QUALITY ASSURANCE ADDENDUM

QAA 1.1

to the

ROCKY FLATS SITE-WIDE QA PROJECT PLAN

FOR CERCLA RI/FS AND RCRA RFI/CMS ACTIVITIES

for

OPERABLE UNIT NO. 1, 881 HILLSIDE AREA

PHASE III RFI/RI

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OPERABLE UNIT NO. 1, 881 HILLSIDE AREA

PHASE III RFI/RI

U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant
Golden, Colorado

Revision 0

FEBRUARY, 1991

TITLE:
Quality Assurance Addendum for Operable Unit No. 1,
881 Hillside Area, Phase III RFI/RI

Approved by:

(For T.G. Greengard)
Gary M Anderson 7/16/91
Manager, Remediation Programs Date

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List of Acronyms

ASME	American Society of Mechanical Engineers
CDH	Colorado Department of Health
CFR	Code of Federal Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE/RFO	U.S. Department of Energy/Rocky Flats Office
DQOs	Data Quality Objectives
EE	Environmental Evaluation
EMAD	Environmental Monitoring and Assessment
EPA	U.S. Environmental Protection Agency
EM	Environmental Management
ER	Environmental Restoration
FSP	Field Sampling Plan
GRRASP	General Radiochemistry and Routine Analytical Services Protocol
H&S	Health and Safety
HSC	Health and Safety Coordinator
IAG	Interagency Agreement
OU-1	Operable Unit No. 1
PM	Project Manager
QA	Quality Assurance
QAA	Quality Assurance Addenda
QAC	Quality Assurance Coordinator
QAPjP	RFP Site-Wide Quality Assurance Project Plan
QAPM	Quality Assurance Program Manager
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facilities Investigation
RFP	Rocky Flats Plant
RI	Remedial Investigation
RP	Remediation Programs
RPD	Remediation Programs Division
RPT	Radiation Protection Technologist
SOPs	Standard Operating Procedures
SOW	Statement of Work
TCLP	Toxic Characteristic Leaching Procedure

INTRODUCTION AND SCOPE

This QA Addendum (QAA) supplements the "Rocky Flats Plant Site-Wide Quality Assurance Project Plan for CERCLA RI/FS and RCRA RFI/CMS Activities" (QAPjP), and establishes the specific QA controls applicable to the field investigation activities described in the Phase III Work Plan/Field Sampling Plan (OU-1 Workplan) for the 881 Hillside Area (Operable Unit No. 1) dated February, 1991.

1.0 ORGANIZATION AND RESPONSIBILITIES

The overall organization of EG&G Rocky Flats and the Environmental Management (EM) Department divisions involved in Environmental Restoration (ER) Program activities is shown in Section 1 in the QAPjP. Individual responsibilities are also described in detail in Section 1 of the QAPjP.

Contractors will be tasked by EG&G Rocky Flats to implement the Phase III Work Plan/Field Sampling Plan (OU-1 Workplan). The specific EM Department personnel who will interface with the Contractors and be authorized to provide technical direction are shown in Figure 1.

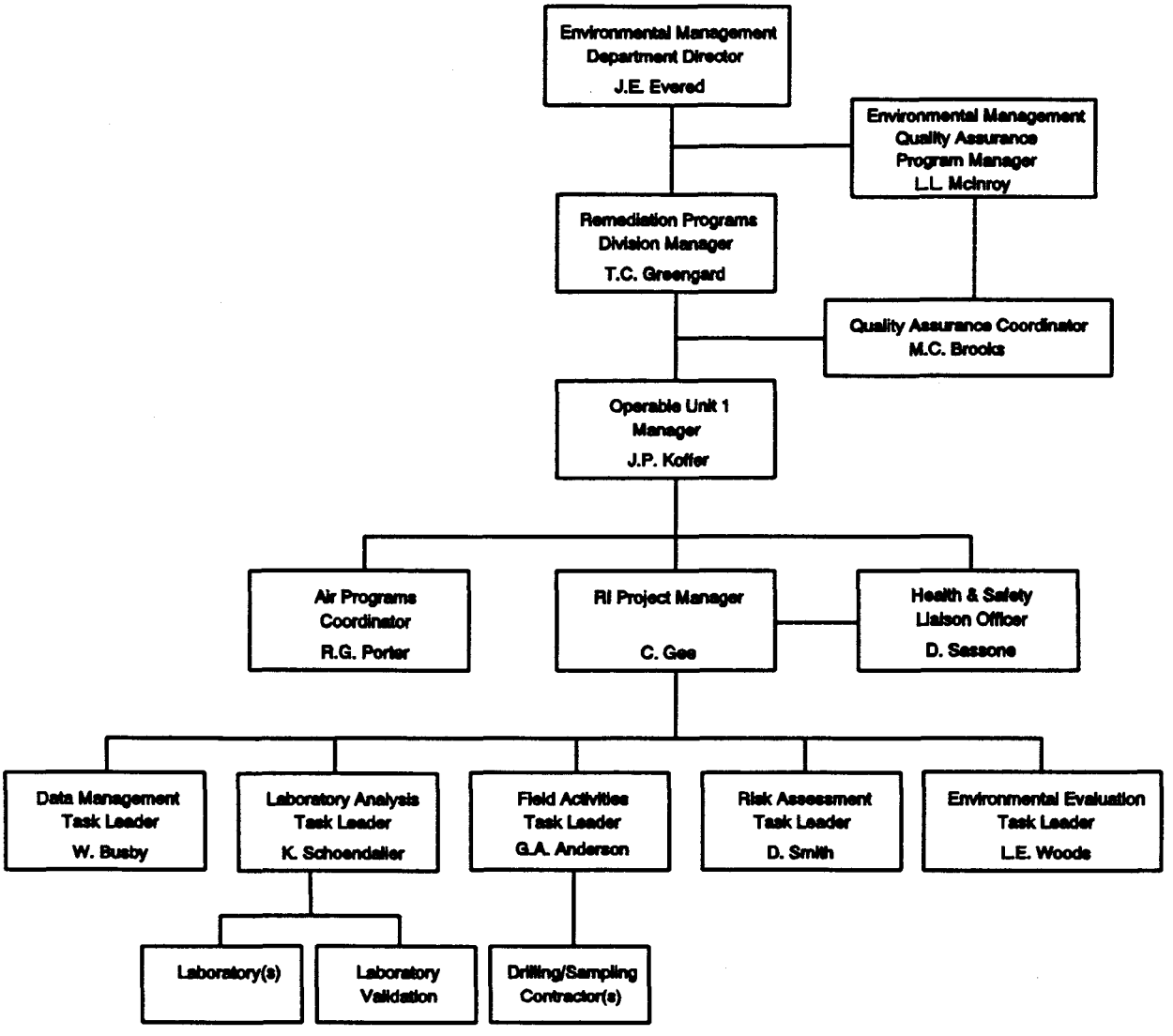
2.0 QUALITY ASSURANCE PROGRAM

This QAA supplements the QAPjP and establishes the specific QA controls applicable to the field investigation activities described in the Phase III RFI/RI Work Plan/Field Sampling Plan for the 881 Hillside Area (Operable Unit No. 1). The QAPjP was written to specifically address QA controls for Interagency Agreement (IAG) related activities.

