QUALITY ASSURANCE ADDENDUM

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

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS PLANT
GOLDEN, COLORADO

REVISION 0

OCTOBER, 1990

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OPERABLE UNIT NO. 1, 881 HILLSIDE AREA PHASE III RFI/RI

Revision 0

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CDH	Colorado Department of Health
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CLP	Contract Laboratory Program (U.S. EPA)
CMS	Corrective Measures Study
DOE	U.S. Department of Energy
DQO	Data Quality Objective
EE	Environmental Evaluation
EMAD	Environmental Monitoring and Assessment Division
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
FS	Feasibility Study
GRRASP	General Radiochemistry and Routine Analytical Services Protocol (EG&G)
GW	Groundwater
H&S	Health and Safety
IAG	Interagency Agreement
IHSS	Individual Hazardous Substance Site (formerly Solid Waste Management Unit)
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completeness
QA	Quality Assurance
QAA	Quality Assurance Addendum
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RFP	Rocky Flats Plant
RI	Remedial Investigation
RPD	Relative Percent Difference
SOP	Standard Operating Procedure
SW	Surface Water

INTRODUCTION AND SCOPE

This QA Addendum (QAA) supplements the "Draft Rocky Flats Plant Site-Wide Quality Assurance Project Plan for CERCLA RI/FS and RCRA RFI/CMS Activities" (QA Project Plan) dated August 23, 1990, and establishes the specific QA controls applicable to the field investigation activities described in the Phase III Work Plan/Field Sampling Plan for the 881 Hillside Area (Operable Unit No. 1).

The primary objectives of the Phase III 881 Hillside Area RFI/RI are to further characterize site physical features, further define contaminant sources, determine the extent of contamination, describe contaminant fate and transport, provide a baseline human health risk assessment, and begin the evaluation of remedial alternatives and treatability studies. In conjunction with the baseline human health risk assessment, an environmental evaluation of the site will also be performed during Phase III to gather and analyze appropriate environmental data in order to determine whether the site poses a current or potential risk to environmental resources in the absence of any remediation. Based on the Phase I and Phase II RFI/RI conclusions and the conceptual site model that has been developed, site-specific Phase III objectives and associated data needs have been developed and are described in this QAA. Specific plans for obtaining the needed data are presented in Sections 5.0 and 6.0 of the Phase III RFI/RI Work Plan/Field Sampling Plan and are also summarized later in this QAA.

1.0 ORGANIZATION AND RESPONSIBILITIES

The organization of the EG&G Rocky Flats divisions involved in RFI/RI activities is shown in Figures 1-1 and 1-2 in the QA Project Plan. Individual responsibilities are described in detail in Section 1.3 of the QA Project Plan.

