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Environmental Restoration Program
Oak Ridge National Laboratory
Waste Area Grouping 13
Remedial Investigation Work Plan

Appendix A
Quality Assurance Project Plan
Waste Area Grouping 13

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Environmental Restoration Program
Oak Ridge National Laboratory
Waste Area Grouping 13
Remedial Investigation Work Plan

Appendix A
Quality Assurance Project Plan
Waste Area Grouping 13

and

Appendix B
Health and Safety Plan
Waste Area Grouping 13

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DOE/OR-941D1
LWA/90-015

DRAFT

Environmental Restoration Program
Oak Ridge National Laboratory
Waste Area Grouping 13
Quality Assurance Project Plan

December 1990

Prepared for
U.S. Department of Energy
Oak Ridge Operations
under contract DE-AC05-90OR21851

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Appendix A

Quality Assurance Project Plan

Waste Area Grouping 13

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Environmental Restoration Program

Oak Ridge National Laboratory

Waste Area Grouping 13

Quality Assurance Project Plan
(QAPjP)

Revision 0

December 1990

____

Remedial Investigation contractor   Date
Program Manager Approval

____

Remedial Investigation contractor   Date
Quality Assurance/Quality Control
Concurrence

____

Remedial Investigation contractor   Date
Deputy Program Manager, Offsite
Concurrence

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ACRONYMS

AAS	Atomic Absorption Spectrometer
ASME	American Society of Mechanical Engineers
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
CRDL	contract required detection limit
CRQL	Contract Required Quantitation Limit
DQO	data quality objective
Energy Systems	Martin Marietta Energy Systems, Inc.
EPA	U.S. Environmental Protection Agency
ES/ER	Energy Systems/Environmental Restoration
ESP	Environmental Surveillance Procedure
FS	Feasibility Study
GC	gas chromatograph
MS	mass spectrometer
M&TE	measuring and test equipment
NBS	National Bureau of Standards
NEPA	National Environmental Policy Act
ORNL	Oak Ridge National Laboratory
PC	percent completeness
PCB	polychlorinated biphenyl
PTCL	Project Target Compound List
PR	percent recovery
QA	quality assurance
QAMS	Quality Assurance Management Staff
QAPjP	Quality Assurance Project Plan
QAPP	Quality Assurance Program Plan
QC	quality control
RAP	Remedial Action Program
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RIC	Remedial Investigation Contractor
RPD	relative percent difference
RRF	response factor
SOP	standard operating procedure
SOW	statement of work
SWMU	Solid Waste Management Unit
TCL	target compound limit
TIC	Tentatively Identified Compound
WAG	Waste Area Grouping
WBS	Work Breakdown Structure

INTRODUCTION

This Quality Assurance Project Plan (QAPjP) has been developed for use in the site preparation, sample collection, and sample analysis activities at the Oak Ridge National Laboratory (ORNL) Waste Area Grouping (WAG) 13 to ensure that appropriate levels of quality assurance (QA) and quality control (QC) are achieved.

PLAN DESCRIPTION

This QAPjP establishes QA requirements and responsibilities applicable to project participants, and establishes the administrative methods through which project participants will implement the requirements of the project. Where no appropriate procedure exists, the QAPjP requires that one be developed by a cognizant individual(s) or organization(s) in accordance with QA/QC procedures that govern preparation of procedures.

This QAPjP integrates requirements from three primary sources: American Society of Mechanical Engineers (ASME) NQA-1-1989 edition, U.S. Environmental Protection Agency (EPA) Quality Assurance Management Staff (QAMS) Interim Guidelines and Specifications for preparing QAPjPs (QAMS-005/80), and the activities that constitute the WAG 13 Project.

NQA-1 defines 18 criteria that must be addressed by a QA plan, and one additional criterion is required by the project (Software QA). QAMS-005/80 defines 16 criteria that must be addressed in an environmental remediation QA project plan. Table I.1 illustrates how the 16 QAMS criteria are addressed by this QAPjP.

PROJECT DESCRIPTION

The Remedial Investigation (RI) effort on the WAG 13 Project began with development of the RI Work Plan, which integrates the following:

- Resource Conservation and Recovery Act (RCRA) Facility Investigation/Corrective Measures Study process of RCRA;
- RI/Feasibility Study process of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); and
- the procedural requirements of the National Environmental Policy Act (NEPA).

Table I.1 QAMS Criteria

QAPjP Content Requirements Per QAMS-005/80	QAPjP Section (NQA-1 Criterion)
Title Page	Title Page
Table of Contents	Table of Contents
Project Description	Introduction
Project Organization and Responsibility	Section 1
QA Objectives for Measurement Data	Sections 3 & 9
Sampling Procedures	Section 9
Sample Custody	Sections 8 & 9
Calibration Procedures and Frequency	Section 12
Analytical Procedures	Section 9
Data Reduction, Validation, and Reporting	Sections 6 & 9
Internal Quality Control Checks	Sections 9 & 18
Performance and System Audits	Section 18
Preventive Maintenance	Section 12
Specific Routine Procedures Used to Assess Data Precision, Accuracy, and Completeness	Sections 3, 9, 15, & 18
Corrective Action	Section 16
Quality Assurance Reports to Management	Sections 2 & 18

The schedule for performing the Phase I RI at WAG 13 is presented in Figure I.1. Work will be performed by the RI contractor (RIC).

SITE DESCRIPTION AND HISTORY

In response to federal and state regulations, ORNL established a Remedial Action Program (RAP) to manage areas where past and current research, development, and waste management activities have resulted in residual contamination of facilities or the environment. The primary objective of the RAP is to clean up the hazardous contamination that may threaten human health and the environment.

To identify compliance requirements under RCRA 3004 (u), which mandate that any hazardous waste management permit issued requires corrective action for all releases from Solid Waste Management Units (SWMUs), ORNL listed all known active and inactive waste management areas, contaminated facilities, and potential sources of continuing releases to the environment and grouped them into twenty contiguous and hydrologically defined WAGs.

Two SWMUs located southwest of the main ORNL complex near the Clinch River have been combined and identified in the RCRA Facilities Assessments as WAG 13. The two SWMUs are located about 1300 ft (400 m) apart in separate portions of the WAG (Figure I.2). A part of this area (SWMU 13.1) was the site of a simulated fallout experiment utilizing ^{137}Cs-tagged particles. Part of the area is currently being used for field studies on air pollution and acid rain effects on vegetation.

SWMU 13.1 consisted of a 5-acre fenced area in a fescue grassland community approximately 330 ft (100 m) north of the Clinch River at mile 20.5. The site included eight 33- by 33-ft (10- by 10-m) treatment plots, each of which was enclosed by metal sheeting that extended 18 inches (46 cm) below the surface and 24 inches (61 cm) above the ground (Figure I.2). In August of 1968, four of the plots were contaminated with ^{137}Cs fused to silica particles, and the remaining four plots were used as controls. This site is presently enclosed by a chain link fence and is not being used.

Numerous experiments with shorter half-life isotopes were also conducted in the vicinity of the cesium plots; however, due to the radioactivity decay process, these isotopes are no longer present in detectable amounts.

SWMU 13.2 was an experimental area used to study ^{137}Cs runoff, erosion, and infiltration on a silt-loam soil. The isotope used in this experiment was sprayed as a liquid on soils having varying degrees of groundcover. A total of 15 mCi of ^{137}Cs was sprayed over a 215 ft^2 (20 m^2) area. This site is currently fenced and not used.

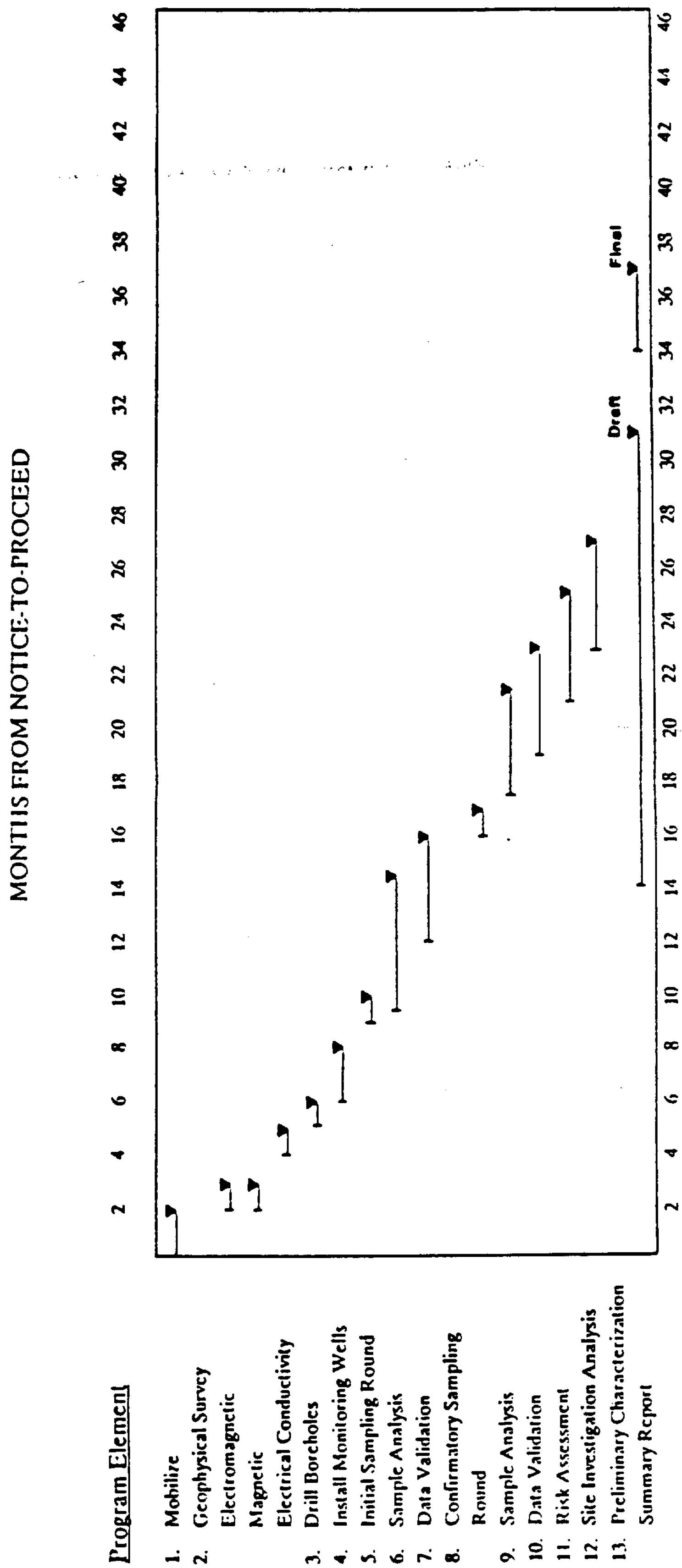

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Figure I.1 Schedule for Performing the Phase I Remedial Investigation at WAG 13.

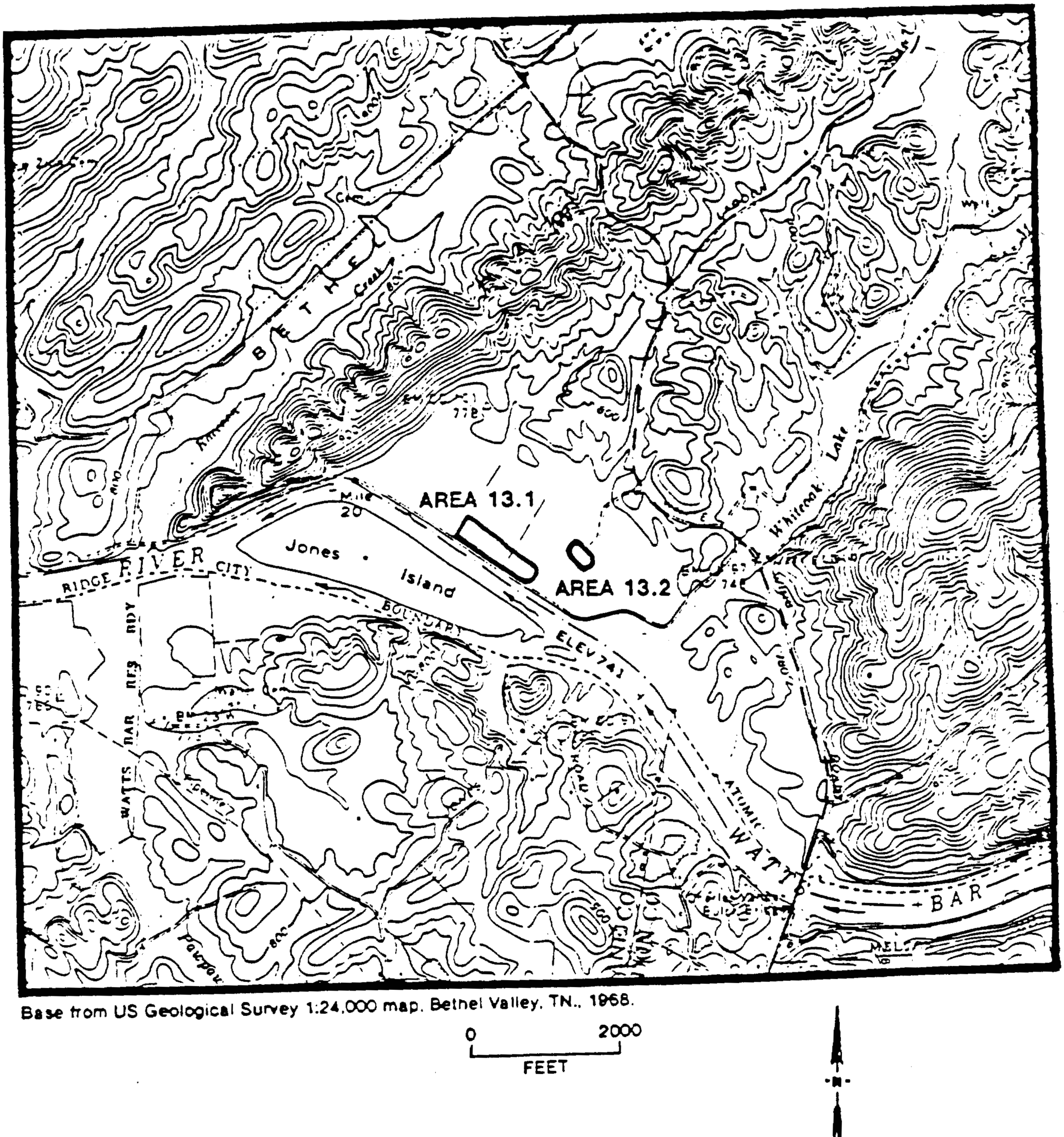

Figure I.2 Location of Environmental Research Areas (WAG 13).

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PROJECT OBJECTIVES AND INTENDED DATA USAGES

The objectives for all SWMUs at ORNL are to determine the nature and extent of contamination, to evaluate the associated risk to human health and the environment, and to identify the preferred remedial action. These objectives are supported by the QAPjP, which specify the following project activities:

- confirming and quantifying the extent of contamination,
- verifying the probable sources of contamination,
- determining potential contaminant migration pathways,
- determining the needs for remedial action, and
- identifying the preferred remedial alternatives.