2.1 Training

All personnel performing activities in accordance with the Environmental Monitoring and Assessment Division (EMAD) Operating Procedures, which are also referred to herein as standard operating procedures (SOPs), specified in this QAA shall receive documented training in the QAPjP,

FIGURE 1. PROJECT MANAGEMENT FOR OPERABLE UNIT 1, 881 HILLSIDE AREA PHASE III



this QAA, and any training specified in the applicable SOPs prior to performing the work, as specified in the QAPjP. Such personnel include, but aren't limited to, those performing or supervising the following activities:

- drilling/boring;
- installation/completion of ground water monitoring wells;
- geological/aquifer testing;
- sample collection (all media);
- sample chain-of-custody/preservation/handling;
- equipment decontamination;
- field measurements (e.g., pH, conductivity, temperature, dissolved oxygen, water level);
- water level measurement;
- data validation; and
- environmental surveying and sample collection.

3.0 DESIGN CONTROL

3.1 Data Quality Objectives

3.1.1 Objectives

The OU-1 Workplan is designed to collect the data necessary to determine the nature, distribution, and migration pathway of contaminants. The following activities will be performed as part of the field investigation:

- Drill and sample soils and wastes within IHSSs;
- Install and sample ground-water monitoring wells;
- Determine sediment composition and quality, grain sizes, and total organic carbon;
- Perform aquifer tests and geotechnical tests;
- Assess air quality;
- Perform aquatic and terrestrial field surveys;

- Collect surface water and sediment samples;
- Collect and analyze terrestrial and aquatic vegetation and animals; and
- Perform toxicity tests to measure the effects of contaminated environmental media on representative species.

Specific objectives and data collection activities are outlined in Table 3-1 of the OU-1 Work Plan.

Sample locations, frequency, and analyses are presented in the OU-1 Work Plan and are summarized in this QAA. Specific SOPs to be implemented by EG&G Rocky Flats and Contractor personnel during all aspects of the field investigation are also identified here.

3.1.2 Precision and Accuracy

CLP Analyses: The Work Plan specifies that EPA Contract Laboratory Program (CLP) analytical protocols be applied when possible. Analytical objectives for data quality for such CLP analyses are contained in the QAPjP as specified in the GRRASP. These guidelines are used by the Environmental Monitoring and Assessment Division (EMAD) or its Contractors to evaluate results generated under CLP protocols. These objectives are listed in Appendix B of the QAPjP and are included here in Appendix A. For those parameters listed in the Work Plan that are not covered in Appendix B of the QAPjP and supplement list are also included in Appendix A, Analytical Methods, Detection Limits, and Data Quality Objectives.

Non-CLP Analyses: When CLP protocols are unavailable for a particular analyte or do not provide a low enough detection limit, analyses shall be performed in accordance with other standard protocols. These methods are also identified in Attachment A. For these analyses, precision and accuracy objectives are based on the control limits specified in the methods.

3.1.3 Completeness

The target completeness objective for both field and analytical data for this project is 90 percent.

3.1.4 Comparability

Comparability is a qualitative parameter that shall be ensured by implementation of an approved sampling and analysis plan, standardized analytical protocols, and SOPs for field activities, and by reporting data in uniform units as specified in the OU-1 Workplan and supplements listed in Table 1.

3.1.5 Representativeness

Representativeness is a qualitative parameter that is ensured through the careful development and review of the sampling and analysis strategy outlined in the OU-1 Workplan and SOPs for sample collection and analysis and field data collection.

3.2 Sampling Locations

3.2.1 Groundwater Samples

Ground water samples shall be collected from the monitoring wells listed below and from boreholes listed in Section 3.2.3, which penetrate the water table. The locations of the monitoring wells are shown in Figure 5-1 in the OU-1 Workplan.

MW01 MW02 MW03 MW04 MW05 MW06 MW07 MW08 MW09 MW10
MW11 MW12 MW13 MW14 MW15 MW16 MW17 MW18 MW19 MW20 MW21 MW22 MW23
MW24 MW25 MW26 MW27 MW28 MW29 MW30 MW31 MW32 MW33 MW34 MW35

3.2.2 Surface Water Samples

During the OU-1 Workplan field investigation, surface water samples shall be collected from the surface water sampling locations listed below. These locations are shown in the OU-1 Workplan.

SW-31 SW-35 SW-44 SW-45 SW-46
SW-66 SW-67 SW-68 SW-69 SW-70

TABLE 1.
Standard Operating Procedures and Field Activities
for Which They are Applicable

Standard Operating Procedures	Well Drilling, Completion, Development	Ground-Water Sampling	Surface-Water Sampling	Sediment Sampling	Surface Soil Sampling	Subsurface Soil/Matl. Sampling	Hydraulic Testing	Source Sampling	Blank Sampling
1.1 Wind Blown Contaminant Dispersion Control	●					●			
1.2 Field Document Control		●	●	●	●		●	●	
1.3 General Equipment Decontamination	●	●	●		●	●	●	●	
1.4 Heavy Equipment Decontamination	●	●	●		●	●	●	●	
1.5 Handling of Purge and Development Water	●	●					●		
1.6 Handling of Personal Protective Equipment	●	●	●		●	●	●	●	
1.7 Handling of Decontamination Water & Wash Water	●	●	●		●	●	●	●	
1.8 Handling of Drilling Fluids & Cuttings	●			●		●			
1.9 Handling of Residual Samples					●	●	●	●	
1.10 Receiving, Labeling, and Handling Waste Containers	●	●				●	●	●	
1.11 Field Communications	●	●	●	●	●	●	●	●	
1.12 Decontamination Facility Operations	●	●	●		●	●	●	●	
1.13 Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples		●	●		●	●	●	●	
1.14 Field Data Management	●	●	●	●	●	●	●	●	
1.15 Use of PIDs and FIDs	x	x	x	x	x	x	x	x	
1.16 Field Radiological Measurements									
a) Walk-Over Surveys	x	x	x	x	x	x	x	x	
b) Sample and Waste Screening	x	x	x	x					
2.1 Water Level Measurements in Wells and Piezometers	●	●					●		
2.2 Well Development									
a) New Wells	●								
b) Redevelopment	●								
2.3 Slug Tests	●						●		
2.4 Pump-In Borehole Packer Testing	●	●							
2.5 Measurements for Groundwater Field Parameters		●					●		
2.6 Groundwater Sampling									
a) Bailer		●							
b) Pump		●							

X - As required by H&S plan.

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TABLE 1. (Continued)
Standard Operating Procedures and Field Activities
for Which They are Applicable

