Environmental Restoration RFCA Standard Operating Protocol for Routine Soil Remediation

Modification 2

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Environmental Restoration
RFCA Standard Operating Protocol
for Routine Soil Remediation

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Approval letter contained in the Administrative Record.

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ACRONYMS

ACM	asbestos-containing material
AL	action level
ALARA	As Low As Reasonably Achievable
ALF	Action Levels and Standards Framework for Surface Water, Ground Water, and Soils
Am	americium
AME	Actinide Migration Evaluation
AOC	Area of Concern
APEN	Air Pollution Emission Notice
AR	Administrative Record
ARAR	Applicable or Relevant and Appropriate Requirement
ASD	Analytical Services Division
bgs	below ground surface
BMP	best management practice
BS	building sump
BZ	Buffer Zone
BZSAP	Buffer Zone Sampling and Analysis Plan
CAD/ROD	Corrective Action Decision/Record of Decision
CAQCC	Colorado Air Quality Control Commission
CCR	Code of Colorado Regulations
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHWA	Colorado Hazardous Waste Act
CID	Cumulative Impacts Document
cm/sec	centimeters per second
CMS/FS	Corrective Measure Study/Feasibility Study
CO	carbon monoxide
COC	contaminant of concern
cpm	counts per minute
CRA	Comprehensive Risk Assessment
CRS	Colorado Revised Statute
CRZ	Contaminant Reduction Zone
CWA	Clean Water Act
cy	cubic yard
DAC	derived air concentration
DNAPL	dense nonaqueous phase liquid
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
dpm	disintegrations per minute
dpm/100 cm^2	disintegrations per minute per 100 square meters
DQO	data quality objective

EDDIE	Environmental Data Dynamic Information Exchange
EDE	effective dose equivalent
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
ER RSOP	ER RSOP for Routine Soil Remediation
EZ/SCA	Exclusion Zone/Soil Containment Area
FD	foundation drain
FDCM	Field Data Collection Model
FIDLER	Field Instrument for the Detection of Low Energy Radiation
FIP	Field Implementation Plan
ft	feet
ft^2	square feet
ft/sec	feet per second
FWPCA	Federal Water Pollution Control Act
FY	fiscal year
GPS	Global Positioning System
H&S	health and safety
HAP	hazardous air pollutant
HASP	Health and Safety Plan
HI	Hazard Index
HPGe	high-purity germanium
hr	hour
HRR	Historical Release Report
IA	Industrial Area
IA Strategy	Industrial Area Characterization and Remediation Strategy
IAG	Interagency Agreement
IASAP	Industrial Area Sampling and Analysis Plan
ICD	initial conceptual design
IDC	Item Description Code
IGD	Implementation Guidance Document
IHSS	Individual Hazardous Substance Site
IM/IRA	Interim Measure/Interim Remedial Action
IMP	Integrated Monitoring Plan
ISEDS	Integrated Sitewide Environmental Data System
ISMS	Integrated Safety Management System
IWCP	Integrated Work Control Program
JHA	Job Hazard Analysis
K-H	Kaiser-Hill Company, L.L.C.
LCDB	Land Configuration Design Basis
LDR	Land Disposal Restriction
LHSU	lower hydrostratigraphic unit
LL	low-level
LLM	low-level mixed
LNAPL	light nonaqueous phase liquid
LRA	Lead Regulatory Agency
$\mu g/100\ cm^2$	micrograms per 100 square centimeters

µg/kg	microgram per kilogram
m^2	square meter
m^3	cubic meters
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mrem	millirem
mrem/yr	millirems per year
N/A	not applicable
NAAQS	National Ambient Air Quality Standard
nCi/g	nanocuries per gram
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFAA	No Further Accelerated Action
NOx	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NPWL	New Process Waste Lines
NRC	Nuclear Regulatory Commission
NSD	new source detection
NSR	New Source Review
NTS	Nevada Test Site
OPWL	Original Process Waste Lines
OSHA	Occupational Safety and Health Act
OU	Operable Unit
PAC	Potential Area of Concern
PAM	Proposed Action Memorandum
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
pCi/L	picocuries per liter
PCOC	potential contaminant of concern
PM	particulate matter
PMJM	Preble's meadow jumping mouse
POC	point of compliance
POE	point of evaluation
PPE	personal protective equipment
ppm	parts per million
PRG	Programmatic Remediation Goal
PSD	Prevention of Significant Deterioration
Pu	plutonium
PU&D	Property Utilization and Disposal
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Program Plan
QC	quality control
R&D	research and development
RAAMP	Radioactive Ambient Air Monitoring Program

RACT	reasonably available control technology
RADMS	Remedial Action Decision Management System
RADP	Remedial Action Decontamination Pad
RAO	remedial action objective
RBZ	Radiological Buffer Zone
RCRA	Resource Conservation and Recovery Act
RCT	Radiological Control Technician
RFCA	Rocky Flats Cleanup Agreement
RFCA Parties	CDPHE, DOE, and EPA
RFCAB	Rocky Flats Citizens Advisory Board
RFCLoG	Rocky Flats Coalition of Local Governments
RFETS (or Site)	Rocky Flats Environmental Technology Site
RFFO	Rocky Flats Field Office
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RSAL	Radionuclide Soil Action Level
RSOP	RFCA Standard Operating Protocol
RWP	Radiological Work Permit
SAP	Sampling and Analysis Plan
SCO	surface-contaminated object
SEP	Solar Evaporation Ponds
SID	South Interceptor Ditch
SNM	Special Nuclear Material
SOR	sum of ratios
STP	Sewage Treatment Plant
SVOC	semivolatile organic compound
SWD	Soil Water Database
SWDA	Solid Waste Disposal Act
SWWB	Site-Wide Water Balance
TEDE	total effective dose equivalent
TPH	total petroleum hydrocarbons
TRU	transuranic
TSCA	Toxic Substances Control Act
TSP	total suspended particulate
U	uranium
UBC	Under Building Contamination
UCL	upper confidence limit
UHSU	upper hydrostratigraphic unit
UST	underground storage tank
VOC	volatile organic compound
WEMS	Waste and Environmental Management System
WGI	Waste Generating Instruction
WIPP	Waste Isolation Pilot Plant
WRE	waste release evaluation
WRR	Waste Requirements Representative
WRW	Wildlife Refuge Worker

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EXECUTIVE SUMMARY

The Environmental Restoration (ER) Rocky Flats Cleanup Agreement (RFCA) Standard Operating Protocol (RSOP) for Routine Soil Remediation (ER RSOP) addresses routine remediation of soil and associated debris at Individual Hazardous Substance Sites (IHSSs), Potential Areas of Concern (PACs), Under Building Contamination (UBC) sites, and other areas, as necessary, at the Rocky Flats Environmental Technology Site (RFETS). Routine remediation of soil and buried debris will primarily consist of excavation and offsite disposal, with offsite treatment as required to meet regulatory and receiver site requirements.

This ER RSOP does not address remediation at the Present Landfill, Original Landfill, Solar Evaporation Ponds (SEP), 903 Lip Area and Americium (Am) Zone, groundwater contaminant plumes, or other nonroutine remediations. These projects will be addressed in separate decision documents.

The ER RSOP will:

- Provide a consistent approach to accelerated action decisions and remediation activities, which will enhance safety, quality, and compliance;
- Streamline the decision-making process by relying on one decision document instead of many; and
- Accelerate remediation schedules by eliminating numerous review cycles.

There are more than 200 potential release sites in the RFETS Buffer Zone (BZ) and Industrial Area (IA). These sites are being considered for routine remediation under this RSOP because (1) the sites have similar potential contaminants of concern (PCOCs) that consist of radionuclides, organic compounds, or metals; (2) the sites may have debris (pipelines, wood, concrete, asphalt, drums, metal, plastics, rubber, fiberglass, or other debris) associated with the soil; (3) contamination is limited to soil; (4) soil can be associated with UBC sites and pipelines; (5) remediation of these sites does not require special engineering designs; and (6) these sites can be remediated by excavation and shipment of waste to offsite locations. The ER RSOP also covers foundation drains, tanks, asphalt and concrete that are part of roads, parking lots, and orphan slabs.

The ER RSOP remediation process starts after characterization of the potential release sites. RFETS staff, in consultation with the regulatory agencies, reviews the characterization data and makes a decision whether site remediation is required and if so, how much. Remediation decisions include evaluation of stewardship and As Low As Reasonably Achievable (ALARA) considerations. Excavation of soil and debris is conducted in conjunction with "in-process" sampling to determine when remediation goals are achieved and confirmation sampling will verify that remediation goals are met. This process results in an efficient, almost real-time implementation of characterization and remediation activities. The excavated soil and debris are segregated by waste type for disposal and all excavations are backfilled, stabilized, and revegetated.

Supporting information provided in this RSOP includes regulatory requirements and processes for environmental protection, work controls, waste management, decision management, health and safety (H&S), and quality assurance (QA).

RFCA mandates the incorporation of National Environmental Policy Act (NEPA) values into RFETS decision documents. This ER RSOP describes potential environmental impacts that may be associated with activities covered under this RSOP and satisfies the RFCA requirement for a "NEPA-equivalency" assessment of environmental consequences.

1.0 INTRODUCTION

Nearly 40 years of nuclear weapons production at the Rocky Flats Environmental Technology Site (RFETS or Site) resulted in soil and debris potentially contaminated with chemical and radioactive substances, which may pose a hazard to human health and the environment. Potential threats were evaluated using a screening-level risk assessment in accordance with Rocky Flats Cleanup Agreement (RFCA) Attachment 4 (DOE et al. 1996) to determine potential human health and environmental risks posed by release sites. The results of this evaluation indicate certain risks to human health and the environment exist, and that accelerated actions, in accordance with this Environmental Restoration (ER) RFCA Standard Operating Protocol (RSOP) for Routine Soil Remediation (ER RSOP), may be warranted at these release sites.

The potential contaminants of concern (PCOCs) in soil and debris are related to plutonium (Pu) and uranium (U) processing activities and associated support facilities and functions. The locations and nature of processes that contributed to the potential releases are well documented. PCOCs associated with past operations are fairly well understood and are similar at many release sites. Based on process knowledge and analytical data, PCOCs include radionuclides (e.g. Pu: ranging from background to 152,000 picocuries per gram [pCi/g]), metals (e.g. sodium: ranging from background to 30,800,000 milligrams per kilogram [mg/kg]), volatile organic compounds (VOCs) (e.g., carbon tetrachloride: ranging from nondetect to 690,000,000 micrograms per kilogram [μg/kg]), and semivolatile organic compounds (SVOCs) (e.g., phenanthrathene: ranging from nondetect to 220,000 μg/kg).

Potential soil and debris (pipelines, wood, concrete, asphalt, drums, metal, plastic, rubber, fiberglass, or other debris) contamination from past operations at RFETS may exist in a number of configurations, including contamination within the top 6 inches, contamination below the top 6 inches but without structural complications, contamination under building floor slabs, and contamination associated with process waste pipelines, storm drains, and sanitary sewer lines. Regardless of the configuration, remediation options for contaminated soil and debris are limited because of technical feasibility constraints related to effectiveness, implementability, and cost.

The ER RSOP addresses routine remediation of soil and associated debris at Individual Hazardous Substance Sites (IHSSs), Potential Areas of Concern (PACs), Under Building Contamination (UBC) sites, and other areas, as necessary, at RFETS. The following routine actions are described in this RSOP:

- Excavation of contaminated soil according to the framework for conducting routine accelerated actions (Section 5.2) and associated debris, and offsite disposal with or without offsite treatment; and

- Excavation of contaminated soil according to the framework for conducting routine accelerated actions (Section 5.2) and associated debris, onsite thermal desorption treatment of VOC-contaminated soil, and onsite backfilling or offsite disposal.

Routine remediation of contaminated soil and buried debris will primarily consist of excavation and offsite disposal, with offsite treatment as required to meet regulatory and receiver site

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requirements. The ER RSOP also provides for onsite treatment using thermal desorption, with soil backfilling if the treated soil meets onsite backfill criteria and thermal desorption is economically favorable and protective of human health and the environment. Routine remediation of contaminated pipelines, drains, slabs, and foundations will primarily consist of excavation and offsite disposal. Consistent with previous remediations and investigations, it is anticipated that most contaminated soil and debris will be low-level (LL), low-level mixed (LLM), or hazardous waste. Nonroutine sanitary waste and small amounts of transuranic (TRU) and TRU-mixed waste may also be found.

The ER RSOP provides for the accelerated action cleanup of soil and debris, is consistent with the long-term remediation objectives of leaving RFETS in a condition that is protective of human health and the environment, and allows future land uses consistent with the Rocky Flats Vision. The final cleanup levels and long-term monitoring requirements will be determined in the Corrective Action Decision/Record of Decision (CAD/ROD). Long-term monitoring requirements will integrate Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA) requirements with Comprehensive Risk Assessment (CRA) requirements. Post-remediation stewardship of remediated areas will include routine monitoring under the Integrated Monitoring Plan (IMP) (DOE 2000a) maintenance of revegetated areas, and, if necessary, additional monitoring and access restrictions. Because the RSOP addresses accelerated actions, long-term stewardship activities cannot be fully addressed at this time.

1.1 PURPOSE AND GOALS

The purpose of the ER RSOP is to serve as the decision document for routine soil and debris remediation at RFETS. This RSOP addresses accelerated action decisions and routine remediation processes for soil and debris.

The goal of the ER RSOP is to provide for safe and effective accelerated actions to address risks posed by contaminated soil and debris in IHSSs, PACs, and UBC sites at RFETS. To meet this goal, the following actions will be implemented through the ER RSOP:

- Define a process for implementing soil and associated debris remediation that:
  - Protects human health and the environment,
  - Meets RFCA cleanup goals,
  - Minimizes generation of waste,
  - Favors offsite disposal of waste, and
  - Is cost effective;
- Coordinate remediation with the decommissioning schedule;
- Use the RFCA consultative process for accelerated action decisions;

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- Ensure that remediation does not pose unacceptable risks to workers or the public; and
- Provide documentation for closure of IHSSs and PACs that are also RCRA Units.

1.2 REGULATORY FRAMEWORK

RFCA, signed by the U.S. Department of Energy (DOE), Colorado Department of Public Health and Environment (CDPHE), and U.S. Environmental Protection Agency (EPA) (the RFCA Parties), on July 19, 1996, provides the regulatory framework for the cleanup of RFETS (DOE et al. 1996). RFCA streamlines remediation of the Site through accelerated actions that include characterization, remediation, and closure of IHSSs, PACs, and UBC sites at RFETS.

RFCA provides the regulatory framework for DOE response obligations under CERCLA and corrective action obligations under RCRA. The RFCA accelerated action process incorporates the requirements of CERCLA and RCRA. After accelerated actions are complete, DOE will develop a Remedial Investigation/Feasibility Study (RI/FS) to describe the completed actions and a CRA to verify that potential contamination remaining at RFETS is within acceptable risk levels as defined by CERCLA and implemented through RFCA. DOE will also develop a CAD/ROD that will include the final action and post-closure monitoring and operation requirements, including 5-year reviews of the Site, to evaluate whether the remedies, including any institutional controls, are effective.

Attachment 5 to RFCA, Action Levels and Standards Framework for Surface Water, Ground Water, and Soils (ALF), provides the rationale and numeric action levels (ALs) for soil. As stated in the ALF, ALs "are numeric levels that, when exceeded, trigger an evaluation, remedial action, and/or management action" (DOE et al. 2003).

Although cleanup levels required to implement the final remedy will be determined in the CAD/ROD, it is anticipated that the accelerated action cleanup will be demonstrated to be protective in the CRA. For the purpose of the ER RSOP, accelerated action remediation goals are based on RFCA soil ALs (DOE et al. 2003) and/or the Subsurface Soil Risk Screen but may be modified by stewardship and As Low As Reasonably Achievable (ALARA) considerations. Additional soil contamination may need to be remediated or managed to protect surface water quality.

During the remediation process, personnel from the DOE Rocky Flats Field Office (RFFO); its contractor, Kaiser-Hill Company, L.L.C. (K-H); CDPHE; and EPA will use the RFCA consultative process to establish and maintain effective working relationships with each other and with the general public.

1.3 ER RSOP MODIFICATIONS

This ER RSOP follows the RSOP approach outlined in RFCA and the Implementation Guidance Document (IGD) (DOE et al. 1999). As this RSOP is implemented through Site closure, new information may require that the document be modified. Modifications to this RSOP will be

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designated sequentially and placed in the Administrative Record (AR) and Appendix A of this document.

1.4 ER RSOP NOTIFICATION

DOE will notify the Lead Regulatory Agency (LRA) prior to implementing the ER RSOP. The Notification may address one or more IHSS Groups in accordance with prior agreement through the consultative process. The ER RSOP Notification will be submitted to the LRA, and to both LRAs if the Notification covers IHSS Groups in both the Industrial Area (IA) and Buffer Zone (BZ) Operable Units (OUs), for review at least 14 calendar days prior to the start of the accelerated action. For IHSS Groups with RCRA Units, the 30-day RCRA review period will begin when DOE informs the LRA through the consultative process that a RCRA Unit will be closed.

The LRA will approve or disapprove the Notification for each IHSS or IHSS Group addressed in the Notification within 14 calendar days after submittal. Any disapproval shall state, with specificity, the changes required to obtain LRA approval, and DOE may resubmit the Notification for 14 calendar day review and approval after making the changes. DOE may also invoke the dispute resolution process in accordance with RFCA, Part 15, Resolution of Disputes, Subpart B, for a disapproval or when the LRA fails to respond within 14 calendar days.

The Notification and LRA approval documentation will become part of the AR and be placed in Appendix B of this document.

The Notification consultative process will include the following activities:

- RFETS staff and the LRA will consult on what the Notification will include;
- RFETS staff will prepare the Notification for regulatory agency review; and
- RFETS staff and the regulatory agencies will attend a briefing to discuss and come to agreement on the Notification at the briefing.

The ER RSOP Notification will include the following:

- Map of IHSSs, PACs, and UBC sites that may require remediation;
- List of contaminants of concern (COCs);
- Basic project assumptions;
- Stewardship analysis;
- Subsurface Soil Risk Screen, to the extent practicable, which includes the Accelerated Action Ecological Screening Process;
- Accelerated action remediation goals;

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- Treatment (if necessary);
- Project-specific monitoring (if any);
- RCRA Units and intended RCRA waste disposition;
- List of documents making up the AR File for the individual project; and
- Projected schedule.

The ER RSOP consultative process described in Section 2.1 is intended to provide the LRA with adequate information regarding the proposed accelerated action. It is anticipated that the LRA will participate in the day-to-day in-process characterization and remediation process to remain informed about sampling activities and results. Remediation maps will be developed within a day or two after characterization through the consultative process. Concurrence on when remediation is finished will be through the consultative process and documented through electronic mail and the Closeout Reports.

2.0 REGULATORY AND STAKEHOLDER INTERFACES

DOE will use the consultative process to establish and maintain effective working relationships with the regulatory agencies and public throughout the accelerated action process. The consultative process, regulatory agency oversight roles, and public participation are discussed in the following sections.

2.1 RFCA CONSULTATIVE PROCESS

The RFCA consultative process will be used throughout the ER RSOP remediation process during planning and at decision points. Figure 1 illustrates the overall remediation process and activities where regulatory agency consultation is expected. As shown on Figure 1, regulatory agencies will be part of the decision process starting with developing the overall remediation strategy and continuing through all decision-making phases. Regulatory agency consultation will occur during the following activities:

- Evaluation of existing characterization data;
- Location of characterization sampling points;
- Development of the Notification;
- Location of remediation areas and identification of COCs;
- Determination whether remediation objectives have been achieved; and
- Location of confirmation sampling locations.

