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Environmental Restoration Program

REMEDIAL INVESTIGATION/FEASIBILITY STUDY OPERABLE UNIT 2, MAIN HILL QUALITY ASSURANCE PROJECT PLAN

MOUND PLANT
MIAMISBURG, OHIO

March 30, 1994

FINAL

(Revision 1)

Department of Energy
Albuquerque Field Office

Environmental Restoration Program
EG&G Mound Applied Technologies

OPERABLE UNIT 2

MAIN HILL REMEDIAL INVESTIGATION

QUALITY ASSURANCE PROJECT PLAN

DEPARTMENT OF ENERGY, MOUND PLANT

MIAMISBURG, OHIO

Approved by Diane M. Spencer 6/20/94 Date
USEPA Region V Remedial Project Manager - Diane Spencer

Approved by 6/21/94 Date
Ohio EPA Site Coordinator - Brian Nickel

Approved by Art K. Kleinrath 6/21/94 Date
DOE Dayton Area Office Remedial Project Manager - Art Kleinrath

Approved by 6/29/94 Date
DOE AL Installation Coordinator - Paul Mann

Approved by 6/22/94 Date
ER Program Manager, Mound Plant - Monte Williams

Approved by 5/25/94 Date
ICF Kaiser Engineers Site Manager - Keith Egan

Approved by Dick McCracken 7/12/94 Date
ICF Kaiser Engineers QA Officer - Dick McCracken

ENVIRONMENTAL RESTORATION PROGRAM

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OPERABLE UNIT 2, MAIN HILL
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ENVIRONMENTAL RESTORATION PROGRAM

EG&G MOUND APPLIED TECHNOLOGIES

FINAL

(REVISION 1)

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ACRONYMS

AA	atomic absorption
AEA	Atomic Energy Act
AL	Albuquerque Field Office
ASTM	American Society for Testing Materials
BFB	bromofluorobenzene
BOD	biological oxygen demand
CAR	Corrective Action Report
CCC	calibration check compound
CCV	continuing calibration verification
CEARP	Comprehensive Environmental Assessment and Response Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CGI	combustible gas indicator
CLP	(EPA) Contract Laboratory Program
COD	chemical oxygen demand
CRDL	contract-required detection limit
CRQL	contract-required quantitation limit
DAO	Dayton Area Office
DFTPP	decafluorotriphenylphosphine
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DQO	data quality objective
EDD	Enforcement Decision Document
EG&G	EG&G Mound Applied Technology
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration (Program)
FFA	Federal Facility Agreement
FIDLER	field instrument for the detection of low-energy radiation
FS	Feasibility Study
FSP	Field Sampling Plan
GC	gas chromatograph
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,6-tetrazocineyclo-tetramethylenetetranitramine
HPLC	high-performance liquid chromatography
HSP	Health and Safety Plan
IATA	International Air Transport Association
ICP	inductively coupled plasma
ICS	interference check sample
ICV	initial calibration verification
IDL	instrument detection limit
IT	International Technology
ITAS	International Technology Analytical Services
LANL	Los Alamos National Laboratory
LCS	laboratory control sample
LLD	lower limit of detection
LRA	linear range analysis
MCL	maximum contaminant level
MDA	minimum detectable activity
MCLG	maximum contaminant level goal
MS	mass spectrometry
MSA	method of standard addition

ACRONYMS (Continued)

MSD	matrix spike duplicate
NA	not applicable
NB	nitrobenzene
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OVA	organic vapor analyzer
PCB	polychlorinated biphenyl
PE	performance evaluation
PETN	pentaerythritol tetranitrate (explosive)
PID	photoionization detector
PM-10	particulates less than 10 microns
PQL	practical quantitation limit
QA	quality assurance
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
QAP	Quality Assurance Program
QAPP	Quality Assurance Project Plan
QC	quality control
QCC	quality control coordinator
RAS	routine analytical services
RCRA	Resource Conservation and Recovery Act
RD/RA	remedial design/remedial action
RDA	remedial design and action
RDX	hexahydro-1,3,5-trinitro-s-triazine cyclotetratmethylene-tetranitramine
RF	radio frequency
RI	remedial investigation
ROD	Record of Decision
RPD	relative percent difference
RRF	relative response factor
RSD	relative standard deviation
SARA	Superfund Amendments and Reauthorization Act
SD	standard deviation
SOP	Standard Operating Procedure
SOW	Statement of Work
SPCC	system performance check compounds
SWMU	solid waste management unit
SW846	"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (U.S. Environmental Protection Agency)
TAL	Target Analyte List
TCL	Target Compound List
TDS	total dissolved solids
TNT	2,4,6-trinitrotoluene (explosive)
TOC	total organic carbon
TSO	Technical Support Office
TSP	total suspended particulates
TSS	total suspended solids
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
VOC	volatile organic compound
WD	waste disposal

1. INTRODUCTION

1.1. OVERVIEW

ICF Kaiser Engineers (ICF KE) has been retained to conduct Remedial Investigation/Feasibility Study (RI/FS) activities at Operable Unit 2 (OU-2) of the U.S. Department of Energy (DOE) Mound Plant in Miamisburg, Ohio. This Quality Assurance Project Plan (QAPjP) is provided to delineate the purpose, policies, standard operating procedures, and organization of the ICF KE Quality Assurance (QA) Program as it applies to these activities. Implementation of the QA program ensures the validity of data collected in support of project activities. Accurate data obtained during sampling and subsequent chemical analyses will provide the information required to establish defensible conclusions and recommendations concerning this site.

Quality assurance (QA) is defined as the overall system of procedures for assuring the reliability of data produced in conjunction with project activities. A QAPP is required for all projects involving sample collection or analysis to ensure that the accuracy, precision, and comparability of submitted data is of a known and documented level. This QAPjP utilizes quality control measures for the routine application of criteria that will achieve prescribed standards of performance for sampling and analysis of environmental media. The intended use of a QAPjP for field sampling operations is to establish and define various QA program requirements as they relate to site investigations, field sampling, and environmental monitoring activities associated with OU-2 at Mound Plant. The plan provides general procedures that delineate how field and laboratory data of known and accepted quality will be generated.

An overall system of quality assurance consists of two elements: quality control and quality assessment. Quality control is a system of procedures performed to control the quality of the data produced in conjunction with project activities. Quality assessment is a program of activities to evaluate the performance of implemented quality control procedures and the quality of the data produced in conjunction with project activities.

This QAPjP describes the quality control procedures for sampling activities (sampling procedures in Section 4 and sample custody in Section 5), for field screening and field measurements (Section 3), and for laboratory analyses (Section 6). Specific quality control steps, defined as quality control checks, for these activities are discussed in Section 8. The standards of performance, defined as acceptance criteria, for these checks are presented in Section 3. Quality control procedures for calibration of field and

laboratory instrumentation are outlined in Section 7. The procedures for data reduction, validation, and reporting are included in Section 9. As part of the quality control program, preventive maintenance procedures for equipment and instrumentation are summarized in Section 11. Corrective actions for the planned field and laboratory activities are necessary for a quality control program in order to keep the quality of generated data under control. The corrective actions for these activities are provided in Section 13.

Quality assessment activities for this RI include evaluation of field and laboratory quality control data, performance and system audits, and issuing of quality assurance reports to management. Procedures for these activities are described in Sections 12, 10, and 14, respectively. The references are discussed in Section 15.

In fulfilling its role of ensuring that the goals of the project are met, the quality assurance program relies on the structure of the project organization and on the effectiveness of key individuals in carrying out their responsibilities. This report describes the project organization and identifies the individuals who are responsible for assessing the collection and generation of data and for ensuring that this data is of defined quality (Section 2).

The intended use of data and the associated acceptance criteria for data quality will be determined before the data collection effort begins. Reported data will include, when appropriate, statements of precision, accuracy, representativeness, completeness, and comparability. Data processing procedures will be documented, reviewed, and revised, as required to meet project data quality requirements.

1.2. ENVIRONMENTAL RESTORATION PROGRAM DESCRIPTION

The Environmental Restoration (ER) Program, formerly known as the Comprehensive Environmental Restoration Program and, before that, the Comprehensive Environmental Assessment and Response Program (CEARP), was initiated by the U.S. Department of Energy (DOE) Albuquerque Operations Office (AL) in 1984 to fulfill its obligations under the following environmental laws:

- The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 300);
- The Resource Conservation and Recovery Act (RCRA) (40 CFR 260-270);

- The National Environmental Policy Act of 1969 (NEPA) (volume 83, page 852 of the U.S. Statutes and Chapter 42, Section 4321 of the U.S. Code); and
- The Atomic Energy Act of 1954 (AEA) (volume 68, page 1919 of the U.S. Statutes and Chapter 42, Section 2011 of the U.S. Code).

The ER Program consists of three phases patterned after the U.S. Environmental Protection Agency (EPA) CERCLA program. Phase I, preliminary assessment/site inspection, was completed at Mound Plant in 1986 and reported in the installation assessment (DOE 1986). Phase II, the remedial investigation/feasibility study (RI/FS), is currently under way at Mound Plant. Phase III, remedial design/remedial action (RD/RA), will implement the remedial alternative chosen in the FS of Phase II. The RD/RA phase includes selection of a remedy; the production of a record of decision (ROD), which describes the chosen remedial action; the design of the remedial action; and the actual performance of the remedial action.

1.3. MOUND PLANT ER PROGRAM

Mound Plant was placed on the CERCLA (Superfund) National Priorities List (NPL) in November, 1989. Pursuant to that status, a CERCLA Section 120 Federal Facility Agreement (FFA) was signed between DOE and EPA (Administrative Docket Number V-W-90-C-075), and became effective October 12, 1990. Because of this, the RI/FS process at Mound Plant, as outlined in the OU-2 Work Plan, follows the methodology that the Superfund program has established for characterizing the nature and extent of risks posed by uncontrolled hazardous waste sites and for evaluating potential remedial options. This approach is a flexible process that is tailored to specific circumstances of individual sites and can be adjusted as additional information becomes available.

The goal of the ER Program at Mound Plant is to reduce adverse impacts on public health and the environment by

- Reducing releases of hazardous or radioactive materials, and
- Bringing all inactive wastes sites requiring remediation into compliance with existing state and federal regulations and requirements.

The FFA between the DOE and the EPA contains both the procedural and substantive requirements for RI/FS work (Administrative Docket Number V-W-90-C-075). As of January, 1991, a similar agreement was being negotiated between the DOE and the Ohio EPA.

As part of the Mound Plant Site-wide ER Program, the OU-9 Site-wide Quality Assurance Project Plan was developed as an umbrella document to provide consistency in approach for quality assurance activities across the individual operable units and minimize redundancy in the preparation quality assurance project plans for the individual OUs to meet regulatory compliance. This quality assurance project for OU-2 is a subset of the larger document and addresses the anticipated unique site-specific QC requirements for OU-2.

1.4. PROJECT DESCRIPTION

The OU-2 (Main Hill) RI/FS has two main objectives. First, the OU-2 Work Plan will provide a summary of the OU-2 RI/FS activities at Mound Plant in order to ensure that a comprehensive investigation will be performed. This objective is accomplished by summarizing the conceptual models, the migration pathways, and the potential impacts to the public and the environment from OU-2. Specific work to be conducted will be detailed in individual operable unit work plans. Once the individual operable unit remedial investigations are complete, the OU-2 investigation will utilize data from all the investigations in order to present a comprehensive report.

Second, specific field investigations will be conducted in OU-2 to address potential contamination and contaminant transport outside the boundary of Mound Plant. These will include regional studies to ascertain the background setting of the plant. Results of these studies will be reported in a series of interim reports or technical memoranda so that the data will be available during the other operable unit investigations.

The current understanding of existing data, data needs, site setting, and work plan rationale, including the design of the sample network for each of these investigations, is described in the OU-2 Work Plan, Sections 5, 6, 7, 8, 9, and 10, supplied as a companion document to this QAPjP. The layout of the Mound Plant buildings located on the Main Hill are shown on Figure 1.1.

These investigations are intended to establish the current level of contamination in the groundwater, soils, sediments, and surface water that surround the plant. The investigations will also determine any air emissions. The specified parameters to be analyzed are designed to determine the presence of contaminants in representative samples. Parameters to be analyzed in the field and laboratory for each task of the investigation are listed in Table I.1. The selected laboratory methods of analysis for these

Table I.1. Analytical Data Quality Objectives

Locations and Depths			
Proposed Soil Sampling Locations:	132 initial locations		
Data Use:	Nature and Extent, Risk Assessment, Alternative Evaluation		
Analytical Parameter List	Analytical DQO Level	Geotechnical Parameters	Analytical DQO Level
VOCs SVOCs TAL inorganics	IV	Grain size distribution Bulk Density Permeability	II
Bismuth Fluoride USATHAMA - listed explosives	III		
TCL pesticides/PCBs	IV		
Isotopic plutonium (238,239/240) Isotopic thorium (229,230,232, 234/235,238) Strontium-90 Tritium Protactinium-231 Gamma spectrometry	V		
Nitrate/nitrite Sulfate Chloride Total organic carbon	III		

Table I.1. (Continued)

Locations and Depths			
Proposed Groundwater Sampling Locations:	4 Existing monitoring wells 7 OU-9 monitoring wells 25 OU-2 monitoring wells 7 Trenches/Pits 8 Seeps Foundation Drains		
Data Use:	Nature and Extent, Risk Assessment, Alternative Evaluation		
Analytical Parameter List	**Analytical DQO Level**	**Field Parameters**	**Analytical DQO Level**
VOCs SVOCs TAL inorganics	IV	Temperature pH Specific conductivity Dissolved oxygen Redox Potential Water level	I
Bismuth Fluoride USATHAMA-listed explosives	III		
TCL pesticides/PCBs	IV		
Isotopic plutonium (238,239/240) Isotopic thorium (229,230,234/235,238) Strontium-90 Tritium Protactinium-231 Gamma spectrometry	V		
Nitrate/nitrite Sulfate Chloride Total organic carbon Nitrite Nutrients (TKN, TP) Total dissolved solids Total suspended solids Alkalinity	III		
TAL inorganics (dissolved)	IV		
Radium-226 Americium-241	III		

Table I.1. (Continued)

Locations and Depths	
Proposed Soil Gas Sampling Location: 39 initial locations. Subsequent sampling locations will be guided by field screening results. Data Use: Determine Soil Boring Locations	
Analytical Parameters	**Analytical DQO Level**
Tetrachloroethane Trichloroethane 1,2-trans-Dichloroethene 1,1,1-Trichloroethane 1,1-Dichloroethane Chloroform Bromodichloronethane Bromoform Toluene Freon 11 Freon 113 Total VOCs	II

Notes: Outside screening for plutonium-238 and thorium-232 is performed using a FIDLER detection system to detect these isotopes.

Explosives include the 11 USATHAMA explosives: HMX; RDX; 1,3,5-TNB; 1,3-DNB; NB; Tetryl; 2A,4,6-DNT; 2,4,6-TNT; S,6,-DNT; and PETN.

PCBs - polychlorinated biphenyls
TAL - Target Analyte List, includes dissolved and/or total metals and cyanide
TCL - Target Compound List
VOC - Volatile Organic Compound

parameters will be performed under EPA's Contract Laboratory Program (CLP) requirements where appropriate and using approved and known methodologies where available.

Objectives for data quality are discussed in the following sections of this QAPjP. However, analytical levels, as defined by the EPA's "Data Quality Objectives for Remedial Response Activities" (EPA 1987), may be assigned to the planned analyses. These analytical levels were designed by the EPA to serve as guidance for obtaining data of appropriate quality for its intended use. A general description of the typical types of analyses performed, the types of data uses, the limitations, and a generic description of data quality are provided for each analytical level (I, II, III, IV, and V) in the EPA guidance. The details of intended data usage for each task are presented in the respective sections of the OU-2 Work Plan. These analytical levels have been applied to each set of parameters to be analyzed and are presented in Table I.1 for each task of the investigation. The purpose for data collection and the media to be investigated for each task are also included in this table.

2. PROJECT ORGANIZATION AND RESPONSIBILITY

Project organization and responsibility are divided among the DOE ER Program Group, which includes the following: the DOE Albuquerque Field Office (DOE AL); the DOE Dayton Area Office (DOA) and its operating contractor, EG&G Mound Applied Technologies, Inc. (EG&G); and the ER Program EG&G subcontractors. The currently identified EG&G subcontractor for OU-2 is ICF Kaiser Engineers, Inc. (ICF KE). If additional EG&G subcontractors are identified at a later date, this section of the QAPjP will be revised. The organization and responsibilities are discussed in detail in the OU-2 Work Plan and shown in summary in Figure 2.1.

2.1. FIELD TEAM RESPONSIBILITIES

The ICF KE field team responsibilities for the OU-2 limited field investigation will consist of performing the field activities specified in the OU-2 Work Plan. The ICF KE field team will have four identified positions: the field team leader, site health and safety coordinator (SHSC), field technicians, and sample document control administrator. The field team leader is responsible for directing the field activities specified in the work plan and communicating progress and any issues to the ICF KE site manager. The SHSC is responsible for ensuring that the health and safety guidelines specified in the Health and Safety Plan are followed. He or she will be trained in first aid and CPR. It is the responsibility of the SHSC to make sure safe work practices are implemented and to report all incidents that occur during the field activities.

The field technicians are responsible for conducting the field activities, as specified in the OU-2 Work Plan, under the supervision of the field team leader.

A sampling team leader will be designated by the field team leader and serve as the sample document control administrator. He or she will be responsible for tracking the locations sampled and will ensure that samples are properly labeled and documented prior to shipment to the laboratory. The administrator will ensure that the sample control procedures specified in this QAPjP and the sampling and analysis plans are followed.

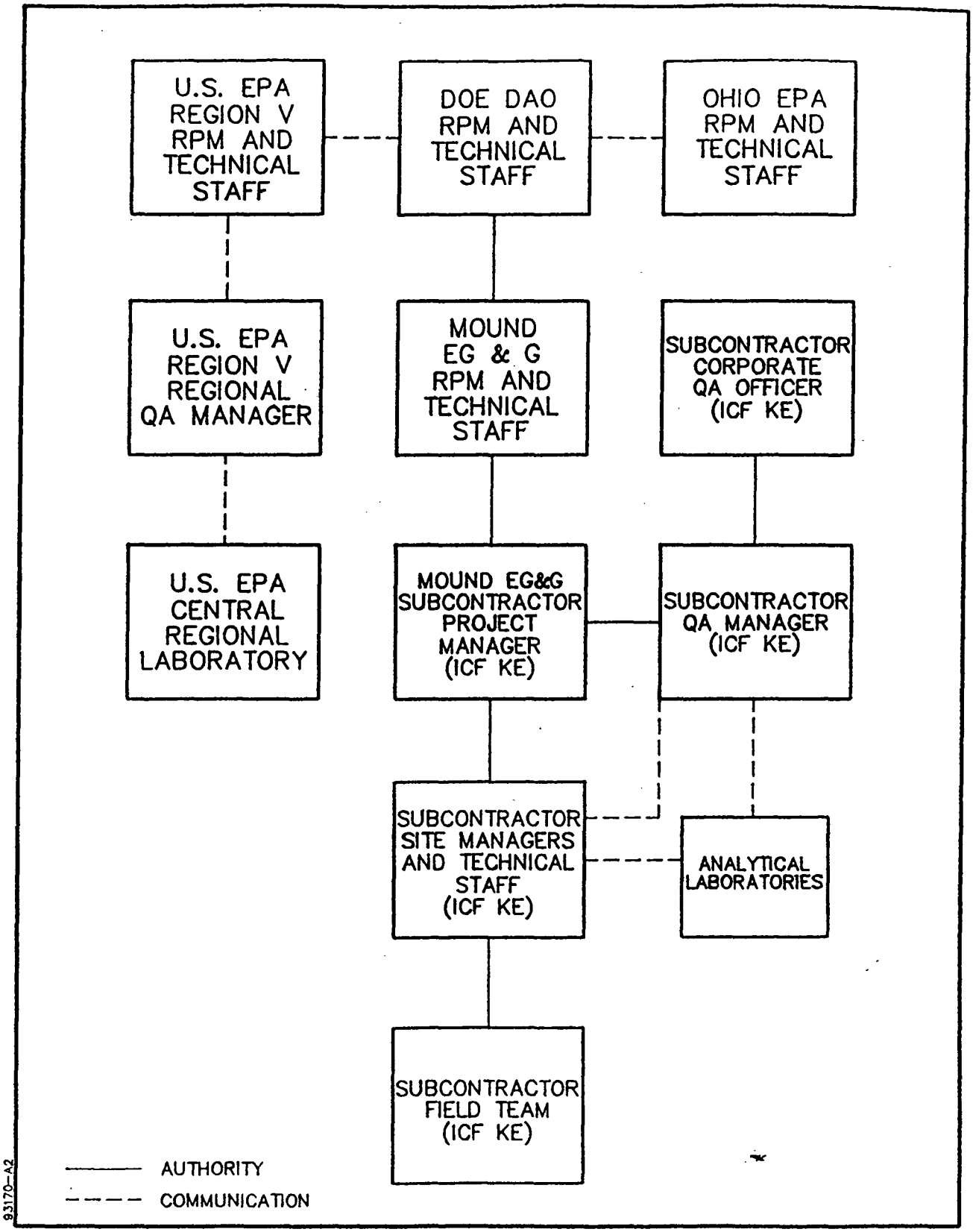

Figure 2.1. OU-2 Organization Chart

2.2. LABORATORY RESPONSIBILITIES

Laboratory responsibilities for this investigation will consist of performing analytical services according to guidelines presented in this QAPjP, reporting all laboratory nonconformances should they occur, and transmitting quality-assured data packages. Technical requirements for the project analytical laboratories will be detailed in the analytical laboratory project QA plan. Analytical laboratory project QA plans will include the following QAPP topics: 1) analyses to be performed, 2) laboratory responsibilities, 3) laboratory sample custody procedures, 4) laboratory quantitation limits (outside the project required limits), 5) laboratory data reduction procedures, 6) laboratory data validation procedures, 7) preventive maintenance, and 8) specific procedures to assess precision, accuracy, and completeness (if different from the QAPP), 9) audits, 10) in-house QC checks, 11) sample containers, and 12) ASTM Type II quality water.

Other laboratories may be used to perform selected analyses depending upon whether the required laboratory services and scheduling requirements can be met. When an additional laboratory is included for services, an additional laboratory specifications attachment will be prepared and submitted to US EPA for approval. At this time, a laboratory has not been identified for the analysis of groundwater and residential well samples. An attachment for the laboratory performing the analyses will be prepared and submitted when the laboratory is identified. These laboratories must also meet the quality assurance requirements presented in this QAPjP.

This section identifies the various general responsibilities within the analytical laboratories. Specific laboratory responsibilities and position titles vary with each laboratory and will therefore be discussed in the laboratory specifications attachments. The quality assurance program defined in this QAPjP takes precedence over equivalent sections in the laboratory quality assurance manuals, unless otherwise referenced. Sections of the laboratory quality assurance manuals may be referenced in the laboratory specifications attachment where they directly apply and when more information is available in the manuals.