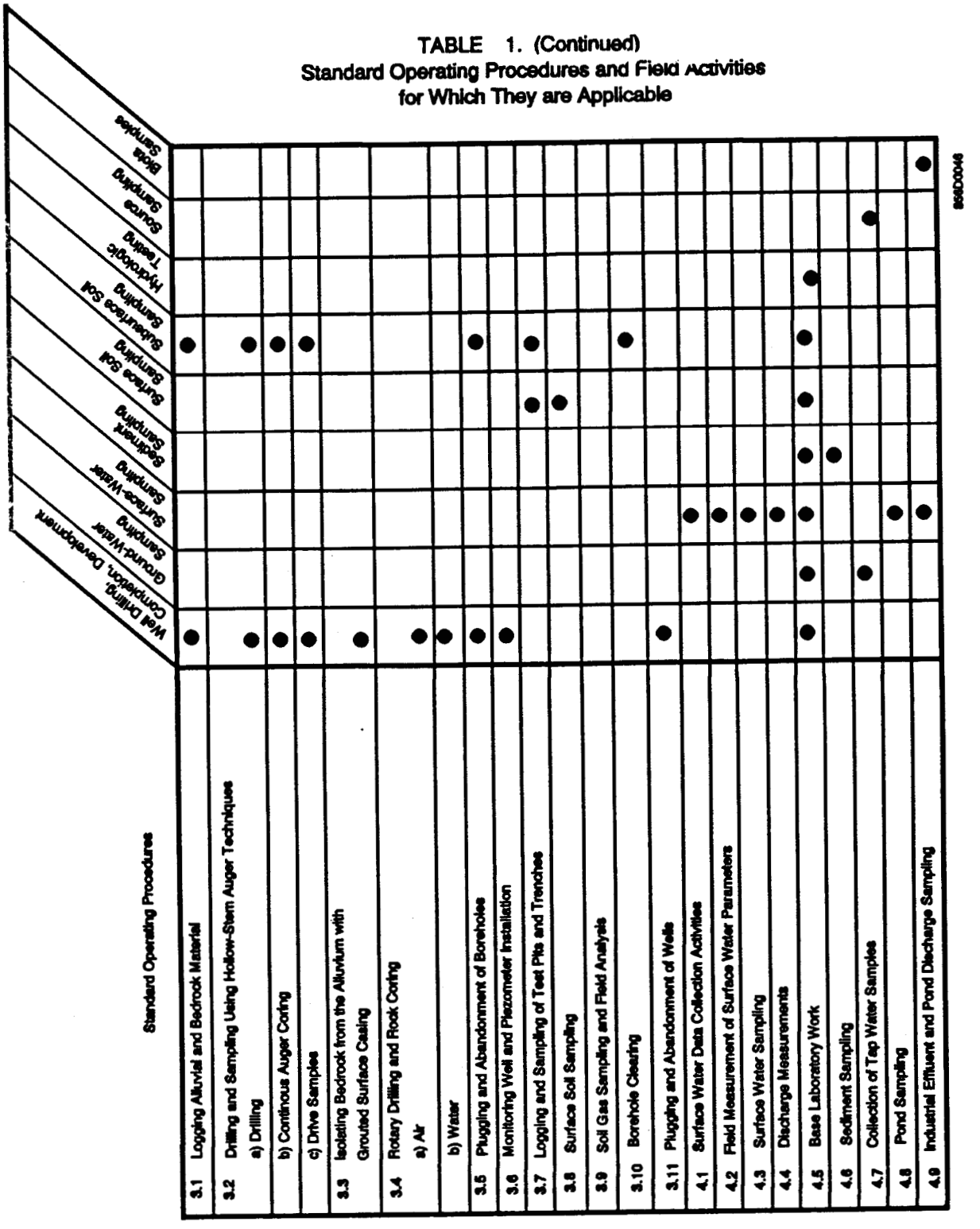

TABLE 1. (Continued)
Standard Operating Procedures and Field Activities for Which They are Applicable

Standard Operating Procedures	Well Drilling, Completion, Development	Ground-Water Sampling	Surface-Water Sampling	Sediment Sampling	Surface Soil Sampling	Subsurface Soil/Rock Sampling	Hydrological Testing	Source Sampling	Biota Sampling
5.1 Sampling of Periphyton									●
5.2 Sampling of Benthic Macroinvertebrates									●
5.3 Sampling of Plankton									●
5.4 Sampling of Fishes									●
5.5 Sampling of Large Mammals									●
5.6 Sampling of Small Mammals									●
5.7 Sampling of Birds									●
5.8 Sampling of Reptiles and Amphibians									●
5.9 Sampling of Terrestrial Arthropods									●
5.10 Sampling of Terrestrial Vegetation									●

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Field reconnaissance will be conducted for locating seeps and springs that are not currently being sampled. If any additional springs or seeps are identified during the field reconnaissance that might potentially impact wildlife, they will be added to the surface water sampling program.

Surface water will be sampled monthly from the surface water sampling stations listed above. Discharge measurements will be conducted in conjunction with the monthly surface water sampling.

3.2.3 Soil Samples

Soil samples will be collected from boreholes and during the installation of the groundwater monitoring wells listed in Section 3.2.1. Samples will be collected beginning two feet below ground surface and continuing every 4 feet to the water table. A final sample will be collected from the base of the first drive in bedrock immediately below the alluvial material. The borehole locations are listed below. The locations are shown in Figure 5-1 in the OU-1 Workplan.

BH01 BH02 BH03 BH04 BH05 BH06 BH07 BH08 BH09 BH10 BH11 BH12
BH13 BH14 BH15 BH16 BH17 BH18 BH19 BH20 BH21 BH22 BH23 BH24
BH25 BH26 BH27 BH28 BH29 BH30 BH31 BH32 BH33 BH34 BH35 BH36
BH37 BH38 BH39 BH40 BH41 BH42 BH43 BH44 BH45 BH46 BH47 BH48
BH49 BH50

3.2.4 Sediment Samples

During the OU-1 Workplan field investigation, sediment samples shall be collected from the locations listed below. These sampling locations are shown in Figure 5-1 of the OU-1 Workplan.

SED-37 SED-38 SED-39

3.2.5 Surficial Soil Samples

In order to characterize the vertical and horizontal extent of surficial soil contamination, surficial soil scrapes and vertical soil profiles will be collected in all three remedial investigation areas, and in the plant areas (buffer zone) south and east of these areas to Indiana Street during the investigation. The specific sampling locations are discussed in Section 5.2.3 of the OU-1 Workplan. Surface scrapes will be collected and analyzed under the Surficial Soil Field Sampling Plan outlined in the Phase II RFI/RI Workplan for OU No. 2.

3.3 Environmental Evaluation: Summary of Surveying and Sampling

Section 6 of the OU-1 Workplan presents a three-stage sequential approach for conducting the environmental evaluation (EE) at the 881 Hillside. Stage I of the EE will include an initial determination of the scope of the environmental evaluation, identification and development of DQOs, conducting of a field inventory, and field sampling. The field inventory will provide qualitative and quantitative information necessary to characterize the biota and trophic relationships at the 881 Hillside Area. Information obtained during the field inventory will also be utilized to finalize the field sampling plan and further define the DQOs. Stage II of the EE will consist of a contamination assessment, including toxicity and exposure assessment, development of the site-specific food web pathway model, and characterization of impact to biota. Stage III will consist of biological contamination studies, including field and laboratory analyses of contaminant levels. Additional toxological-type investigations may be included. Remediation criteria and an EE Report will also be developed during Stage III.

A preliminary field sampling plan is described in Section 6.8 of the OU-1 Workplan. The field surveys conducted during Stage I of the EE will provide information needed to further develop this plan, including determining final sampling locations and establishing reference areas. Field sampling will be conducted during Stage I and Stage III (although field samples collected during Stage I will be used for toxicity tests and contamination studies of Stage III where possible). Field samples will be collected for the following environmental parameters:

- Terrestrial vegetation,
- Terrestrial wildlife (including small and large mammals, reptiles, and birds),
- Terrestrial arthropods (invertebrates),
- Periphyton,
- Benthos, and
- Fish.

Preliminary sampling locations are described in Section 6.8.2 of the OU-1 Workplan.

The applicable SOPs for EE field sampling are listed in Table 1 as SOPs 5.1 through 5.10. Section 6.8.4 contains additional detail on proposed surveying and sampling methods.

3.4 Hydrologic Testing

Pumping and tracer tests will be performed in the Woman Creek Alluvium to determine solute transport times. The test locations are shown in Figure 5-2 of the OU-1 Workplan. Hydrologic testing will be performed in accordance with SOPs 2.3, Pump-in Borehole Packer Testing, and 2.4, Slug Tests (Table 1), and Section 5.2.1.3 of the OU-1 Workplan.

3.5 Equipment Decontamination

Non-dedicated sampling equipment shall be decontaminated between sampling locations in accordance with SOP 1.3, General Equipment Decontamination (Table 1). Other equipment (e.g., heavy equipment) potentially contaminated during drilling, hydrogeologic/geologic testing, boring, sample collection, etc. shall also be decontaminated as specified in SOP 1.4, Heavy Equipment Decontamination (Table 1).