Because DOE and K-H will use the RFCA consultative process throughout the remediation process, opportunities for consultation are highlighted on activity, decision, and process flow diagrams throughout this RSOP.

The regulatory agencies will have access to project-specific data in the following formats:

- Soil Water Database (SWD) – The regulatory agencies have access to the sitewide environmental database through the Integrated Sitewide Environmental Data System (ISEDS).
- Remedial Action Decision Management System (RADMS) (Section 12.1) – This system is intended to provide access to characterization and remediation data, with data management tools at regulatory agency onsite RFETS offices.

RADMS will provide the regulatory agencies with access to characterization and remediation data at the same time the ER staff has access to the data. Additionally, the regulatory agencies will have the capability to query data, map data, and run statistical and geostatistical algorithms.

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Figure 1. Overall Accelerated Action Process

The use of RADMS at RFETS will facilitate full regulatory agency consultation on all decisions. Results of the characterization and remediation processes will be formalized in a Closeout or Data Summary Report for each IHSS Group. These reports will be approved by the regulatory agencies, and approval of these reports constitutes agency concurrence with a proposal of No Further Accelerated Action (NFAA) in accordance with ALF Section 4 and 5.

2.2 REGULATORY OVERSIGHT

ER RSOP activities have three phases: planning, implementation, and closeout. Each phase provides the opportunity for interaction between the regulatory agencies and DOE. Each phase has one or more RFCA decision points and additional checks and balances through which CDPHE and EPA will fulfill their regulatory oversight obligations. Decision points and additional checks and balances are briefly described below and summarized in Table 1.

2.2.1 Planning

The key planning decision documents supporting the accelerated actions are the Industrial Area Sampling and Analysis Plan (IASAP) (DOE 2001a), the Buffer Zone Sampling and Analysis Plan (BZSAP) (DOE 2002a), and this ER RSOP. The IASAP and BZSAP guide all characterization required to support accelerated action activities under the ER RSOP. The sampling plans contain two key features, each with its own regulatory agency involvement and decision points. First, the sampling plans regard the IA and BZ as single projects and contain all data quality objectives (DQOs) and sampling methodologies to guide characterization of these areas through closure.

While the regulatory agencies' initial checkpoint is approval of these decision documents, the sampling plans contain a provision for formal modification if changes to DQOs or methodologies not addressed by the original plans are required. Modification of the plans requires agency approval.

Second, the sampling plans contain an Addendum element. The Addendum accommodates the Site's obligation to administratively disposition every IHSS, PAC, and UBC site. It acts as a tracking vehicle over the period required to complete ER RSOP actions by identifying sites that will be characterized. The Addendum contains the target sites, site maps, site-specific PCOCs, existing qualified sampling data, starting-point sampling locations, and sampling methodology. The Addendum is prepared in consultation with the agencies and is subject to their approval. The first agency checkpoint in the ER RSOP process is approval of the Sampling and Analysis Plan (SAP) Addenda.

The second agency checkpoint in the ER RSOP process is approval of the ER RSOP itself, and the third checkpoint is the submittal of the ER RSOP Notification. The intent to invoke the RSOP is provided through a Notification issued by DOE to the regulatory agencies. The LRA will have 14 calendar days to approve the Notification (see Section 1.4).

Table 1. Regulatory Agency Oversight of ER RSOP Accelerated Actions

	ACTIVITY	DESCRIPTION	AGENCY INTERFACE	AGENCY CHECKPOINT
PLANNING	IASAP and BZSAP	The SAPs are RFCA decision documents that describe the strategy, methods, and data quality requirements for characterizing contaminant release sites in soil at RFETS.	• Continuous agency/DOE consultation throughout development of drafts and resolution of agency and public comments • Consultation on document modification, if necessary	• Approval of modifications to the two documents
PLANNING	Prepare SAP Addenda (annual and opportunity)	The addenda describe the release sites targeted for characterization during a fiscal year (FY) and when Site closure activities provide advance characterization opportunities.	• Consultation regarding target sites and sampling methods	• Approval of the Addenda
PLANNING	ER RSOP	The ER RSOP is a RFCA decision document for remediation of routine contaminant release sites in soil at RFETS.	• Continuous agency/DOE consultation throughout development of drafts and resolution of agency and public comments • Consultation on document modification, if necessary	• Approval of modifications to the document
PLANNING	Prepare RSOP Notification (annual and opportunity)	The Notification is the RFCA-required declaration of intent by DOE to invoke the RSOP. Notification will be made on an annual (FY) basis and when Site closure activities provide unanticipated remediation opportunities. Release sites targeted in the Notification will match those in the corresponding sampling Addendum.	• Consultation regarding target sites, work planning, and schedule	• Approval of the Notification

	ACTIVITY	DESCRIPTION	AGENCY INTERFACE	AGENCY CHECKPOINT
IMPLEMENTATION	Perform characterization and remediation	This activity consists of sampling target release sites as described in the approved Addendum and in accordance with IASAP and BZSAP methods and data requirements. Implementation tasks include defining the area of concern (AOC), excavating remediation areas, performing confirmation sampling, reviewing confirmation results, excavating more soil if needed, and backfilling the excavation.	• Continuous agency/DOE consultation during the sampling, data interpretation, excavation, and confirmation activities. Requires agency presence at RFETS and active participation in the day-to-day decision-making regarding shifts in sampling strategy, data sufficiency, and remediation stopping point.	• Concurrence on remediation map • Concurrence when remediation is complete • Issuance of a Stop Work Order
CLOSEOUT	Prepare Closeout Report	The Closeout Report is the RFCA decision document that describes the results of the remediation, including demarcation of the excavation, confirmation sampling results, waste disposition and No Further Accelerated Action (NFAA) concurrence.	• Review and comment on Draft Closeout Report	• Approval of Final Closeout Report

The ER RSOP consultative process described in Section 2.1 is intended to provide the LRA with adequate information regarding the proposed accelerated action. The LRA will remain informed about sampling activities and results. Concurrence will be reached on remediation maps through the consultative process shortly after characterization. Concurrence on when remediation is finished will be through the consultative process and documented through electronic mail and Closeout Report.

As with the sampling plans, the ER RSOP contains a provision for modification. If, during implementation, it is determined that a substantive change to the RSOP is required for routine soil remediation, it will be modified accordingly. Modifications will follow the RFCA process, which addresses regulatory agency approval and public comment.

2.2.2 Implementation

Characterization sampling is performed largely with onsite analysis and the data are then translated into remediation maps to guide remediation crews. As sampling progresses, new data could indicate a needed shift in the sampling strategy. This could include taking more or fewer samples than anticipated or applying a different statistical analysis method. While a shift in approach would not necessarily require additional agency approval, the sampling plans are designed to accommodate real-time agency participation to ensure concurrence (Sections 2.1 and 12.1). Regulatory agency participation and concurrence on remediation goals are checkpoints, along with concurrence on when remediation is complete. Failure to reach concurrence could result in failure to approve the Closeout Report and, possibly, issuance of a stop work order.

2.2.3 Closeout

The purpose of closeout is to document the accelerated action activities. The Closeout Report summarizes characterization data, the assessment of the data quality, the action taken, demarcation of excavation, confirmation sampling results, remediation waste volume and disposition, any changes in remediation approach and the rationale behind the change, Subsurface Soil Risk Screen, Accelerated Action Ecological Screening Process, near-term stewardship requirements and long-term stewardship recommendations, and the demarcation of residual contamination left in place on an IHSS or IHSS Group basis.

The Closeout Report is a RFCA decision document and the vehicle by which the regulatory agencies approve completion of the accelerated action. Until the agencies approve the Closeout Report, the accelerated action performed under the ER RSOP is not finished. Consequently, the Closeout Report not only serves as the RFCA-defined decision point, but as a checkpoint during the implementation phase. That is, DOE's interest is best served by achieving concurrence on the cleanup progress during implementation rather than at the end when resources have been re-directed to the next site.

2.3 PUBLIC PARTICIPATION

Stakeholder input to the ER RSOP and the ER RSOP process is solicited and received through:

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- The formal RFCA RSOP and Closeout Report review process, which incorporates the requirements of CERCLA and RCRA. Public comments on the ER RSOP are provided in the Responsiveness Summary, located in Appendix C; and

- Public meetings, including:

  - The Rocky Flats Citizens Advisory Board (RFCAB) meetings,
  - The Rocky Flats Coalition of Local Governments (RFCLoG) meetings, and
  - The ER/D&D Status Meetings.

Routine updates on the implementation of the ER RSOP will be provided at the ER/D&D Status Meetings or similar status meetings at a different time of day. It is anticipated that these updates will include the following information, as available:

- RSOP Notifications;
- RSOP Modifications;
- Characterization and remediation schedules;
- Status and results of ongoing IHSS Group characterizations;
- Remediation areas including COCs and extent of remediation;
- Stewardship and ALARA evaluations;
- Status and results of ongoing remediation activities; and
- Results of post-remediation confirmation sampling.

Additionally, the ER staff will continue to provide information at specific stakeholder meetings, as requested. Communication with stakeholders is also facilitated by use of the Internet. The Site Internet site (www.rfets.gov) has a link to the Environmental Data Dynamic Information Exchange (EDDIE), which includes Site environmental information. The ER section contains current reports and information and will be updated as new information becomes available. The ER section will be updated with the following information specific to actions associated with the ER RSOP:

- IASAP and BZSAP Addenda;
- ER RSOP Notifications;
- Closeout Reports; and
- Annual IA Strategy Updates.

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Additionally, the web site contains information on upcoming public meetings, reports for public comment, and other environmental and decommissioning information.

3.0 SITE DESCRIPTION

RFETS is located approximately 16 miles northwest of Denver, Colorado, in northern Jefferson County. The Site occupies approximately 10 square miles. Boundaries and major features are illustrated on Figure 2. Most of the buildings are located within an industrial complex of approximately 350 acres (the IA) surrounded by a BZ of approximately 6,150 acres.

Materials defined as hazardous substances by CERCLA, as well as those defined as hazardous constituents by RCRA or the Colorado Hazardous Waste Act (CHWA), or as toxic substances as defined by the Toxic Substances Control Act (TSCA), may have been released to the environment at various locations across RFETS. Potential release sites covered under this RSOP are listed in Table 2.

PCOCs in soil and debris at these release sites vary; however, based on process knowledge and analytical data, PCOCs include radionuclides (e.g., Pu: ranging from background to 152,000 pCi/g), metals (e.g. sodium: ranging from background to 30,800,000 mg/kg), VOCs (e.g., carbon tetrachloride: ranging from nondetect to 690,000,000 µg/kg) and SVOCs (e.g., phenanthrathene: ranging from nondetect to 220,000 µg/kg).

Potential releases were identified at 194 IHSSs, PACs, UBC sites, and tanks in the IA, as illustrated on Figure 3. The IA contains 400 buildings, along with other structures, roads, and utilities, and is where the bulk of RFETS mission activities took place between 1951 and 1989 (DOE et al. 1996). Most of the buildings and associated structures were used for processing activities associated with weapons production. Descriptions of potential release sites are found in Appendix C of the IASAP (DOE 2001a). In the BZ, potential releases were identified at 42 IHSSs and PACs, as illustrated on Figure 4. The BZ contained support functions, disposal areas, and undisturbed buffer areas. Descriptions of historical operations in the BZ are presented in Appendix C of the BZSAP (DOE 2002a).

Descriptions of historical operations and releases in the IA and BZ are also presented in the Historical Release Report (HRR) (DOE 1992).

Before RFCA went into effect, the IHSSs were grouped into 16 OUs as part of the Interagency Agreement (IAG). The OU consolidation prior to RFCA established the BZ and IA OUs and left the original OUs 1, 3, and 7 intact. OUs 5 and 6 remain in place with minor modifications. The 236 IHSSs, PACs, UBC sites, and associated tanks were further consolidated into 58 IA Groups (Figure 3) and 8 BZ Groups (Figure 4) as part of the 1999 IA Characterization and Remediation Strategy (IA Strategy) (DOE 1999a) and the Closure Project Baseline. Table 2 lists the pre-RFCA OUs, IHSSs, PACs, UBC sites, and tanks in the IA and BZ OUs. Descriptions of IHSSs, PACs, and UBC sites, based on previous studies, are included in the IASAP (DOE 2001a) and BZSAP (DOE 2002a).

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Figure 2. Rocky Flats Environmental Technology Site

Table 2. Potential Release Sites

IHSS Group	Old Operable Unit No.	Current Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft²)	Historical Notes
000-2	OU 9	IA	Original Process Waste Lines (OPWL)	000-121		Underground network pipes/tanks; multiple breaks and leaks
	OU 9	IA	Valve Vault West of Building 707	700-123.2	2,476	Process waste migration along containment pipe and into ditch
	N/A	IA	Building 123 Process Waste Line Break	100-602	14,514	Line, valve vault, bedding material (conduit) between Buildings 123 and 443
	OU 9	IA	Tank 29 – OPWL	000-121		Aboveground waste process tank; possible leaks
	OU 9	IA	Tank 31 – OPWL	000-121		Below-grade, open-top sewage tank
	OU 9	IA	Low-Level Radioactive Waste Leak	700-127	2,500	Multiple line breaks and leaks
	OU 9	IA	Process Waste Line Leaks	700-147.1	16,427	Multiple line breaks and leaks; diverse release paths
	OU 14	IA	Radioactive Site 700 Area	700-162	141,294	Residual hot spots along 8th Street
000-3	N/A	IA	Sanitary Sewer System	000-500		Routine and incidental waste discharges to sinks, sumps, lines
	N/A	IA	Storm Drains	000-505		
	OU 6	IA	Old Outfall – Building 771	700-143	6,167	Contaminated waste water outfall area; one hot spot in nearby culvert
	OU 13	IA	Central Avenue Ditch Caustic Leak	000-190	186,016	Caustic release to Central Ave. Ditch, Walnut Creek, and B-1
000-4	N/A	IA	New Process Waste Lines (NPWL)	000-504		
100-1	N/A	IA	UBC 122 – Medical Facility	UBC 122	9,768	Drum leaks and possible line leaks
	OU 9	IA	Tank 1 – OPWL – Underground Stainless Steel Waste Storage Tank	000-121		Overflows and leaks from underground tank
100-2	N/A	IA	UBC 125 – Standards Laboratory	UBC 125	17,736	Possible spills from calibration lab (mercury)
100-3	N/A	IA	Building 111 Transformer polychlorinated biphenyl (PCB) Leak	100-607	356	Transformer leak
100-4	OU 13	IA	UBC 123 – Health Physics Laboratory	UBC 123	18,885	Disposal out windows and waste line leaks
	N/A	IA	Waste Leaks	100-148	14,143	Unlocated waste spills; OPWL leaks
	N/A	IA	Building 123 Scrubber Solution Spill	100-611	294	Process waste leak
100-5	N/A	IA	Building 121 Security Incinerator	100-609	599	Incinerator; accepted PCB-laden paper
300-1	OU 13	IA	Oil Burn Pit #1	300-128	914	Burn and airborne contamination area
	OU 13	IA	Lithium Metal Site	300-134(N)	7,126	Burn area
	OU 13	IA	Solvent Burning Grounds	300-171	11,412	Burn area
300-2	N/A	IA	UBC 331 – Maintenance	UBC 331	4,986	Possible spills from maintenance activities
	OU 13	IA	Lithium Metal Destruction Site	300-134(S)	23,728	Lithium burn areas (two)
300-3	N/A	IA	UBC 371 – Plutonium Recovery	UBC 371	114,147	Known spills of wastewater and process solutions
300-4	N/A	IA	UBC 374 – Waste Treatment Facility	UBC 374	27,131	Multiple spills and potential leaks from waste lines
300-5	OU 10	IA	Inactive D-836 Hazardous Waste Tank	300-206	627	Condensate water spill from line to tank
300-6	N/A	IA	Pesticide Shed	300-702	4,380	Herbicide/pesticide spills/leaks in shed and surrounding area
400-1	N/A	IA	UBC 439 – Radiological Survey	UBC 439	5,107	Possible spills from machining operations
400-2	N/A	IA	UBC 440 – Modification Center	UBC 440	40,166	Possible spills from machining operations

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IHSS Group	Old Operable Unit No.	Current Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft²)	Historical Notes
400-3	N/A	IA	UBC 444 – Fabrication Facility	UBC 444	123,113	Overflows and leaks of process solutions
	N/A	IA	UBC 447 – Fabrication Facility	UBC 447	19,182	Possible spills and leaks from ongoing processes
	OU 12	IA	West Loading Dock Building 447	400-116.1	2,009	Spills and leaks impacting soil and groundwater beneath dock
	OU 12	IA	Cooling Tower Pond West of Building 444	400-136.1	7,654	Evaporation holding pond
	OU 12	IA	Cooling Tower Pond East of Building 444	400-136.2	7,097	Cooling tower blowdown pond
	OU 10	IA	Buildings 444/453 Drum Storage	400-182	3,465	Leaking drums and oil spills
	OU 10	IA	Inactive Building 444 Acid Dumpster	400-207	1,288	Known spills to containment berm (possible leakage)
	OU 10	IA	Inactive Buildings 444/447 Waste Storage Site	400-208	864	Possible leakage from drum storage
	N/A	IA	Transformer, Roof of Building 447	400-801	1,597	Transformer leakage via downspouts possibly to storm drain
	N/A	IA	Beryllium Fire – Building 444	400-810	15,073	Drainage, holding basin, and airborne contamination from fire
	OU 9	IA	Tank 4 – OPWL Process Waste Pits	000-121		Potential leaks and overflows
	OU 9	IA	Tank 5 – OPWL Process Waste Tanks	000-121		Potential leaks and overflows
	OU 9	IA	Tank 6 – OPWL Process Waste Floor Sump and Foundation Drain Floor	000-121		Potential leaks and overflows
	OU 12	IA	South Loading Dock Building 444	400-116.2	1,113	Windblown, drum leakage, dumping
400-4	N/A	IA	Miscellaneous Dumping, Building 460 Storm Drain	400-803	18,932	Dumping to storm drain, extending along open ditch
	N/A	IA	Road North of Building 460	400-804	1,393	Hot spots from falling ingots covered w/asphalt
400-5	OU 10	IA	Sump #3 Acid Site (Southeast of Building 460)	400-205	1,693	Leakage from container overflows in berm area
	N/A	IA	RCRA Tank Leak in Building 460	400-813	356	Pipe leakage beneath building
	N/A	IA	RCRA Tank Leak in Building 460	400-815	356	Possible leakage from spills to secondary containment
400-6	OU 12	IA	Radioactive Site South Area	400-157.2	438,409	Dumping, surface runoff, air releases, open surface storage
400-7	N/A	IA	UBC 442 – Filter Test Facility	UBC 442	2,583	Leaking barrels, discharges
	OU 13	IA	Radioactive Site North Area	400-157.1	51,169	Leaking drums, drainage to ditches
	OU 10	IA	Building 443 Oil Leak	400-129	6,434	Leaks and spills from underground tanks (six)
	OU 12	IA	Sulfuric Acid Spill Building 443	400-187	20,206	Multiple leaks and sprays from storage tank
400-8	N/A	IA	UBC 441 – Office Building	UBC 441		
	OU 12	IA	Underground Concrete Tank	400-122		Overflows and leaking from tanks
	OU 9	IA	Tank 2 – Concrete Waste Storage Tank	000-121		Potential leaks and overflows
	OU 9	IA	Tank 3 – Concrete Waste and Steel Waste Storage Tanks	000-121		Potential leaks and overflows
400-10	N/A	IA	Sandblasting Area	400-807	9,583	Open air sandblasting
	OU 12	IA	Fiberglass Area West of Building 664	600-120.2	5,449	Multiple spills around work area (resin and solvents)
	OU 14	IA	Radioactive Site West of Building 664	600-161	53,346	Punctured and leaking drums, hydraulic leaks