The management of the laboratories identified for this program must assume the following general quality assurance responsibilities:

- Approve the quality assurance manual, project specific requirements, and standard operating procedures;

- Approve laboratory reports;
- Implement the quality assurance program (QAP) for the laboratory;
- Oversee the training program;
- Evaluate analytical techniques, instrumentation, and quality control procedures;
- Assure that project QAPPs are implemented in the laboratory;
- Develop and approve corrective actions to out of control situations (as defined by the lab project QA plan);

Supervisors for a given analytical group will:

- Supervise analysts;
- Schedule analyses;
- Review analytical data;
- Schedule preventative and routine maintenance; and
- Report out of control and nonconforming situations to management (as defined by the lab project QA plan).

The laboratory quality assurance group will:

- Monitor the implementation of the QAPP;
- Prepare quality control samples to be inserted into the sample stream;
- Notify management of out of control situations (as defined by the lab project QA plan);
- Perform quality assurance audits;
- Perform quality assurance training program; and
- Perform statistical analyses on the quality control results.

The laboratory analysts/technicians will:

- Perform their assigned tasks in accordance with the established and requested protocols and procedures;

- Perform preventative and routine maintenance;
- Report out-of-control situations (as defined by the lab project QA plan); and
- Perform data processing.

2.3. QUALITY ASSURANCE RESPONSIBILITIES

Quality assurance for the environmental investigation is the responsibility of all ER Program personnel. Responsibilities include detailed monitoring and review of all procedures used to perform every aspect of the remedial investigation. All personnel involved with the ER Program activities will strictly adhere to the implementation of the QAPP, Mound Plant ER Program SOPs, analytical laboratory procedures, data acceptance criteria, and data reporting schedules.

Primary responsibility for project quality rests with the ER Program EG&G subcontractor, ICF KE, project manager. Specific responsibilities include the management of quality assurance issues as they relate to the ER Program, ensuring that nonconformances are corrected, and ensuring the overall quality, timeliness, and cost-effectiveness of the activities performed by ER Program EG&G subcontractors. The project manager is also responsible for coordinating and maintaining consistency between this QAPjP and those of the various subcontractors at Mound Plant and across the ER Program as a whole.

The ICF KE Quality Assurance project officer (QAO) is independent of project line management to ensure no conflict of interest in implementing and monitoring the Quality Assurance/Control Program. The direct tie to ICF KE's Corporate QA Officer, Yvonne Fernandez, also ensures consistent interpretation and application of various QA guidance documents and programs (e.g., EPA, DOE, ASTM, USATHAMA, TQM, etc.). The ICF KE project QAO reports directly to the ICF KE Program Manager.

The responsibilities of the QAO for the project are:

- Development and implementation of the QAPP;
- Prepares and implements project QA procedures to provide controls consistent with the requisite quality of project deliverables. Identifies appropriate QA/QC source documents (such as EPA QAMS-005, DOE ER Program SOPs, ASME NQA-1) and applicable elements.
- Ensures, through document review, that the project execution documents, such as work plans, adequately reflect the guidance from the source documents.

- Verifies, through systems and performance audits at field and office locations, that published and approved QA/QC procedures are properly and completely followed and appropriate for the technical activities performed. All audits result in documentation of the findings, recommendations for improvement, and/or corrective measures for any deficiencies. Reports of surveillance, audits, and corrective actions are given to the Project Manager, his staff, and the Corporate Quality Assurance Officer.

- Ongoing review of individual quality assurance procedures;

- Ensuring that laboratory activities are consistent with the objectives and requirements of this QAPjP;

- Coordination of quality assurance training;

- Overall coordination of the quality assurance/quality control plan;

- Project quality assurance/quality control; and

- Periodic reports to management, including suggestions for performing and verifying corrective actions.

Although it is the QAO's responsibility to ensure compliance with this QAPjP, it is the responsibility of the installation and site managers to implement the quality assurance program and to maintain a strong line of communication with the QAO.

The QAO and the designated auditors will have the following qualifications at minimum:

- Bachelors degree in an appropriate scientific discipline and five years of work experience in RI/FSs with a focus on quality assurance, and

- Two years of experience in performing field activities (for field auditors), or

- Two years of experience in an environmental analytical laboratory (for laboratory auditors).

The QAO is also responsible for validating and assessing analytical data. Either the QAO or his or her designee will perform data validation. The following minimum qualifications are required to perform data validation:

- Bachelors degree in chemistry,

- Two years of work experience in an environmental analytical laboratory, and

- Two years of experience in performing data validation activities.

If a data reviewer having all three qualifications cannot be obtained with all reasonable attempts, a data reviewer having at least one of the qualifications will be obtained and the work product will be reviewed by an individual with all the minimum qualifications.

Subcontractors generating data for the RI are responsible for ensuring that the precision, accuracy, completeness, and representativeness of their data are known and documented. To ensure that responsibilities are uniformly met, each subcontractor will be required to adhere to this QAPjP and to Mound Plant ER Program SOPs.

An ER Program EG&G subcontractor internal kickoff meeting will be held before field work begins to review the operable unit-specific project work and quality assurance plan(s) and procedures. The kickoff meeting will be attended by, at a minimum, the following ER Program EG&G subcontractor personnel: the project manager or deputy project manager, the installation manager, the site manager, the field manager, the project QAO, and all personnel assigned to the field effort. Attendance at this meeting will be documented to provide evidence of quality assurance indoctrination for the field activities to be conducted during the RI at Mound Plant. Such documents are to be maintained by the QAO and filed in Mound Plant project files.

3. QUALITY ASSURANCE OBJECTIVES FOR DATA MEASURES IN TERMS OF PRECISION, ACCURACY, COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

The overall quality assurance objectives for field sampling, field measurements, and laboratory analysis are to produce data of known and sufficient quality to support the site evaluation and the selection of remedial alternatives. Specifically, the Data Quality Objectives (DQOs) for OU-2 are:

- Obtain environmental data through the collection of a variety of sample matrices and concentration levels within OU-2 to adequately characterize the nature and extent of radioactive contamination;
- Obtain environmental data through the collection of a variety of sample matrices and concentration levels within OU-2 to adequately characterize the nature and extent of chemical contamination;
- Obtain RI quality data to support a risk assessment for OU-2 and the site-wide risk assessment for Mound Plant; and
- Obtain environmental data of sufficient quality to support the record of decision (ROD) addressing the need for removal actions, interim remedial actions, remedial actions, and no further action determinations in accordance with CERCLA/SARA and the Mound Plant FFA.

The reliability of data generated in support of the OU-2 RI/FS will be assessed through the evaluation of statistical data quality indicators consisting of accuracy, precision, representativeness, comparability, and completeness. These indicators are used to qualify the data upon which ICF KE will base its conclusions and recommendations.

3.1. ACCURACY

Accuracy is defined as a measurement of the bias in a system. Potential sources of bias include: sampling process; field contamination; preservation errors; sample management; sample matrix; sample preparation; and analysis technique. Sampling accuracy for this project will be assessed through the evaluation of field blanks consisting of equipment rinse blanks and trip blanks. Analytical accuracy will be assessed through the evaluation of quality control samples and matrix spikes. All data will be validated in accordance with acceptable validation protocols.

3.2. PRECISION

Precision is a measurement of the reproducibility of data under a specified set of conditions. It is a quantitative measure of the variability of a group of measurements compared to the group mean measurement. Sampling precision will be assessed through the evaluation of duplicate samples. Analytical precision will be evaluated through the use of duplicate analyses. The analytical data acquired from the laboratory will be validated to determine the impact of out-of-control conditions on sample results (as defined by the lab project QAP plan).

3.3. REPRESENTATIVENESS

Representativeness is a qualitative parameter indicating the degree to which sample data represent the characteristics of the population, parameter variations at a sampling point, or an environmental condition. All samples collected will be as representative of the sample matrix as practicable. Representativeness will be achieved by defining environmental and procedural conditions, sample locations, sample quantity, and analytical parameters. Poor environmental conditions will be avoided to the extent feasible through scheduling adjustments so that factors such as weather do not impact adversely on sample collection. In addition, sampling activities will be conducted in accordance with the SOPs listed in this QAPjP as Appendix A. Deviations from these SOPs will be documented and justified in the quality assurance reporting activities.

Field screening measurements may also be used to assist in selecting samples for laboratory analysis. The SOP for ground-water sampling activities, for example, requires that pH, conductivity, and temperature measurements are to be taken during well purging to confirm that ground-water samples are collected after stabilization has occurred. The SOP for soil sampling calls for using a photoionization detector (PID) or its equivalent to screen for total volatile organic compounds as one means to select those soil samples that will be sent to the laboratory for analysis.

3.4. COMPARABILITY

Comparability is a qualitative parameter defining the level of confidence with which one data set can be compared to another. Field screening and sample collection data will be reported on standardized forms and in a standardized logbook to facilitate comparison of data. ICF KE has ensured the consistency of analytical QA/QC procedures and reporting by the establishment of detailed laboratory specifications and

field screening SOPs. All offsite analytical work will be performed in accordance with established EPA procedures, thus making the data comparable with previous and future analytical results.

3.5. COMPLETENESS

Completeness is defined as the percentage of measurements that are judged to be valid measurements. Completeness goals for the ER Program have been established for field measurements, sample collection, and laboratory analyses. The specific completeness goals can be found in the OU-9 QAPP. It will be assumed that data will be generated in real time, and that a high degree of completeness will be obtained.

Appropriate procedures and quality control checks will be used so that known and acceptable levels of accuracy and precision are maintained for each data set. This section defines the project goals for accuracy, precision, completeness, representativeness, and comparability for measurement data. These goals are primarily expressed in terms of acceptance criteria for the quality control checks performed and are listed in Tables III.1 through III.3. The field and laboratory quality control checks planned for this investigation are presented in the OU-9 Site-wide QAPP. Quality assurance goals for field measurements and field screening are also discussed.

Table III.1. Summary of Quality Control Procedures for Field Screening and Field Measurements

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
SOP 2.2	pH	Calibration with two buffer solutions (pH 4 and 7 or 7 and 10) (for accuracy)	Before and after a well purge	± 0.1 units of true value	Recalibrate; check pH meter; replace probe and meter if necessary.
		Calibration check with one buffer solution (for accuracy)	Once per well, after alkalinity analysis	± 0.1 units of true value	Recalibrate.
SOP 2.2	Electrical conductivity	Calibration (3 standards) (for accuracy)	Before and after sample shift	± 10% of true value	Recalibrate; check meter; replace probe or meter if necessary.
		Calibration check (1 standard) (for accuracy)	One per ten or fewer field samples collected	± 20% of true value	Recalibrate.
SOP 2.2	Temperature	Duplicate sample (for precision)	One per ten or fewer field samples collected	± 1°C	Evaluate data usability.
		Calibration (for accuracy)	NA	± 2°C (manufacturer's specification)	NA

NA - Not Applicable

Table III.1. (2 of 4)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
SOP 2.2	Dissolved O_2	Duplicate sample (for precision)	One per ten or fewer field samples collected.	$\leq$ 20% RPD	Evaluate data for useability.
		Calibration (for accuracy)	One per day	$\pm$ 10% of expected value	Recalibrate; check probe and meter; replace if necessary.
SOP 6.1	Combustible gas level	Calibration (1 standard) (for accuracy)	Once per day	$\pm$ 10% of true value	Recalibrate.
		Duplicate standard (for precision)	Once per day	$\pm$ 20% of initial calibration	Remeasure.
SOP 6.2	Organic vapor level (PID)	Initial calibration (for accuracy)	Once per day	$\pm$ 10% of true value	Recalibrate.
		Duplicate standard (for precision)	Once per day	$\pm$ 20% of initial calibration	Remeasure.
SOP 3.1	Water level	Duplicate measurement (for precision)	Once per well sampled	$\pm$ 0.02 feet of first reading	Remeasure.
SOP 3.3	Water level (transducer)	Depth response (for accuracy)	Once per test	$\leq$ 2-5% difference, measured vs. recorded	Return transducer to the manufacturer for calibration.

NA - Not Applicable

Table III.1. (3 of 4)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
SOP 6.7	Low-energy gamma radiation	Source check (for accuracy)	Once per day	± 3xSD	Check instrument settings (voltage, gain, etc.); remeasure source.
		Background check (for accuracy)	Once per day	± 3xSD	Clean detector and nearby surfaces; ventilate room; recheck.
		Voltage plateau (for accuracy)	Once per week	Voltage should be 1100 to 1300V	Check voltage setting and re-plateau beginning at 900V. If still outside range, replace probe and check again. Do not exceed 1400V.
		Replicate measurement (for precision)	Once every 10 measurements	± 4xSD	Identify and correct problem; remeasure.
SOP 6.4	Alpha surface contamination	Source check (for accuracy)	Once per day or after instrument adjustments or repairs	± 10% of expected value	Check instrument settings (gain, voltage, etc.) recheck; replace if still out.
		Background count (10 minutes) (for accuracy)	Once per day	≤2 cpm	Clean detector and nearby surfaces; check for light leaks; replace probe if necessary.
		Replicate measurement (for precision)	once every 10 measurements	± 4xSD	Identify and correct problem, remeasure.
SOP 6.3	Organic Vapor Level (F10)	Calibration (for accuracy)	Once per day	± 10% of true value	Recalibrate
		Duplicate Standard (for precision)	Once per day	± 20% of initial calibration	Identify and correct problem; remeasure

NA - Not Applicable

Table III.1. (Page 4 of 4)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
SOP 2.2	Oxidation-Reduction Potential	Calibration (for accuracy)	Once per day	± 10% of true value	Recalibrate; check meter; replace electrode and meter if necessary.
		Duplicate sample (for precision)	One per ten or fewer field samples collected	≤ 20% RPD	Evaluate data for useability.
SOP 6.15	Gamma-Ray Fields	Source check (for accuracy)	Once per day	± 10% of known value	Check instrument settings, recheck; replace if still outside criteria.
		Background check (for accuracy)	Once per day	± 10% of previous value	Check instrument settings, recheck; replace if still outside criteria.

NA - Not Applicable

Source: DOE, 1993

Table III.2. Summary of Quality Control Procedures For Field Activities and Laboratory Measurements: Surface Water/Groundwater and Soil/Sediment Samples

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
NAS 1962[a]	Isotopic uranium				
NAS 1965[a]	Isotopic plutonium	Field quality control			
NAS 1960[b]	Isotopic thorium				
ASTM D2460-70[c]	Radium-226	Duplicate	1 every 10 or fewer field samples (water)	$\pm$ 4 x SD[e,f,t]	Evaluate data for useability.
EML Am-01[a]	Americium-241		1 every 10 or fewer field samples (soil)	NA	Evaluate variability.
		Equipment (rinsate) blank[d]	1 every 10 or fewer field samples (water)	$\leq$ 10 x level in associated samples[t]	Evaluate potential sources; Evaluate associated data for useability.
		Laboratory quality control			
		Background (1000 minutes)	Once per week	For background subtraction; minimum detectable activity	Identify and correct problem; recount
		Pulse check	Once per day	Peak counts at 5 meV $\pm$ 3 x SD	Identify and correct problem; recheck.
		Method blank	1 per 20 samples of a similar matrix	$\leq$ 2 x MDA	Identify and correct problem. Reanalyze blank.

NA - Not Applicable

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Table III.2. (page 2 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
NAS, 1962[a]	Isotopic uranium				
NAS, 1965[a]	Isotopic plutonium				
NAS, 1960[b]	Isotopic thorium				
ASTM D2460-70[c]	Radium-226	Method spike	1 per 20 samples of a given matrix or 1 whenever a batch of samples is prepared in a day, whichever is more frequent	± 3 x SD[e] normalized deviations	Identify and correct problem; evaluate associated sample results for useability.
EML Am-01[d] (continued)	Americium-241				
		Matrix spike	1 per 20 samples of a similar matrix	± 3 x SD[e] normalized deviations	Evaluate data for useability.
		Replicate sample	1 per 20 samples of a similar matrix	+ 4 x SD[e,f] normalized range	Evaluate data for useability.
E906.0[g]	Tritium	Field quality control			
		Duplicate	1 every 10 or fewer field samples (water)	+ 4 x SD[e,f,t]	Evaluate data for useability.
			1 every 10 or fewer field samples (soil)	Not applicable	Evaluate variability.
		Equipment (rinsate) blank[d]	1 every 10 or fewer field samples (water)	≤ 10 x level in associated samples[t]	Evaluate potential sources; Evaluate associated data for useability.
		Laboratory quality control			
		Background	Once per day	+ 3 x SD, limit-gross contamination; background subtracts	Identify and correct problem.
		Source check	Once per day	± 3 x SD	Identify and correct problem.

NA - Not Applicable

Table III.2. (page 3 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
E906.0[e] (continued)	Tritium	Method blank	1 per 20 samples of a given matrix or 1 whenever a batch of samples is prepared in a day, whichever is more frequent	≤ 2 x MDA	Identify and correct problem; reanalyze blank.
		Method spike	1 every 20 or fewer field samples of a similar matrix	± 3 x SD[e] normalized deviations	Identify and correct problem; associated sample results for useability.
		Matrix spike	1 every 20 or fewer field samples of a similar matrix	± 3 x SD[e] normalized deviation	Identify and correct problem; evaluate associated sample results for useability.
		Replicate sample	1 every 20 or fewer field samples of a similar matrix	+ 4 x SD[e,f] normalized range	Identify and correct problem; associated sample results for useability.
Nuclear Data, Inc., 1986[h]	Gamma radiation	Field quality control			
		Duplicate	1 every 10 or fewer field samples (water) 1 every 10 or fewer field samples (soil)	+ 4 x SD[e,f,t] Not applicable	Evaluate data for useability. Evaluate variability.
		Equipment (rinsate) blank[d]	1 every 10 or fewer field samples (water)	≤ 10 x level in associated samples[t]	Evaluate potential sources; Evaluate associated data for useability.
		Laboratory quality control			
		Background (10 minutes)	Once per day	No identifiable peaks; ± 20% error	Identify and correct problem; recount.

NA - Not Applicable

Table III.2. (page 4 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
Nuclear Data, Inc., 1986[h] (continued)	Gamma radiation	Background (1000 minutes)	Once per month	NA; Stored for background subtraction	Not Applicable
		Source check	Once per day	± 3 x SD	Identify and correct problem; recount.
		Mixed standard	Initial setup and as necessary	Full range energy, linearity and efficiency calibration ± 5% of known standard	Not Applicable
		Replicate sample[i]	1 every 20 or fewer samples of a similar matrix	+ 4 x SD[e,f] normalized range	Identify and correct problem; evaluate associated sample results for useability.
NAS 1960[1] Martin 1979[2] PHS 1985[3]	Strontium-90	Field Quality Control			
		Duplicate	1 every 10 or fewer field samples (water)	+ 4 x SD [e,f,t]	Evaluate data for useability.
			1 every 10 or fewer field samples (soil)	Not applicable	Evaluate variability.
		Equipment (rinsate) blank[d]	1 every 10 or fewer field samples (water)	≤ 10 x level in associated samples[t]	Evaluate potential sources; Evaluate associated data for useability.
		Laboratory Quality Control			
		Method blank	Once per day	≤ 2 x MDA	Identify and correct problem; reanalyze.
		Background check	Once per week	+ 3 x SD, limit-gross contamination	Identify and correct problem; recheck.
		Instrument reliability	Once per day	+ 3 x SD	Identify and correct problem; recheck.

NA - Not Applicable

Table III.2. (page 5 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
NAS 1960[1] Martin 1979[2] PHS 1965[3] (continued)	Strontium-90	Method spike	1 per 20 samples of a similar matrix	± 3 x SD Normalized deviations	Identify and correct problem; evaluate associated sample results for useability.
		Matrix spike	1 per 20 samples of a similar matrix	± 3 x SD Normalized deviations	Evaluate data for useability.
		Replicate sample	1 per 20 samples of a similar matrix	+ 4 x SD Normalized range	Evaluate data for useability.
		Plateau	Once per year	NA	NA
		Efficiency determination	Once per year	NA	NA
CLP SOW[j]	Organochlorine pesticides/PCBs (TCL)[k]	Field quality control			
		Duplicate	1 every 10 or fewer field samples (water) 1 every 10 or fewer field samples (soil)	≤ 35% RPD[l] N/A	Evaluate data for useability. Evaluate variability.
		Equipment (rinsate) blank[d]	1 every 10 or fewer field samples (water)	≤ 10 x level in associated samples[t]	Evaluate potential sources; evaluate associated data for useability.
		Laboratory quality control			
		Method blank	1 per 20 samples of a given matrix or 1 whenever a batch of samples is prepared in a day, whichever is more frequent; see CLP SOW	≤ CRQL; surrogate retention times per CLP SOW	Investigate source; Reextract and reanalyze associated samples. See CLP SOW.
		Sulfur cleanup blank	When portion of samples require sulfur clean up	≤ CRQL; surrogate retention times per CLP SOW	Investigate source; reextract and reanalyze associated samples. See CLP SOW.

NA - Not Applicable

Table III.2. (page 6 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
CLP SOW [1] (continued)	Organochlorine pesticides/PCBs (TCL)[a]	Instrument blank	CLP SOW	CLP SOW	See CLP SOW.
		Matrix spike	1 per 20 samples of a given matrix in a case or fewer; see CLP SOW	See Table III.3; surrogate retention times per CLP SOW	Evaluate data for useability.
		Matrix spike duplicate	1 per 20 samples of a given matrix in a case or fewer; see CLP SOW	See Table III.3; surrogate retention times per CLP SOW	Evaluate data for useability.
		Laboratory Control Sample	1 per 20 samples of given matrix or 1 whenever a batch of samples is prepared in a day, whichever is more frequent	See Table III.3	Evaluate associated data for useability.
		Surrogate spike	All lab and field samples	See Table III.3	Evaluate data for useability.
		Calibration (initial and continuing)	CLP SOW	CLP SOW	Recalibrate, see CLP SOW.
		GC/MS confirmation	Any sample with a detection from the TCL list for pesticides/PCBs	CLP SOW	See CLP SOW.
		Retention times and Retention time window	CLP SOW	CLP SOW	See CLP SOW.

NA - Not Applicable

Table III.2. (page 7 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
CLP SOW [j] Modification D	Volatile organic compounds	Field quality control			
		Trip blank	1 per shipping container to Lab	≤ 10 x level in associated samples[t]	Evaluate potential sources; Evaluate associated data for useability.
		Duplicate	1 every 10 or fewer field samples (water) 1 every 10 or fewer field samples (soil)	≤ 35% RPD[t] N/A	Evaluate data for useability. Evaluate variability.
		Equipment (rinsate) blank[d]	1 every 10 or fewer field samples (water)	≤ 10 x level in associated samples[t]	Evaluate potential sources; Evaluate associated data for useability.
		Ambient blank	1 every 20 or fewer field samples	≤ 10 x level in associated samples[t]	Evaluate potential sources; Evaluate associated data for useability.
		Laboratory quality control			
		Method blank	Once per 12-hour period	≤ 5 x CRQL of [1] ≤ CRQL others	Investigate source; reanalyze associated samples.
		Matrix spike	1 per 20 samples of a given matrix in a case or fewer; see CLP SOW	See Table III.3	Evaluate data for useability.
		Matrix spike duplicate	1 per 20 samples of a given matrix in a case or fewer; see CLP SOW	See Table III.3	Evaluate data for useability.
		Laboratory Control Sample	Once per 12-hour period	See Table III.3	Evaluate associated data for useability.

