vapors equal to or greater than .05 mg/m3

3. Mercury content found in the soil in excess of 0.2 mg/L by the Toxicity Characteristic Leaching Procedure (TCLP)

If either criteria #1 and #2 indicated a positive reading, the soil remediation program is initiated. Soil sampling had been used solely for verification purposes at remediation sites. If the criteria #1 and #2 are negative and show no signs of mercury then the verification sample is taken and the mercury house is reconstructed.

1.4 PAST REMEDIATION EXPERIENCE

In response to the inquiries of well site operators concerning visible mercury contamination at the mercury meter stations, EPNG initiated a cleanup program in the Farmington Division. In March of 1988 EPNG crews followed remediation guidelines as set forth in the Mercury Protocol developed by an EPNG Task Force. Approximately 340 mercury meter sites have been remediated in the Farmington area.

1.5 SITE BACKGROUND AND SETTING

1.5.1 FARMINGTON DESCRIPTION

The EPNG Farmington Division operates over 10,000 well site meters in the San Juan Basin covering an area of approximately 32,000 sq. mi. in size. It is divided into three operating areas which contain the following field Districts: Angel Peak, Kutz, Ballard, Blanco, Lowry, Lindrith and Ojito. The field districts are subdivided into runs which may consist of 50 to 70 well sites each.

The well sites are located on private, federal, national forest and Indian property. Typically, the meter stations are located on bare property approximately 1/2 to 1 acre in size. The surrounding terrain varies from arid desert, mountain forest to river valleys. A systems map displaying the Farmington Division and its' operating areas is shown in Figure 1.

Although their primary concern is for EPNG employees' health and safety, a secondary concern which EPNG has considered is for the protection of the environment. The Farmington Division has prioritized certain areas of the San Juan Basin for Phase 1 of the investigation/remediation program. The areas to be given priority will be the metering stations with mercury meters and those which had mercury meters, located in the State of New Mexico, Energy and Minerals Department Oil Conservation Division (OCD) designated sensitive water zones.

1.5.2 FACILITY DESCRIPTION

The metering stations in the Farmington Division are typically very similar. An overall site plan and details of a mercury flow meter station are illustrated in the Work Plan. The well sites and mercury flow meter stations are described in the following paragraphs.

WELL SITE

A typical well site consists of the valves (x-mas tree), a production unit to separate oil & gas, associated tanks, a dehydration unit, pit, and the connection to the distribution line (dogleg). The metering station is usually located near the well valve system. The line connection to the gathering system (dogleg)

is typically located at the lateral or well tie line, which may vary significantly in distance.

METER STATION

A standard metering station in the Farmington Division consists of a sheet metal house mounted on a 6' x 4' wooden skid with a dirt floor. This building is ventilated with several small screened openings on the side near the roof. The building has two entrances on either side, one of which can be opened from the outside and the other from the inside. Full access can be obtained to the meter by removing the safety latch from the exterior of one of the doors, entering and releasing the safety latch of the other door from the inside. The doors have a safety bar at the top to maintain the doors in the open position while maintenance operations are in progress.

The mercury flow meter consists of a static and differential pressure recorder with a manifold connected to the meter run flange. A U-tube is located at the rear of the flow meter which is secured by a stand and saddle. The meter may contain from 7 lbs to 12 lbs of mercury. The meter run connects the well to EPNG's gathering system and has an in-line flange housing an orifice plate.

A temperature recorder is sometimes part of the meter station. It can be located off to one side of the meter hut or in-line and adjacent to the mercury meter. The temperature recorder contains a small amount of mercury (2 oz.) in an armored capillary tube.

1.5.3 MERCURY METERS

Meters are placed at all well sites to measure the amount of gas purchased and/or transported through EPNG's pipeline system. The basic function of a meter station is to record the static pressures and differential pressures on a circular chart. The static pressure is provided from in-line measurements and the differential pressures are measured at the orifice flange. The run technicians are required to visit the individual metering stations on a frequency at least equal to the chart measuring capacity (8, 16, 31 days). The run technicians calibrate the meter quarterly and inspect the orifice plates yearly. Other duties of the run technician include editing circular charts, cleaning, changing chart drive batteries and inking pens.

There are various reasons for mercury spillage within the metering stations and a few are listed as follows:

Maintenance

Some droplets of mercury escape while routine maintenance is performed on the meter or when a routine check is made on the orifice plate (Mercury which has collected at the orifice plate and flange is released when the plate is removed for inspection).

Leaks

Mercury can also be spilled as a result of leaks due to aging seals and gaskets, or as a result of high line pressures.

Pressure

The most common cause of spills is attributed to severe fluctuations in pressure from the well. Many wells periodically are turned off (shut-in) to build pressure. The meter check valves, in some instances, are unable to absorb the sudden pressure surge causing carry-over into the meter run when the well is reactivated. The meter U-tube fitting and gasket may also fail when the well is reactivated.

Typical elements which may leak due to high line pressures are:

* U-TUBE
  The U-tube is a metal tube located behind the metering box. The sources of mercury spillage are identified as the failure of the tubing itself and/or at the mechanical connection points. The capture of possible mercury spillage is addressed in the Work Plan.

* PIN REGISTER
  The pin register located in the small metal metering box is a source for very small leaks caused by high pressures during start-up. The small mercury spillage is somewhat contained by virtue of the metering box casing and door. The leakage of mercury is addressed in the Work Plan.

Vandalism

Vandalism of the metering equipment can occur.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The Mercury Meter Site Investigation/Remediation project is considered an EPNG Operations and Engineering Function. The organizational structure for this Function is illustrated in Figure 3.

Management personnel from EPNG's Farmington Division, North Region Engineering Compliance (NREC) and Environmental & Safety Affairs Department (ESAD) will be utilized for the Farmington Project as high-lighted in Figure 3. Description of primary project personnel and their responsibilities are presented below:

2.1 AUTHORITY AND RESPONSIBILITIES

The authority and responsibilities of the persons presented on the Farmington project organization chart on Figure 4 are as follows:

2.1.1 PROJECT MANAGER

Mr. M.D. Blanco, Division Project Manager for the Farmington Division, will serve as Project Manager for activities in the Farmington Division. Project Management responsibilities and activities will include but not be limited to:

* Scheduling field activities
* Data management
* Project budgeting

* Manpower management

* Project coordination

The Project Manager will rely on the North Region Compliance Manager for matters pertaining to quality assurance and health and safety issues.

2.1.2 COMPLIANCE MANAGER

Mr. K.E. Beasley, North Region Engineering Compliance Manager, will serve as the project's Compliance Manager. The Compliance Manager will act independently from the Project Manager and will be responsible for the following activities:

* Advising the Project Manager

* Managing quality assurance

* Managing health and safety

* Monitoring the progress and direction of the project

* Monitoring compliance of the project with QA objectives

The Health and Safety Officer and the QA Officers report directly to the Compliance Manager. The Compliance Manager has the authority to provide final rulings on interpretations for the work plan, QAPP and the Health and Safety Plan.

2.1.3 ESAD TASK MANAGER

Mr. M.W. Chintis, Senior Environmental Scientist for ESAD, will serve as the ESAD Task Manager. The ESAD Task Manager will provide project support in the environmental, safety, regulatory and technical areas. His responsibilities will include but not be limited to:

* Ensure that the Work Plan, QAPP, Health and Safety Plan and all project activities are in accordance with all current applicable regulations.

* Coordinate all regulatory agency matters with the project's Regulatory Liaison Consultant.

* Administer the contracting of all project laboratories, hazardous waste disposal and resource recovery operations

* Administer the contracting of all consulting work and act as the liaison with all project Consultants

* Coordinate all QA/QC oversight performed by the Consultants; and screen and advise on all corrective measures recommended by Consultants

* Administer the collection and storage of all validated project records, data and calculations

* Provide project consulting in all technical areas

* Distribute all consultant correspondence to the Project Team

2.1.4 REGULATORY LIAISON CONSULTANT

Mr. J.C. Bridges, environmental consultant for ESAD, will serve in the capacity as a Regulatory Liaison Consultant. His responsibility is to participate in communications with government regulators and agencies on the behalf of EPNG for this project. He will provide regulatory interpretation for EPNG. The Regulatory Liaison Consultant reports to the ESAD Task Manager.

2.1.5 QA/QC OFFICER

Ms. S.D. Miller Senior Compliance Specialist for North Region Compliance Engineering, will serve as the project's QA Officer. The QA Officer will be responsible for verifying that sampling and analytical operations are carried out in compliance with the QAPP. The QA Officer or her designee will perform audits of field and lab documents and specify corrective action as required. The QA Officer will report the QA audit results to the Compliance Manager. Mr. J.A. Lambdin will serve as the Alternate QA Officer and Lab Coordinator.

2.1.6 LAB COORDINATOR

Mr. J.A. Lambdin, Regional Lab Superintendent for the North Region will be the project Lab Coordinator. The Lab Coordinator's responsibilities will include but not be limited to:

* Preparing sample containers for field activities

* Receiving samples from the field

* Validating and checking the completeness of chain-of-custody forms.

* Preparation and shipping of samples to the analytical laboratory

* Preparation and maintenance of soil to be used for field blank samples

* Coordination with the designated analytical laboratories including any laboratory audits

* Validation of chemical analysis results

* Approval of chemical analysis results for entry into the validated data base

* Serving as an alternate QA Officer

2.1.7 FIELD OPERATIONS COORDINATOR

Mr. J.C. Allen, Division Coordinator for special projects in the Farmington Division, will serve as the project's Field Operations Coordinator. His responsibilities will include:

* Supervise and schedule work crews

* Conduct all crew safety meetings

* Procure, manage and distribute all field supplies, equipment and materials

* Ensure the proper maintenance and calibration of field instruments and equipment

* Administer the budget associated with field operations

* Ensure the field activities conform to the Work Plan, QAPP and Health and Safety Plan requirements

* Obtain validated forms from Lab Coordinator, perform additional verifications, enter pertinent data into the project's data base, organize and release data to the ESAD Task Manager

2.1.8 FIELD STAFF

The Field Operations Coordinator will supervise seven crews, two Field Inspectors and a Field Data Clerk. The Field Specialist will be the lead in each crew and will have the following responsibilities:

* Protect the health and safety of site workers

* Record all site and sample information; and complete the Chain-of-Custody form, Meter Site Data form and all other required forms

* Collect and preserve site samples per QAPP procedures

* Coordinate and supervise all site activities

2.1.9 HEALTH AND SAFETY OFFICER

Mr. J.E. Dolan and Mr. R. Rojas, Senior Safety Representatives for the North Region Safety Department, will serve as the Project Health and Safety Officers. Their responsibilities will include:

* Oversee and or conduct all training provided to field crews associated with the Health and Safety Program

* Ensure that all site activities are conducted in accordance with the Health and Safety Plan

* Provide field audits of health and safety procedures and implement corrective measures

* Evaluate mercury vapor levels for Level B PPE requirement, and provide oversight of all activities involving Level B PPE

* Verify the medical and training qualifications of personnel that will participate in the field activities

* Monitor the medical surveillance program and approve personnel to continue participation in the field activities

* Oversee all field crew safety meetings

* Audit maintenance and calibration of health and safety related instruments

2.2 PROJECT COMMUNICATIONS

The Project Manager will manage the information systems and the program record systems. Incoming project-related materials in the form of correspondence, sketches, authorizations or other information shall be marked with the date received and the file number. The Project Manager shall then route the materials as required. QA audit reports shall be sent for review to the Compliance Manager.

As soon as it is practicable, incoming correspondence originals shall be placed in the project central file. If the correspondence is required by the project personnel for reference, a copy should be made rather than releasing the original from the files.

Project-related materials transmitted externally from EPNG, including correspondence, reports and sketches, shall be appropriately reviewed, approved, and signed prior to transmittal. Outgoing correspondence, except for QA audits, shall be signed by the Project Manager and the originator of the correspondence.

All project-related materials, both incoming and outgoing, will be kept in locked files, separate from other EPNG files. Management of the information systems and the program record system will be controlled by the Project Manager.

2.2.1 RECORDS ADMINISTRATION

This project will require the administration of files at the Farmington Division and at ESAD in El Paso. The records systems managed by the Project Manager shall provide adequate control, confidentiality, and retention for project related information. Record control shall include receipt from external sources, transmittal, transfer to ESAD, and indication of record status. Record retention shall include receipt at storage areas, indexing and filing, maintenance, and retrieval. All project files will be secured and maintained in a designated EPNG facility. Project information will be filed according to the codes described in section 5 of the Work Plan.

Control of Records

The control of records provides for the flow of information both internal and external to EPNG. After receiving information from external sources, completing the field phases of the project, completing analyses, and issuing reports or other transmittals, associated records shall be submitted to the EPNG central project files. This shall include records generated by subcontractors. Records shall be legible and easily identifiable. In addition, field records and records transmitted between EPNG and contractors shall be adequately protected from damage and loss during transfer (for example hand carrying or making copies prior to shipment).

Field records, laboratory data summaries, numerical calculations, reports, and other data transmittals, copies of proposals, purchase orders, contracts, correspondence, memorandums, telephone records, photographs or reference

material shall be transferred to the project central file for final storage. Documentation and verification of computer programs shall be submitted to the project central file for storage.

Records submitted to the project central file should be bound, placed in folders or binders, or otherwise secured for filing.

Record Status

All individuals on the project staff shall be responsible for identifying and reporting obsolete or superseded project-related information to the Project Manager on a periodic basis. In turn, the Project Manager shall notify the project and laboratory staffs and quality assurance personnel of the resulting status change in project documents, such as sketches and project procedures. It shall be the responsibility of the Project Manager to notify personnel of changes in quality assurance procedures.

In general, outdated documents shall be marked "void." One copy of void documents shall be maintained for the project files with the reasons for and date of voiding clearly indicated.

The notation "Preliminary" or "Draft" shall be marked on documents to denote calculations, drawings, and other materials which:

* Have not been formally checked

* Are based on information which has not been formally checked

* Do not contribute to final project information.

Record Retention

Information associated with the project shall be retained in the EPNG office central project files at ESAD and at the Farmington Division. The central project files must contain all data generated by the project.

The files at ESAD will include the following:

* General information

* Plans prepared for the project

* Correspondence

* Weekly reports

* Internal Memoranda

* Chain-of-Custody Forms

* Meter Site Data Forms

* Hot work Permits

* Manifests for soil removal and storage

* Noncompliance corrective action reports

* Reports of Data Evaluations

* Contractor Information

* Validated Chemical Analysis Packages

* Spill Incident Reports

* Information from past remediations

* Quality Assurance Reports

* All documents and data generated by the project

Project records shall be received at various locations by personnel designated by the Project Manager. Designated personnel shall check that incoming records have proper identification for filing, are legible, and are in suitable condition for storage. Only designated personnel shall index and file records.

For the project central file, the individual file folders shall be divided into appropriate categories based on content and numbered and filed sequentially within each category.

The records at the project central file shall be listed on a numbered index to facilitate locating the records. The index shall be kept in a separate folder, at the front of the file.

Information on project material not stored in the project central file should be included with the index, if appropriate.