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IHSS Group	Old Operable Unit No.	Current Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft^2)	Historical Notes
500-1	OU 13	IA	Valve Vaults 11, 12, 13	300-186	48,345	Leaks and discharges from transfer pipes and vaults
	OU 16	IA	Scrap Metal Storage Site	500-197	89,320	Residual contamination from removal of process and building scrap
	OU 13	IA	North Site Chemical Storage Site	500-117.1	115,489	Surface storage of contaminated material, uranium chips
500-2	OU 13	IA	Radioactive Site Building 551	500-158	62,166	Wastebox leakage, exterior contaminated drums transferred
500-3	N/A	IA	UBC 559 – Service Analytical Laboratory	UBC 559	34,544	Plutonium waste line leaks and breaks
	N/A	IA	UBC 528 – Temporary Waste Holding Building	UBC 528	432	OPWL leaks/valve vault overflows
	OU 9	IA	Radioactive Site Building 559	500-159	5,363	Broken process waste lines
	OU 9	IA	Tank 7 – OPWL - Active Process Waste Pit	000-121		Potential leaks and overflows
	OU 9	IA	Tank 33 – OPWL - Process Waste Tank	000-121		Potential leaks and overflows
	OU 9	IA	Tank 34 – OPWL - Process Waste Tank	000-121		Potential leaks and overflows
	OU 9	IA	Tank 35 – OPWL - Building 561 Concrete Floor Sump	000-121		Potential leaks and overflows
500-4	OU 13	IA	Middle Site Chemical Storage	500-117.2	91,616	Minor leaks and spills, partial asphalt cover
500-5	N/A	IA	Transformer Leak - 558-1	500-904	356	PCB-oil leaks to concrete pad
500-6	N/A	IA	Asphalt Surface Near Building 559	500-906	356	1-gallon F001 spill from liquid hose transfer
500-7	N/A	IA	Tanker Truck Release of Hazardous Waste from Tank 231B	500-907	859	Liquid and solid sludge release to soil
600-1	N/A	IA	Temporary Waste Storage - Building 663	600-1001	42,803	Leaking, punctured, and spilled drums (concrete pad)
600-2	N/A	IA	Storage Shed South of Building 334	400-802	63,641	Leaking and spilled drums to concrete pad
600-3	OU 12	IA	Fiberglass Area North of Building 664	600-120.1	4,650	Multiple spills around work area
600-4	OU 14	IA	Radioactive Site Building 444 Parking Lot	600-160	143,752	Releases from drums and boxes stored on ground
600-5	N/A	IA	Central Avenue Ditch Cleaning	600-1004	14,885	Soil spreading from ditch to area around tanks
600-6	N/A	IA	Former Pesticide Storage Area	600-1005	356	Pesticide spills to dirt floor
700-1	N/A	IA	Identification of Diesel Fuel in Subsurface Soil	700-1115		Subsurface fuel leak
700-2	N/A	IA	UBC 707 – Plutonium Fabrication and Assembly	UBC 707	107,710	Process line leaks/breaks
	N/A	IA	UBC 731 – Building 707 Process Waste	UBC 731	4,000	Process spills/OPWL leaks and breaks
	OU 9	IA	Tank 11 – OPWL - Building 731	000-121		Potential leaks and overflows
	OU 9	IA	Tank 30 – OPWL - Building 731	000-121		Potential leaks and overflows
700-3	N/A	IA	UBC 776 – Original Plutonium Foundry	UBC 776	142,889	Airborne/tracked contamination fires and explosions/liquid waste spills
	N/A	IA	UBC 777 – General Plutonium Research and Development	UBC 777		Process spills/OPWL leaks/fire contamination
	N/A	IA	UBC 778 – Plant Laundry Facility	UBC 778	26,609	Laundry water spills/OPWL leaks and breaks
	N/A	IA	UBC 701 – Waste Treatment Research and Development	UBC 701	5,645	Possible spills from Research and Development (R&D) laboratory

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IHSS Group	Old Operable Unit No.	Current Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft^2)	Historical Notes
	OU 8	IA	Solvent Spills West of Building 730	700-118.1	246	Carbon tetrachloride overflows and line leaks
	OU 14	IA	Radioactive Site 700 Area No.1	700-131	7,072	Fire and explosion resulting in soil contamination
	OU 8	IA	Radioactive Site West of Buildings 771/776	700-150.2(S)	27,113	Airborne and tracked contamination from fire, cleanup, and rain
	OU 8	IA	Radioactive Site South of Building 776	700-150.7	18,589	Airborne and tracked contamination from fire, cleanup, and rain
	N/A	IA	French Drain North of Buildings 776/777	700-1100	1,567	Possible pathway for contamination from explosion and fire
	OU 9	IA	Radioactive Site 700 Area Site #4, Tank 9 – Two 22,500-Gallon Concrete Laundry Tanks	700-132	1,187	Potential leaks and overflows
	OU 9	IA	Radioactive Site 700 Area Site #4, Tank 10 – Two 4,500-Gallon Process Waste Tanks	700-132		Potential leaks and overflows
	OU 9	IA	Tank 18 – OPWL – Concrete Laundry Waste Lift Sump	000-121		Potential leaks and overflows
	OU 8	IA	Solvent Spills North of Building 707	700-118.2	633	Tank leaks and rupture
	OU 8	IA	Sewer Line Overflow	700-144(N)	1,710	Pressurized sewer line breaks and overflows
	OU 8	IA	Sewer Line Overflow	700-144(S)	2,330	Pressurized sewer line breaks and overflows
	N/A	IA	Transformer Leak South of Building 776	700-1116	356	Dielectric fluid leak to pad, gravel, and soil
	OU 8	IA	Radioactive Site Northwest of Building 750	700-150.4	394	Leaks and backups of stored decontamination fluid
700-4	N/A	IA	UBC 771 – Plutonium and Americium Recovery Operations	UBC 771	97,553	Fire, sewer line breaks, process waste line leaks
	N/A	IA	UBC 774 – Liquid Process Waste Treatment	UBC 774	15,776	Tank overflows, drain breaks
	OU 8	IA	Radioactive Site West of Buildings 771/776	700-150.2(N)	27,113	Fire, explosion, tank overflows
	OU 8	IA	Radioactive Site 700 North of Building 774 (Area 3) Wash Area	700-163.1	18,613	Contaminated equipment wash area
	OU 8	IA	Radioactive Site 700 Area 3 Americium Slab	700-163.2	2,270	Buried contaminated Americium slab 8'x8'x10"
	OU 9	IA	Abandoned Sump Near Building 774 Unit 55.13 T-40	700-215	960	Mixed waste storage tank
	OU 8	IA	Hydroxide Tank, KOH, NaOH Condensate	700-139(N)(b)	342	Overflows/spills from aboveground KOH/NaOH tanks
	OU 9	IA	30,000-Gallon Tank (68)	700-124.1	1,133	Overflows/leaks from tank
	OU 9	IA	14,000-Gallon Tank (66)	700-124.2		Overflows/leaks from tank
	OU 9	IA	14,000-Gallon Tank (67)	700-124.3		Overflows/leaks from tank
	OU 9	IA	Holding Tank	700-125		Tank overflows
	OU 9	IA	Westernmost Out-of-Service Process Waste Tank	700-126.1	383	Below-grade leaks/overflows
	OU 9	IA	Easternmost Out-of-Service Process Waste Tank	700-126.2	370	Below-grade leaks/overflows
	OU 9	IA	Tank 8 – OPWL – East and West Process Tanks	000-121		Potential leaks and overflows
	OU 9	IA	Tank 12 – OPWL – Two Abandoned 20,000-Gallon Underground Concrete Tanks	000-121		Potential leaks and overflows

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IHSS Group	Old Operable Unit No.	Current Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft²)	Historical Notes
	OU 9	IA	Tank 13 – OPWL – Abandoned Sump - 600 Gallons	000-121		Potential leaks and overflows
	OU 9	IA	Tank 14 – OPWL – 30,000-Gallon Concrete Underground Storage Tank (68)	000-121		Potential leaks and overflows
	OU 9	IA	Tank 15 – OPWL – Two 7,500-Gallon Process Waste Tanks (34W, 34E)	000-121		Potential leaks and overflows
	OU 9	IA	Tank 16 – OPWL – Two 30,000-Gallon Concrete Underground Storage Tanks (66, 67)	000-121		Potential leaks and overflows
	OU 9	IA	Tank 17 – OPWL – Four Concrete Process Waste Tanks (30, 31, 32, 33)	000-121		Potential leaks and overflows
	OU 9	IA	Tank 36 – OPWL – Steel Carbon Tetrachloride Sump	000-121		Potential leaks and overflows
	OU 9	IA	Tank 37 – OPWL – Steel-Lined Concrete Sump	000-121		Potential leaks and overflows
	OU 8	IA	Caustic/Acid Spills Hydrofluoric Tank	700-139.2	918	Spills and leaks infiltrating surrounding soil
	OU 9	IA	Concrete Process 7,500-Gallon Waste Tank (31)	700-146.1	1,507	Frequent tank overflows and leakage
	OU 9	IA	Concrete Process 7,500-Gallon Waste Tank (32)	700-146.2		Frequent tank overflows and leakage
	OU 9	IA	Concrete Process 7,500-Gallon Waste Tank (34W)	700-146.3		Frequent tank overflows and leakage
	OU 9	IA	Concrete Process 7,500-Gallon Waste Tank (34E)	700-146.4		Frequent tank overflows and leakage
	OU 9	IA	Concrete Process 7,500-Gallon Waste Tank (30)	700-146.5		Frequent tank overflows and leakage
	OU 9	IA	Concrete Process 7,500-Gallon Waste Tank (33)	700-146.6		Frequent tank overflows and leakage
	OU 8	IA	Radioactive Site North of Building 771	700-150.1	24,779	Airborne, leaking drums, tracked contamination
	OU 8	IA	Radioactive Site Between Buildings 771 and 774	700-150.3	5,037	Broken process waste line
700-5	N/A	IA	UBC 770 – Waste Storage Facility	UBC 770	3,111	Possible leakage from stored waste containers
700-6	OU 8	IA	Buildings 712/713 Cooling Tower Blowdown	700-137	14,962	Ground placement of tower sludge/blowdown water leaks
	OU 8	IA	Caustic/Acid Spills Hydroxide Tank Area	700-139.1(S)	923	Multiple spills and leaks
700-7	N/A	IA	UBC 779 – Main Plutonium Components Production Facility	UBC 779	43,360	Building over original Solar Pond/water spills and leaks
	OU 8	IA	Building 779 Cooling Tower Blowdown	700-138	14,962	Underground cooling tower water line break
	OU 8	IA	Radioactive Site South of Building 779	700-150.6	4,435	Tracked contamination
	OU 8	IA	Radioactive Site Northeast of Building B779	700-150.8	13,054	Tracked contamination
	N/A	IA	Transformer Leak - 779-1/779-2	700-1105	712	PCB oil released from transformer
	OU 9	IA	Tank 19 – OPWL - Two 1,000-Gallon Concrete Sumps	000-121		Potential leaks and overflows
	OU 9	IA	Tank 20 – OPWL - Two 8,000-Gallon Concrete Sumps	000-121		Potential leaks and overflows

IHSS Group	Old Operable Unit No.	Current Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft²)	Historical Notes
	OU 9	IA	Tank 38 – OPWL - 1,000-Gallon Steel Tanks	000-121		Potential leaks and overflows
700-8	OU 10	IA	750 Pad – Pondcrete/Saltcrete Storage	700-214	139,658	Pondcrete/saltcrete spills/pad runoff not contained
700-10	N/A	IA	Laundry Tank Overflow – Building 732	700-1101	1,856	Wastewater tank overflow
700-11	N/A	IA	Bowman's Pond	700-1108	4,741	Tanks/process line leaks/footing drain accumulation area
	OU 8	IA	Hydroxide Tank, KOH, NaOH Condensate	700-139.1(N)(a)	2,520	Multiple spills and leaks
700-12	N/A	IA	Process Waste Spill – Portal 1	700-1106	356	Valve vault water spilled onto street
800-1	N/A	IA	UBC 865 – Materials Process Building	UBC 865	41,558	OPWL leaks/spills from coating ops and R&D activities
	N/A	IA	Building 866 Spills	800-1204	2,623	Vent pipe and tank overflows
	N/A	IA	Building 866 Sump Spill	800-1212	364	Leak from sump pump
	OU 9	IA	Tank 23 – OPWL	000-121		Potential leaks and overflows
800-2	N/A	IA	UBC 881 – Laboratory and Office	UBC 881	79,222	Multiple leaks/broken waste lines
	N/A	IA	Building 881, East Dock	800-1205	2,426	Possible unknown contamination/condensate spill
	OU 9	IA	Tank 24 – OPWL – Seven 2,700-Gallon Steel Process Waste Tanks	000-121		Potential leaks and overflows
	OU 9	IA	Tank 32 – OPWL – 131,160-Gallon Underground Concrete Secondary Containment Sump	000-121		Potential leaks and overflows
	OU 9	IA	Tank 39 – OPWL – Four 250-Gallon Steel Process Waste Tanks	000-121		Potential leaks and overflows
800-3	N/A	IA	UBC 883 – Roll and Form Building	UBC 883	49,325	Process waste water leaks and overflows
	N/A	IA	Valve Vault 2	800-1200	4,541	Transfer line leak
	OU 9	IA	Tank 25 – OPWL – 750-Gallon Steel Tanks (18, 19)	000-121		Potential leaks and overflows
	OU 9	IA	Tank 26 – OPWL – 750-Gallon Steel Tanks (24, 25, 26)	000-121		Potential leaks and overflows
	N/A	IA	Radioactive Site South of Building 883	800-1201	1,500	Multiple areas of contamination from Plant operations
800-4	N/A	IA	UBC 886 – Critical Mass Laboratory	UBC 886	13,517	Leaks and spills from criticality experiments
	OU 9	IA	Tank 21 – OPWL – 250-Gallon Concrete Sump	000-121		Potential leaks and overflows
	OU 9	IA	Tank 22 – OPWL – Two 250-Gallon Steel Tanks	000-121		Potential leaks and overflows
	OU 9	IA	Tank 27 – OPWL – 500-Gallon Portable Steel Tank	000-121	31,400	Potential leaks and overflows
	OU 14	IA	Radioactive Site #2 800 Area, Building 886 Spill	800-164.2	31,400	Tank leak
800-5	N/A	IA	UBC 887 – Process and Sanitary Waste Tanks	UBC 887	378	Leaks and breaks in process waste lines
	OU 10	IA	Building 885 Drum Storage	800-177	1,064	Possible releases from waste storage
800-6	N/A	IA	UBC 889 – Decontamination and Waste Reduction	UBC 889	2,603	Radiological car wash area/OPWL leaks/waste tank breaches
	OU 14	IA	Radioactive Site 800 Area Site #2 Building 889 Storage Pad	800-164.3	28,944	Leaks/spills/rainwater transport from storage area

IHSS Group	Old Operable Unit No.	Current Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft^2)	Historical Notes
	OU 9	IA	Tank 28 – Two 1,000-Gallon Concrete Sumps	000-121		Potential leaks and overflows
	OU 9	IA	Tank 40 – Two 400-Gallon Underground Concrete Tanks	000-121		Potential leaks and overflows
900-1	N/A	IA	UBC 991 – Weapons Assembly and R&D	UBC 991	59,849	Potential line leaks/valve vault breaches and overflows
	OU 8	IA	Radioactive Site Building 991	900-173	5,970	Small spills and equipment wash area
	OU 8	IA	Radioactive Site 991 Steam Cleaning Area	900-184	4,125	Equipment cleaning area
	N/A	IA	Building 991 Enclosed Area	900-1301	3,939	Possible leaks from waste containers/material storage
	N/A	IA	PAC 900-1307, Explosive Bonding Pit	900-1307		Soil beneath and around building slab and pit
900-2	OU 2	BZ	Oil Burn Pit No. 2	900-153	6,403	Oil contaminated with uranium was burned in two parallel trenches
	OU 2	BZ	Pallet Burn Site	900-154	3,152	Wooden pallet burn area
900-3	OU 10	IA	904 Pad, Pondcrete Storage	900-213	127,334	Spillage and rainwater runoff of stored pondcrete/saltcrete
900-4&5	OU 10	IA	S&W Building 980 Contractor Storage Facility	900-175	5,819	Leaks and spills from drum storage
	N/A	IA	Gasoline Spill Outside Building 980	900-1308	356	Gas overflow during filling
900-11	OU 2	BZ	903 Pad	900-112	146,727	Leaks and spills from drum storage
	OU 2	BZ	Hazardous Disposal Area	900-140	65,498	Reactive metal destruction and disposal site
	OU 2	BZ	East Firing Range	SE-1602	465,173	Dispersal of lead and depleted uranium from routine weapons firing
900-12	OU 2	BZ	Trench T-5	NE-111.2	19,235	Disposal of sanitary wastewater treatment plant sludge
	OU 2	BZ	Trench T-6	NE-111.3	4,089	Disposal of sanitary wastewater treatment plant sludge
	OU 2	BZ	Trench T-8	NE-111.5	13,135	Disposal of sanitary wastewater treatment plant sludge
	OU 2	BZ	Trench T-9	NE-111.6	21,061	Disposal of sanitary wastewater treatment plant sludge
	OU 2	BZ	Trench T-10	NE-111.7	4,271	Disposal of sanitary wastewater treatment plant sludge
	OU 2	BZ	Trench T-11	NE-111.8	5,776	Disposal of sanitary wastewater treatment plant sludge
NE/NW	OU 10	BZ	Property Utilization and Disposal (PU&D) Yard – Drum Storage	174a	4,342	Leaks and spills from RCRA drum storage
	N/A	BZ	OU 2 Treatment Facility	NE-1407	356	Leaks and spills from process operations
	N/A	BZ	Trench T-12 Located at OU 2 East Trenches	NE-1412	7,449	Disposal of sanitary waste sludge and flattened drums
	N/A	BZ	Trench T-13 Located at OU 2 East Trenches	NE-1413	5,090	Disposal of sanitary waste sludge and flattened drums
	N/A	BZ	North Firing Range	NW-1505	117,748	Currently in use
NE-1	OU 6	BZ	Pond A-1	142.1	39,294	Received wastewater effluent from the IA spill control
	OU 5	BZ	Pond C-2	142.11	168,524	Received discharge from the South Interceptor Ditch (SID)

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IHSS Group	Old Operable Unit No.	Current Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft²)	Historical Notes
	OU 6	BZ	Pond A-2	142.2	61,373	Received wastewater effluent from the IA spill control
	OU 6	BZ	Pond A-3	142.3	122,909	Received wastewater effluent from the IA
	OU 6	BZ	Pond A-4	142.4	254,102	Received wastewater effluent from the IA
	OU 6	BZ	Pond A-5	142.12	12,256	Received wastewater effluent from the IA
	OU 6	BZ	Pond B-1	142.5	11,396	Flow-through retention pond, received treated sanitary effluent and process waste
	OU 6	BZ	Pond B-2	142.6	33,761	Flow-through retention pond, received treated sanitary effluent and process waste
	OU 6	BZ	Pond B-3	142.7	18,422	Flow-through retention pond, received treated sanitary wastewater effluent discharge
	OU 6	BZ	Pond B-4	142.8	11,731	Flow-through retention pond, received treated sanitary effluent and process waste
	OU 6	BZ	Pond B-5	142.9	129,515	Flow-through retention pond, received treated sanitary effluent and process waste
	OU 5	BZ	Pond C-1	142.1	39,294	Retention and monitoring pond, received sanitary sewage discharge and runoff from the 903 Pad Area
NE-2	OU 2	BZ	Trench T-7	111.4	15,565	Disposal of sanitary waste sludge
SW-1	OU 5	BZ	Ash Pit 1	133.1	13,960	Disposal of combustible waste ash and noncombustible trash
	OU 5	BZ	Ash Pit 2	133.2	26,624	Disposal of combustible waste ash and noncombustible trash
	OU 5	BZ	Ash Pit 4	133.4	10,749	Disposal of combustible waste ash and noncombustible trash
	OU 5	BZ	Concrete Wash Pad	133.6	35,274	Deposition of potentially contaminated ash
	N/A	BZ	Recently identified ash pit (also referred to as TDEM-2)	SW-1702	5,588	Disposal of combustible waste ash, depleted uranium and metallic debris
	OU 2	BZ	Ryan's Pit (Trench 2)	109	261	Disposal of VOCs and drum carcasses

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Figure 3. Industrial Area Groups

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Figure 4. Buffer Zone IHSSs and PACs

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3.1 PREVIOUS STUDIES AND REMEDIAL ACTIONS

Numerous studies conducted at RFETS include RCRA Facility Investigation/Remedial Investigations (RFI/RIs), risk assessments, Interim Measure/Interim Remedial Actions (IM/IRAs), and Corrective Measure Studies/Feasibility Studies (CMS/FSs). Previous studies in the IA include RFI/RI studies initiated at all previous IA OUs, Phase I and Phase II RFI/RIs and an IM/IRA at OU 4 (Solar Evaporation Ponds [SEP]), and a preremedial investigation at Bowman's Pond. Previous studies in the BZ include RFI/RIs at OU 1 (881 Hillside), OU 2 (903 Pad, Mound, and East Trenches), OU 5 (Woman Creek), OU 6 (Walnut Creek), OU 7 (Present Landfill), and OU 11 (West Spray Field). Remedial actions were conducted at Trenches T-1, T-2, T-3, and T-4, the Mound Site, and Ryan's Pit in the BZ, and polychlorinated biphenyl (PCB) sites in the IA.