NA - Not Applicable

Table III.2. (page 8 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
CLP SOW [1] Modification D (continued)	Volatile organic compounds	System monitoring compounds	All lab and field samples	See Table III.3	See CLP SOW.
		Instrument performance check	Daily or each 12-hour period, whichever is more frequent	CLP SOW	Retune; Reanalyze associated samples.
		Calibration	CLP SOW	CLP SOW	Recalibrate before sample analysis.
		Retention time window	CLP SOW	± 0.06 relative retention time units (sample and standard)	See CLP SOW.
		Qualitative verification	When a detection occurs in a sample	CLP SOW	See CLP SOW.
		Calibration check	With every calibration	CLP SOW	Recalibrate.
		Internal standard	Every standard and sample	CLP SOW	See CLP SOW.
		Continuing calibration check	Once each 12-hour period	CLP SOW	Identify source and correct. Recalibrate if source not found and corrected.
		Surrogate spike	All lab and field samples	See Table III.3	Evaluate associated data for useability

NA - Not Applicable

Table III.2. (page 9 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
SW8010[a] SW8020[a]	Halogenated and aromatic volatile organic compounds	Field quality control			
		Trip blank	1 per shipping container to lab	≤ 10 x level in associated samples[t]	Evaluate potential sources; Evaluate associated data for useability.
SW8030[a]	Acrylonitrile, Acetonitrile				
		Duplicate	1 every 10 or fewer field samples (water)	≤ 35% RPD[t]	Evaluate data for useability.
		Equipment (rinsate) blank[d]	1 every 10 or fewer field samples (water)	≤ 10 x level in associated samples[t]	Evaluate potential sources; Evaluate associated data for useability.
		Sample bank blank[e]	1 every 20 or fewer field samples	≤ 10 x level in associated samples[t]	Evaluate potential sources; Evaluate associated data for useability.
		Ambient blank	1 every 20 or fewer field samples	≤ 10 x level in associated samples[t]	Evaluate potential sources; Evaluate associated data for useability.
		Laboratory quality control			
		Method blank	1 per 20 samples of a given matrix or 1 whenever a batch of samples is prepared in a day, whichever is more frequent	<PQL	Identify and correct source. Reanalyze blank and associated samples.
		Calibration	5 points; when calibration check criteria exceeded	≤ 20% RSD for calibration factors	Recalibrate.
		Calibration check	Once per 10 samples analyzed	± 15% from initial response factor	Recalibrate.

NA - Not Applicable

Table III.2. (page 10 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
SW8010[a] SW8020[a] SW8030[a] (continued)	Halogenated and aromatic volatile organic compounds Acrylonitrile, Acetonitrile	Matrix spike	1 per 20 samples of a given matrix	See Table III.3	Evaluate data for useability.
		Matrix spike duplicate	1 per 20 samples of a given matrix	See Table III.3	Evaluate data for useability.
		Surrogate spikes	All field and lab samples	See Table III.3	Check calculations, surrogate and standard solutions, and instrument. If problem not identified then reanalyze sample.
		Retention time window	When new column installed and as needed	± 3 x SD of three retention times for each analyte as per SW846	Identify source, correct problem.
		Laboratory control sample (LCS)	1 per 20 samples of a given matrix or 1 whenever a batch of samples is prepared in a day, whichever is more frequent	See Table III.3	Identify and correct problem prior to further sample analyses, reanalyze.
CLP SOW [3] Modification D	Semivolatile organic compounds	Field quality control			
		Duplicate	1 every 10 or fewer field samples (water)	≤ 55% RPD[1]	Evaluate data for useability.
			1 every 10 or fewer field samples (soil)	Not Applicable	Evaluate variability.
		Equipment (rinsate) blank[d]	1 every 10 or fewer field samples (water)	≤ 10 x level in associated samples[1]	Evaluate potential sources; Evaluate associated data for useability.

NA - Not Applicable

Table III.2. (page 11 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
CLP SOW [1] Modification D (continued)	Semivolatile organic compounds	Laboratory quality control			
		Method blank	1 per 20 samples of a given matrix or whenever a batch of samples is prepared in a day, whichever is more frequent; see CLP SOW	≤ 5 x CRQL phthalate esters ≤ CRQL others	Investigate source; reextract and reanalyze associated samples.
		Matrix spike	1 per 20 sample of a given matrix or fewer; see CLP SOW	See Table III.3	Evaluate data for useability.
		Matrix spike duplicate	1 per 20 samples of a given matrix or fewer; see CLP SOW	See Table III.3	Evaluate data for useability.
		Laboratory Control Sample (LCS)	1 per 20 samples of a given matrix or 1 whenever a batch of samples is prepared in day, whichever is more frequent	See Table III.3	Evaluate data for useability
		Surrogate spike	All lab and field samples	See Table III.3	See CLP SOW.
		Instrument performance check	Daily or each 12-hour period, whichever is more frequent	CLP SOW	Retune; reanalyze associated samples.
		Calibration	CLP SOW	CLP SOW	Recalibrate before sample analysis.
		Calibration check	With every calibration	CLP SOW	Recalibrate.
		Internal standard	Every standard and sample	CLP SOW	See CLP SOW.

NA - Not Applicable

Table III.2. (page 12 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
CLP SOW [j] Modification D (continued)	Semivolatile organic compounds	Continuing calibration check	Once each 12-hour period	CLP SOW	Identify source and correct. Recalibrate if source not found and corrected.
		Retention time window	CLP SOW	± 0.06 relative retention time units (sample and standard)	See CLP SOW.
		Qualification verification	When a detection occurs in a sample	CLP SOW	See CLP SOW.
CLP SOW[n] Modification A	Metals and cyanide or calcium, potassium, sodium, magnesium, iron, and manganese	Field quality control			
		Duplicate	1 every 10 or fewer field samples (water)	≤ 25% RPD[t]	Evaluate data for useability.
			1 every 10 or fewer field samples (soil)	Not Applicable	Evaluate variability.
		Equipment (rinsate) blank[n]	1 every 10 or fewer field samples (water)	≤ 10 x level in associated samples[t]	Evaluate potential sources; Evaluate associated data for useability.
		Laboratory quality control			
		Initial and continuing calibration blanks (ICB, CCB)	After every ICV and CCV or 10% or every 2 hours, whichever is more frequent	≤ CRDL	Correct problem; recalibrate; reanalyze preceding 10 samples or all since last good blank.

NA - Not Applicable

Table III.2. (page 13 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
CLP SOW[a] Modification A (continued)	Metals and cyanide or calcium, potassium, sodium, magnesium, iron, and manganese	Preparation blank (PB)	1 per 20 samples of a given matrix or 1 whenever a batch of samples is prepared in a day, whichever is more frequent; see CLP SOW	≤ CRDL	If sample results < 10 x CRDL, but > CRDL, redigest and reanalyze.
		Laboratory control sample (LCS)	1 per group of samples in a delivery group or batch, whichever is more frequent	80-120% Recovery	Correct problem; redigest and reanalyze associated samples.
		Initial calibration verification std. (ICV)	CLP SOW	CLP SOW	See CLP SOW.
		Continuing calibration verification std. (CCV)	CLP SOW	CLP SOW	See CLP SOW.
		Linear range check standard (CRI, CRA) (ICP and AA only)	CLP SOW	Not established	None.
		Interference check sample (ICS) (ICP only)	Sample twice per 8-hour shift, or at beginning and end of analysis run, whichever is more frequent	± 20% of true value	Correct problem; recalibrate reanalyze samples since last good ICS.

NA - Not Applicable

Table III.2. (page 14 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
CLP SOW[a] Modification A (continued)	Metals and cyanide or calcium, potassium, sodium, magnesium, iron, and manganese	ICP Serial dilution (L) (ICP only)	1 per group of samples of a given matrix, concentration, or each delivery group, whichever is more frequent	If result > 50 x IDL: ± 10% difference	Evaluate data for useability.
		Spike sample (S)	1 per group of samples of a given matrix, concentration, or sample delivery group, whichever is more frequent.	75-125% Recovery	Evaluate data for useability.
		Sample dup. (D) (sample replicate)	1 per group of samples of a given matrix, concentration, or sample delivery group, whichever is more frequent.	If result ≥ 5 x CRDL: ± 20% RPD If result ≤ 5 x CRDL: ± CRDL	Evaluate data for useability.
		Method std. addition GFAA[a] only (MSA)	CLP SOW	CLP SOW	See CLP SOW.
		Linear range analysis (LRA) (for ICP only)	CLP SOW	CLP SOW	Reanalyze.

NA - Not Applicable

Table III.2. (page 15 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
CLP SOW[n] Modification A (continued)	Metals and cyanide or calcium, potassium, sodium, magnesium, iron, and manganese	Interelement corrections (for ICP only)	Once per year or or when instrument adjusted	CLP SOW	CLP SOW.
E325.1[q]/SW9250[n]	Chloride, (Cl)	Field quality control			
E325.2[q]/SW9251[n]					
E353.2[q]	Nitrate-Nitrite (NO_3-NO_2)				
E375.2[q]	Sulfate (SO_4)				
E351.3[q]	Total nitrogen, (N)	Duplicate	1 every 10 or fewer field samples (water)	≤ 25% RPD[t]	Evaluate data for useability.
E365.1[q]	Total phosphorus (P)				
E354.1[q]	Nitrite		1 every 10 or fewer field samples (soil)	Not Applicable	Evaluate variability.
E340.2[q]	Fluoride				
E350.1 and 350.3[q]	Ammonia				
		Equipment (rinsate) blank[r]	1 every 10 or fewer field samples (water)	≤ 10 x level in associated samples[t]	Evaluate potential sources; Evaluate associated data for useability.
		Laboratory quality control			
		Method blank	1 per 20 samples of a given matrix or 1 whenever a batch of samples is prepared in a day, whichever is more frequent	<PQL	Correct problem; reanalyze.
		Calibration (3 points) and Reagent Blank	When instrument conditions change or when calibration check criteria exceeded	Correlation coefficient ≥ 0.995 or plot curve for nonlinear analytes	Recalibrate

NA - Not Applicable

Table III.2. (page 16 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
E325.1[a]/SW9250[b] E325.2[a]/SW9251[b] E353.2[a] E375.2[a] E351.3[a] E365.1[a] E354.1[a] E340.2[a] E350.1 and 350.3[a] (continued)	Chloride, (Cl) Nitrate-Nitrite (NO_3-NO_2) Sulfate (SO_4) Total nitrogen, (N) Total phosphorus (P) Nitrite Fluoride Ammonia	Calibration check	Prior to sample analysis and one per 20 samples analyzed	± 15% of initial calibration response	Identify and correct problem; recalibrate.
		Matrix spike	1 per 20 samples of a given matrix	75-125% Recovery	Evaluate data for useability.
		Matrix spike duplicate	1 per 20 samples of a given matrix	≤ 20% RPD	Evaluate data for useability.
		Laboratory Control Sample (chloride, nitrate)	1 for each calibration	Vendor specification	Evaluate data for useability.
E160.1[a] E160.2[a]	Total dissolved solids (TDS) Total suspended solids (TSS)	Field quality control			
		Duplicate	1 every 10 or fewer field samples (water)	≤ 25% RPD[f]	Evaluate data for useability.
		Equipment (rinsate) blank[d]	1 every 10 or fewer field samples (water)	≤ 10 x level in associated samples[f]	Evaluate associated data for useability.
		Laboratory quality control			
		Method blank	1 per 20 samples of a given matrix or 1 whenever a batch of samples is prepared in a day, whichever is more frequent	<PQL	Identify and correct problem. Reanalyze blank.

NA - Not Applicable

Table III.2. (page 17 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
E160.1[a] E160.2[a] (continued)	Total dissolved solids (TDS) Total suspended solids (TSS)	Replicate sample	1 per 20 samples analyzed	≤ 20% RPD	Reanalyze a replicate sample; report both results.
		Laboratory control sample (LCS)	1 per 20 samples analyzed	Vendor specification	Identify and correct problem.
E415.1[a]/E415.2[a]	Total organic carbon (TOC)	Field quality control			
		Duplicate	1 every 10 or fewer field samples (water)	≤ 35% RPD[t]	Evaluate data for useability.
			1 every 10 or fewer field samples (soil)	Not Applicable	Evaluate data for useability.
		Equipment (rinsate) blank[d]	1 every 10 or fewer field samples (water)	≤ 10 x level in associated samples[t]	Evaluate associated data for useability.
		Laboratory quality control			
		Method blank	1 per 20 samples of a given matrix or 1 whenever a batch of samples is prepared in a day, whichever is more frequent	<PQL	Correct problem; reanalyze blank.
		Calibration	When instrument conditions change or when calibration check criteria exceeded	Second reading must be within 25% of initial	Recalibrate.
		Calibration check	1 per 20 samples analyzed	± 15% of initial calibration response	Recalibrate.
		Matrix spike (MS)	1 per 20 samples of a given matrix	75-125% Recovery	Evaluate data for useability.

NA - Not Applicable

Table III.2. (page 18 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
E415.1[g]/E415.2[g] (continued)	Total organic carbon (TOC)	Matrix spike duplicate (MSD)	1 per 20 samples of a given matrix	≤ 20% RPD	Evaluate data for useability.
		Replicate sample	4 analyses for every sample	≤ 20% RPD	Reanalyze sample.
USATHAMA[s]	Explosives	Field quality control			
		Duplicate	1 every 10 or fewer field samples (water)	≤ 35% RPD[t]	Evaluate data for useability.
			1 every 10 or fewer field samples (soil)	Not Applicable	Evaluate variability.
		Equipment (rinsate) blank[d]	1 every 10 or fewer field samples (water)	≤ 10 x level in associated samples[t]	Evaluate potential sources; Evaluate associated data for useability.
		Laboratory quality control			
		Method blank	1 per 20 samples of a given matrix or 1 whenever a batch of samples is prepared in a day, whichever is more frequent	<POL	Reanalyze blank.
		Calibration	(5 pt.) when calibration check limit criteria exceeded	≤ 15% RSD of average RF	Recalibrate.
		Surrogate Spike	All lab and field samples	See Table III.3	Reanalyze

NA - Not Applicable

Table III.2. (page 19 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
USATHAMA[a] (continued)	Explosives	Matrix spike (MS)	1 per 20 samples of a given matrix	See Table III.3	Evaluate data for useability.
		Matrix spike duplicate (MSD)	1 per 20 samples of a given matrix	See Table III.3	Evaluate data for useability.
		Laboratory Control Sample (LCS)	1 per 20 samples of a given matrix or 1 whenever a batch of samples is prepared in a day, whichever is more frequent	See Table III.3	Evaluate data for useability.
		Retention time window	With every calibration check	Column and Compound Specific	Identify source, correct problem; reanalyze samples since last good calibration check.
		Calibration check	Prior to sample analysis and 1 per 10 samples analyzed	± 25% of peak height of initial 10 x TRL calibration standard	Recalibrate.
		Secondary column confirmation	Every positive detection ≥ POL	Not applicable	Evaluate positive identification of analytes.
E310.1	Alkalinity	Field quality control			
		Duplicate	1 every 10 field samples	≤ 35% RPD[1]	Evaluate data for useability.
		Laboratory quality control			
		Method blank	1 per 20 samples of a given matrix or 1 whenever a batch of samples is prepared in a day, whichever is more frequent	≤ POL	Identify and correct source; Reanalyze blank prior to sample analysis.
		Calibration	pH 4 and 7 standards; once every 10 samples	± 0.1 units of true value	Recalibrate; check pH meter, replace probe and meter if necessary.
		Calibration check	After initial calibration with pH 4 standard	± 0.1 units of true value	Recalibrate.

NA - Not Applicable

Table III.2. (page 20 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
SW9081[a]	Cation exchange capacity (CEC)	Field quality control			
ASTM D422-63 [r]	Particle size analysis	Duplicate	1 every 10 field samples (soil)	Not applicable	Evaluate variability.
ASTM D854-83 [r]	Specific gravity	Laboratory quality control			
ASTM D-2974[r]	Organic content and moisture content	Method blank (CEC) analyzed	1 per 20 samples	as per SW846	Identify source; correct problem, reanalyze blank.
ASTM D-2434[r]	Hydraulic conductivity				
ASTM D-4253,[r] D-4254	Relative density				
SW9045[a]	Soil pH				
E310.1[a]	Alkalinity				
ASTM D-4253[r]	Maximum density	Sample replicate	1 per 20 samples analyzed	≤ 20 RPD	Correct problem; reanalyze a replicate sample.
502.2[u]	Volatile organic compounds[v]	Field Quality Control			
		Duplicate	1 every 10 or fewer field samples (water)	≤ 25% RPD[t]	Evaluate data for useability.
		Trip blank	1 per shipping container to laboratory	≤ 10 x level in associated samples[t]	Evaluate potential sources; evaluate associated data for useability.
		Equipment (rinsate) blank	1 every 10 or fewer field samples collected.	≤ 10 x level in associated samples[t]	Evaluate potential sources; evaluate associated data for useability.
		Sample bank blank	1 every 10 or fewer field samples collected.	≤ 10 x level in associated samples[t]	Evaluate potential sources; evaluate associated data for useability.
		Ambient blank	1 every 10 or fewer field samples collected.	≤ 10 x level in associated samples[t]	Evaluate potential sources; evaluate associated data for useability.

NA - Not Applicable

Table III.2. (page 21 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
502.2[a] (continued)	Volatile organic compounds[e]	Laboratory Quality Control			
		Laboratory reagent blank (method blank)	1 per 10 samples of a given matrix or 1 whenever a batch of samples is prepared in a day, whichever is more frequent	≤ PQL	Identify and correct problem; reanalyze blank and associated samples.
		Laboratory fortified blank (blank spike)	1 every 20 samples analyzed of a given matrix	80-120%; 20% RSD	Identify and correct problem prior to further sample analysis.
		Calibration	5 points; when calibration check criteria exceeded	≤ 10 % RSD for calibration factors	Recalibrate.
		Calibration check	Once every day or every 10 samples, whichever is more frequent.	± 20% RPD from initial response factor	Recalibrate.
		Matrix spike	1 every 10 samples of a given matrix	See Table III.3	Evaluate data for useability.
		Matrix spike duplicate	1 every 10 samples of a given matrix	See Table III.3	Evaluate data for useability.
		Surrogate spike	Every field and laboratory sample	See Table III.3; method 502.2	Evaluate data for useability.
		Check standard	Once every 10 or fewer samples analyzed	80-140% recovery	Reanalyze failed analyte.

NA - Not Applicable

Table III.2. (page 22 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
502.2[a] (continued)	Volatile Organic Compounds[e]	Low level check	Once per week	60-140% recovery	Identify and correct problem; reanalyze check for the failed analytes.
		Laboratory control sample	Once every 20 or fewer sample analyzed.	80-120%; SD ≤ 30% of result.	Reanalyze LCS for failed analytes.
		Retention time windows	When new column installed and as needed	± 0.1 minutes	Identify source, correct problem.
		Secondary column confirmation	Every positive detection ≥ PQL	NA	Evaluate positive identification of analyte.
CLP SOW [a,c] Modification B	Metals, CN[e]	Field quality control			
		Duplicate	1 every 10 or fewer field samples (water)	≤ 25% RPD[f]	Evaluate data for useability.
		Equipment (rinsate) blank	1 every 10 or fewer field samples (water)	≤ 10 x level in associated samples[f]	Evaluate potential sources, evaluate associated data for useability.
		Laboratory quality control			
		Initial and continuing calibration blanks (ICB, CCB)			
		• ICP, mercury, cyanide	After every ICV and CCV or 10% or every 2 hours, whichever is more frequent	≥ IDL	Correct problem; recalibrate; reanalyze preceding 10 samples or all since last good blank.

NA - Not Applicable

Table III.2. (page 23 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
CLP SOW "A" Modification B (continued)	Metals, CN"	· graphite AA	One every 5 samples	≥ IDL	Correct problem; recalibrate; reanalyze preceding 5 samples or all since last good blank.
		Preparation blank (PB)	One every sample delivery group or batch of 10 samples, whichever is more frequent.	≤ CRDL	If sample results < 10 x CRDL, but > CRDL, redigest and reanalyze.
		Laboratory control sample (LCS)	One every sample delivery group or batch of 10 samples, whichever is more frequent.	85-115% recovery	Correct problem; redigest and reanalyze associated samples.
		Initial calibration verification std. (ICV) and continuing calibration verification std. (CCV)			
		· ICP, mercury, cyanide	Per CLP SOW	Per CLP SOW	See CLP SOW.
		· Graphite AA	Initially ICV, and CCV every 5 samples	90-110% recovery	See CLP SOW.
		Linear range check standard (CRI, CRA) (for ICP and AA only)	Per CLP SOW	Not established	None.

NA · Not Applicable

Table III.2. (page 24 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
CLP SOW [illegible] Modification B (continued)	Metals, CN[illegible]	Interference check sample (ICS) (for ICP only)	Per CLP SOW	Per CLP SOW	See CLP SOW.
		ICP Serial dilution (L) (for ICP only)	Per CLP SOW	Per CLP SOW	See CLP SOW.
		Spike sample (S)	One every group of samples of similar matrix, concentration, sample delivery group or batch of 10 samples, whichever is more frequent	85-115% recovery 80-120% recovery Hg, Cn	Evaluate data for useability.
		Sample duplicate (D) (sample replicate)	One every group of samples of similar matrix, concentration, sample delivery group, or batch of 10 samples, whichever is more frequent	10% RPD or < IDL difference 15% RPD Hg, Cn	Evaluate data for useability.
		Method std. addition (MSA), GFAA only	Per CLP SOW	Per CLP SOW	See CLP SOW.
		Linear range analysis (LRA) (for ICP only)	Per CLP SOW	Per CLP SOW	See CLP SOW.
		Interelement corrections (for ICP only)	Once per year or when instrument is adjusted	CLP SOW	See CLP SOW

NA - Not Applicable

Table III.2. (page 25 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
CLP SOW [a] Modification C	Lanthanides	Field quality control			
		Duplicate	1 every 10 or fewer field samples (water) 1 every 10 or fewer field samples (soil)	≤ 25% RPD[c] Not Applicable	Evaluate data for useability. Evaluate variability.
		Equipment (rinsate) blank[d]	1 every 10 or fewer field samples (water)	≤ 10 x level in associated samples[c]	Evaluate potential sources; evaluate associated data for useability.
		Laboratory quality control			
		Initial and continuing calibration blanks (ICB, CCB)	After every ICV and CCV or 10% or every 2 hours, whichever is more frequent	≤ CRDL	Correct problem; recalibrate; reanalyze preceding 10 samples or all since last good blank.
		Preparation blank (PB)	1 per 10 samples of a given matrix or 1 whenever a batch of samples is prepared in a day, whichever is more frequent	≤ CRDL	If sample results < 10 x CRDL, but > CRDL, redigest and reanalyze.
		Laboratory control sample(LCS)	1 per group of samples in a delivery group or batch, whichever is more frequent	80-120% recovery	Correct problem; redigest and reanalyze associated samples.
		Initial calibration verification aid (ICV)	CLP SOW	CLP SOW	See CLP SOW.
		Continuing calibration verification aid (CCV)	CLP SOW	CLP SOW	See CLP SOW.
		Linear range check standard (CRI, CRA)	CLP SOW	Not established	None.
		Interference check sample (ICS)	Sample twice per 8-hour shift, or at beginning and end of analysis run, whichever is more frequent	± 20% of true value	Correct problem; recalibrate reanalyze samples since last good ICS.