For original sketches and quality assurance files, all material shall be filed only by file number. Computer files of generic program documentation and verification shall be organized by program name.

The record storage in the central files shall utilize facilities providing a suitable environment to minimize deterioration or damage and prevent loss. The facilities shall, where possible, have controlled access and shall provide protection from excess moisture and temperature extremes. Records shall be secured in binders, placed in folders or envelopes, or otherwise secured for storage in containers (for example steel file cabinets).

Storage systems shall provide for the prompt retrieval of information for reference or use outside the storage areas. For the project central file, sign out sheets shall be maintained so that a record of files removed is available.

Onsite Records

Appropriate requirements for the field control and retention of records generated as a result of site remediation, sampling, and testing shall be followed. A file, similar to the project central file, will be established and maintained in Farmington by Data Management Clerk, under the direction of the Project Manager.

Upon completion of the field program or program phase, the file in Farmington will be transferred to, and integrated with, the EPNG central office central project files at ESAD.

2.2.2 CHANGE CONTROL

It is imperative that the status of work items be up-to-date. A status system includes:

* Formal document and design drawing revision
* Non-conformance identification, documentation, and reporting
* Change documentation and approval

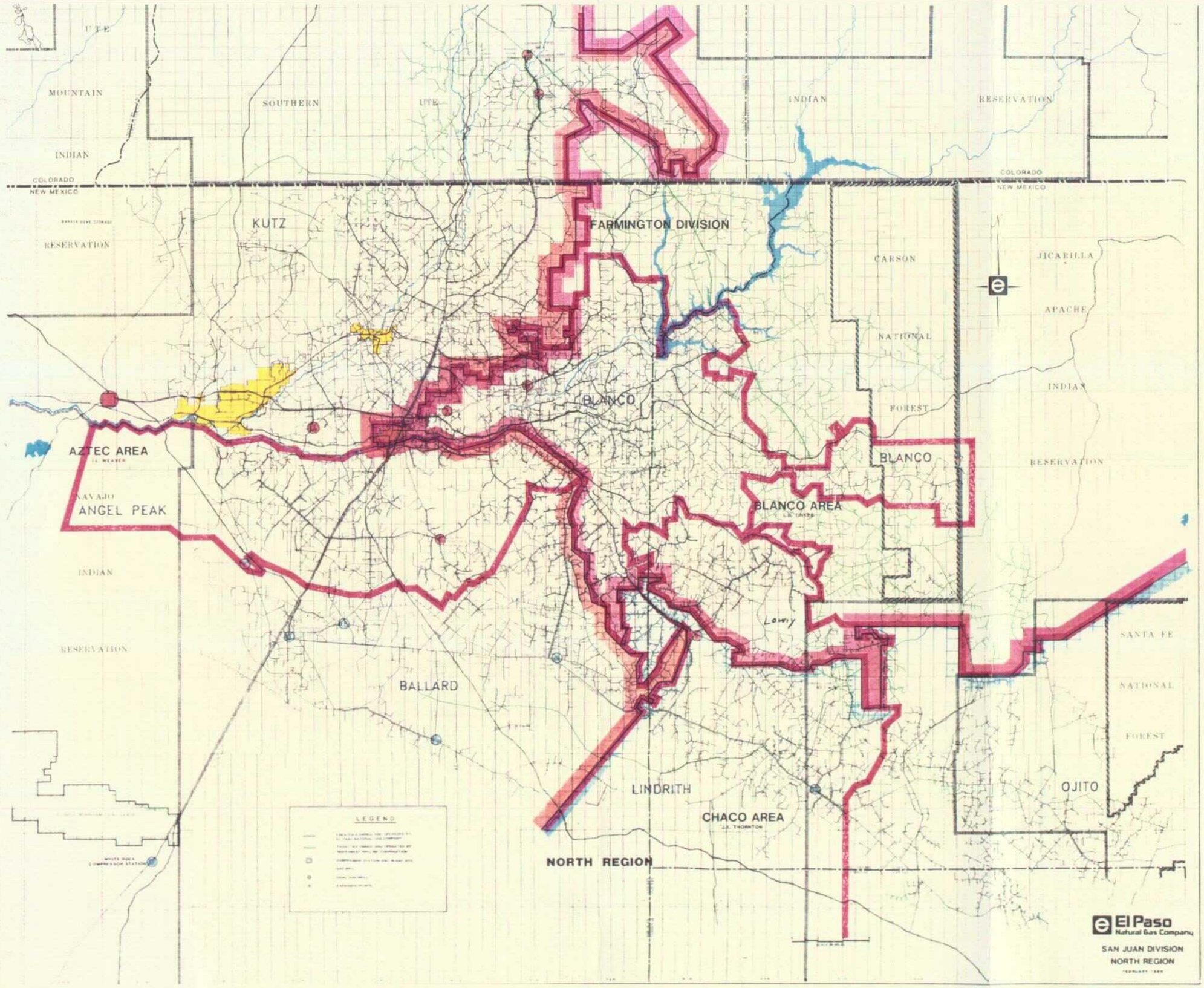
Change from original design documents, procedures, and specifications is possible. Change does not imply a non-conformance to the work, but simply means that the original plans must be altered because of information, events, or innovations that occur during the work.

Changes must be documented, evaluated, and reported as they occur. It is necessary to manage change so that the actual course of the project, not the original plan, can be demonstrated and justified.

It is the responsibility of project personnel to record the change and to make the documentation available as appropriate to project or laboratory management. The effect of the change upon the project shall be evaluated by the project or laboratory management, quality assurance personnel, and/or subcontractor management.

Approval and signatures documenting the approval will be provided by the Project Manager prior to implementing changes. The effect of change on the project should be evaluated by appropriate personnel and approved by management prior to implementation. Review and written approval for changes which affect the project activities should be provided by the project manager. Following the review and approval process, notification of the change should be made to appropriate personnel and affected documents revised as necessary to reflect the work as actually performed.

Project documents and must be reviewed, approved, distributed, and revised as necessary. This control will provide approved, up-to-date information.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APACHE
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NAVAJO
ANGEL PEAK
INDIAN
RESERVATION
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BALLARD
LINDRITH
CHACO AREA
J.R. THORNTON
NORTH REGION
SANTA FE
NATIONAL
FOREST
OJITO
LEGEND
El Paso
Natural Gas Company
SAN JUAN DIVISION
NORTH REGION

Figure 1

CORPORATE ORGANIZATION CHART

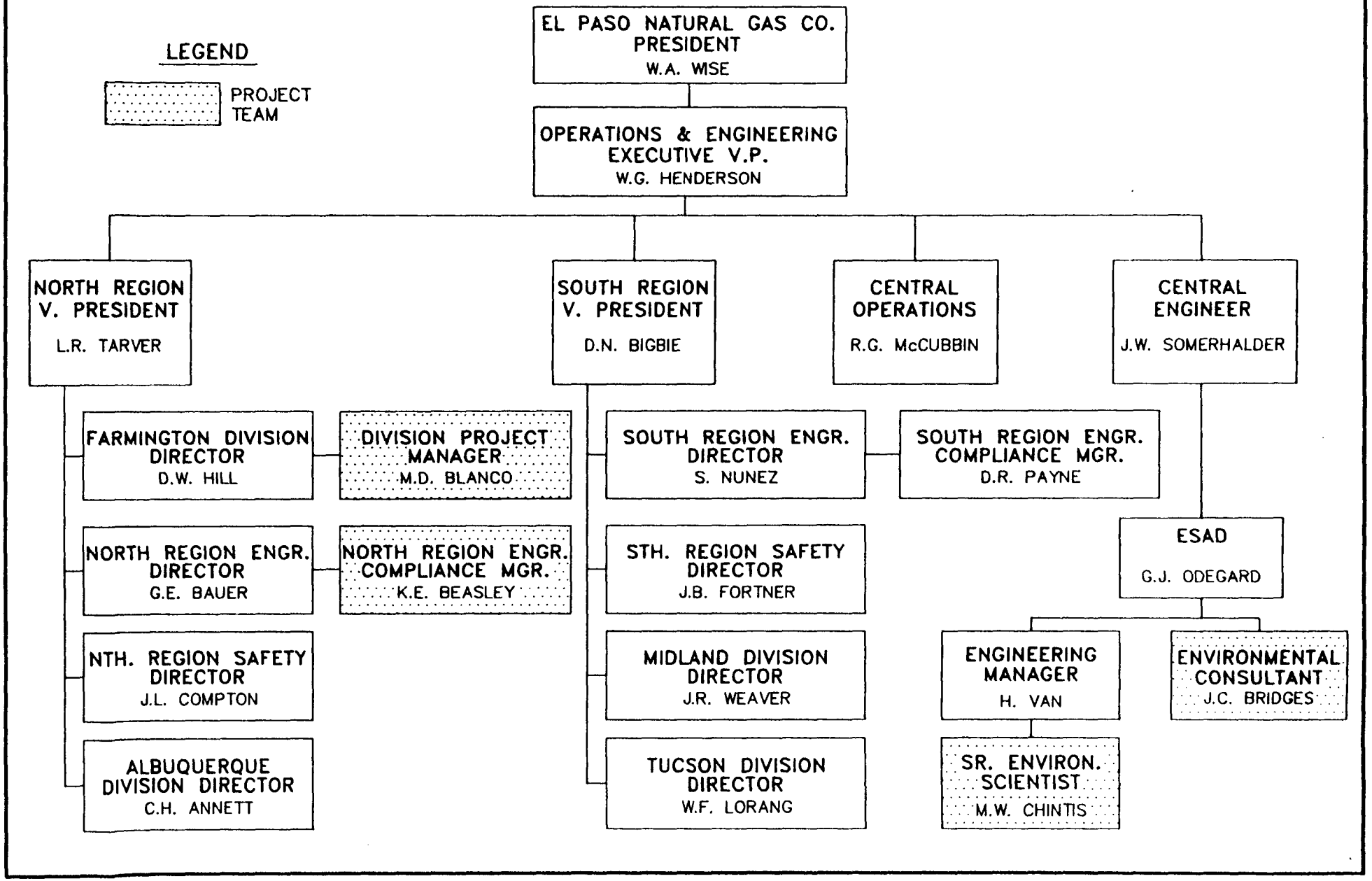

FIGURE 2

PROJECT ORGANIZATION CHART

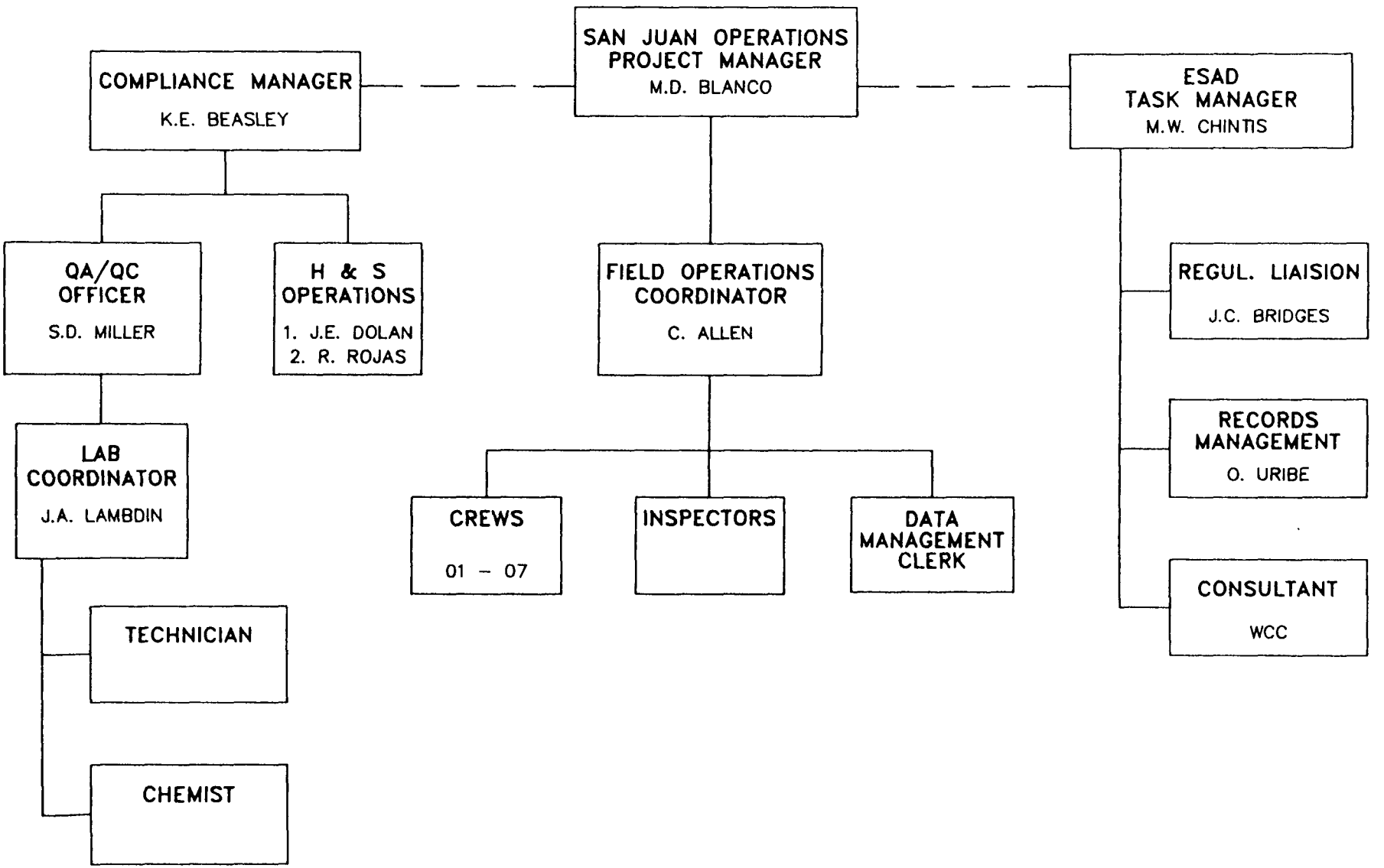

FIGURE 3

Quality Assurance Project Plan

Work Copy

Mercury Meter Site Investigation/Remediation Farmington, New Mexico

Prepared for

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3.0 DATA QUALITY OBJECTIVES FOR MEASUREMENT

The activities performed for this project will require measurements resulting in different types of data. Visual observations made during screening will yield qualitative data. Screening for mercury vapors will yield semi-quantitative data. Chemical analyses of soil samples will yield quantitative data. The data quality objectives for each of these measurements are provided below.

SCREENING DATA OBJECTIVES

The primary quality assurance objective of screening will be to detect whether mercury contamination is present in the soil, whether mercury contamination has been removed from the soil floor, and to monitor the air for health and safety purposes. The excavated soil floor will be screened by visual inspection and with a vapor analyzer.

Visual screening will consist of inspection for visible mercury and for indications of mercury contamination. A Jerome 411 or a Bacharach MV-2 mercury vapor analyzer will be used to detect mercury vapors in a meter house.