3.2 GEOLOGY

At RFETS, relatively flat-lying Quaternary surficial deposits overlie Cretaceous bedrock. The surficial deposits consist primarily of the Rocky Flats Alluvium and artificial fill materials (EG&G 1992). The alluvium ranges from approximately 100 feet (ft) thick at the western edge of the Site to approximately 1 ft thick at the eastern edge of the Site, and consists of unconsolidated, poorly sorted coarse gravels, coarse sands, and gravelly clays with discontinuous lenses of clay, silt, and sand. The Rocky Flats Alluvium is truncated by erosion immediately east of the IA.

The alluvium unconformably overlies weathered claystone bedrock consisting of the Upper Cretaceous Arapahoe and Laramie Formations. The Arapahoe Formation ranges from 0 to approximately 50 ft thick and consists of siltstones and claystones with sandstone lenses. In some areas, such as near the SEP, well-sorted and coarse-grained sandstone is present. This sandstone provides a preferential migration pathway; however, it is interrupted by erosion and does not provide an offsite pathway for groundwater and contaminant migration. The Laramie Formation unconformably underlies the Arapahoe Formation. Beneath the Site, the Laramie Formation is 600 to 800 ft thick and consists primarily of claystone with siltstone; fine-grained sandstone and coal lenses are also present (EG&G 1995a).

3.3 SURFACE WATER HYDROLOGY

Three intermittent streams drain RFETS: Rock Creek, Walnut Creek, and Woman Creek. The northwestern corner of RFETS is drained by Rock Creek, which flows northeast through the BZ to its offsite confluence with Coal Creek. North and South Walnut Creeks and an unnamed tributary drain the northern part of the Site. The confluence of North and South Walnut Creeks is east of Ponds A-4 and B-5. The South Interceptor Ditch (SID), located between the IA and Woman Creek, collects runoff from the southern part of RFETS and ultimately diverts the water to Pond C-2. Water from the A-, B-, and C-series ponds is monitored and discharged periodically. Woman Creek is diverted over the SID, flows around Pond C-2, and then flows offsite into the Woman Creek Reservoir.

3.4 HYDROGEOLOGY

Two hydrostratigraphic units are present at RFETS: the upper hydrostratigraphic unit (UHSU) and the lower hydrostratigraphic unit (LHSU). The UHSU consists of the unconfined saturated Rocky Flats Alluvium and weathered Arapahoe and Laramie Formation bedrock. This hydrostratigraphic unit contains most of the groundwater impacted by Site activities. The LHSU consists of the unweathered Arapahoe and Laramie Formations. Claystones and silty claystones in this unit act as an aquitard, inhibiting downward groundwater movement. The geometric mean of measured hydraulic conductivity values in the Rocky Flats Alluvium is approximately 10^{-4} centimeter per second (cm/sec). LHSU conductivities are generally lower than those of the overlying UHSU because of the higher percentage of fine-grained material (EG&G 1995b).

Groundwater within the UHSU primarily flows west to east along the bedrock contact with the underlying Arapahoe and Laramie Formation claystones. Groundwater elevations are highest in the spring and early summer when precipitation is high and evapotranspiration is low. Groundwater elevations decline during the remainder of the year, and some areas of the UHSU are seasonally dry. Groundwater from the UHSU discharges at springs and seeps on the hillsides at the contact between the alluvium and bedrock, and where sandstone lenses subcrop in drainages, and does not migrate offsite (EG&G 1995b).

To the west, where the alluvium is thickest, depth to the water table is 50 to 70 ft below ground surface (bgs). Depth to water generally decreases from west to east as the surficial material thins. Depth to water ranges from less than 2 ft to 22 ft (EG&G 1995b). Engineered structures cause variations in water levels and saturated thickness. The impact of building footing drains, utility corridors, and other structures has not been evaluated; however, these structures are believed to impact groundwater flow and are being evaluated as part of the Site-Wide Water Balance (SWWB).

The majority of remediation activities will be conducted in Rocky Flats Alluvium. However, basements of some buildings extend into the weathered Arapahoe or Laramie Formations. Because of the deep basements, UHSU groundwater may be intercepted beneath some buildings.

4.0 INTERFACES

Because this ER RSOP covers projects across the Site, implementation requires interaction with Site organizations performing many functions. These activities are not remediation activities under this RSOP but are interface points. Some activities could be covered under other decision documents. Key interfaces are described below and illustrated on Figure 5.

4.1 DECOMMISSIONING

The decommissioning staff is responsible for dismantling Site structures and infrastructure. ER staff will work closely with decommissioning staff so remediation projects can be scheduled and resources can be managed effectively. Additionally, information from decommissioning activities will be used during remediation planning and implementation.

Approximately 90 percent of the potentially contaminated sites that may require soil remediation are associated with buildings or supporting infrastructure. Consequently, close interaction with decommissioning staff will be required.

ER will work with decommissioning staff to achieve an integrated process to minimize risk to workers and the environment, minimize generation of remediation waste, streamline technical processes, and reduce project costs. The project interface points and division of responsibilities are included in the RSOP for Facility Disposition (DOE 2004).

4.2 COMPLIANCE

The RFETS compliance organizations are responsible for guiding and supporting Site regulatory strategy and compliance. ER staff will work with compliance staff to ensure remediation is compliant with RFCA and identified Applicable or Relevant and Appropriate Requirements (ARARs). Remediation of RCRA Units will be coordinated with compliance staff to ensure data generated during ER remediation activities are available for the closure of RCRA Units.

4.2.1 RCRA Compliance

Compliance staff is responsible for ensuring Site activities are in accordance with RCRA requirements. Part of this responsibility includes overseeing the closure of RCRA-regulated units. Because ER staff will be responsible or partly responsible for the closure of some RCRA Units, interaction and data transfer between ER and compliance organizations is critical. Project interface points and divisions of responsibilities include the following:

- ER staff will consult with compliance staff on the location and status of RCRA-regulated units.
- ER staff will remediate RCRA-regulated ER units in accordance with Section 6.5.3 of this RSOP.
- ER staff will document remediation activities in the Closeout Report. Compliance staff will use this information to update the RCRA permit and the Master List of RCRA Units.

Figure 5. Key Project Interfaces

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- ER staff will document remediation activities in the Closeout Report. Compliance staff will use this information to update the RCRA permit and the Master List of RCRA Units.

4.3.2 Environmental Monitoring

The IMP (DOE 2000a) provides a template for routine data collection for groundwater, soil, surface water, air, and ecology in the IA and BZ and around decommissioning and remediation projects. Interaction and data transfer between the compliance and ER organizations is ongoing. Project interface points and divisions of responsibilities include the following:

- ER staff will consult with compliance staff on the location of surface water, groundwater plumes, and ecological resources during project planning to develop protection requirements.
- ER staff will inform compliance staff when and where remediation actions are planned. This information will be used in planning project-specific surface water, groundwater, and air monitoring activities. The compliance staff will write SAPs to direct project-specific monitoring in accordance with the IMP.
- ER staff will notify compliance staff when surface water, groundwater, or ecological resources are encountered at a project site.
- ER staff will provide compliance staff with a yearly summary of stewardship recommendations based on completed accelerated actions.

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4.4 WASTE MANAGEMENT

The RFETS waste management organization is responsible for Site waste management activities. ER staff will work closely with waste management staff on waste characterization and transportation issues. Of critical importance is the ability to move ER remediation waste from the remediated area. Additionally, ER staff will work with waste management staff to remove packaged waste currently located in waste storage facilities within IHSS and PAC boundaries. Project interface points and divisions of responsibility include the following:

- ER staff will inform waste management staff of upcoming projects, potential waste types, and volumes prior to the start of remediation projects.
- The waste management organization will assign a Waste Requirements Representative (WRR) who will be responsible for providing waste management guidance and assistance to the project.
- The WRR will issue a Waste Generating Instruction (WGI) for all waste streams that identifies waste characteristics, U.S. Department of Transportation (DOT) packaging and label requirements, waste packing instructions, characterization requirements for treatment and disposal, and document requirements.
- ER staff will be responsible for waste characterization, segregation, and packaging.
- The WRR will verify that packaged waste meets WGI requirements and has been entered into the Waste and Environmental Management System (WEMS) before the waste is transferred to the waste management organization.
- Waste management staff will be responsible for storage, transportation, and disposal of ER remediation waste.

4.5 SITE SERVICES

A key Site function is provided by the site services organization that is responsible for all Site systems. ER staff relies on the site services organization for a number of support functions. Project interface points and divisions of responsibilities include the following:

- ER staff will consult with site services staff before excavation to determine whether utilities are present in the excavation area.
- Site services staff will continue to provide fire, emergency, road, and maintenance support services through closure.
- Site services staff will cap or seal and abandon in place underground water distribution systems deeper than 3 ft below existing grade.
- Site services staff will close the water utility system. If the system is closed before ER remediation is complete, ER staff will be required to provide water for dust suppression, decontamination, and other uses.

- Site services staff will remove all manholes.
- Site services staff will close the electrical power system. Power poles will be cut off at grade. After the power system is shut down, ER staff will be required to provide generators for power requirements.
- Site services staff will close the Sewage Treatment Plant (STP) and associated sanitary sewer lines. The STP and associated sewer lines will be flushed in accordance with the RSOP for Facility Disposition (DOE 2004). ER staff will characterize soil surrounding the sewer lines, remediate contaminated soil as necessary, flush contaminated pipe, and foam or grout pipelines deeper than 3 ft below existing grade.
- Storm drains will be maintained through the end of Fiscal Year (FY) 05 (approximately). Some components of the clean storm drain system may be maintained or modified as part of long-term stewardship needs after Site closure. ER staff will characterize soil around the remaining storm drains and remediate as necessary. Contaminated storm drains will be removed. Storm drains deeper than 3 ft below existing grade will be foamed or grouted and abandoned in place.

5.0 ACCELERATED ACTION DECISIONS

Accelerated action decisions will be made based on remedial action objectives (RAOs), evaluation of characterization and existing analytical data in accordance with BZSAP (DOE 2002a) and IASAP (DOE 2001a) DQOs, and ALARA and stewardship considerations. These decision criteria are discussed below and illustrated in figures throughout this section. Because ARARs are considered during accelerated actions and are used, in part, to determine RAOs, they are included with RAOs in Section 5.1.

5.1 LONG-TERM REMEDIAL ACTION OBJECTIVES

RAOs are contaminant- and medium-specific goals designed to protect human health and the environment and are used to guide the accelerated actions. The overall long-term RAOs for RFETS soil are as follows:

1. Provide a remedy consistent with the RFETS goal of protection of human health and the environment;

2. Provide a remedy that minimizes the need for long-term maintenance and institutional or engineering controls; and

3. Minimize the spread of contaminants during implementation of accelerated actions.

5.1.1 Soil

The amount and quality of characterization information for the IHSSs, PACs, and UBC sites that will be addressed through actions taken under this RSOP vary greatly. The COCs, range of contamination, and types of debris expected in contaminated soil are discussed in previous sections of this RSOP and in the reference documents listed in Section 15.0. Characterization information is based on existing characterization data, including sampling, process knowledge, and waste stream characterization, and on contaminants encountered and successfully removed in previous soil removal accelerated actions, including those removed through low-temperature thermal desorption at other IHSSs. Soil RAOs include the following:

4. Protect the WRW from exposure to soil that would result in a lifetime excess cancer risk of 1 x10-5 or a Hazard Index (HI) greater than or equal to 1;

5. Protect surface water quality; and

6. Protect ecological resources.

Following implementation of accelerated actions, final remedial/corrective action decisions, including final cleanup levels, will be determined in a CAD/ROD. The final remedial/corrective action decisions specified in a CAD/ROD may require additional work, to protect human health and the environment.

5.1.2 Applicable or Relevant and Appropriate Requirements

RFCA is a CHWA corrective action order and a CERCLA Section 120 interagency agreement. Under RFCA paragraph 25d, the approved ER RSOP becomes part of RFCA and therefore part of the CHWA corrective action order. This ER RSOP does not change any provision of the body of RFCA. Actions under this ER RSOP occurring in the IA in response to releases of hazardous wastes or hazardous constituents (including soil or other media that contains hazardous wastes or constituents, or debris contaminated with hazardous wastes or constituents), and to close interim status or permitted units are regulated under CHWA authority as provided in RFCA, rather than under CERCLA authority. This ER RSOP, and CDPHE decisions pursuant to it, provides the administrative means for implementing CHWA authority. Pursuant to RFCA paragraph 97 and Section X of the RFETS CHWA permit, the ER RSOP also functions as a modification to the Site's closure plan for regulated units addressed in the ER RSOP. And pursuant to Section 6.5.3 of this ER RSOP, the ER RSOP Notification functions as the closure description document for units closed under this ER RSOP. Refer to RFCA Parts 8 and 9, and in particular paragraphs 13d, 68, and 96 -105.

To the extent the foregoing actions under this ER RSOP occurring in the IA address hazardous wastes or hazardous constituents, relevant CHWA regulations apply to those actions taken under this ER RSOP, and are not CERCLA ARARs. Other actions under this ER RSOP, i.e., those that address radionuclides or other hazardous substances that are not hazardous wastes or constituents, as well as all actions that occur in the BZ (because such actions would be regulated under CERCLA authority) must attain, to the maximum extent practicable, federal and state ARARs listed in Table 3.

Wastes generated by activities under this ER RSOP are remediation wastes as defined in RFCA paragraph 25 bf.

5.2 DECISION FRAMEWORK

The ER RSOP decisions are based on the Preliminary Data Quality Objectives for the Industrial Area Sampling and Analysis Plan (DOE 2000b). The framework for accelerated action decisions contain data aggregation and AL comparison rules as illustrated on Figures 6 and 7. Data aggregation and AL comparison methods are detailed in the IASAP (DOE 2001a) and the BZSAP (DOE 2002a). Action will be taken based on these DQOs in accordance with the following:

- When the ratio of the 95% upper confidence limit (UCL) of the mean COC concentration across an Area of Concern (AOC) to the RFCA soil AL is greater than one for soil in the top 6 inches for non-radiological and U contaminants and the top 3 ft for radiological contaminants (Pu and/or americium [Am]).

- When the sum of the ratios (SORs) of the 95% UCLs of the mean concentration for radiological COCs within an AOC to their respective RFCA soil ALs is greater than 1 for soil in the top 3 ft for radiological (Pu, Am, and U) contamination.