3.6 Air Quality

Ambient air concentrations modeling to estimate environmental risk which results from airborne transport of 881 Hillside contaminants to potential receptors is discussed in Section 6.3.1 of the OU-1 Workplan.

3.7 Quality Control Samples

To assure the quality of the field sampling technique, collection of field quality control (QC) samples are incorporated into the sampling scheme. Field QC sample collection frequencies for the field investigations are shown in Table 2. A specific sampling schedule will be prepared by the sampling subcontractor for EMAD approval prior to sampling.

In addition, a QC sample, which will consist of an extra volume of a designated field sample, shall be collected at a 5-percent frequency for each specific sample matrix. QC samples shall be collected and submitted to the laboratory to allow for the analysis of laboratory QC samples to provide the laboratory a check on its internal operations. The volume required for the QC sample shall be double that of a normal sample.

3.7.1 Objectives for Field QC Samples

Equipment rinsate blanks are considered acceptable (with no need for data qualification) if the concentration of analytes of interest is less than three times the required detection limit for each analyte as specified in Appendix A. Field duplicate samples will agree within 30 percent relative percent difference for aqueous samples and 40 percent for homogenous, non-aqueous samples. EMAD or a Contractor will be responsible for verifying these criteria and shall be responsible for checking to see if they are met and for qualifying data.

3.7.2 Laboratory QC

Laboratory QC procedures are used to provide measures of internal consistency of analytical and storage procedures. The laboratory contractor will submit to EMAD for approval written SOPs that are consistent with or equivalent to EPA-CLP QC procedures. Laboratory QC techniques to ensure consistency and validity of analytical results (including detecting potential laboratory contamination of samples) include using reagent blanks, field blanks, internal standard reference materials, laboratory replicates, and field duplicates. The laboratory contractor will follow the standard

TABLE 2
FIELD QC SAMPLE COLLECTION FREQUENCY

Activity	Frequency
Field Duplicate	1 in 20[1]
Trip Blank[2]	1 sample per shipping container[3]
Equipment Rinsate Blank	1 in 20[4]
Triplicate Samples (benthic samples)	For each sampling site.
Drilling and Decontamination Fluids	Sample source and analyze for all analytes of interest prior to use.

1. Or per sampling event, whichever is more frequent.
2. For samples to be analyzed for volatile organics only.
3. A trip blank shall not be used for radiochemistry samples because radionuclide samples are less likely to be contaminated from direct exposure to air than are samples of volatile organics.
4. One equipment rinsate blank in twenty samples for each specific sample matrix being collected when non-dedicated equipment is being used.

evaluation guidelines and QC procedures, including frequency of QC checks, that are applicable to the particular type of analytical method being used. All results will be forwarded to EMAD for review and verification.

3.8 Field and Analytical Procedures

Field and laboratory analytical procedures to be followed for RFI/RI are shown in Table 1 and Appendix A. Methods for toxicological analyses will be selected after contaminants of concern and receptor species have been identified.

3.9 Data Reduction, Validation, and Reporting

3.9.1 Analytical Reporting Turnaround Times

Analytical reporting turnaround times are as specified in the QAPjP.

3.9.2 Data Validation

Guidelines used to evaluate analytical data are referenced in Section 3.3.4.2 of the QAPjP. The laboratory validation process is also illustrated in Figure 3-1 of the QAPjP. Field data validation will be performed as specified in Section 3.3.4.2 of the QAPjP. The process of sample collection, field data validation, sample transfer (chain-of-custody), sample analysis and data validation is illustrated in Figure 8-1 of the QAPjP.

3.9.3 Data Reduction

Reduction of laboratory measurements and laboratory reporting of analytical parameters shall be in accordance with the procedures specified for each analytical method. The reduced data will be used in the data validation process to verify that the laboratory control and the overall system DQOs have been met.

4.0 PROCUREMENT DOCUMENT CONTROL

Contractors will perform the field investigation described in the OU-1 Workplan. The Contractors will be required to implement all requirements contained in the OU-1 Workplan, the QAPjP, this QAA, and all applicable SOPs referenced in these documents. Analytical services will also be contracted for analysis of field samples. Appropriate requirements from the QAPjP, this QAA, and the GRRASP shall be passed on to any organizations performing these analyses. Contractors may also be utilized to validate analytical data packages. Applicable requirements from this QAA shall be transmitted to the validation Contractor.

The implementing Contractors will be required to provide the materials necessary for performing the work described in the OU-1 Workplan.

Contractors may be required to submit a QA Program that meets the applicable requirements of the QAPjP and this QAA.

5.0 INSTRUCTIONS, PROCEDURES, AND DRAWINGS

The OU-1 Workplan describes the activities to be performed. The plan will be reviewed and approved in accordance with the requirements for instructions, procedures, and drawings outlined in the QAPjP.

SOPs approved for use are identified in Table 1, which also indicates their applicability. Environmental survey and sampling procedures for environmental evaluations are presented in the OU-1 Workplan. Any additional quality-affecting procedures proposed for use but not identified here will be developed and approved as required by the QAPjP prior to performing the affected activity.

6.0 DOCUMENT CONTROL

The following documents will be controlled in accordance with the QAPjP:

- Phase III 881 Hillside Area RFI/RI Work Plan/Field Sampling Plan;
- Rocky Flats Plant Site-Wide Quality Assurance Project Plan for CERCLA RI/FS and RCRA RFI/CMS Activities (QAPjP);
- Quality Assurance Addendum (QAA) to the Rocky Flats Site-Wide QAPjP for Operable Unit No. 1, 881 Hillside Area Phase III RFI/RI Activities;
- SOPs (all SOPs specified in the QAPjP and this QAA);
- Interim Measures/Interim Remedial Action Plan and Decision Document, 881 Hillside Area, Operable Unit No. 1, January, 1990, Final.

7.0 CONTROL OF PURCHASED ITEMS AND SERVICES

Contractors that provide services to support the OU-1 Workplan activities will be selected and evaluated as outlined in the QAPjP. This includes preaward evaluation/audit of proposed Contractors as well as periodic audit of the acceptability of Contractor performance during the life of the contract. Such audits shall be performed at least annually or once during the life of the project, whichever is more frequent. See also Section 18.0 of the QAPjP.

8.0 IDENTIFICATION AND CONTROL OF ITEMS, SAMPLES, AND DATA

8.1 Sample Containers/Preservation

Appropriate volumes, containers, preservation requirements, and holding times for samples are presented in Tables 8-1 through 8-4 of the QAPjP. Requirements for environmental evaluation are included in Table 3.

8.2 Sample Identification

RFI/RI samples shall be labeled and identified in accordance with the SOPs specified in Table 1 and shall have unique identification that traces the sample to the source(s) and indicates the method(s), date, the sampler(s), and conditions prevailing at the time of sampling. Sample identification for environmental evaluation samples is discussed in Section 6.0 of the Work Plan/Field Sampling Plan.

8.3 Chain-of-Custody

Sample chain-of-custody will be maintained through the application of SOP 1.3, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples, and as illustrated in Figure 8-1 of the QAPjP for all environmental samples collected during field investigations.

9.0 CONTROL OF PROCESSES

The overall process of collecting samples, performing analysis, and inputting the data into a database is considered a process that requires control. The process is controlled through a series of written procedures that govern and document the work activities. The process is illustrated diagrammatically in Section 8.3.2 of the QAPjP.

10.0 INSPECTION

Procured materials and construction activities (e.g., groundwater monitoring well installation) shall be inspected (as applicable) in accordance with the requirements specified in Section 10.0 of the QAPjP.