VERIFICATION SOIL SAMPLING DATA OBJECTIVES

The primary objective of collecting soil samples is to determine the concentration of leachable mercury in the soil. The concentration of leachable mercury will be compared to the regulatory limit that defines a hazardous waste. The regulatory limit is 0.2 mg/L in the TCLP leachate. The verification soil samples will be extracted in accordance with the leaching procedure

promulgated in 40 CFR part 261 Appendix II as the Toxicity Characteristic Leaching Procedure (TCLP) and designated as EPA Method 1311. The analysis of the TCLP leachate for mercury will be in accordance with the Cold Vapor Atomic Absorption (Cold Vapor AA) analytical method described in the Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) Statement of Work (SOW) titled "U.S. EPA Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration, SOW No. 788, Revised February 1989 and June 1989", (EPA CLP SOW No. 788).

The reporting limit for Cold Vapor AA mercury analysis of the TCLP leachate is much less than action level of 0.2 mg/L. A typical detection limit for mercury in deionized water (rinsate) is less than 0.0002 mg/L. The reporting limit for mercury in the TCLP leachate will be 0.002 mg/L for verification samples for this project.

3.1 PURPOSE AND DEFINITIONS

The purpose of the Quality Assurance/Quality Control (QA/QC) procedures is to produce quantitative data that meet (or exceed) the requirements of standard analytical methods and satisfy the project requirements. The objectives of the QA efforts for this project are as follows:

* Providing the mechanism for ongoing control and evaluation of the quality of data measurement throughout the project.

* Utilizing quality control data to define data quality for various measurement parameters in terms of precision and

* Verifying that all soil samples are accurately and precisely collected, analyzed and documented.

Precision

Precision is the measure of variability of individual sample measurements. Precision will be assessed from the laboratory analyses of duplicate samples. Precision will be measured as the relative percent difference (RPD) in the results of analysis of duplicate samples as described in Section 12.

Average percent difference and the standard deviation of the concentration data will be used to evaluate the acceptability of the data. Data to be used in the evaluation will meet the criteria defined here and in Section 8.2.3 of this Plan. Confidence intervals will be derived for data sets using standard statistical methods. The criteria for laboratory QC samples by EPA CLP SOW No.788 are presented in Table 1.

Accuracy

Accuracy is the measure of a system bias. Bias is the difference between the true value and the mean of the laboratory analyses. Accuracy will be assessed from the set of matrix spike samples as described in section 12 of this plan. The accuracy criteria for the laboratory QC samples by the EPA CLP SOW No. 788 method are also presented in Table 1.

Completeness

Completeness is a measure of the amount of the data meeting the data evaluation criteria obtained from a measurement system

compared to the amount that was expected to be obtained. The completeness of data reflect the degree to which required samples specified in the appropriate sampling plan have been collected and the necessary analysis performed, in order to create a sufficient validated data base to meet the project objectives.

The objective for completeness for this project is 90 percent. It is anticipated that no more than 10 percent (or one sample if the population is less than 10) of the sample results will be invalid due to leakage, damage during shipment, or laboratory data outside QC criteria of accuracy and precision. If the completeness objective of 90 percent is not met, an evaluation will be undertaken to determine if re-sampling is required to provide adequate data to meet specific program objectives.

Representativeness

Representativeness is the degree to which the data accurately and precisely represent the concentration of leachable mercury in the samples. Representativeness is a function of sample location selection and sample collection and analysis techniques. The objective of the verification sampling program is to obtain discrete samples from the excavated meter house floor which are representative of soil having the highest concentration of leachable mercury. The rationale for the selection of sample location is provided in the project plans (including this QAPP). The rationale for the location of the discrete verification sample is presented in Section 4.1.2 of this Plan. Sample collection and analysis methods were selected according to the data quality objectives described above.

Comparability

Comparability expresses the confidence with which one set of data can be compared with another set of data. Comparability can be related to precision and accuracy since these quantities are measures of data reliability. Qualitatively, data subjected to strict QA/QC procedures will be deemed more reliable than data not subject to strict QA/QC procedures. The sampling method used, chain-of-custody procedures, EPA analytical methods, qualified laboratories and establishment of strict QA procedures and sampling guidelines provide the basis for uniformity in all data collection and analysis activities to maintain comparability.

3.2 ACCURACY, PRECISION AND SENSITIVITY OF ANALYSIS

Accuracy and precision criteria for mercury are shown on Table 1. The accuracy and precision of laboratory analyses of samples will be determined by testing of laboratory blank, duplicates, and spiked samples in accordance with the frequencies shown in Table 2. The sensitivity of testing is the reporting limit shown in Table 3.

3.3 ANALYTICAL QUALITY OBJECTIVE

The analytical quality objective is to demonstrate meter site cleanup by removal of contaminated soil. Analysis of the verification samples will demonstrate that the concentration of leachable mercury in soil at the remediated meter sites is below the EPA established limit for the hazardous characteristic of toxicity with respect to mercury. The EPA established limit, using the TCLP for mercury, is 0.20 mg/L. Demonstration of site cleanup will be supported by analyzing additional laboratory samples

(duplicates, blanks, and spikes). Matrix spike samples will be collected in the laboratory by obtaining the leachate from a designated sample and spiking the leachate before digestion. The analytical data will be validated according to the EPA procedures defined in "Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses, July 1, 1988" (Validation Guidelines), prepared for the USEPA Hazardous Site Evaluation Division. In addition to the quality assurance performed under the Validation Guidelines, the average percent recovery of mercury from matrix spike samples will be calculated for each sample batch. This average percent recovery will be applied to the measured concentrations of mercury in the other samples in the batch as shown in section 12 and in accordance with EPA Method 1311.

3.4 FIELD QUALITY OBJECTIVES

Field duplicates of verification soil samples and field blank soil samples will be collected in the field and submitted to the analytical laboratory to provide a means to evaluate the quality of the data resulting from field activities. A duplicate aliquot of the leachate from designated verification samples will be spiked with mercury by the analytical laboratory and analyzed as the matrix spike sample. In addition to samples collected in the field, samples of a uniform reference soil will be collected by the Lab Coordinator and analyzed with the other samples. The Lab Coordinator will collect rinsate samples on a manufactured lot basis from each shipment of clean, unused disposable sampling tools. The Lab Coordinator will analyze these rinsate samples in the EPNG laboratory.

The objective of analyzing field duplicate samples will be to check for sampling and analytical reproducibility. The objective of the

analyzing matrix spike samples will be to check the sensitivity of the analytical testing procedures. The objective of analyzing field blank samples will be to check for procedural contamination and cross contamination during shipment and storage of samples. The objective of analyzing rinsate samples will be to monitor the cleanliness and suitability of disposable sampling tools and, if necessary, to evaluate the effectiveness of decontamination activities. The objective of analyzing the reference soil will be to compare the analysis results to the sample's true concentration of mercury in order to measure and monitor the overall effectiveness of laboratory performance. The level of this field QC effort will be as presented on Table 4. The analysis of field QC samples will be qualitatively evaluated to monitor for problems in data acceptability.

Field duplicates will be obtained at the frequencies indicated in Table 3. The field duplicate sample will consist of collecting a duplicate verification sample. Field blanks will be obtained in the field by collecting samples of field blank soil in the same manner as verification samples. Rinsate samples will be collected for sampling equipment, one sample for each manufactured lot, by rinsing unused disposable sampling equipment with deionized water and collecting the rinsate. Rinsate samples will be collected from the final deionized water rinse when reusable sampling tools are decontaminated as described in section 4.4 of this Plan.

3.5 FIELD MEASUREMENTS

Measurement data will be generated in many field activities that are incidental to collecting samples for analytical testing or unrelated to soil sampling. These activities include, but are not limited to, the following:

* Identifying the meter code number at the meter station

* Documenting time, temperature and weather conditions

* Measuring concentrations of combustible gases

* Screening with a mercury vapor analyzer

* Recording the location of visible mercury or soil visibly contaminated with mercury.

* Estimating the volume of soil removed from the site

* Recording the location of the verification sample

The general QA objective for field data is to obtain reproducible and comparable measurements to a degree of accuracy consistent with the intended use of such data through the documented use of standard procedures. The data from the mercury vapor analyzer screening is to determine if soil excavation should continue. Measurements taken during screening will be recorded as displayed on the instrument. The meter code is a number unique within the EPNG system. This number must be recorded exactly. Measurements of the location of mercury contamination and verification samples will be recorded within a tolerance of $\pm$ 0.1 foot from at least two walls of the meter house.

4.0 SAMPLING PROCEDURES

The sample collection activities of the Mercury Meter Investigation/Remediation are detailed in the Work Plan and include the rationale for the sampling program. In summary, the soil sampling activities will be accomplished in two parts:

* Sampling and stockpiling a representative background soil to be used for field blanks.

* Verification sampling

The sampling procedures are presented in the subsequent paragraphs. The Work Plan should be referenced for specific sampling details.

4.1 SAMPLE COLLECTION PROCEDURES

The sample collection procedures presented in this section are based on "A Compendium of Superfund Field Operation Methods, OSWER Directive 9355.0-14, December 1987".

4.1.1 FIELD BLANK SOIL

The soil to be sampled and analyzed for field blanks for this project will be collected from surficial soils in the Farmington area. The soil in these locations should contain only naturally occurring concentrations of mercury. The total volume of soil collected must be sufficient to allow characterization by TCLP for mercury and to provide enough field blanks for the project. All of the collected field blank soil will then be combined, thoroughly mixed, homogenized and stockpiled.

Initially, five grab samples from the stockpile will be collected and analyzed by TCLP for mercury. The results will be statistically evaluated with respect to data sufficiency for waste characterization using the procedures described in SW 846, 3rd Edition, or equivalent. If the evaluation shows that the number of analyses is not sufficient, then additional grab samples will be collected and analyzed. The field blank samples will be derived from this stockpiled soil once characterization is sufficient.

4.1.2 VERIFICATION SAMPLING

The soil at the mercury meter site will be screened for indications of mercury contamination. Screening will consist of visual inspections for indications of mercury contamination and/or using a mercury vapor detector to detect mercury vapors above background levels. The soil will be excavated until mercury contamination is not indicated by screening. Verification samples will be collected after screening indicates the mercury-contaminated soil has been removed.

Verification samples will be collected at the location determined by the grid sampling method described in Section 3.1 of the FSP. Verification samples will be discrete soil samples.

4.1.3 FILL SOIL SAMPLING

EPNG will undertake a sampling and analysis effort at all sources of fill material to be used at the remediated meter sites. This sampling and analysis effort will measure the concentrations of leachable mercury in 2 to 3 samples from each source. This effort will protect the remediated sites from the introduction of fill soil containing concentrations of leachable mercury in excess of

the regulatory limit.

4.2 SAMPLE IDENTIFICATION

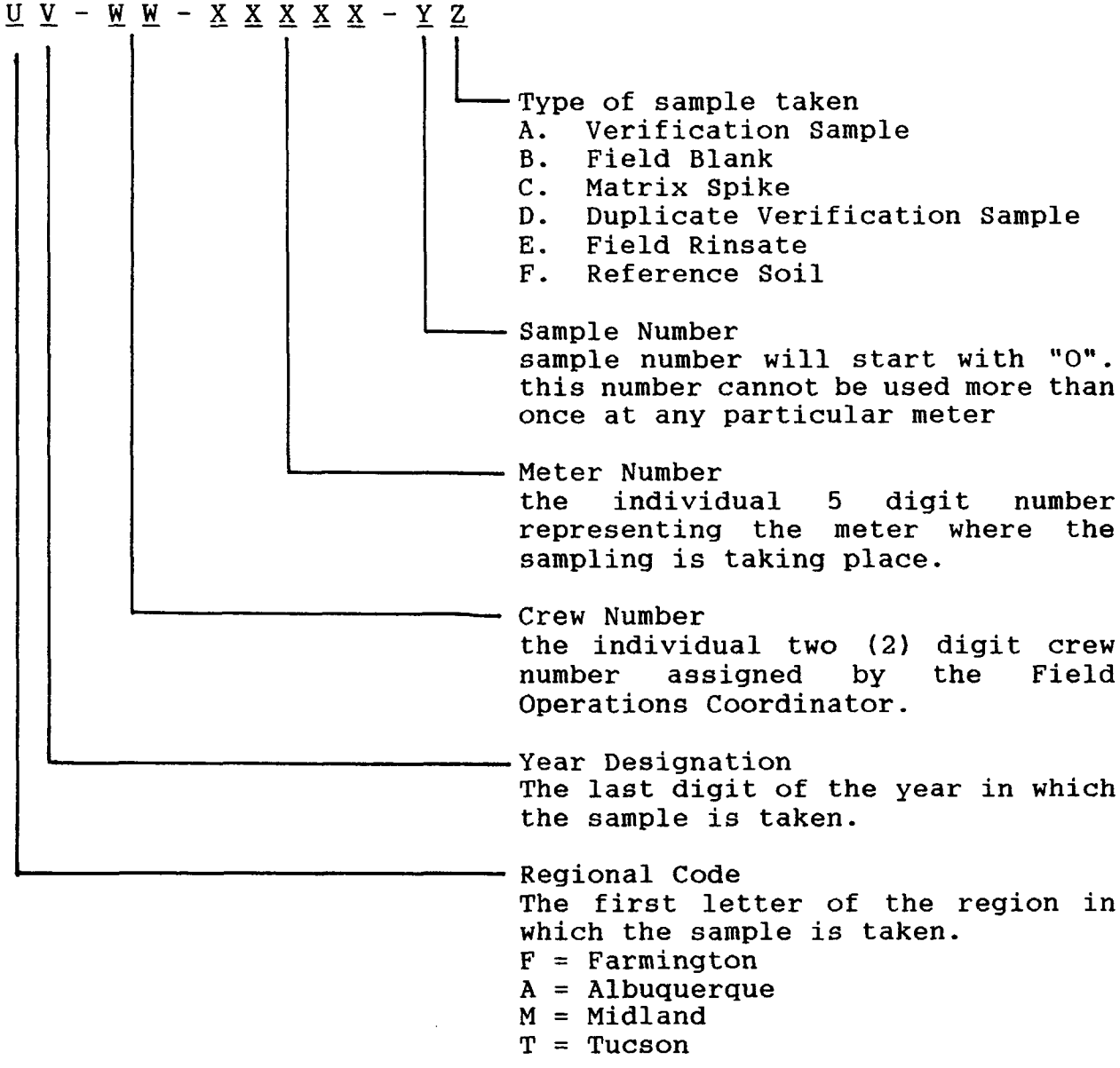
All samples will be identified by a unique numbering system. The sample number will be referenced to the unique meter code number. Sample labels provide security, identification, and integrity.

4.2.1 SAMPLE LABELING

The format for labeling samples is provided below. As an example of the labeling procedure, the label for a Field Blank sample collected at meter 01121 in the Farmington Region by the 02 crew in 1990 where this is the fourth sample taken at the meter station would read, F0-02-01121-4B. This sample identification code will identify each sample on the sample label and chain-of-custody form.