Table 3. Applicable or Relevant and Appropriate Requirements

Requirement	Citation	Compliance Strategy	Excavate	Stabilize or Treat
Colorado Air Quality Control Commission (CAQCC) Regulations • Emission Control Regulations for Particulates, Smoke, Carbon Monoxide, and Sulfur Oxides - Opacity - Fugitive Particulate Emissions - Construction Activities - Storage and Handling of Materials - Haul Roads - Haul Trucks	5 Code of Colorado Regulations (CCR) 1001 5 CCR 1001-3 Section II.A.1 Section III.D Section III.D.2(b) Section III.D.2(c) Section III.D.2(e) Section III.D.2(f)	The Site will not allow the emission into the atmosphere of any air pollutant that is in excess of 20 percent opacity from covered sources. Certified visible emissions evaluators will be available to ensure compliance. Use a combination of dust control measures (Section 7.0) that may include covering loads, speed reduction, water sprays, road cleaning, covering or stabilization of spoil piles, and ceasing work at certain wind speeds.	X	X
• Air Pollutant Emission Notice (APEN)	5 CCR 1001-5, Part A	APENs will be submitted as appropriate in accordance with RFCA. Fuel consumption limits for fuel-fired equipment will be followed.	X	X
• Construction Permits	5 CCR 1001-5, Part B	Construction permits are not required; however, requirements such as fuel consumption limits for fuel-fired equipment will be followed.	X	X
• Emissions of VOCs - Transfers of VOCs	5 CCR 1001-9 Regulation Number 3	Use submerged fill or bottom filling equipment when transferring VOCs to any tank, container, or vehicle compartment with a capacity exceeding 56 gallons.	X	X
• Disposal of VOCs - Construction Permit Requirements	5 CCR 1001-9 Regulation Number 3 Section V	VOCs will not be disposed by evaporation or spillage unless reasonably available control technologies (RACTs) are utilized.	X	X
National Emission Standards for Hazardous Air Pollutants (NESHAP) • National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities - Standard	40 Code of Federal Regulations (CFR) 61, subpart H 61.92	The Site Radioactive Ambient Air Monitoring Program (RAAMP) sampling network is used to verify compliance with the 10 millirems per year (mrem/yr) standard.	X	X

Requirement	Citation	Compliance Strategy	Excavate	Stabilize or Treat
- Emission Monitoring and Test Procedures	61.93	Radionuclide emission measurements will be made at all release points that have a potential to discharge radionuclides into the air that could cause an effective dose equivalent (EDE) to the most impacted member of the public in excess of 1 percent of the standard (0.1 mrem/yr).	X	X
- Compliance and Reporting	61.96	Site personnel perform radionuclide air emission assessments on all new and modified sources. Appropriate notifications are submitted for sources with calculated controlled emissions that exceed 0.1 mrem/yr EDE.	X	X
Clean Water Act (CWA), Colorado Basic Standards and Methodologies for Surface Water	40 CFR 131, 138 5 CCR 1002-31	Surface water quality will be monitored in accordance with RFCA Attachment 5 requirements.	X	X
Discharges of Dredged or Fill Material into Waters of the United States • Discharges Requiring Permits	33 USC 1344 33 CFR 323.3	On-site remedial actions do not require permits, but actions requiring discharge of dredge or fill material into waters of the United States must meet substantive requirements of any Nationwide or Regional Permit or specific NPDES permit that may otherwise be required.	X	X
DOE Compliance with Floodplain/Wetlands Environmental Review Requirements	10 CFR 1022		X	X
• Floodplain/Wetlands Determination	.11	A/L	X	X
• Floodplain/Wetlands Assessment	.12	A/L		
• Applicant Responsibilities	.13	A/L		
National Pollutant Discharge Elimination System (NPDES) Regulations • Best Management Practices (BMP) Program	40 CFR 122, 125 .104	Compliance with current Site Storm Water Management Plan will constitute field compliance with FWPCA.	X	X
Endangered Species Act (ESA)	50 CFR 402	Identify and minimize early in the planning stage of an action any potential conflicts between the action and federally listed species.	X	
Migratory Bird Treaty	50 CFR 10	Prevent or minimize contact with listed birds and nests. Consult with the responsible RFETS ecologist.	X	

Requirement	Citation	Compliance Strategy	Excavate	Stabilize or Treat
Solid Waste Disposal Act (SWDA) **Colorado Hazardous Waste Act (CHWA)** Solid Waste Disposal Sites and Facilities • Definitions	6 CCR 1007-2 Section 1.2	Soil generated during remediation will be characterized. Contaminated soil will then be placed in containers for offsite disposition. If contaminated soil is not immediately shipped to a waste disposal facility, waste will be managed onsite in accordance with substantive requirements.	X	
Identification and Listing of Hazardous Waste	6 CCR 1007-3, Part 261	All remediation waste will be characterized to determine a hazardous waste classification.	X	X
Generator Standards • Hazardous Waste Determinations • Hazardous Waste Accumulation Areas	6 CCR 1007-3 Part 262 262.11 262.34(a)(i)(ii)(iv excluding A&B); (a)(4); (c)(1)	Waste characteristics will be determined. Waste will be staged onsite in appropriate storage facilities.	X	
Contingency Plan and Emergency Procedures • Purpose and Implementation • Emergency Coordinator • Emergency Procedures	6 CCR 1007-3 Part 264, Subpart D .51 (b) .55 .56 (a-i)	Emergencies such as fire, explosion, or release of hazardous waste will be mitigated immediately. A designated employee will be responsible for coordinating emergency response actions.	X	X
Manifest System, Record Keeping, and Reporting • Operating Record • Record Keeping	6 CCR 1007-3, Part 264, Subpart E 264.73 264.74	Use of WEMS and compliance with RFETS disposal procedures will constitute compliance.	X	X
Use and Management of Containers • Condition of Containers • Compatibility of Waste in Containers • Management of Containers • Inspections	6 CCR 1007-3 Part 264, Subpart I .171 .172 .173 .174	Containers will be maintained in good condition and kept closed except when adding or removing waste. Waste will be compatible with containers.	X	X

Requirement	Citation	Compliance Strategy	Excavate	Stabilize or Treat
Miscellaneous Units • • • • Environmental Performance Standards • Monitoring, Analysis, Inspection, Response, Reporting, and Corrective Action • Post-Closure Care	6 CCR 1007-3 Part 264, Subpart X [40 CFR Part 264, Subpart X] .601 .602 .603	The thermal desorption unit will be designed, constructed, operated, and maintained in a manner that protects groundwater, surface water, wetlands, soil, and air.		X
Air Emission Standards for Process Vents • Standards: Process Vents • Standards: Closed-Vent Systems and Control Devices • Test Methods and Procedures	6 CCR 1007-3 Part 264, Subpart AA .1032 .1033 .1034	Air emission standards will be incorporated into the design of process vents associated with thermal desorption operations to achieve compliance with requirements for hazardous wastes with organic concentrations equal to or greater than 10 parts per million (ppm) (by weight).		X
Corrective Action for Solid Waste Management Units • Temporary Units • • Staging Piles	6 CCR 1007-3, Part 264.553 (a-e) [40 CFR Part 264, Subpart S] .554(a-k)	Hazardous or mixed waste may be stored in a temporary unit. This status is appropriate because of the short duration of operation of the unit, limited potential for release from the unit, and type of unit being established. The volume of Tier I soil will be wrapped in material that will isolate it from surrounding environmental media or in some other manner that meets the requirements of 264.554(d)(1).	X	X
Thermal Treatment	6 CCR 1007-3 Part 265, Subpart P	Operating parameters will be incorporated in system design as appropriate for thermal desorption technology.	X	X
Land Disposal Restrictions (LDRs) • Dilution Prohibited as a Substitute for Treatment • LDR Determination (Determination if Hazardous Waste Meets the LDR Treatment Standards) • Special Rules for Wastes that Exhibit a Characteristic • Universal Treatment Standards for VOCs	6 CCR 1007-3 Part 268 [40 CFR Part 268] .3 .7 .9 (a-c) .48	Hazardous remediation waste treated in the thermal desorption unit will meet the substantive requirements outlined in the regulation.		X

Requirement	Citation	Compliance Strategy	Excavate	Stabilize or Treat
Toxic Substances Control Act (TSCA) Disposal Requirements • Applicability • Disposal Requirements • PCB Remediation Waste • PCB Bulk Product Waste • Disposal of R&D and Chemical Analyses Wastes	40 CFR 761 761.50 761.60 761.61 761.62 761.64	All PCB waste stored or disposed will be controlled to meet applicable requirements.	X	
Chronic Beryllium Disease Prevention Final Rule • Definitions • Waste Disposal • Warning Labels • Release Criteria	10 CFR 850 .3 .32 .38(b-c)	Debris suspected of being contaminated with beryllium >0.2 microgram per 100 square centimeters (□g/100 cm^2) will be controlled and disposed so as to meet applicable requirements.	X	
Radiation Control Emergency Plan – Required if material quantity exceeds Schedule E of Part 3 (e.g., 2 curies of alpha emitters) and evaluation shows maximum dose to offsite person from release exceeds 1 rem (5 rem to thyroid).	6 CCR 1007-1 RH 3.9.11	DOE maintains its Emergency Plan in accordance with DOE Order 151.1, *Comprehensive Emergency Management System.*	X	X
Decommissioning Plan Contents – Must include a description of methods used to ensure protection of workers and the environment against radiation hazards during decommissioning.	RH 3.16.4.3.3	Procedures to meet 10 CFR 835, *Occupational Radiation Protection,* and the Site's Integrated Work Control Program (IWCP) process will be described for proposed actions.	X	X
Decommissioning Plan Contents – Must include a description of the planned final radiation survey.	RH 3.16.4.3.4	Planned implementation of the Decommissioning Characterization Protocols or any final sampling and analysis plan for environmental media will be described.	X	X

Requirement	Citation	Compliance Strategy	Excavate	Stabilize or Treat
Decommissioning Plan Contents – Must include a description of the intended final condition of the site, buildings, and/or outdoor areas upon decommissioning.	RH 3.16.4.3.6	The intended condition upon completion of an accelerated action will be described in the Notification.	X	X
Decommissioning Plan Contents – If proposing to use the criteria in RH 4.61.3 or RH 4.61.4 (restricted access), the plan must include analysis demonstrating that reductions in residual radioactivity necessary to comply with the provisions of RH 4.61.2 (unrestricted access) would result in net public or environmental harm or were not being made because residual levels of contamination associated with restricted conditions are ALARA, taking into account consideration of any detriments expected to potentially result from decontamination and waste disposal.	RH 3.16.4.3.7.1	The analysis will be part of any accelerated action or final action regulatory decision document for environmental media cleanup projects proposing restricted access.	X	X
Decommissioning Plan Contents – If proposing to use the criteria in RH 4.61.3 or RH 4.61.4 (restricted access), the plan must include an analysis demonstrating that if institutional controls were no longer in effect, the dose criteria of RH 4.61.3.3 (described below) will be met.	RH 3.16.4.3.7.3		X	X

Requirement	Citation	Compliance Strategy	Excavate	Stabilize or Treat
Decommissioning Plan will be approved by CDPHE if information therein meets RH 3.16 and RH 4.61, decommissioning is completed as soon as practicable, and the health and safety of the public is adequately protected.	RH 3.16.4.6	This section also specifies requirements for a long-term care warranty under RH 3.9.5.10 that may be required if using the criteria in RH 4.61.3 or RH 4.61.4 (restricted access). The RFCA Parties agree that further analysis is required to determine whether long-term care warranty requirements are relevant and appropriate to Rocky Flats. Planned implementation of Site-approved procedures to meet DOE Order 5400.5, *Radiation Protection of the Public and the Environment,* and the Site's IWCP process, which includes LRA involvement, will be described for proposed actions. The Closure Project Baseline is focused on achieving decommissioning as soon as practicable.	X	X
Site radiation survey to establish residual contamination levels and/or confirm absence of contamination. As appropriate, survey building/outdoor areas that contain residual radioactivity.	RH 3.16.6.2	Requirements for radiation surveys are met through the Reconnaissance Level Characterization Survey Plans and Pre-demolition Survey Plans for facility decommissioning and through SAPs and the IMP for ER.	X	X
Submittal of final survey report, units, and other information specifies, as appropriate, that gamma levels be reported at 1 meter from the surface in microrem/hour (hr), removable and fixed contamination in disintegrations per minute per 100 square centimeters (dpm/100 cm^2), and radioactive concentrations in picocuries per liter (pCi/L) or per gram. Identify instruments used and certify proper calibration/testing.	RH 3.16.6.3	Same as RH 3.16.6.2 above	X	X
Radiation Protection Program – To the extent practicable, procedures and controls used shall be based on sound radiation protection principles to achieve public doses that are ALARA.	RH 4.5.2	Planned implementation of Site-approved procedures to meet 10 CFR 835, *Occupational Radiation Protection*, DOE Order 5400.5, *Radiation Protection of the Public and the Environment,* and the Site's IWCP process, which includes LRA involvement, will be described for proposed actions.	X	X

Requirement	Citation	Compliance Strategy	Excavate	Stabilize or Treat
Radiation Protection Program – Imposes constraint on air emissions of radioactive material to the environment. "Individual member of the public likely to receive the highest dose" will not be expected to receive a total effective dose equivalent (TEDE) greater than 10 mrem/yr from air emissions. Requires exceedance reporting and corrective action to ensure against recurrence.	RH 4.5.4	Listed only for completeness of this table. NESHAP already identified as ARAR. Radionuclide NESHAP- required monitoring established at Site perimeter is used to determine potential for exposure to individual member of the public.	X	X
Dose Limits for Individual Members of the Public – TEDE from licensed operations less than 100 mrem/yr above background, exclusive of medical exposure and exposure from disposal by sanitary sewer. Dose rate in unrestricted areas less than 2 mrem/hr.	RH 4.14.1	Site-approved procedures to meet DOE Order 5400.5, *Radiation Protection of the Public and the Environment,* are based on the same dose rate limits.	X	X
Dose Limits for Individual Members of the Public – Surveys of radiation levels in unrestricted areas and radioactive materials in effluents released to unrestricted areas shall be made to demonstrate compliance with the dose limits for individual members of the public in RH 4.14.	RH 4.15.1	Surveys are conducted pursuant to Site-approved procedures to meet DOE Order 5400.5, *Radiation Protection of the Public and the Environment.* Radionuclide NESHAP- required monitoring established at Site perimeter is used to determine potential for exposure to individual member of the public. Surface water is monitored in accordance with the IMP and RFCA Attachment 5.	X	X
Dose Limits for Individual Members of Public – Provides the means to demonstrate compliance with RH 4.14: by measurement or calculation that dose does not exceed the annual limit or by demonstrating that annual average radioactive material concentration released in gaseous and liquid effluents at boundary of the unrestricted area does not exceed Appendix B, Table II, "Effluent Concentrations."	RH 4.15.2.1 and .2	Site-approved procedures to meet DOE Order 5400.5, *Radiation Protection of the Public and the Environment,* are based on the same dose rate limits. Radionuclide NESHAP required monitoring established at Site perimeter is used to determine potential for exposure to individual member of the public. Surface water is monitored in accordance with the IMP and RFCA Attachment 5.	X	X

Requirement	Citation	Compliance Strategy	Excavate	Stabilize or Treat
Surveys shall be made as necessary to evaluate radiation levels, concentrations of radioactive material and potential radiological hazards that could be present.	RH 4.17.1	Planned implementation of Site-approved procedures to meet 10 CFR 835, *Occupational Radiation Protection*, DOE Order 5400.5, *Radiation Protection of the Public and the Environment,* and the Site's IWCP process, which includes LRA involvement, will be described for proposed actions. Requirements for radiation surveys are met through the Reconnaissance Level Characterization Survey Plans and Predemolition Survey Plans for facility decommissioning and through SAPs and the IMP for ER.	X	X
Instruments and equipment used for qualitative radiation measurements must be calibrated at intervals not to exceed 12 months, unless otherwise noted by regulation.	RH 4.17.2		X	X
Waste Disposal – Shall dispose only by transfer to authorized recipient, by release in effluents within the limits of subpart RH 4.14 (discussed above), or as authorized pursuant to (pertinent to RFETS) RH 4.34, *Method for Obtaining Approval of Proposed Disposal Procedures,* or RH 4.35, *Disposal by Release into Sanitary Sewerage.*	RH 4.33	Transfer to authorized recipient is met through compliance with the "offsite rule," 40 CFR 300.440. Proposals for onsite disposal of radioactive waste (if any) will be part of any accelerated action, or any final action regulatory decision document for environmental media cleanup projects proposing specific disposal methods. RH Part 11, *Special Land Ownership Requirements,* which addresses requirements if government ownership of RFETS is transferred to private ownership, and RH Part 14, *Licensing Requirements for Land Disposal of Low Level Radioactive Waste,* will be reviewed for relevant and appropriate requirements for cleanup projects proposing specific disposal methods.	X	X
Radiological Criteria (for Decommissioning) – Determination of dose and residual activity levels which are ALARA must take into account consideration of any detriments expected to potentially result from decontamination and waste disposal.	RH 4.61.1.3	The analysis will be part of any accelerated action for environmental media cleanup projects and will be provided in the Notification unless it is included in the RSOP itself and any final action regulatory decision document. See the Radionuclide Soil Action Level (RSAL) Regulatory Analysis for the RFCA Parties understandings regarding implementation of the "Decommissioning Rule."	X	X

Requirement	Citation	Compliance Strategy	Excavate	Stabilize or Treat
Criteria for Unrestricted Use – Residual radioactivity above background has been reduced to levels that are ALARA and results in TEDE to the average member of the critical group that does not exceed 25 mrem/yr, including groundwater sources of drinking water.	RH 4.61.2	The analysis will be part of any accelerated action for environmental media cleanup projects and any final action regulatory decision document. See the RSAL Regulatory Analysis for the RFCA Parties understandings regarding implementation of the "Decommissioning Rule."	X	X
Criteria for Restricted Use – Must demonstrate that further residual radioactivity reductions to meet Unrestricted Use: 1. Would result in net public or environmental harm, OR 2. Are not being made because residual levels are ALARA.	RH 4.61.3.1	See the RSAL Regulatory Analysis for the RFCA Parties understandings regarding implementation of the "Decommissioning Rule."	X	X
Criteria for Restricted Use – 1. Provisions made for durable, legally enforceable institutional controls that provide reasonable assurance that TEDE to the average member of the critical group will not exceed 25 mrem/yr, AND 2. If institutional controls were no longer in effect, TEDE above background is ALARA and would not exceed either 100 mrem/yr OR 500 mrem/yr, if demonstrated that further reductions are not technically achievable, would be prohibitively expensive, or would result in net public or environmental harm.	RH 4.61.3.2 and .3	See the RSAL Regulatory Analysis for the RFCA Parties understandings regarding implementation of the "Decommissioning Rule."	X	X
Alternate (Decommissioning) Criteria 1. Analysis provides assurance that public health and safety would continue to be protected and unlikely that TEDE would be more than 100 mrem/yr. 2. Employment of restrictions on site use that minimize exposures at the site. 3. Doses are reduced to ALARA.	RH 4.61.4.1.1 through .3	See the RSAL Regulatory Analysis for the RFCA Parties understandings regarding implementation of the "Decommissioning Rule."	X	X

Figure 6. Framework for Conducting Routine Accelerated Actions for Radiologically Contaminated Soil

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Figure 7. Framework for Conducting Routine Accelerated Action for Nonradiologically and Uranium-Contaminated Soil

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- When COC concentrations are below RFCA soil ALs, an evaluation of whether an accelerated action is necessary to protect surface water and/or ecological resources shall be done:

– Protection of surface water will be based on an evaluation of whether the contaminated soil source could cause an exceedance of surface water standards in accordance with ALF Section 2. This evaluation will consider whether environmental pathways and sufficient quantity of COCs exist that could cause an exceedance. An evaluation may also consider the chemical and physical characteristics of COCs, the potential for natural attenuation, and whether a groundwater intercept system does or will exist.

– Protection of ecological resources will be based on an evaluation triggered by an exceedance of ecological ALs in Table 3 in ALF. This evaluation will include the considerations listed in Section 4.2.C of ALF. Section 5.2.2 contains additional information regarding the accelerated action ecological screening process.

- When analytical results indicate a hot spot is present according to the elevated measurement comparison in the IASAP (DOE 2001a) and BZSAP (DOE 2002a).

A detailed description of the data aggregation, analysis, and hot spot determination is presented in the IASAP (DOE 2001a) and BZSAP (DOE 2002a).

5.2.1 Radionuclide-Contaminated Soil

Radionuclide-contaminated soil with Pu and/or Am activities greater than RFCA soil ALs between 0 and 3 ft will be removed. When Pu and/or Am soil activity between 3 and 6 ft below the surface exceeds the areal or volumetric extent for Pu and/or Am contamination levels specified in Table 4, removal will be triggered. When soil removal is initiated below 3 feet through application of Table 4 criteria, removal will continue in lifts between 3 and 6 feet until activity levels less than 1 nanocurie per gram (nCi/g) are achieved. Subsurface soil samples are 2-ft thick intervals of soil at given depths below the surface. Therefore, sampling locations that cover an 80-square-meter (m^2) area represent characterized volumes of approximately 50 m3 for each 2-ft thick soil sample. Soil from deeper than 6 ft with Pu and/or Am activities greater than 3 nCi/g will be evaluated for removal as diagramed on Figure 6.