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

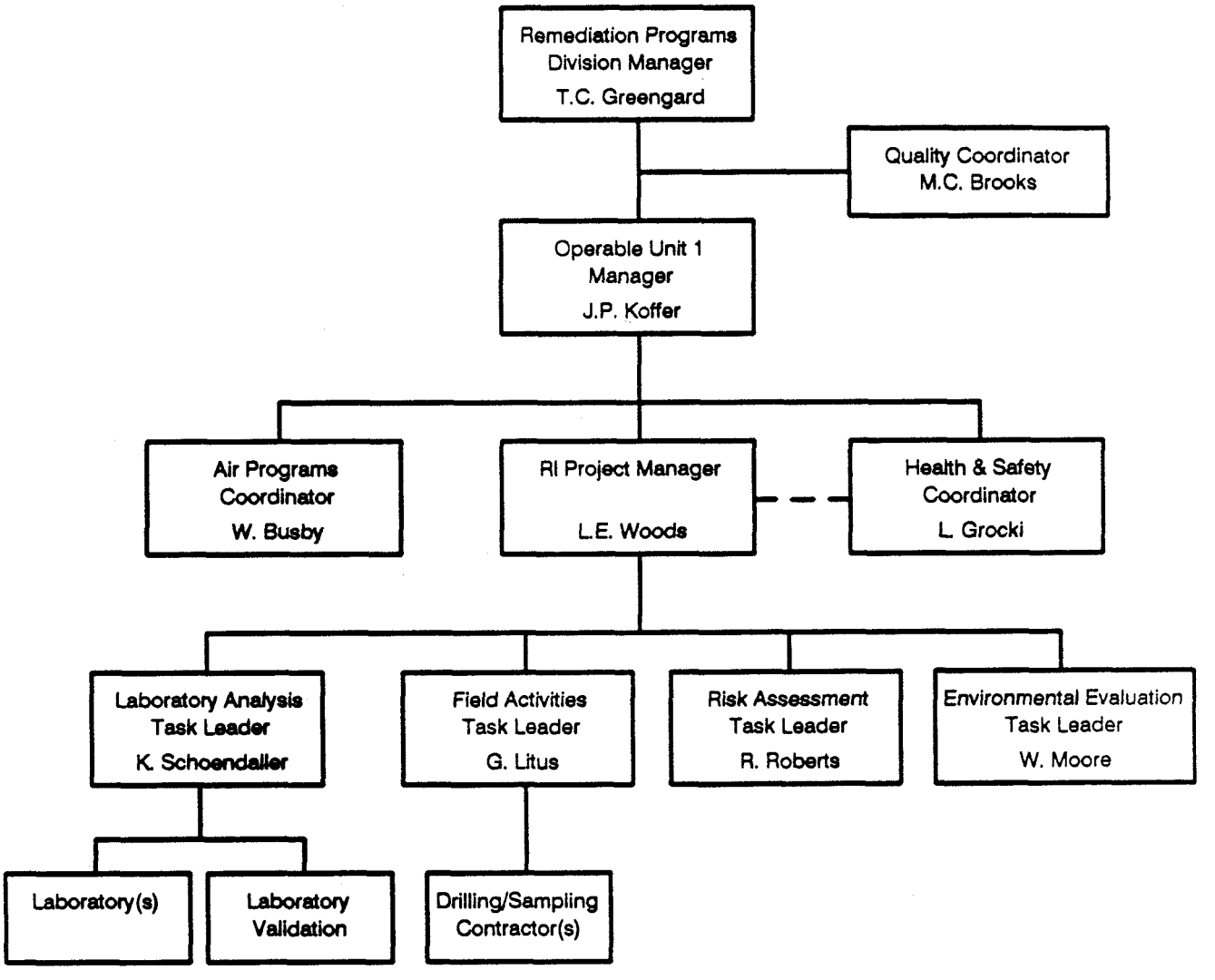
2.0 QUALITY ASSURANCE PROGRAM

This QAA supplements the "Rocky Flats Plant Site-Wide Quality Assurance Project Plan for CERCLA RI/FS and RCRA RFI/CMS Activities" (QA Project Plan), 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 QA Project Plan was written to specifically address QA controls for Interagency Agreement (IAG) related activities. The content was driven by DOE RFP SOP 5700.6B, which requires that a QA program be implemented for all Rocky Flats Plant activities based on ANSI/ASME NQA-1, "Quality Assurance Requirements for Nuclear Facilities", as well as the IAG which specifies that a QA Project Plan for IAG related activities be developed in accordance with EPA QAMS-005/80, "Interim Guidelines and Specifications for Preparing QA Project Plans." The 18 element format of NQA-1 was selected as the basis for both the plan and subsequent addenda with the applicable elements of EPA QAMS-005/80 incorporated where appropriate.

2.1 Training

All personnel performing activities in accordance with the SOPs specified in this QAA shall receive documented training in the QAA and the applicable SOPs prior to performing the work as specified in Section 2.4 of the QA Project Plan. Such personnel include, but aren't limited to, those performing or supervising the following activities:

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



- 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

Objectives:

The Phase III field investigation is designed to meet the objectives outlined in Table 1. The following activities shall 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.

Sample locations, frequency, and analyses are presented in Section 5.0 and 6.0 of the Phase III Work Plan/Field Sampling Plan and are summarized later 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. Some field methods, especially for biota sampling, are contained in the Phase III Work Plan/Field Sampling Plan and have been included by reference in this QAA.

Data quality objectives (DQOs) are quantitative and qualitative statements which specify the quality and quantity of data collection required. DQOs are typically expressed in terms of precision, accuracy, representativeness, comparability, and completeness (PARCC). Only precision and accuracy can be expressed in purely quantitative terms. Each of the PARCC parameters is defined in detail in Appendix A of the QA Project Plan.

TABLE 1
PHASE III OBJECTIVES AND DATA NEEDS

Objective	Data Need
Characterize Site Physical Features	
1) Determine the extent of saturation and groundwater flow directions for the unconfined flow system both spatially and temporally.	- Install additional monitoring wells and piezometers. - Maintain a database of water levels from which water table maps, saturated thickness maps, cross sections, and hydrographs can be prepared.
2) Describe the interaction between the surface water and groundwater pathways.	- Compare water levels and water quality data from surface water sampling locations and groundwater monitoring wells to evaluate the interconnection between these two media. Data analysis shall also rely on groundwater flow directions and seep locations.
3) Quantify material properties.	- Perform flow, slug, or packer tests to develop hydraulic conductivity and storativity values for surficial materials.
Characterize Contaminant Sources	
1) Characterize the nature and distribution of waste materials remaining on-site.	- Collect samples from boreholes drilled directly through IHSSs where possible. Collect waste samples as well as soil samples from beneath the wastes. Analyze samples for TCL volatiles, semi-volatiles, and pesticides/PCBs, TAL metals, as well as radionuclides and inorganics.
2) Characterize soils beneath wastes as well as soils at sites where wastes have been removed as potential contaminant sources.	- Same as above.

TABLE 1
PHASE III OBJECTIVES AND DATA NEEDS (cont'd)

Objective	Data Need
3) Identify which sites or subareas of sites are sources of contaminants in groundwater.	- Install alluvial groundwater monitoring wells directly beneath sites to assess groundwater levels and quality. - Install alluvial groundwater monitoring wells directly up- and downgradient of each site to pinpoint the source of contaminants.
Characterize the Nature and Extent of Contamination	
1) Determine the horizontal and vertical extent of surficial radionuclide soil contamination due to wind dispersion.	- Collect surficial soil scrapes in the study area following Colorado Department of Health sampling procedures and analyze for radionuclides.
2) Determine the nature and extent of groundwater contamination in surficial materials.	- Install alluvial groundwater monitoring wells in surficial materials located between areas of known groundwater contamination and areas with no groundwater contamination to delineate the extent. Collect groundwater samples and analyze for TCL volatiles, semi-volatiles, and pesticides/PCBs, TAL metals, radionuclides, and inorganics.

TABLE 1
PHASE III OBJECTIVES AND DATA NEEDS (cont'd)

Objective	Data Need
3) Determine the location and extent of weathered and unweathered sandstone units and associated contamination.	- Install bedrock monitoring wells in new boreholes in which sandstones are encountered. This shall include boreholes which were initially planned for installing alluvial wells, as well as selected boreholes planned specifically to characterize bedrock. Produce east-west and north-south geologic and hydrologic cross-sections as data permit. Collect groundwater samples and analyze for TCL volatiles, semi-volatiles, and pesticides/PCBs, TAL metals, radionuclides and inorganics.
4) Characterize surface water and sediment quality	- Continue collection of surface water from existing monitoring stations on a monthly basis. Establish sediment stations directly associated with the 881 Hillside as sediment availability permits. Analyze samples for TCL volatiles, TAL metals, radionuclides, and inorganics. Analyze surface water samples for both dissolved and total metals and radionuclides to determine if constituents are suspended or dissolved. Continue routine flow rate measurements at surface water stations.
Provide a Baseline Risk Assessment	
1) Describe contaminant fate and transport.	- Use existing literature and field data to describe the physicochemical processes associated with site contaminants. Incorporate Phase III results into risk analysis.