The field specialist is responsible for verifying that each sample is put in the appropriate sample container. At the time of sampling, this person must fill in the time sampled, the date sampled, sign and complete the sample's label. Once this information has been put on the sample label and the sample label affixed to the container jar, the label will be covered with clear tape to protect this information and a custody seal applied to the jar. The sample identification code will be used to identify each sample on the chain-of-custody form. By the end of the sampling day, the field specialist must deposit all samples at the central drop off point.

Each sample container shall be labeled in the following format:



4.2.2 SAMPLE CONTROL

Sample coolers will be under the direct observation of EPNG personnel at all times, or secured with custody seals to detect tampering. If samples are not attended, they will be kept under secured storage. All samples will be secured at a drop off point along with copies of meter site data forms and chain-of-custody (COC) forms.

Samples will be placed in coolers containing ice or blue ice packs directly after collection. Samples will be put into refrigeration at 4 degrees C or left in coolers and maintained at 4 degrees C in a secured storage area. Prior to shipment to the analytical laboratory, a person other that the one who packed the cooler, will verify the samples, COC and other documentation.

4.3 SAMPLE HANDLING

Soil samples will be collected and placed in the appropriate containers for analytical testing. The samples will be preserved as described above.

4.4 DECONTAMINATION AND CROSS-CONTAMINATION CONTROLS

In order to verify that the disposable sampling tools are free from contamination, a rinsate sample will be collected from each manufactured lot of sampling tools before sampling for mercury analysis. This rinsate will be analyzed for mercury by the Lab Coordinator in the EPNG laboratory. Verification samples are to be taken using sampling tools from any lot that has been determined to be free from contamination (less than the detection limit for

mercury). All reusable sampling equipment will be decontaminated before reuse.

Sampling tools will be decontaminated as described below:

* A thorough wash using a phosphate free detergent and a brush, if required, to remove all particulate matter.

* A thorough rinse with deionized water to remove detergent.

* A rinse with 0.1 N nitric acid

* A final rinse with deionized water which will be sampled and labeled the rinsate sample.

Digging tools will be cleaned according to the following procedure before site mobilization and between handling of samples:

* Wash in tap water and detergent

* Rinse with tap water

* Air dry

* Wrap in foil or plastic

Rinse water will be containerized, transported, and stored in the soil stockpile area. Small amounts of wash water and rinse water may be added to the excavated soil.

Personnel will wear appropriate protective clothing during decontamination as required by the Health and Safety Plan. All protective equipment (gloves, boots, etc.) will be decontaminated after use or they will be disposed of in containers, labeled, dated, and stored until disposed of at an approved facility. Disposable safety equipment will be considered to be contaminated after use and will be packaged and disposed of by EPNG.

4.5 DOCUMENTATION OF SAMPLE ACTIVITIES

For documentation purposes, all information pertinent to field observations and sampling will be recorded on the Meter Site Data Form or the Chain-of-Custody Form. Examples of these forms are shown in Figures 6 and 7.

5.0 SAMPLE CUSTODY

A record of each sample collected will be kept on a chain-of-custody (COC) form (Figure 7). The chain-of-custody form will provide an accurate written record which can be used to trace the custody of samples from the time of collection through data analysis and reporting. The following will be specified for each sample on the chain-of-custody form:

1. Sample number
2. Sample date
3. Sample time
4. Sampler's signature
5. Preservation technique

A sample is considered in custody if it is:

* In one's actual possession

* In view, after being in physical possession

* Locked so that no one can tamper with it, after having been in physical custody

* In a secured area

The Field Specialist will be responsible for obtaining the sample, completing the sample label, securing the sample container and filling out the COC form. Samples will be kept in a cooler containing ice or blue ice packs. At the end of each work day the Field Specialist will deliver the samples, COC forms and other site forms to the designated central drop off stations. The COC form

and other site forms will be contained in a plastic zip-locked bag and placed in a locked refrigerator at the drop off station with the samples.

At the beginning of each work day, the Field Inspector, will collect the samples, COC form and other site forms from the designated drop off station. The Field Inspector will immediately verify the sample, sample label and identification, COC form and other site forms. The Field Inspector will also sign the COC form. If the samples have been tampered with or preserved improperly, the Field Inspector will meet immediately with Field Specialist to initiate a nonconformance corrective action report (NCR, the form is shown in Figure 8). The Field Inspector will collect all of the samples, COC forms and other forms from all designated stations and keep them, at all times, in a cooler containing ice or blue ice packs.

The Lab Coordinator or designee, will receive, review and approve the Field Inspector's collected samples, COC forms, verifications, and any NCR reports. All NCR reports will, however, require final approval from the QA Officer prior to releasing any samples. The QA Officer may reject the NCR report and request that a new sample be collected.

The Lab Coordinator will package and ship the samples and COC forms to the designated laboratory. The designated laboratory is responsible for completing the COC form, filing a copy for their records and sending the original with results to the lab coordinator for record keeping upon completing the analysis.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

6.1 RESPONSIBILITIES

Measuring and testing equipment used in the field and the laboratory shall be controlled by a formal calibration program. Calibrating measuring and testing equipment may be performed internally using in-house reference standards, or externally by agencies or manufacturers. The responsibility for the calibration of laboratory equipment rests with the analytical laboratory personnel.

6.2 CALIBRATION PROCEDURES

Documented and approved procedures shall be used for calibrating measuring and testing equipment. Whenever possible, widely accepted procedures, such as those published by the ASTM or U.S. EPA, or procedures provided by manufacturers in equipment manuals, shall be adopted.

Calibrated equipment shall be uniquely identified by using either the manufacturer's serial number, an EPNG equipment identification number, or other means. This identification, along with a label indicating when the next calibration is due (only for equipment not requiring daily calibration), shall be attached to the equipment. If this is not possible, records traceable to the equipment shall be readily available for reference.

It is the responsibility of all personnel to check the calibration status from the due date labels or records prior to using the equipment.

Measuring and testing equipment shall be calibrated at prescribed intervals and/or as part of the operational use. Calibrating frequency shall be based on the type of equipment, inherent stability, manufacturer's recommendations, values given in national standards, intended use, and experience. Equipment shall be calibrated, whenever possible, using reference standards having known relationships to nationally recognized standards (e.g., National Institute of Standards and Technology "NIST") or accepted values of physical constants. If national standards do not exist, the basis for calibration shall be documented.

Reference standards (physical and chemical) shall be used only for calibration. Physical standards shall be stored separately from measuring and testing equipment. Equipment that fails calibration or becomes inoperable during use, shall be removed from service, segregated to prevent inadvertent use and shall be tagged to indicate it is out of calibration. Such equipment shall be repaired and recalibrated to the satisfaction of the EPNG Lab Coordinator, Project Manager and Health and Safety Officer as applicable. Equipment that cannot be repaired shall be replaced.

Records shall be prepared and maintained for each piece of calibrated measuring and testing equipment, to indicate that established calibration procedures have been followed. Records for EPNG field equipment used only for this specific project shall be kept in the project files. The designated laboratory shall maintain calibration records in its file.

6.2.1 EQUIPMENT CALIBRATION

Field calibration procedures will be performed on field instrumentation as follows:

* Mercury Vapor Meter -
  The Jerome 411 and the Bacharach MV-2 is calibrated at the factory. The Functional Test described in the instrument operation and maintenance manual will be performed once a month.

* Methane Gas Explosimeter -
  A Calibration Test Assembly Model A is available to periodically check the explosimeter with a known concentration of methane in air. The explosimeter calibration should be checked after replacement of the filament, ballast lamp, flashback arresters, after prolonged periods of non-use, or if catalytic "poisons" (such as leaded gasoline) may be present in the sample.

  Calibration of field equipment shall be documented, referenced, and maintained in the project files.

* Hydrogen Sulfide Analyzer -
  The hydrogen sulfide analyzer will be calibrated weekly against a known reference hydrogen sulfide concentration at the EPNG laboratory.

* Field Thermometer -
  The Field Specialist is to calibrate the thermometer used in the field to measure the ambient temperature. The field thermometer will be calibrated in the EPNG on a

weekly basis using a certified standard thermometer.

6.2.2 LABORATORY EQUIPMENT CALIBRATION

Laboratory calibration procedures for analytical testing will be performed in accordance with EPA Method 1311 and EPA CLP protocols. Accuracy and precision criteria are presented on Table 2. Table 3 presents the QC level of effort for EPA CLP analysis.

7.0 ANALYTICAL PROCEDURES

Analytical methods to be used for mercury analysis of field blank soil samples, TCLP Leachate from verification soil samples and grid samples, and quality control samples will be in accordance with EPA CLP SOW NO. 788, and the extraction procedure will be in accordance with EPA Method 1311. The Standard Operating Procedures (SOPs) for each of the analyses, as described in EPA Method 1311 or EPA CLP SOW No. 788, shall be followed. All analyses will be performed for mercury concentration only.

Quality assurance data regarding the extraction procedure will be provided by the designated laboratory. All calculations will be clearly presented. The date and time of the start and completion of the extraction procedure will be provided.

The range for chemical analysis by the above procedure is from 0.002 TO 2.0 mg/L. If a measurement produces a result less than 0.002 mg/L, the result will be recorded by EPNG as <0.002 mg/L. If the designated laboratory measures a mercury concentration in a sample (from the TCLP leachate) greater than 2.0 mg/L, the laboratory has the option of completing the analysis according to EPA CLP protocols or, alternatively, reporting a one page summary report. This will allow the laboratory to more rapidly report results to EPNG and will enable EPNG to revisit those sites requiring additional remediation. Additional remediation and verification sampling and analysis will be undertaken if the concentration exceeds the regulatory threshold limit.

The spike level for this project using EPA CLP procedures has been set initially at 10 ug/L. The laboratory has the option to adjust the spike level according to criteria set forth within the quality

assurance section of the EPA CLP procedure based on the concentrations of mercury in the samples, to provide usable matrix spike data.

The basic CLP procedure is for the determination of multiple analytes. For this project, only one analyte (mercury) is to be measured, therefore diluted samples will be allowed as long as there is a positive response for mercury and the concentration is greater than the reporting limit specified above.

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

Data reduction, validation and reporting will follow strict guidelines as presented in this section. The only data that will be entered by EPNG into the validated data base will be the data that meets the record keeping, quality assurance/quality control criteria and reporting formats as defined in this QA protocol.

Laboratory data validation will follow the data validation procedures specified in "Functional Guidelines for Evaluating Organic and Inorganic Analyses", U.S. EPA, 1989, for all mercury analyses. In addition, the laboratory data for the extraction procedure by TCLP and the results of the chemical analysis of the TCLP leachate will be validated for compliance with EPA Method 1311.

The data will be classified as accepted (quantified or qualified), or rejected based upon the validation procedures. Data qualifiers are shown in section 8.2.3 of this document. For samples where the analytical data have been rejected, EPNG will make a decision to re-sample. Only data that are classified as quantified or qualified will be entered into the validated data base.

The following sections describe the procedures to be used in data reduction, validation and reporting of analytical data.

8.1 SAMPLING DATA

The purpose for establishing sampling data management procedures is to maintain accurate records of all samples taken and to follow the status of the sample, location and analytical results, while minimizing the duplication of record keeping activities and the

possibilities for error. The tabulation and flow of all data management information is provided on Figure 6.

8.1.1 SAMPLING RECORD KEEPING

The Field Operations Coordinator will supply each crew with a list of meters to be visited. The list will include QC samples to be collected along with the verification samples.

The Field Specialist is responsible for verifying that each sample is collected in the appropriate sample container. At the time of sampling this person must fill in the time sampled, the date sampled, and sign and complete the sample label. By the end of the sampling day, the Field Specialist must deliver all the samples to the central collection center.

The Laboratory Coordinator is responsible for shipping the full sample containers, after comparing the sample container labels with chain-of-custody forms. The COC original must be sent with the samples to the Laboratory and one copy should be sent to the EPNG Lab Coordinator for his project files.

8.1.2 SAMPLE DATA MANAGEMENT

When the samples are ready to be sent to the designated laboratory, the Laboratory Coordinator will examine the samples and note their condition. At the time the samples are shipped, the Lab Coordinator will have a copy of the chain-of-custody form that includes information on the sample numbers and the corresponding information on the date sampled, time sampled, and the date shipped.

8.2 ANALYTICAL DATA

8.2.1 DATA FLOW

The laboratory will be responsible for reviewing all chemical analyses according to their internal QA/QC procedures. Data will be verified by the laboratory for compliance with procedures, prior to the delivery of the data package to EPNG. Completed data packages will be available for review by the Lab Coordinator and the QA Officer who will also evaluate the data. Problems should be resolved and data validated before the data is reported to the Data Management Clerk. Following satisfactory completion of all data checks by the laboratory and the QA officer, the data will be available for entering the validated data base.

Priority of data review and release will be handled through the direction of the Project Manager.

8.2.2 DATA MANAGEMENT

Due to the extensive sampling and analysis efforts required for this project, a detailed data management program will be implemented. A flow chart outline of the data management process is presented in Figure 6. Sample tracking and validation of meter site data and analytical data are performed as part of the data management process. The analytical results will be transferred to a computerized data base, as each set of data is validated.

The basic data management system has been set up to provide verification throughout the system of sample collection to the analysis of results for documentation of mercury meter site cleanup. The objective of the data management system is to provide

verified and valid documentation to support the remediation program. The specific organization, review steps and validation of the data is described within the Work Plan and is shown schematically by Figure 6. Audits of the procedures, sampling, analyses and document filing and storage will be undertaken to verify proper documentation and compliance with this QAPP and the other project plans.

The data will be stored under the categories of data collected and data analyzed. This system will enable retrieval of information specific to various uses and provides management information for the long term project.

8.2.3 DATA VALIDATION

The field data package (calibration records, chain-of-custody, etc.) will be reviewed for completeness and correctness. Validation of analytical data will be completed before any of the results are approved. The validation process described below will be completed by the Lab Coordinator as a separate process from the designated laboratory's data review (see 8.2.1). The completed data packages will be sent on an analytical lot basis to validation personnel.

The following is a brief description of the methods that will be used during validation of the laboratory data. The data validation process for CLP analysis will be in accordance with "Laboratory Data Validation, Functional Guidelines for Evaluating Inorganic Analyses," USEPA, July 1,1988. The validation will be performed on all samples analyzed, and the results will be summarized in a report for each lot of reported sample data. Qualified data will

be reported as such, and the appropriate qualifiers will be used for reporting. The following data qualifiers will be used:

U - The material was analyzed for, but was not detected. The associated numerical value is the sample quantification limit

J - The associated numerical value is an estimated quantity

R - The data are unusable (mercury may or may not be present in excess of the regulatory limit). Re-sampling and reanalysis is necessary for verification.

N - Presumptive evidence of presence of mercury in excess of the regulatory limit

NJ- Presumptive evidence of the presence of the mercury at an estimated quantity

UF- Mercury was analyzed for, but was not detected. The sample quantitation limit is an estimated quantity.

Data qualified as "R" shall be rejected. Data qualified otherwise shall be accepted. The reviewer may determine that qualifiers other than those listed above are necessary to describe or qualify the data. In these instances, all additional qualifiers will be defined and the QA Officer will decide to accept or reject those data after consultation with the Project Manager and ESAD Task Manager.