The following field activities will support the project objectives outlined for WAG 13:

- geophysical, electromagnetic, magnetometer, and electrical resistivity surveys to define underlying structures;
- installation of monitoring wells between SWMU 13.1 and the Clinch River to determine if any radioactive contamination is migrating into the groundwater;
- installation of three sets of paired monitoring wells, one paired with one of the single wells between SWMU 13.1 and the Clinch River and two paired wells upgradient to determine vertical groundwater flow;
- analysis of groundwater and surface water samples for:
  - radionuclides, and
  - volatile and semivolatile organics (one round) to ensure that only radioactive contamination exists on-site and to determine if contaminants from White Oak Lake are migrating into the groundwater under the site;
- surface water and sediment sampling and analysis for: radionuclides to characterize contamination migration in surface streams at two on-site streams and at four locations along the Clinch River (one upstream, one abreast SWMU 13.3, and two downstream); and
- analysis radionuclides to characterize any airborne migration of radionuclides from the site; and

- slug tests in selected wells to determine hydraulic conductivities of water conducting horizons.

TARGET COMPOUNDS

All compounds on the Project Target Compound List (PTCL) will be analyzed initially to ensure that all potential chemicals of concern are identified. Tentatively Identified Compounds (TIC) analyses will be required for all gas chromatograph/mass spectrometer (GC/MS) methods as specified by the Contract Laboratory Program (CLP) methods. The PTCLs are presented in Tables I.2, I.3, I.4, I.5, and 6, along with the project-required detection limits. Tables I.2 through I.4 include the parameters listed in the CLP Statement of Work (SOW) for organics analysis, consisting of volatile organics, semivolatile organics, pesticides, and polychlorinated biphenyl (PCB) fractions, respectively. Table I.5 includes those inorganic parameters to be determined by the CLP SOW for inorganics analysis. Analytes for which CLP analytical procedures do not exist will be analyzed using Standard Operating Procedures (SOPs) based on EPA-approved methods.

DELIVERABLES

Deliverables for this project are listed below:

- approved Phase I RI Work Plan
- Baseline Risk Assessment
- Technical Interim Memorandum
- Preliminary Risk Assessment
- Site investigation Analysis
- Preliminary Characterization Summary Report

Table I.2. Volatile Organic Compounds Targeted for Analysis

Compound	CAS Number[b]	Detection Limits[a] Low Water[c, d] (ug/L)	Low Soil/ Sediment[e] (ug/Kg)
Chloromethane	74-87-3	10	10
Bromomethane	74-83-9	10	10
Vinyl Chloride	75-10-4	10	10
Chloroethane	75-00-3	10	10
Methylene Chloride	75-09-2	10	10
Acetone	67-64-1	10	10
Carbon Disulfide	75-15-0	10	10
1,1-Dichloroethane	75-35-4	10	10
1,1-Dichloroethane	75-34-3	10	10
1,2-Dichloroethee (cis and trans)	540-59-0	10	10
Chloroform	67-66-3	10	10
1,2-Dichloroethane	107-06-2	10	10
2-Butanone	78-93-3	10	10
1,1,1-Trichloroethane	71-55-6	10	10
Carbon Tetrachloride	56-23-5	10	10
Bromodichloromethane	75-27-4	10	10
1,1,2,2-Tetrachloroethane	79-34-5	10	10
1,2-Dichloropropane	78-87-5	10	10
trans-1,3-Dichloropropene	10061-02-6	10	10
Trichloroethene	79-01-6	10	10
Dibromochloromethane	124-48-1	10	10

Table I.2 Volatile Organic Compounds Targeted for Analysis (Continued)

Compound	CAS Number[b]	Detection Limits[a] Low Water[c, d] (ug/L)	Detection Limits[a] Low Soil/ Sediment[e] (ug/Kg)
1,1,2-Trichloroethane	79-00-5	10	10
Benzene	71-43-2	10	10
cis-1,3-Dichloropropene	10061-01-5	10	10
Chloromethane	74-87-3	10	10
Bromoform	75-25-2	10	10
2-Hexanone	591-78-6	10	10
4-Methyl-2-Pentanone	108-10-1	10	10
Tetrachloroethene	127-18-4	10	10
Toluene	108-88-3	10	10
Chlorobenzene	108-90-7	10	10
Ethyl Benzene	100-41-4	10	10
Styrene	100-42-5	10	10
Total Xylenes	1330-20-7	10	10

[a]Detection limits for water are project required. Detection limits for soils are EPA contract required quantitation limits (EPA 1990a).

[b]Chemical Abstracts Service (CAS) identifying number, American Chemical Society.

[c]In reagent water.

[d]Medium Water Detection Limits for Volatile TCL Compounds are 100 times the individual Low Water detection limits given in the table.

[e]Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated for soil/sediment calculated on dry weight basis will be higher.

NOTE: Specific detection limits are highly matrix-dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Interference between compounds detected in a sample may require a higher detection limit. Medium and low levels are determined by the X-factor calculations from the hexadecane screening extract.

Table I.3 Semivolatile Organic Compounds Targeted for Analysis

Compound	CAS Number[b]	Detection Limits[a] Low Water[c, d] (ug/L)	Low Soil/ Sediment[e] (ug/Kg)
Phenol	108-95-2	10	330
Bis(2-Chloroethyl)ether	111-44-4	10	330
2-Chlorophenol	95-57-8	10	330
1,3-Dichlorobenzene	541-73-1	10	330
1,4-Dichlorobenzene	106-46-7	10	330
1,2-Dichlorobenzene	95-50-1	10	330
2-Methylphenol	95-48-7	10	330
Bis(20Chloroisopropyl) ether	108-60-1	10	330
4-Methylphenol	106-44-5	10	330
N-Nitroso-di-n-Dipropylamine	621-64-7	10	330
Hexachloroethane	67-72-1	10	330
Nitrobenzene	98-95-3	10	330
Isophorone	78-59-1	10	330
2-Nitrophenol	88-75-5	10	330
2,4-Dimethylphenol	105-67-9	10	330
Bis(2-Chloroethoxy) methane	111-91-1	10	330
2,4-Dichlorophenol	120-83-2	10	330
1,2,4-Trichlorobenzene	120-82-1	10	330
Naphthalene	91-20-3	10	330
4-Chloroaniline	106-47-8	10	330
Hexachlorobutadiene	87-68-3	10	330
4-Chloro-3-methylphenol (para-chloro-meta-cresol)	59-50-7	10	330
2-Methylnaphthalene	91-57-6	10	330

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Table I.3. Semivolatile Organic Compounds Targeted for Analysis (Continued)

Compound	CAS Number[b]	Detection Limits[a] Low Water[c, d] (ug/L)	Low Soil/ Sediment[e] (ug/Kg)
Hexachlorocyclopendiene	77-47-4	10	330
2,4,6-Trichlorophenol	88-06-2	10	330
2,4,5-Trichlorophenol	95-95-4	10	1700
2-Chloronaphthalene	91-58-7	10	330
2-Nitroaniline	88-74-4	10	1700
Dimethyl Phthalate	113-11-3	10	330
Acenaphthylene	208-96-8	10	330
2,6-Dinitrotoluene	606-20-2	10	330
3-Nitroaniline	99-09-2	10	1700
Acenaphthene	83-32-9	10	330
2,4-Dinitrophenol	51-28-5	10	1700
4-Nitrophenol	100-02-7	10	1700
Dibenzofuran	132-64-9	10	330
2,4-Dinitrotoluene	121-14-2	10	330
Diethylphthalate	84-66-2	10	330
4-Chlorophenyl Phenyl ether	7005-72-3	10	330
Fluorene	86-73-7	10	330
4-Nitroaniline	100-01-6	10	1700
4,6-Dinitro-2-methylphenol	534-52-1	10	1700
N-nitrosodiphenylamine	86-30-6	10	330
4-Bromophenyl Phenyl ether	101-55-3	10	330
Hexachlorobenzene	118-74-1	10	330
Pentachloroprophenol	87-86-5	10	1700

Table I.3. Semivolatile Organic Compounds Targeted for Analysis (Continued)

Compound	CAS Number[b]	Detection Limits[a] Low Water[c, d] (ug/L)	Detection Limits[a] Low Soil/Sediment[e] (ug/Kg)
Phenanthrene	85-01-8	10	330
Anthracene	120-12-7	10	330
Carbazole	86-74-8	10	330
Di-n-butylphthalate	84-74-2	10	330
Fluoranthene	206-44-0	10	330
Pyrene	129-00-0	10	330
Butylbenzylphthalate	85-68-7	10	330
3'3-Dichlorobenzidine	91-94-1	10	330
Benzo(a)anthracene	56-55-3	10[f]	330
Chrysene	218-01-9	10[f]	330
Bis(2-ethylhexyl)phthalate	117-81-7	10	330
Di-n-octyl Phthalate	117-84-0	10	330
Benzo(b)fluoranthene	205-99-2	10[f]	330
Benzo(k)fluoranthene	207-08-9	10[f]	330
Ideno(1,2,3-cd)pyrene	193-39-5	10	330
Dibenz(a,h)anthracene	53-70-3	10	330
Benzo(g,h,i)perylene	191-24-2	10	330
Benzo(a)pyrene	50-32-8	10	330

[a]Detection limits for water are project required. Detection limits for soils are EPA contract required quantitation limits (EPA 1990a).

[b]CAS identifying number, American Chemical Society.

[c]In reagent water.

[d]Medium Water Detection Limits for Semi-Volatile TCL Compounds are 100 times the individual Low Water detection limits.

[e]Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated for soil/sediment calculated on dry weight basis will be higher.

[f]Medium Soil/Sediment Detection Limits for Semi-Volatile TCL Compounds are 100 times the individual Low Soil/Sediment detection limits.

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Table I.3. Semivolatile Organic Compounds Targeted for Analysis (Continued)

[a]These parameters are reported as total.

NOTE: Specific detection limits are highly matrix-dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Interference between compounds detected in a sample may require a higher detection limit.

Table I.4 Pesticides and PCBs Targeted for Analysis

Compound	CAS Number[b]	Detection Limits[a] Low Water[c, d] (ug/L)	Low Soil/ Sediment[e] (ug/Kg)
alpha-BHC	319-84-6	0.05[g]	1.7
beta-BHC	319-85-7	0.05[g]	1.7
delta-BHC	319-86-8	0.05[g]	1.7
gamma-BHC (Lindane)	58-89-9	0.05	1.7
Heptachlor	76-44-8	0.05	1.7
Aldrin	309-00-2	0.05	1.7
Heptachlor Epoxide	1024-57-3	0.05	1.7
Endosulfan I	959-98-8	0.05	1.7
Dieldrin	60-57-1	0.1	3.3
4,4'DDE	72-55-9	0.1[g]	3.3
Endrin	72-20-8	0.01	3.3
Endosulfan II	33213-65-9	0.1	3.3
4,4'-DDD	72-54-8	0.1[g]	13.3
Endosulfan Sulfate	0131-07-8	0.10[g]	3.3
Endrin Aldochyde	7421-36-3	0.1[b]	3.3
[illegible]	[illegible]	[illegible]	[illegible]
Methoxychlor	72-43-5	0.5	17
Endrin Ketone	53494-70-5	0.5	3.3
Toxaphene	8001-35-2	0.5[g]	170.0
Aroclor-1016	12674-11-2	1[h]	33
Aroclor-1221	11104-28-2	1[h]	33
Aroclor-1232	11141-16-5	2[h]	67

Table I.4 Pesticides and PCBs Targeted for Analysis (Continued)

Compound	CAS Number[b]	Detection Limits[a] Low Water[c, d] (ug/L)	Detection Limits[a] Low Soil/ Sediment[e] (ug/Kg)
Aroclor-1248	12672-29-6	1.0[h]	33
Aroclor-1254	11097-69-1	1.0[h]	33
Aroclor-1260	11096-82-5	1.0[h]	33

[a]Detection limits for water are project required. Detection limits for soils are EPA contract required quantitation limits (EPA 1990a).

[b]CAS identifying number, American Chemical Society.

[c]In reagent water.

[d]Medium Water Detection Limits for Pesticide TCL compounds are 100 times the individual Low Water detection limits.

[e]Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated for soil/sediment calculated on dry weight basis will be higher.

[f]Medium Soil/Sediment Detection Limits for pesticide TCL compounds are 15 times the individual Low Soil/Sediment detection limits.

[g]Estimated

[h]Quantitation Limit (EPA 1990a).

NOTE: Specific detection limits are highly matrix-dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Interference between compounds detected in a sample may require a higher detection limit.

Table I.5 Inorganic Constituents Targeted for Analysis

Inorganic Constituent	Detection Limits[a,b]	
	Low Water[c]	Low Soil/ Sediment[d]
	(ug/L)	(ug/Kg)
Aluminum	80	20
Antimony	2	6
Arsenic	2	1
Barium	5	20
Beryllium	1	0.5
Cadmium	2	0.5
Calcium	500	500
Chromium	8	1
Cobalt	6	5
Copper	6	2.5
Iron	80	10
Lead	2	0.5
Magnesium	100	500
Manganese	5	1.5
Mercury	0.1	0.1
Nickel	15	4
Potassium	2000	500
Selenium	2	0.5
Silver	3	1
Sodium	1000	500
Thallium	2	1
Vanadium	5	5
Zinc	20	2
Cyanide	5	1

[a]Detection limits for water are project required. Detection limits for soils are EPA contract required quantitation limits (EPA 1990a).

Table I.5 Inorganic Constituents Targeted for Analysis (Continued)

[b]Specific detection limits are highly matrix-dependent. The detection limits listed herein aer provided for guidance and may not always be achievable.

[c]In reagent water.

[d]Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated for soil/sediment calculated on dry weight basis will be higher.

NOTE: Specific detection limits are highly matrix-dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Interference between compounds detected in a sample may require a higher detection limit.

Table L6 Analytes to be Determined by SOPs

Analyte	Method	Detection Limits Water (ug/L)	Detection Limits Soil/Sediments (ug/Kg)
Conductivity	SOP[a] (E120.1)	0.1 umho/cm	NA[b]
pH	SOP (E150.1)	[c]	NA
Temperature	SOP (E170.1)	NA	NA
TPH[d]	SOP (E418.1)	1,000	10,000
Anions	SOP (E300.0)		
Chloride		150	NA
Fluoride		50	NA
Bromide		150	NA
Sulfate		2,100	NA
Nitrate		130	NA
Nitrite		40	NA
Chlorinated Herbicides	SOP (SW8150)		
2,4-D		15	1,000
2,4-DB		10	1,000
2,4,5-T		5	150
2,4,5-TP (SILVEX)		5	150
Dalapon		75	4,000
Dicamba		5	200
Dichloroprop		10	500
Dinoseb		1	50
MCPA		2,500	200,000
MCPP		2,000	150,000
Radiological	SOP (SW9310)		

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Table I.6 Analytes to be Determined by SOPs (Continued)

Analyte	Method	Detection Limits	
		Water (ug/L)	Soil/ Sediments (ug/Kg)
Gross Alpha		1.0[e]	NA
Gross Beta		4.0	NA
Total Dissolved Solids	SOP (E160.1)	4.0[f]	NA
Dioxins & Dibenzofurans	SOP (SW8280)	0.002[f]	2[f]
2,3,7,8 - TCDD	g	0.001[f]	1[f]

[a]SOP = Standard Operating Procedure [E = EPA methods for chemical analysis of water and wastes (EPA 1983)] and [(SW = EPA Test methods for evaluating Solid Wastes (EPA 1986)]

[b]NA = Not applicable

[c]Effective measurement range for pH 2 to pH 12.