TABLE 3

HOLDING TIMES, PRESERVATION METHODS, AND SAMPLE CONTAINERS FOR BIOTA SAMPLES

	Holding Time From Date Collected	Preservation Method	Container	Approximate Sample Size
SAMPLES FOR METALS ANALYSES				
TERRESTRIAL VEGETATION				
- Metals Determined by ICP**	6 mos.	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	25 g
- Metals Determined by GFAA**	6 mos.	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	25 g
- Hexavalent Chromium	24 hours	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	25 g
- Mercury	28 days	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	5 g
Periphyton and Benthic Macroinvertebrates				
- Metals Determined by ICP	6 mos.	Freeze & ship w/dry ice	Plastic	25 g
- Metals Determined by GFAA	6 mos	Freeze & ship w/dry ice	Plastic	25 g

TABLE 3

HOLDING TIMES, PRESERVATION METHODS, AND SAMPLE CONTAINERS FOR BIOTA SAMPLES

	Holding Time From Date Collected	Preservation Method	Container	Approximate Sample Size
- Hexavalent Chromium	24 hours	Freeze & ship w/dry ice	Plastic	25 g
- Mercury	28 days	Freeze & ship w/dry ice	Plastic	5 g
SAMPLES FOR RADIONUCLIDE ANALYSES				
Terrestrial Vegetation				
- Uranium 223, 234, 235, 238 Americium 241 Plutonium 239, 240	6 mos	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	1 kg
Periphyton and Benthic Macroinvertebrates				
- Uranium 233, 234, 245, 238 Americium 241 Plutonium 239, 240	6 mos	Freeze & ship w/dry ice	Plastic	1 kg

* Sample size may vary with specific laboratory requirements.

**ICP = Inductively Coupled Argon Plasma Emission Spectroscopy. Metals to be determined include Ba, Cr, Cu, and Fe.

+GFAA = Graphite Furnace Atomic Absorption Spectroscopy. Metals to be determined include As, Cd, Li, Pg, Se, and Sr.

11.0 TEST CONTROL

Pumping and tracer tests will be conducted according to the methods described in Section 5.3.1.3 of the OU-1 Workplan. The procedures concerning these tests, as described in SOPs 2.2, Well Development, 2.3, Pump in Borehole Packer Testing, and 2.4, Slug Tests, will be followed.

12.0 CONTROL OF MEASURING AND TEST EQUIPMENT (M&TE)

12.1 Field Equipment

Specific conductivity, temperature, pH, and dissolved oxygen content of water samples shall be measured in the field. Field measurements will be taken and the instruments calibrated as specified in SOP 4.2 (see Table 1). Measurements shall be made using the following equipment (or EG&G-approved alternates):

- Specific Conductivity: HACH Conductivity Meter
- Dissolved Oxygen: HACH Dissolved Oxygen Meter
- pH: HACH pH Meter (this meter will also be used for temperature measurements)

Each piece of field equipment shall have a file that contains:

- Standard operating procedures (i.e., SOP 4.2);
- Routine preventative maintenance procedures, including a list of critical spare parts to be provided or available in the field;
- Calibration methods, frequency, and description of the calibration solutions; and
- Standardization procedures (traceability to nationally recognized standards).

The above information shall, in general, conform to the manufacturer's recommended operating procedures or shall explain the deviation from said procedures.

12.2 Laboratory Equipment

Laboratory analyses will be performed by contracted laboratories. The equipment used to analyze environmental samples shall be calibrated, maintained, and controlled in accordance with the requirements contained in the specific analytical protocols used.

13.0 HANDLING, STORAGE, AND SHIPPING

Samples shall be packaged, transported, and stored in accordance with SOP 1.13, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples. Maximum sample holding times are shown in Table 3.

EMAD will develop and implement an SOP for handling and storing construction materials to ensure only appropriate, accepted materials are used and are handled and stored to prevent contamination or damage prior to use/installation.

14.0 STATUS OF INSPECTION, TEST, AND OPERATIONS

The requirements for the identification of inspection, test, and operating status shall be implemented as specified in Section 14.0 of the QAPjP. A log specifying the status of all boreholes and groundwater monitoring wells shall be maintained by EMAD, which will include: well/borehole identification number, ground elevation, casing depth of hole, depth to bedrock, static water level (as applicable), depth to top and bottom of screen (as applicable), diameter of hole, diameter of casing, and top/bottom of casing.

15.0 CONTROL OF NONCONFORMANCES

The requirements for the identification, control, evaluation, and disposition of nonconforming items, samples, and data will be implemented as specified in Section 15.0 of the QAPjP. Nonconformances identified by the implementing contractor shall be submitted to EG&G for processing as outlined in the QAPjP.

16.0 CORRECTIVE ACTION

The requirements for the identification, documentation, and verification of corrective actions for conditions adverse to quality will be implemented as outlined in Section 16.0 of the QAPjP. Conditions adverse to quality identified by the implementing contractor shall be documented and submitted to EG&G for processing as outlined in the QAPjP.

17.0 QUALITY ASSURANCE RECORDS

QA records will be processed in accordance with the SOP 1.2, Field Document Control. QA records to be generated during 881 Hillside Area Phase III activities include, but are not limited to:

- Field Logs (e.g., sample collection notebooks/logs for water, sediment, and air)
- Calibration Records
- Sample Collection & Chain-of-Custody Records
- Drilling Logs
- Hydrologic Testing Documentation
- Geologic Testing Documentation
- Work Plan/Field Sampling Plan
- QAPjP/QAA
- Audit/Surveillance/Inspection Reports
- Nonconformance Reports
- Corrective Action Documentation
- Data Validation Results
- Analytical Results
- Procurement/Contracting Documentation
- Training/Qualification Records
- Inspection Records

18.0 QUALITY VERIFICATION

The requirements for the verification of quality shall be implemented as specified in Section 18.0 of the QAPjP. Audits of Contractors providing field investigation, construction, and analytical support services shall be performed at least annually or once during the life of the project, whichever is more frequent.

19.0 SOFTWARE CONTROL

The requirements for the control of software shall be implemented as specified in Section 19.0 of the QAPjP. Only database software is anticipated to be used for the OU-1 Workplan activities. SOPs applicable to the use of the database storing environmental data are SOP 1.14, Field Data Management.

APPENDIX A

Analytical Methods, Detection Limits, and Data Quality Objectives

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

(OU-1 Analyte-Specific Supplement)

Analyte	Method	SW	GW	SOIL	SED	Required Detection Limits Water	Required Detection Limits Soil/Sed.	Precision Objective	Accuracy Objective
INDICATORS									
Total Organic Carbon	APHA 5310[1]	X^U	X^F	X	X	1 mg/L	1 mg/kg	20%RPD	80-120% LCS Recovery
Dissolved Organic Carbon	APHA 5310[2]	X^U	X^F			1 mg/L	1 mg/kg	20%RPD	80-120% LCS Recovery
INORGANICS									
Other Metals									
Silica (as Si and SiO2)	EPA CLPSOW	X^F	X^F	X	X	100 mg/L	20 mg/kg	**	***
ANIONS									
Ammonium	TBD	X^U	X^U	X	X	1 mg/L	TBD		
Bromide	TBD			X	X	N/A	TBD		
Orthophosphate	EPA 365.2	X^U	X^U	X	X	0.1 mg/L	TBD	**	***

TBD = To be determined. Analytes not required by IAG nor addressed by GRRASP.

1. American Public Health Association (APHA), Standard Methods for the Examination of Water and Wastewater, 17th Edition, New York, NY, 1989.
2. DOC is defined as the fraction of TOC that passes through a 0.45 micron pore-diameter filter.