NA - Not Applicable

Table III.2. (page 26 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
CLP SOW * Modification C	Lanthanides (continued)	ICP Serial dilution (L)	1 per group of samples of a given matrix, concentration, or each delivery group, whichever is more frequent	If results > 50 x IDL ± 10% difference	Evaluate data for useability.
		Spike sample (S)	1 per group of samples of a given matrix, concentration, or sample delivery group, whichever is more frequent	75-125% Recovery	Evaluate data for useability.
		Sample dup. (D) (sample replicate)	1 per group of samples of a given matrix, concentration, or sample delivery group, whichever is more frequent	If results ≥ 5 x CRDL; ± 20% RPD If results ≤ 5 x CRDL; ± CRDL	Evaluate data for useability.
		Linear range analysis (LRA) for ICP	CLP SOW	CLP SOW	Reanalyze.
		Interelement corrections for ICP	Once per year or when instrument adjusted	CLP SOW	CLP SOW.

NA - Not Applicable

Table III.2. (27 of 27)

Analytical Method	Parameter	Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
SW8290[b]	PCDDs[a] PCDFs[a] 2,3,7,8-TCDD 2,3,7,8-TCDF	**Field Quality Control**			
		Duplicate	1 every 10 or fewer field samples	Not Applicable	Evaluate variability.
		Equipment (rinsate) blank	1 every 20 or fewer field samples	≤ 10 x level in associated samples	Evaluate potential sources. Evaluate associated data for usability.
		Laboratory Quality Control			
		Method blank	1 per 20 samples or fewer of a given matrix	≤ quantitation limit for all isomers except OCDD/OCDF and HpCDD/HpCDF. OCDD/OCDF and HpCDD/HpCDF must be ≤ 3 x quantitation limit.	Investigate source; contact Weston for resolution.
		Matrix spike	1 per 20 samples or fewer of a given matrix	See Table III.3	Evaluate data for usability.
		Matrix spike duplicate	1 per 20 samples or fewer of a given matrix	See Table III.3	Evaluate data for usability.
		Tuning criteria	Beginning and end of each 12 hour period or shift, whichever is more frequent.	Per SW8290	Correct problem; reanalyze required stsandards; recalibrate if necessary.
		Calibration	Initial 5 point	Per SW8290	Recalibrate before sample analysis.
SW8290	PCDDs, PCDFs, 2,3,7,8-TCDD, 2,3,7,8-TCDF (continued)	Internal standard	Every sample	40%-135% recovery of internal standard	Perform carbon column cleanup; if still not within criteria, contact Weston for resolution.
		Column performance check solution	Beginning of each 12-hour period	Per SW8290	Identify source and correct
		Continuing calibration check	Each beginning and end of each 12-hour period	Per SW8290	Identify source and correct. Recalibrate if source not found and corrected.

NA - Not Applicable

2,3,7,8-TCDD - tetrachloridibenzo-p-dioxin
2,3,7,8-TCDF - tetracholorodibenzofuran
GC - gas chromatograpphy
MDL - method detection limit
MS - matrix spikes.

PCDD - Polychlorinated dibenzo-p-dioxin
PCDF - Polychlorinated dibenzofuran
RPD - relative percent difference

Table III.2. (page 27a of 27)

[a]A sample bank blank monitors for VOCs potentially present in the surrounding environment where samples are commonly handled before shipment. The blank is prepared with organic-free deionized water in sample vials, capped with no bubbles, and placed in the desired location during sample handling.
[b]"The Radiochemistry of Plutonium," G.H. Coleman, NAS-NS-3058, National Academy of Sciences, September 1965, and "The Radiochemistry of Uranium," NAS-NS-3050, National Academy of Sciences, March 1962.
[c]"The Radiochemistry of Thorium," E.K. Hyde, NAS-NS-3004, National Academy of Sciences, January 1960.
[d]"Standard Test Methods for Radium in Water," ASTM, latest version.
[e]To be prepared for sampling locations without dedicated sampling equipment.
[f]Procedures according to "Environmental Radioactivity Laboratory Intercomparison Studies Program," U.S. EPA, EPA-600/4-81-004.
[g]"Improved Evaluation of Environmental Radiochemical Inorganic Solid Matrix Replicate Precision: Normalized Range Analysis Revisited," J.W. Dillard and R.E. Gladd, 36th Annual Conference on Bioassay, Analytical, and Environmental Radiochemistry, Oakridge, TN., 1990.
[h]"Prescribed Procedures for Measurement of Radioactivity in Drinking Water," U.S. EPA, EPA-600/4-80-032, latest version.
[i]ND 9900 VAX/VMS Spectroscopy Application Package User's Manual (09-0196), Nuclear Data, Inc., Schauumberg, IL. August 1986.
[j]Counted twice on different detectors.
[k]USEPA Contract Laboratory Program Statement of Work for Organic Analysis, Document No. OLM01.6, August 1991.
[l]Target Compound List.
[m]For methylene chloride, acetone, toluene, or 2-butanone.
[n]"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, U.S.EPA, November 1986 or most recent version.
[o]USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis, Document No. ILM01.0, March 1990.
[p]Target Analyte List.
[q]Graphite furnace atomic absorption.
[r]"Methods for Chemical Analysis of Water and Wastes," U.S. EPA, EPA-600/4-79-020, revised March 1983.
[s]Soil and Rock; Dimension Stone, Geosynthetics Vol. 4.08. 1991 Annual Book of ASTM Standards Section 4 "Construction."
[t]USATHAMA Methods for Ion Nitroexplosives in Water by HPLC, and Nitroexplosives in Soils by HPLC.
[u]All field quality control samples associated with a batch of samples will be evaluated as a unit. This criterion is designed for evaluating an isolated quality control sample and does not take into account the interdependencies of quality control results. Corrective actions will be taken at all levels of detection in the blank samples associated with field sampling. The criterion applies only if there is a positive detection of the same compound in associated samples. All data will be evaluated on a case-by-case basis; therefore, this criterion may not be applicable at times (e.g., reported levels near detection limit).
[v]"Manual for the Certification of Laboratories Analyzing Drinking Water," EPA/570/9-90/008 Revision 2.0 to Method 502.2. U.S. EPA.
[w]For analysis of residential well samples.
[x]Arsenic, selenium, cadmium, lead, antimony, and thallium will be analyzed by graphite furnace atomic absorption. Zeeman background correction will be used. Deuterium background correction may be used for lead and antimony instead of Zeeman background correction.
[1]"The Radiochemistry of Barium, Calcium, and Strontium," D.N. Sunderman and D.W. Townley, NAS-NS-3010. National Academy of Sciences, January 1960.
[2]"Determination of Strontium-89 and -90 in Soil with Total Sample Decomposition," D.B. Martin, Analytical Chemistry, October 1979.
[3]"Procedures for Determination of Stable Elements and Radionuclides in Environmental Samples," Public Health Service Publication 999-RH-10, January 1965.
[4]"EML Procedures Manual," HASL-300, Environmental Measurements Laboratory, U.S. Department of Energy, 27th Edition.
[5]4-Nitrotoulene will be used for the PETN surrogate and quantified with the analysis of the other explosives.

Table III.3. Laboratory Control Limits for Matrix Spikes, Matrix Spike Duplicates, and Surrogate Spikes: Surface Water/Groundwater and Soil/Sediment Samples

ANALYTICAL METHOD	SPIKING COMPOUNDS	SPIKE CONCENTRATION		ADVISORY LIMITS			
		Water	Soil	Percent Recovery (%)[a]		Relative Percent Difference (%)	
		(µg/L)	(µg/kg)[c]	Water	Soil	Water	Soil
SW8010 and SW8020	Matrix Spike[b]/LCS						
	Bromodichloromethane	*	*	42-172	60-140	≤15	≤30
Halogenated	Bromoform	*	*	13-159	60-140	≤15	≤30
and Aromatic	Carbon tetrachloride	*	*	43-143	60-140	≤15	≤30
Volatile	Chloroform	*	*	49-133	60-140	≤15	≤30
Organic	Dibromochloromethane	*	*	24-191	60-140	≤15	≤30
Compounds	1,4-Dichlorobenzene	*	*	42-143	60-140	≤15	≤30
	1,2-Dichloroethane	*	*	51-147	60-140	≤15	≤30
	1,1-Dichloroethene	*	*	28-167	60-140	≤15	≤30
	1,1,1-Trichloroethane	*	*	41-138	60-140	≤15	≤30
	Trichloroethene	*	*	35-146	60-140	≤15	≤30
	Vinyl chloride	*	*	28-163	60-140	≤15	≤30
	Benzene	*	*	39-150	60-140	≤15	≤30
	Surrogates						
	Bromochloromethane	30	30	59-117	70-130	≤15	≤30
	Fluorobenzene	30	30	48-120	70-130	≤15	≤30
	o-Chlorofluorobenzene	30	30	44-124	70-130	≤15	≤30
SW8030	Matrix Spike[b]/LCS						
	Acrylonitrile	*	NA	70-135	NA	≤ 15	NA

NA - Not Applicable

Table III.3. (Page 2 of 5)

ANALYTICAL METHOD	SPIKING COMPOUNDS	SPIKE CONCENTRATION		ADVISORY LIMITS			
		Water	Soil	Percent Recovery (%)[a]		Relative Percent Difference (%)	
		(µg/L)	(µg/kg)[c]	Water	Soil	Water	Soil
CLP SOW Pesticides/ PCBs	Matrix Spike/LCS						
	Lindane	*	*	56-123	46-127	≤15	≤50
	Heptachlor	*	*	40-131	35-130	≤20	≤31
	Aldrin	*	*	40-120	34-132	≤22	≤43
	Dieldrin	*	*	52-126	31-134	≤18	≤38
	Endrin	*	*	56-121	42-139	≤21	≤45
	4,4'-DDT	*	*	38-127	23-134	≤27	≤50
	Surrogate						
	Tetrachloro-m-xylene	per CLP SOW	per CLP SOW	60-150	60-150	NA	NA
	Decachlorobiphenyl	per CLP SOW	per CLP SOW	60-150	60-150	NA	NA
CLP SOW Volatile Organic Compounds	Matrix Spike/LCS						
	1,1-DCE	*	*	61-145	59-172	≤14	≤22
	Trichloroethene	*	*	71-120	62-137	≤14	≤24
	Benzene	*	*	76-127	66-142	≤11	≤21
	Toluene	*	*	76-125	59-139	≤13	≤21
	Chlorobenzene	*	*	75-130	60-133	≤13	≤21
	Surrogates						
	Toluene-d8	per CLP SOW	per CLP SOW	88-110	84-138	NA	NA
	4-Bromo-fluorobenzene	per CLP SOW	per CLP SOW	86-115	59-113	NA	NA
	1,2-Dichloroethane-d4	per CLP SOW	per CLP SOW	76-114	70-121	NA	NA

NA - Not Applicable

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ANALYTICAL METHOD	SPIKING COMPOUNDS	SPIKE CONCENTRATION		ADVISORY LIMITS			
		Water	Soil	Percent Recovery (%)[a]		Relative Percent Difference (%)	
		(µg/L)	(µg/kg)[c]	Water	Soil	Water	Soil
CLP SOW Semivolatile Organic Compounds	Matrix Spike/LCS						
	Phenol	•	•	12-110	26-90	≤42	≤35
	2-Chlorophenol	•	•	27-123	25-102	≤40	≤50
	1,4-Dichlorobenzene	•	•	36-97	28-104	≤28	≤27
	N-nitroso-di-n-propyl-amine	•	•	41-116	41-126	≤38	≤38
	1,2,4-Trichlorobenzene	•	•	39-98	38-107	≤28	≤23
	4-Chloro-3-methylphenol	•	•	23-97	26-103	≤42	≤33
	Acenaphthene	•	•	46-118	31-137	≤31	≤19
	4-Nitrophenol	•	•	10-80	11-114	≤50	≤50
	2,4-Dinitrotoluene	•	•	24-96	28-89	≤38	≤47
	Pentachlorophenol	•	•	9-103	17-109	≤50	≤47
	Pyrene	•	•	26-127	35-142	≤31	≤36
	Surrogates						
	Nitrobenzene-d5	per CLP SOW	per CLP SOW	35-114	23-120	NA	NA
	2-Fluorobiphenyl	per CLP SOW	per CLP SOW	43-116	30-115	NA	NA
	p-Terphenyl-d14	per CLP SOW	per CLP SOW	33-141	18-137	NA	NA
	Phenol-d5	per CLP SOW	per CLP SOW	10-110	24-113	NA	NA
	2-Fluorophenol	per CLP SOW	per CLP SOW	21-110	25-121	NA	NA
	2,4,6-Tribromophenol	per CLP SOW	per CLP SOW	10-123	19-122	NA	NA
	2-Chlorophenol-d4	per CLP SOW	per CLP SOW	33-110	20-130	NA	NA
	1,2-Dicholorobenzene-d4	per CLP SOW	per CLP SOW	16-110	20-130	NA	NA

NA - Not Applicable

Table III.. (Page 4 of 5)

ANALYTICAL METHOD	SPIKING COMPOUNDS	SPIKE CONCENTRATION		ADVISORY LIMITS			
		Water	Soil	Percent Recovery (%)[a]		Relative Percent Difference (%)	
		(µg/L)	(µg/kg)[c]	Water	Soil	Water	Soil
502.2 Volatile Organic Compounds	Matrix Spike/LCS						
	1,1,1-Trichloroethane	0.1-5	NA	80-120	NA	20%	NA
	1,1,2,2-Tectrachloroethane	0.1-5	NA	80-120	NA	20%	NA
	1,1-Dichloroethene	0.1-5	NA	80-120	NA	20%	NA
	1,2-Dichloroethane	0.1-5	NA	80-120	NA	20%	NA
	Benzene	0.1-5	NA	80-120	NA	20%	NA
	Bromodichloromethane	0.1-5	NA	80-120	NA	20%	NA
	Bromoform	0.1-5	NA	80-120	NA	20%	NA
	Chlorobenzene	0.1-5	NA	80-120	NA	20%	NA
	Cis-1,3-Dichloropropene	0.1-5	NA	80-120	NA	20%	NA
	Ethylbenzene	0.1-5	NA	80-120	NA	20%	NA
	Tetrachloroethene	0.1-5	NA	80-120	NA	20%	NA
	Toluene	0 1-5	NA	80-120	NA	20%	NA
	Trans-1,2-Dichloroethene	0.1-5	NA	80-120	NA	20%	NA
	Trans-1,3-Dichloropropene	0 1-5	NA	80-120	NA	20%	NA
	Trichlorrethene	0.1-5	NA	80-120	NA	20%	NA
	Xylenes (total)	0.1-5	NA	80-120	NA	20%	NA
	Surrogates						
	Fluorobenzene	10	NA	80-120*	NA	20%	NA
	1-Chloro-2-Bromopropane	10	NA	80-120*	NA	20%	NA

NA - Not Applicable

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Table III.5 (Page 5 of 5)

ANALYTICAL METHOD	SPIKING COMPOUNDS	SPIKE CONCENTRATION		ADVISORY LIMITS			
		Water	Soil	Percent Recovery (%)[e]		Relative Percent Difference (%)	
		(µg/L)	(µg/kg)[c]	Water	Soil	Water	Soil
USATHAMA Explosives	Matrix Spike/LCS[d] (low concentration)						
	RDX	11.6	4.4	62-87	40-160[e]	32[f]	40[e,f]
	1,3,5-TNB	28	2.6	85-100	40-160[e]	19	30
	2,4,6-TNT	5.6	2.6	78-102	40-160[e]	29	40
	2,6-DNT	1.0	2.6	66-102	40-160[e]	45	60
	2,4-DNT	0.8	0.6	74-99	40-160[e]	31	40
	Matrix Spike/LCS[d] (high concentration)						
	RDX	56	22	49-71	40-160	19	30
	1,3,5-TNB	140	13	85-106	40-160	20	30
	2,4,6-TNT	29	13	63-104	40-160	19	30
	2,6-DNT	5.0	13	74-96	40-160	19	30
	2,4-DNT	4.0	3.0	77-100	40-160	20	30
	Surrogate						
	4-Nitrotoluene[h]	4.0	25	50-150	50-150	NA	NA

[a]Percent recovery limits for water are those established in SW846. The control limits for soil matrix spikes and surrogates and for precision are project-established advisory limits until enough data points are generated to develop control charts.
[b]Spike amount is for low concentration soils.
[c]Control limits for sample matrix spikes have not been determined. These recoveries are based on blank spikes. Actual recoveries may vary.
[d]Control limits have not been established for solid matrices. These limits are project-established advisory limits for data evaluation purposes and not for validation and will be used until control charts have been developed.
[e]Precision is expressed for this analysis as the difference between the highest percent recovery and lowest percent recovery, as defined in the USATHAMA Quality Assurance Manual (USATHAMA 1990).
[f]Matrix spike recoveries are advisory limits only.
[g]Actual spiking concentration may change due to performance of method validation.
[h]Sample will be spiked at a concentration at least 25% above the sample concentration, unless the concentration is less than the detection limit, where the spike concentration will be 2 to 5 times the method detection limit.

NA - Not Applicable

Note: Recoveries may vary depending upon sample matrix. These recoveries are based on using reagent water.

Source: DOE, 1993

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4. SAMPLING PROCEDURES

An environmental sample is defined as representative physical evidence collected from ground water, sediment, soil, or surface water matrices for subsequent chemical and/or physical analysis and monitoring. Data acquired from chemical and physical analyses will be used to characterize existing site conditions and to make inferences concerning the nature, extent, and degree of site contamination.

The OU-2 investigation will follow standard operating procedures (SOPs) in collecting environmental samples and performing other specific field activities. Activities that will be performed as part of the investigation include the sampling of surface water and groundwater; surface and subsurface soils; and sediments. Additional activities to be performed include water level measurements, drilling and logging, and health and safety screening. These activities are discussed in detail in the OU-2 Field Sampling Plan (FSP) and the OU-2 Work Plan. However, the procedures for these activities will be summarized in this section as part of the quality assurance plan for the investigations. The SOPs developed for the Mound Plant ER Program that will be followed are listed in Appendix A of this QAPjP. It should be noted that the Mound Plant ER Program SOPs have been revised in response to comments from both EPA Region V and Ohio EPA.

4.1. GENERAL PROCEDURES FOR SAMPLING

General procedures for all sampling activities address instructions to field personnel; sample control and documentation; sample containers; handling, packaging, and shipping of samples; and equipment decontamination.

4.1.1. Instructions to Field Personnel

Prior to beginning each type of sampling event, the field manager will meet with the assigned personnel and review the purpose and objectives. This meeting will provide final clarification and allow a review and discussion of the sampling event details. The procedures for instructions to field personnel can be found in Mound Plant ER Program SOP 1.1, General Instructions for Field Personnel (Appendix A).

4.1.2. Sample Control and Documentation

The steps required for sample control, sample identification, data recording, and chain-of-custody documentation are defined in Mound Plant ER Program SOP 1.3, Sample Control and Documentation (Appendix A).

4.1.3. Sample Containers, Preservation and Holding Times

Guidance in the selection of suitable containers for samples, requirements for container cleaning, required sample volumes, sample collection, holding times, and the recommended preservation techniques are defined in Mound Plant ER Program SOP 1.4, Sample Containers and Preservation (Appendix A).

4.1.4. Sample Shipment

Samples are to be shipped and prepared for shipment according to Mound Plant ER Program SOP 1.5, Guide to the Handling, Packaging, and Shipping of Samples (Appendix A).

4.1.5. Equipment Decontamination

All field sampling equipment will be decontaminated before and after use in accordance with Mound Plant ER Program SOP 1.6, General Equipment Decontamination (Appendix A).

4.2. WATER SAMPLING

SOPs specific to groundwater sampling and surface water sampling have been developed for the Mound Plant ER Program. A protocol for purging wells prior to sampling is presented as Mound Plant ER Program SOP 2.1, Presample Purging of Wells (revision 1) (DOE 1992). Techniques for sampling monitoring wells and commercial/municipal/domestic wells are established in Mound Plant ER Program SOPs 2.3, 2.4, 2.6 and 2.7 (revision 1) (DOE 1991) and SOP 2.5 (revision 0) (DOE 1991). These procedures cover the sampling of monitor wells with a bucket-type bailer, a submersible pump, and a peristaltic pump. Guidelines for surface water sampling are provided in Mound Plant ER Program SOP 2.9, Surface Water Sampling (revision 1) (DOE 1991).

Also included in the Mound Plant ER Program SOPs is a specific groundwater sampling protocol for volatile organic compounds, Mound Plant ER Program SOP 2.8, Sampling for Volatile Organics (revision 0) (DOE 1991). This protocol ensures that a representative sample is collected and transported for volatile organic analysis.

4.3. SOIL/SEDIMENT SAMPLING

Surface and subsurface soil sampling procedures to be followed for this investigation are provided in Mound Plant ER Program SOPs 5.2 (revision 3) (DOE 1992), 5.3 (revision 2) (DOE 1992) and 5.8 (revision 1) (DOE 1991). These procedures consist of protocols for sampling with a spade and scoop (surface and subsurface), subsurface soil sampling with a hand auger and thin wall sampler, and surface soil sampling with a stainless steel surface soil sampler. Soil and rock borehole logging and sampling procedures to be followed are also presented as Mound Plant ER Program SOP 5.1, Soil and Rock Borehole Logging and Sampling (revision 1) (DOE 1991).

Sediment sampling will be accomplished with a spade or scoop, as outlined in Mound Plant ER Program SOP 5.2 (revision 3) (DOE 1992). Specific procedures for sampling sediment in streams, rivers, and ponds are outlined in Mound Plant ER Program SOP 5.9 (revision 0) (DOE 1992).

4.4. OTHER FIELD ACTIVITIES

Additional OU-2 field activities to be included as part of the quality assurance plan are water level measurements; drilling and logging; sample preservation; decontamination; sample storage, handling, and shipping; sample numbering; waste material handling; and specific analytical field measurements. Water level measurements of depth-to-water in boreholes, monitor wells, or potentiometers will be performed according to Mound Plant ER Program SOP 3.1, Water Level Measurement (revision 1) (DOE 1992). Drilling and logging procedures for soil and rock borings and monitor wells are specified in Mound Plant ER Program SOPs 4.1, (revision 2), 4.1.1 (revision 0), 4.2, 4.3, 4.4, and 5.1 (revision 1) (DOE 1992). The guidelines for handling and disposal of derived wastes for this project will follow the Mound Plant ER Program SOP 1.15, Guide to Management of Investigation-Derived Waste.

Tables III.1 and III.2 in Section 3.0 includes the QA requirements for sample collection, holding times, preservation, and storage conditions. In addition, the following general SOPs will be employed during the field activities:

Activity	SOP	Revision	Reference
- Sample Containers and Preservation	1.4	4	DOE 1993
- Sample handling, packaging and shipping of samples	1.5	2	DOE 1993
- Equipment decontamination	1.6	2	DOE 1993
- Management of Investigation-Derived Material	1.15	2	DOE 1993
- Field Measurements	2.2	2	DOE 1993

Sample numbering will occur in accordance with the Mound Plant ER Program sample identification scheme, as described in Section 1 of the OU-2 Field Sampling Plan.