[d]TPH = Total Petroleum Hydrocarbons

[e]Picocuries per liter.

[f]Detection limits have not been published by EPA for all analytes. They are highly compound - and matrix - specific. The values given are estimated.

[g]Following method described in "National Dioxin Studies Analytical Procedures and Quality Assurance Plan for the Analysis of 2, 3, 7, 8 TCDD in Tiers 3-7 Samples of the EPA National Dioxin Study" (EPA 1985).

1. QUALITY ASSURANCE ORGANIZATION

1.1 PURPOSE

This section describes the organizational structures, functional responsibilities, and levels of authority for quality-affecting activities on the WAG 13 Project.

1.2 REQUIREMENTS

Current RIC and subcontractor project organization, responsibilities, and lines of authority shall be maintained in the offices of the RIC Program Manager.

1.3 SCOPE

This section applies to the RIC and to any subcontractors performing work on the project.

1.4 RESPONSIBILITIES

Responsibilities of the Program Manger, Deputy Program Manager Task Leader, and QA/QC Officer are defined in the Martin Marietta Energy Systems, Inc. (Energy Systems) (ES)/Environmental Restoration (ER) ORNL Quality Assurance Program Plan (QAPP) and are referenced in the appropriate sections of this QAPjP. Responsibilities of the work breakdown structure (WBS) Element Managers and WBS Subelement Managers are defined in this section and referenced in other appropriate sections of this QAPjP.

1.5 RIC ORGANIZATION

1.5.1 Tasks and WBS

Administrative and technical activities performed on the WAG 13 RI Project and their WBS designations are presented in Figure 1.1. Tasks include:

- RI Work Plan (WBS 201100)
- Data Analysis
    - Existing Data Analysis

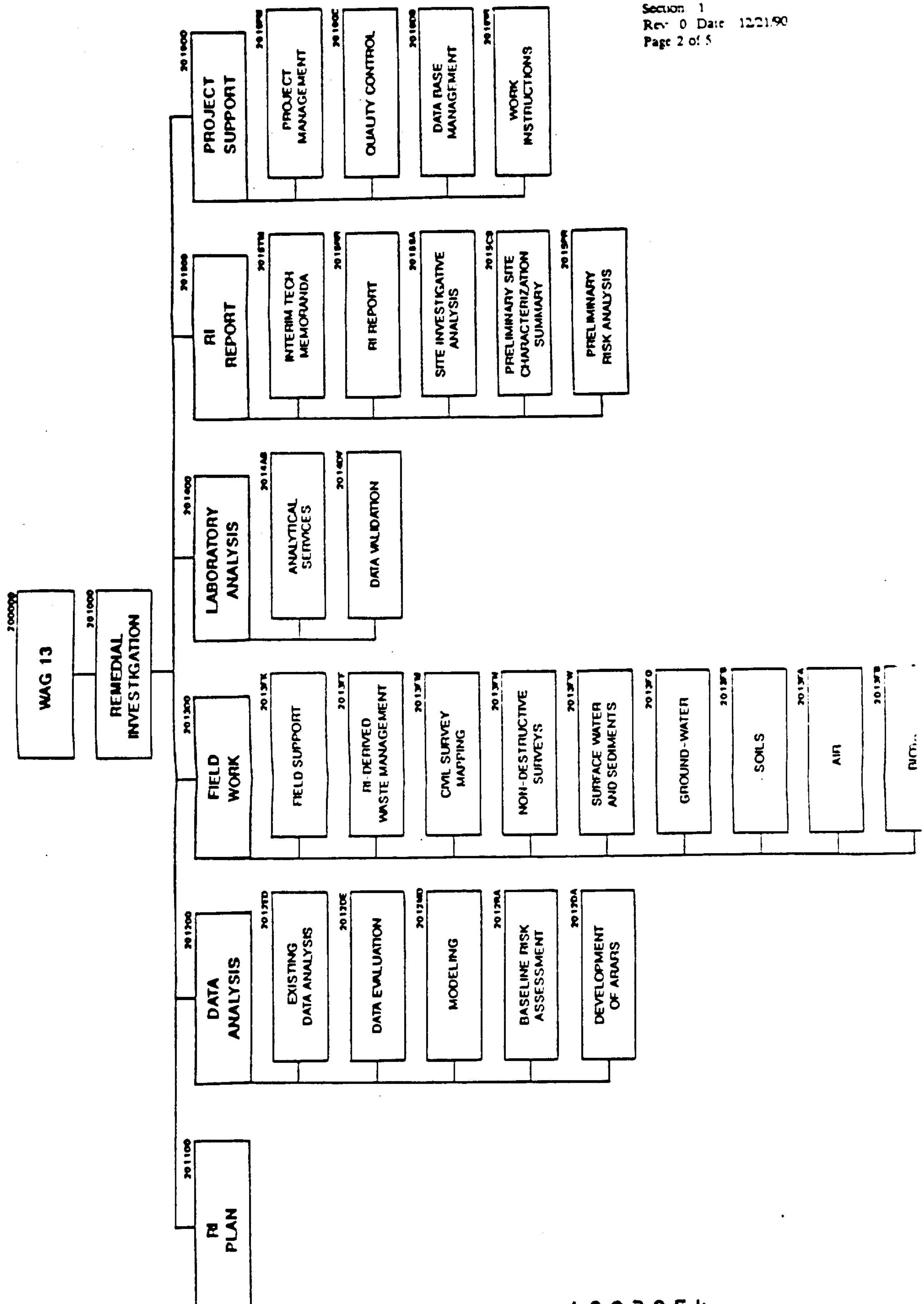

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Figure 1.1 Work Breakdown Structure for Phase I Remedial Investigation at WAG 13.

  - Data Evaluation
  - Modeling
  - Baseline Risk Assessment
  - Development of applicable, relevant, and appropriate requirements

- Field Work (WBS 201300)
  - Field Support
  - RI-Derived Waste Management
  - Civil Surveying and Mapping
  - Nondestructive Surveys
  - Surface Water and Sediments
  - Groundwater
  - Soils
  - Air
  - Biota

- Laboratory Analysis (WBS 201400)
  - Analytical Services
  - Data Validation

- RI Report
  - Interim Technical Memoranda
  - Preliminary Characterization Summary report
  - Site Investigation Analysis
  - Preliminary Risk Analysis

- WAG 13 Project Support (WBS 201600)
  - Project Management
  - QC
  - Data Base Management
  - Work Instructions

1.5.2 Responsibilities

Responsibility assignments for WBS Elements are delineated in Figure 1.2. The appropriate individual, under the cognizance of the program manager, is responsible for managing the execution of a work element. Specifically, they are to ensure that:

- RIC activities conducted in support of their element are planned and executed in accordance with this plan.
- Technical personnel who furnish services are qualified by experience or training to perform the work.
- Personnel assigned to perform work in support of their element are qualified by experience or training to comply with technical and QA requirements applicable to the work being performed.

1.5.3 Project Personnel

Project personnel are responsible for performing work in accordance with this QAPjP.

WORK BREAKDOWN STRUCTURE							FIFTH LEVEL TASK DESIG-NATOR	RESPONSIBILITY		
WBS LEVEL					ELEMENT ID	ELEMENT DESCRIPTION		FSS MANAGER	WAG MANAGER	E S & H MANAGER
1	2	3	4	5						
		X			201000	WAG 13 RI	-		•	
			X		201100	RI PLAN	-		•	
			X		201200	DATA ANALYSIS	-		•	
				X	2012ED	EXISTING DATA ANALYSIS	ED		•	
				X	2012DE	DATA EVALUATION	DE		•	
				X	2012MD	MODELING	MD		•	
				X	2012RA	BASELINE RISK ASSESSMENT	RA		•	
				X	2012DA	DEVELOPMENT OF ARARs	DA		•	
			X		201300	FIELD WORK	-		•	
				X	2013FK	FIELD SUPPORT	FK	•		
				X	2013FF	RI-DERIVED WASTE MANAGEMENT	FF	•		
				X	2013FM	CIVIL SURVEY AND MAPPING	FM	•		
				X	2013FN	NONDESTRUCTIVE SURVEYS	FN	•		
				X	2013FW	SURFACE WATER AND SEDIMENTS	FW	•		
				X	2013FQ	GROUNDWATER	FQ	•		
				X	2013FS	SOILS	FS	•		
				X	2013FB	BIOTA	-		•	
				X	2013FA	AIR	-		•	
			X		201400	LABORATORY ANALYSIS	-		•	•
				X	2014AS	ANALYTICAL SERVICES	AS			•
				X	2014DV	DATA VALIDATION	DV			
			X		201500	RI REPORT	-		•	
				X	2015TM	INTERIM TECHNICAL MEMORANDA	TM		•	
				X	2015RR	RI REPORT	RR		•	
				X	2015SA	SITE INVESTIGATIVE ANALYSIS	SA		•	
					2015CS	PRELIMINARY SITE CHARACTERIZATION SUMMARY	-		•	
					2015PR	PRELIMINARY RISK ANALYSIS	-		•	
			X		201600	WAG 13 PROJECT SUPPORT	-		•	
				X	2016PM	PROJECT MANAGEMENT	PM		•	
				X	2016QC	QUALITY CONTROL	QC		•	
				X	2016DB	DATA BASE MANAGEMENT	DB		•	
				X	2016WI	WORK INSTRUCTIONS	WI		•	

Figure 1.2 Responsibility Assignment Matrix for WAG 13 Phase I Remedial Investigation

2. QUALITY ASSURANCE PROGRAM

2.1 PURPOSE

This section describes the project-level program to be used to ensure the quality of work performed on the WAG 13 Project by the RIC or by subcontractors and/or suppliers to the RIC performing work on this project.

2.2 REQUIREMENTS

The RIC and all subcontractors to the RIC shall perform quality-affecting work in accordance with the requirements of this QAPjP or in accordance with an independently developed QAPjP that is responsive to the ES/ER ORNL QAPP and has been approved by the RIC Program Manager.

2.3 SCOPE

This section applies to all RIC personnel, subcontractor personnel, supplier personnel, and any other personnel providing items and/or services for the WAG 13 RI project. For the purposes of this QAPjP, "subcontractor" shall represent any firm providing services to the RIC (e.g., data collection firms, analytical laboratories, data management firms, waste management, and/or transport firms, etc.), and "supplier" shall represent any firm providing items or materials used in conducting remediation activities.

2.4 RESPONSIBILITIES

Responsibilities are defined in the ES/ER ORNL QAPP and are referenced in the appropriate sections of this QAPjP.

2.5 QUALITY ASSURANCE PROJECT PLAN

This QAPjP represents the integration of the following:

- ASME NQA-1 format and requirements (18 criteria),
- EPA QAMS guidelines and requirements (16 criteria), and
- WAG 13 project activities.

2.6 QUALITY ASSURANCE PROJECT REQUIREMENTS

The scope of the project requires that all of the NQA-1 QA criteria be addressed by this QAPjP, that EPA QAMS guidelines and activities be incorporated into the 18 criteria where appropriate, and that all project activities affecting quality fall under the mandate of this plan.

Paragraphs 2.6.1 through 2.6.19 present summaries of the 19 sections that comprise this QAPjP.

2.6.1 Organization

RIC and subcontractor current responsibilities and lines of authority will be documented and maintained in the office of the RIC Program Manager.

2.6.2 Quality Assurance Program

Project QA activities require planning, description, training, and assessment. These requirements are described in this section.

2.6.3 Design Control

Control of project design activities are described in Section 3 of this QAPjP. Design activities include the development of plans, models, schemes, strategies, etc., that will lead to the development of the project's goals and objectives. The primary design document subject to control is the RI Work Plan, including the development of data quality objectives (DQOs).

2.6.4 Procurement Document Control

The RIC and its subcontractors must document all project procurement activities and control the documentation as described in Section 4 of this QAPjP.

2.6.5 Instructions, Procedures, and Drawings

Project activities will be identified and performed in accordance with formal instructions, procedures, plans, models, and drawings, which are described in Section 5 of this QAPjP. Activities addressed in this section include, but are not limited to, model conceptualization, document preparation, sampling and analysis, data reduction and validation, and environmental monitoring.

2.6.6 Document Control

Some project documents that specify quality requirements or outline activities that may affect quality will require control in accordance with Section 6 of this QAPjP. Controls include, but are not limited to, the preparation, review, approval, release, and revision of documents.

2.6.7 Control of Purchased Items and Services

Project activities will require the acquisition of items and services that will affect quality. Section 7 of this QAPjP addresses the control of such acquisitions with respect to specifications, subcontractor/supplier qualifications, and verification that specifications of procured services/items are met. Section 7 also contains the requirement that RIC subcontractors submit a QAPjP responsive to the ES/ER ORNL QAPP or furnish written agreement that they will abide by the requirements of this QAPjP.

2.6.8 Identification and Control of Items

Section 8 of this QAPjP describes the many project activities affecting quality that will involve the use or generation of items that will require control. The primary classes of items identified for control include, but are not limited to, data collection instruments and equipment and environmental samples that are subject to chain-of-custody management.

2.6.9 Control of Process

Many project activities will require special processes. Section 9 of this QAPjP describes the methods of control for these processes. Special processes include, but are not limited to, environmental monitoring, data collection, data analysis, waste management, and data reduction, validation, and reporting.

2.6.10 Inspection

Section 10 describes the inspection program intended to ensure that items provided for project activities are in compliance with appropriate requirements. Compliance of activities is ensured through surveillance as required in Section 18, Audits and Surveillances.

2.6.11 Test Control

Section 11 mandates that project activities (including results) and equipment that require tests for verification of compliance or accuracy are identified in written procedures and that an appropriate test protocol for each item or activity is described.

2.6.12 Control of Measuring and Test Equipment (MT&E)

Project data collection activities will require M&TE and instruments that will be controlled according to guidelines outlined in Section 12. Measurements that affect data quality collected will be taken with equipment and/or instruments that are controlled, calibrated, adjusted, and maintained at predetermined intervals in accordance with the approved procedures as outlined in Section 12.

2.6.13 Handling, Storage, and Shipping

Project data collection activities will require the handling, cleaning, storing, packaging, and shipping of environmental samples that must be controlled to prevent compromising the integrity of the data and, in the case of hazardous material, to protect human health and the environment. Section 13 requires that these activities be controlled by approved procedures and by assuring that individuals and firms handling, packaging, storing, and shipping environmental samples are experienced or trained in the proper techniques.

2.6.14 Inspection, Test, and Operating Status

Section 14 requires the identification of activities associated with the inspection, testing, or operating status of an item or area that could affect the quality of environmental samples or adversely impact human and environmental health.

2.6.15 Control of Nonconforming Items

Provisions for the identification and disposition of nonconforming items are established in Section 15.

2.6.16 Corrective Action

Conditions that may adversly affect the quality of project deliverables or environmental data or adversely impact human or environmental safety and health will be identified and corrected by authorized personnel employing approved and documented procedures as required by Section 16 of this QAPjP.

2.6.17 Quality Assurance Records

Project QA records will be generated, identified, captured, classified, retained, and maintained in accordance with Section 17 of this QAPjP and its implementing procedures. QA records include any documentation of quality or the lack of quality in document preparation, data collection, reduction, and reporting, as well as in assessments of the QA program's effectiveness.