** Precision objective = control limit specified in referenced method.

*** Accuracy objective = control limit specified in referenced method.

F = Filtered

U = Unfiltered

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	GW	SOIL	SED	Required Detection Limits: Water	Required Detection Limits: Soil/Sed.	Precision Objective	Accuracy Objective
INDICATORS									
Total Suspended Solids	EPA 160.2[d]	X[U]				10 mg/L	NA	20%RPD[f]	80-120% LCS Recovery
Total Dissolved Solids	EPA 160.1[d]	X[F]	X[F]			5 mg/L	NA	20%RPD[f]	80-120% LCS Recovery
pH	EPA 150.1[d]	X[U]	X[F]			0.1 pH units	0.1 pH units	NA	±0.05 pH units
INORGANICS									
Target Analyte List - Metals		X[F]	X[F]	X	X			WATER/SOIL	WATER/SOIL
Aluminum	EPA CLP SOW[e]					200 ug/L[4]	40 mg/Kg[4]	**	***
Antimony	EPA CLP SOW[e]					60	12		
Arsenic (GFAA)	EPA CLP SOW[e]					10	2		
Barium	EPA CLP SOW[e]					200	40		
Beryllium	EPA CLP SOW[e]					5	1.0		
Cadmium	EPA CLP SOW[e]					5	1.0		
Calcium	EPA CLP SOW[e]					5000	2000		
Chromium	EPA CLP SOW[e]					10	2.0		
Cobalt	EPA CLP SOW[e]					50	10		
Copper	EPA CLP SOW[e]					25	5.0		
Cyanide	EPA 335.3 (modified for CLP)[e,d]					5	10		
Iron	EPA CLP SOW[e]					100 ug/L[4]	20 mg/Kg[4]	**	***
Lead (GFAA)	EPA CLP SOW[e]					3	1.0		
Magnesium	EPA CLP SOW[e]					5000	2000		
Manganese	EPA CLP SOW[e]					15	3.0		
Mercury (CVAA)	EPA CLP SOW[e]					0.2	0.2		
Nickel	EPA CLP SOW[e]					40	8.0		
Potassium	EPA CLP SOW[e]					5000	2000		

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	GW	SOIL	SED	Required Detection Limits Water	Required Detection Limits Soil/Sed.	Precision Objective	Accuracy Objective
Selenium (GFAA)	EPA CLP SOW[a]					5	1.0		
Silver	EPA CLP SOW[a]					10	2.0		
Sodium	EPA CLP SOW[a]					5000	2000		
Thallium (GFAA)	EPA CLP SOW[a]					10	2.0		
Vanadium	EPA CLP SOW[a]					50	10		
Zinc	EPA CLP SOW[a]					20	4.0		
Other Metals		X[U]	X[F]	X	X			WATER/SOIL	WATER/SOIL
Molybdenum	EPA CLP SOW[b] (ICAP)					8 ug/L[4]	40 mg/Kg[4]	**	***
Cesium	EPA CLP SOW[b]					1000	200		
Strontium	EPA CLP SOW[b]					200	40		
Lithium	EPA CLP SOW[b]					100	20		
Tin	EPA CLP SOW[b]					200	40		
Other Inorganics									
Percent Solids	EPA 160.3[d]			X	X	NA	10 mg	NA	NA
Sulfide	EPA 376.1[d]			X	X	NA	4 ug/g	Same as metals	Same as metals
ANIONS								Water/Soil	Water/Soil
Carbonate	EPA 310.1[d]	X[U]	X[U]			10 mg/L	NA	Same as metals	Same as metals
Bicarbonate	EPA 310.1[d]	X[U]	X[U]			10 mg/L	NA		
Chloride	EPA 325.2[d]	X[U]	X[U]			5 mg/L	NA		
Sulfate	EPA 375.4[d]	X[U]	X[U]			5 mg/L	NA		
Nitrate as N	EPA 353.2[d] or 353.3[d]	X[U]	X[U]			1 mg/L	NA		
Fluoride	EPA 340.2[d]	X[U]	X[U]			5 mg/L	NA		
Oil and Grease	EPA 413.2[d]	X[U]				5 mg/L	NA	**	***
*Total Petroleum	EPA 418.1[d]			X	X	NA	10 mg/Kg	NA/40	NA/80-120

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	GW	SOIL	SED	Required Detection Limits Water	Required Detection Limits Soil/Sed.	Precision Objective	Accuracy Objective
Hydrocarbons									
Target Compound List - Volatiles	EPA CLP SOW[c]	X[U]	X[U]	X	X			WATER/SOIL	WATER/SOIL
Chloromethane	EPA CLP SOW[c]					10 ug/L	10 ug/Kg (low)[3]	**	***
Bromomethane	EPA CLP SOW[c]					10	10		
Vinyl Chloride	EPA CLP SOW[c]					10	10		
Chloroethane	EPA CLP SOW[c]					10	10		
Methylene Chloride	EPA CLP SOW[c]					5	5		
Acetone	EPA CLP SOW[c]					10	10		
Carbon Disulfide	EPA CLP SOW[c]					5	5		
1,1-Dichloroethene	EPA CLP SOW[c]					5	5		
1,1-Dichororethane	EPA CLP SOW[c]					5 ug/L	5 ug/Kg(low)[3]		
total 1,2-Dichloroethene	EPA CLP SOW[c]					5	5		
Chloroform	EPA CLP SOW[c]					5	5		
1,2-Dichloroethane	EPA CLP SOW[c]					1	5		
2-Butanone	EPA CLP SOW[c]					10	10		
1,1,1-Trichoroethane	EPA CLP SOW[c]					5	5		
Carbon Tetrachloride	EPA CLP SOW[c]					5	5		
Vinyl Acetate	EPA CLP SOW[c]					10	10		
Bromodichloromethane	EPA CLP SOW[c]					5	5		
1,2-Dichloropropane	EPA CLP SOW[c]					5	5		
cis-1,3-Dichloropropene	EPA CLP SOW[c]					5	5		
Trichloroethene	EPA CLP SOW[c]					5	5		
Dibromochloromethane	EPA CLP SOW[c]					5	5		
1,1,2-Trichloroethane	EPA CLP SOW[c]					5	5		
Benzene	EPA CLP SOW[c]					5	5		
trans-1,2-Dichloropropene	EPA CLP SOW[c]					5	5		
Bromoform	EPA CLP SOW[c]					5	5		
4-Methyl-2-pentanone	EPA CLP SOW[c]					10	10		
2-Hexanone	EPA CLP SOW[c]					10	10		

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	GW	SOIL	SED	Required Detection Limits Water	Required Detection Limits Soil/Sed.	Precision Objective	Accuracy Objective
Tetrachloroethene	EPA CLP SOW[c]					5	5		
Toluene	EPA CLP SOW[c]					5	5		
1,1,2,2-Tetrachoroethane	EPA CLP SOW[c]					5	5		
Chlorobenzene	EPA CLP SOW[c]					5	5		
Ethyl Benzene	EPA CLP SOW[c]					5	5		
Styrene	EPA CLP SOW[c]					5	5		
Total Xylenes	EPA CLP SOW[c]					5	5		
Target Compound List - Semi-Volatiles			X[u]	X	X			WATER/SOIL	WATER/SOIL
Phenol	EPA CLP SOW[c]					10 ug/L	330 ug/Kg[3]	**	***
bis(2-Chloroethyl)ether	EPA CLP SOW[c]					10	330		
2-Chlorophenol	EPA CLP SOW[c]					10	330		
1,3-Dichlorobenzene	EPA CLP SOW[c]					10	330		
1,4-Dichlorobenzene	EPA CLP SOW[c]					10	330		
Benzyl Alcohol	EPA CLP SOW[c]					10	330		
1,2-Dichlorobenzene	EPA CLP SOW[c]					10	330		
2-Methylphenol	EPA CLP SOW[c]					10	330		
bis(2-Chloroisopropyl)ether	EPA CLP SOW[c]					10	330		
4-Methylphenol	EPA CLP SOW[c]					10	330		
N-Nitroso-Dipropylamine	EPA CLP SOW[c]					10	330		
Hexachloroethane	EPA CLP SOW[c]					10	330		
Nitrobenzene	EPA CLP SOW[c]					10	330		
Isophorone	EPA CLP SOW[c]					10	330		
2-Nitrophenol	EPA CLP SOW[c]					10	330		
2,4-Dimethylphenol	EPA CLP SOW[c]					10	330		
Benzoic Acid	EPA CLP SOW[c]					50	1600		
bis(2-Choroethoxy)methane	EPA CLP SOW[c]					10	330		
2,4-Dichlorophenol	EPA CLP SOW[c]					10	330		
1,2,4-Trichlorobenzene	EPA CLP SOW[c]					10	330		
Naphthalene	EPA CLP SOW[c]					10	330		