The following procedures should detect problems which would reject data. The problem data will not be reported. However, rejected data will be addressed in the validation report to evaluate completeness goals.

1) Compile a list of all investigative samples.

2) Compile a list of all QC samples, including but not limited to:

-Field blanks
-Laboratory blanks
-Laboratory duplicates
-Matrix spikes
-Laboratory control spikes
-Reference soil samples

3) Review chain-of-custody documents for completeness and correctness.

4) Review laboratory analytical procedures and instrument performance criteria.

-Sample media identification
-Sample location and description
-Proper concentration units
-Proper significant figures

5) Laboratory records and data package requirements will be checked to asses completeness of the data package.

6) This data summary will be reviewed for potential data quality problems including:

-Unexpected results
-Laboratory contaminants in reagents
-Unusual concentration/identification relationships

-Samples in which dilution was necessary
-Samples which may have exhibited "carry over"

7) A sample summary will be prepared to assess precision, accuracy and completeness of the analytical data.

Laboratory performance results will be documented using validation procedures precision and/or accuracy evaluations. The validation personnel will provide a means to notify the laboratory and initiate appropriate corrective actions, if warranted.

Despite all efforts to achieve the objectives of the laboratory QA/QC plan, the potential for error exists in laboratory chemical analyses and in the data reporting process. Every reasonable effort will be made to compare and double-check data entered into the data management system and data entered into the validated data base in accordance with the procedures described in this document.

All analytical results are to be classified as accepted (quantified or qualified) or rejected through data validation activities. Quantified data are to be used in laboratory reports at the numerical value identified. Qualified data are to be used as an estimate and are not to be used as a quantitative measurement. Rejected data are not to be entered in the validated data base. No further use is to be made of the rejected data.

8.3 CALCULATION, COMPUTER PROGRAMS, DRAWINGS

During remediation activities, calculations, drawings and computer programs may be generated. In order to maintain consistency in the development of the data, verification procedures are presented.

Analysis and assessment activities shall be performed in a planned and controlled manner. Performance responsibility rests with the Project Manager. Prior to initiating the activities, the Project Manager shall discuss the scope of the work, contractual and regulatory requirements, and applicable quality assurance/quality control procedures with assigned personnel. The Project Manager, may request this of the Quality Assurance personnel.

8.3.1 PROCEDURES.

Analyses, assessments and their results shall be documented to provide evidence of satisfactory work performance. Documentation may include calculations, computer programs, sketches, and tables.

Calculations shall be legible and in a form suitable for reproduction, filing, and retrieval. Documentation shall be sufficient to permit a technically qualified individual to review and understand the calculations and verify the results.

Computer programs that may be used in this project shall be completely documented and verified. Computer output shall be dated and clearly identified as to contents.

The results of analysis and assessments, may be presented in sketches and tables of various forms. Sketches shall be uniquely identified by a drawing or meter number and appropriate title. Sketches of site conditions shall be signed and dated by the person making the sketch and the onsite inspector who has checked the sketch.

8.3.2 VERIFICATION

Calculations, computer program input, sketches and tables shall be formally checked using the process outlined in the following paragraphs.

Verification of calculations shall be performed by an individual(s) other than the person who performed the original work, or specified the method or input the parameters to be used. The individual(s) selected shall have the appropriate technical expertise in the calculation subject. It is emphasized that a numerical check is not sufficient. The checker is responsible for every item on every sheet-including the completion of the title block and page numbers.

Sketches shall be checked like calculations. If a sketch is revised, the entire checking process shall be repeated for the revised areas only. Under no circumstances shall revisions be made without the formal checking procedure.

9.0 INTERNAL QUALITY CONTROL

Quality control for field sampling includes collecting duplicate samples, field blanks and rinsate blanks. Methods used to validate precision and accuracy of the chemical analyses and to support the representativeness, comparability, and completeness of the work include:

* Description of the calibration of methods and instruments,

* Description of routine instrument checks (noise levels, drift, linearity, etc).,

* Documentation of traceability of instrument standards, samples and data,

* Documentation on analytical methodology and QC methodology,

* Description of applicable performance audits with appropriate audit materials,

* Description of controls for interference contaminants in analytical methods (use of reference blanks and check standards for method accuracy and precision),

* Description of levels of routine maintenance to verify analytical reliability, and

* Documentation of sample preservation and transport.

TRANSCRIPTIONS

All data transcriptions for final reports will be reviewed before reporting. Data transcription requirements vary, but are monitored in accordance with requirements for accuracy and legibility.

VERIFICATION AND REVIEW

The Lab Coordinator is to verify that the designated laboratory:

* Verifies that there are no contaminants in all associated blanks.

* Compares samples and duplicates for matches in data results.

* Reviews spike recovery data to make sure they are within quality acceptance limits.

* Verifies calibration performance for acceptability.

* Reviews the designated laboratory's internal quality assurance for acceptability.

Upon meeting all technical criteria, the sample folder will then be reviewed to:

* Make sure that mercury concentrations have been properly recorded

* Verify accuracy of calculations on mercury quantities

The Lab Coordinator examines the entire sample file to verify that all data transcriptions and documentation included, meets EPNG requirements. A laboratory supervisor also reviews all data enclosed to verify that the data transcriptions are free from error and that all documents are legible and in order.

The EPNG laboratory QA department performs the review of completed folders on a percent complete basis to verify that the data is present so that EPNG can complete the data validation.

10.0 PERFORMANCE AND SYSTEM AUDITS

In order to verify that the integrity of the data and related information is maintained, both field activities and laboratory audits will be conducted.

10.1 FIELD AUDITS

Early in the project, the QA/QC officer or his or her designee will conduct at least one field sampling performance audit of each crew to verify that the sampling protocol is being followed by field personnel. The audit will not be announced to field personnel to effect an unbiased audit. The auditor will prepare a summary audit report containing the results of the evaluation and recommendations for any corrective actions. An audit will be conducted whenever personnel in a crew change or every 6 months.

At a minimum, the auditor will check the following items to determine the completeness and accuracy of field activities:

1. Sample Labels.
   A selected number of sample labels will be examined to determine if they were filled out properly and completely.

2. Chain-of-Custody Procedures.
   Several chain-of-custody records will be examined to determine if they were properly filled out; if parameters for analysis were properly identified; if all custody transfers were documented; and if the date and time of transfer were recorded.

3. Field Notes.

The notes will be examined to determine if the proper recording format is being followed; if all measurements and field observations are being documented suitably to explain and reconstruct field activities.

Intermittent additional audits may be performed by members of the quality assurance team for each field sampling task. Field audit reports will be presented to the Compliance Manager on a form as shown in Appendix A.

10.2 DESIGNATED LABORATORY AUDIT

An onsite laboratory evaluation helps to verify that all the necessary quality control is being applied by the laboratory in order to deliver a high quality product. One designated laboratory audit of each laboratory used for sample analysis will be performed by EPNG prior to the program. Should problems arise Quality Control Additional Audits may be performed. An internal laboratory audit by the respective laboratory QA Officer will be performed during the program, and reported to the Compliance Officer using a form as shown in Appendix B.

Quality assurance evaluations allow the evaluators to determine that:

* The organization and personnel are qualified to perform assigned tasks

* Adequate facilities and equipment are available

* Complete documentation, including chain-of-custody of samples, and internal sample tracking is being implemented

* Required analytical methodology is being used

* Adequate analytical quality control, calibration including reference samples, control charts, and documented corrective action measures, is being provided

* Acceptable data handling, documentation techniques and data review are being used.

11.0 PREVENTIVE MAINTENANCE

The primary objective of a preventive maintenance program is to help verify the timely and effective completion of a measurement effort.

The preventive maintenance program is designed to minimize the down time of crucial sampling and/or analytical equipment due to expected or unexpected component failure. In implementing this program, efforts are focused in three primary areas.

* Establishment of maintenance responsibilities

* Establishment of maintenance schedules for major and/or critical instrumentation and apparatus, and documentation of maintenance activities in equipment logs

* Establishment of an adequate inventory of critical spare parts and equipment

Contract laboratories are inspected to verify that similar preventive maintenance programs are in operation, and are properly documented including the following:

* Accepting data with an acknowledged level of uncertainty

* Re-sampling and analyzing

* Re-calibration of instruments using freshly prepared calibration standards

* Replacement of reagents that give unacceptable blank values

* Additional training of laboratory personnel in correct implementation of sample preparation and analysis methods

Whenever corrective action is necessary to eliminate the cause of nonconformance, a closed-loop corrective action system will be used. As appropriate, the Lab Coordinator, Quality Assurance Officer, or the Project Manager will verify that all of these steps are followed:

* The problem will be defined.

* Responsibility for investigating the problem will be assigned.

* The cause of the problem will be investigated and determined.

* A corrective action to eliminate the problem will be determined.

* Responsibility for implementing the corrective action will be assigned and accepted.

* The effectiveness of the corrective action will be established.

* The fact that the corrective action has eliminated the problem will be verified.

The Field Operation Coordinator will be responsible for the repair and/or replacement of damaged field equipment.

When laboratory or field equipment is damaged or it cannot be verified that it will produce acceptable data, the equipment will be removed from service to be repaired or replaced. The equipment will not be returned to service until it has been verified that it is capable of producing acceptable data. Acceptable data as referenced here is data which meets quality assurance criteria for precision, accuracy, and representativeness. Equipment leased or purchased to replace damaged equipment shall be capable of producing equivalent data, and shall be calibrated before its use.

If non-analytical type field equipment is damaged, it will be repaired immediately such that work may progress, or be replaced with similar or equivalent equipment such that the project objectives and the approved work plan will be met. The analytical laboratory manager and Field Operations Coordinator shall retain documentation for the repair and/or replacement of laboratory and field equipment, respectively.

12.0 DATA MEASUREMENT ASSESSMENT PROCEDURES

This section summarizes QA/QC procedures for assessing the chemical data derived from the sampling and chemical analysis tasks.

The data validation procedures will be used by the QA Officer and the Lab Coordinator for assessing duplicate and spike samples and checking blank samples that are submitted to the analytical laboratory from the field, or generated internally by the laboratory in accordance with the QAPP. The purpose of implementing these procedures is to verify that the chemical analysis data generated during the project are accurate, precise, complete, and representative of site conditions.

Detailed discussions of the procedures for data validation are presented in Section 8.2.3. The format for QC data assessment reporting is presented below.

12.1 PROCEDURES FOR ASSESSING DATA ACCURACY, PRECISION, COMPLETENESS AND REPRESENTATIVENESS

Chemical data derived from the project will be assessed for accuracy and precision for both the analytical laboratory and field sample collection programs. The primary goal of the program is to verify that the data reported during the project are representative of conditions at the meter sites. To meet this goal, a combination of procedures and qualitative evaluations will be used to check the quality of the data. Sample recollection and analysis will be used only if the data are rejected and sample results are deemed to be critical to the determination of a project objective. The Compliance Manager will determine when resampling and analysis are necessary.

The QA/QC assessment program will evaluate the project's data based on the types of quality control samples described in Section 3.4 (spikes, blanks, duplicates, etc). The procedures for evaluating both the project and laboratory QA/QC data are the same, and are presented below for QA/QC spikes, blanks, and duplicate samples. The control limits for accuracy and precision are shown on Table 1. The data will be considered representative if it meets the acceptance criteria for accuracy, precision, completeness and the quality of practice.

12.2 BLANKS

The evaluation procedure for blanks is a qualitative review of the chemical analysis data reported by the laboratories. The procedure for assessing blank samples will be as follows:

1) Tabulation of the data from the blank samples.

2) Identification of any blank samples that have mercury detected in the sample.

3) If no mercury is detected in the blank samples, the data are ready for entry into the appropriate report.

4) If any mercury is found in blank samples, the concentration will be reported and the field data for that period of time will be assessed for potential problems with data interpretation. Data may be prevented from entering the validated data base on the basis of mercury being detected in blank samples. Appropriate notations, however, will be made in the data base reports.

5) Quality control records will be maintained for each source of water which is used in the designated laboratory. These records shall demonstrate over time the presence/absence and level of mercury found.

12.3 SPIKES

The procedure for assessing spike samples will be as follows:

Tabulate spike sample data and calculate the Spiked Sample Recovery Percent (%R) as shown below for each sample.

$$\%R = \frac{(SSR-SR)}{SA} \times 100$$

where:
SSR = total concentration found in spiked sample
SR = original concentration in sample prior to spiking
SA = actual spike concentration added to sample

A comparison of the calculated spiked sample recoveries will be made to the percent recovery for mercury as shown on Table 1.

The percent recovery from the matrix spike sample will be applied as shown below to the analysis of each accompanying sample in the batch.

$$CR = \frac{LR}{\%R} \times 100$$

where:
CR = calculated analytical result
LR = laboratory measured analytical result
%R = spiked sample recovery percent as described above

The CR values will be calculated for each sample in accordance with EPA Method 1311. The CR values are to be used for all data verification, statistical analyses, and evaluation.

12.4 DUPLICATES

The procedure for assessing duplicate samples will be as follows:

Tabulate duplicate sample data and calculate the Relative Percent Difference (RPD) as shown below for each duplicate pair:

$$RPD\ (\%) = \frac{X1 - X2}{X} \times 100$$

where:
X1 = concentration for Sample 1 of duplicate
X2 = concentration for Sample 2 of duplicate
X = average of Samples 1 and 2

The calculated relative percent difference will be compared to the control limit values given in Table 1 to qualitatively evaluate the significance of the data. The evaluation will focus on historic variations in concentrations, and whether the problem is limited to one sampling location, sample homogeneity, etc. If data quality problems arise, the analytical data will be annotated, and the laboratory will be notified for corrective action, as appropriate. Data will be reported only if approved by data validation personnel or the QA Officer. The laboratory and the data validation personnel must review the analytical data in a timely fashion for an effective data evaluation process.

12.5 LABORATORY DATA VERIFICATION AND REVIEW

The laboratory data verification and review process will be performed by the Lab Coordinator and the QA Officer. It includes a review of the data file for completeness, the results, and a

preliminary QA/QC review. The laboratory data package (or report) is reviewed to locate and check the following, where appropriate:

* Laboratory and field blanks for verification of frequency and that there is no mercury in the associated blanks and, if present, assess its impact on interpretation of the data

* Field and laboratory duplicates to determine if the data results match adequately, and if the frequencies are acceptable

* Spike recovery data to assure they are within quality acceptance limits, that frequencies are acceptable, and that the average of the percent recovery from the matrix spike analysis is applied to the other samples in each batch

* Calibration documentation to verify equipment performance is acceptable

* Accuracy and precision of Laboratory Control Samples

* Instrument tuning documentation to verify successful completion

* Holding time evaluation

12.6 IDENTIFICATION OF OUTLIERS

A reported concentration value that is much different from most other values in a data set for the same group is referred to as an "outlier." The reasons for outliers can include:

* Inconsistent sampling or analytical chemistry methodology
* Errors in transcription of data values or decimal points
* Actual but extreme concentration values
* Amended errors in analytical methodologies

The procedures described for data validation and review will identify any outliers that are due to the first two causes mentioned above. Any outlier not attributable to these two causes may be due to actual but extreme concentration values. The data point in question will then be compared to data from a reference soil. Sample results designated as "outliers" may be resampled and analyzed if deemed to be necessary by the Compliance Manager.