2.6.18 Audits

Section 18 requires the RIC to establish and implement a planned and scheduled project audit and surveillance program to verify the application and implementation of QA procedures by the RIC and personnel.

2.6.19 Software Quality Assurance

Some project activities will require the utilization of administrative and/or technical software. Section 19 requires that software used in support of project activities be controlled.

2.7 PLANNING

Project planning shall address the three primary project activities: document preparation; data collection and analysis; and data reduction, validation, and reporting. Planning should include: (1) a definition of project scope and objectives, (2) assignments of quality levels, (3) the application of appropriate QA requirements and procedural controls, (4) the identification of information to be collected and analyzed. Equally it should encompass applicable quality standards and criteria, field and laboratory testing equipment and procedures, and required QA records.

2.8 PERSONNEL SELECTION, INDOCTRINATION, AND TRAINING

WBS Subelement Managers are responsible for defining the qualifications required for performing work within their area of responsibility. Requirements and methods for verifying and documenting compliance shall be incorporated into project work plans.

In addition to maintaining performance qualifications, all project personnel shall be trained in the specific application of this QAPjP and its implementing procedures to the extent appropriate for their work activities. WBS Element Managers, under the cognizance of the Task Leader, shall implement QA/QC procedures governing indoctrination and training.

2.9 INDEPENDENT ASSESSMENTS

The QA/QC Officer shall provide independent overview of this QAPjP and be responsible for establishing a program of project-level QA assessment, in accordance with the QA/QC procedures governing program assessment, to measure the adequacy and effectiveness of the QA Program.

3. DESIGN CONTROL

3.1 PURPOSE

This section commits project personnel to systematic control over the preparation and maintenance of project design documents and instruments.

3.2 REQUIREMENTS

Design refers to the plans and strategies developed in pursuit of the project's goals and objectives. Design activities shall be controlled with respect to design input, design output, design interfaces, design adequacy, and design change.

3.3 SCOPE

This section applies to RIC personnel, subcontractor personnel, and/or supplier personnel involved in project design activities.

3.4 RESPONSIBILITIES

Responsibilities are defined in the ES/ER ORNL QAPP and are referenced in the appropriate sections of this QAPjP.

3.5 THE DESIGN CONTROL SYSTEM

WBS Element Managers, in conjunction with the Task Leader and QA/QC Officer, shall assure that design activities conducted within their areas of responsibility are performed in accordance with the requirements of QA/QC procedures governing design review.

WBS Element Managers, in conjunction with the Task Leader and QA/QC Officer, shall assure that design changes affecting the quality of items or activities within their areas of responsibility are implemented in accordance with the requirements of the ES/ER ORNL QAPP and with QA/QC documents governing controlled documents.

3.6 PROJECT DESIGN DEVELOPMENT

Primary project design documents and/or instruments and their relationship to project objectives are summarized in paragraphs 3.6.1 through 3.6.3.

3.6.1 The Environmental Impact Statement Implementation Plan

The Environmental Impact Statement Implementation Plan requires integration of the RCRA Facility Investigation (RFI)/Corrective Measures Study process of RCRA, the RI/FS process of CERCLA, and the procedural requirements of NEPA. The WBS Element Manager, under the cognizance of the Task Leader, shall assure that the plan is developed in accordance with QA/QC procedures governing design review.

3.6.2 The RI Work Plan

Elements of the RI Work Plan for WAG 13 shall include, but not be limited to, the following:

- development of DQOs in a three-stage process:
  - identity of decision types,
  - identity of data uses/needs, and
  - design data collection program;
- incorporation of field sampling methods and procedures;
- incorporation of field sample chain-of-custody procedures;
- incorporation of provisions for laboratory analysis procedures;
- incorporation of procedures for data reduction, validation, and reporting;
- incorporation of a health and safety plan; and
- incorporation of a data management plan.

The WBS Element Manager shall ensure that the RI Work Plan is created in accordance with QA/QC procedures governing design review.

4. PROCUREMENT DOCUMENT CONTROL

4.1 PURPOSE

This section commits project personnel to the systematic control of documentation for procurement activities conducted on behalf of the WAG 13 Project.

4.2 REQUIREMENTS

The RIC shall initiate and maintain a system of control over the documentation of all procurement activities.

4.3 SCOPE

This section applies to all RIC and subcontractor personnel who procure items or services for use on the project.

4.4 RESPONSIBILITIES

Responsibilities are defined in the ES/ER ORNL QAPP and are referenced in the appropriate sections of this QAPjP.

4.5 PROCUREMENT DOCUMENT CONTROL

The RIC, under the cognizance of the Task Leader, shall develop and issue a procedure for procurement document control in accordance with the requirements of the ES/ER ORNL QAPP.

WBS Element Managers, in conjunction with the Task Leader and the QA/QC Officer, shall assure that items and services procured for activities within their areas of responsibility are procured and documented in accordance with the requirements of the ES/ER ORNL QAPP, and in accordance with QA/QC procedures governing controlled documents and procurement.

5. INSTRUCTIONS, PROCEDURES, AND DRAWINGS

5.1 PURPOSE

This section commits project personnel to the use of documented instructions and procedures when performing quality-affecting activities for the WAG 13 Project.

5.2 REQUIREMENTS

Project activities affecting quality shall be prescribed by and performed in accordance with documented instructions, procedures, and drawings.

5.3 SCOPE

This section applies to the generation and use of instructions, procedures, and drawings used for quality-affecting activities for RIC personnel as well as subcontractor and supplier personnel.

5.4 RESPONSIBILITIES

Responsibilities are defined in the ES/ER ORNL QAPP and are referenced in the appropriate sections of this QAPjP.

5.5 CONTROL OF INSTRUCTIONS, PROCEDURES, AND DRAWINGS

WBS Element Managers, in conjunction with the QA/QC Officer, shall ensure that activities conducted within their areas of responsibility are conducted in accordance with written instructions, procedures, or drawings and that the instructions, procedures, or drawings have been developed or appropriated for use in accordance with the requirements of the ES/ER ORNL QAPP and with QA/QC procedures governing preparation of procedures.

WAG 13 activities for which approved instructions, procedures, and drawings must be in place prior to commencement of activity include, but are not limited to, the following:

- document preparation;
- environmental sampling;
- risk assessment;
- modeling;

- handling, packaging, storing, and shipping of hazardous and nonhazardous environmental samples;
- environmental monitoring;
- personnel decontamination;
- chain-of-custody procedures;
- data analysis; and
- data reduction, validation, and reporting.

6. DOCUMENT CONTROL

6.1 PURPOSE

This section commits project personnel to the systematic control of documents that significantly impact quality on the WAG 13 Project.

6.2 REQUIREMENTS

Project documents that significantly impact quality shall be controlled by an administrative system managed by the RIC.

6.3 SCOPE

This section applies to project documents that prescribe quality requirements or specify activities that have the potential to affect quality. These documents may be generated, used, reviewed, and/or altered by RIC personnel, subcontractor personnel, supplier personnel, or other personnel who provide items and/or services to the project.

6.4 RESPONSIBILITIES

Responsibilities are defined in the ES/ER ORNL QAPP and are referenced in the appropriate sections of this QAPjP.

6.5 PROJECT DOCUMENT CONTROL

Project documents subject to administrative control shall be controlled in accordance with the requirements of the ES/ER ORNL QAPP.

WBS Element Managers, in conjunction with the QA/QC Officer, shall ensure that documents specifying quality or quality-affecting activities within their areas of responsibility are generated, appropriated, reviewed, used, altered, and distributed in accordance with the requirements of the ES/ER ORNL QAPP and with QA/QC procedures governing controlled documents.

Project documents (or instruments) that specify quality or prescribe activities affecting the quality of the WAG 13 project include, but are not limited to, the following:

- The RI Work Plan
- Field Sampling Plan

- Data Management Plan
- The WAG 13 Project QAPjP
- Energy Systems Environmental Surveillance Program QC Program Manual
- Other pertinent Energy Systems QA documentation

7. CONTROL OF PURCHASED ITEMS AND SERVICES

7.1 PURPOSE

This section commits project personnel to the systematic control of items and/or services procured for use on the WAG 13 Project.

7.2 REQUIREMENTS

RIC personnel shall plan and document all activities that affect the control of purchased items and services to ensure the quality of those items and services.

7.3 SCOPE

This section applies to RIC personnel, subcontractor personnel, and supplier personnel involved to any extent in project procurement activities and/or to personnel providing items and/or services to the project.

7.4 RESPONSIBILITIES

Responsibilities are defined in the ES/ER ORNL QAPP and are referenced in the appropriate sections of this QAPjP.

7.5 PROCUREMENT DOCUMENT CONTROL

Procurement is a function of the procurement organization(s). Procurement for the project shall be conducted under the cognizance of the Task Leader. WBS Element Managers shall furnish the following assistance, as required, for purchase activities affecting their areas of responsibility:

- procurement planning,
- definition of acceptance criteria,
- development and/or approval of technical and regulatory specifications,
- subcontractor and/or supplier evaluation,
- bid evaluation, and
- item and/or service evaluation and acceptance.

WBS Element Mangers, in conjunction with the QA/QC Officer, shall ensure that items or services procured for activities within their areas of responsibility are procured in accordance with the requirements of the ES/ER ORNL QAPP and with QA/QC procedures governing procurement.

8. IDENTIFICATION AND CONTROL OF ITEMS

8.1 PURPOSE

This section commits all project personnel to the systematic identification and control of quality-affecting items used or generated by the WAG 13 Project.

8.2 REQUIREMENTS

The RIC shall apply controls to ensure that only correct and accepted items are used for project activities that may affect quality and that samples and data generated by project activities are placed under the control of this section.

8.3 SCOPE

This section applies to RIC and subcontractor personnel who use or generate items that affect or verify quality.

8.4 RESPONSIBILITIES

Responsibilities are defined in the ES/ER ORNL QAPP and are referenced in the appropriate sections of this QAPjP.

8.5 CONTROL OF ITEMS

Items subject to control under this section include engineered items, nonengineered items, samples, and data. WBS Element Managers shall be responsible for the identification of items used or generated within their areas of responsibility. WBS Element Managers, in conjunction with the RIC Procedures Coordinator and the QA/QC Officer, shall assure that appropriate procedures are used in the control of these items.

8.5.1 Engineered and Nonengineered Items

The RIC shall establish and issue procedures for marking items in accordance with the requirements of the ES/ER ORNL QAPP.

8.5.2 Samples and Data

WBS Element Managers, in conjunction with the Task Leader and the QA/QC Officer, shall ensure that the marking and identification of environmental samples and data are accomplished in accordance with Environmental Surveillance Procedure (ESP)-500, Manual Chain-of-Custody Procedures.

9. CONTROL OF PROCESSES

9.1 PURPOSE

This section commits project personnel to the control of special processes required for achievement of WAG 13 project goals and objectives.

9.2 REQUIREMENTS

Special processes that affect quality or that are used to verify quality shall be controlled and performed by qualified personnel using procedures in accordance with specified requirements. The QA objectives for all measurement data include considerations for precision, accuracy, completeness, representativeness, and comparability.

9.2.1 Precision

Measurement objectives for precision for this project will pertain to field and laboratory data. Precision is the agreement of multiple measurement values of the same property conducted under comparable conditions. Field measurement data include pH, conductivity, turbidity, temperature, and magnetometer readings.

The objective for precision for the selected project laboratories is to equal or exceed the precision demonstrated for the applied analytical methods on similar samples. Precision is evaluated by comparing multiple measurements of the same parameter under the same conditions and it is expressed in terms of Relative Percent Differences (RPD), which can be calculated according to the following equation:

$$RPD = (D_1 - D_1)/(D_1 + D_2)/2 \times 100$$

where:

D_1 = First Duplicate Value [percent recovery (PR)]

D_2 = Second Duplicate Value (PR)

Acceptable levels of precision will vary according to the sample matrix, the specific analytical method used, and the concentration relative to the method detection limit.

9.2.1.1 Contract Laboratory Program Criteria

Spiking is required for semivolatile organics and pesticide/PCBs by the CLP and for the analysis of Volatile Organic Analytes by SOPs. Spiking parameters, along with advisory limits on the RPD for each of these compounds, are listed in Table 9.1.

For metal analyses, the CLP-specified control limit on the RPD is 20 percent if both analyses are greater than five times the Contract Required Detection Limit (CRDL). If one or both of the analysis results are below five times the CRDL, the RPD is not calculated, and the results must agree within $\pm$ one CRDL.

9.2.1.2 Non-Contract Laboratory Program Criteria

For analyses that are not included in the CLP, specifications for spiking compounds and RPD criteria are listed in the project-required SOPs. Each SOP is based on a published EPA method whose QC recommendations and requirements have been incorporated into the SOP.

9.2.2 Accuracy

Accuracy is the degree to which the measured value represents the true value of that parameter. The accuracy of the data affect the number of significant figures that may be used in reporting the data.

9.2.2.1 Field Instrument Accuracy

Field data should equal or exceed factory specifications for the equipment being used. Where spiking of samples is not appropriate, analysis of known check samples will be performed. Field data should be reported to the number of significant figures specified in Subsection 9.5.6, Data Reduction, Validation, and Reporting.

9.2.2.2 Laboratory Instrument Accuracy

Laboratory data should equal or exceed the accuracy demonstrated for the applied analytical methods for samples of similar matrix and concentration of contaminants. Accuracy is expressed as PR and determined by analyzing a sample and its corresponding matrix spike sample. The PR can be calculated using the formula:

$$PR = \frac{S_s - S_o}{S_A} \times 100$$

where:

S_o = The background value, or the value obtained by analyzing the sample

Table 9.1 Percent Recovery and Relative Percentage Difference Advisory Limits for Matrix Spike and Matrix Spike Duplicate Samples[a]

Fraction	Matrix Spike Compound	Water PR[b] (Percent)	Water RPD[c] (Percent)	Soil/Sediment PR (Percent)	Soil/Sediment RPD (Percent)
VOA[d]	1,1-Dichloroethene	61-145	14	59-172	22
VOA	Trichloroethene	71-120	14	62-137	24
VOA	Chlorobenzene	75-130	13	59-133	21

S_A = Concentration of the spike added to the sample
S_s = Value obtained by analyzing the sample with the spike added

Matrix spike and duplicate spike analyses are used to determine the effect of matrix interference on analysis results. Aliquots of the same sample are prepared in the laboratory, and each aliquot is treated exactly the same throughout the analytical process. A matrix spike duplicate sample is prepared in the same manner as the matrix spike sample.

The degree of accuracy, or the recovery of analyte that can be expected from the analysis of the QA and spiked samples, depends upon the matrix, analysis method, and compound or element being analyzed.

9.2.2.3 Contract Laboratory Program Criteria

CLP criteria are used to evaluate accuracy in QC samples. Matrix spikes are used to determine the accuracy for organics and inorganics, while matrix spike duplicates are used for organics only. For metals analyses by furnace atomic adsorption spectroscopy, the CLP SOW specifies that post-digestion sample spike recovery be 85 percent to 115 percent. Quantitation should be performed by the Method of Standard Additions. The control limits for spike recovery of pre-digestion spikes are 75 percent to 125 percent. Spike recoveries outside these limits necessitate flagging of data.