Table 4. Contamination and Extent Trigger Levels for Pu- and/or Am-Contaminated Soil Removal

Contamination Level (nCi/g)	Areal Extent Limit (m^2)	Volume Extent Limit (m^3)
7	0	0
6	40	25
5	50	31
4	60	37
3	80	50

During the accelerated action, DOE and the LRA will evaluate whether ALARA or stewardship considerations would warrant additional remedial action. Generally, additional action will be limited to the "one more equivalent measure" concept and will be based on whether additional removal would eliminate the need for future stewardship actions. In general, meeting the RFCA soil AL in the top 3 ft of radiologically contaminated soil satisfies ALARA.

In accordance with Section 5.3.C.5 of ALF, if contamination between 1 and 3 nCi/g is found between 3 and 6 feet in depth at multiple sampling points for an IHSS or group of IHSSs in close proximity, DOE and the LRA will evaluate the potential exposure risk and consult with the community regarding the need for further action.

5.2.2 Accelerated Action Ecological Screening Process

In addition to meeting the RFCA WRW AL, accelerated actions will be based on reducing risk to ecological receptors. The accelerated action ecological screening process is separated into two distinct methodologies to develop decisions for Preble's Meadow Jumping Mouse (PMJM) and non-PMJM for protecting overall populations or communities. Once the accelerated action ecological screening process is complete, maps will be prepared of the site that delineate targeted areas for ecological evaluation. These maps, professional judgement, and agency consultation will be used to determine the appropriate action. The professional judgement and consultation process will consider factors that may mitigate risk estimates such as bioaccumulation factors and spatial distribution, and whether habitat destruction during an accelerated action could be more harmful than the presence of the contaminant. The evaluation could also indicate that additional sampling is required before a decision can be made.

Once the accelerated action ecological screening process is defined and the maps have been prepared, the information will be included in this document as Appendix D.

5.3 ROUTINE ACTIONS

The term "routine" as used in the ER RSOP is generally consistent with other industry definitions of the term (i.e., activities of a repetitive nature guided by procedures). Three key considerations support the ER RSOP concept of routine (versus nonroutine):

1. All ER RSOP actions involve the excavation of soil and associated debris. Furthermore, the range of PCOCs is fairly narrow and remediation options are limited.

2. Although both the amount of contamination and configuration of contaminant release sites vary, the remediation options remain limited. The variation in configuration and amount of contamination may change the complexity of the cleanup action; however, the essential repetitiveness of the remediation remains the same. Variations in complexity are addressed through application of the appropriate work controls.

3. Nonroutine remediation actions are those that require special engineering design and/or regulatory agency approval. These actions are not covered under the ER RSOP and include closure of the two landfills and the SEP, remediation of groundwater plumes, the 903 Lip Area and Am Zone.

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Remediation through excavation of contaminated soil and associated Original Process Waste Lines (OPWL) at IHSSs, PACs, and UBC sites and OPWL outside of IHSSs, PACs, and UBC sites, including the sealing of pipes, is covered under this ER RSOP.

It is anticipated that contaminated soil and debris in all IHSSs, PACs, and UBC sites, except those excluded above, will be remediated under the ER RSOP. This would include the OPWL, New Process Waste Lines (NPWL), sanitary sewers, and storm drains, as well as several other belowground structures (slabs, foundation drains, sumps, tanks, and other structures) that will not be dealt with during decommissioning.

Figure 8 illustrates the difference between routine and nonroutine actions. As shown in this figure, the decision whether an action is routine can be made before remediation or may be made during remediation when more information is available. If the contamination can be remediated through excavation, it is routine. If the excavation technique is not described in the ER RSOP, a modification will be developed before remediation proceeds. If special work controls are required, they are developed and implemented before remediation. If, during remediation, unanticipated complexities are encountered, a decision whether the contamination can be remediated through excavation is made. If the contamination can be remediated through excavation, work is paused and additional work controls are evaluated and implemented.

Figure 8. Routine versus Nonroutine Actions

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If DOE were confident (before remediation started) that remediation would require more than excavation (e.g., excavation plus a diversion ditch), a Proposed Action Memorandum (PAM) or IM/IRA would be developed instead of invoking the ER RSOP. Figure 8 also illustrates the sequence of events for routine actions where debris, incidental water, or high contaminant levels are found.

5.4 SCREENING OF ALTERNATIVES

Four alternatives were screened for RFCA accelerated actions for routine soil removal of IHSSs at RFETS:

1. No Accelerated Action;

2. Removal of Soil based on Wildlife Refuge Worker Land Use Scenario;

3. Removal of Soil Based on the Rural Resident Land Use Scenario; and

4. Cover in Place.

These alternatives were identified as the most viable alternatives that apply to the soil COCs. One alternative that was eliminated from further screening was removal of soil to March 21, 2000, RFCA ALs. This alternative was not considered because the RFCA Parties believe the RFCA soil ALs (DOE et al. 2003) provide greater overall risk reduction than the March 21, 2000, RFCA ALs. While potential impacts to surface water standards were considered in evaluating the alternatives, this document does not address the remediation of groundwater or surface water contamination. To the extent possible, previous actions for similar situations were used to provide information for the analysis. The alternatives were evaluated for effectiveness, implementability, and cost consistent with RFCA Appendix 3, IGD Appendix B, Preparation of an Environmental Restoration (ER) IM/IRA document (DOE et al. 1999).

5.4.1 Alternative 1: No Accelerated Action

Under this alternative, no additional accelerated action would be taken at individual IHSSs or IHSS groups. Short- and long-term surface water monitoring would continue to monitor surface water quality with respect to the standards. Individual institutional controls beyond current access and management controls would not be identified for each IHSS; however, specific institutional controls would be included, as appropriate, in the final remedy selected for RFETS. Contamination associated with the OPWL will be left in place. While an alternative may include monitoring and still be considered "no action" (EPA 1999), because this alternative would require institutional controls, it may be considered "no further accelerated action."

Effectiveness

Effectiveness considers whether the alternative provides protection of human health and the environment.

Protectiveness

In the short term, there would likely be no increased adverse impact to water quality, or increases in toxic fumes, fugitive dust emissions, or transportation of hazardous and/or radioactive materials, because no soil would be disturbed by an accelerated action (Section 13.0). However, contaminated surface soil may continue to migrate. Subsurface soil could become exposed or contribute to groundwater and/or surface water impacts, and ecological receptors may be impacted. There would likely be no adverse impact to worker health and safety because workers would not be exposed to contaminated soil (Section 8.0). However, this alternative would not be effective for overall protection of human health and the environment in the long term, nor would all the ER RSOP RAOs or ARARs be achieved, because "no accelerated action" would leave soil in place with contamination greater than the CERCLA risk range.

Achieve Remedial Objectives

Soil RAOs would not be achieved. In the short and long term, the toxicity, volume of contamination, and mobility, including migration of contaminants by erosion or infiltration, would not be reduced because this alternative does not include any level of treatment or containment. Residual contamination would be a concern because "no accelerated action" would leave soil in place with contamination greater than the CERCLA risk range. Under this alternative, existing Site management and access controls would be maintained until a comprehensive final remedy (i.e., long-term solution including institutional controls) is implemented in the future. Costs for short-term care, monitoring, controls, and so forth will continue to accrue.

<u>Implementability</u>

Implementability addresses the technical and administrative feasibility of implementing an alternative and the availability of the services and materials required.

Technical Feasibility

This alternative is technically feasible because (1) there are no construction or operation requirements; (2) successful performance can be demonstrated; (3) the alternative does not require any adaptation to environmental conditions; and (4) there is no need for permits. However, "no accelerated action" could result in additional institutional controls for the site and increased monitoring either through additional monitoring stations or longer-term monitoring.

Availability of Services and Materials

The availability of field equipment, (e.g., backhoes and offsite treatment and disposal facilities) would not be required. However, personnel and services, monitoring, and outside laboratory testing may be required in the short and long term to address any increased monitoring that may be required. Removal would not occur under this alternative; therefore, there would be no post-removal site control requirements. However, as noted above, short- and long-term Site management and access controls would be required.

Administrative Feasibility

This alternative is administratively feasible because there is no need for coordination with other offices or agencies for permits, easements or right-of-ways, or zoning variances. There may be an impact to adjoining property if contamination were to migrate offsite. Under this alternative, existing Site management and access controls would be maintained until a comprehensive final remedy (i.e., long-term solution including institutional controls as appropriate) is implemented in the future. Costs for short-term care, monitoring, controls, and so forth would continue to accrue.

This alternative is not acceptable to the State or local communities.

Costs

Evaluation of costs should consider the capital costs to engineer, procure, and construct the required equipment and facilities, and the operating and maintenance costs associated with the alternative.

Capital Cost

In the short term, this would be an inexpensive alternative to implement because Site management and access controls are already in place pursuant to closure project work. Capital costs may be incurred if additional fences or structures to prevent access are required or if additional monitoring is required, and perhaps for longer periods if nothing is done soon and the spread of contamination were to occur.

Operation and Maintenance

Costs of additional institutional controls and long-term monitoring costs associated with this alternative will be on the order of $10 million each year during the first five years after the Site is closed. It is anticipated that yearly costs after this time will be reduced to approximately $2 million or $3 million.

Present Worth Cost

This analysis was not completed. It is assumed that the alternative would be implemented fairly soon; therefore, today's dollars are a fair estimate.

5.4.2 Alternative 2: Removal of Soil Based on Wildlife Refuge Worker Land Use Scenario

Under this alternative, soil with contaminant concentrations greater than RFCA Attachment 5 soil ALs (DOE et al. 2003) will be removed following the framework in ER RSOP Figures 6 and 7. This framework implements the Action Determinations required by RFCA Attachment 5, Sections 4.2 and 5.3. This soil removal action could occur with offsite disposal with or without onsite or offsite treatment unless treatment reduces contamination to levels below the RFCA soil ALs, in which case the soil may be returned to the RFETS environment. Contamination associated with OPWL will be addressed as described in Section 6.0 of this ER RSOP.

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Under this alternative, soil with contaminant concentrations greater than RFCA Attachment 5 soil ALs (DOE et al. 2003) will be removed following the framework in Figures 6 and 7. This framework implements the Action Determinations required by RFCA Attachment 5, Sections 4.2 and 5.3 and calls for additional excavation beyond that required by RFCA soil ALs if necessary to protect ecological resources and surface water standards at a POC.

Excavated soil will be shipped offsite for disposal with or without onsite or offsite treatment unless treatment reduces contamination to levels below RFCA soil ALs, in which case the soil may be returned to the RFETS environment (see RFCA Attachment 5, Section 1.1, Put Back Levels). It is anticipated that thermal desorption will be used as the onsite treatment method (Section 6.5.2).

Effectiveness

Effectiveness considers whether the alternative provides protection of human health and the environment.

Protectiveness

In the short term, there may be adverse impacts to surface water quality, and an increase in fugitive dust emissions, toxic fumes, and transportation of hazardous and/or radioactive material (Section 13.0). Potential impacts to water and air would be temporary and controllable with mitigation measures (Section 7.0). There would be an impact to worker health and safety because workers would be exposed to contaminated soil. These impacts could be controlled with mitigation measures (Section 8.0).

This alternative would be protective of human health and the environment in the long term because removal to RFCA soil ALs described in ALF (DOE et al. 2003) would be protective of the future surface users (WRWs and ecological receptors) and achieve ARARs. Soil left in place above the RFCA soil ALs would only be left after consultation with the regulatory agencies. The radionuclide ALs would protect a rural resident in the event the land use is not restricted to a wildlife refuge. This alternative would reduce toxicity, mobility, and volume of contamination, which would reduce the risk posed to the public, WRWs, ecological receptors, and surface water quality.

Achieve Remedial Objectives

The first RAO would be achieved because the RFCA soil ALs are calculated to protect refuge workers and ecological receptors respectively. Processes are in place to evaluate impacts to the WRWs, ecological receptors, and surface water standards. The level of treatment or containment would be high because contaminated soil that could impact a WRW, ecological receptor, or surface water standard would be removed. Under this alternative, existing Site management and access controls would be maintained until a comprehensive final remedy (i.e., long-term solution including institutional controls as appropriate) is implemented in the future. Costs for short-term care, monitoring, controls, and so forth would continue to accrue.

Contaminated soil removal based on RFCA Attachment 5 ALs would contribute to the efficient performance of the final remedy because IHSSs are generally smaller than the exposure unit areas used to calculate the ALs. Thus, when applied across a larger exposure unit area, the risk resulting from any residual soil contamination after an accelerated action (in many instances essentially all contamination would be eliminated by the removal of soil with contaminant concentrations greater than RFCA ALs) would likely be at the low end of the CERCLA risk screen for the reasonably anticipated future land use.

This alternative would be protective of human health and the environment in the long term because removal to the depths described in ALF (DOE et al. 2003) would be protective of the reasonably anticipated future surface user (i.e., the WRW). DOE would remove contaminated soil with nonradionuclide and U-contaminant concentrations exceeding RFCA soil ALs until contaminant concentrations are less than the RFCA soil AL or to a depth of 6 inches. DOE would remove radiologically contaminated material to activities less than 50 pCi/g or to a depth of 3 ft.

Under this alternative, between 3 and 6 ft below the surface, the Subsurface Soil Risk Screen will be used to evaluate whether additional removal is required. Soil with areal or volumetric extent exceeding the values listed in Table 4 would be removed to an activity less than 1 nCi/g. This has been established to limit the potential annual radiation dose to a WRW or rural resident surface user to meet decommissioning rule dose-based standards and prevent unacceptable risk to a WRW. In characterizing subsurface soil, the samples represent a 2-ft-thick interval of soil. Therefore, an 80-m^2 area represents a characterized volume of approximately 50 m^3.

Between 3 and 6 ft, the principle of ALARA would be applied such that if additional excavation incidental to removal of soil contamination already being removed would result in significant additional source removal, then the additional removal would occur. This would be implemented by removing one equivalent measure of soil when an activity of 1 nCi/g has been achieved.

Under this alternative, ER RSOP Figure 6 would be followed and applied to decisions for residual contamination below 6 ft. The evaluation would focus on whether a reasonable exposure pathway to the anticipated surface user could cause exposure above the action objectives. Therefore, when RFCA soil ALs are exceeded at depths greater than 6 ft in high erosion areas and when a sufficient quantity of COCs exists that would cause an exceedance of surface water standards, additional excavation would occur. Common WRW activities at other wildlife refuges include post-hole digging, vegetation management, and road maintenance. These activities do not require soil excavation deeper than 6 ft. In addition, in general, burrowing animals do not burrow to depths greater than 6 ft, and consequently do not bring disturbed, contaminated soil from below this depth to the surface. Where uncertainty regarding appropriate action exists for contamination deeper than 6 ft, the consultative process among the RFCA Parties will be invoked.

Implementability

Implementability addresses the technical and administrative feasibility of implementing an alternative and the availability of the services and materials required.

Technical Feasibility

This alternative is technically feasible because removal would be implemented using standard construction equipment and operations. Currently, an experienced workforce, with specific excavation experience at RFETS, is in place and has demonstrated through previous performance that it can implement routine soil accelerated actions in accordance with the ER RSOP using safe and compliant techniques. This alternative is technically adaptable to environmental conditions as field decisions can be made fairly quickly if more or less soil needs to be removed. Endangered Species Act considerations will be evaluated on a project-by-project basis and any wetland issues could be accommodated by mitigation or restoration.

Based on accelerated actions taken to date, it is anticipated that removal would result in contaminant concentrations below the RFCA soil ALs. This would contribute to the efficient performance of the final remedy.

Availability of Services and Materials

Standard construction equipment and trained personnel are readily available to implement this alternative. Offsite laboratory testing services and treatment and disposal facilities exist for the contaminated soil that will be excavated during the actions in the short-term; however, the availability of these facilities in the future cannot be predicted. Post-removal Site control would be required.

Administrative Feasibility

This alternative is administratively feasible because there would be no need for coordination with other offices and agencies for permits, easements or right-of-ways, or zoning variances. There may be an impact to adjoining property if contamination were to migrate offsite. Under this alternative, existing Site management and access controls would be maintained until a comprehensive final remedy (i.e., institutional controls as appropriate) is implemented in the future. Costs for short-term care, monitoring, controls, and so forth would continue to accrue.

This alternative is believed to be acceptable to the State and local communities.

Costs

Evaluation of costs should consider the capital costs to engineer, procure, and construct the required equipment and facilities, and the operating and maintenance costs associated with the alternative.

Capital Cost

Removal of soil under this alternative would cost approximately $200 million. This is based on an estimated 180 acres and 160,000 cubic yards (cy) of soil that would be removed (characterization, removal, backfill, and treatment).

Operation and Maintenance

Long-term operation and maintenance costs are expected to be low because contaminated soil that could adversely impact the WRWs, ecological receptors, or water quality standards would be removed. Long-term stewardship costs would be reduced by approximately $1 million or $2 million per year from the no accelerated action alternative.

Present Worth Cost

This analysis was not completed. It is assumed that the alternative would be implemented fairly soon; therefore, today's dollars are a fair estimate.

5.4.3 Alternative 3: Removal of Soil Based on the Rural Resident Land Use Scenario

Under this alternative, soil contaminated above levels that pose a lifetime excess cancer risk of 1×10^{-6} to a rural resident would be removed. The rural resident scenario is not a reasonably anticipated future use of RFETS. Because a rural residential user may build a structure that includes a basement, removal to a depth of 10 ft is included in this alternative.

Under this alternative, soil with contaminant concentrations greater than RFCA Appendix 3, RFCA IGD, Appendix N, Programmatic Remediation Goals (PRGs), for the rural residential scenario would be removed. This soil removal action could occur with offsite disposal with or without onsite or offsite treatment unless treatment reduces contamination to levels below rural residential PRGs, in which case the soil could be used as backfill.

<u>*Effectiveness*</u>

Effectiveness considers whether the alternative provides protection of human health and the environment.

Protectiveness

In the short term, there would be an increased adverse impact to water quality, and an increase in toxic fumes, fugitive dust emissions, and transportation of hazardous and/or radioactive material. However, potential impacts to water and air would be temporary and controllable with mitigation measures (Section 7.0). There would be a potentially adverse impact to worker health and safety because workers would be exposed to contaminated soil and would be involved in potentially extensive excavation of surface and subsurface soil (Section 8.0). During remediation, there may be the potential of an increased adverse impact to the public at the Site boundary. There could also be an increased adverse impact to ecological receptors during remediation because additional areas of the Site would be disturbed. In the long term, this alternative would be effective for overall protection of human health and the environment because unrestricted use could be allowed at RFETS. ARARs would be achieved.

Achieve Remedial Objectives

Soil RAOs would be surpassed because more soil would need to be excavated to protect rural resident use levels than to protect a WRW. In the short and long term, the toxicity, volume of contamination, and mobility, including migration of contaminants by erosion or infiltration, would be reduced. The level of treatment or containment would be high because all contaminated soil above unrestricted use levels would be removed. There would be no long-term concern over residual effects. No additional Site management, access controls, or long-term solution would be required for areas where soil was removed in accordance with this RSOP after all accelerated actions were completed. Costs for short-term care, monitoring, controls, and so forth would decrease.

Implementability

Implementability addresses the technical and administrative feasibility of implementing an alternative and the availability of the services and materials required.

Technical Feasibility

This alternative is technically feasible because removal would be implemented using standard construction equipment and operations; however, some excavations may be in areas that pose some difficulties (e.g., work around buried utilities, fairly deep excavations) and may require specialized equipment and shoring techniques. Shallow groundwater infiltration into excavations in the range of 10 ft below the surface may pose excavation problems. Currently, an experienced workforce, with specific excavation experience at RFETS, is in place and has demonstrated through previous performance that it can implement routine soil accelerated actions in accordance with the ER RSOP using safe and compliant techniques. However, the large soil volumes that may need to be removed from the subsurface may require special techniques and might not be implemented quickly.