13.0 CORRECTIVE ACTION

During the course of this investigation, it will be the responsibility of the QA/QC Officer and the sampling team members to see that all measurement and sampling procedures are followed as specified and that measurement data meet the prescribed acceptance criteria. In the event a problem is discovered, it is imperative that prompt and prescribed action be taken to correct the problem. Corrective action will be initiated, for instance, if QC data are found to exceed acceptability limits. Corrective action may be initiated by the QA Officer based upon QC data or audit results. The required corrective action will be documented.

13.1 DOCUMENTATION AND VERIFICATION

The need for corrective action will be identified as a result of the field audits previously described as well as by other means (e.g., equipment malfunction). If problems become apparent that are identified as originating in the field, corrective action will take place. If corrective action does not resolve the problem, appropriate personnel will be assigned to investigate and evaluate the cause of the problem. Once a corrective action is implemented, the effectiveness of the action will be verified.

Nonconforming items and activities are those which do not meet the project requirements or approved work procedures. Nonconformances may be detected and identified by:

* Project Staff-
  During the performance of field investigation and testing, supervision of subcontractors, and preparation and verification of numerical analyses

* Laboratory Staff-
  During the preparation for and performance of laboratory testing, calibration of equipment, and quality control activities

* Quality Assurance Personnel-
  During the performance of audits

Each nonconformance affecting quality shall be documented by the personnel identifying or originating it. For this purpose, a standard form (e.g., nonconformance report, results of laboratory analysis quality control tests, audit report, internal memorandum, or letter) shall be used as appropriate. Documentation shall, when necessary, include:

* Identification of the individual(s) identifying or originating the nonconformance

* Cause and description of the nonconformance

* Any required approval signatures

* Method(s) for correcting the nonconformance (corrective action) or description of the variance granted

* Schedule for completing corrective action

Documentation shall be made available to project, laboratory, and/or quality assurance management. It is the responsibility of the Project Manager, Laboratory Manager, and/or cognizant quality assurance personnel to then notify personnel of the nonconformance.

Completion of corrective actions for significant nonconformances should be verified by the QA Officer as part of future auditing activities. Verification of corrective actions will be reported in weekly reports to the Compliance Manager. An example of a noncompliance and corrective action report form is shown on Figure 7.

Any significant recurring nonconformance should be evaluated by project, laboratory, and/or quality assurance personnel to determine its cause and appropriate changes instituted in project requirements and procedures to prevent future recurrence. When such an evaluation is performed, the results shall be documented.

13.2 IMMEDIATE CORRECTIVE ACTION

Any equipment or instrument malfunction will require corrective actions. The laboratory quality control charts are working tools that identify appropriate corrective actions to be taken when a control limit has been exceeded. They provide the framework for uniform actions as part of normal operating procedures. The actions taken should be noted in field or laboratory log books and described on a form similar to Figure 7. These on-the-spot corrective actions will be applied daily as necessary.

13.3 LONG-TERM CORRECTIVE ACTION

The need for long-term corrective action may be identified by standard QC procedures, control charts, performance or system audits, and/or data validation. Any quality problem that cannot be solved by corrective action falls into the long-term category.

Documentation of the problem is important in corrective action. The responsible person may be an analyst, laboratory QA manager, sampler, QA Officer, or the Project Manager. In general, the QA Officer will investigate the situation and determine who will be responsible for implementing the corrective action. The Project Manager will verify that the long-term corrective action has been taken, appears to be effective, and at appropriate later dates, verify that the problem has been resolved.

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

Quality Assurance reports will include a tabulation of the analytical data and an explanation of any sampling conditions or QA/QC problems and their possible effects on data quality. In addition, audit reports will be issued as appropriate.

14.1 ANALYTICAL QA REPORTS

The designated laboratory program manager, laboratory QA coordinators, QA Officer, and the data validation personnel will communicate as needed to verify that all QA/QC practices are being carried out and to review possible or potential problem areas. Data anomalies are to be investigated to assess whether they are a result of operator or instrument deviation, or if they are a true reflection of the site or task function.

Final QA reports will contain a discussion of QA/QC evaluations summarizing the quality of the data collected and will be used as appropriate for each phase of the project. The objective of the project QA/QC summary will be to ensure that the data are sufficient in quality and quantity to support the remediation activities. The QA/QC summary will include:

1. Tabulated results of the analytical data

2. A report from the QA Officer evaluating the results of field and laboratory audits as described in Section 10.0

3. A tabulation of the data validation work sheets for each batch analysis from the data validation

personnel, evaluating the validity of the analytical data with respect to accuracy, precision, and completeness.

4. A summary of significant QA problems and the corrective actions taken to rectify the situation

5. A report by the QA Officer summarizing the validity of the analytical data with respect to accuracy, precision, completeness, representativeness and comparability

The QA Officer will submit weekly QA reports to the Compliance Manager. The Compliance Manager is responsible for approving these QA reports.

14.2 AUDIT REPORTS

Audit reports will be submitted to the Compliance Manager upon completion of any audits. These reports will describe the person involved with the audits, the issue being audited, and the findings of the audit. Any follow-up or repeat audit to verify corrective action will also be reported.

TABLES

TABLE 1

ACCURACY AND PRECISION CRITERIA FOR ANALYTICAL TESTING
MERCURY METER SITE INVESTIGATION/REMEDIATION

Parameters	Sample	Control Limits (1) Water
Mercury	TCLP Extraction Vessel Blank	+D.L.(2)
	Calibration Blank	+D.L.(3)
	Initial Calibration Verification	80-120%(3)
	Continuing Calibration Verification	80-120%(3)
	Matrix Spike Recovery (%R) (5)	75-125%(3)
	Duplicate Sample Analysis	+D.L. or 20% RPD (3)
	Laboratory Control Samples (LCS)	(4)

D.L. = Detection Limit
RPD = Relative Percent Difference

Notes:

(1) All samples are to be analyzed using the cold vapor atomic absorption method for water described in "USEPA Contract Laboratory Program, Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration," SOW No. 788, including revisions of February 1989 and June 1989 (EPA CLP SOW No. 788).

(2) This control limit will be imposed initially, but will be evaluated during the course of the project.

(3) EPA CLP SOW No. 788.

(4) Control limits for LCS are set specifically for each laboratory.

(5) Spike level will initially be 10 ug/L and may be adjusted according to the normal mercury concentrations observed by the laboratory.

TABLE 2

QC LEVEL OF EFFORT FOR EPA CLP ANALYTICAL TESTING

Parameters	Samples	Frequency
Mercury	Extraction Vessel Blank (Cold Vapor AA)	One for every 10 extractions
	Calibration Blank (Cold Vapor AA)	Each calibration, beginning and end of each run.
	Initial Calibration Verification (Cold Vapor AA)	Daily and immed-ately after each instrument calibration; at least four standards must have been used in establishing the calibration curve.
	Continuing Calibration Verification (Cold Vapor AA)	Beginning and end of each run; 10% frequency or every 2 hours.
	Matrix Spike Analysis (Cold Vapor AA)	One per case or one per 20 samples received.
	Duplicate Sample Analysis (Cold Vapor AA)	One per case or one per 10 samples received.
	Laboratory Control Sample Analysis (Cold Vapor AA)	One per batch or one per 20 samples received

TABLE 3

FIELD QUALITY CONTROL SAMPLE FREQUENCY
MERCURY METER SITE INVESTIGATION/REMEDIATION

Sample	Matrix	
	Soil	Water
Field Duplicate	1 in 20	NA
Field Blank	1 in 20	NA
Matrix Spike(1)	1 in 20	NA
Reference Soil(2)	1 in 100	NA
Rinsate	NA	(3)

NA = Not Applicable

Notes:

(1) A matrix spike needs to be performed for every 20 samples and the average percent recovery applied to the chemical analyses in accordance with the method found in 40 CFR part 261 Appendix II titled the Toxicity Characteristic Leaching Procedure (TCLP) and designated as EPA Method 1311.

(2) A soil sample obtained from an index source and analyzed with the other soil samples.

(3) A rinsate sample will be collected from several unused disposable sampling tools on a lot shipment basis. The rinsate will be analyzed before the tools are used to verify that they are free from mercury contamination.

TABLES 4

CONTAINERS, PRESERVATION, AND HOLDING TIMES
MERCURY METER SITE INVESTIGATION/REMEDIATION

Parameter	Matrix	(2) Container	(2) Preservation	Maximum Holding Time(1) From:VTSC(3) To: TCLP Extraction	From:TCLP Extraction To:Cold Vapor AA
Mercury	Water (Rinsate)	G, 1-1L(2)	HN03 to pH<2	NA	28 days
	Soil	G, 8oz., w.m.	Cool, 4 C	28 days	28 days

G = Glass
w.m. = wide mouth

NOTES:

(1) Holding Times are from TCLP, Method 1311, 40 CFR part 261 Appendix II.

(2) Containers and preservation are from "USEPA Contract Laboratory Program, Statement of Work for Inorganics Analyses, Multi-Media, Multi-Concentration", SOW No. 788, including revisions of February 1989 and June 1989.

(3) VTSC means Validated Time of Sample Collection.

(4) Laboratory may allow use of a wide mouth bottle.

TABLE 5

ANALYTICAL METHODS
MERCURY METER SITE INVESTIGATION/REMEDIATION

Sample Type	Parameter	TCLP Extraction(1) EPA Method 1311	EPA (2) Method
Soil	Mercury	1311	245.1 CLP-M
Water (Rinsate)	Mercury	NA	245.1 CLP-M

Notes:

NA = Not Applicable

(1) Extraction procedure found 40 CFR part 261 Appendix II described as Toxicity Characteristic Leaching Procedure (TCLP) and titled EPA Method 1311.

(2) EPA CLP Methods from USEPA Contract Laboratory Program, Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration," SOW No. 788 including revisions of February 1989 and June 1989. Method 245.1 and/or the automated method 245.2 CLP-M are acceptable for the analysis.

APPENDICES

APPENDIX A
FIELD AUDIT REPORT FORM

APPENDIX A
FIELD AUDIT REPORT FORM

FIELD AUDIT
CHECKLIST

Project Quality Assurance Officer: _____

Meter Number _____

Study Date (s) _____

Contract Laborer _____

Field Specialist _____

Other personnel and affiliation _____

_____

_____

_____

_____

_____

1) PLANNING AND PREPARATION A, X, OR N

What document (s) is (are) relevant to this audit _____
Date (s) Issued _____
Document(s) _____

2) FIELD ACTIVITIES

2.1) Pre-mobilization

Was a QA/QC meeting held before a new crew initiated site activities _____
Date of meeting _____

2.2) Meter Site Data Form

Identified meter number _____
Field Specialist, Run Specialist, _____
Contract Laborer _____
Description of sampling methodology (ref:QAPP) _____
Description of equipment decontamination procedures _____
Identified weather conditions _____
Maps are adequately dimensioned and locations referenced _____
In-field calibration of instruments recorded _____
Activities and field observations are adequately described _____

A=ACCEPTABLE
X=UNACCEPTABLE (OR NO)
N=NOT APPLICABLE

FIELD AUDIT
CHECKLIST

3) SAMPLING — A, X OR N

3.1) Sample entries include:

Sample identification number, date/time collected _____

Sampler's signature _____

Field observations _____

3.2) Sample Collection

Was exclusion zone established? _____
Were adequate quantities of sample collected? _____
Were proper containers used? _____
Was proper preservation of sample performed? _____
Was any equipment used pre-calibrated? _____

3.3) General Procedures

3.3.1) Were sampling locations properly selected? _____
If No, explain _____

3.3.2) Were new disposable latex gloves worn during collection of samples? _____
Remarks _____

3.3.3) Was sampling equipment protected from possible contamination prior to sample collection? _____
If No, explain _____

3.3.4) If equipment was cleaned in the field, were proper procedures used? _____
If No, explain _____

3.3.5) Field instruments used during this investigation? _____

3.3.6) Equipment used to collect soil? _____
List: _____

A, X, OR N

3.3.7) What procedures were used for the collection of these samples? _____

3.3.8) Note any deficiencies observed during the collection of soil/ sediment samples _____

3.3.9) What other type of samples were collected during this investigation? _____

3.3.10) What were the procedures were for the collection of these samples? _____

3.3.11) Who collected samples? _____

3.4 Sample Handling

Were shipping containers properly sealed using custody seals and evidence tape? Were sample custody procedures followed and samples stored in secure areas? _____

4.0) FIELD DOCUMENTATION AND CHAIN-OF-CUSTODY

4.1) Were chain-of-custody records completed for all samples? _____

4.2) Were sample tag numbers cross referenced to chain-of-custody forms? _____

4.3) Were all samples properly sealed at the time of collection? _____

4.4) Were samples kept in a secure place after collection? _____

4.5) Were all sample tags and chain-of-custody forms signed by sample collector(s)? _____

4.6) Were sampling locations adequately documented? _____

A=ACCEPTABLE
X=UNACCEPTABLE (OR NO)

N=NOT APPLICABLE

FIELD AUDIT
CHECKLIST

A, X, OR N

4.7) Were samples shipped to a contract laboratory? _____

If Yes:
Were the COC forms filled out properly? _____
Were the samples properly packed for shipment? _____
Were the shipping containers properly sealed? _____

5.0 QUALITY ASSURANCE/QUALITY CONTROL

(While all of these QA/QC procedures are not necessarily used, please identify the specific techniques which were employed by sampling personnel).

5.1) Did the sampling personnel utilize any field blanks? _____
5.2) Were any rinsate blanks collected? _____
5.3) Were any duplicate samples collected? _____
If, Yes, describe their handling. ____
_____
_____

A=ACCEPTABLE
X=UNACCEPTABLE (OR NO)
N=NOT APPLICABLE

APPENDIX B

ANALYTICAL LABORATORY AUDIT REPORT FORM

PART A	PERSONNEL AND EQUIPMENT AUDIT CHECKLIST
PART B	LABORATORY AUDIT CHECKLIST
PART C	EXIT INTERVIEW WORKSHEET

APPENDIX B
ANALYTICAL LABORATORY AUDIT REPORT FORM

PART A

PERSONNEL AND EQUIPMENT AUDIT CHECKLIST

1.0 ORGANIZATION AND PERSONNEL
2.0 INSTRUMENTATION
2.1 TCLP BOTTLE EXTRACTION VESSEL
2.2 INORGANIC INSTRUMENTATION
2.3 DATA REDUCTION
3.0 CALIBRATION MATERIALS
4.0 LABORATORY DOCUMENTATION

1.ORGANIZATION AND PERSONNEL (Continued)

Is the organization adequately staffed to meet project commitments in a timely manner? ___ ___

Will the Quality Assurance Officer be available during the onsite audit? ___ ___

Name: _____

Does the laboratory Quality Assurance Officer report to senior management levels? ___ ___

Was the Project Manager available during the evaluation? ___ ___

If not, was his substitute during the audit familiar with this specific project? ___ ___

Please attach the most recent laboratory organization chart. If there have been changes, please mark them on the chart.