Under CLP, organic parameters do not use full spike recovery procedures for all target analytes. Selected compounds are spiked into duplicate aliquots of the same sample and recoveries are calculated. Advisory CLP limits are listed in Table 9.1, and CLP limits for the appropriate surrogate compounds for each method are listed in Table 9.2.

9.2.3 Representativeness

Because the samples collected must be representative of the population, the population must be statistically characterized, and the degree to which the data accurately and precisely represent a characteristic of the population, parameter variations at a sampling point, a process, or an environmental condition assessed. A "t" test will be used to determine representativeness when fewer than 31 samples are tested. Data will be tested against the normal distribution when 31 or more samples are available for testing.

Sampling devices will be cleaned between each sampling event to ensure that sample contamination does not occur. Decontamination procedures are discussed in Section 9.5.1.1.

Representativeness of specific samples will be achieved by the following:

- sample collection from the most representative location,
- proper use of sampling procedures and equipment,

Table 9.2 Surrogate Spike Control Limits[a]

Fraction	Surrogate Compound	Percent Recoveries: Soil/Sediment (Percent)	Percent Recoveries: Water (Percent)
VOA[b]	1,2-Dichloroethane-d4	70-121	76-114
VOA	4-Bromofluorobenzene	59-113	86-115
VOA	Toluene-d8	84-138	88-110
SV-BN[c]	Nitrobenzene-d5	23-120	35-114
SV-BN	1,2-Dichlorobenzene-d4	20-130[d]	16-110[d]
SV-BN	Terphenyl-d14	18-137	33-141
SV-BN	2-Fluorobiphenyl	30-115	43-116
SV-A[e]	2-Fluorophenol	25-121	21-100
SV-A	2,4,6-Tribromophenol	19-122	10-123
SV-A	Phenol-d5	24-113	10-110
SV-A	2-Chlorophenol-d4	20-130[d]	33-110[d]
PEST[f]	Tetrachoro-m-xylene	60-150[g]	60-150[g]
PEST	Decachlorobiphenyl	60-150[d]	60-150[d]

[a]From EPA Contract Laboratory Program (CLP) Statement of Work (SOW) 3/90 for organics analysis (EPA 1990a). For VOA fraction, these are now referred to as "system monitoring compounds."

[b]VOA = Volatile Organic Analytes

[c]SV-BN = Semivolatile Organics-Base Neutral Extractable Fraction

[d]Advisory surrogate only; see CLP SOW 3/90, p. D-54/SV, paragraph 8.5.2ff determine the corrective actions required if these limits are exceeded.

[e]SV-A = Semivolatile Organics-Acid Extractable Fraction

[f]Advisory surrogate only at this time. Frequent failures to meet the limits warrant investigation, and may raise questions as to data acceptability (CLP SOW 3/90, p. E-29/PEST, paragraph 7.3).

[g]PEST = Pesticides and PCBs

- analysis by methodologies required for the parameters and detection limits, and

- analysis within specified holding times.

9.2.4 Comparability

Comparability describes the ease and absence of error with which data from one sample, sampling round, site, laboratory, project, or remedial study stage can be compared to those of another. The objective for comparability is determined on a qualitative rather than quantitative basis.

All data will be calculated and reported in units consistent with other organizations reporting similar data. The objectives for comparability are:

- demonstrate traceability of standards to National Bureau of Standards (NBS) or EPA sources,

- to use standard analysis methodologies,

- to report results from similar matrices in consistent units,

- to apply appropriate levels of QC within the context of the laboratory QA Program, and

- to participate in interlaboratory studies to document laboratory performance.

9.2.5 Completeness

Completeness is the amount of valid data obtained from the measurement system, either field or laboratory, versus the amount of data expected from the system expressed in the Percent Completeness (PC), which can be calculated using the following equation:

$$PC = \frac{\text{Number of samples having acceptable data}}{\text{Number of samples collected}}$$

At the end of each sampling event, an assessment of the completeness of the data will be performed and, if PC objectives are not met, a resampling of the parameter will occur. The PC objective for this project shall be greater than or equal to 90 percent for laboratory results and field data.

9.3 SCOPE

This section applies to environmental monitoring; environmental sampling; data management and analysis; and data reduction, validation, and reporting activities conducted or controlled by RIC or subcontractor personnel.

9.4 RESPONSIBILITIES

Responsibilities are defined in the ES/ER ORNL QAPP and are referenced in the appropriate sections of this QAPjP.

9.5 SPECIAL PROCESSES

Procedures may be modified or new procedures may be generated to address special conditions or objectives. Modified or new procedures shall be incorporated for use after documented approval is obtained from the RIC Program Manager.

9.5.1 Decontamination

All equipment will be decontaminated before use to prevent sample contamination.

9.5.1.1 Drilling Equipment

The following steps will be taken to decontaminate drill rigs and drill pipe (and other large equipment associated with sampling that will not come into contact with the sample medium):

- clean with high-pressure steam cleaner;
- wash with potable water and non-phosphate, laboratory-grade detergent;
- rinse with potable water; and
- rinse with deionized, analyte-free water.

Deionized, analyte-free water will be processed by passing potable water through a commercial deionizer and through a carbon filter, in that order. To prevent breakthrough, this set is followed by an identical set. The water will be sampled between sets every week and analyzed for metals, anions, and volatile and semivolatile organics.

The drill rig, drill pipe, and all downhole equipment will be steamcleaned before going on-site and will be decontaminated in accordance with ESP-901 before work is begun. All downhole equipment will be decontaminated between each borehole.

9.5.1.2 Sampling Equipment

Sampling equipment that comes in contact with the environmental media to be sampled will receive additional, more intensive cleaning. This equipment includes Shelby tubes, continuous core samplers, split spoons, hand towels, beakers, bailers, submersible pumps, and tube samplers for sampling contents of drums. The procedure to be used depends on the analyses to be conducted on a given sample and are specified in ESP-900.

9.5.2 Environmental Monitoring

WBS Element Managers, in conjunction with the Project Health and Safety Officer and the QA/QC Officer, shall ensure that environmental monitoring activities are designed to detect the presence of and measure the potential for release of materials that may pose a threat to human health or the environment.

9.5.2.1 Monitoring Well Installation Development

Groundwater monitoring wells will be installed in accordance with ESP-600 and must be successfully developed before groundwater sampling begins. Well development water will be collected and stored in a bulk holding tank. Monitoring well development methods and requirements are described in ESP-600. Requirements for disposal of development water are specified in the RI Work Plan.

9.5.2.2 Groundwater Level Measurement

Groundwater levels will be determined according to ESP-302-1 in all wells before purging. Wells known to contain floating materials will have both the depth-to-materials and depth-to-water measured.

Groundwater levels in sealed wells will be allowed to equilibrate after opening the well. An initial measurement immediately after unsealing will be compared with a measurement made 5 minutes later. If these two successive measurements agree within $\pm$ 0.01 ft., the groundwater will be deemed to be in equilibrium.

9.5.3 Environmental Sampling

WBS Element Managers, in conjunction with the Task Leader and the QA/QC Officer, shall assure that environmental sampling conducted within their areas of responsibility is conducted in accordance with the appropriate procedure or combination of procedures as specified in the RI Work Plan.

9.5.3.1 Groundwater Sampling

Volatile Organics and Immiscible Liquids: Monitoring wells will be checked for organic vapor and light . - dense immiscible liquids before purging and sampling. A portable photoionization detector meter will be used in accordance with ESP-307-6 to determine the presence of organic vapor in the well casing. The presence of light or dense immiscible liquids will then be determined according to field procedure FP 6-5.

Well Purging: Monitoring wells will be purged before sampling as specified in the RI Work Plan. The purging rate will be controlled to avoid cascading or excessive agitation within the well. All equipment lowered into the well will be decontaminated before use following ESP-900. Specific procedures for purging high and low yield wells are described in ESP-302-2.

Groundwater samples will be collected immediately after purging or, if conditions prevent immediate sampling, within eight hours of purging using equipment specified in the RI Work Plan.

Groundwater will be sampled in accordance with procedures outlined in the RI Work Plan. Samples with the most volatile parameters and those not being split will be collected first. Sample containers will be filled directly from the bailer. Samples for parameters other than volatiles will be taken from composites if splits are obtained. The types of sample containers and preservatives to be used for water samples are listed in ESP-701. Temperature, pH, and conductivity will also be measured at the time of sampling. A sample of water will be placed in a 1-L jar and measurements taken from it. Equipment specified in the RI Work Plan will be used to perform these measurements.

Surface Water and Groundwater Samples for Metals and Anions: Surface water and groundwater samples for metals and anions will be filtered directly into the sample container and preserved as described in Table 9.3. All filtering equipment will be decontaminated between wells, following procedures specified in the RI Work Plan. Unfiltered samples for metals will be obtained for surface water and groundwater samples from water supply wells. Separate field QC samples will be collected for both filtered and unfiltered samples.

9.5.3.2 Soils Sampling

Subsurface soil samples collected during borehole drilling and surface soil samples will be obtained for lithologic description and chemical analysis. Sampling techniques are described in the RI Work Plan. Sample containers and specifications for preservation are listed in ESP-701 and summarized in Table 9.4. Objectives for the geotechnical analyses are specified in the RI Work Plan and summarized below:

- Permeability
- Grain size
- Unit weight
- Volume

Table 9.3 Summary of Sample Containment and Sample Preservation Methods for Water Samples

Parameter	Analytical Method	Sample Container: Qty[a,b]	Sample Container: Type	Preservation Methods	Holding Times[c]
ORGANICS					
TCL[d]-VOA[e]	CLP[f] SOW	4	40-ml glass vials, Teflon-lined septum cap	Cool, 4°C 4 Drops HCl	Within 10 days of VTSR[g]
TCL-SV[h] Chlorinated Herbicides	CLP SOW SOP[i] (SW[j] 8150)	1	1-gal narrow-mouth amber glass bottle, Teflon-lined cap	Cool, 4°C	Extraction within 7 days of VTSR; analysis within 40 days of VTSR
P/P[k]	CLP SOW	1	1-liter narrow-mouth amber glass bottle, Teflon-lined cap	Cool, 4°C pH 5-9	Extraction within 7 days of VTSR; analysis within 40 days of VTSR
TPH[l]	SOP (E[m] 418.1)	2	1-liter narrow-mouth glass bottle, Teflon-lined cap	Cool, 4°C HCl (5 ml)	28 days
Dioxins and Dibenzofuran	SOP (SW 8280)	1	1-gal amber glass bottle, Teflon-lined cap	Cool, 4°C	Extraction within 7 days of VTSR; analysis within 40 days of VTSR
INORGANICS					
Metals	CLP SOW	1	500-ml polyethylene bottle	HNO_3 to pH<2	6 months; mercury - 26 days of VTSR
Common Anions	SOP (E 300.0)	1	500-ml polyethylene bottle	Cool, 4°C NaOH to pH>12	28 days; nitrate and nitrite 48 hours
CN	CLP SOW	1	500-ml polyethylene bottle	Cool, 4°C	14 days
Gross Alpha and Gross Beta		1	1-liter polythene bottle	HNO_3 to pH<2	14 days

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Table 9.3 Summary of Sample Containment and Sample Preservation Methods for Water Samples (Continued)

[a]One in 20 samples shall be collected in triplicate for matrix spike and matrix spike duplicate analyses in accordance with CLP protocols.

[b]An additional 1-liter glass bottle with teflon-lined lid will be used when all three analyte groups (SV, P/P, Chlor. Herb.) are to be analyzed. An additional 1-gal bottle will be used to collect samples for matrix spike duplicate samples.

[c]Holding time is the time between sample collection and sample analysis, or the time between sample receipt and sample analysis if VTSR is designated. Samples must be delivered to the laboratory within 48 hours of collection.

[d]TCL = Target Compound List
[e]VOA = Volatile Organics
[f]CLP SOW = Contract Laboratory Program Statement of Work
[g]VTSR = Verified Time of Sample Receipt
[h]SV = Semivolatile Organics
[i]SOP = Standard Operating Procedure
[j]SW = Method described in EPA 1986a
[k]P/P = Pesticides/PCBs
[l]TPH = Total Petroleum Hydrocarbons
[m]E = Method described in EPA 1983

Table 9.4 Summary of Sample Containment and Sample Preservation Methods for Soil and Sediment Samples

Parameter	Analytical Method	Sample Container Qty[a]	Sample Container Type	Preservation Methods	Holding Times[b]
ORGANICS					
TCL[c]-VOA[d]	SOP[e](CLP[f]-VOA)	1	120-ml wide-mouth amber glass jar, Teflon-lined lid	Cool, 4°C	Within 10 days of VTSR[g]
SV[h], P/P[i]	CLP SOW	1	120-ml wide-mouth amber glass jar, Teflon-lined lid	Cool, 4°C	Extraction within 10 days of VTSR
Chlorinated Herbicides	SOP (SW[j] 8150)	1	120-ml wide-mouth amber glass jar, Teflon-lined lid	Cool, 4°C	Analysis within 40 days of VTSR
TPH[k]	SOP (E[l] 418.1)	1	120-ml wide-mouth amber glass jar, Teflon-lined lid	Cool, 4°C	Not applicable
Dioxins and Dibenzofuran	SOP (SW 8280)	1	120-ml wide-mouth amber glass jar, Teflon-lined lid	Cool, 4°C	Extraction within 14 days; analysis within 40 days
INORGANICS					
Metals	CLP SOW	1	250-ml wide-mouth amber glass jar	Cool, 4°C	6 months; mercury - 26 days
CN	CLP SOW	1	250-ml wide-mouth amber glass jar	Cool, 4°C	14 days

[a]One in 20 samples shall be collected in triplicate for matrix spike and matrix spike duplicate analyses in accordance with CLP protocols.

[b]Holding time is the storage time between the times of sample collection and sample analysis, or the storage time between sample receipt and sample analysis if VTSR is designated. Samples must be delivered to the laboratory within 48 hours of collection.

[c]TCL = Target Compound List
[d]VOA = Volatile Organics
[e]SOP = Standard Operating Procedure
[f]CLP = Contract Laboratory Program
[g]VTSR = Verified Time of Sample Receipt
[h]SV = Semivolatile Organics
[i]P/P = Pesticides/PCBs
[j]SW = Method described in EPA 1986a
[k]TPH = Total Petroleum Hydrocarbons
[l]E = Method described in EPA 1983

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- Porosity
  - moisture content
  - specific gravity

9.5.3.3 Surface Water and Sediments Sampling

Sampling containers and preservation procedures for surface water samples are the same as those for groundwater. Surface water sampling procedures are described in the RI Work Plan.

Sample containers and preservation procedures for sediment samples are the same as those for soils. Sediment sampling procedures are described in the RI Work Plan. Temperature, pH, and conductivity will also be measured at the time of sampling. These measurements will be taken from a 1-L jar. Equipment specified in the RI Work Plan will be used to perform these measurements.

9.5.3.4 Sampling Procedures

Procedures shall be selected from the following Energy Systems ESPs as approved for use by the RIC. New procedures modified from other sources may also be used if approved by the RIC.