This alternative is technically adaptable to environmental conditions as field decisions can be made fairly quickly if more or less soil needs to be removed. Endangered Species Act considerations will be evaluated on a project-by-project basis and any wetland issues could be accommodated by mitigation or restoration.

This alternative would contribute to the efficient performance of the final remedy.

Availability of Services and Materials

Standard construction equipment and trained personnel are readily available to implement this alternative, except that some excavation areas may be difficult to work with standard equipment e.g., buried utilities and very deep excavations. Offsite laboratory testing services and treatment and disposal facilities exist for the contaminated soil that would be excavated during the action in the short term; however, the future availability of these facilities cannot be predicted. This alternative could require more offsite disposal capacity for soil that cannot be treated or returned to the environment than other alternatives, and additional acquisition of soil that may be needed for backfill purposes. Post-removal site control would not be required.

Administrative Feasibility

This alternative is administratively feasible because there is no need for coordination with other offices or agencies for permits, easements or right-of-ways, or zoning variances. There may be a

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short-term impact to adjoining property if contamination were to migrate offsite; however, the potential long-term impact would be removed. Under this alternative, existing Site management and access controls would be maintained until all accelerated actions are complete. There would be no need for long-term Site management, access controls, or institutional controls. Costs for short-term care, monitoring, controls, and so forth would continue to accrue until all of the accelerated actions were complete, but would decrease over time as removals were completed.

This alternative is believed to be acceptable to the State and local communities.

<u>Costs</u>

Evaluation of costs should consider the capital costs to engineer, procure, and construct the required equipment and facilities, and the operating and maintenance costs associated with the alternative.

Capital Cost

Removal of soil under this alternative would cost approximately 100 times more than Alternative 2. This is based on the approximately 980 acres and 16,000,000 cy of soil that would be removed (characterization, remediation, backfill, and treatment).

Operation and Maintenance

Long-term operation and maintenance costs are expected to be low because contaminated soil will be removed to allow for unrestricted use of RFETS. Long-term stewardship costs would be reduced and potentially eliminated.

Present Worth Cost

This analysis was not completed. It is assumed that the alternative would be implemented fairly soon; therefore, today's dollars are a fair estimate.

5.4.4 Alternative 4: Cover in Place

Because special engineering design and regulatory approval would be required for a cover, this alternative is nonroutine and could not be implemented under the ER RSOP; a separate decision document would be required. Under this alternative, a cover would be designed to be protective of the reasonably anticipated future land users: WRWs, ecological resources, and surface water quality standards. The cover would be installed over soil that exceeds RFCA Attachment 5 soil ALs (DOE et al 2003). No soil would be removed. Therefore, although characterization would be conducted, contamination associated with OPWL would be left in place.

<u>Effectiveness</u>

Effectiveness considers whether the alternative provides protection of human health and the environment.

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Protectiveness

Because of the dispersion of IHSSs in the IA and the impracticality of covering individual IHSSs, it is anticipated that the cover would be placed over the majority of the IA and 100 acres in the BZ. In the short term, there may be an adverse impact to water quality, fugitive dust emissions, and the public and workers because of the transportation and placement of fill material that would be required for a cover. No toxic fumes would be expected. In the long term, overall human health and the environment would be protected because contact with soil with contaminant concentrations greater than RFCA soil ALs would be eliminated. The areas of the Site considered under this alternative are neither RCRA-permitted nor have interim status; therefore, the cover would be designed to meet the RAOs and not RCRA cap or cover requirements. All ARARs, except for Nuclear Regulatory Commission (NRC) ARARs, would be attained.

Achieve Remedial Objectives

Soil RAOs would be achieved, after the accelerated action is in place, because there would be no contact with soil above the RFCA soil ALs. The level of treatment or containment would be high because the exposure pathways to contaminated soil that could impact WRWs, ecological receptors, or surface water standards would be eliminated. Because contaminated soil would not be removed, residual effects would remain a long-term concern. Under this alternative, existing Site management and access controls would be maintained until a comprehensive final remedy (i.e., institutional controls as appropriate) is implemented in the future. Costs for short-term care, monitoring, controls, and so forth would continue to accrue.

Implementability

Implementability addresses the technical and administrative feasibility of implementing an alternative and the availability of the services and materials required.

Technical Feasibility

This alternative is technically feasible because a cover would be implemented using standard construction equipment and operations. Currently, there is an experienced workforce with demonstrated performance in place that could implement this alternative using safe and compliant techniques. This alternative is technically adaptable to environmental conditions. Endangered Species Act considerations will be evaluated on a project-by-project basis and any wetland issues could be accommodated by mitigation or restoration.

Availability of Services and Materials

While standard construction equipment is readily available, trained personnel are not readily available to implement this alternative. Soil would need to be located, procured, and transported to RFETS. Offsite laboratory testing services exist if needed in the short term; however, the future availability of these facilities cannot be predicted. Treatment and disposal facilities would not be needed. Because removal would not occur under this alternative, post-removal Site

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control would not be required; however, short- and long-term Site management and access controls would be needed.

Administrative Feasibility

Because special engineering design and regulatory approval would be required for a cover, this alternative is nonroutine and could not be implemented under the ER RSOP; a separate decision document would be required. This alternative is otherwise administratively feasible because there would be no need for coordination with other offices or agencies for permits, easements or right-of-ways, or zoning variances. There could be an impact to adjoining property if the cover was to fail and contamination was to migrate offsite. Under this alternative, existing Site management and access controls would be maintained until a comprehensive final remedy (i.e., institutional controls as appropriate) is implemented in the future. Costs for short-term care, monitoring, controls, and so forth would continue to accrue.

This alternative is not believed to be acceptable to the State and local communities.

Costs

Evaluation of costs should consider the capital costs to engineer, procure, and construct the required equipment and facilities, and the operating and maintenance costs associated with the alternative.

Capital Cost

Constructing a cover in place would cost approximately 10 times more than Alternative 2. This is based on the 502 acres (IA and BZ) that would need to be covered, and the capital costs to engineer, procure, and construct the cover, as well as equipment and personnel costs.

Operation and Maintenance

Operation and maintenance costs would be high. Long-term stewardship costs would be approximately the same as those in Alternative 2.

Present Worth Cost

This analysis was not completed. It is assumed that the alternative would be implemented fairly soon; therefore, today's dollars are a fair estimate.

5.4.5 Comparative Analysis of Alternatives

Four alternatives passed the initial screening based on effectiveness, implementability, and cost. These alternatives are compared with each other in this section. The purpose of the comparative analysis is to identify the advantages and disadvantages of each alternative relative to the others so that one alternative can be identified as the recommended action.

Table 5 presents a comparative analysis of alternatives based on a semiquantitative ranking system that considers effectiveness, implementability, and cost. Each category has been scored either low (L), medium (M), or high (H). A low score means that the criteria cannot be achieved, a medium score means that the criteria can be achieved most of the time, and a high score means that the criteria will always be achieved or is not required under the alternative.

Environmental consequences were scored 1 through 3. A score of 1 means that the consequence is low, a score of 2 means that the consequence is moderate, and a score of 3 means that the consequence is high.

Alternative 2 is identified as the preferred alternative for accelerated actions. Alternatives 1 and 4 are not recommended because of their low acceptance to State and local communities. Although Alternative 3 is acceptable to the State and local communities, the benefit gained by attempting to remove soil to allow for rural residential use does not outweigh the high cost. Alternative 2 is the preferred alternative because of its overall protection of human health and the environment, its ability to achieve the RAOs, and its demonstration of acceptable performance and implementability on previous actions taken at RFETS.

5.5 LONG-TERM STEWARDSHIP

Accelerated action planning and implementation include consideration of long-term stewardship goals. The stewardship evaluation, conducted during the accelerated action planning process, takes into account potential post-closure actions so that accelerated actions are consistent with the RFCA Vision for long-term stewardship. The results of the stewardship evaluation, which will include whether additional remediation is warranted, will be documented in the ER RSOP Notification. The results of the stewardship evaluation (Figure 9) will be used during the accelerated action implementation in conjunction with the ALARA process.

Many of the stewardship controls will be applied on a sitewide basis and will not be affected by individual actions discussed in this RSOP. DOE will consider additional remediation beyond ALs in those cases where remediation would eliminate the need for specific institutional controls.

5.5.1 Accelerated Actions

In accordance with the framework for conducting routine accelerated actions for contaminated soil (Section 5.2), protection of surface water will be considered through the subsurface risk screen process. Additionally, when removal of the contaminants is the action, long-term stewardship considerations are unlikely to lead to any modification of the type of action to be undertaken but could affect the extent of the action. The ER RSOP also includes work controls and procedures to protect human health and the environment during accelerated actions. Long-term adverse impacts from the actual remediation activities are not expected.

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Table 5. Comparative Analysis of Alternatives

Screening Criteria	Alternative 1: No Remedial Action	Alternative 2: Removal of Soil Based on Wildlife Refuge Worker Land Use Scenario	Alternative 3: Soil Removal Based on the Rural Resident Use Scenario	Alternative 4: Cover in Place
Effectiveness				
Protectiveness				
Human health protection	L	M	H	M
Workers protection	H	M	H	M
Environmental protection	L	M	H	M
ARAR attainment	L	H	H	L
Achieve Remedial Objectives				
Level of treatment/ containment	L	M	H	H
No residual effect concerns	L	M	H	L
Control until long-term solution implemented	H	H	H	H
Implementability				
Technical Feasibility				
Construction and operation	H	H	H	H
Demonstrated performance	H	H	H	L
Adaptable to environmental conditions	L	H	H	H
Need for permits	H	H	H	H
Availability of Services and Materials				
Equipment	H	H	H	H
Personnel and services	H	H	H	L
Outside laboratory testing	H	H	H	H
Offsite treatment and disposal	H	H	H	H
Post-removal site control	H	H	H	H
Administrative Feasibility				
Permits required	H	H	H	H
Easements or right-of-ways required	H	H	H	H
Impact on adjoining property	H	M	H	M
Ability to impose institutional controls	H	H	H	H

Screening Criteria	Alternative 1: No Remedial Action	Alternative 2: Removal of Soil Based on Wildlife Refuge Worker Land Use Scenario	Alternative 3: Soil Removal Based on the Rural Resident Use Scenario	Alternative 4: Cover in Place
Acceptable to State and local communities	L	M	H	L
Costs				
Capital cost	H	M	L	L
Operation and maintenance	H	H	H	L
Present worth cost	NA	NA	NA	NA
Environmental Consequences				
Soil and geology	1	2	3	1
Air quality	1	2	3	1
Water quantity and quality	1	3	3	3
Human health and safety	1	2	3	1
Ecological resources	1	2	2	3
Cultural resources	1	1	1	1
Visual changes	1	1	1	3
Noise	1	2	2	2
Transportation	1	2	3	3
Socioeconomics/ Environmental justice	1	1	1	1
Cumulative effects	1	2	2	2
Unavoidable adverse effects	1	1	1	1
Short-term uses versus Long-term productivity	1	3	3	2
Irreversible and irretrievable commitments of resources	1	2	3	3

Figure 9. Stewardship and ALARA Process Overview

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In accordance with RFCA, excavation to RFCA soil ALs, in accordance with the framework for conducting routine accelerated actions for contaminated soil (Figures 6 and 7), is considered protective of human health and the environment for the anticipated land use. However, additional long-term stewardship considerations may impact decisions made in accordance with this RSOP.

Evaluation of long-term stewardship criteria is incorporated into the planning process. The stewardship evaluation will be conducted during the planning process, because all of the stewardship evaluation criteria, except the amount of contamination in soil, will be known at that time. The stewardship evaluation will be conducted by ER staff in consultation with the regulatory agencies to determine whether additional remediation is required and will be included in the ER RSOP Notification. Accelerated action remediation goals may be modified by results of the stewardship and ALARA evaluations. When accelerated action remediation goals are achieved, confirmation samples will be collected and the remediation area will be surveyed. Based on the amount and configuration of residual contamination, near-term requirements will be implemented and long-term recommendations for institutional or physical controls will be documented in the Closeout Report. Stewardship recommendations will be summarized yearly for use in the RI/FS and RFETS Stewardship Plan. Remediation data, including levels and location of residual contamination, if any, will be documented in the Closeout Report and archived for use in the RI/FS, CRA, and CAD/ROD.

The long-term stewardship evaluation includes the following:

- Proximity to other contaminant sources;
- Surface water protection;
- Monitoring requirements; and
- Near-term and long-term institutional controls or physical controls.

Figure 9 illustrates an overview of the long-term stewardship evaluation and its relationship to ALARA and remediation activities. This stewardship evaluation will consider the factors shown on Figure 9 and described in the following sections.

Proximity to Other Contaminant Sources

Surrounding and adjacent IHSS Groups may influence post-remediation impacts from IHSS Group remediations. These impacts are best considered in whole rather than individually so that institutional controls and monitoring requirements can be consolidated. Combining stewardship considerations for these areas could result in additional remediation and/or more effective stewardship actions especially if engineered controls are needed. For example, when an IHSS Group is isolated from other contaminant sources, additional remediation will be considered. This could result in a reduction of potential future institutional controls over large areas.

Surface Water Protection

In accordance with the framework for conducting routine accelerated action for contaminated soil (Section 5.2), protection of surface water will be ensured through a separate evaluation step.

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Accelerated actions taken under this RSOP contribute to long-term stewardship through source removal. Additionally, future RFCA decision documents regarding surface water quality may impact this RSOP approach.

Areas where soil is remediated in accordance with the framework for conducting routine accelerated actions for contaminated soil (Section 5.2) will be backfilled according to Section 6.11, stabilized, and revegetated in order to prevent erosion of soil with residual contamination into surface water.

Where a pathway to surface water exists, either by overland flow or groundwater transport, the following questions will be addressed:

- What are the most direct surface and subsurface pathways to surface water?
- Do characterization data indicate there are COCs in soil of sufficient quantity to impact surface water?
- Do monitoring results from points of evaluation (POEs) or POCs (Figure 10) indicate there are surface water impacts from the area under consideration?
- Is the IHSS Group in an area with high erosion potential, based on ALF Figure 1 (DOE et al. 2003)?
- Is there evidence of groundwater contamination above RFCA ALs downgradient of the IHSS Group?

If additional remediation and/or management are indicated, the consultative process will be used to determine the following:

- Remediation targets (area and COCs), if necessary; and
- Management actions, if necessary, which may include stabilization, monitoring, or best management practices (BMPs).

Monitoring

Current surface water and groundwater monitoring networks are shown on Figures 10 and 11, respectively. The current monitoring system may be modified by addition of surface water or groundwater performance monitoring stations in accordance with the IMP. The evaluation of monitoring requirements will be based on the following:

- Do monitoring results from POEs or POCs (Figures 10 and 11) and performance monitoring stations indicate there are groundwater or surface water impacts from the area under consideration?

Figure 10. Surface Water Monitoring Locations

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Figure 11. Groundwater Monitoring Locations

- Can the impact be traced to a specific IHSS Group?
- Will additional remediation reduce the cost of long-term monitoring?
- Are additional monitoring stations or wells needed?
- Can existing monitoring locations be deleted if additional remediation is conducted?

If the impacts can be traced to a specific IHSS Group, additional remediation or monitoring may be indicated. If additional remediation or monitoring is indicated, the consultative process will be used to determine additional remediation targets or the type and placement of additional monitoring stations.

The benefit of conducting additional remediation to reduce long-term monitoring requirements will be evaluated during remediation in conjunction with the ALARA evaluation. This evaluation will include a soil volume estimate, remediation costs, and disposal costs to reduce contamination to appropriate levels. These costs will be compared to the cost of reducing long-term monitoring requirements. Long-term monitoring costs will be described in the Stewardship Plan.

Performance monitoring stations will be used, if necessary, to provide additional monitoring around areas during remediation. Additional monitoring may be required at sites that are not remediated to RFCA soil ALs according to the framework for conducting routine accelerated actions for contaminated soil (Figures 6 and 7) or at areas that have the potential to adversely impact surface water.

Additional remediation may eliminate the need for existing monitoring stations. The consultative process will be used to determine when monitoring stations can be eliminated.

Institutional Controls

Besides continued restricted Site access, institutional controls will be used for near-term management and long-term stewardship. While the selection of individual institutional controls is dependent upon the final remedy selected, and therefore cannot be known at this time, the following institutional controls will be used as appropriate to protect human health and the environment:

- Prohibition on the construction and use of buildings in contaminated areas;
- Prohibition on drilling wells for water use into contaminated groundwater, the use of contaminated groundwater, and/or pumping groundwater that could adversely affect the remedy;
- Restrictions on excavation in areas above subsurface contamination or intrusion into subsurface contamination;
- Restrictions on activities that cause soil disturbance in areas with surface soil contamination; and

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- Other restrictions to protect engineered controls (such as covers, groundwater barriers, and treatment cells) and monitoring systems.

The anticipated extent of areas with institutional controls at closure is shown on Figure 1 of ALF (DOE et al. 2003). The anticipated boundary of areas that will be subject to institutional controls is subject to modification based on characterization, future response actions, results of the CRA, and the final remedial/corrective action decision in the final CAD/ROD. In addition, the RFCA Parties presume there will be no residential development at RFETS.

Section 25-15-320 of the Colorado Revised Statute (CRS) requires an environmental covenant under certain conditions. As of May 2003, the Parties have not reached agreement on the applicability of this statute to the federal government. If an agreed-upon resolution cannot be reached, each Party reserves its rights as provided in RFCA Part 18.

Other Site work control processes may also be used to control access to these sites.

Engineered Controls

Engineered controls, including physical controls such as signs and fences, will be used for near-term management and long-term stewardship. It is anticipated that physical controls may consist of the following:

- Caps or covers;
- Erosion controls (grading, terracing, etc.);
- Diversion ditches;
- Holding ponds;
- Groundwater barriers;
- Permanent fencing and signage; and
- Additional fencing and signage within Site boundaries for areas that are capped and areas where excavation or other activities are restricted.

Engineered controls will be described in a separate RFCA decision document. Decision documents could include PAMs, IM/IRAs, or a CAD/ROD.

Many of the previously discussed controls will be applied on a sitewide basis and will not be affected by individual actions discussed in this RSOP. DOE will consider additional remediation beyond RFCA soil ALs in those cases where remediation would eliminate the need for specific institutional or engineered controls.

Documentation

Stewardship activities and information will be documented so that information is available for the RI/FS, CRA, CAD/ROD, and long-term stewardship planning. Table 6 lists where information will be available.

Table 6. Stewardship Documentation

Activity/Information	Archived In	Information Format
Stewardship evaluation	ER RSOP Notification, Closeout Report, annual stewardship summary	Text
Location and characterization of residual contamination	Closeout Report, HRR, SWD, RADMS	Text and electronic data
Location and characterization of remaining pipelines	Closeout Report, HRR, SWD, RADMS	Text and electronic data
Stewardship recommendations	Closeout Report, annual stewardship summary	Text

Confirmation sampling (Section 6.10) will be conducted at remediated areas in accordance with the IASAP (DOE 2001a) and BZSAP (DOE 2002a). Information gathered during sampling will include characterization data, confirmation sampling data, maps of residual contamination areas, and stewardship recommendations. These data will be included in the Closeout Report (Section 6.13) and the AR, and will be available for long-term stewardship planning.