TABLE 1
PHASE III OBJECTIVES AND DATA NEEDS (cont'd)

Objective	Data Need
2) Assess the threat to public health and the environment from the no action remedial alternative.	- Prepare a baseline risk assessment as part of the RFI/RI data analysis based on Phase I and Phase II RFI/RI results.
Perform a Baseline Risk Assessment	
1) Describe the existing ecological setting.	- Review existing literature and data and collect field data to define habitats, vegetation, wildlife, and aquatic species.
2) Identify key food chain species that likely represent the major flow of energy and major pathways for contaminant transfer from physical environmental media to higher trophic level receptors.	- Same as above. Also, once key species are identified, collect tissue samples for contaminant analysis.
3) Perform an environmental risk assessment to determine whether a potential or real threat exists to key biological receptors from 881 Hillside Area contaminated releases.	- Utilize contaminant data gathered during Phase III RFI/RI. - Perform environmental surveys. Review existing literature and data.

Quantitative DQOs shall be established for biota samples in Stage I of a three-stage process described in the WP/FSP.

Precision and Accuracy:

CLP Analyses: The Phase III Work Plan/Field Sampling 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 EPA's CLP Statements of Work. These guidelines shall be used as the Phase III DQOs by the Environmental Monitoring and Assessment Division (EMAD) or its Contractors to evaluate results generated under CLP protocols. These objectives are incorporated by reference in Table 2.

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 identified in Table 2. For these analyses, precision and accuracy objectives are based on the control limits specified in the methods. These objectives are included by reference in Table 2.

Completeness:

Completeness is the percentage of the total number of measurements that are judged to be valid, or acceptable with qualifications. Field and analytical data may be specified at different completeness levels. The target completeness objective for both field and analytical data for this project is 90 percent.

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. Comparability is an indicator of how well newly collected data will be compatible with previously collected data and data collected at other locations.

TABLE 2, 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	25%RPD	80-120% LCS Recovery
Total Dissolved Solids	EPA 160.1[d]	X[U]	X[F]			5 mg/L	NA	25%RPD	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[U]	X[F]	X	X			WATER/SOIL (% RPD)	WATER/SOIL (% Recovery)
Aluminum	EPA CLP SOW[a]					200 ug/L[4]	40 mg/Kg[4]	**	***
Antimony	EPA CLP SOW[a]					60	12		
Arsenic	EPA CLP SOW[a]					10	2		
Barium	EPA CLP SOW[a]					200	40		
Beryllium	EPA CLP SOW[a]					5	1.0		
Cadmium	EPA CLP SOW[a]					5	1.0		
Calcium	EPA CLP SOW[a]					5000	2000		
Chromium	EPA CLP SOW[a]					10	2.0		
Cobalt	EPA CLP SOW[a]					50	10		
Copper	EPA CLP SOW[a]					25	5.0		
Cyanide	EPA 335.3 (modified for CLP)[a,d]					5	10		

TABLE 2, 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
Target Analyte List - Metals (continued)		X[U]	X[F]	X	X			WATER/SOIL (% RPD)	WATER/SOIL (% Recovery)
Iron	EPA CLP SOW[a]					100 ug/L[4]	20 mg/Kg[4]	**	***
Lead	EPA CLP SOW[a]					3	1.0		
Magnesium	EPA CLP SOW[a]					5000	2000		
Manganese	EPA CLP SOW[a]					15	3.0		
Mercury	EPA CLP SOW[a]					0.2	0.2		
Nickel	EPA CLP SOW[a]					40	8.0		
Potassium	EPA CLP SOW[a]					5000	2000		
Selenium	EPA CLP SOW[a]					5	1.0		
Silver	EPA CLP SOW[a]					10	2.0		
Sodium	EPA CLP SOW[a]					5000	2000		
Thallium	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 (% RPD)	WATER/SOIL (% Recovery)
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	**	***
Sulfide	EPA 376.1[d]			X	X	NA	4 ug/g	**	***

TABLE 2, 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
ANIONS								Water/Soil (%RPD)	Water/Soil (% Recovery)
Carbonate	EPA 310.1[d]	X[U]	X[U]			10 mg/L	NA	**	***
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 Hydrocarbons	EPA 418.1[d]			X	X	NA	10 mg/Kg	NA/40	NA/80-120
Target Compound List - Volatiles	EPA CLP SOW[c]	X[U]	X[U]	X	X			WATER/SOIL (% RPD)	WATER/SOIL (% Recovery)
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		

TABLE 2, 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
Target Compound List - Volatiles (continued)		X[U]	X[U]	X	X			WATER/SOIL (% RPD)	WATER/SOIL (% Recovery)
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 601/602[j]					0.1	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 601/602[j]					0.1	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		
Tetrachloroethene	EPA 601/602[j]					0.1	5		
Toluene	EPA CLP SOW[c]					5	5		
1,1,2,2-Tetrachoroethane	EPA 601/602[j]					0.1	5		
Chlorobenzene	EPA 502.2[d]					5	5		
Ethyl Benzene	EPA 502.2[d]					5	5		
Styrene	EPA 502.2[d]					5	5		
Total Xylenes	EPA 502.2[d]					5	5		

TABLE 2, 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
Target Compound List - Semi-Volatiles			X[U]	X	X			WATER/SOIL (%RPD)	WATER/SOIL (% Recovery)
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		
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		

TABLE 2, 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
Target Compound List - Semi-Volatiles (continued)			X[U]	X	X			WATER/SOIL (%RPD)	WATER/SOIL (% Recovery)
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		

TABLE 2, 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
Target Compound List - Semi-Volatiles (continued)			X[U]	X	X			WATER/SOIL (%RPD)	WATER/SOIL (% Recovery)
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		
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		

TABLE 2, 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
Target Compound List - Pesticides/PCBs (continued)			X[U]	X	X			WATER/SOIL (%RPD)	WATER/SOIL (% Recovery)
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		
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		