- ESP-301-1, Water Sampling Using a Dipper
- ESP-301-2, Peristaltic Pump for Sampling Surface Waters
- ESP-301-3, Sampling with an Automatic Sampler
- ESP-301-4, Grab Sampling with Kemmerer Bottles
- ESP-301-5, Stream Flow Measurements
- ESP-302-1, Groundwater Sampling Procedures: Water Level Measurements Using Water Level Indicator
- ESP-302-2, Groundwater Sampling Procedures: Guidelines for Well Purging
- ESP-302-3, Groundwater Sampling Procedures: Using a Bailer
- ESP-302-4, Groundwater Sampling Procedures: Using a Gas-Driven Piston Pump

- ESP-302-5, Groundwater Sampling Procedures: Using a Bladder Pump
- ESP-303-1, Soil Sampling with a Spade and Spoon
- ESP-303-2, Soil Sampling with an Auger
- ESP-303-3, Soil Sampling Using a Trier
- ESP-303-4, Penetration Test and Spilt-Barrel Sampling
- ESP-303-5, Subsurface Soil Sampling with Shelby Tubes
- ESP-303-6, Rock Coring and Sample Collection
- ESP-303-7, Soil Gas Sampling
- ESP-304-1, Sediment Sampling Procedures: Streambeds
- ESP-304-2, Sediment Sampling Procedures: Deepwater (Lake)
- ESP-305-1, High-volume air sampling for particulate matter
- ESP-305-2, Low-volume air sampling for particulate matter
- ESP-306, Procedures for Sampling Biological Materials
- ESP-307-1, Field Measurements Procedures: Temperature
- ESP-307-2, Filed Measurements Procedures: pH (Hydrogen Ion Concentration)
- ESP-307-3, Field Measurements Procedures: Dissolved Oxygen
- ESP-307-4, Field Measurements Procedures: Residual Chlorine
- ESP-307-5, Field Measurements Procedures: Oxidation/Reduction Potential of Water
- ESP-307-6, Field Measurements Procedures: Organic Vapor Detection
- ESP-307-7, Field Measurements Procedures: Operation of Radiation Survey Instruments
- ESP-308-1, Composite Procedures

- ESP-308-2, Wipe Sample Procedures
- ESP-308-3, Container Sampling: Drums and Tanks
- ESP-400, Field QC
- ESP-600, Groundwater Sampling Procedures: Well Installation, Development, and Abandonment

9.5.4 Analytical Procedures

Where possible, EPA CLP Routine Analysis Services analytical methods should be followed.

9.5.4.1 Contract Laboratory Program Procedures

For the analysis of Target Compound List (TCL) parameters by CLP protocols, the laboratory will follow methods detailed in the CLP SOW for organic analyses and for inorganic analyses. TIC will be required for all GC/MS methods.

If it is impossible to quantify samples in parts per billion (as in the case of drums or tanks where pure waste in encountered), the samples will be diluted and analyzed, and the detection limits will be raised for all analytes.

9.5.4.2 Non-Contract Laboratory Program Procedures

Non-CLP procedures will be based on EPA analytical methods and will be developed in the same manner as CLP basic methods. Approved Non-CLP methods will specify:

- procedures for sample preparation;
- instrument startup and performance checks;
- procedures to establish actual and required detection limits for parameters;
- initial and continuing calibration check requirements;
- specific methods for each sample matrix type; and
- required analyses for method blanks, trip blanks, field blanks, matrix spikes, matrix spike duplicates, and laboratory control samples.

Table 9.5 summarizes the analyte group and EPA method from which SOPs for chemical analyses are derived. Radiological analytical methods are presented in Table 9.6 and Table 9.7.

9.5.5 Data Management and Analysis

WBS Element Managers, in conjunction with the Task Leader and the QA/QC Officer, shall ensure that data collected within their areas of responsibility are managed and analyzed in accordance with requirements and procedures specified in the Data Management Plan of the RI Work Plan. Procedures shall be selected from the following Energy Systems ESPs as approved for use by the RIC. New procedures or procedures modified from other sources may also be used if approved by the RIC.

- ESP-400, Field QC
- ESP-500, Manual Chain-of-Custody Procedures
- ESP-700, Chemical Analysis
- ESP-701, Sample Preservation and Container Materials
- ESP-800, Packaging Environmental Sample for Transportation
- ESP-900, Cleaning and Decontaminating Sample Containers and Sampling Devices
- ESP-901, Equipment decontamination
- ESP-1000, Waste Management
- ESP-1100, Statistical Sampling Design

9.5.6 Data Reduction, Validation, and Reporting

The Project Manager shall ensure data reduction, validation, and reporting techniques comply with the requirements and procedures specified and/or referenced in the RI Work Plan.

9.5.6.1 Data Reduction

Field Data: The following standard field measurement techniques will be used during all phases of the project:

- Electromagnetic conductivity readings to 1 millimhos per meter,

Table 9.5. Non-Contract Laboratory Program Analytical Methods

Analyte Group	SOP[a]	Method[b]
Volatile Organics	SOP (EPA 524) CLP SOW[c] (High Concentration)	EPA 524
Conductivity	SOP (E120.1)	E120.1
pH	SOP (E150.1)	E150.1
Temperature	SOP (E170.1)	E170.1
Total Petroleum Hydrocarbons	SOP (E418.1)	E418.1
Common Anions	SOP (E300.0)	E300.0
Chlorinated Herbicides	SOP (SW8150)	SW8150
Dioxins and Dibenzofurans	SOP (SW8280)	SW8280

[a]Standard Operating Procedure

[b]Method Sources are: (1) Methods identified as "Exxx.x" are described in Methods for the Chemical Analysis of Water and Wastes (EPA 1983). (2) Methods identified as "SWxxxx" are described in *Test Methods for Evaluating Solid Waste* SW-846 (EPA 1986a).

[c]Contract Laboratory Program Statement of Work for Organics, Multimedia, High Concentration (EPA 1988).

Table 9.6. Radiological Analytical Methods

Analyte Group/Radionuclide	Method	Reference
Gross Alpha and Beta	SW9310	EPA[a], 1986a
Americium 241	E-AM-00-01	HASL[b]-300 Manual
Carbon 14	Radioelement Analysis - C14	EPA-520/5-84-006
Cesium 134	D-04	HASL-300-Manual
Cesium 137	D-04	HASL-300-Manual
Cobalt 58	D-04	HASL-300-Manual
Cobalt 60	D-04	HASL-300-Manual
Iodine 129	D-04	HASL-300-Manual
Lead 210	(No method number specified)	HASL-300-Manual
Neptunium 237	E-NP-01-01	HASL-300-Manual
Niobium 95	D-04	HASL-300-Manual
Polonium 210	The Radiochemistry of Polonium	NAS[c]
Potassium 40	EPA 258.1	
Plutonium (Isotopic)	NAS-NS-3058	NAS
Radium 226	EPA 903.1	
Radium 228	EPA 904.0	
Radon	Radon Emanation	EPA-600/4-80-032
Strontium 89	Radioassay	NCRH[d]
Strontium 90	RPM[e]	EPA-520/5-84-006
Technetium 99	EPA Method EC-186	
Thorium (Isotopic)	NAS-NS-3004	
Tritium	RPM	EPA-520/5-84-006
Uranium (Total)	ASTM[f] D-2097	
Uranium (Isotopic)	E-U-04-01	HASL-300-Manual

[a]EPA = U.S. Environmental Protection Agency

Table 9.6. Radiological Analytical Methods

[b]HASL = Health and Safety Laboratory, EPA
[c]NAS = National Academy of Science
[d]NCRH = National Center for Radiologic Health
[e]RPM = Radiochemistry Procedures Manual
[f]ASTM = American Society for Testing and Materials

Table 9.7. Geotechnical Analytical Methods

Procedure Title	Method
Method for Conducting Permeability Tests	COE[a] EM-1110-2-1906
Method for Determining Atterberg Limits	ASTM[b] D-4318-84
Method for Determining Grain Size	ASTM D-422-63
Method for Determining Unit Weight	ASTM D-2937-83
Method for Determining Moisture Content	ASTM D-2216-80
Method for Determining Specific Gravity	ASTM D-854-83
Method for Sampling Using Shelby Tubes	ASTM D-1587-83
Method for Sampling Using Split Spoon	ASTM D-1586-84
Method for Sampling Using Hand and Machine Auger	ASTM D-1452-80
Method for Preserving and Transporting Soil Samples	ASTM D-4220-83

[a]COE = U.S. Army Corps of Engineers
[b]ASTM = American Society for Testing and Materials

- Magnetometer readings to either 1 or 10 gammas depending on sensor attached to instrument,
- Electrical resistivity readings to within 0.5 ohm/ft,
- Explosimeter readings to within $\pm$ 0.2 percent,
- Photoionization readings to $\pm$ 0.2 ppm,
- Nephelometer readings to 0.1 nephelometric turbidity units,
- pH to 0.1 standard units,
- Specific conductance to two significant figures below 100 umhos/cm and three significant figures above 100 umhos/cm,
- Temperature to the nearest 0.5°C,
- Water levels measured to the nearest 0.02 ft,
- Soil sampling depths to the nearest 0.5 ft, and
- Altitudes above National Geodetic Vertical Datum of 1929 of measuring points in monitoring wells and surface water elevations of $\pm$ 0.01 ft.

Laboratory Data: Procedures to be used for calculations and data reduction are specified in the corresponding analysis method.

All calculations and data used to arrive at the reported value for each sample will be entered into a bound laboratory notebook for each analytical procedure. These data will be stored in client files and should be traceable to original entries in bound notebooks. Instrument chart recordings and calculator print-outs will be labeled and attached to their respective pages in the notebooks or are cross-referenced and stored in the project file.

All calculations shall be checked by the analyst before reporting the results, and the analyst's supervisor or a designated alternate shall check a minimum of 10 percent of all calculations before releasing any analytical reports. Results obtained from extreme ends of standard curves generated by linear regression programs will be checked against graphically produced standard curves if the correlation coefficient of the program curve is less than 0.995.

Concentration units will be listed on all calculation sheets and in all reports and any special conditions noted. The analysis report will include the unique sample number as well as details of sample receipt and report preparation.

Gas Chromatograph/Mass Spectrometer Data: Compounds will be identified and quantified by data reduction programs in the mass spectrometer data system. Identity is based on a combination of retention time and prominent ions. All positive identifications and quantitations will be checked by an experienced GC/MS chemist. Quantitation is performed by the data system using an internal standard calculation on a major ion of the compound. A multi-point calibration curve is generated, and relative response factors (RRF) are calculated for each point using the formula

$$RRF = \frac{(Ax)\,(Cis)}{(Ais)\,(Cx)}$$

where:

Ax	=	area under the chromatograph curve resulting from the analyte response;
Cis	=	the internal standard concentration;
Ais	=	area under the chromatograph curve resulting from the internal standard response; and
Cx	=	concentration of the analyte.

The average response factor is then calculated. Analyte concentrations will be calculated using the formulas described in the respective EPA CLP or SOP methods.

QC includes a daily calibration check. If any response factor for a compound does not agree with the average response factor within limits set by the method, corrective action will be taken, including recalibration if required. The system tune should be checked with standard tuning compounds as detailed in the method. Blanks will be analyzed as described in the method plus whenever deemed necessary by the analyst. All samples will be spiked with surrogates. If surrogates or matrix spikes are outside recommended control limits, steps should be taken as described in the laboratory method.

9.5.6.2 Data Validation

Field Data: Field data should be validated using the following four procedures:

- Routine checks during the processing of data (e.g., looking for errors in identification codes).

- Evaluation of the internal consistency of data sets (e.g., plotting the data and testing for outliers).

- Checks for consistency of the data set over time by visually comparing data sets against gross upper limits obtained from historical data sets or by testing for historical consistency. Anomalous data will be flagged.

- Checks for consistency with parallel data sets (e.g., comparing data from the same region of the aquifer or volume of soil).

The purpose of these validation checks is to identify outliers, which are defined as nonconformance to the pattern established by other observations. Outliers may be the result of miscalculations or instrument breakdowns. On the other hand, outliers may also be manifestations of a greater degree of spatial or temporal variability than expected.

After an outlier has been identified, obvious mistakes in the data or calculations will be corrected and the correct value inserted. If the correct value cannot be obtained, the data may be excluded. An attempt should be made to explain the existence of the outlier. If no plausible explanation can be found for the outlier, it may not be excluded, but a note to that effect will be included in the report.

Laboratory Data: Data will be reviewed and validated using EPA guidance for analyses conducted by CLP methods. Analytical reports for analyses performed using CLP methods will be validated at EPA Level IV. All other analytical reports shall meet EPA Level III QA requirements and be validated at EPA Level IV. To allow for the correct level of data validation, all EPA Level IV reports shall include all raw data, including any and all preparatory stages, such as extractions or digestions. All EPA Level III reports will include the EPA Level IV deliverables. The project QA manager will designate individuals external to the laboratories to validate all laboratory data. In addition, 10 percent of these results will be audited to ensure that the validation process has been properly completed. If any validation errors are discovered within a data set, the entire data set shall be revalidated by a different data validator.

9.5.6.3 Reporting

Contract Laboratory Program Reporting Requirements: For all CLP analyses, data reporting will be according to CLP requirements as published in the current CLP SOW. The laboratory report should show traceability to the sample analyzed and contain the following information:

- project identification;

- field sample number;

- laboratory sample number;
- sample matrix description;
- date of sample collection;
- date of sample receipt at laboratory;
- analytical method description and reference citation;
- initial calibrations;
- individual parameter results and raw data;
- date of analysis (extraction, first run, and subsequent runs);
- recoveries of surrogates and matrix spikes;
- quantitation limits achieved;
- all internal QC checks and procedures;
- dilution or concentration factors; and
- corresponding QC report to include method blanks, blank/spikes, and continuing calibration checks.

All CLP analyses shall be reported using full CLP data packages.

Standard Operating Procedure Reporting Requirements: Results of all SOP analyses shall be reported with full CLP packages, as specified in the SOP. In all cases, the SOP reports shall be modeled on CLP Data Packages and will meet EPA Level III Reporting requirements.

Data Qualifiers: For both CLP and SOP analysis reports, EPA-defined data qualifiers will be required. All qualifiers used in any analytical report will be defined in the case narrative.

The 10 EPA-defined data qualifiers for organics analysis are:

1. U Analyzed for but not detected. Report as the Contract Required Quantitation Limit (CRQL) the basis of dilutions made and percentage moisture for soils.

2. J An estimated value.

   a. A value less than CRQL but greater than Method Detection Limit is reported. The CRQL must be adjusted for dilutions made and percentage moisture for soil.

   b. A TIC compound is reported and the quantitation is estimated based upon assumption of a response factor of 1:1 with the internal standard.

3. C Pesticides where the identification has been confirmed by GC/MS as required for single component pesticides present in concentrations equal to or greater than 10 ng/ul in the final extract.

4. B The compound was found in the blank as well as the sample. TICs must also be flagged as well as TCL compounds.

5. E Compounds identified whose concentrations exceed the calibrated range of the instrument. When the sample is diluted and reanalyzed and compounds found in the original analysis are diluted out, both results are reported on separate analytical reports.

6. D All compounds quantified when a sample has been diluted and reanalyzed.

7. A A TIC is a suspected aldol-condensation product.

8. X Other flags may be required to properly qualify the results for a specific situation. The flag selected must be clearly defined in the Case Narrative.

9. N Presumptive evidence of a compound. This flag is only used for TICs, where the identification is based on a mass spectral library search. It is applied to all TIC results.

10. P A pesticide/Aroclor target analyte when there is greater than 25 percent difference for detected concentrations between the two GC columns. The lower of the two values is reported on Form I and flagged with a "P."