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	GW	SOIL	SED	Required Detection Limits Water	Required Detection Limits Soil/Sed.	Precision Objective	Accuracy Objective
4-Chloroanaline	EPA CLP SOW[c]					10	330		
Hexachlorobutadiene	EPA CLP SOW[c]					10	330		
4-Chloro-3-methylphenol	EPA CLP SOW[c]					10	330		
2-Methylnaphthalene	EPA CLP SOW[c]					10	330		
Hexachlorocyclopentadiene	EPA CLP SOW[c]					10 ug/L	330 ug/Kg[3]	**	***
2,4,6-Trichlorophenol	EPA CLP SOW[c]					10	330		
2,4,5-Trichlorophenol	EPA CLP SOW[c]					50	1600		
2-Chloronaphthalene	EPA CLP SOW[c]					10	330		
2-Nitroanaline	EPA CLP SOW[c]					50	1600		
Dimethylphthalate	EPA CLP SOW[c]					10	330		
Acenaphthylene	EPA CLP SOW[c]					10	330		
2,6-Dinitrotoluene	EPA CLP SOW[c]					10	330		
3-Nitroaniline	EPA CLP SOW[c]					50	1600		
Acenaphthene	EPA CLP SOW[c]					10	330		
2,4-Dinitrophenol	EPA CLP SOW[c]					50	1600		
4-Nitrophenol	EPA CLP SOW[c]					50	1600		
Dibenzofuran	EPA CLP SOW[c]					10	330		
2,4-Dinitrotoluene	EPA CLP SOW[c]					10	330		
Diethylphthalate	EPA CLP SOW[c]					10	330		
4-Chlorophenol Phenyl ether	EPA CLP SOW[c]					10	330		
Fluorene	EPA CLP SOW[c]					10	330		
4-Nitroanaline	EPA CLP SOW[c]					50	1600		
4,6-Dinitro-2-methylphenol	EPA CLP SOW[c]					50	1600		
N-nitrosodiphenylamine	EPA CLP SOW[c]					10	330		
4-Bromophenyl Phenyl ether	EPA CLP SOW[c]					10	330		
Hexachlorobenzene	EPA CLP SOW[c]					10	330		
Pentachlorophenol	EPA CLP SOW[c]					50	1600		
Phenanthrene	EPA CLP SOW[c]					10	330		
Anthracene	EPA CLP SOW[c]					10 ug/L	330 ug/Kg[3]	**	***
Di-n-butylphthalate	EPA CLP SOW[c]					10	330		
Fluoranthene	EPA CLP SOW[c]					10	330		

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	GW	SOIL	SED	Required Detection Limits Water	Required Detection Limits Soil/Sed.	Precision Objective	Accuracy Objective
Pyrene	EPA CLP SOW[c]					10	330		
Butyl Benzylphthalate	EPA CLP SOW[c]					10	330		
3,3'-Dichlorobenzidine	EPA CLP SOW[c]					20	660		
Benzo(a)anthracene	EPA CLP SOW[c]					10	330		
Chrysene	EPA CLP SOW[c]					10	330		
bis(2-ethylhexyl)phthalate	EPA CLP SOW[c]					10	330		
Di-n-octyl Phthalate	EPA CLP SOW[c]					10	330		
Benzo(b)fluoranthene	EPA CLP SOW[c]					10	330		
Benzo(k)fluoranthene	EPA CLP SOW[c]					10	330		
Benzo(a)pyrene	EPA CLP SOW[c]					10	330		
Indeno(1,2,3-cd)pyrene	EPA CLP SOW[c]					10	330		
Dibenz(a,h)anthracene	EPA CLP SOW[c]					10	330		
Benzo(g,h,i)perylene	EPA CLP SOW[c]					10	330		
Target Compound List - Pesticides/PCBs			X[U]	X	X			WATER/SOIL (%RPD)	WATER/SOIL (% Recovery)
alpha-BHC	EPA CLP SOW[c]					0.05 ug/L	8.0 ug/Kg[3]	**	***
beta-BHC	EPA CLP SOW[c]					0.05	8.0		
delta-BHC	EPA CLP SOW[c]					0.05	8.0		
gamma-BHC (Lindane)	EPA CLP SOW[c]					0.05	8.0		
Heptachlor	EPA CLP SOW[c]					0.05	8.0		
Aldrin	EPA CLP SOW[c]					0.05 ug/L	8.0 ug/Kg[3]	**	***
Heptachlor Epoxide	EPA CLP SOW[c]					0.05	8.0		
Endosulfan I	EPA CLP SOW[c]					0.05	8.0		
Dieldrin	EPA CLP SOW[c]					0.10	16.0		
4,4'-DDE	EPA CLP SOW[c]					0.10	16.0		
Endrin	EPA CLP SOW[c]					0.10	16.0		
Endosulfan II	EPA CLP SOW[c]					0.10	16.0		
4,4'-DDD	EPA CLP SOW[c]					0.10	16.0		
Endosulfan Sulfate	EPA CLP SOW[c]					0.10	16.0		
4,4'-DDT	EPA CLP SOW[c]					0.10	16.0		

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	GW	SOIL	SED	Required Detection Limits Water	Required Detection Limits Soil/Sed.	Precision Objective	Accuracy Objective
Methoxychlor	EPA CLP SOW[c]					0.5	80.0		
Endrin Ketone	EPA CLP SOW[c]					0.10	16.0		
alpha-Chlordane	EPA CLP SOW[c]					0.5	80.0		
gamma-Chlordane	EPA CLP SOW[c]					0.5	80.0		
Toxaphene	EPA CLP SOW[c]					1.0	160.0		
AROCLOR-1016	EPA CLP SOW[c]					0.5	80.0		
AROCLOR-1221	EPA CLP SOW[c]					0.5	80.0		
AROCLOR-1232	EPA CLP SOW[c]					0.5	80.0		
AROCLOR-1242	EPA CLP SOW[c]					0.5	80.0		
AROCLOR-1248	EPA CLP SOW[c]					0.5	80.0		
AROCLOR-1254	EPA CLP SOW[c]					1.0	160.0		
AROCLOR-1260	EPA CLP SOW[c]					1.0	160.0		
RADIONUCLIDES								(Replicate Analyses)	(Laboratory Control Sample)
Gross Alpha	f,g,h,i,k,l,m,n,s	$X^{F,U}$	X^{F}	X	X	2 pCi/L	4 pCi/g	**	***
Gross Beta	f,g,h,i,k,l,m,n,s	$X^{F,U}$	X^{F}	X	X	4 pCi/L	10 pCi/g		
Uranium 233+234	f,h,i,l,m,n,s	$X^{F,U}$	X^{F}	X	X	0.6 pCi/L	0.3 pCi/g		
Uranium 235,238	f,h,i,l,m,n,s	$X^{F,U}$	X^{F}	X	X	0.6 pCi/L	0.3 pCi/g		
Americium 241	i,l,p,q,s	$X^{F,U}$	X^{F}	X	X	0.01 pCi/L	0.02 pCi/g		
Plutonium 239+240	i,l,o,p,s	$X^{F,U}$	X^{F}	X	X	0.01 pCi/L	0.03 pCi/g		
Tritium	f,g,h,l,m,s	X^{U}	X^{U}	X	X	400 pCi/L	400 pCi/L		
Strontium 89,90	f,h,i,l,m,s			X	X	NA	1 pCi/g		
Strontium 90 only	f,h,i,l,m,s	$X^{F,U}$	X^{F}			1 pCi/L	NA		
Cesium 137	i,l,m,s	$X^{F,U}$	X^{F}	X	X	1 pCi/L	0.1 pCi/g		
Radium 226	f,g,h,i,m,l,s	$X^{F,U}$	X^{F}			0.5 pCi/L	0.5 pCi/g		
Radium 228	f,g,h,i,m,l,s	$X^{F,U}$	X^{F}			1 pCi/L	0.5 pCi/g		