TABLE 2, 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
RADIONUCLIDES									
Gross Alpha	f,g,h,i,k,l,m,n	$X^{F,U}$	X^{F}	X	X	2 pCi/L	4 pCi/g	**	***
Gross Beta	f,g,h,i,k,l,m,n	$X^{F,U}$	X^{F}	X	X	4 pCi/L	10 pCi/g		
Uranium 233+234,235,238	f,h,i,m,n	$X^{F,U}$	X^{F}	X	X	0.6 pCi/L	0.3 pCi/g		
Americium 241	p,q	$X^{F,U}$	X^{F}	X	X	0.01 pCi/L	0.02 pCi/g		
Plutonium 239+240	o,p	$X^{F,U}$	X^{F}	X	X	0.01 pCi/L	0.03 pCi/g		
Tritium	f,g,h,m	X^{U}	X^{U}	X	X	400 pCi/L	400 pCi/L		
Strontium 89,90	f,h,i,m			X	X	NA	1 pCi/g		
Strontium 90 only	f,h,i,m	$X^{F,U}$	X^{F}			1 pCi/L	NA		
Cesium 137	m	$X^{F,U}$	X^{F}	X	X	1 pCi/L	0.1 pCi/g		
Radium 226	f,g,h,m[5]	$X^{F,U}$	X^{F}			0.5 pCi/L	0.5 pCi/g		
Radium 228	f,g,h,m[5]	$X^{F,U}$	X^{F}			1 pCi/L	0.5 pCi/g		

Analyte	Method	SW	GW	SOIL	SED	Readability Objective	Accuracy
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%

TABLE 2, 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 limit specified in referenced method.
*** Accuracy objective = control limit specified in referenced method.
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:

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

   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.
   x = The radioactive decay constant for the particular radionuclide.
   t = The elapsed time between sample collection and counting.
   Aliq = Sample volume.
   DUR = Duration time in minutes.

TABLE 2, 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. US 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.

Representativeness:

Representativeness is a qualitative parameter that is ensured through the careful development and review of the sampling and analysis strategy and the use of appropriate SOPs for sample collection and analysis and field data collection.

3.2 Sampling Locations

Groundwater Samples:

Ground water samples shall be collected from the monitoring wells listed below. The locations of the monitoring wells are shown in Figure 5-1 in the Phase III Work Plan/Field Sampling Plan.

MW20 MW21 MW22 MW23 MW24 MW25 MW26 MW27 MW28 MW29
MW30 MW31 MW32 MW33 MW34 MW35

Surface Water Samples:

During the Phase III field investigation, surface water samples shall be collected from the surface water sampling locations listed below. These locations are shown in Figure 2-17 of the Phase III Work Plan/Field Sampling Plan.

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

Field reconnaissance shall 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 shall be added to the surface water sampling program.

The surface water sampling locations will be sampled monthly. Discharge measurements will be conducted in conjunction with the monthly surface water sampling.

Soil Samples:

Soil samples shall be collected from boreholes and during the installation of groundwater monitoring wells. Samples shall be collected at 2-ft intervals until the borehole/monitoring well reaches the water table. The soil sampling locations are listed below. The locations are shown in Figure 5-1 in the Phase III Work Plan/Field Sampling Plan.

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	MW01	MW02	MW03	MW04	MW05	MW06	MW07	MW08	MW09	MW10
MW11	MW12	MW13	MW14	MW15	MW16	MW17	MW18	MW19	MW33		

Sediment Samples:

During the Phase III field investigation, sediment samples shall be collected from the locations listed below. These sampling locations are shown in Figure 5-1 of the Phase III Work Plan/Field Sampling Plan.

SED-37 SED-38 SED-39

Surficial Soil Samples:

In order to characterize the vertical and horizontal extent of surficial soil plutonium contamination, surficial soil scrapes and vertical soil profiles shall 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 Work Plan/Field Sampling Plan. Surface scrapes shall be collected and analyzed in accordance with CDH procedures.

Environmental Evaluation Samples:

Both Stage I and Stage III field sampling activities shall be located and timed to the extent possible to coincide with collection of other media samples such as soils, surface water and ground water.

The field sampling plan for Stage I is based on the assumption that brief field surveys will be conducted in the winter, spring, summer and fall of 1991 and that the ecological field inventory will take place within the May-June 1991 timeframe.

Environmental sampling procedures are presented in Section 6.8 of the Phase III Work Plan/Field Sampling Plan. At this point in time the environmental evaluation studies shall consist of a three-stage approach as described in the Phase III Work Plan/Field Sampling Plan.

Stage III tissue analysis studies shall require the sampling of contaminated and control areas in order to establish a relationship between contaminated conditions and background conditions in areas not exposed to RFP contamination. Selection of the reference areas shall be based on criteria developed in the Stage I preliminary planning process. Potential selection criteria include species to be sampled or similarity to 881 Hillside in terms of topography, aspect, soils, vegetation, range type, and land use history. Reference areas shall be upwind from prevailing air flow patterns through RFP and upstream from drainage off RFP.

The aquatic species reference areas ideally should be located in Rock Creek. A site visit shall be made of the proposed aquatic sampling locations (existing surface water sampling points SW-31, SW-32, SW-46, SW-70, Pond C-2) at 881 Hillside. Habitat characteristics shall be noted if not previously recorded in on-going RFP studies (depth, flow, substrate type, pool/riffle, aquatic/streamside vegetation, etc.). This process shall be repeated at potential reference sites. The reference site locations shall be based on data quality objectives and the measurement endpoints selected in the Stage I and Stage III sampling plans.

Locations for Vegetative Sampling

Stage I vegetation inventory and sampling for phytosociological data shall be performed at 881 Hillside, South Interceptor Ditch and along Woman Creek south and east of 881 Hillside. A systematic walk-through of these areas shall be conducted during the field surveys and spring field inventory.

A stratified randomization procedure shall be utilized to identify sampling locations for the quantitative vegetative description portion of the field inventory. The basis for selecting a random procedure of vegetation transect/plot location is to obtain as unbiased an estimator as possible of true population parameters for cover, density and frequency. Stratification is required because several distinct vegetation types appear to be present in the study area, including prairie grassland, marsh, streambank vegetation, well-vegetated disturbed areas, and sparsely vegetated disturbed areas.