4.5. SUMMARY OF SAMPLING ACTIVITIES

The field sampling plans for the investigation includes the number of samples and their frequency.

5. SAMPLE CUSTODY

A sample provides physical evidence of existing conditions at a site. It is essential that control of this evidence be established to ensure sample integrity. The sample control and documentation procedures given in SOP 1.3 (revision 1) (DOE 1992) will be followed during OU-2 field activities. Sample collection procedures will be documented by sample location and number in a bound, sequentially page-numbered logbook and by implementing chain-of-custody procedures. Sample custody will be documented from the date and time a sample is collected through all transfers of custody until it is received by the laboratory. Once the sample has been received by the laboratory, internal laboratory sample tracking protocols will be initiated to document sample custody through final disposition, and will also track the analysis status of the sample. The information provided in this section is generic to all sampling activities. Specific information concerning sampling methods documentation and custody protocols is contained in the appropriate sampling method section of the OU-2 Field Sampling Plan.

5.1. FIELD CUSTODY PROCEDURES

A detailed field logbook will be kept describing all activities accomplished in the field, such that project activities could be reconstructed without relying on communications with the field team participants. The Mound Plan ER Program SOPs 1.1 and 1.3 outline the proper use and the general document control procedures for field staff when using field log books. Entry specifications for each type of sampling procedure are provided in the SOPs for each individual sampling method or procedure. The following information, however, will be included in each field logbook at a minimum:

- Purpose of sampling;
- Location, description, and log of photographs of each sampling point;
- Details of the sample site;
- Identification of sampling team members;
- Sample matrix (i.e., ground-water, soil, sludge, or wastewater);
- Number and volume of samples taken;
- Sampling methodology, including indication of grab or composite sample;
- Field calibrations record;

- Sample preservation, if applicable;
- Date and time sample was collected;
- Sample identification number(s);
- Field observations;
- Field measurements (e.g., pH, conductivity, explosivity, and water depth); and
- Dated signature of the personnel responsible for the field logbook entries and observations.

Sample containers will either be hand delivered or shipped via Federal Express to the designated laboratory. All shipping containers returned to the laboratory will contain a chain-of-custody form documenting the contents. The form will be completed by a sampling team member with the following information recorded:

- Project name and site;
- Client name, address, and phone number;
- Sampler's name, firm, and phone number;
- Sample number, date, time of collection, and matrix;
- Analyses required;
- Preservative used, if applicable;
- Analysis turn-around time requested;
- Relinquishing agent's signature and date and time samples were relinquished; and
- Any other descriptive or explanatory information deemed pertinent by the sampler.

The steps necessary for sample control, sample identification, and data recording are defined in Mound Plant ER Program SOP 1.3, Sample Control and Documentation (Appendix A).

5.2. LABORATORY CUSTODY PROCEDURES

Sample custody files will be maintained by laboratory personnel. The designated sample custodian will accept custody of the shipped samples and verify that the information on the sample labels matches the information on the chain-of-custody records. The custodian will annotate his or her record with observations as to the condition of the shipping container and will enter the sample label data into the sample tracking system and a unique laboratory number will be assigned to each sample. The custodian will assure that all samples are transferred to the proper analyst or are stored in the appropriate secure area (as defined by the lab project QA plan). All documentation for sample custody and transfer will be readily available upon request.

Laboratory personnel will be responsible for the care and custody of samples from the time samples are received by the analyst until the unused portion of the sample is disposed of as waste after all necessary quality assurance checks have been completed. All identifying tags, data sheets, chain-of-custody forms, and other laboratory records shall be retained as part of the laboratory's permanent file.

5.3. SAMPLE HANDLING, PACKAGING, AND SHIPPING

Information and references that must be reviewed prior to the selection of appropriate packaging materials, shipping containers, and shipping labels are defined in Mound Plant ER Program SOP 1.5, Guide to the Handling, Packaging, and Shipment of Samples (Appendix A). The shipment of all samples during the OU-2 investigation activities with follow current DOT/IATA regulations.

5.4. DOCUMENTATION

Records will be kept by the ER Program EG&G subcontractor to document the quality assurance/quality control activities. The documentation records shall include the following:

- Communications
  - internal and external
- Quality Assurance/Quality Control
  - procedures
  - chain of custody
  - audit reports
  - laboratory quality control reports

  - deviation notification forms
  - non conformance/corrective action reports

- Technical information
  - analytical data
  - field data
  - field log books
  - graphic resources
  - data quality acceptance
  - calculations/evaluations
  - data review reports

- Management
  - schedule
  - budget
  - release site data base

- Health and Safety
  - plans/procedures
  - audit reports

- Documents
  - plans
  - reports

All file documentation will be maintained by the DOE or its subcontractor under the ER Program document control system.

6. LABORATORY ANALYTICAL METHODS

6.1. GENERAL

Standard EPA, ASTM, DOE or National Academy of Sciences analytical protocols will generally be employed in specifying and conducting laboratory analyses. Any method cited or used must describe, in detail, the exact sample handling and analytical procedures and materials required. The following items must be included in the procedure:

- Sample matrix;
- Principle of method;
- Sample size requirements;
- Detection limits;
- Interferences and corrective measures;
- Apparatus (including instrument parameters);
- Reagents;
- Calibration procedures;
- Sample preparation (i.e., extraction, digestion);
- Diagrams or tables that describe the method;
- Step-by-step analytical procedure;
- Details of calculation;
- Quality control requirements (i.e., blanks, spikes, replicates);
- Report requirements; and
- References.

6.2. LABORATORY ANALYTICAL METHODS

6.2.1. Volatile Organic Compounds

Groundwater samples will be analyzed for halogenated and aromatic VOCs using gas chromatography with a Hall electrolytic conductivity detector and a photoionization detector. The methodologies to be followed are EPA methods 8010 for halogenated compounds and 8020 for aromatic compounds (EPA 1986). These methods were chosen over the CLP SOW for groundwater samples in order to achieve lower detection limits. A capillary column (either RTX 502.2, DB-624 or equivalent), which can resolve those compounds listed on Table VI.1, will be required for this method to obtain better resolution. Because some of the additional VOCs may co-elute with other compounds on the specified capillary column, a GC/MS confirmation or second column confirmation will be performed for any detection at a retention time with potential coelution problems.

Soil/sediment and surface water samples will be analyzed for VOCs by the CLP SOW using gas chromatography and mass spectrometry as a means for compound identification. A modification (Modification D) to the CLP SOW has been prepared to account for six additional volatile organic compounds: acrylonitrile, acetonitrile, trichlorotrifluorethane, iodomethane, hexane, and diethyl benzene.

EPA drinking water method 502.2 using gas chromatography, capillary column, and a Hall electrolytic conductivity and photoionization detector in series will be implemented for residential well samples. Detection limits for this method are also lower than the CLP methodology. All detections above the quantitation limit will be confirmed on a second column or by GC/MS.

EPA Method 8030 with the purge and trap technique (5030) will be used to identify acrylonitrile and acetonitrile in groundwater samples (including residential well samples). This gas chromatography method uses a flame ionization detector to detect these volatile organic compounds.

6.2.2. Semivolatile Organic Compounds

The EPA CLP SOW document number OLM01.8 (EPA 1990a), using gas chromatography/mass spectrometry, will be the methodology followed for semivolatile organic compound analysis of groundwater, surface water, and soil/sediment samples. 2-Benyzl-4-chlorophenol has been added to this

Table VI.1. Analytical Methods, Parameters, and Quantitation Limits Surface Water/Groundwater and Soil/Sediment Samples

Parameters	Analytical Methods		Quantitation Limits[a]	
	Water	Soil/Sediment	Water (µg/l)	Soil Sediment (µg/kg)
1. Volatile Organic Compounds (VOCs), Groundwater				
1.1 Purgeable Halocarbons	SW 5030/SW8010[b]			
Vinyl chloride			1.0	NA
Trichlorofluoromethane			2.0	NA
1,1-Dichloroethene			1.3	NA
Methylene chloride (dichloromethane)			5.0	NA
1,1-Dichloroethane			0.7	NA
Trichloromethane (chloroform)			0.5	NA
1,1,1-Trichloroethane			0.3	NA
Carbon tetrachloride			1.2	NA
1,2-Dichloroethane			0.3	NA
Trans-1,2-dichloroethene			1.0	NA
Cis-1,2-dichloroethene			1.0	NA
Trichloroethene			1.2	NA
1,2-Dichloropropane			0.4	NA
Bromodichloromethane			1.0	NA
Dibromomethane			2.0	NA
2-Chloroethyl vinyl ether			1.3	NA
Cis-1,3-dichloropropene			3.4	NA
Trans-1,3-dichloropropene			3.4	NA
1,1,2-Trichloroethane			0.2	NA
Tetrachloroethene			0.3	NA
Dibromochloromethane			0.9	NA
1-Chlorohexane			1.0	NA
Chlorobenzene			2.5	NA
1,1,1,2-Tetrachloroethane			1.0	NA
Bromoform			2.0	NA
1,1,2,2-Tetrachloroethane			0.3	NA
1,2,3-Trichloropropane			1.0	NA
Phenyl bromide (bromobenzene)			2.0	NA
Chlorotoluene			1.0	NA
1,3-Dichlorobenzene			3.2	NA
1,4-Dichlorobenzene			2.4	NA
1,2-Dichlorobenzene			1.5	NA
Bis(2-chloroisopropyl)ether			20.0	NA
Additional Compounds:				
Trichlorotrifluoroethane			2	NA

NA - Not Applicable

Table VI.1. (Page 2 of 14)

Parameters	Analytical Methods		Quantitation Limits[a]	
	Water	Soil/Sediment	Water (µg/l)	Soil Sediment (µg/kg)
1.2 Purgeable Aromatic Compounds, Groundwater	SW5030/SW8020[b]	NA		
Benzene			2.0	NA
Chlorobenzene			2.0	NA
1,2-Dichlorobenzene			4.0	NA
1,3-Dichlorobenzene			4.0	NA
1,4-Dichlorobenzene			3.0	NA
Ethylbenzene			2.0	NA
Toluene			2.0	NA
Xylenes			2.0	NA
Additional Compounds:				
Diethylbenzene			1	NA
Vinyl acetate			3	NA
Carbon disulfide			5	NA
Acetone			20	NA
Methylethyl ketone (2-butanone)			10	NA
Methylisobutyl ketone (4-methyl-2-pentanone)			5	NA
Acrylonitrile	SW5030/SW8030	NA	10	100
Acetonitrile	SW5030/SW8030	NA	10	100
2. Volatile Organic Coumpounds (VOCs), Soil/Sediment and Surface Water	CLP SOW[c] Modification D	CLP SOW[c] Modification D		Low Soil/ Sediment[d]
Chloromethane			10	10
Bromomethane			10	10
Vinyl Chloride			10	10
Chloroethane			10	10
Methylene chloride			5	5
Acetone			10	10
Carbon disulfide			5	5
1,1-Dichloroethene			5	5
1,1-Dichloroethane			5	5
1,2-Dichloroethene (total)			5	5
Chloroform			5	5
1,2-Dichloroethane			5	5
2-Butanone			10	10
1,1,1-Trichloroethane			5	5
Carbon Tetrachloride			5	5
Bromodichloromethane			5	5
1,2-Dichloropropane			5	5
Cis-1,3-Dichloropropene			5	5
Trichloroethene			5	5

NA - Not Applicable

Table VI.1. (Page 3 of 14)

Parameters	Analytical Methods		Quantitation Limits[a]	
	Water	Soil/Sediment	Water (µg/l)	Soil Sediment (µg/kg)
Dibromochloromethane			5	5
1,1,2-Trichloroethane			5	5
Benzene			5	5
Trans-1,3-dichloropropene			5	5
Tribromomethane			5	5
4-Methyl-2-pentanone			10	10
2-Hexanone			10	10
Tetrachloroethene			5	5
Toluene			5	5
1,1,2,2-Tetrachloroethane			5	5
Chlorobenzene			5	5
Ethylbenzene			5	5
Styrene			5	5
Xylenes (total)			5	5
Additional Compounds:				
Acrylonitrile			100	100
Acetonitrile			100	100
Diethylbenzene			5	20
Trichlorotrifluoroethane			5	10
Hexane			10	10
Iodomethane			NA	10
Vinyl Acetate			10	10
3. Semivolatile Organic Compounds	CLP SOW[c] Modification D	CLP SOW[c] Modification D		Low Soil/ Sediment[d]
Phenol			10	330
Bis(2-chloroethyl)ether			10	330
2-Chlorophenol			10	330
1,3-Dichlorobenzene			10	330
1,4-Dichlorobenzene			10	330
1,2-Dichlorobenzene			10	330
2-Methylphenol			10	330
2,2'-Oxybis (1-Chloropropane)*			10	330
4-Methylphenol			10	330
N-nitroso-di-n-dipropylamine			10	330
Hexachloroethane			10	330
Nitrobenzene			10	330
Isophorone			10	330
2-Nitrophenol			10	330

* Previously known by the name bis(2-chloroisopropyl)ether.

NA - Not Applicable

Table VI.1. (Page 4 of 14)

Parameters	Analytical Methods		Quantitation Limits[a]	
	Water	Soil/Sediment	Water (µg/l)	Soil Sediment (µg/kg)
2,4-Dimethylphenol			10	330
Bis(2-chloroethoxy)methane			10	330
2,4-Dichlorophenol			10	330
1,2,4-Trichlorobenzene			10	330
Naphthalene			10	330
4-Chloroaniline			10	330
Hexachlorobutadiene			10	330
4-Chloro-3-methylphenol (Para-chloro-meta-cresol)			10	330
2-Methylnaphthalene			10	330
Hexachlorocyclopentadiene			10	330
2,4,6-Trichlorophenol			10	330
2,4,5-Trichlorophenol			25	800
2-Chloronaphthalene			10	330
2-Nitroaniline			25	800
Dimethylphthalate			10	330
Acenaphthylene			10	330
2,6-Dinitrotoluene			10	330
3-Nitroaniline			25	800
Acenaphthene			10	330
2,4-Dinitrophenol			25	800
4-Nitrophenol			25	800
Dibenzofuran			10	330
2,4-Dinitrotoluene			10	330
Diethylphthalate			10	330
4-Chlorophenyl-phenyl ether			10	330
Fluorene			10	330
4-Nitroaniline			25	800
4,6-Dinitro-2-methylphenol			25	800
N-Nitrosodiphenylamine			10	330
4-Bromophenyl-phenylether			10	330
Hexachlorobenzene			10	330
Pentachlorophenol			25	800
Phenanthrene			10	330
Anthracene			10	330
Carbazole			10	330
Di-n-butylphthalate			10	330
Fluoranthene			10	330
Pyrene			10	330
Butylbenzylphthalate			10	330
3,3'-Dichlorobenzidine			10	330

NA - Not Applicable

Table VI.1. (Page 5 of 14)

Parameters	Analytical Methods		Quantitation Limits[a]	
	Water	Soil/Sediment	Water (µg/l)	Soil Sediment (µg/kg)
Benzo(a)anthracene			10	330
Chrysene			10	330
Bis(2-Ethylhexyl)phthalate			10	330
Di-n-octylphthalate			10	330
Benzo(b)fluoranthene			10	330
Benzo(k)fluoranthene			10	330
Benzo(a)pyrene			10	330
Indeno(1,2,3-cd)pyrene			10	330
Dibenz(a,h)anthracene			10	330
Benzo(g,h,i)perylene			10	330
Additional Compounds:				
2-Benzyl-4-Chlorophenol			10	330
Benzyl alcohol			10	330
Benzoic acid			50	1600
4. Pesticides and PCBs	CLP SOW[c]	CLP SOW[c]		
alpha-BHC			0.05	1.7
beta-BHC			0.05	1.7
delta-BHC			0.05	1.7
gamma-BHC (Lindane)			0.05	1.7
Heptachlor			0.05	1.7
Aldrin			0.05	1.7
Heptachlor epoxide			0.05	1.7
Endosulfan I			0.05	1.7
Dieldrin			0.10	3.3
4,4'-DDE			0.10	3.3
Endrin			0.10	3.3
Endosulfan II			0.10	3.3
4,4'-DDD			0.10	3.3
Endosulfan sulfate			0.10	3.3
4,4'-DDT			0.10	3.3
Methoxychlor			0.50	17
Endrin ketone			0.10	3.3
Endrin aldehyde			0.10	3.3
alpha-Chlordane			0.05	1.7
gamma-Chlordane			0.5	1.7
Toxaphene			5.0	170
Aroclor-1016			0.50	33
Aroclor-1221			0.50	67
Aroclor-1232			0.50	33
Aroclor-1242			0.50	33
Aroclor-1248			0.50	33

NA - Not Applicable

Table VI.1. (Page 6 of 14)

Parameters	Analytical Methods		Quantitation Limits[a]	
	Water	Soil/Sediment	Water (µg/l)	Soil Sediment (µg/kg)
Aroclor-1254			0.50	33
Aroclor-1260			0.50	33
5. Metals (Target Analyte List)	CLP SOW[e] Modification A	CLP SOW[e] Modification A		(mg/kg)
Aluminum			20	4
Antimony			10	2
Arsenic			10	2
Barium			200	40
Beryllium			1	0.2
Cadmium			5	1
Calcium			5000	2000
Chromium			10	2
Cobalt			50	10
Copper			25	5
Iron			100	20
Lead			3	0.6
Magnesium			5000	1000
Manganese			15	3
Mercury			0.2	0.1
Nickel			40	8
Potassium			5000	1000
Selenium			5	1
Silver			10	2
Sodium			5000	1000
Tallium			10	2
Vanadium			10	2
Zinc			20	4
Additional Elements:				
Molybdenum			20	2
Bismuth			150	30
Lithium			100	10
6. Cyanide	CLP SOW[e]	CLP SOW[e]	10	2
7. Common Anions			(mg/L)	(mg/kg)
Nitrate-Nitrite[3]	E353.2[g]	E353.2[g]	0.2	2[f]
Chloride[3]	E325.1[g]/E325.2	SW9250[b]/SW9251	1.0	5[f]
Sulfate[3]	E375.2[g]	E375.2[g]	5	50
Nitrite	E354.1[g]	NA	0.01	NA
Ammonia	E350.1[g]	NA	0.01	NA
Fluoride[3]	E340.2[g]	E340.2[g]	0.1	0.025
8. Total Nitrogen	E351.3[g]	NA	0.10	NA
9. Total Phosphorus	E365.1[g]	NA	0.10	NA

NA - Not Applicable

Table VI.1. (Page 7 of 14)

Parameters	Analytical Methods		Quantitation Limits[a]	
	Water	Soil/Sediment	Water (µg/l)	Soil Sediment (µg/kg)
10. Total Organic Carbon (TOC)[3]	E415.1/E415.2[g]	E415.1/E415.2	1	25
11. Total Dissolved Solids (TDS)	E160.1[g]	NA	4	NA
12. Total Suspended Solids (TSS)	E160.2[g]	NA	10	NA
13. Alkalinity	E310.1[g]	NA	5	NA
14. Cation Exchange Capacity	NA	SW9081[b,h]	NA	5 mg/L
15. Particle Size Analysis	NA	ASTM D422-63[i]	NA	NA
16. Specific Gravity	NA	ASTM D854-83[i]	NA	NA
17. Moisture Content	NA	ASTM D2974[i]	NA	NA
18. Organic Content	NA	ASTM D2974-87[i]	NA	NA
19. Hydraulic Conductivity	NA	ASTM D2434-68[i]	NA	NA
20. Relative and Minimum Density	NA	ASTM D4254-83[i]	NA	NA
Maximum Density		ASTM D4253-83[i]	NA	NA
21. Clay Mineralogy	NA	X-ray Diffraction	NA	NA
22. Explosives[3]	USATHAMA[j]	USATHAMA[j]	(µg/L)	(mg/kg)
HMX			20	3.0
RDX			6.0	2.5
NB			15	1.5
1,3-DNB			15	1.5
1,3,5-TNB			15	1.5
2,4-DNT			0.5	0.5
2,6-DNT			0.5	1.5
TNT			3.0	1.5
2A,4,6-DNT			3.0	1.5
Tetryl			3.0	2.5
PETN			1	1
23. Radionuclides			(pCi/L)	(pCi/g dry)
Gamma Spectrometry	Nuclear	Nuclear		
- Data Inc.,	Data Inc.,			
americium-241 (soils)	1986[n]	1986[n]	NA	1[m]
cobalt-60			20[l]	1[m]
cesium-137			20[l]	1[m]
bismuth-210 metastable			15[l]	1[m]
bismuth-207			15[l]	1[m]
potassium-40			350	10[m]
radium-226 (soils)			NA	0.3[m]
Tritium[3]	R906.0[o]	R906.0[o]	500 pCi/L	50 pCi/g[q]
Plutonium Isotopes	NAS, 1965[r]	NAS, 1965[r]	1[t]	1.0[s]
Thorium Isotopes	NAS, 1960[t]	NAS, 1960[t]	1[t]	1.0[s]
Radium-226	ASTM D2460-70[u]	NA	1[v]	NA
Uranium Isotopes	NAS, 1962[s]	NAS, 1962[s]	1	0.6
Strontium-90	NAS, 1960[t]	NAS, 1960[t]	5	1.0

NA - Not Applicable

Table VI.1. (Page 8 of 14)

Parameters	Analytical Methods		Quantitation Limits[a]	
	Water	Soil/Sediment	Water (µg/l)	Soil Sediment (µg/kg)
Americum-241	EML Am-01[2]	NA	1	NA
24. Volatile Organic Compounds (VOCs), residential well samples				
24.1 Purgeable Halocarbons	502.2[w]	NA	µg/L	µg/kg
Vinyl chloride			0.5	NA
Trichlorofluoromethane			1.0	NA
1,1-Dichloroethene			1.0	NA
Methylene chloride (dichloromethane)			2.0	NA
Trans-1,2-dichloroethene			0.5	NA
Cis-1,2-dichloroethene			0.5	NA
1,1-Dichloroethane			0.5	NA
Trichloromethane (chloroform)			0.5	NA
1,1,1-Trichloroethane			1.0	NA
Carbon tetrachloride			0.5	NA
1,2-dichloroethane			0.5	NA
Trichloroethene			0.5	NA
1,2-Dichloropropane			0.5	NA
Bromodichloromethane			0.5	NA
Dibromomethane			0.5	NA
Cis-1,3-dichloropropene			0.5	NA
Trans-1,3-dichloropropene			0.5	NA
1,1,2-Trichloroethane			0.5	NA
Tetrachloroethene			1.0	NA
Dibromochloromethane			0.5	NA
Chlorobenzene			0.5	NA
1,1,1,2-Trtrachloroethane			0.5	NA
Bromoform			1.0	NA
1,1,2,2-Tetrachloroethane			0.5	NA
1,2,3-Trichloropropane			0.5	NA
Trichloroethene			0.5	NA
1,2-Dichloropropane			0.5	NA
Bromodichloromethane			0.5	NA
Dibromomethane			0.5	NA
Cis-1,3-dichloropropene			0.5	NA
Trans-1,3-dichloropropene			0.5	NA
1,1,2-Trichloroethane			0.5	NA
Tetrachloroethene			1.0	NA
Dibromochloromethane			0.5	NA
Chlorobenzene			0.5	NA
1,1,1,2-Tetrachloroethane			0.5	NA
Bromoform			1.0	NA