If more than five qualifiers are required for a sample, the "X" flag will be used to combine several other qualifiers and an explanation will be given in the Case Narrative.

The combination of flags "BU" or "UB" is prohibited because the B flag is used only if the compound is found in the sample.

Data qualifiers for reporting the type of metals analyses are:

- P - ICP
- A - Atomic Absorption Spectrometer (AAS) flame
- F - AAS furnace
- CV - Cold vapor
- NA - Analyte not required

Data qualifier for reporting metals concentrations are:

- B - Less than Instrument Detection Limit.
- E - Estimated due to interference. An explanation is required under comments on the form or on the cover page if the interference applies to all samples in the set.
- M - Duplicate injection precision is not met. AAS Furnace analyses are performed in duplicate. The absorbance/ concentration values must agree within $\pm$ 20 percent.
- N - The PR of the spiked sample is not within the control limits.
- 5 - The reported value was determined by the method of standard additions.
- 10 - The analysis spike, a spike added to the sample digestate, has a PR out of control limits (85 to 115 percent), and the sample absorbance is less than 50 percent of the spike absorbance.
- * The RPD for duplicate analyses is not within control limits.
- + The correlation coefficient for the method standard addition is less than 0.995.

No combination of S, W, and + can be used. These flags are mutually exclusive.

10. INSPECTION

10.1 PURPOSE

This section commits project personnel to an inspection system for items used on the WAG 13 Project.

10.2 REQUIREMENTS

Items used in data collection, analysis, and handling shall be inspected for compliance with approved specifications.

10.3 SCOPE

This section applies to RIC and subcontractor personnel who use items, including equipment, to conduct project activities.

10.4 RESPONSIBILITIES

Responsibilities are defined in the ES/ER ORNL QAPP and are referenced in the appropriate sections of this QAPjP.

10.5 PROJECT INSPECTION

Inspections shall be performed on items procured, furnished, and used for the collection, analysis, and handling of environmental samples and on items used in the management of hazardous and mixed waste.

The QA/QC Officer shall determine inspector qualifications for each item to be inspected and shall schedule the inspection in accordance with requirements outlined in the ES/ER ORNL QAPP.

WBS Element Managers, under the cognizance of the Task Leaders, shall ensure that items subject to inspection within their areas of responsibility are inspected and the inspection results documented in accordance with QA/QC procedures governing inspection and procurement, as applicable.

Project activities shall be monitored and inspected in accordance with the requirements of QAPjP Section 18, Audits and Surveillances.

11. TEST CONTROL

11.1 PURPOSE

This section commits project personnel to verify the conformance of items used for the WAG 13 Project.

11.2 REQUIREMENTS

Tests required to verify conformance of items to specified requirements and to demonstrate that items will perform satisfactorily in service shall be conducted in accordance with specifications and the results properly documented.

11.3 SCOPE

This section applies to all RIC, subcontractor, and supplier personnel providing items and/or services for the project.

11.4 RESPONSIBILITIES

Responsibilities are defined in the appropriate section of the ES/ER ORNL QAPP and are referenced in the appropriate sections of this QAPjP.

11.5 TEST CONTROL

The requirements for testing shall be specified in appropriate documents related to the item. When testing is specified for various items, WBS Element Managers, in conjunction with the QA/QC Officer, shall ensure that appropriate project personnel are available to plan and conduct all necessary tests, to evaluate test results, and document test results in accordance with specified test parameters and with the requirements of the ES/ER ORNL QAPP.

12. CONTROL OF MEASURING AND TEST EQUIPMENT

12.1 PURPOSE

This section commits project personnel to the proper use of M&TE used on the WAG 13 Project.

12.2 REQUIREMENTS

Tools, gauges, instruments, and other M&TE used for project activities affecting quality shall be used, calibrated, and maintained in accordance with specified procedures. Documentation of these activities is also required.

12.3 SCOPE

This section applies to M&TE used by RIC and subcontractor personnel to conduct environmental monitoring and sampling.

12.4 RESPONSIBILITIES

Responsibilities are defined in the appropriate section of the ES/ER ORNL QAPP and are referenced in the appropriate sections of this QAPjP.

12.5 MEASURING AND TEST EQUIPMENT CONTROLS

12.5.1 Procurement, Identification, and Selection

WBS Element Managers, under the cognizance of the Task Leader and in conjunction with the M&TE Coordinator, shall assure that M&TE procured for use in their areas of responsibility is procured in accordance with QA/QC procedures governing procurement and the requirements of the ES/ER ORNL QAPP.

The RIC M&TE Coordinator shall establish procedures for identifying the required M&TE and for creating an M&TE inventory.

12.5.2 Calibration, Maintenance, and Operation

The TSC M&TE Coordinator, under the cognizance of the Task Leader, shall specify the calibration, adjustment, operation, and maintenance requirements for each piece of M&TE to be included in the M&TE inventory. Specifications shall be in accordance with the requirements of the ES/ER ORNL QAPP and the manufacturer's recommendations, and shall be directly traceable to the appropriate piece of M&TE.

12.5.2.1 Calibration Procedures and Frequency for Field Equipment

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in a manner such that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

Field Instruments

Field instruments will be calibrated at intervals specified by the manufacturer or more frequently as conditions dictate. This category includes pH meters, thermometers, nephelometers, specific conductivity meters, portable gas chromatographs, and Organic Vapor Analyzers or Organic Vapor Photoionization Detectors. If calibration/checkout procedures are not met, the equipment should be tagged "out of service" and returned to the manufacturer for service. The method and frequency of calibration and the proper use of field instruments are summarized in Table 12.1.

Geophysical Instruments

Geophysical instruments, including magnetometers, electromagnetic conductivity meters, and ground penetrating radar equipment, will be calibrated at intervals established in the RI Work Plan.

12.5.2.2 Calibration Procedures and Frequency for Laboratory Equipment

Approved written procedures will dictate laboratory equipment calibration. Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing QC activities. These records will be filed where the work is performed and will be subject to a QA audit. The laboratory will maintain personnel and parts or service contracts with vendors to perform in-house maintenance. Where analyses use EPA CLP procedures, calibration protocols and frequencies will follow the applicable CLP RAS SOW. Those analyses governed by SOPs will require appropriate specified calibration.

Organic Analyses

GC/MS instruments will be tuned by analysis of p-bromofluorobenzene for volatile organic analyses and by decafluorotriphenyl phosphine for semi-volatile organic analyses. The tuning criteria for these reference compounds are given in Table 12.2 and Table 12.3. Tuning will be verified every 12 hours of operation.

After tuning, initial calibration is achieved using a five point calibration curve. Continuing calibration will be verified as specified in the method, or at least each working

Table 12.1. Summary of Field Monitoring Equipment Calibration and Use

Equipment	Use	Units of Measure	Calibration Procedures
Portable Photo-ionization Gas Analyzer	Air monitoring during field operations for presence of organic vapors. Soil vapor monitoring at selected sites.	Parts per Million	Calibrate daily with known gas and concentration.
Explosimeter	Air monitoring during field operations for presence of combustible gases.	Percent of Lower Explosive Limit	Calibrate daily with known gas and concentration. Daily testing in known explosive environment (gas tank) and zero adjustment in clean environment.
pH Meter	Measure groundwater pH during development, purging, and sampling of monitoring wells and sampling of surface waters.	Standard Units	Calibrate by laboratory standard pH solutions. Calibrate in the field daily using laboratory-prepared standard solutions.
Specific Conductance Meter	Measure groundwater specific conductance during development, purging, and sampling of monitoring wells and sampling of surface waters.	Micromhos Per Centimeter	Calibrate daily using laboratory-prepared known conductivity solution.
Thermometer	Groundwater temperature measurements during development, purging, and sampling of monitoring wells and surface water sampling locations.	Degrees Celsius	Calibrated by manufacturer.
Water-Level Indicator	Groundwater level measurements in monitoring wells.	Feet	Calibrated by manufacturer. Calibration check will be made periodically using a surveyors' tape.

Table 12.1. Summary of Field Monitoring Equipment Calibration and Use (Continued)

Equipment	Use	Units of Measure	Calibration Procedures
Colorimetric Tubes	Hand pump specific amounts of ambient air through a colorimetric tube to measure organic vapors.	Visual ppm	Calibrate air pump daily using airflow meter from manufacturer.
Nephelometer	Measures turbidity in groundwater samples during monitoring well development.	Nephelometric Turbidity Units (NTU)	Calibrate daily with a 5.0 NTU Standard Solution Cell.

Table 12.2 BFB[a] Key Ions and Ion Abundance Criteria[b]

Mass	Ion Abundance Criteria
50	15.0% - 40.0% of the base peak
75	30.0% - 60.0% of the base peak
95	base peak, 100% relative abundance
96	5.0% - 9.0% of the base peak
173	less than 2.00% or mass 174
174	greater than 50.0% of the base peak
175	5.0% - 9.0% of mass 174
176	greater than 95.0% but less than 101.0% of mass 174
177	5.0% - 9.0% of mass 176

[a]BFB = p-bromofluorobenzene
[b]Contract Laboratory Program Statement of Work for Organics Analysis (EPA 1990a).

Table 12.3. BFTPP[a] Key Ions and Ion Abundance Criteria[b]

Mass	Ion Abundance Criteria
51	30.0% - 60.0% of mass 198
68	less than 2.0% of mass 69
70	less than 2.0% of mass 69
127	40.0% - 60.0% of mass 198
197	less than 1.0% or mass 198
198	base peak, 100% relative abundance
199	5.0% - 9.0% of mass 198
275	10.0% - 30.0% of mass 198
365	greater than 1.00% of mass 198
441	present but less than mass 443
442	greater than 40.0% of mass 198
443	17.0% - 23.0% of mass 442

[a]BFTPP = Decafluorotriphenyl phosphine
[b]Contract Laboratory Program Statement of Work for Organics Analysis (EPA 1990a).

day, using criteria specified in the method. Standards will be with EPA or NBS traceable and spiked with internal standards and surrogate compounds.

The area of the primary characteristic ion for each compound in the standard is tabulated against the concentration. Retention time should agree within 0.006 units except for N-nitrosodimenthylamine. The RRF for each compound will be calculated relative to an internal standard selected according to EPA CLP recommendations.

Instruments and equipment will be calibrated at approved intervals specified by the manufacturer or analytical method (whichever is more frequent). Gas chromatographs will be calibrated by analysis of standard solutions containing target compounds which do not coelute. At least five analysis standards on the detector's linear range will be used to calibrate a RRF for each compound. Calibration is verified every 12 hours of operation by mid-range standard analysis. If the variance is 15% of the initial value, corrective action will be taken.

Metals Analysis

For metals analysis, instruments will be calibrated by a minimum of three calibration standards prepared by dilution of certified stock solutions. Blanks are prepared with one calibration standard at the quantitation limit for the metal being analyzed. The other standards will be used to bracket the concentration range of the samples. Calibration standards will contain acids at the same concentration as the digestates.

Continuing calibration standards from different stock solutions will be prepared and analyzed after each ten samples or each two hours of continuous operation, whichever comes first. Values must agree within $\pm$ 10% of the initial value or corrective action will be required.

For Inductively Coupled Plasma Emission Spectrophotometers, quantitation limit linearity will be verified with a standard prepared at two times the quantitation limit concentration. Standards will be run at the beginning and end of each sample analysis or twice per 8-hour period, whichever is more frequent.

12.5.3 Use of Measuring and Test Equipment

WBS Element Managers, in conjunction with the QA/QC Officer, shall ensure by direct observation and access to the usage log that M&TE used in their areas of responsibility are appropriate for the work item and that operations and documentation are in accordance with the relevant specifications.

13. HANDLING, STORAGE, AND SHIPPING

13.1 PURPOSE

This section commits project personnel to follow special procedures for the handling, storage, and shipping of environmental samples and/or hazardous and mixed waste generated by the WAG 13 Project.

13.2 REQUIREMENTS

The handling, packaging, storage, and shipping of environmental samples shall be controlled to prevent loss, damage, deterioration, or compromise to sample integrity. Handling, packaging, storage, and shipping of hazardous and mixed waste shall be controlled to ensure human and environmental health and safety.

13.3 SCOPE

This section applies to RIC and subcontractor personnel who handle, package, ship, or receive environmental samples or hazardous and mixed waste.

13.4 RESPONSIBILITIES

Responsibilities are defined in the ES/ER ORNL QAPP and are referenced in the appropriate sections of this QAPjP.

13.5 HANDLING, STORAGE, AND SHIPPING OF ENVIRONMENTAL SAMPLES

Procedures may be modified or new procedures may be generated to address special conditions or objectives. Modified or new procedures shall be incorporated for use only if approved by the RIC Program Manager.

Procedures shall be selected from the following Energy Systems ESPs as approved by the RIC.

- ESP-500 Manual Chain-of-Custody Procedures
- ESP-701 Sample Preservation and Container Materials
- ESP-800 Packaging Environmental Samples for Transportation
- ESP-1000 Waste Management

13.5.1 Handling, Packaging, and Storage

WBS Element Managers, in conjunction with the Task Leader and the QA/QC Officer, shall ensure that environmental samples collected within their areas of responsibility are handled and packaged in accordance with the requirements and procedures specified in the RI Work Plan.

13.5.1.1 Bottle Preparation

EPA-approved bottles will be used and submitted to the laboratory for blank analysis unless the supplier certifies them to be free of contaminants. CLP acceptance criteria for target analytes shall be observed.

13.5.1.2 Sample Containment and Preservation

The selection of durable sample containers will be appropriate for the type of sample taken. Sample labels will be filled out in indelible, waterproof, black ink at time of sampling and affixed to each container. They will identify:

- sample number,
- collector's name,
- date and time of collection,
- location the sample was taken from,
- preservatives added, if any.

13.5.1.3 Sample Packaging

After filling, bottles will be sealed to prevent cross contamination and placed in an approved shipping container. If the samples require cooling, they will be covered with ice packs or crushed ice in plastic bags. Coolers will be sealed with custody tape and shipped overnight to the designated laboratory. Samples must be shipped within 24 hours of collection. A chain-of-custody form will accompany all samples to provide documentation and enable tracing of possession.

13.5.2 Shipping

The RIC Procedures Coordinator, in conjunction with the Deputy Program Manager, shall establish procedures for transporting environmental samples. These procedures shall be incorporated into the RI Work Plan.

WBS Element Managers, in conjunction with the QA/QC Officer, shall assure that environmental samples collected within their areas of responsibility are transported in accordance with the requirements and procedures in the RI Work Plan.

13.5.2.1 Sample Labeling

Separate identification labels will be affixed to each sample bottle identifying the:

- project identification;
- sample identification;
- preservatives added, if any;
- date of collection;
- time of collection; and
- required analytical method numbers.

13.5.2.2 Sample Numbering

A sample numbering system will be employed to uniquely identify each sample and to provide the following information:

- project identification (X-10),
- site identification (WAG 13),
- sample location identification (the numeric character will vary with the site number):
  - Soil boring location No. 1 (SB 1)
  - monitoring well location No. 1 (MW 1)
  - Surface water sampling location No. 1 (SWL 1)
  - Sediment sampling location No. 1 (SOL 1)
  - Ambient air sampling location No. 1 (AAL 1)
- sampling media and sample number: (the number following code for soil samples will reflect the sampling depth)
  - Soil sample, number, and depth (SS1)
  - Groundwater sample (GW)
  - Surface water sample (SD)

- Sediment sample (SD)
- Ambient air (AA)

Examples: X-10-WAG 13-SB2-SS1, 0-1.5: the first soil sample taken at 0-1.5 ft from soil boring No.2 at WAG 13, X-10.