Sample plot locations shall be located near the soil sampling sites whenever possible. The exact location of the study plots shall be selected by a double randomization procedure. The first, used to select the soil sample locations, is described in Section 5.2.3 of the Phase III Work Plan/Field Sampling Plan. From each soil sampling point, the centerpoint of a vegetation plot shall then be selected based on a random distance (to 10 m) and random direction, using random numbers tables. Plot locations shall be selected until an adequate number has been selected for each major vegetation type. Locations shall be discarded under several conditions: where the selected location is in a vegetation type for which an adequate number of plots has already been selected; where the vegetation of the plot is not homogeneous (located in more than one type, or across an ecotone); and where the plot would be located in buildings or paved areas. A similar process shall be used for transects along Woman Creek and the South Interceptor Ditch, where the sample locations will be located in the general area of the soil, sediment or water sampling points. Since vegetation types associated with these features tend to be linear, the randomization process may require limits on direction. In addition, multiple plots shall be located near (within 50 m) of each water sampling point, to provide an adequate sample size.

Locations for Periphyton Sampling

Periphyton samples shall be collected at the following surface water sampling locations: SW-31, SW-32, SW-46, SW-70 and Pond C-2. Should periphyton be absent at a particular location, then the nearest location downstream supporting periphyton shall be sampled and located on a map.

Locations for Wildlife Sampling

A terrestrial wildlife inventory shall be conducted within the 881 Hillside area, the South Interceptor Ditch and along Woman Creek south and east of the 881 Hillside. Small mammal sampling shall be conducted, to the extent possible, at the vegetative sampling locations.

Benthic organisms and fish shall be collected at SW-31, SW-32, SW-46, SW-70 and Pond C-2. If no aquatic habitat is present at these designated locations, then the nearest downstream location with suitable habitat shall be sampled. The intent is to sample for benthos and fish at locations that also are sampled for sediments and surface waters.

Stage III Tissue Sampling Locations

Locations for the collection of Stage III tissue samples (terrestrial vegetation, periphyton, benthos, macrobenthos, fish)) shall be based on surface water, soil and sediment sample locations, as well as potential contaminant release areas. Stage III sampling locations shall include Stage I sampling sites (i.e. five x,y coordinate blocks), designated locations near or within IHSSs 102, 107, 130, 119.1 and 119.2 and 130; and, surface water sampling locations SW-31, SW-32, SW-46, SW-70 and Pond C-2. Depending on the analysis and selection of contaminants of concern, contaminant sources, key receptor species, contaminant pathways and exposure points, the above sampling locations may change. The intent is to collect tissue samples where existing abiotic media sampling occurs, to the extent possible.

Sample Frequency

Stage I field surveys will be conducted during 1-week periods in the winter, spring, summer, and fall of 1991. Special note of transitory species, migratory species, and seasonal breeding habits will be made during these multi-season surveys.

Stage I field inventory sampling will occur during the May-June 1991 time frame. Where possible, samples collected during the inventory will be saved and used in the Stage III tissue analysis studies.

3.3 Environmental Evaluation: Summary of Surveying and Sampling

Stage I shall consist of general field surveys to characterize the biota at 881 Hillside. In addition, all existing information shall be reviewed to identify data gaps and to make a preliminary determination of the contaminants of concern. Based on the Stage I evaluation, DQOs shall then be refined.

Vegetation Surveying

Structural and compositional data for the 881 Hillside and reference area shall be obtained by quantitative sampling. Shrubs shall be sampled using a line-strip transect 3m by 20m in size. Shrub cover, density, and frequency shall be recorded for each species found within the transect. Herbaceous cover and frequency are obtained from a $1.0m^2$ quadrat, and herbaceous density from a $0.25m^2$ quadrat along the line-strip transect at 0, 10m, and 20m. A single line-strip transect and quadrat shall be sampled at each sample location. Trees encountered during the field study shall be identified, counted, and mapped. Sample adequacy shall be based on shrub density; an adequate number of samples is obtained when the standard error of the mean density is equal to or less than ten percent of the mean density. Specific field procedures to be followed are included in Section 6.0 of the Work Plan/Field Sampling Plan.

Wildlife Surveying

It is not the intent of this field survey to provide population data on wildlife, aquatic life, birds, or invertebrate organisms. The survey is planned to note the presence or absence of the above in order to

identify potential contaminant pathways through the food chain. Survey procedures shall include a systematic walk-through of the 881 Hillside area to record all ecological features such as animal sign, sightings, burrows, dens, nests, etc. Small mammals shall be sampled by live trap transects placed in three locations for three nights. Each transect shall consist of 25 traps baited with rolled oats or barley and placed 15m apart. Species, sex, life history stage, and reproductive condition shall be recorded and the animal released alive. A sweep net shall be used to collect insects and other invertebrates found in the vegetation canopy. Ground-dwelling invertebrates shall be noted as encountered. All invertebrates shall be identified to order. Specific field procedures to be followed are included in Section 6.0 of the Work Plan/Field Sampling Plan.

Vegetation Collection

Terrestrial vegetation shall be collected by clipping within a $1m^2$ quadrat or larger and separating selected species for tissue analysis. Triplicate samples shall be taken at each location. One hundred grams of material (wet weight) shall be collected per sample for analysis. Roots and above-ground tissues shall be analyzed separately (one-half of the above-ground tissues shall be washed with distilled water in the laboratory prior to analysis to separate deposition from accumulation).

Periphyton Collection

Within the South Interceptor Ditch, Woman Creek channel, and Pond C-2, periphyton shall be collected in a homogenous area by scraping and removing the periphyton (floating or attached algal mats) from its substrate or from surface floating samplers (artificial substrate) placed in the sample location over a 28-day period. Triplicate samples of algal mats shall be taken at each location. One-hundred grams of material (wet weight) shall be collected per sample for analysis. Glass slides removed from artificial substrate device shall be scraped clean of periphyton and the material identified to genera.

Benthos Collection

Within the South Interceptor Ditch, Woman Creek channel, and Pond C-2, benthic organisms shall be collected with a Surber sampler and/or Ekman grab as specified in the Work Plan/Field Sampling Plan. Organisms shall be sorted, identified, and counted. The sediment shall be sieved through a standard screen, and retained macroinvertebrates shall be sorted by species (or genera) and counted.