NA - Not Applicable

Table VI.1. (Page 9 of 14)

Parameters	Analytical Methods		Quantitation Limits[a]	
	Water	Soil/Sediment	Water (µg/l)	Soil Sediment (µg/kg)
1,1,2,2-Tetrachloroethane			0.5	NA
1,2,3-Trichloropropane			0.5	NA
Phenyl bromide (bromobenzene)			0.5	NA
Chlorotoluene			0.5	NA
1,3-Dichlorobenzene			0.5	NA
1,4-Dichlorobenzene			0.5	NA
1,2-Dichlorobenzene			0.5	NA
Carbon disulfide			5	NA
Vinyl acetate			20	NA
Methyl ethyl ketone (2-butanone)			1	NA
Nethyl isobutyl ketone (4-methyl-2-pentanone)			2	NA
Additional Comments:				
Trichlorotrifluroethane			2	NA
2-Chloroethylvinylether			1.3	NA
Bis (2-Chloroisopropyl) ether			2.0	NA
1-Chlorohexane			20	NA
24.2 Purgeable Aromatic Compounds, residential well samples	502.2[w]	NA		
Benzene			2.0	NA
Chlorobenzene			2.0	NA
1,2-Dichlorobenzene			1.5	NA
1,3-Dichlorobenzene			3.2	NA
1,4-Dichlorobenzene			2.4	NA
Ethylbenzene			2.0	NA
Toluene			1.0	NA
Xylenes			1.0	NA
Additional Compounds:				
Diethylbenzene			1	NA
Acetone			20	NA
Acetonitrile	SW5030	SW8030	10	NA
Acrylonitrile	SW5030	SW8030	10	NA
25. Semivolatile Organic Compounds (semiVocs), (residential well samples)	CLP SOW[c,z] Modification D	NA		
phenol			5	NA
bis-(2-Chloroethyl)ether			5	NA
2-Chlorophenol			5	NA
2-Methyphenol			5	NA
2,2'-oxybis(1-Chloropropane)			5	NA
4-Methylphenol			5	NA
N-Nitroso-di-n-propylamine			5	NA
Hexachloroethane			5	NA

NA - Not Applicable

Table VI.1. (Page 10 of 14)

Parameters	Analytical Methods		Quantitation Limits[a]	
	Water	Soil/Sediment	Water (µg/l)	Soil Sediment (µg/kg)
Nitrobenzene			5	NA
Isophorone			5	NA
2-Nitrophenol			5	NA
2,4-Dimethylphenol			5	NA
bis-(2-Chloroethoxy)methane			5	NA
2-4-Dichlorophenol			5	NA
1,2,4-Trichlorobenzene			5	NA
Naphthalene			5	NA
4-Chloraniline			5	NA
Hexachlorobutadiene			5	NA
4-Chloro-3-methylphenol			5	NA
2-Methylnaphthalene			5	NA
Hexachlorocyclopentadiene			5	NA
2,4,6-Trichlorophenol			5	NA
4,5-Trichlorophenol			5	NA
2-Chloronaphthalene			5	NA
2-Nitroaniline			20	NA
Dimethylphthalate			5	NA
Acenaphthylene			5	NA
2,6-Dinitrotoluene			5	NA
3-Nitroaniline			20	NA
Acenaphthene			5	NA
2,4-Dinitrophenol			20	NA
4-Nitrophenol			20	NA
Dibenzofuran			5	NA
2,4-Dinitrotoluene			5	NA
Diethylphthalate			5	NA
4-Chlorophenyl-phenylether			5	NA
Fluorene			5	NA
4-Nitroaniline			20	NA
4,6-Dinitro-2-methylphenol			20	NA
N-Nitrosodiphenylamine			5	NA
4-Bromophenyl-phenylether			5	NA
Hexachlorobenzene			5	NA
Pentachlorophenol			20	NA
Phenanthrene			5	NA
Anthracene			5	NA
Di-n-butylphthalate			5	NA
Fluoranthene			5	NA
Pyrene			5	NA
Butylbenzylphalate			5	NA

NA - Not Applicable

Table VI.1. (Page 11 of 14)

Parameters	Analytical Methods		Quantitation Limits[a]	
	Water	Soil/Sediment	Water (µg/l)	Soil Sediment (µg/kg)
3,3'-Dichlorobenzidine			5	NA
Benzo(a)anthracene			5	NA
Chrysene			5	NA
bis-(2-Ethylhexyl)phthalate			5	NA
Di-n-octylphthalate			5	NA
Benzo(b)fluoranthene			5	NA
Benzo(k)fluoranthene			5	NA
Benzo(a)pyrene			5	NA
Indeno(1,2,3-cd)pyrene			5	NA
Dibenz(a,h)anthracene			5	NA
Benzo(g,h,i),perylene			5	NA
Additional Compounds:				
2-benzyl-4-chlorophenol			10	NA
Benzyl alcohol			10	NA
Benzoic acid			50	NA
26. Pesticides/PCBs (Residential well samples)	CLP SOW[c,x]	NA		
alpha-BHC			0.01	NA
beta-BHC			0.01	NA
delta-BHC			0.01	NA
gamma-BHC (Lindane)			0.01	NA
Heptachlor			0.01	NA
Aldrin			0.01	NA
Heptachlor epoxide			0.01	NA
Enduosulfan I			0.01	NA
Dieldrin			0.02	NA
4,4'-DDE			0.02	NA
Endrin			0.01	NA
Endosulfan II			0.02	NA
4,4'-DDD			0.02	NA
Endosulfan sulfate			0.02	NA
4,4'-DDT			0.02	NA
Endrin ketone			0.02	NA
Endrin aldehyde			0.02	NA
alpha-Chlordane			0.01	NA
gamma-Chlordane			0.01	NA
Toxaphene			1.0	NA
Aroclor-1016			0.5	NA
Aroclor-1221			0.5	NA
Aroclor-1232			0.5	NA
Aroclor-1242			0.5	NA

NA - Not Applicable

Table VI.1. (Page 12 of 14)

Parameters	Analytical Methods		Quantitation Limits[a]	
	Water	Soil/Sediment	Water (µg/l)	Soil Sediment (µg/kg)
Aroclor-1248			0.5	NA
Aroclor-1254			0.5	NA
Aroclor-1260			0.5	NA
27. TAL metals and Cyanide (residential well samples)	CLP SOW[v] Modification B	NA		
Aluminum			20	NA
Antimony			10	NA
Arsenic			2	NA
Barium			200	NA
Beryllium			1	NA
Cadmium			2	NA
Calcium			5000	NA
Chromium			10	NA
Cobalt			50	NA
Copper			25	NA
Iron			100	NA
Lead			2	NA
Magnesium			5000	NA
Manganese			15	NA
Mercury			0.2	NA
Nickel			40	NA
Potassium			5000	NA
Selenium			2	NA
Silver			10	NA
Sodium			5000	NA
Thallium			2	NA
Vanadium			10	NA
Zinc			20	NA
Cyanide			10	NA
Additional Elements:				
Molybdenum			20	NA
Tin			50	NA
Bismuth			150	NA
Lithium			100	NA
28. Lanthanides	NA	CLP SOW Modification C		
Lanthanum			NA	40,000
Cerium			NA	40,000
Praseodymium			NA	40,000
Neodymium			NA	40,000
Samarium			NA	40,000

NA - Not Applicable

Table VI.1. (Page 13 of 14)

Parameters	Analytical Methods		Quantitation Limits[a]	
	Water	Soil/Sediment	Water (µg/l)	Soil Sediment (µg/kg)
Europium			NA	40,000
Gadolinium			NA	40,000
Terbium			NA	40,000
Dysprosium			NA	40,000
Volium			NA	40,000
Thulium			NA	40,000
Ytterbium			NA	40,000
Lutetium			NA	40,000

a For non-CLP analyses, these are expected method detection limits based on reagent grade water or a purified solid matrix. Actual quantitation limits may be higher depending upon the nature of the sample matrix. The limit reported on final laboratory reports will take into account the actual sample volume or weight, percent moisture (where applicable), and the dilution factor, if any. The quantitation limits for the additional nonroutine analytes may vary, depending upon the results of the method validation study.

b "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, 3rd edition, U.S. EPA, November 1986.

c "U.S. EPA Contract Laboratory Program, Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration." Document No. OLMO1.8 Quantitation limits are contract-required quantitation limits (CRQLs) with the exception of additional organic compounds. The minimum quantitation limits will be reported by the laboratory.

d Medium Soil/Sediment CRQLs are 125 times the low soil/sediment CRQLs for volatile organic compounds and 60 times the low soil/sediment CRQLs for semivolatile organic compounds. Estimated detection limits for metals in soil are based on a 1-gram sample diluted to 200 mL.

e "U.S. EPA Contractor Laboratory Program, Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration." Document No. ILM01.0. Quantitation limits are CRDLs except for vanadium, beryllium, antimony, aluminum and additional elements. The minimum quantitation limits will be reported by the laboratory.

f Based on a 10-gram soil sample and 100 mL volume of extractant and a soil moisture content between 0 and 10 percent (rounded). Actual quantitation limit will vary with the sample and extractant amounts and will depend upon the nature of the soil matrix.

g "Methods for Chemical Analysis of Water and Wastes," U.S. EPA, EPA-600/4-79-020 revised March 1983.

h If soils are acidic, CEC will be analyzed by "Method of Soil Analysis, Part 2 Chemical and Microbiological Properties," by H.D. Chapman, American Society of Agronomists. 1965.

i "1991 Annual Book of American Society of Testing Materials Standards," Section 4, Construction, Volume 04.08, Soil and Rock, Building Stones, Geotextiles," ASTM 1990.

j USATHAMA Methods "Ion Nitroexplosives in Water by HPLC" and "Nitroexplosives in Soil by HPLC."

k As cesium-137, assumes no interfering lines.

l Based on 900-mL sample size.

m Based on 650-gram dry sample

n ND 9900 VAX/VMS Spectroscopy Application Package User's Manual (09-0196), Nuclear Data, Inc. Schaumberg, IL, August 1986.

o "Prescribed Procedures for Measurement of Radioactivity in Drinking Water", U.S. EPA, EPA-600/4-80-032, latest version.

p Based on 100-mL sample size.

q Dependent upon percent moisture in sample, based on 10 grams.

r "The Radiochemistry of Plutonium", G.H. Coleman, NAS-NS-3058, National Academy of Sciences, September 1965.

s Based on 2-gram dry sample.

t "The Radiochemistry of Thorium," E.K. Hyde. NAS-NS-3058, National Academy of Sciences, January 1960.

u "Standard Test Methods for Radium in Water," ASTM, latest version.

v Based on 1,000 mL sample size.

w "Manual for the Certification of Laboratories Analyzing Drinking Water," USEPA, EPA/570/9-90/008, April 1990.

x These are the maximum quantitation limits that can be reported for residential well samples.

y Arsenic, selenium, antimony, cadmium, lead, and thallium will be analyzed by graphite, furnace with Zeeman background correction. Lead and antimony have the option for deuterium background correction.

z "The Radiochemistry of Uranium", J.E. Grindler, NAS-NS-3050, National Academy of Sciences, March, 1962.

NA - Not Applicable

Table VI.1. (Page 14 of 14)

1 "The Radiochemistry of Barium, Calcium, and Strontium," D.N. Sunderman and D.W. Townley, NAS-NS-3010, National Academy of Sciences, January 1960.
"Determination of Strontium-89 and -90 in Soil With Total Sample Decomposition," D.B. Martin, Analytical Chemistry, October 1979.
"Procedures for Determination of Stable Elements and Radionuclides in Environmental Samples," Public Health Service Publication 999-RH-10, January 1965.

2 "EML Procedures Manual," HASL-300, Environmental Measurements Laboratory, U.S. Department of Energy 27th Edition.

3 Procedure includes a statement of work, provided in Appendix C.

NA - Not Applicable

method. A modification (Modification D) to the CLP SOW (See Appendix B) has been prepared to accommodate this additional compound.

Residential well samples collected during the OU-9 field effort using procedures described in the OU-9 QAPP will also be analyzed by the CLP SOW, however lower quantitation limits are needed, as noted on Table VI.1.

6.2.3. Pesticides/PCBs

The CLP SOW document number OLM01.8 will be used to analyze groundwater, surface water, and soil/sediment samples. This method uses gas chromatography for separating and identifying the TCL pesticide/PCB compounds. The capillary columns specified in the method will be used.

Residential well samples collected during the OU-9 field effort using procedures described in the OU-9 QAPP also will be analyzed by the CLP SOW (Document No. OLM01.8); however, lower quantitation limits have been specified on Table VI.1.

6.2.4. Metals

Groundwater, surface water, and soil/sediment samples will be analyzed for the TAL of metals according to the CLP SOW (EPA 1990b). Inductively coupled plasma (ICP) will be used to detect all the TAL metals with the exception of mercury, arsenic, lead, selenium, thallium, and potassium, which will be detected by atomic absorption (AA) (flame AA for potassium, cold vapor AA for mercury, and graphite AA for the others). Additional elements to be detected by ICP are: bismuth, molybdenum, lithium, and tin. These modifications to the method have been prepared as "Modification A" to the CLP SOW (See Appendix B). ICP metals will also be digested according to EPA Method 200.7 with a fourfold concentration in order to reach lower detection limits for aluminum, antimony, beryllium, and vanadium.

Residential well samples will also be analyzed by the CLP SOW (Document No. ILM01.0 EPA 1990b) for the TAL metals with modifications in quality control procedures (see Table III.2) and methodologies for specific analytes. Arsenic, selenium, antimony, cadmium, lead, and thallium will be analyzed by graphite furnace atomic absorption according to CLP SOW with Zeeman background correction. Antimony and lead may have a deuterium background correction instead of Zeeman. This modification will accommodate potential interferences that can arise during analysis of these elements. Additional

elements to be detected by ICP are: bismuth, molybdenum, lithium, and tin. These modifications have been prepared as "Modification B" to the CLP SOW (See Appendix B).

6.2.5. Radionuclides

Groundwater, surface water, and soil/sediment samples will be analyzed for isotopic plutonium, isotopic thorium, isotopic uranium, americium-241, strontium-90, and radium-226 according to the laboratory-developed SOPs. These methods are based on established procedures of EPA (EPA 1980), DOE (DOE, 1982), the National Academy of Sciences, or ASTM (ASTM, 1991). With the exception of strontium-90, alpha spectrometry is used to detect alpha emissions from the isotopes of interest. A surface barrier detector is used for identifying plutonium, uranium, and radium-226.

6.2.5.1 Alpha Spectrometry

Specific isotopes from alpha spectrometry include americium-241 (waters), plutonium-238, 239/240; uranium-234, uranium-235, uranium-238; and thorium-227 (for calculation of actinium-227), thorium-228, thorium-230, and thorium-232. Soil samples are prepared using acid digestion procedures to concentrate the isotopes of interest in an aqueous matrix. The alpha emitting isotopes in these acid extracts and in water samples are precipitated from the aqueous solution. The precipitates are redissolved and subjected to a sequential separation of alpha isotopes by elution from anion/cation exchange resins. The separated alpha isotopes are counted using a surface barrier detector. Specific isotopes determined by alpha spectrometry include americium-241 (for waters); plutonium-238, 239/40; uranium-234, 235, and 238; and thorium-227 (for calculation of actinium-227), thorium-228, 229, and 232.

6.2.5.2. Strontium-90

All strontium present in the sample is assumed to be strontium-90, due to the short half-life of strontium-89 and the knowledge of process at Mound Plant. Soil samples are subjected to acid digestion to remove interferences and concentrate the strontium as an aqueous matrix. Sr-90 is precipitated from aqueous samples and extracts. Interferences are reduced by continued precipitations of the strontium carrier. The beta activity of Sr-90 is determined with a gas flow proportional detector, immediately after removal of yttrium-90.

6.2.5.3 Gamma Spectrometry

Gamma spectrometry measures gamma radiation over a given spectrum and will be used to determine the gamma radiation levels in water and soil/sediment samples. Particular isotopes of interest that will be detected as gamma radiation are radium-226 (soil samples), bismuth-210 metastable, americium-241 (soil samples), cobalt-60, cesium-137, bismuth-207, polonium-210, and potassium-40. Analysis will be performed according to the instrument's spectroscopy application user's manual. Sample preparation and analysis procedures are provided in the laboratory SOPs. The detection limits listed on Table VI.1 are based on cesium-137 and assume no interfering lines. Detection limits of individual isotopes may vary.

6.2.5.4 Tritium

Groundwater, surface water and soil/sediment samples will be analyzed for tritium according to EPA Method 906.0 ("Prescribed Procedures of Measurement of Radioactivity in Drinking Water," EPA-600/4-81-004). Beta emissions are detected using a liquid scintillation method with a fluorescence detector. A Statement of Work for preparation of soil samples for tritium analysis is provided in Appendix C.

6.2.6. Explosives

Both soils/sediments and water samples will be analyzed for ten USATHAMA explosives and pentaerythritol tetranitrate (PETN) using high performance liquid chromatography (HPLC). Analysis will be performed according to laboratory SOPs which are based on and approved by the USATHAMA quality assurance program. Second column confirmation will be performed if positive results are obtained on the primary column. PETN will be detected at a different wavelength (220 nm) on a separate analytical run. A Statement of Work for analysis of PETN is provided in Appendix C.

6.2.7. Chloride, Nitrate-Nitrite, Sulfate, Ammonia, Fluoride and Total Phosphorus

Soil/sediment or water samples will be analyzed for either chloride, nitrate-nitrite, ammonia, fluoride, sulfate, and total phosphorus. Analysis will be performed using colorimetry, based on EPA Methods 325.1/325.2 or 9250/9251 for chloride, 353.2 for nitrate-nitrite, 350.3 or 350.1 for ammonia, 375.2 for sulfate, and 365.1 for total phosphorus (EPA 1984 and EPA 1986). Fluoride will be detected using an ion-selective electrode using EPA Method 340.2. Soil/sediment samples will be extracted with deionized water

for the dissolution of the desired anions prior to analysis, according to the statement of work in Appendix C. Soil detection limits are based on a 10-gram soil sample, 100 mL of extractant, and a soil moisture content between 0 and 10 percent. The actual detection limit will vary depending upon these variables. The laboratory will perform only one of the identified methods for chloride for a given field investigation.

6.2.8. Total Kjeldahl Nitrogen

Groundwater and surface water samples will be analyzed for total Kjeldahl nitrogen using EPA Method 351.3 (EPA 1983). Analysis consists of converting nitrogen to ammonia, then detecting the ammonia by colorimetry using Nesslerization.

6.2.9. Total Organic Carbon

Soil/sediment samples and groundwater/surface water samples will be analyzed for total organic carbon (TOC), using EPA 415.1 or 415.2. Analysis consists of converting organic carbon to carbon dioxide, which is detected by a non-dispersive infrared detector. Soil/sediment samples undergo a pyrolysis to release the carbon dioxide to be detected. This preparation procedure is described in a Statement of Work in Appendix C.

6.2.10. Nitrite, Soil pH, and Alkalinity

Groundwater samples will be analyzed in a field laboratory for nitrite, and alkalinity and soil samples for soil pH in order to meet the required holding times. Nitrite will be analyzed by EPA Method 354.1 using spectrophotometry for detection of the formed diazonuim compound.

Soil pH will be performed according to the SW846 electrometric procedure, SW9045.

Alkalinity will be measured using the tritrametric method in EPA method 310.1. Carbonate and bicarbonate species will be calculated based on the measurement and the pH of the sample and by making assumptions on alkalinity relationships.

6.2.11. Total Dissolved Solids (TDS) and Total Suspended Solids (TSS)

TSS and TDS for groundwater and surface water samples will be analyzed according to EPA Methods 160.1 and 160.2 (EPA 1984).

6.2.12. Cation Exchange Capacity (CEC), Specific Gravity, Particle Size Analysis, Hydraulic Conductivity, Organic Content, Soil Moisture, Maximum Density, and Relative Density

Selected soil samples will be analyzed for CEC, specific gravity, particle size analysis, hydraulic conductivity, organic content, soil moisture, and relative density. CEC will be analyzed by EPA Method 9081. The sodium measurement as part of the CEC analysis will be performed by ICP using CLP SOW methodology as stated in this document for metals. The other physical parameters will be analyzed by the procedures specified in the ASTM Methods noted on Table VI.1.

6.2.13. Cyanide

Cyanide will be analyzed according to the CLP SOW for water and soil samples. This method uses spectrophotometry. The required detection limits for cyanide are 10 μg/L for water and 2 mg/kg for soil.

6.2.14. Lanthanides

Soil/sediment samples will be analyzed for lanthanides using ICP per the CLP SOW. Lanthanides include the elements lanthanum, cerium, praseodymium, neodymium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and lutetium. A modification (Modification C) to the CLP SOW Document No. ILM01.0 defines the procedures applicable to lanthanides.

6.2.15. Dioxin/Furans

Soil/sediment and water samples will be analyzed for all 2,3,7,8-substituted isomers and total isomer homologs (tetra through octa) for polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans, using methodology based on SW-846 method 8290. This is a high-resolution gas chromatography (HRGC)/high-resolution mass spectrometry (HRMS) method, using isotopically-labeled internal standards for quantitation. Specific qualitative criteria, per method 8290, must be met for a gas chromatographic peak to be identified as a PCDD or PCDF. Table VI.1 lists the expected quantitation limits for this method and Table III.2 lists the required quality control procedures for the method.

7. CALIBRATION PROCEDURES AND FREQUENCY

Before any instrument is used as a measuring device, the instrument's response to known reference materials (traceable to an appropriate agency standard such as NIST, NBS, or ASTM) must be determined. The manner in which various instruments are calibrated is dependent upon the particular type of instrument and its intended use. All sample measurements must be made within the calibrated range of the instrument. For laboratory analyses, appropriate sample dilution is performed if the instrument response is greater than the upper end of the calibration range.

The contractor's Equipment Manager is responsible for ensuring that the following practices and procedures are implemented for all equipment under his/her control:

- Establishing a calibration and maintenance schedule for all measurement and testing devices in accordance with manufacturers' specifications. The method and interval of calibration will be contingent upon the type of device, stability characteristics, required accuracy, and other conditions affecting measurement control.

- Determine the proper range, type, and accuracy for the equipment-specific calibration test being performed based on the manufacturers instructions, the contractor's SOPs, and his or her experience with the equipment in use.

- Maintain a master calibration file in the corporate storage warehouse and record daily calibration checks in the field log books for each measurement and testing device that includes at least the following information:.

  - Name of device;

  - Device serial and/or identification number;

  - Frequency of calibration;

  - Date of last calibration;

  - Name of party performing last calibration; and

  - Due date for next calibration.

- Mark measurement and testing equipment with calibration due dates when possible. Otherwise, alternative methods of tracking a device's calibration due date (such as by serial number) shall be employed.

- Calibrate measurement and testing equipment in accordance with the manufacturers' specification or the requirements of a written SOP. Each

instrument shall be calibrated prior to use, and documentation shall be available that substantiates the type and frequency of calibration.