Additional Comments

2.0 INSTRUMENTATION

2.1 TCLP BOTTLE EXTRACTION VESSEL

Instrument	Manufacturer	Model	Construction Material

2.2 INORGANIC INSTRUMENTATION - pH METERS, AUTO-ANALYZERS, FLASHPOINT, ETC.

Instrument	Manufacturer	Analysis	Model/Revision	Installation Date (Updates?)

2.3 DATA REDUCTION

What software packages are used in data reduction?

Instrument	Method	Software	Software Verified?
AA:	Metals		

Comments on Data Reduction Software:

3.0 CALIBRATION MATERIALS

Test	Source of Standards(s)*	Source of Reference Samples**
Metals		

*Standard materials used to prepare calibration standards.
**Reference samples supplied to verify external accuracy.

4.0 LABORATORY DOCUMENTATION

1) Quality Assurance Manual

Please provide a copy of the laboratory QA manual.

2) Standard Operating Procedures

Please provide a copy of the laboratory operating procedures.

APPENDIX B
ANALYTICAL LABORATORY AUDIT REPORT FORM

PART B
LABORATORY AUDIT CHECKLIST

1.0 LABORATORY OPERATIONS
- 1.1 SAMPLE RECEIPT AND STORAGE AREA
- 1.2 GENERAL LABORATORY FACILITIES
- 1.3 INORGANIC INSTRUMENTATION
  ATOMIC ABSORPTION (AA)
  SPECTROMETER
- 1.4 METALS ANALYSES

2.0 INFORMATION MANAGEMENT
- 2.1 SAMPLE TRACKING
- 2.2 DATA REDUCTION
- 2.3 REPORTING

3.0 CRITICAL OBSERVATIONS
- 3.1 CAPACITY
- 3.2 RESPONSIVENESS
- 3.3 REPORTING
- 3.4 EFFECTIVENESS OF QA PROGRAM

LABORATORY AUDIT CHECKLIST

1.0 General Information

Laboratory: _____

Address: _____

Phone No.: _____

Date Audited: _____

Auditor(s): _____

Title: _____

Personnel Contacted:

Name	Title	Subject	Phone Number

1.1 SAMPLE RECEIPT AND STORAGE AREA

ITEM	YES	NO	COMMENT
Is a sample custodian designated? If yes, name of sample custodian. Name:_____	___	___	
Are written Standard Operating Procedures (SOPs) developed for receipt and storage of samples?	___	___	
Are chain-of-custody forms checked with samples? Does the laboratory handle the forms properly?	___ ___	___ ___	
Are the samples and/or aliquots adequately tracked through the laboratory?	___	___	
Is the appropriate portion of the SOP available to the analyst at the sample receipt/storage area?	___	___	
Are the sample shipping containers opened in a manner which prevents possible laboratory contamination?	___	___	
Are samples documented with preservative?	___	___	
Are samples stored in such a way as to maintain their preservation?	___	___	
Are volatile samples stored separately from semi-volatile samples?	___	___	

ITEM	YES	NO	COMMENT
Are low level samples/standards stored separately from high level samples/standards?	___	___	
Are adequate facilities provided for storage of samples, including cold storage?	___	___	
Are previously analyzed samples kept until the date the report is finalized and accepted by the client?	___	___	
Is the temperature of the cold storage recorded daily in a logbook?	___	___	
Are temperature excursions noted and are appropriate actions taken when required?	___	___	
Are the sample receipt/storage and temperature logbooks maintained in a manner consistent with CLP?	___	___	
Are the thermometers used for storage areas referenced to a NBS or ASTM certified or traceable thermometer? How often?	___	___	
Has the QA Officer or supervisor of the individual maintaining the notebook/bench sheet personally examined and reviewed the notebook/bench sheet periodically, and signed his/her name therein, together with the date and appropriate comments as to whether or not the notebook/bench sheet is being maintained in an appropriate manner?	___	___	

Additional Comments:

1.2 GENERAL LABORATORY FACILITIES

When touring the facilities, give special attention to: (a) the overall appearance of organization and neatness, (b) the proper maintenance of facilities and instrumentation. (c) the general adequacy of the facilities to accomplish the required work.

ITEM	YES	NO	COMMENT
Is the laboratory maintained in a clean and organized manner?	___	___	
Does the laboratory appear to have adequate workspace (120 sq. feet, 6 linear feet of unencumbered bench space per analyst)?	___	___	
Does the laboratory appear to have the capacity to handle the facility samples? (How many samples/day do they process?)	___	___	
Are voltage control devices used on major instrumentation?	___	___	
Are the toxic chemical handling areas either a stainless steel bench or an impervious material covered with absorbent material?	___	___	
Are contamination-free areas provided for trace level analytical work?	___	___	
Are contamination-free work areas provided for handling of toxic material (e.g., glove box)?	___	___	
Are exhaust hoods provided to allow contamination-free work with volatile materials?	___	___	

ITEM	YES	NO	COMMENT
Is the air flow of the hoods periodically checked and recorded (i.e., once per quarter)?	___	___	
What is flowrate maintained in the hoods?			
Are chemical waste disposal policies/ procedures well defined and followed by the laboratory?	___	___	
Person responsible: _____			
Are temperature excursions noted and are appropriate actions taken when required?	___	___	
Can the laboratory supervisor document that trace-free water is available for the preparation of standards and blanks?	___	___	
How is the water pumped to/through the lab?			
How is the VOA reagent water prepared?			
Is the analytical balance located away from drafts and areas subject to rapid temperature changes?	___	___	
Is the balance routinely checked with the appropriate range of class S weights before each use and are the results recorded in a logbook?	___	___	
For standards preparation?	___	___	
For sample weights?	___	___	
Has the balance been calibrated within one year by a certified technician?	___	___	

ITEM	YES	NO	COMMENT
Are pH and ion selective meters operational and properly maintained?	___	___	
Is a UV-Visible spectrophotometer operational and properly maintained?	___	___	
Do adequate procedures exist for disposal of waste liquids from the AA spectrometers?	___	___	
Is the laboratory secure?	___	___	
Are the solvent storage cabinets properly vented as appropriate for the prevention of possible laboratory contamination?	___	___	
Are analytical reagents dated upon receipt?	___	___	
Are reagent inventories maintained on a first-in, first-out basis?	___	___	
Are analytical reagents checked out before use?	___	___	
Are reagent grade or higher purity chemicals (Ultrex-metals, pesticide-grade organics) used to prepare standards?	___	___	
Are fresh analytical standards prepared at a frequency consistent with good QA/QC?	___	___	
Metals?	___	___	

ITEM	YES	NO	COMMENT
Are reference materials properly labeled with concentrations, date of preparation, and the identity of the person preparing the samples?	___	___	
Are standards kept in proper containers, with necessary preservatives and storage temperatures?	___	___	
Is a spiking/calibration standards preparation and tracking logbook(s) maintained?	___	___	
Are the primary standards traceable to EPA standards? If not, where?	___	___	
Are standards stored separately from sample extracts?	___	___	
Do the analysts record bench data in a neat and accurate manner?	___	___	
Has the supervisor of the analyst maintaining the notebook/bench sheet personally examined and reviewed the documentation periodically, and signed his/her name therein. together with the data and appropriate comments as to whether or not the documentation is being maintained in an appropriate manner?	___	___	
Are volatile and semi-volatile solutions properly segregated?	___	___	
Is the appropriate portion of the SOP available to the analyst at the sample preparation area?	___	___	

ITEM	YES	NO	COMMENT
Is the SOP for glassware washing posted at the cleaning station?	___	___	
Are the SOPs for the glassware washing and cleaning adequate for the particular analyses?	___	___	
Is the temperature of the refrigerator/ freezers recorded daily?	___	___	
Are temperature excursions noted and appropriate actions taken when required?	___	___	

Additional Comments:

1.3 INORGANIC INSTRUMENTATION ATOMIC ABSORPTION (AA) SPECTROMETER

ITEM	YES	NO	COMMENT
Is instrumentation consistent with that reported by the laboratory?	___	___	
Are calibration results kept in a permanent record?	___	___	
Is a permanent service record maintained in a logbook?	___	___	
Has the instrument been modified in any way?	___	___	
Is the instrument properly vented?	___	___	
Is the unit equipped with flameless accessory?	___	___	
Is background correction automatically performed?	___	___	
Is service maintenance by contract?	___	___	
Is preventative maintenance applied?	___	___	

Additional Comments on Atomic Absorption (AA) Spectrometer:

1.4 METALS ANALYSES

ITEMS	YES	NO	COMMENTS
Were the proper analytical methods utilized?	___	___	
-For mercury?	___	___	
Were the samples properly preserved?	___	___	
-4 C for soil and water samples?	___	___	
-For rinsate samples (nitric acid to pH<2)?		___	___
Were the proper holding times followed?	___	___	
-Sampling to extraction (28 days)?	___	___	
-Extraction to analysis (28 days)?	___	___	
Was the correct digestion procedure utilized?	___	___	
Were TCLP extractor blanks run?	___	___	
Were the results within QC limits?	___	___	
Were daily blanks run?	___	___	
Are the results within QC limits?	___	___	
Were the sample results blank corrected?	___	___	
Were daily standard(s) run?	___	___	
Were the results within QC limits?	___	___	
Was a matrix spike analyzed with the batch?	___	___	
Is the recovery acceptable?	___	___	
Is an interference suggested?	___	___	
Has the percent recovery been applied to the other analyses in the batch?	___	___	

ITEM	YES	NO	COMMENT
Was a duplicate sample analyzed with the batch?	___	___	
Is the precision acceptable?	___	___	
Did a rinsate sample accompany the batch?	___	___	
Are the results acceptable?	___	___	
Are the results <5X sample results?	___	___	
Have the detection limits been calculated?	___	___	
Are they lower than those in the method?	___	___	
Are the bench sheets accurate and well organized?	___	___	
Are the sample results calculated accurately from sample preparation to the final value(including dilution factors)?	___	___	

Additional Comments:

2.0 INFORMATION MANAGEMENT CHECKLIST

2.1 SAMPLE TRACKING

ITEM	YES	NO	COMMENT
Is computer hardware consistent with questionnaire?	___	___	
Is there a computerized sample tracking system in place?	___	___	
If not, describe tracking methodology used.			
If so, is sample status readily available?	___	___	
Is there a warning system for holding time expirations?	___	___	
How are special requests handled?			
How are standard requests handled?			

2.2 DATA REDUCTION

What software packages are used in data reduction?

Instrument	Method	Software	Software Verified?
AA:	Metals		

Comments on Data Reduction Software:

2.3 REPORTING

ITEM	YES	NO	COMMENT
Is report generating software included in data reduction software?	___	___	

If so, for what instruments/methods?

What software packages other than those cited above are used in report generation?

Method	Software

For analyses which do not include computerized data reduction/reporting, how are data verified?

Have report generating software packages been independently verified?

How are final reports verified with input data?

3.0 CRITICAL OBSERVATION CHECKLIST

3.1 CAPACITY

ITEM	YES	NO	COMMENTS
How many samples/month does the lab process?			
How many shifts are normally run per day?			
Does each shift have a Senior Supervisor?	___	___	
Is floor and storage space adequate?	___	___	
Estimate normal workload (hours/day and days/week) for staff and supervisory personnel?			
How does the lab handle overload?			
-Extra shifts?	___	___	
-Subcontract to outside lab?	___	___	
-Subcontract to lab with same company (sister lab)?	___	___	

If outside subcontractors are used, identify which and for what test.

Method	Subcontract Lab

ITEM	YES	NO	COMMENT
Does the laboratory provide QA of subcontractor work? Explain.	___	___	
If sister labs are used, are procedures and QA reviews consistent?	___	___	

Additional Comments:

3.2 RESPONSIVENESS

Are senior technical personnel available for same-day consultation?	___	___	
Are specific individuals assigned for client contact?	___	___	
How long before a client request is typically answered?	___	___	

Additional Comments:

3.3 REPORTING

ITEM	YES	NO	COMMENTS
What is the calculated average turnaround time from sample receipt to report delivery?			
Can holding times be verified from reports?	___	___	
Are reports signed by either the analyst or a QC reviewer?	___	___	
Is a case narrative provided with reports?	___	___	
What types of QC reports are available? Is there an extra charge? Attach examples.	___	___	
If appropriate, has laboratory provided examples of reporting format?	___	___	
Can analysts verify proper instrument performance (calibration, continuing calibration, interference check standard, spike recovery, blanks, as appropriate) during analysis at the time of the audit?			
Are QC criteria met before samples are analyzed?	___	___	

3.4 EFFECTIVENESS OF QA PROGRAM

Is there a consistent understanding of the lab's QA protocols, including corrective actions at all levels:	___	___	
-Management	___	___	
-QA Officers	___	___	
-Supervisory	___	___	
-Staff	___	___	
-Technicians	___	___	

ITEM	YES	NO	COMMENT
List all laboratory certifications:			
Are SOPs and QAP consistent with current regulatory guidance?	___	___	
When was the last revision?			