3.4 Hydrologic Testing

Pumping and tracer tests shall be performed in the Woman Creek Alluvium to determine solute transport times. The test locations are shown in Figure 5-2 of the Phase III Work Plan/Field Sampling Plan. Hydrologic testing will be performed in accordance with the EG&G SOPs specified in Table 3 of this QAA and Section 5.2.1.3 of the Work Plan/Field Sampling Plan.

3.5 Equipment Decontamination

Non-dedicated sampling equipment shall be decontaminated between sampling locations in accordance with the EG&G SOPs specified in Table 3. Other equipment (e.g., heavy equipment) potentially contaminated during drilling, hydrogeologic/geologic testing, boring, sample collection, etc. shall also be decontaminated as specified in the applicable EG&G SOPs listed in Table 3.

TABLE 3
APPLICABLE SOPs

Standard Operating Procedures	Well Drilling, Completion, Development	Ground-Water Sampling	Surface-Water Sampling	Sediment Sampling	Surface Soil Sampling	Subsurface Soil/Mat. Sampling	Hydrologic Testing	Source Sampling	Biota Sampling
EMA - 0161 Ambient Air Sampling	X							X	
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 Rocky Flats Plant Access and Control	●	●	●	●	●	●	●	●	●
1.13 Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples		●	●	●	●	●	●	●	●
1.14 Data Base Management	●	●	●	●	●	●	●	●	●
1.15 Use of PIDs and FIDs	X	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	X
b) Sample and Waste Screening	X	X	X	X	X	X	X	X	X
2.1 Water Level Measurements in Wells and Piezometers	●	●					●		
2.2 Well Development a) New Wells	●								
b) Redevelopment	●								
2.3 Pump-in Borehole Packer Tests	●						●		
2.5 Measurements for Groundwater Field Parameters		●					●		
2.6 Groundwater Sampling a) Bailer		●							
b) Pump		●							
3.1 Logging Alluvial and Bedrock Material	●					●			

X - As required by H&S plan.

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TABLE 3
APPLICABLE SOPs (cont'd)

Standard Operating Procedures	Well Drilling, Completion, Development	Ground-Water Sampling	Surface-Water Sampling	Sediment Sampling	Surface Soil Sampling	Subsurface Soil Sampling	Hydrologic Testing	Source Sampling	Biota Samples
3.2 Drilling and Sampling Using Hollow-Stem Auger Techniques									
a) Drilling	●					●			
b) Continous Auger Coring	●					●			
c) Drive Samples	●					●			
3.3 Isolating Bedrock from the Alluvium with Grouted Surface Casing									
a) In Borings	●								
b) In Monitor Wells	●								
3.4 Rotary Drilling and Rock Coring									
a) Air	●								
b) Water	●								
3.5 Plugging and Abandonment of Boreholes	●					●			
3.6 Monitoring Well and Piezometer Installation	●								
3.8 Surface Soil Sampling					●				
3.9 Soil Gas Sampling and Field Analysis									
3.10 Borehole Clearing						●			
4.1 Surface Water Data Collection Activities			●						
4.2 Field Measurement of Surface Water Parameters			●						
4.3 Surface Water Sampling			●						
4.4 Discharge Measurements			●						
4.5 Base Laboratory Work	●	●	●	●	●	●	●	●	●
4.6 Sediment Sampling				●					
TBD Collection of Waste Samples								●	
TBD Controlling the Interaction of Surface Water with Groundwater	●					●	●		
TBD Sampling Footing Drains, Cleanouts, and Manholes								●	
TBD Installation of Wellpoints							●		

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3.6 Air Quality

It is necessary to model ambient air concentrations to estimate environmental risk which results from airborne transport of 881 Hillside contaminants to potential receptors. Emission estimates must first be generated as a model input. Emission estimates shall be calculated for surface wind erosion and from the diffusion through the top layer of soil of volatiles and semivolatiles existing below the surface. Wind erosion emissions shall be estimated for total particulates, metals, and radionuclides while soil diffusion emissions shall be estimated for volatiles and semivolatiles detected below the surface, as determined from groundwater surface soil, and soil boring sampling results from around the pipelines and storage tanks. Air quality dispersion modeling using a Chi/Q approach, which assumes a unit emission rate, shall be performed. Compound-specific emission rates shall then be multiplied by the modeled impacts to produce compound-specific ambient concentration estimates, since predicted concentrations are directly proportional to the emission rate.

Based on the dispersion modeling results, 24-hour and annual compound-specific ambient concentrations shall be estimated at a set of receptor points on and downwind of the actual 881 Hillside area. Pathways shall then be defined as appropriate using these receptors, and risks calculated as necessary. These ambient concentrations shall then be used to perform a baseline risk assessment for each chemical of concern detected above background levels in the soil and groundwater.

3.7 Quality Control Checks

To assess 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 Phase III 881 Hillside Area field investigations are shown in Table 4. Field matrix spikes and matrix spike duplicates will be collected and analyzed if appropriate.

In addition, a QC sample, which shall consist of an extra volume of a designated field sample, shall be collected at a 5-percent frequency for each specific sample matrix. Adequate volume of the QC sample shall be collected and submitted to the laboratory to allow for the analysis of spikes, duplicates, and serial dilutions 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.

TABLE 4
FIELD QC SAMPLE COLLECTION FREQUENCY

Activity	Frequency
Field Duplicate	1 in 20[1]
Trip Blank[2]	1 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.

Objectives for Field QC Samples:

Equipment rinsate blanks shall be 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 Table 2. Field duplicate samples shall agree within 30 percent relative percent difference (RPD) for aqueous samples and 40 percent RPD for homogenous, non-aqueous samples to be considered valid. The EG&G EMAD or a Contractor shall be provided with these criteria and shall be responsible for checking to see if they are met and for qualifying data as necessary.

3.8 Analytical Procedures

Field and laboratory analytical procedures to be followed for RFI/RI are shown in Table 2. Methods for toxicological analyses will not be selected until contaminants of concern and receptor species have been identified.