Analyte	Method	SW	GW	SOIL	SED	Readability Objective	Accuracy

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	GW	SOIL	SED	Required Detection Limits Water	Required Detection Limits Soil/Sed.	Precision Objective	Accuracy Objective
FIELD PARAMETERS									
pH	1	X	X			± 0.1 pH unit		± 0.2 pH units	
Specific Conductance	1	X	X			2.5 umho/cm[7] 25 umho/cm[8] 250 umho/cm[9]		± 2.5% max. error at 500, 5000, 50000 umhos/cm plus probe; ± 3.0% max error at 250, 2500, and 25000 plus probe accuracy of ± 2.0%.	
Temperature	1	X	X			± 0.1°C		± 1.0°C	
Dissolved Oxygen	1	X				± 0.1 mg/L		± 10%	

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

* For samples collected from IHSSs 102 and 105 only [BH01,BH02,BH03,BH04,BH05,BH06,BH07,BH08 (MW33),BH09,BH15,BH16,BH17,BH18,MW01,MW02,MW03,MW33 (BH08)].
** Precision objective = control limits specified in referenced method and/or Data Validation Guidelines.
*** Accuracy objective = control limits specified in referenced method (in GRRASP for radionuclides).
F = Filtered
U = Unfiltered

1. Measured in the field in accordance with instrument manufacturer's instructions. The instruments to be used are specified in Section 12.
2. Medium soil/sediment required detection limits for pesticide/PCB TCL compounds are 15 times the individual low soil/sediment required detection limit.
3. Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.
4. Higher detection limits may only be used in the following circumstance: If the sample concentration exceeds five times the detection limit of the instrument or method in use, the value may be reported even though the instrument or method detection limit may not equal the required detection limit. This is illustrated in the example below:

   For lead:

   Method in use - ICP
   Instrument Detection Limit (IDL) - 40
   Sample Concentration - 220
   Required Detection Limit (RDL) - 3

   The value of 220 may be reported even though the instrument detection limit is greater than the RDL.

   Note: The specified detection limits are based on a pure water matrix. The detection limits for samples may be considerably higher depending on the sample matrix.
5. If gross alpha > 5 pCi/L, analyze for Radium 226; if Radium 226 > 3 pCi/L, analyze for Radium 228.
6. The detection limits presented were calculated using the formula in N.R.C. Regulatory Guide 4.14, Appendix Lower Limit of Detection, pg. 21, and follow:

$$LLD = \frac{4.66\ (BKG/BKG\ DUR)^{1/2}}{(2.22)(Eff)(CR)(SR)(e^{-\lambda t})(Aliq)}$$

Where:
LLD = Lower Limit of Detection in pCi per sample unit.
BKG = Instrument Background in counts per minute (CPM).
Eff = Counting efficiency in cpm/disintegration per minute (dpm).
CR = Fractional radiochemical yield.
SR = Fractional radiochemical yield of a known solution.
λ = The radioactive decay constant for the particular radionuclide.
t = The elapsed time between sample collection and counting.
Aliq = Sample volume.
BKG DUR = Background count duration in minutes.

$$MDA = \frac{4.66\ (BKG/Sample\ DUR)^{1/2}}{(2.22)(Eff)(CR)(SR)e^{\lambda t}(Aliq)}$$

MDA = Minimum Detectable Activity in pCi per sample unit
BKG = same as for LLD
Eff = same as for LLD
CR = same as for LLD
SR = same as for LLD
λ = same as for LLD
t = same as for LLD
Aliq = same as for LLD
Sample DUR = sample count duration in minutes

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

7. On 500 umho/cm range.
8. On 5000 umho/cm range.
9. On 50000 umho/cm range.

a. U.S. Environmental Protection Agency Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration, 7/88 (or latest version).
b. U.S. Environmental Protection Agency Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration, 7/88 (or latest version). The specific method to be utilized is at the laboratory's discretion provided it meets the specified detection limit.
c. U.S. Environmental Protection Agency Contract Laboratory Program Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, 2/88 (or latest version).
d. Methods are from "Methods for Chemical Analysis of Water and Wastes," U.S. Environmental Protection Agency, 1983, unless otherwise indicated.
e. Methods are from "Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods," (SW-846, 3rd Ed.), U.S. Environmental Protection Agency.
f. U.S. Environmental Protection Agency, 1979, Radiochemical Analytical Procedures for Analysis of Environmental Samples, Report No. EMSL-LY-0539-1, Las Vegas, NV, U.S. Environmental Protection Agency.
g. American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1985. Standard Methods for the Examination of Water and Wastewater, 16th ed., Washington, D.C., Am. Public Health Association.
h. U.S. Environmental Protection Agency, 1976. Interim Radiochemical Methodology for Drinking Water, Report No. EPA-600/4-75-008. Cincinnati U.S. Environmental Protection Agency.
i. Harley, J.H., ed., 1975, HASL Procedures Manual, HASL-300; Washington, D.C., U.S. Energy Research and Development Administration.
j. U.S. EPA, 1982. "Methods for Organic Analysis of Municipal and Industrial Waste Water." EPA-600/4-82-057.
k. "Handbook of Analytical Procedures," USAEC, Grand Junction Lab. 1970, page 196.
l. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," EPA-600/4-80-032, August 1980, Environmental Monitoring and Support Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268.
m. "Methods for Determination of Radioactive Substances in Water and Fluvial Sediments," U.S.G.S. Book 5, Chapter A5, 1977.
n. "Acid Dissolution Method for the Analysis of Plutonium in Soil," EPA-600/7-79-081, March 1979, U.S. EPA Environmental Monitoring and Support Laboratory, Las Vegas, Nevada, 1979.
o. "Procedures for the Isolation of Alpha Spectrometrically Pure Plutonium, Uranium, and Americium," by E.H. Essington and B.J. Drennon, Los Alamos National Laboratory, a private communication.
p. "Isolation of Americium from Urine Samples," Rocky Flats Plant, Health, Safety, and Environmental Laboratories.
q. "Radioactivity in Drinking Water," EPA 570/9-81-002.
r. If the sample or duplicate result is <5 x IDL, then the control limit is ± IDL.
s. U.S. EPA, 1987. "Eastern Environmental Radiation Facility Radiochemistry Procedures Manual." EPA-520/5-84-006.