Document	Last Revision Date
SOP	
QAP	

Is there a formal staff training program?	___	___	
How are new analysts certified?	___	___	
Has the QA Officer verified any computer programs used for data reduction and reporting?	___	____	

If so, how? Attach documentation:

Software	Verified By	Date	Comments

ITEMS	YES	NO	COMMENT
Is there an internal QA audit program?	___	___	
If so, what is the frequency?			_____
How are audits documented?			_____
Request documentation from the most recent audit.			
Does the internal program include corrective actions?	___	___	
How are these implemented?			_____
Does the laboratory participate in performance evaluation programs?	___	___	
Request the most recent results.			
Do they have the records on file for easy review?	___	___	
Have they analyzed the compounds that they report for the facility?	___	___	
What percentage of the possible analytes did they analyze?	___	___	
Did the lab have acceptable performance on the QA samples for the reported analytes? (Note the problem analytes.)	___	___	
For the analytes outside of acceptable limits, did the lab conduct any corrective action?	___	___	
Was the corrective action documented?	___	___	

Additional Comments:

_____

_____

_____

_____

_____

ITEM	YES	NO	COMMENT
Did the lab have acceptable performance on The QA samples for the reported analytes? (Note the problem analytes.)	___	___	
For the analytes outside of acceptable limits, did the lab conduct any corrective actions?	___	___	
Was the corrective action documented?	___	___	

Additional Comments:

Has the laboratory participated in performance evaluations other than the EPA WP or WS series?	___	___	
Has the lab been a part of an external QA program?	___	___	
Is the lab's performance acceptable?	___	___	
Is there a mechanism established for corrective action on analyses with poor performance?	___	___	
Does the lab have a regularly scheduled internal QA program?	___	___	

Additional Comments:

SUMMARY CHECKLIST

ITEM	YES	NO	COMMENT
Do responses to the evaluation indicate that project and supervisory personnel are aware od QA/QC and its application to the project?	___	___	
Do project and supervisory personnel place positive emphasis on QA/QC?	____	___	
Have responses, with respect to QA/QC aspects of the project, been open and direct?	___	___	
Has a cooperative attitude been displayed by all project and supervisory personnel?	___	___	
Does the organization place the proper emphasis on quality assurance?	___	___	
Have any QA/QC deficiencies been discussed before leaving?	___	___	
Is the overall quality assurance adequate to accomplish the objectives of the project?	___	___	
Has corrective action(s), recommended during previous evaluations, been implemented? If not, provide details under additional comments.	___	___	

Additional Comments:

APPENDIX B
ANALYTICAL LABORATORY AUDIT
REPORT FORM

PART C
EXIT INTERVIEW WORKSHEET

PART I

1.0 BASIC CAPABILITIES

2.0 LABORATORY OPERATIONS

3.0 CRITICAL OBSERVATIONS

PART II

1.0 AREAS OF DEFICIENCY

EXIT INTERVIEW WORKSHEET
Part 1

Laboratory Facility: _____
Date: _____
Prepared by: _____

		1	2	3	Comment
1.0	BASIC CAPABILITIES				
	a - Facilities				
	b - Organization and Personnel				
	c - Analytical instrumentation				
	d - Calibration materials				
	e - Laboratory documentation				
2.0	LABORATORY OPERATIONS				
	a - Sample receipt and handling				
	b - Sample tracking				
	c - Sample preparation				
	d - Analytical methods				
	e - Data reduction and reporting				
	f - Data review and documentation				
3.0	CRITICAL OBSERVATIONS				
	a - Capacity				
	b - Responsiveness				
	c - Reporting				
	d - Effectiveness of QA Program				

1 - Satisfactory

2 - Not Satisfactory - Any item rated "Not Satisfactory" must be listed on the attached form with a full explanation of the deficiency. All such items should be discussed with laboratory management and corrective actions agreed upon and noted. The attached form must be signed and dated by the audit team and by laboratory management. A copy should be left with the laboratory for implementation of corrective action.

3 - Not Reviewed - Items listed as "Not Reviewed" must also be accompanied by an explanation, although corrective actions may not be required.

EXIT INTERVIEW WORKSHEET
Part II

AREAS OF DEFICIENCY

Item #	Explanation of Deficiency	Corrective Action

Signature:

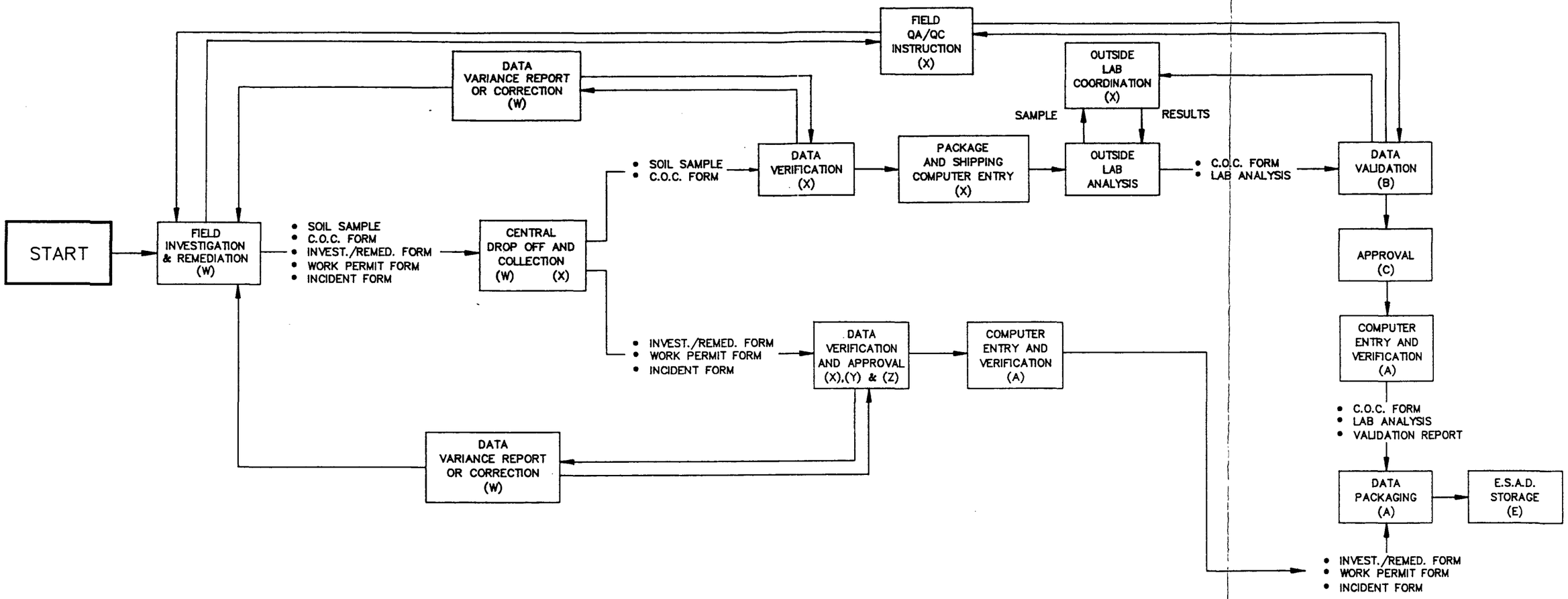
_____ Date:_____ _____ Date:_____
Auditor Lab Director

_____ Date:_____ _____ Date:_____
Auditor Lab Director

90H3012C/D:EPNGQALC.PTC

90301206

Woodward-Clyde Consultants



LEGEND

W : FIELD CREW
X : LAB TECHNICIAN
Y : FIELD INSPECTOR
Z : OPERATION COORDINATOR
A : DATA MANAGEMENT CLERK
B : CHEMIST
C : LAB SUPERVISOR
E : ESAD DOCUMENT MANAGER

MERCURY METER SITE INVESTIGATION/REMEDATION PROGRAM

DATA & SAMPLE FLOW CHART

DATE: 3/16/90	BY: M.D.B.
REVISED : 4/17/90	
REVISED :	

FIGURE 6

FIGURES

METER SITE DATA FORM

LOCATION INFORMATION

METER CODE [ ][ ] - [ ][ ][ ] LOCATION NAME _____

DATE [ ][ ] - [ ][ ] - [ ][ ] RUN NUMBER [ ][ ]-[ ][ ]-[ ][ ]

TIME OF ARRIVAL _____ AM PM SPECIALIST _____

TIME OF DEPARTURE _____ AM PM CONTRACTOR _____

CREW NUMBER [ ][ ] RUN TECH. _____

VISITORS: _____ [ ]AUDITOR [ ]REGULATOR [ ]OPERATOR [ ]OTHER

_____ [ ]AUDITOR [ ]REGULATOR [ ]OPERATOR [ ]OTHER

_____ [ ]AUDITOR [ ]REGULATOR [ ]OPERATOR [ ]OTHER

OBSERVATIONS

METER TYPE: [ ]MERCURY [ ]EFM [ ]DRY FLOW

IS A METER HOUSE PRESENT? [ ]YES [ ]NO

FLOOR TYPE: [ ]NATURAL [ ]MANMADE

SOIL TYPE: [ ]SAND [ ]CLAY [ ]SANDSTONE

[ ]LOOSE GRAVEL [ ]LOOSE ROCK

[ ]OTHER _____

WEATHER CONDITIONS:

WIND: [ ]CALM [ ]BLOWING DUST

MOISTURE: [ ]RAINING [ ]SNOWING [ ]DRY

TEMPERATURE: _____ °F

VISIBLE MERCURY OBSERVED? [ ] YES [ ]NO

IF YES [ ]SURFACE [ ]BELOW SURFACE [ ]BOTH

VAPOR READINGS

EXPLOSIMETER READING _____ %LEL

*PRIOR TO PAN INSTALLATION

INITIAL: BREATHING ZONE: _____ MG/M³

FLOOR: _____ MG/M³

TEMPERATURE: _____ °F

*FINAL: BREATHING ZONE: _____ MG/M³

FLOOR: _____ MG/M³

TEMPERATURE: _____ °F

REMEDIATION

AMOUNT OF FREE MERCURY RECOVERED _____ POUNDS

AMOUNT OF SOIL REMOVED _____ INCHES _____ APPROXIMATE # OF lbs

NUMBER OF CONTAMINATED SKIDS [ ]1 [ ]2 [ ]3 [ ]4 [ ]NONE

OTHER ITEMS REQUIRING DISPOSAL _____

IS A RETURN VISIT REQUIRED? [ ]YES [ ]NO

SAMPLING

VERIFICATION SAMPLE# [ ][ ] - [ ][ ] - [ ][ ][ ][ ] - [ ] - [ ] [ ]NOT SAMPLED

ADDITIONAL VERIFICATION SAMPLE TAKEN? [ ]YES [ ]NO

IF YES, SAMPLE#: [ ][ ] - [ ][ ] - [ ][ ][ ][ ] - [ ] - [ ]

QA/QC SAMPLES TAKEN? [ ]YES [ ]NO

IF YES, TYPE: [ ]DUPLICATE [ ]BLANK [ ]FIELD RINSATE [ ]MATRIX SPIKE

QA/QC SAMPLE# [ ][ ][ ][ ] - [ ][ ][ ][ ] - [ ][ ] - [ ][ ]

CHAIN OF CUSTODY FILLED OUT? [ ]YES [ ]NO

SAMPLE(S) LABELLED? [ ]YES [ ]NO SAMPLE(S) KEPT AT 4°C? [ ]YES [ ]NO

DECONTAMINATION

EQUIPMENT DECONTAMINATED? [ ]YES [ ]NO PERSONNEL DECONTAMINATED? [ ]YES [ ]NO

SPILL CONTROL MEASURES

WAS THE U-TUBE BAGGED? [ ]YES [ ]NO WAS A FIBERGLASS PAN INSTALLED? [ ]YES [ ]NO

COMMENTS: _____

_____

_____

CREW SIGNATURE _____ DATE _____

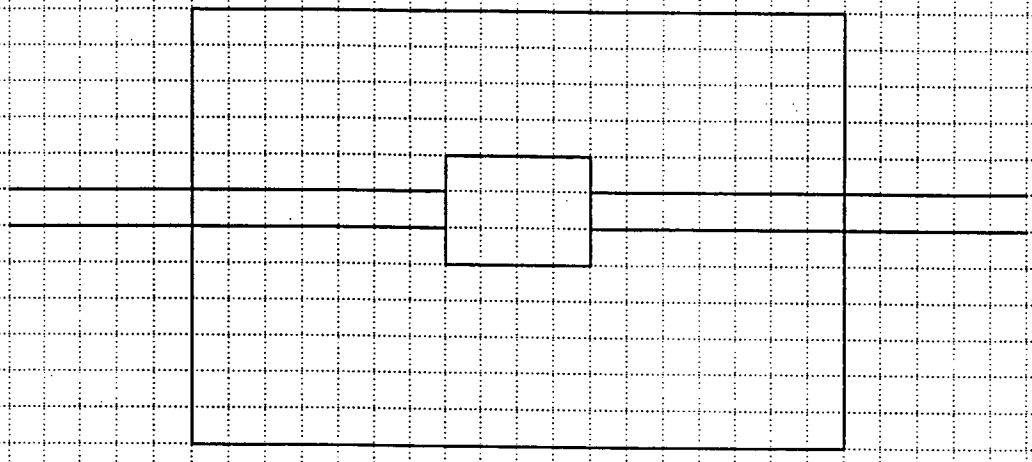
CREW SIGNATURE _____ DATE _____

CREW SIGNATURE _____ DATE _____

VALIDATION APPROVAL _____ DATE _____

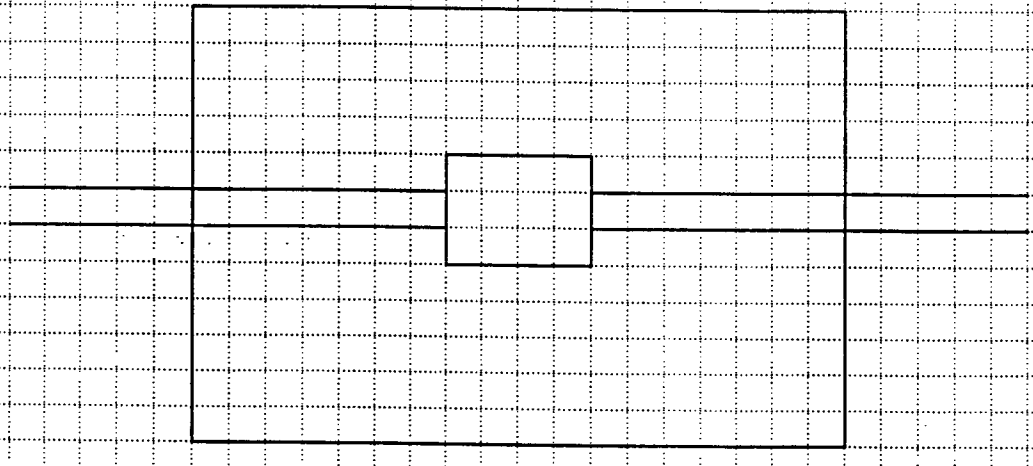
Figure 4. Meter Site Data Form (Front Side)

LOCATION OF VISIBLE MERCURY



1. Denote areas where visible mercury was found on the soil surface with an "S."
2. Denote areas where visible mercury was found below the soil surface with an "X." Areas marked with an "X" should be footnoted with approximate depths.

LOCATION WHERE SAMPLE WAS SECURED



1. Denote area where primary sample was taken with "V1."
2. If a secondary verification sample was taken, denote with "V2."

Figure 4. Meter Site Data Form (Back Side)

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME/SITE NAME
SAMPLERS: *(Signature)*	DATE :

SAMPLE NO.	DATE	TIME	COMP.	GRAB	SAMPLE SOURCE AND DESCRIPTION	TYPE AND NO. OF SAMPLE CONTAINERS	PRESERVATION TECHNIQUE	REQUESTED ANALYSIS				REMARKS

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks :	
Carrier Co: Air Bill No:		Carrier Phone No.		Date Results Reported / by: (Signature)	

Figure 5. Chain-of-Custody Form

NON-CONFORMANCE AND CORRECTIVE ACTION REPORT (NCR)

DATE: _____
NCR NO: _____

SUBMITTAL

TO: Compliance Officer
QA/QC Officer

Description of Non-conformance and Cause: _____

_____

_____

Proposed Corrective Action _____

_____

_____

Submitted by _____ Location _____
Approved by _____ Date _____

CORRECTIVE ACTION (by Project Manager or Designee)

Implementation of Action Assigned to: _____

Actual Corrective Action: _____

_____

_____

_____

Implementation verbally approved by QA Officer on _____
Date

Action implemented on _____
Date

_____
Signature

VERIFICATION (By QA/QC Officer or Designee)

Corrective Action implementation reviewed and work inspected by _____
on _____

Corrective Action verified by _____ on _____

(Use additional sheet or memo if needed)

Figure 7. NCR Report Form