3.9 Data Reduction, Validation, and Reporting

Analytical Reporting Turnaround Times:

Contractually required analytical reporting turnaround times are shown in Table 5.

TABLE 5
ANALYTICAL REPORTING TURNAROUND TIMES*

Analysis Package	Sample Data Diskette	Supporting Data Documentation
All Except Radiochemistry:	45 days	50 days
Radiochemistry:	61 days	66 days

*Calendar days.

Data Validation:

Data validation entails an examination of the sample data package which includes the QC data and the raw sample data to verify that the field and laboratory data falls within the required control limits, the analytical results are correctly transcribed from the instrument printouts, and which, if any, field samples are related to any laboratory QC samples found to be beyond control limits. The objective of data validation is to identify any unreliable or invalid field or laboratory measurements and also to verify compliance with the analytical protocols and field SOPs. The methods that shall be used to perform laboratory data validation are shown in Table 6. Field data validation shall be performed as specified in Section 3.3.3.2 of the QA Project Plan.

Data Reduction:

Reduction of laboratory measurements and laboratory reporting of analytical parameters shall be in accordance with the procedures specified for each analytical method (see Table 2). 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.

TABLE 6
DATA VALIDATION GUIDELINES

Data validation shall be performed by EMAD or Contractor personnel in accordance with the following functional guidelines:

- U.S. EPA, Laboratory Data Validation Functional Guidelines for Evaluating Organics Data (2/88).
- U.S. EPA, Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Data (7/88).
- EG&G Rocky Flats, Water Quality Parameter Data Validation Guidelines (3/90).
- EG&G Rocky Flats, Radiochemical Data Validation Guidelines - Radium 226 Analysis of Soil and Water by Radon Emanation (Version 2.0, Rev. May 1990).
- EG&G Rocky Flats, Radiochemical Data Validation Guidelines - Isotopic Analyses by Alpha Spectrometry (Version 2.0, Rev. May 1990).
- EG&G Rocky Flats, Radiochemical Data Validation Guidelines - Tritium Analyses by Liquid Scintillation (Version 2.0, Rev. May 1990).
- EG&G Rocky Flats, Radiochemical Data Validation Guidelines - Gross Alpha/Beta by Gas Proportional Counters (Version 2.0, Rev. May 1990).
- EG&G Rocky Flats, Radiochemical Data Validation Guidelines - Gamma Spectroscopy (in preparation).

4.0 PROCUREMENT DOCUMENT CONTROL

Contractors shall be utilized to perform the RFI/RI field investigation described in the Phase III Work Plan/Field Sampling Plan. The Contractors shall be required to implement all requirements contained in the Work Plan/Field Sampling Plan, the QA Project Plan, this QAA, and all SOPs referenced in these documents. Analytical services will also be contracted for analysis of field samples. Appropriate requirements from the QA Project Plan, this QAA, and the GRRASP shall be passed on to any organizations performing these analyses. A Contractor may also be utilized to validate analytical data packages. Appropriate requirements from Section 3.0 of this QAA shall be transmitted to the validation Contractor.

The implementing Contractors shall be required to provide the materials necessary for performing the work described in the Work Plan/Field Sampling Plan.

The Contractor shall be required to submit a QA Program that meets the applicable requirements in the QA Project Plan, this QAA, NQA-1, and EPA QAMS-005/80.

5.0 INSTRUCTIONS, PROCEDURES, AND DRAWINGS

The Phase III Work Plan/Field Sampling Plan describes the activities to be performed. The plan shall be reviewed and approved in accordance with the requirements for instructions, procedures, and drawings specified in Section 5.0 of the QA Project Plan.

SOPs approved for use for RFI/RI are identified in Table 3, which also indicates their applicability. Environmental survey and sampling procedures for environmental evaluations are presented in Section 6.0 of the Work Plan/Field Sampling Plan. Any additional quality-affecting procedures proposed for use but not identified here shall be developed and approved as required in Section 5.0 of the QA Project Plan prior to performing the affected activity.

6.0 DOCUMENT CONTROL

The following documents, as a minimum, shall be controlled in accordance with the requirements specified in Section 6.0 of the QA Project Plan/EE QA Project Plan:

- 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 (QA Project Plan);
- Quality Assurance Addendum to the Rocky Flats Site-Wide QA Project Plan for CERCLA RFI/RI and RCRA RFI/CMS Activities for Operable Unit No. 1, 881 Hillside Area Phase III RFI/RI Activities; and
- SOPs (all SOPs specified in the QA Project Plan and this QA Addendum).

7.0 CONTROL OF PURCHASED ITEMS AND SERVICES

The Contractors that shall provide services identified in Section 4 of this QAA shall be selected and evaluated as specified in Section 7.0 of the QA Project Plan. 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 (as applicable). 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 QA Project Plan).

8.0 IDENTIFICATION AND CONTROL OF ITEMS, SAMPLES, AND DATA

8.1 Sample Containers/Preservation

Appropriate sample volumes, containers, and preservation requirements for RFI/RI are shown in Table 7. Similar requirements for environmental evaluation are included in Table 8.

TABLE 7
SAMPLE CONTAINERS, SAMPLE PRESERVATION, AND HOLDING TIMES FOR WATER, SOIL, AND SEDIMENTS

SOIL AND SEDIMENT

Analyte	Container	Preservative	Holding Time
TAL Metals	8 oz. glass	4°C	180 days (Hg 28 days)
Non-TAL Metals	8 oz. glass	4°C	180 days
pH	8 oz. glass	4°C	ASAP
Nitrate	8 oz. glass	4°C	48 hours
Sulfide	8 oz. glass	4°C	28 days
Percent Solids	8 oz. glass	4°C	
TCL Volatiles	4 oz. glass, Teflon-lined cap	4°C	14 days
TCL Base/Neutral/Acids[1]	8 oz. glass, Teflon-lined cap	4°C	7 days/40 days[2]
TCL Pesticides/PCBs	8 oz. glass, Teflon-lined cap	4°C	7 days/40 days[2]
Petroleum Hydrocarbons	8 oz. glass, Teflon-lined cap	4°C	7 days/40 days[2]
Gross Alpha/Beta	32 oz. glass	None	180 days
Plutonium 239+240	32 oz. glass	None	180 days
Americium 241	32 oz. glass	None	180 days
Uranium 233+234, 235, 238	32 oz. glass	None	180 days
Strontium 89, 90	32 oz. glass	None	180 days
Cesium 137	32 oz. glass	None	180 days
Tritium	32 oz. glass	None	180 days