X-10-WAG 13-MW3-GW: groundwater sample from monitoring well No. 3, WAG 13, X-10.

13.6 HANDLING, PACKAGING, STORAGE, AND SHIPPING OF HAZARDOUS AND MIXED WASTE

WBS Element Managers, under the cognizance of the Task Leader, shall ensure that hazardous and mixed wastes generated during data collection activities in their areas of responsibility are managed in accordance with the requirements of the project Waste Management Plan.

14. INSPECTION, TEST, AND OPERATING STATUS

14.1 PURPOSE

This section commits project personnel to the use of physical status indicators and/or documentation relative to inspection, testing, operating, and support activities for the WAG 13 Project.

14.2 REQUIREMENTS

The status of items or areas subject to inspection and test activities shall be maintained through indicators such as physical location and tags, markings, signs, travelers, stamps, inspection records, or other suitable means.

14.3 SCOPE

This section applies to RIC and subcontractor personnel involved in controlling the status of items, processes, areas, systems, or structures.

14.4 RESPONSIBILITIES

Responsibilities are defined in the ES/ER ORNL QAPP and are referenced in the appropriate sections of this QAPjP.

14.5 INSPECTION, TEST, AND OPERATING STATUS

Items, processes, and areas subject to inspection or test activities shall be specified in appropriate documents traceable to the item, process, or area, and provisions shall be made for status designation in accordance with the requirements of the ES/ER ORNL QAPP.

WBS Element Managers shall ensure by observation and access to appropriate documents that the status of items, processes, and areas under their control are designated in accordance with specifications and shall document the assurance in appropriate field logbooks.

15. CONTROL OF NONCONFORMING ITEMS

15.1 PURPOSE

This section commits project personnel to ensure that nonconforming items will not be used on the WAG 13 project.

15.2 REQUIREMENTS

Items not conforming to specified requirements shall be identified, segregated, evaluated, documented, and dispositioned.

15.3 SCOPE

This section applies to RIC, subcontractor, and supplier personnel furnishing items (i.e., documents, materials, components, equipment, or services) for use on the project.

15.4 RESPONSIBILITIES

Responsibilities are defined in the ES/ER ORNL QAPP and are referenced in the appropriate sections of this QAPjP.

15.5 NONCONFORMANCE IDENTIFICATION, REPORTING, AND DISPOSITION

WBS Element Managers, in conjunction with the Task Leader and the QA/QC Officer, shall ensure that items within their areas of responsibility found to be in noncompliance with specified requirements are identified, reported, and dispositioned in accordance with the ES/ER ORNL QAPP and with QA/QC procedures governing control of nonconforming items.

16. CORRECTIVE ACTION

16.1 PURPOSE

This section commits project personnel to a system of corrective action applied in response to significant conditions adverse to quality on the WAG 13 Project.

16.2 REQUIREMENTS

Conditions that may adversely affect project quality shall be identified and corrected. The identification, cause, corrective action to prevent recurrence, and documentation shall be reported to appropriate levels of management.

16.3 SCOPE

This section applies to RIC, subcontractor, and supplier personnel who discover conditions that may adversely affect project quality.

16.4 RESPONSIBILITIES

Responsibilities are defined in the ES/ER ORNL QAPP and are referenced in the appropriate sections of this QAPjP.

16.5 CORRECTIVE ACTION SYSTEMS

The Corrective Action System is described in the ES/ER ORNL QAPP.

WBS Element Managers, under the cognizance of the Task Leader, shall ensure that conditions adverse to quality occurring within their areas of responsibility are reported in writing to the QA/QC Officer.

Upon confirmation that a significant condition adverse to quality exists, the QA/QC Officer, in conjunction with the cognizant WBS Element Manager, will initiate the corrective action system in accordance with the requirements of the ES/ER ORNL QAPP and with QA/QC procedures governing corrective action.

17. QUALITY ASSURANCE RECORDS

17.1 PURPOSE

This section commits project personnel to a system of control for documents designated as QA Records for the WAG 13 Project.

17.2 REQUIREMENTS

Records that provide evidence of quality shall be generated, specified, prepared, and maintained in accordance with requirements and procedures described or referenced herein.

17.3 SCOPE

This section applies to RIC, subcontractor, and supplier personnel who generate or process records designated by the Deputy Program Manager as QA records.

17.4 RESPONSIBILITIES

Responsibilities are defined in the ES/ER ORNL QAPP and are referenced in the appropriate sections of this QAPjP.

17.5 QUALITY ASSURANCE RECORDS CONTROL

The Task Leader, in conjunction with the QA/QC Officer, shall ensure that records designated as QA generated within their areas of responsibility are processed in accordance with the requirements of the ES/ER ORNL QAPP and with QA/QC procedures governing QA records management.

17.5.1 Sample Custody

To produce quality records that can be used in legal actions, sample custody and documentation procedures will be followed. Persons involved in sample handling will be trained in chain-of-custody procedures before field sampling activities begin, and the number of persons handling samples will be restricted. All samples will be accompanied by a Chain-of-Custody Record when shipped to the laboratory (Figure 17.1). Split samples sent to different laboratories will require separate chain-of-custody records. The individuals sending and receiving samples will sign, date, and note time on the record and document discrepancies.

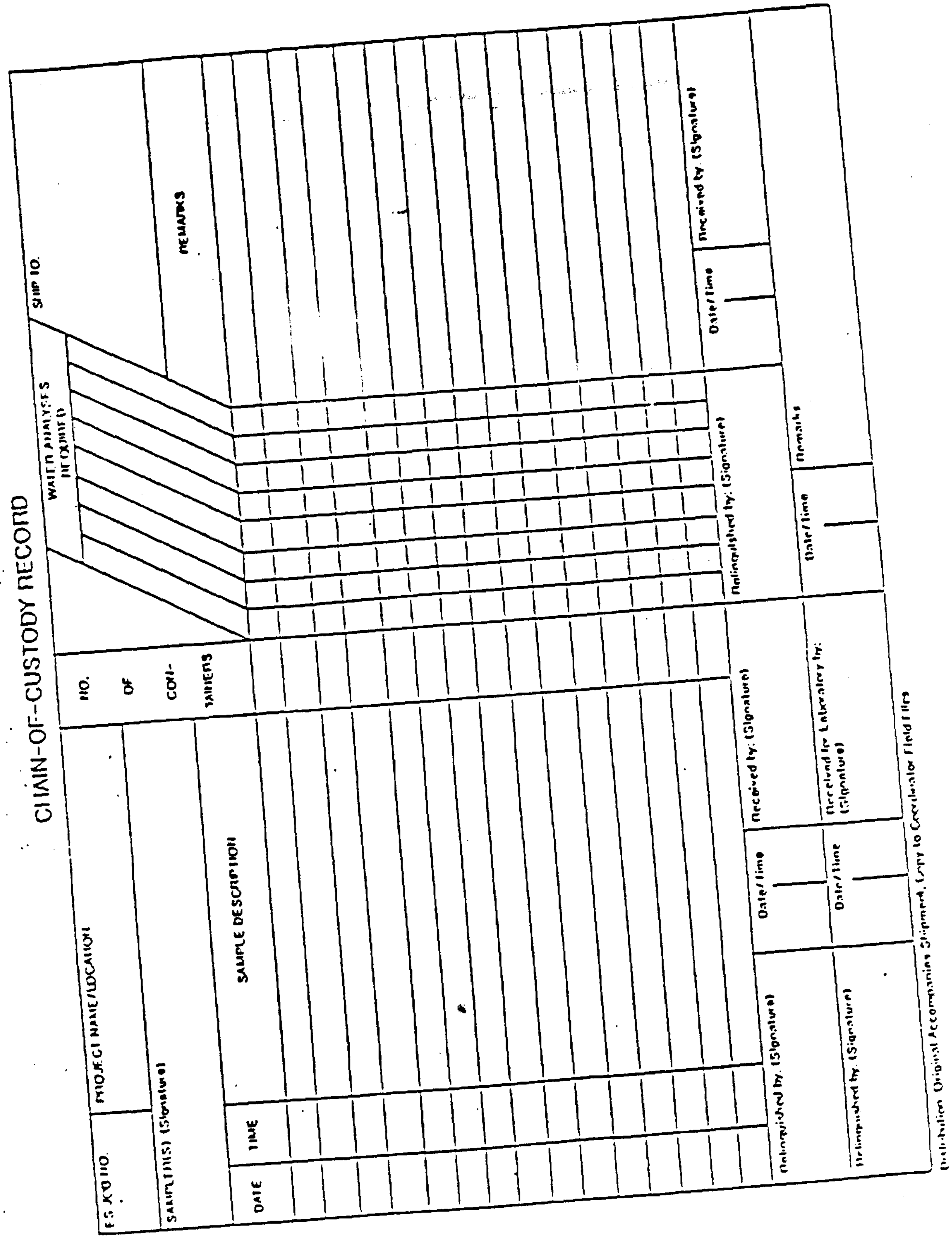

Figure 17.1 Chain-of-Custody Record 1023917

Two copies of this record will accompany all samples to the laboratory. The laboratory will maintain one copy, and the completed original will be returned to the project manager with the final analytical report. Chain-of-custody forms will be used to document sample custody transfer from the sampler to the laboratory. Bills of lading for shipments by air express will also be retained as part of permanent custody documentation.

17.5.1.1 Sample Custody Requirements

A sample is under custody if:

- it is in your actual possession;
- it is in your view, after being in your physical possession;
- it was in your physical possession and you locked it up to prevent tampering; or
- it is in a designated and identified secure area.

17.5.1.2 Sample Custody in the Field

To document, establish, and maintain custody of field samples, labels will be completed legibly using waterproof ink and affixed to containers. All sample information will be recorded in logbooks. The Field Sample Custodian will retain custody until proper transfer and dispatch, and the Field Team Leader will determine if proper procedures have been followed and if additional samples are required.

17.5.1.3 Transfer of Custody and Shipment

All samples transferred and shipped from the field will require a completed Chain-of-Custody Record and appropriate packaging, sealing, and shipping as specified in the RI Work Plan.

17.5.1.4 Laboratory Custody Procedures

Laboratory personnel will check all incoming samples for integrity and note observations on the chain-of-custody record. If spillage, leakage, possible mixing, contamination, tampering, or violations of retention times are observed, the Sample Custodian should notify the Field Sample Custodian or Field Team Leader immediately. Tests shall not be performed on samples of questionable integrity.

Samples are assigned a unique identification number that will be recorded on the laboratory report. All samples will be stored at 4°C and analyzed according to specified methods. The Chain-of-Custody Record will be returned to the project manager for permanent storage.

To maintain chain-of-custody, the Laboratory Sample Custodian will:

- examine the cooler to verify that the proper temperature was maintained,
- verify agreement between labels and the Chain-of-Custody Record,
- notify the Field Sample Custodian or Team Leader of deviations and disallow testing of affected samples,
- document discrepancies on the Chain-Of-Custody form,
- sign and date "Received by laboratory" box when data and samples are correct and seals are intact,
- test samples to verify proper preservation in the field,
- distribute to appropriate personnel and record names of individuals receiving the samples in internal laboratory records, and
- record and track the location of all samples at all times.

To ensure the proper custody of data generated at the laboratory, a copy of all data entered by the analyst shall be kept and identified with project number and other necessary information, and a permanent copy of instrumentation electronic data sheets shall be made and archived as well.

Samples will be classified as not contaminated, contaminated, or hazardous according to analysis results and will be disposed of accordingly or returned to ORNL for disposition.

18. AUDITS AND SURVEILLANCES

18.1 PURPOSE

This section describes a project audit and surveillance program that shall be used to ensure that this QAPjP is being implemented on the WAG 13 Project.

18.2 REQUIREMENTS

Audits shall be planned, scheduled, performed, reported, and corrective action verified for all quality-affecting project activities. Surveillances shall be conducted to assess the quality of activities in process and may be used to supplement audits.

18.3 SCOPE

This section is applicable to all quality-affecting activities conducted on the project, including document preparation, data collection, and data analysis as well as data reduction, validation, and reporting.

18.4 RESPONSIBILITIES

Responsibilities are defined in the ES/ER ORNL QAPP and are referenced in the appropriate sections of this QAPP.

18.5 AUDITS

Audit activities shall be conducted in accordance with the requirements of the ES/ER ORNL QAPP and with QA/QC procedures governing audits and surveillances.

The QA/QC Officer, in conjunction with the Task Leader, shall establish audit frequencies and schedule audits based on a project activity's complexity, importance, and potential impact on quality.

Auditors shall be qualified and certified in accordance with the ES/ER ORNL QAPP and with QA/QC procedures governing certification of audit personnel.

WBS Element Managers shall assist the Task Leader in scheduling and conducting audits of activities performed in their areas of responsibility and shall respond to audit findings by taking the necessary action to correct identified deficiencies in accordance with QA/QC procedures governing corrective actions.

WBS Element Managers shall ensure that audit activities conducted within their areas of responsibility reach closure status and are documented in accordance with the ES/ER ORNL QAPP.

18.6 SURVEILLANCES

Surveillances shall be conducted in accordance with QA/QC procedures governing audits and surveillances.

The QA/QC Officer, in conjunction with the Task Leader, shall establish a surveillance schedule according to the scope of project activities.

The QA/QC Officer shall assign a surveillance Team Leader and team members and will be responsible for ensuring that team personnel are knowledgeable in, but not directly responsible for, the activities under surveillance.

Surveillances shall be planned and performed using a prepared checklist which clearly identifies and defines the work elements to be evaluated.

Surveillance results shall be documented in a report in accordance with QA/QC procedures governing audits and surveillances.

WBS Element Managers shall provide support and access to surveillance teams operating within their areas of responsibility and shall respond to issued surveillance reports within 15 working days of issuance in accordance with QA/QC procedures governing audits and surveillances.

Surveillance reports shall remain active until all deficiencies are corrected in accordance with QA/QC procedures governing corrective action.

19. SOFTWARE QUALITY ASSURANCE

19.1 PURPOSE

This section commits project personnel to systematic control of all software used on the WAG 13 Project.

19.2 REQUIREMENTS

Computer software utilized for project activities shall be classified and controlled according to its purpose.

19.3 SCOPE

This section applies to RIC subcontractor and supplier personnel who use software for project activities.

19.4 RESPONSIBILITIES

Responsibilities are defined in the ES/ER ORNL QAPP and are referenced in the appropriate sections of this QAPjP.

19.5 PROJECT COMPUTER SOFTWARE

In accordance with the requirements of the ES/ER ORNL QAPP, all project software shall be classified as either Noncritical or Critical.

WBS Element Managers, under the cognizance of the Task Leader, shall ensure that software utilized within their areas of responsibility has been classified in accordance with QA/QC procedures governing software QA and that it has been developed or procured in accordance with written specifications and procedures reflecting the requirements of the ES/ER ORNL QAPP.

WBS Element Managers shall ensure that access to software used for activities within their areas of responsibility is controlled in accordance with QA/QC procedures governing software QA.

20. REFERENCES

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