- Employ appropriate methods to ensure proper handling, storage, and care of the test equipment in order to maintain required test accuracy.

7.1. FIELD EQUIPMENT

Applicable field instruments to be used during the investigation will be calibrated according to the specifications set forth in the respective Mound Plant ER Program SOPs (Appendix A). The respective Mound Plant ER Program SOPs for field equipment include the following:

2.2 Field Measurements on Ground and Surface Water Samples
3.1 Water Level Measurement
3.3 Operational Check of Pressure Transducers Used in Measuring Water Levels in Wells
6.1 Health and Safety Monitoring of Combustible Gas Levels
6.2 Health and Safety Monitoring of Organic Vapors with a Photoionization Detector
6.3 Health and Safety Monitoring of Organic Vapors with a Flame Ionization Detector
6.4 Total Alpha Surface Contamination Measurements
6.7 Near Surface and Soil Sample Screening for Low-Energy Gamma Radiation Using the FIDLER

Instruments will be calibrated at least once per day during field use. Table III.1 in Section 3 summarizes the calibration procedures, frequency of calibration and acceptance criteria necessary for the calibration to be valid for applicable field measurements and field screening.

Records for each field instrument used as part of this program will be maintained to ensure its capability of providing accurate and precise measurements. Records will be maintained on instrument maintenance and calibration. Such records will be reviewed prior to their use in the field. Tracking of instrument records will be accomplished by assigning a unique number to each instrument that will correspond to its records file.

The field measurement and field screening instruments that may be used in the field during the environmental investigation are presented in the following subsections.

7.2. LABORATORY EQUIPMENT

Laboratory instrument calibrations typically consist of two types, initial calibration and continuing calibration. Initial calibration procedures establish the calibration range of the instrument and determine

instrument response over that range. Typically, three to five analyte concentrations are used to establish instrument response over a concentration range. The instrument response over that range is commonly expressed as a correlation coefficient (e.g., for UV-visible/infrared spectrophotometry) or by a response factor, amount/response (e.g., for GC, GC/MS, or high-performance liquid chromatography).

Continuing calibration usually includes measurement of one or more calibration standards. The response is compared to the initial measured instrument response. Continuing calibration is performed at least once per operating shift for laboratory analyses.

Instrument calibration procedures for CLP analyses will be performed according to the CLP SOW for inorganic and organic analyses. For non-CLP analyses, calibration procedures will be performed as described in the approved analytical method and are described in the approved laboratory SOPs. Calibration procedures for all laboratory analyses, along with frequency and acceptance criteria, are summarized in Table III.2 in Section 3.

8. INTERNAL QUALITY CONTROL CHECKS

Internal quality control checks are performed as part of a field investigation in order to monitor and assess the quality of the data generated. Quality control checks are used to evaluate the accuracy and precision of field screening, field measurements, sampling technique, and laboratory analyses. Acceptance criteria for the quality control checks, and corrective actions to be taken if criteria are not met, have been established for this program so that data of known quality is obtained (Table III.2). The following subsections summarize those internal quality control checks.

8.1. SCREENING AND FIELD MEASUREMENTS

Quality control procedures for screening and field measurements are limited to checking the reproducibility of the measurement by obtaining multiple readings and by calibrating the instruments (when appropriate) with either internal references or external standards. The frequency of these checks and acceptance criteria are presented on Table III.1.

8.2. FIELD SAMPLING

Field conditions and sampling techniques for surface water, groundwater, soil and sediment can be assessed by the collection of trip blanks, equipment (rinsate) blanks, ambient blanks, and duplicate samples for selected laboratory analyses. Blank samples will not be labeled as such so that laboratory bias is minimized. The laboratory will be kept from using these samples for internal quality control by indicating which samples are to be used for internal quality control on the chain-of-custody record.

Trip, ambient, and equipment blanks monitor environmental conditions or sampling technique in order to detect potential sample contamination. Trip blanks monitor for volatile organic contamination during sample transport and storage for soil and water matrices. Trip blanks are prepared in the laboratory by filling vials with organic-free deionized water (ASTM Type II quality), sealing the vials with no air bubbles, and transporting them to the site. These blanks remained unopened while stored with the collected samples (one set per sample cooler).

Equipment (rinsate) blanks are used to evaluate the decontamination technique of soil and water sampling equipment that is not dedicated to a given sampling location. Equipment blanks are prepared by filling

sample bottles with organic-free, deionized water (ASTM Type II quality) that has been routed through a decontaminated sampling device, including the filtering apparatus (metal samples only).

Ambient blanks monitor for VOCs potentially present in the surrounding environment where a sample is being collected. These are collected at selected sampling locations at a frequency of one per 20 samples by placing organic-free deionized water (ASTM Type II quality) in sample vials, capping the vials with no air bubbles, and shipping them to the lab for VOA analysis.

Trip blanks are collected such that one set of sample vials accompanies each cooler that contains samples for volatile organic analysis. Equipment blanks are collected for every 10 or fewer samples and will be analyzed for the same parameters as the samples collected with the equipment.

Collection of duplicate samples will be used to measure the precision of the sampling technique. A duplicate sample is collected for every sample group, including every 10 or fewer water samples or every 10 or fewer soil samples collected in the field. A relative percent difference is calculated for the duplicate sample analysis as defined in Section 3 and is used to evaluate sampling precision. Monitoring analytical precision is discussed in the following section, Laboratory Analyses. Acceptance criteria for precision of duplicate field samples has not been established. A high variation in soil sample results for the primary and duplicate sample is common due to the nonhomogeneous nature of soils; therefore, duplicate soil sample results will be assessed accordingly.

A bottle lot blank will be prepared if there is an indication from the analytical results that a non-CLP analyte is a bottle contaminant. At least one bottle for each lot used for non-CLP analytes will be stored in the shipping box for this purpose. A bottle blank will be prepared by filling the sample bottle with organic-free, deionized water (ASTM Type II quality), and capping it.

8.3. LABORATORY ANALYSES

Internal quality control checks for CLP analyses are specified in the organic SOW (EPA 1990a) and the most current inorganic SOW (EPA 1990b). These quality control checks are summarized on Table III.2 along with frequency and acceptance criteria. Corrective actions to be taken, if any acceptance criteria are not met, are specified in the EPA CLP SOWs for organic and inorganic analyses.

Internal quality control checks for non-CLP analyses are specified in the analytical method and in Table III.2. Additional quality control checks for some analyses will be performed and are also summarized in Table III.2. Frequency of the checks, acceptance criteria, and corrective actions (as presented in Table III.2) are based on guidance in the analytical method. Laboratory established control limits may be specified (once a lab is selected) if they exceed those given in the method or if no limits are given in the method. Quality control samples that will be evaluated for the data quality indicators include:

- **Method Blanks.** A method blank is defined as a volume of deionized distilled laboratory water, or in some cases a purified solid matrix analyzed using the same reagents and procedures as used on the environmental samples. Data obtained from method blank samples indicate whether environmental samples may have been contaminated during the sample handling and analytical process. A method blank will be processed daily at the beginning of the analytical batch sequence.

- **Split Samples.** Split samples will be derived from a single sample that is homogenized, divided into two or more equal parts, and then placed into separate containers. The initial sample will be split in the field prior to delivery to the laboratory. Split samples will be analyzed by a laboratory selected by the party or parties requesting the split sample.

- **Surrogate Spikes.** Surrogate compounds are organic constituents similar in chemical composition, extraction, and chromatography to the analytes of interest, but which are not normally found in environmental samples. An assessment of surrogate recoveries provides information on the accuracy and precision of the analytical method. Surrogate compound spikes will be required for GC/MS analysis and will be spiked into all samples.

- **Matrix Spikes and Duplicates.** Matrix Spike and Matrix Spike Duplicate analyses are performed to evaluate the effect of the sample matrix upon the analytical methodology. Method precision and its relationship to the specified matrix is determined through an assessment of matrix spike recoveries.

- **Laboratory Control Samples.** Laboratory control samples will be used to assess the laboratory's analytical performance and provides an indication of the level of analytical method accuracy.

- **Calibration Check Samples.** These are standard sample solutions analyzed to determine instrument calibration accuracy. The calibration check standard solution is developed separately from the working standards used to initially calibrate the instrument.

9. DATA REDUCTION, VALIDATION, AND REPORTING

9.1. FIELD AND TECHNICAL DATA

The field and technical (non-laboratory) data that will be collected during the RI effort at Mound Plant can generally be characterized as either objective or subjective data. Objective data include all direct measurements such as field screening/analytical parameters and water level measurements. Subjective data include descriptions and observations made in the field by the field sampling team member for things such as sample texture, nonhomogeneity, the change in color or degassing upon the addition of preservative to a sample, etc. Test boring and well logs include both types of data, in that the data recorded in the field are descriptive but can be reduced using the standardized lithologic coding system.

9.2. LABORATORY DATA

9.2.1. Laboratory Data Reduction

The computation of analytical results from the raw data generated is performed as prescribed in the various analytical methods. The step-by-step calculations are provided in the referenced analytical method. Data reduction procedures unique to the laboratories used are specified in the analytical laboratory project QA plan. Sample results will not be corrected for method blank results.

Laboratory data is stored separately for each project by the laboratory. Included in the file are calibration records, raw analytical data, processing of data, data validation, quality control samples results, data reports, and project-specific requirements. These records are kept for a minimum of 10 years. The EG&G subcontractor and EPA Region V will be notified of intent to dispose of Mound Plant data.

The laboratory limits access to laboratory data files and the laboratory's electronic database. Only laboratory personnel as designated in their position description are allowed to access the files and the database. The database will be accessed by individual password only. Each individual will be limited to areas in the database which relate directly to their positional responsibilities.

9.2.2. Laboratory Data Validation

Data validation procedures performed in the laboratory are described in the analytical laboratory project QA plan. In addition to the data review performed by the appropriate laboratory, ICF KE will validate the analytical data.

Data Generated Under CLP

Validation by ICF KE will be performed on all CLP organic and inorganic analyses in a step-by-step approach. These data will first be evaluated against the requirements of this QAPjP. The CLP-generated data (TCL organic compounds and TAL inorganic parameters) will then be evaluated according to EPA CLP validation procedures ("Laboratory Data Validation - Functional Guidelines for Evaluation of Inorganic Analyses, July 1, 1988;" and "Laboratory Data Validation - Functional Guidelines for Evaluation of Organic Analyses, February 1, 1988," prepared by the EPA Data Review Work Group, latest revisions).

Non-CLP Data

The Mound Plant ER Program will use the criteria described in this section to evaluate the acceptability of all non-CLP data. Non-CLP analyses include volatile organic compounds in groundwater, radiological constituents, common anions, total nitrogen and phosphorous, total dissolved solids, total suspended solids, alkalinity, TOC, and explosives.

The evaluation of these analytical results will consist of the following components:

- Were the appropriate SOPs followed during sample collection?
- Were the samples containerized and handled as described in the FSP and SOPs?
- Were the appropriate number and type of field quality control samples collected?
- Are the data packages complete (subsection 9.2.3)?
- Did the field and laboratory quality control checks meet the established acceptance criteria (Section 3)?

9.2.3. Laboratory Data Reporting

Laboratory data reporting will be provided on electronic media (as ASCII files of a specified format) and in hard copy data reports. All data report packages (i.e., hard copy results and supporting data) received from the laboratory will be single copy, legible, paginated, reproducible, and unbound. Complete packages are shipped only with the electronic data deliverable in no greater than three laboratory batches in any given day of shipment. Only data report packages containing all results for a given field batch will be shipped. Laboratory batches cannot be any greater in size than the identified field batch.

The data report packages are reviewed by a supervisor of a given analytical group or his/her designee for the completeness requirements specified in this section and the analytical laboratory project QA plan. The supervisor's designee can not be the preparer of the data report package. At least one identical copy of the data package must be kept in the project files at the laboratory.

Contents of Data Reports

Laboratory data reports will contain sufficient data to verify each aspect of the analysis, including sample preparation, instrument calibration, sample analysis, and calculation of the final result. All laboratory data report packages for each type of analysis will contain a case narrative that summarizes the following information on the given set of samples analyzed:

- Date of issue;
- The laboratory analysis performed;
- Any deviations from the stated analytical method;
- The laboratory batch number;
- The laboratory SOP number and revision date;
- The instrument settings and columns used;
- The number of samples and the sample matrices;
- A reference to the quality control procedures performed for the specific methods used, including the reference to the acceptance criteria used.;
- The contents of the laboratory report;

- The project name and number;
- The condition of the sample received (e.g., whether preserved and packaged properly);
- Whether sample holding times were met and identification of those samples for which they were not met;
- Any observations that may have had an impact on the analyses;
- Any technical problems affecting the analysis and corrective actions taken;
- Laboratory quality control checks that did not meet the project criteria (as specified in the QAPP) and/or laboratory criteria (include any corrective actions taken and any known possible reasons for the results); and
- The laboratory manager's signature approving the issuance of the data package.

A copy of the chain-of-custody form with all relinquished signatures will accompany each data package.

10. PERFORMANCE AND SYSTEM AUDITS

Audits may consist of two types, system audits and performance audits. The purpose of a system audit is to determine whether appropriate project systems such as equipment, instruments, procedures, qualified personnel, etc., are in place. Performance audits are used to indicate whether those systems are functioning properly and capable of meeting project requirements. Internal audits will be conducted by the EG&G subcontractor's project QAO or the subcontractor's designated auditor to verify the existence of a quality control system and evaluate the level of compliance with that system for quality control measures, standards, records, and project documentation and control. External audits will be performed by EPA Region V, the Region V Central Regional Laboratory, and/or the Region V Central District Office.

The QAO or the subcontractor's designee will be responsible for conducting audits. The auditor must have a working knowledge of Mound Plant and of the associated operable unit, and a detailed understanding of the QAPjP, associated SOPs, and the FSP. The auditor is also expected to have an understanding of technical issues related to the field and laboratory sampling program. Finally, the QAO or the designated auditor must exhibit experience with quality assurance audits.

10.1. TECHNICAL PERFORMANCE AUDITS

Technical performance audits will be conducted by the ICF KE QAO or assigned qualified personnel of ICF KE on an ongoing basis during the project, as field data are generated, reduced, and analyzed. These audits will be scheduled and executed as part of work on each operable unit. All numerical analyses, including manual calculations, mapping, and computer modeling, will be documented and will be the subject of performance audits in the form of quality control review, numerical analysis, and peer review. Technical peer review is the responsibility of the Mound Plant ICF KE project manager and will be performed for project data reductions, analyses, and reports.

10.2. FIELD PERFORMANCE AUDITS

The ICF KE's QAO or the designated auditor will perform at least one internal field performance audit during each phase (i.e., drilling, soil sampling, water sampling, etc.) of the investigation. Field sampling and associated activities will be audited at least once. The purpose of field performance audits is to

ensure that the methods and protocols detailed in this QAPP are being consistently adhered to in the field.

Field performance audits will be performed using an audit checklist of the format presented in Figure 10.1. The QAO will base the audit questions on all procedures to be followed in the field, as found in the Work Plan, Field Sampling Plan, and other applicable guidance documents. The field performance audit will include a review of the following activities:

- Air, soil/sediment, groundwater/surface water, biological tissue sampling procedures;
- Field measurements and field screening procedures;
- Field logbook documentation;
- Sample labeling, handling, and custody procedures;
- Decontamination and storage of equipment;
- Completion of ER Program field forms;
- The number and type of quality control samples collected; and
- Drilling procedures.

These activities will be reviewed for their adherence to the procedures established in the FSP, Mound Plant ER Program SOPs, and the QAPP. Audit questions will be developed by the QAO. These checklists are used to ensure completeness of the review and to document the results of the audit.

As part of the field audit, field operation records will be reviewed to verify that field-related activities were performed in accordance with appropriate project procedures. Items reviewed will include, but are not limited to, field equipment calibration records, daily field logs, and chain-of-custody documentation. Upon audit completion, an audit report containing observations and any findings and associated corrective actions will be submitted to the ER Program EG&G installation coordinator, ICF KE project manager, and installation manager. These reports will be delivered to EPA upon their request.

EPA Region V, the Region V Central Regional Laboratory, and/or the Region V Central District Office are responsible for performing external audits of field activities.

SAMPLE AUDIT CHECKLIST

FACILITY	AUDITOR(S)	DATE

ACTIVITY/REQUIREMENT	AUDIT QUESTIONS	ANSWER			AUDITOR COMMENTS
		Yes	No	N/A	

SAMAUDCK/PANTEX/3-30-89

Reference: Operable Unit 9, Quality Assurance Project Plan, June 1993

Figure 10.1. Sample Audit Checklist Form

10.3. PROJECT SYSTEM AUDITS

The DOE or its subcontractor director of quality assurance may periodically, on an unannounced basis, call for a corporate project audit (system audit). The project manager must respond by submitting the project QAPP, and the auditor will then determine whether the QAPP is in place. The auditor will also determine whether the audits called for in the QAPP have been, and are being, conducted. Certain projects are identified by the director of quality assurance for a more formal audit on a scheduled basis.

Those audits evaluate, in depth, the implementation of the QAPP in the project as it applies to field and laboratory data analysis and reduction procedures. The division operations manager, in the role of division quality assurance officer, may ask the director of quality assurance to perform an audit or may personally conduct the audit.

10.4. LABORATORY AUDITS

10.4.1. Laboratory System Audits

The EPA Region V Central Regional Laboratory will perform external system audits of the laboratories, as necessary, for this program. This audit may include an onsite visit of the laboratory. An audit of the analytical laboratories will also be performed by the ER Program EG&G subcontractor QAO prior to the implementation of the RI. The system audit will consist of review of the laboratory quality assurance manual; the instrumentation and/or analytical system developed for the analyses of interest; sample preparation methodologies; laboratory sample handling, log-in, and custody procedures; data reduction and reporting procedures; data validation procedures; instrument calibration procedures; the quality control program developed for the methods; and other laboratory procedures that may impact the laboratory analyses to be performed for this investigation. The laboratory systems audit checklist to be used for the OU-2 investigation is the same one presented in the Mound Plant OU-9 QAPP, Appendix D. Results of laboratory systems audits including the checklist and reports to the laboratory will be distributed to EG&G Mound and DOE, Ohio EPA, and USEPA upon their request.

10.4.2. Laboratory Performance Audits

An onsite performance audit of the analytical laboratories may be performed at least once and as determined necessary during this investigation by the ER Program EG&G subcontractor QAO. The

performance audit will evaluate at a minimum the laboratories' performance on the following activities specific to the investigation:

- Implementation and follow-through of the laboratory quality control program established for this investigation as defined in the QAPP,
- Sample custody and handling procedures,
- Analytical methods followed as defined in the QAPP,
- Sample tracking,
- Data reduction,
- Data validation,
- Instrument calibration,
- Sample preparation, and
- Documentation of data analysis/data reduction.

The EG&G subcontractor will perform a GC/MS magnetic tape audit once per year per laboratory on selected data packages.

Results of performance audits will be distributed to EG&G Mound, DOE, and US EPA upon their request.

The analytical laboratory will participate in one or more of the following:

- USEPA CLP round robin program (laboratories performing chemical analyses);
- USEPA RAD Intercompanies Program Studies (laboratories performing radiological analyses);
- U.S. DOE Environmental Measurements Laboratory Quality Assurance Program (laboratories performing radiological analyses);
- Or a comparable cross check program.

The results of the EPA cross-check program are evaluated by the EPA, and the results are published as part of the public record. The DOE Environmental Measurement Laboratory performance samples will be reviewed by the DOE or their subcontractor to ensure acceptable laboratory performance.

The laboratory quality assurance coordinator has responsibility for monitoring the internal quality assurance program. The quality assurance coordinator is responsible for scheduling, coordinating, and conducting internal performance audits and for reviewing data for performance samples received. The quality assurance officer supplies blind performance samples to the laboratory at least semiannually.

External performance audits of the laboratories will also be conducted by the EPA Region V Central Regional Laboratory as necessary. This audit may include an onsite visit to the laboratories.

10.4.3. Laboratory Monitoring

Laboratories conducting analyses on samples collected at Mound Plant will be routinely monitored by the EG&G subcontractor. The following monitoring activities will be performed:

- The topics of daily communication with the laboratory will be established prior to receipt of samples. The primary points of contact within the laboratory and the EG&G subcontracting firm will be identified. Daily communication during field sampling and routine communication with the laboratory contact during sample analysis will, at a minimum, include:
  - Sample receipt
  - Status of sample analysis
  - Nonconformances
  - Data reporting
  - Other anomalies in program

Results of the above will be submitted to the EG&G subcontractor by the laboratory as a laboratory monthly progress report.

- The EG&G subcontractor will ensure the laboratory implements project QAPP requirements by having the laboratory prepare a Quality Assurance Summary (QAS) which is used by the group leaders and analysts. The QAS summarizes project-required sample handling, QC, and methodology which deviates from normal laboratory operations. The QAS is reviewed and approved by the EG&G subcontractor.

- The laboratory will supply the primary contact a controlled copy of SOPs, including all updates. SOPs will be reviewed by the EG&G subcontractor as they are updated to ensure laboratory procedures do not conflict with program requirements.

- Performance evaluation (PE) samples will be submitted blind at least annually per laboratory during a field sampling program for selected analytes. Procedures for collection of PE samples are provided in Appendix F of the Mound Plant OU-9 QAPP.

- Split samples are collected as necessary for a given program and submitted blind to a second laboratory. Procedures are presented in Appendix F of the Mound Plant OU-9 QAPP. Split samples are sent at a minimum of one per 50 or less critical samples collected as defined for the operable unit specific program.

- A performance audit is conducted as necessary by the EG&G subcontractor. When recurring nonconformances or severe impact on data quality or data usage occurs, a performance audit will be conducted by the EG&G subcontractor.

- Project opening meetings with the laboratory will be conducted prior to field sampling by the EG&G subcontractor to discuss: 1) project requirements, 2) communications, 3) sample shipment, 4) implementation of the QAPP, 5)data reporting, and 6) documentation of nonconformances to the QAPP.

- Data packages are reviewed by the EG&G subcontractor for completeness within one month of receipt.

- Data validation will be initiated within six weeks of complete data package receipt to identify any technical deficiencies in the data.

11. PREVENTIVE MAINTENANCE

Proper preventive maintenance of field and laboratory equipment is a necessary element in achieving equipment reliability and minimizing equipment downtime.

11.1. FIELD EQUIPMENT

Field equipment will be properly calibrated, properly charged, and in good general working condition before the beginning of each working day. The required equipment checks and their frequency for each type of field equipment to be used are defined in Mound Plant ER Program SOPs 2.2, Field Measurements on Ground and Surface Water Samples (revision 2), 3.1, Water Level Measurement (revision 1), 6.1, Health and Safety Monitoring of Combustible Gas Levels (revision 1), 6.2, Health and Safety Monitoring of Organic Vapors with a Photoionization Detector (revision 1) 6.4, Total Alpha Surface Contamination Measurements (revision 0), and 6.7, Near Surface and Soil Sample Screening for Low-Energy Gamma Radiation Using the FIDLER (revision 0). Table III.1 in Section 3 summarizes the checks to be performed during the OU-2 investigation. Any nonoperational field equipment will be removed from service and returned to the supplier, and a replacement will be obtained. Field equipment will not be repaired in the field. The following spare parts will be kept in the field for the groundwater sampling effort: extra titration kit, pH electrodes, pH meter, electrical conductivity meter, water level indicator, dissolved oxygen meter, thermometer, bailer, and pump motor. Maintenance records will be maintained for each field instrument according to a unique number affixed to the instrument. These records will be reviewed prior to their use in the field to ensure that instrument maintenance and calibration are up-to-date.