WATER

Analyte	Container	Preservative	Holding Time
TAL Metals	1 L Poly.	HNO_3 to pH<2, 4°C	180 days (Hg 28 days)
Non-TAL Metals			
Carbonate	500 mL Poly.	4°C	14 days
Bicarbonate	500 mL Poly.	4°C	14 days
Chloride	500 mL Poly.	4°C	28 days
Sulfate	500 mL Poly.	4°C	28 days
Nitrate	500 mL Poly.	4°C	48 hours
Fluoride	500 mL Poly.	4°C	28 days

TABLE 7 (cont'd)
SAMPLE CONTAINERS, SAMPLE PRESERVATION, AND HOLDING TIMES FOR WATER, SOIL, AND SEDIMENTS

WATER (cont'd)

Analyte	Container	Preservative	Holding Time
Total Suspended Solids (SW)	500 mL Poly.	4° C	7 days
pH	500 mL Poly.	4° C	ASAP
Total Dissolved Solids	100 mL Poly.	4° C	7 days
Cyanide	500 mL Poly.	NaOH to pH>12, 4° C	12 days
TCL Volatiles	3-40 mL vials w/Teflon-lined septum caps	4 drops conc. HCl, 4° C	14 days
TCL Base/Neutral/Acids[1]	1 L amber glass	4° C	7 days/ 40 days[2]
TCL Pesticides/PCBs	1 L amber glass	4° C	7 days/ 40 days[2]
Gross Alpha/Beta	2-1L Poly.	HNO_3 pH<2	180 days
Radium 226, 228	2-1L Poly.	HNO_3 pH<2	180 days
Tritium	100 mL glass	None	None
Uranium 233+234,235,238	1 L Poly.	HNO_3 pH<2	180 days
Strontium 89,90	1 L Poly.	HNO_3 pH<2	180 days
Cesium 137	1 L Poly.	HNO_3 pH<2	180 days
Americium 241	2.5 L Poly.	HNO_3 pH<2	180 days
Plutonium 239+240	2.5 L Poly.	HNO_3 pH<2	180 days

1. TCL semi-volatiles.
2. 7 days from collection to extraction, 40 days from extraction to analysis.

TABLE 8

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 Macroinvertibrates				
- 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
- Hexavalent Chromium	24 hours	Freeze & ship w/dry ice	Plastic	25 g
- Mercury	28 days	Freeze & ship w/dry ice	Plastic	5 g

TABLE 8

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

	Holding Time From Date Collected	Preservation Method	Container	Approximate Sample Size
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.

8.2 Sample Identification

RFI/RI samples shall be labeled and identified in accordance with the SOPs specified in Table 3 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 requirements for environmental evaluation samples are included in Section 6.0 of the Work Plan/Field Sampling Plan.

8.3 Chain-of-Custody

A required part of any sampling and analytical program is the integrity of the sample from collection to data reporting. The documentation of the sample's history is referred to as chain-of-custody. Sample chain-of-custody shall be maintained through the application of the SOPs specified in Table 3 for all environmental samples collected during field investigations.

9.0 CONTROL OF PROCESSES

Those activities requiring control are governed by EG&G SOPs (see Table 3) and other portions of this QAA (and the QA Project Plan).

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 QA Project Plan.

11.0 TEST CONTROL

Test control requirements shall apply to Treatability Studies when they are performed. Such tests shall be performed and documented in accordance with the requirements for test control specified in Section 11.0 of the QA Project Plan.

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

12.1 RFI/RI Field Equipment

Specific conductivity, temperature, pH, and dissolved oxygen content of water samples shall be measured in the field. Field measurements shall be taken and the instruments calibrated as specified in EG&G procedure SW-SOP-4.2 (see Table 3). 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 protocol package that contains:

- Standard operating procedures (i.e., EG&G SW-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.

Any other measurements or M&TE not discussed here shall be calibrated and maintained in accordance with manufacturer's instructions (if calibration and maintenance are addressed) or a SOP prepared in accordance with Section 5.0 of the QA Project Plan.

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 (see Table 2).

13.0 HANDLING, STORAGE, AND SHIPPING

RFI/RI samples shall be packaged, transported, and stored in accordance with the applicable SOPs specified in Table 3. EE samples shall be packaged and stored in accordance with the requirements in Section 6.8 of the Phase III Work Plan/Field Sampling Plan. Maximum RFI/RI sample holding times are shown in Table 7.

The implementing Contractor shall 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 QA Project Plan. A log specifying the status of all boreholes and groundwater monitoring wells shall be maintained.

15.0 CONTROL OF NONCONFORMANCES

The requirements for the identification, control, evaluation, and disposition of nonconforming items, samples, and data identified by EG&G shall be implemented as specified in Section 15.0 of the QA Project Plan. Nonconformances identified by the implementing contractor shall be submitted to EG&G for concurrence and approval of the proposed corrective action(s) and disposition.

16.0 CORRECTIVE ACTION

The requirements for the identification, documentation, and verification of corrective actions for conditions adverse to quality identified by EG&G shall be implemented as specified in Section 16.0 of the QA Project Plan. Conditions adverse to quality identified by the implementing contractor shall be documented and submitted to EG&G for approval of the proposed corrective action(s).

17.0 QUALITY ASSURANCE RECORDS

All QA records shall be maintained in accordance with the methods established in Section 17.0 of the QA Project Plan. 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
- QA Project Plan/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 QA Project Plan. 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 (see also Section 18.0 of the QA Project Plan).

19.0 SOFTWARE CONTROL

The requirements for the control of software shall be implemented as specified in Section 19.0 of the QA Project Plan. Only database software is anticipated to be used at this time. EG&G SOPs applicable to the use of the database for storing environmental data are specified in Table 3.