All field instruments will be properly protected against inclement weather conditions during the field investigation. Each instrument is specially designed to maintain its operating integrity during variable temperature ranges that are representative of ranges that will be encountered during cold-weather working conditions. At the end of each working day, all field equipment will be decontaminated following Mound Plant ER Program SOPs, taken out of the field, and secured in a cool, dry room for overnight storage.

All subcontractor equipment (e.g., drill rigs and water trucks) will arrive at the site in proper working condition each day. Before the start of work each day, the field supervisor will inspect all equipment for fluid leaks. Cables on drill rigs will also be inspected. If a leak is detected or a cable is frayed, the equipment will be removed from service for repair or replacement.

11.2. LABORATORY EQUIPMENT

The ability to generate valid analytical data requires that all analytical instrumentation be properly maintained. All analytical laboratories used for the OU-2 program will have a full service contract or an equivalent maintenance program on all major instruments. Specific preventive maintenance programs for each laboratory are presented in the laboratory specifications attachments.

12. SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

The procedures to assess precision, accuracy, and completeness are presented in Section 3 of this QAPjP. The definition and acceptance criteria are used to assess precision, accuracy, and completeness can be found in Section 3 (Tables III.1 through III.3). Precision will be assessed from measurements duplicates taken of the same measurement at different times. The relative percent difference (RPD) will be used to establish a time profile of method performance. The equation for RPD is provided below.

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

Where:

A = Original Concentration

B = Duplicate Concentration

When sufficient data has been collected, an average RPD and standard deviation will be calculated for reporting and quality control limit delineation. The standard deviation is defined as the square root of the variance of a set of values and is calculated using the equation:

$$s = \sqrt{\frac{\sum_{i=1}^{n} (Xi - \bar{X})^2}{n-1}}$$

where: Xi = Individual Measurement

$\bar{X}$ = average of the individual measurements

n = Number of individual measurements

In the laboratory, control charts will be maintained to provide a timely assessment of precision for measurement functions. Warning and control limits will be established for all measurements. The warning limits will be reported as the mean + 2 standard deviation units, and the control limits will be reported as + 3 standard deviation units. The control charts and the associated control limits will be updated following the last twenty points or annually, whichever occurs first.

Accuracy will be assessed from measurements of known concentrations of reference materials. The assessment for accuracy will be independent of the routine calibration process (e.g., reference materials will be obtained from independent source and will be prepared independently). The percent recovery will be used to assess accuracy using the following equation:

$$P = \frac{A - B}{T} (100)$$

where:

P = Percent recovery

A = Analytical result from spiked sample

B = Independently measured background level

T = True value

In the laboratory, control charts will be maintained to provide a timely assessment of accuracy for measurement functions. Warning and control limits will be established for all measurements. The warning limits will be reported as the mean $\pm$ 2 standard deviation units, and the control limits will be reported as $\pm$ 3 standard deviation units. The control charts and the associated control limits will be updated following the last twenty points or annually, whichever occurs first.

The precision and accuracy requirements for CLP organic analyses, CLP inorganic analyses, and non-CLP analyses are given in Tables III.2 and III.3. All analytical data are reviewed relative to those criteria. For any quality control checks outside the acceptance criteria, the results will be assessed by the EG&G subcontractor for data usability. The acceptance criteria for field quality control checks do not take into account the interdependencies of the checks. Since many of the quality control checks are interrelated (e.g., both a method blank and a trip blank could have contaminants), each batch of analytical data will be assessed on a case-by-case basis. Field blank results associated with soil/sediment data will be used only to provide information on the potential for contamination to exist in the soil/sediment samples and will not be used for quantitative purposes.

The laboratory will review the results of laboratory quality control checks listed on Table III.2. If the results are outside the acceptance criteria, then the corrective actions identified in Section 13 will be performed as needed.

The initial responsibility for monitoring the quality of an analytical system lies with the analyst. The analyst will verify that all quality control procedures are followed and that results of analysis of quality control samples are within acceptance criteria. If acceptance criteria limits are exceeded, appropriate corrective actions will be taken and out-of-control situations will be described in the analytical report case narrative.

13. CORRECTIVE ACTION PROTOCOLS

13.1. FIELD CORRECTIVE ACTION

The initial responsibility for monitoring the quality of field measurements and observations lies with the field personnel. The field manager is responsible for verifying that all quality control procedures are followed according to the Mound Plant ER Program QAPP. This requires that the field manager assess the correctness of field methods and their ability to meet quality assurance objectives. If a problem occurs that might jeopardize the integrity of the project or cause some specific quality assurance objective not to be met, it is the responsibility of all field project staff to report it. Field project staff must report all such suspected problems by initiating a corrective action report (CAR) and submitting it to the field manager (Figure 13.1). The field manager will submit the CAR to the site manager, the project manager, and the project QAO for formal investigation. Corrective actions to selected problems are presented on Table XIII.1. The field site leader will document the problem, develop the corrective action, and document the results, using the form shown in Figure 13.1. He or she will initiate the corrective action and identify and direct the appropriate personnel to implement the corrective action. Any data used subject to a CAR will be flagged. Copies of the documentation form will be provided to the site manager, the ICF KE project manager, and the project QAO. The project QAO will log all corrective action reports.

13.2. LABORATORY CORRECTIVE ACTION

The initial responsibility for monitoring the quality of an analytical system lies with the analyst. In this pursuit, the analyst will verify that all standard operating procedures and quality control procedures are followed according to the approved laboratory QA program and that the results of analysis of quality control samples are within acceptance criteria.

If his assessment reveals that any of the quality control acceptance criteria are not met, he or she must immediately assess the analytical system to correct the problem. The deficiency is reported to the appropriate supervisor, who will complete and sign a nonconformance memorandum form and notify the laboratory Quality Control Coordinator. Written laboratory nonconformances are reported to the Quality Assurance Director monthly.

Page___of___

MOUND PLANT ER PROGRAM
CORRECTIVE ACTION REPORT

[1]Responsible Organization	[2]Date	[3]☐ QF No.___	[4]Work Order No. ____-____-
[5]Identified During	[6]Persons Contacted	[7]Manager	Notified/Date
[8]Requirement			
[9]Finding/Condition Adverse to Quality			
[10a]Significant Condition Adverse to Quality ☐ Yes ☐ No		[10b]Hardware Related ☐ Yes ☐ No Tags applied ☐ Yes ☐ No	
[11]Issue Date			
[12]Initiator Date	[13]Validation Date	[14]QA Manager Date	
[15]Impact On In-Process or Completed Work			
[16]Root Cause of the Adverse Condition			
[17]Remedial Correction Action		Committed Completion Date:	
[18]Corrective Action to Prevent Recurrence		Committed Completion Date:	
[19]Response Prepared By Signature: Date:		[20]Project Manager Approval Signature: Date:	
[21]Response Evaluation ☐ Accept ☐ Reject Comment _____		22 QA Manager _____ Date_____ QA Officer _____ Date_____	
[23]Verification of Correction Action ☐ Accept ☐ Reject Comment _____		24 QA Manager _____ Date_____	
[25]Closure QA Manager _____ Date _____		26 QA Officer _____ Date _____	
27 Tending Codes: _____			

M9QAD12.W13

Figure 13.1. Corrective Action Report

Table XIII.1. Corrective Actions to Specific Field Activities

Problem	Corrective Action
Broken sample bottle	Notify laboratory to determine if enough sample volume, with correct preservation and bottle type, is available from other bottles collected for the location. If not, then resample the location. If a well and breakage occurs within 4 hours of collection resample well. If after 4 hours from collection, repurge and resample the well.
Incorrect parameters requested	Notify field manager and laboratory and correct.
Samples collected in wrong bottle bottle or incorrect preservation	Notify field manager and laboratory. Resample the location for the parameters which were sampled incorrectly.
Discrepancy in or incomplete chain-of-custody form	Document the discrepancy. Notify the field manager and laboratory.
Missing ER Program field form	Take available information from field log and transcribe to the form. Note on form the missing data and attach memo documenting the missing information.
Incorrect sample packing	Laboratory will notify the contact in the EG&G subcontractoring firm. Field manager will be notified.
Missing information or incorrect information in field log book.	Responsible field personnel will make correction on the current page of the logbook and will refer to the page with incorrect or missing information.
Incorrect format used in field logbook	Note in logbook at which point it was discovered. Begin using correct format.
Required quality control sample not collected in a given day	Notify field manager. Collect additional quality control sample. If a trip blank is not collected where required, assess impact on associated samples results.

Table XIII.1. (continued)

Problem	Corrective Action
Misidentified sample location	Notify field manager. Contact laboratory and have them not analyze samples. Sample the correct location.
Field instruments and equipment not decontaminated according to the Mound ER Program SOPs	Remeasure parameter or perform the activity again with a properly decontaminated instrument or equipment.
No or incomplete decontamination between samples collected during drilling.	Responsible field personnel will note in logbook if discovered during the activity and will correct. The QAM will include nonconformance in the monthly quality assurance report. Evaluate sample data for usability.
No or incomplete decontamination drilling equipment between sample locations	Responsible field personnel will note in logbook if discovered during the activity and will correct. The QAM will include nonconformance in the monthly quality assurance report. Evaluate sample data for usability.
Chain-of-custody form not sent with samples	If chain-of-custody seals are not broken, notify field manager. Fax copy and send originals overnight to laboratory. Resample if chain-of-custody seals are broken prior to receipt by laboratory.
Measurement of internal temperature of samples outside specified range	Notify field manager. Resample all associated samples as determined necessary.
Health and safety field screening measurement missed	Notify field manager and site safety coordinator.

The nature of the corrective action obviously depends on the nature of the problem. For example, if a continuing calibration verification is determined to be out of control, the corrective action may require recalibration of the analytical system and reanalysis of all samples since the last acceptable continuing, calibration standard. Specific corrective actions to exceeded acceptance criteria for laboratory quality control checks are summarized in Table III.2. Corrective actions to be taken for CLP analyses (TCL VOCs, semivolatile organic compounds, pesticides/PCBs, and TAL inorganics) are presented in the CLP SOW for organic analyses, and the CLP SOW for inorganic analyses. If samples analyzed under the CLP procedures exceed holding times, the laboratory will analyze new samples at no cost to the client.

The laboratory reports all sample variances (e.g., insufficient sample size, extract loss during concentration, sample matrix problems, solvent contamination) in a nonconformance report which contains the following information:

- Client name,
- Project name,
- Operational unit and task,
- Date of occurrence,
- Analysis method,
- Laboratory batch number,
- Affected client sample IDs,
- Nature of nonconformance,
- Criteria not met,
- Responsible analyst or technician,
- Corrective action taken,
- Signature of project manager,
- Signature of section/unit manager, and
- Signature of QA coordinator.

13.3. CORRECTIVE ACTIONS RESULTING FROM AUDITS

The project QAO and audit team will prepare a formal report of all audit proceedings. The programmatic impact of a negative finding, such as the lack of or failure to use an appropriate procedure, will be determined by the project QAO and reported to the individuals identified in section 10. A corrective action plan and schedule will be requested, and the project manager will be responsible for ensuring that action to correct the problem has been developed and initiated, and any special expertise has been made available. The ICF KE project manager will also be responsible for implementing the corrective action and ensuring that no additional work, dependent on the activity, is performed until the problem is corrected. Corrective action may include reanalyzing the samples (if holding time permits), resampling, and evaluating and amending the sampling and analytical procedures.

The ICF KE project manager will approve the corrective action and will be responsible for ensuring that the corrective action adequately addresses the problem. The project QAO will ensure that corrective actions for problems are implemented by

- Evaluating all reported problems,
- Controlling additional work on the related activity,
- Maintaining the log of CARs, and
- Ensuring CARs are included in the site documentation files.

Following implementation of satisfactory corrective action, the project QAO will conduct follow-up activities sufficient to verify this implementation. Such confirmation will be documented, along with any further recommendations, in a formal closeout report for the audit. The closeout report will be distributed to the individuals identified in Section 14, as appropriate.

14. QUALITY ASSURANCE REPORTS TO MANAGEMENT

Quality assurance reports to management will consist of prior notification of activities and reports on activities. Reports will encompass both routine reports and special reports, including written reports and memoranda documenting data assessment activities, results of data validations, audits, nonconformances, corrective actions, and quality notices. The management hierarchy receiving some or all of the reports will include DOE DAO (the RPM), the EG&G Mound Manager of Environmental Restoration, the DOE AL Program Manager, and the DOE RI/FS contractor project manager. Reports may be distributed to RI/FS subcontractors at the discretion of the DOE RPM and the RI/FS contractor project manager.

Prior notification of all quality assurance activities will be provided to all managers through the vehicle of RI/FS monthly progress reports that also contain information about all RI/FS activities, and through special trip notices that notify managers of contractor and subcontractor travel. Monthly RI/FS progress reports will routinely discuss upcoming activities, including field work and scheduled audits. Any of the managers listed above may use the notification to identify the need for, and schedule quality assurance audits in connection with, scheduled field work.

Monthly reports will also describe the progress, the completion, and sometimes the results of quality assurance activities. Descriptions of the completion of activities will serve as notice to all managers of the availability of quality assurance reports. Results of quality assurance activities may be summarized for inclusion in monthly reports. Each quality assurance activity shall be documented in a report separate from any summary or description included in the monthly RI/FS progress report.

The quality control coordinator (QCC) and the quality assurance/quality control director will prepare routine reports to management indicating effectiveness of the laboratory quality assurance program. The QCC will prepare a monthly summary report of the internal review activities of laboratory performance and submit the report to the quality assurance/quality control director. Reports of the semiannual system audits will be distributed to the Vice President of the laboratory service, laboratory manager, regional director of analytical operations, and the quality assurance/quality control director.

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APPENDIX A

STANDARD OPERATING PROCEDURES

NOTE: The actual SOPs can be found in Appendix A of the OU-9 QAPP.

MOUND PLANT ER PROGRAM

LIST OF STANDARD OPERATING PROCEDURES

SECTION 1 - GENERAL

1.1 General Instructions for Field Personnel
1.2 General Surface Geophysics
1.3 Sample Control and Documentation
1.4 Sample Containers and Preservation
1.5 Guide to the Handling, Packaging, and Shipping of Samples
1.6 General Equipment Decontamination
1.7 Sampling for Removable Alpha Contamination
1.8 Personnel Decontamination - Level D Protection
1.9 Personnel Decontamination - Level C Protection
1.10 Personnel Decontamination - Level B Protection
1.12 Air Particulate Sampling with a Real-Time Aerosol Monitor
1.15 Guide to Waste Management

SECTION 2 - WATER SAMPLING

2.1 Presample Purging of Wells
2.2 Field Measurements on Ground and Surface Water Samples
2.3 Sampling Monitoring Wells with a Bladder Pump
2.4 Sampling Monitoring Wells with a Bucket-Type Bailer
2.5 Sampling Monitoring Wells with a Submersible Pump
2.6 Sampling Monitoring Wells with a Peristatic Pump
2.7 Sampling commercial/Municipal/Domestic Wells
2.8 Sampling for Volatile Organics
2.9 Surface Water Sampling
2.10 Stream Flow Measurements Using Flumes, Velocity Cross Sectional Area, and Direct Volume
2.11 Stream Flow Measurements Using Weirs

SECTION 3 - HYDRAULIC TESTING

3.1 Water Level Measurement
3.3 Operational Check of Pressure Transducers Used in Measuring Water Levels in Wells

SECTION 4 - DRILLING AND LOGGING

4.1 Soil Boring
4.1.1 Methods to Control Communication of Subsurface Contaminants Within and Between Saturated Zones During Drilling and Well Installation
4.2 Rock Boring
4.3 Monitoring Well Installation
4.4 Monitoring Well Development
4.6 Test Pit Logging and Sampling
4.7 Piezometer Installation
4.8 Piezometer Development

SECTION 5 - SOIL SAMPLING

5.1 Soil and Rock Borehole Logging and Sampling
5.2 Soil Sampling with a Spade and Scoop
5.3 Subsurface Solid Sampling with Hand Auger and Thin-Wall Sampler
5.4 General Soil Gas Sampling and Field Chemcial Analysis
5.8 Soil Sampling with a Stainless Steel Surface Soil Sampler
5.9 Sediment Sampling Procedures for Streams, Rivers, and Ponds

SECTION 6 - HEALTH AND SAFETY

6.1 Health and Safety Monitoring of Combustible Gas Levels
6.2 Health and Safety Monitoring of Organic Vapors with a Photoionization Detector
6.3 Health and Safety Monitoring of Organic Vapors with a Flame Ionization Detector
6.4 Total Alpha Surface Contamination Measurements
6.7 Near Surface and Soil Sample Screening for Low-Energy Gamma Radiation Using the FIDLER
6.11 Beta-Gamma Radiation Measurements
6.15 Measurement of Gamma-Ray Field Using A Sodium Iodide (No. I) Detector
6.16 Heat Stress Monitoring

NOTE: The actual SOPs can be found in Appendix A of the OU-9 QAPP.

APPENDIX B

CONTRACT LABORATORY PROGRAM STATEMENT OF WORK MODIFICATIONS

MODIFICATION A:	Statement of Work for Inorganic Analysis, Multi-media, Multi-concentration
MODIFICATION B:	Statement of Work for Inorganic Analysis (Residential Groundwater), Multi-media, Multi-concentration
MODIFICATION C:	Statement of Work for Lanthanide Analysis, Multi-media, Multi-concentration
MODIFICATION D:	Statement of Work for Organic Analysis, Multi-media, Multi-concentration

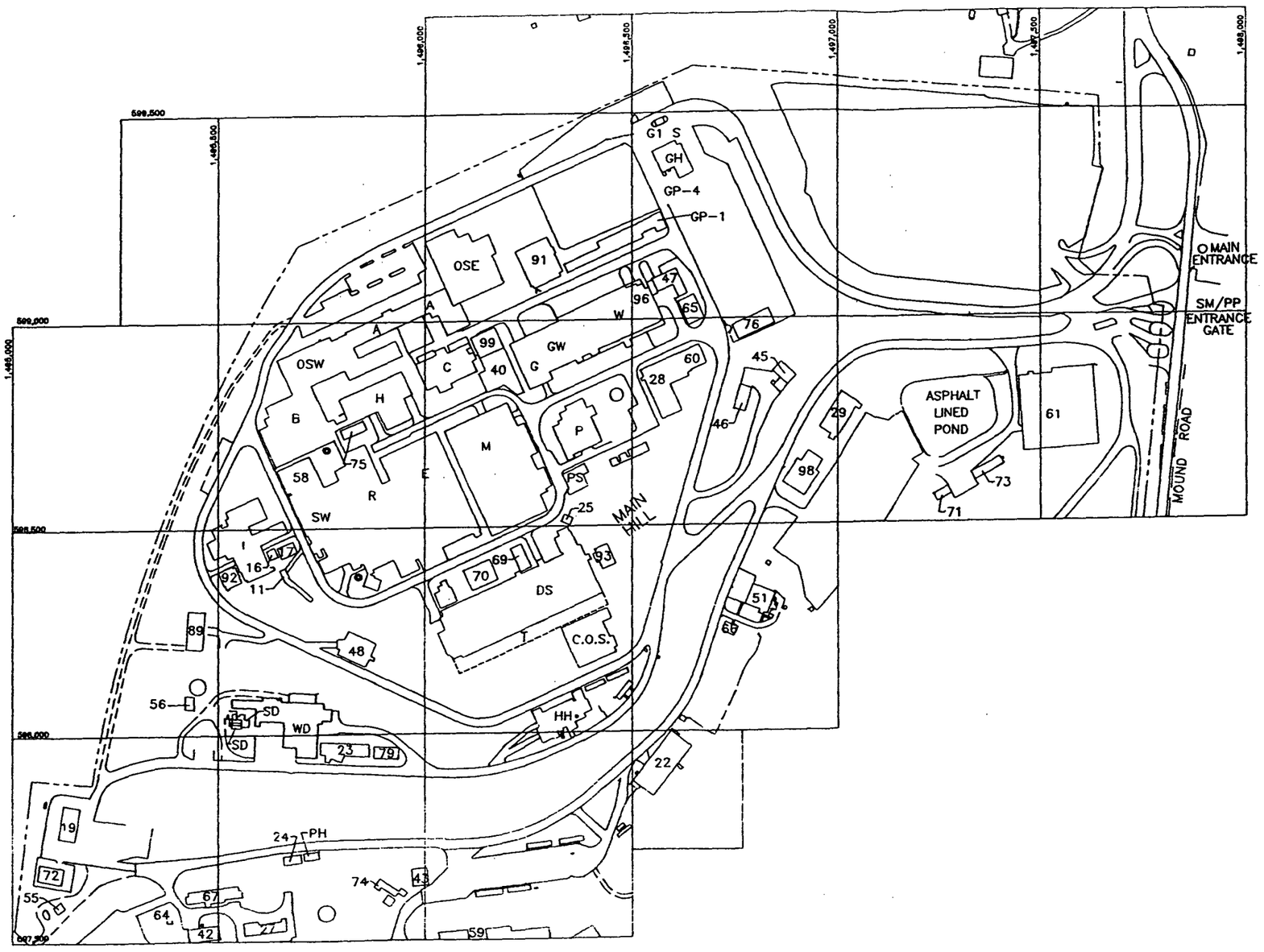
NOTE: The actual statement of work modifications can be found in Appendix B of the OU-9 QAPP.

APPENDIX C

STATEMENTS OF WORK FOR SELECTED LABORATORY ANALYSES

SOW-001	PETN Soil Extraction and Analysis
SOW-002	PETN Water Extraction and Analysis
SOW-003	Soil Preparation for Common Organic, Inorganic, and Selected Radiological Analyses
SOW-004	Tritium Cryogenic Soil Preparation
SOW-005	Total Organic Carbon Soil Preparation
SOW-006	Soil Preparation for Anion Analysis

NOTE: The actual statements of work can be found in Appendix C of the OU-9 QAPP.



NOTES:

1. THE ELECTRONIC BASE MAP DATA FILE WAS OBTAINED BY ICF KAISER ENGINEERS, CINCINNATI, OHIO, FROM ROY F. WESTON, INC., ALBUQUERQUE, NEW MEXICO, WHO OBTAINED IT FROM WOOLPERT CONSULTANTS, INC., DAYTON, OHIO. THE DATA WERE PHOTOGRAMMETRICALLY COMPILED FROM AERIAL PHOTOGRAPHY DATED 12/08/85.

2. WESTON CONVERTED MOUND PLANT COORDINATES TO OHIO STATE PLANE COORDINATES USING AN ALGORITHM PROVIDED BY OAK RIDGE NATIONAL LABORATORY, GRAND JUNCTION PROJECT OFFICE.

LEGEND:

- 53 STRUCTURES
- PAVED ROADWAY
- UNPAVED ROADWAY
- MOUND PLANT BOUNDARY

Figure 1.1 Mound Plant areas and main building