Groundwater and surface water monitoring results are documented in quarterly IMP reports. The Closeout Report and IMP reports become part of the AR.

5.5.2 Sitewide Studies

Several of the sitewide studies currently in progress will have a significant effect on stewardship activities. Results of these studies will be summarized in the RI/FS. These studies and their contribution to long-term post-closure stewardship goals are described below.

Actinide Migration Evaluation

Actinide Migration Evaluation (AME) staff evaluates the behavior and mobility of actinides in surface water, groundwater, and soil environments. Results of AME studies may be used when planning stewardship activities. AME studies and their relevance to stewardship planning include the following:

- Report on Soil Erosion and Surface Water Sediment Transport Modeling for the Actinide Migration Evaluations at the Rocky Flats Environmental Technology Site (DOE 2000c) – Results of this study include average erosion rates for Site watersheds, erosion mechanisms, actinide source areas that have the potential to impact surface water quality, and model simulations for Pu-239/240 and Am-241 concentrations in Site streams. The results of this study may be used to evaluate potential impacts to surface water from soil erosion sitewide and at IHSSs, PACs, and UBC sites that have surface soil radionuclide

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activities less than RFCA ALs. Additionally, erosion-modeling results may be used in implementing erosion controls at remediation sites.

- Final Report on Phase Speciation of Pu and Am for Actinide Migration Studies (DOE 2000d) – Results of this study indicate Pu and Am solubility is limited in natural water. Both Pu and Am can be transported by sorption onto and migration with colloidal particles. Particulate transport is the dominant mechanism for Pu migration at RFETS. The results of this study may be used to evaluate potential impacts to surface water at IHSSs, PACs, and UBC sites.

- Air Transport and Deposition of Actinides at the Rocky Flats Environmental Technology Site (DOE 1999b) – This study focused on emission of actinides into the air from contaminated soil or debris (resuspension), transport of airborne actinides (dispersion), and removal of actinide-contaminated particles from the air to soil or water (deposition). The results of this study will be used when planning dust and other airborne contaminant controls at remediation sites.

- FY01 studies focused on the relationship between actinides and colloid stability in the environment. Results of these studies may be used, when available, to plan and implement erosion controls at remediation sites.

Site-Wide Water Balance

The purpose of the SWWB is to develop information to support a hydrologic design basis for RFETS closure activities. ER remediation, sitewide closure activities, and the final end-state configuration have the potential to significantly alter groundwater, surface water, and near-surface flow at the Site. Many RFETS closure decisions are dependent on SWWB information. The objectives of the SWWB are to provide RFETS with a management tool for the following:

- Evaluate how the sitewide water hydrology changes from present to final Site configuration;

- Predict surface water impacts from groundwater for present and final Site configuration;

- Provide data for the final IA configuration (cover design and land recontouring) to protect surface water quality;

- Provide information for the CRA and CAD/ROD; and

- Provide information for stewardship planning.

Land Configuration Design Basis

The purpose of the Land Configuration Design Basis (LCDB) Project is to define the design basis upon which a final land configuration can be developed. In conjunction with identifying the functional design objectives and developing the design basis, three bounding scenarios (wetlands, retention, and source isolation) were identified to represent relative extremes of distinct and unique approaches.

The bounding scenarios have been modeled and were evaluated by AME staff. Output from these evaluations will be used to aid in formulation of an initial conceptual design (ICD) component description. This ICD component description will be used as a discussion point and to help guide decommissioning, ER, and stewardship decisions. Data gaps that must be addressed prior to the development of a conceptual design and final design will also be identified.

5.6 ALARA

RFETS-specific requirements include implementation of DOE Order 5400.5, *Radiation Protection of the Public and the Environment,* ALARA Objectives. The definition of ALARA in DOE Order 5400.5 is,

> "ALARA is a phrase (acronym) used to describe an approach to radiation protection to control or manage exposures (both individual and collective to the work force and the general public) and releases of radioactive material to the environment as low as social, technical, economic, practical, and public policy considerations permit. As used in this Order, ALARA is not a dose limit, but rather it is a process that has as its objective the attainment of dose levels as far below the applicable limits of the Order as practicable."

These objectives are consistent with the ALARA objectives specified in the Radiation Control ARARs, Table 3, Section 5.1.2 of this RSOP. Table 7 lists locations in the ER RSOP or other decision documents where the ARARs are addressed.

Table 7. ARAR Requirements

ARAR Requirement	ARAR Citation (Table 3)	Decision Document Where ARAR Is Implemented
Methods to Ensure Protection of Workers	RH 3.16.4.3.3	ER RSOP Sections 6.2, 8.0, and 9.0
Description of Final Radiation Survey	RH 3.16.4.3.4	IASAP and BZSAP Sections 4.5 and 4.6
Intended Final Condition	RH 3.16.4.3.6	ER RSOP Notification
ALARA Analysis	RH 3.16.4.3.7.1 RH 3.16.4.3.7.3	ER RSOP Section 5.6
Institutional Controls	RH 3.16.4.3.7.3 RH 3.16.4.6	CAD/ROD
Radiation Surveys	RH 3.16.6.2	IASAP and BZSAP Sections 4.5 and 4.6
Submittal of Survey Report	RH 3.16.6.3	Closeout Report
Radiation Protection Program	RH 4.5.2	Incorporated through ER RSOP Sections 6.2, 8.0, and 9.0
Radiation Protection Program – Air	RH 4.5.4	ER RSOP Section 7.0
Radiation Protection Program – Dose limits	RH 4.14.1 RH 4.15.1 RH 4.15.2.1 RH 4.15.2.1	Incorporated through ER RSOP Sections 6.2, 8.0, and 9.0
Radiation Protection Program – Surveys	RH 4.17.1 RH 4.17.2	IASAP and BZSAP and incorporated through ER RSOP Sections 6.2, 8.0, and 9.0
Waste Disposal	RH 4.33	ER RSOP Section 10.0

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ARAR Requirement	ARAR Citation (Table 3)	Decision Document Where ARAR Is Implemented
Radiological Criteria	RH 4.61.1.3	ER RSOP Section 5.6
Criteria for Unrestricted Use	RH 4.61.2	RFCA Attachment 5 and Appendix M
Criteria for Restricted Use	RH 4.61.3.1 RH 4.61.3.2 RH 4.61.3.3	RFCA Attachment 5 and Appendix M
Alternate Criteria	RH 4.61.4.1.1 through .3	RSAL Regulatory Analysis

The RFCA Parties are consulting regarding the process by which the common ALARA objectives are evaluated in relation to the cleanup actions covered by this RSOP. This consultation will include consideration of public comments regarding the ALARA approach.

5.6.1 ALARA Evaluation

Remediation of soil through excavation is a conservative measure and excavation to RFCA soil ALs or as indicated by the Subsurface Soil Risk Screen is protective of human health and the environment for the appropriate land use. Because the ER RSOP covers accelerated actions, an ALARA evaluation will be used to determine whether additional remediation is indicated at IHSS Group remediations. The ALARA evaluation process and its relationship to stewardship and remediation are shown on Figure 9.

The principle of ALARA will be applied such that if incidental additional excavation will result in significant additional source removal, then the additional removal will occur. Application of ALARA will be most appropriate where the extent of contamination is defined by a sharp concentration gradient or where a small volume of additional excavation would eliminate isolated areas of residual contamination. Areas of diffuse contamination will probably not require additional removal based on ALARA principles. If sufficient data are available, the application of ALARA may be indicated before field activities start. If this is the case, the application of ALARA will be documented in an ER RSOP Notification. Otherwise, the ALARA evaluation will be conducted through the consultative process. The ALARA evaluation will be conducted during remediation in consultation with the regulatory agencies. The ER RSOP ALARA evaluation will consider health and safety (H&S), technical feasibility, and cost.

The ER Project Manager and H&S Manager will conduct the ALARA evaluation in consultation with the regulatory agencies. During field implementation of the ER RSOP, the Project Manager and H&S Manager will evaluate in-process remediation data, H&S data, and physical conditions, in consultation with the regulatory agencies, to determine whether additional remediation is required to achieve ALARA. If additional remediation is reasonable, remediation will continue. When remediation goals are achieved, confirmation samples will be collected and the remediation area will be surveyed. Remediation data including levels and location of residual contamination, if any, will be documented in the Closeout Report and archived for use in the RI/FS, CRA, and CAD/ROD.

These ALARA evaluation considerations are described in detail in the following sections.

Health and Safety Evaluation

The H&S of workers is a prime concern during remediation especially during excavation. Although work controls will be used to control hazards to workers, there may be instances when continued excavation will endanger the H&S of the workers. If safety limits are exceeded during excavation to achieve ALARA, remediation will stop and the remediation will be considered ALARA. The decision to stop work because of H&S concerns will be made by the project H&S Manager and will be in accordance with current Site work controls (Section 8.0).

Technical Feasibility Evaluation

Technical feasibility will depend on the specifics of the contamination, the work processes required to continue the remediation, area- and weather-specific factors, and other technical considerations appropriate for that work.

Cost Evaluation

For the purpose of the ER RSOP ALARA analysis, the evaluation will include estimates of the cost of additional soil removal, as well as the following criteria:

- Type of waste;
- Excavation and debris removal;
- Waste sampling;
- Waste packaging;
- Waste transportation and disposal;
- Backfill purchase and transportation; and
- Backfilling, compaction, and revegetation.

The uncertainty of the estimates will be informally addressed through the consultative process.

5.7 SUMMARY

Decisions will be made throughout the planning and implementation phases of accelerated actions in consultation with the regulatory agencies. These decisions, their associated actions, and when they occur in the accelerated action process are summarized on Figure 12.

Accelerated action decisions will be made within the context of RFCA and regulatory requirements. RFCA and regulatory requirements guide data evaluation, the stewardship and ALARA evaluations, preparation of the Notification, and development of work control documents. These will be used to direct field implementation of accelerated actions.

Key decisions made during implementation are the following:

- Is remediation required?
- Does the ALARA evaluation indicate additional remediation?
- Does the stewardship evaluation indicate additional remediation or institutional or physical controls are required?
- Have remediation objectives been achieved?

Soil remediation waste will be appropriately disposed. Institutional and/or engineering controls will be implemented, if required, after field work is complete.

Accelerated action decisions and results will be documented through the closeout process. Data will be conveyed to the regulatory agencies and public through the Closeout Report and will be archived through RADMS in the Site environmental database (SWD) and the AR.

Figure 12. Accelerated Action Summary

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6.0 PROJECT APPROACH

The approach to soil and associated debris remediation at RFETS includes several key components that will be used routinely for each IHSS, PAC, or UBC site remediation. These components include the following:

- RFCA consultative process;
- Work process planning;
- Remediation; and
- Documentation.

6.1 WORK PROCESS

Figure 13 illustrates the routine remediation work processes and includes (1) the characterization process and how it fits in with the remediation process, (2) work planning, (3) data analysis, (4) soil and associated debris remediation, and (5) the Closeout Report.

IHSSs, PACs, and UBC sites will be sampled and evaluated in accordance with the IASAP (DOE 2001a) and BZSAP (DOE 2002a) to determine whether remediation is required. After characterization is complete, the analytical data will be evaluated and an accelerated action decision will be made. If remediation is required, a map of the remediation target will be prepared and discussed with the LRA.

6.2 WORK PLANNING

Accelerated actions are conducted in accordance with the five core principles of the Integrated Safety Management System (ISMS):

- Define the work scope;
- Identify and analyze the hazards;
- Identify and implement controls;
- Perform the work; and
- Provide feedback.

Figure 13. ER RSOP Work Planning Process

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At RFETS, ISMS is implemented through the Integrated Work Control Program (IWCP), which provides the framework for mitigating adverse impacts to workers, the public, and the environment. ISMS is implemented through Site-specific work control documents, as shown on Figure 13. Because work conducted in accordance with the ER RSOP is routine, preparation of work controlling documents and processes have been streamlined. Streamlined documents and processes include the IASAP (DOE 2001a), BZSAP (DOE 2002a), ER RSOP, Health and Safety Plan (HASP), Quality Assurance Program Plan (QAPP), Field Implementation Plan (FIP), Auditable Safety Analysis, Soil Disturbance Permit, Environmental Checklist, Criticality Safety Review, and Waste Instructions. These documents and processes were developed to provide requirements, methods, work controls, and instructions for all projects covered under this ER RSOP. Addenda will be developed for individual projects, as necessary.

Site-specific work control documents and requirements include the following:

- IA and BZ SAPs;
- ER RSOP for Routine Soil Remediation;
- Job site walkdown to determine potential hazards and equipment needs;
- Job Hazard Analysis (JHA), which includes specific work hazards and appropriate hazard controls;
- HASP Addendum, which includes project-specific additions to the remediation HASP;
- FIP Addendum, which includes project-specific additions to the remediation FIP;
- RFETS-specific permits and requirements (as required) including:
  - Auditable Safety Analysis,
  - Soil Disturbance Permit to document potential contamination in areas where soil will be disturbed,
  - Radiological Work Permit (RWP) to document radiological controls (exposure limits) if necessary,
  - ALARA Job Review to determine operation controls to limit worker exposure,
  - Ecological Clearance to determine whether ecological resources may be impacted and whether impacts can be mitigated,
  - Criticality Safety Review to determine whether additional engineered or administrative safety controls are required,
  - Waste Instructions that include anticipated waste streams, packaging instructions, and sampling and analysis requirements,
  - Training Matrix, which includes project personnel, required training, and documentation of training, and

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  - Plan of the Week/Day to schedule, authorize, and control remediation activities and discuss planned activities and scheduling;

- Environmental Checklist to determine impacts to the environment and the impact of regulatory requirements;

- Management Readiness Assessment to document that all requirements for the project have been met; and

- Pre-Evolution Briefing conducted prior to the start of the remediation field work to ensure project personnel understand the project, hazards and controls, H&S requirements, and other Site requirements for the project.

6.3 REMEDIATION MAPS

Remediation maps will be developed using statistical and geostatistical analysis of characterization data. It is anticipated that geostatistical analysis will be used when sufficient data are available and there is a spatial correlation of the data. At hot spots, geostatistical analysis may not be appropriate, and a standard spatial contouring approach will be used.

6.3.1 Geostatistical Remediation Maps

As part of data analysis, a geostatistical approach may be used to generate potential remediation targets. Initially, maps showing the probability of exceeding the cleanup goals at IHSSs, PACs, and UBC sites are generated. From these "probability of exceedance" maps, remediation target maps can be developed for remediation goals at a number of levels of remediation reliability. The geostatistical approach is iterative and based on remediating to below required cleanup goals. Previous applications indicate this approach provides a high level of confidence that confirmation sampling will verify remediation is complete.

The process for determining remediation locations is described below.

4. Characterization data will be used to develop maps and histograms of the known distribution of contamination.

5. A variogram, which describes the geostatistical spatial correlation between the samples, will be generated.

6. The histogram, sample values, location, and variogram will be used for the geostatistical simulations. The simulations indicate the likely concentration and level of uncertainty about a concentration in nonsampled areas. The simulations are processed to produce maps defining the spatial distribution of the contaminants and the inherent uncertainty in the spatial distribution.

7. Probability maps that describe the likelihood that a contaminant value at any nonsampled location exceeds a RFCA soil AL will be generated.

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8. An excavation map will be developed from the probability map. The excavation map requires that an acceptable reliability of remediation is determined.

The geostatistical approach is designed for contamination that exhibits spatial correlation, not for developing a remediation plan around a single "hot spot." Based on characterization sampling, a decision will be made as to whether the samples define a distributed contaminant (apply geostatistical approach) or a localized hot spot (as defined in Chapter 10 of Gilbert [1987]).

6.3.2 Hot Spot Remediation Maps

In areas where hot spots are identified, remediation maps may use a variety of isopleth algorithms (including kriging, inverse distance functions, and triangulations, or similar spatial estimating techniques) for hot spot delineation, as stated in Section 5.3 of the IASAP (DOE 2001a) and BZSAP (DOE 2002a). Data will be presented using RADMS (Section 12.0).

6.4 IN-PROCESS ANALYSIS AND CONFIRMATION SAMPLING

The characterization team will conduct confirmation sampling and analysis on remediated areas to verify the site has been cleaned up with respect to remediation goals. The confirmation sampling and analysis will provide a representative assessment of the magnitude and spatial configuration of the COC(s) after remediation. The characterization team will implement an in-process and confirmation sampling approach that combines remediation with field instrument analysis.

During remediation, the characterization team will collect soil samples and use field analytical instrumentation to determine when remediation goals have been achieved. After remediation goals have been achieved based on field instrument data, confirmation sampling locations will be determined using statistical or geostatistical techniques as described in the IASAP (DOE 2001a) and BZSAP (DOE 2002a). Post-remediation confirmation samples will be collected and analyzed onsite if appropriate data quality can be demonstrated. Otherwise, confirmation samples will be sent to an offsite laboratory for analysis. Offsite laboratory results will be verified and validated in accordance with RFETS Analytical Services Division (ASD) requirements.

The number and distribution of confirmation samples will be based on a 90 percent probability of detecting residual contamination greater than the cleanup goal and the size and spatial variability of the remediated site. Statistical or geostatistical sampling strategies will ensure the appropriate numbers of samples are collected from unbiased locations.

6.5 SOIL AND DEBRIS REMEDIATION

This section describes the routine remediation actions covered by this ER RSOP. Excavation, treatment to meet regulatory and receiver site requirements, and disposal will be the dominant type of remediation action implemented through this ER RSOP. Thermal desorption may be considered if it is more technically and economically favorable for the given site condition, can be implemented within the constraints of the Site closure schedule, and is protective of human

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health and the environment. The Notification will identify treatment, if any, chosen for each IHSS Group.

Routine remediation of soil and buried debris will consist of excavation and offsite disposal, with offsite treatment as required to meet regulatory and receiver site requirements. Soil remediation through excavation was successful at Trench 1 (DOE 1999c), Trenches 3 and 4 (DOE 1996a), Ryan's Pit (DOE 1997a), and the Mound Site (DOE 1997b) at RFETS.

Engineering and administrative controls will be implemented prior to and during excavation and treatment activities to control the spread of radiological and hazardous contaminants in accordance with job-specific work controls (Sections 6.2 and 9.0). Remediation activities will meet the substantive requirements of ARARs.

6.5.1 Excavation, Offsite Treatment, and Disposal

The remediation process for soil and associated debris is shown on Figure 14. Soil and associated debris with contaminant concentrations greater than RFCA soil ALs or as indicated by the Subsurface Soil Risk Screen will be excavated and disposed of offsite, with offsite treatment as necessary to meet regulatory or receiver site requirements. Soil and debris will be excavated with heavy machinery, including backhoes, front-end loaders, excavators, and vacuum systems. Cranes and other lifting equipment will be used for debris removal as necessary. All excavated soil and debris will be segregated by size, material type, and waste type. The waste will be transferred to rolloffs or other waste containers, managed onsite in accordance with substantive ARARs (Section 5.1.2), and dispositioned offsite. Soil and debris will be characterized to evaluate compliance with regulatory or receiver site requirements. Contaminated soil and debris that do not require treatment will be transferred to rolloffs or other waste containers, managed in accordance with substantive ARARs (Section 5.1.2), and dispositioned offsite.

After soil and debris with contaminant concentrations greater than RFCA soil ALs or as indicated by the Subsurface Soil Risk Screen are removed, the excavation will be backfilled with onsite or offsite soil that meets backfill criteria described in Section 6.11. The backfilled excavation will be stabilized and revegetated in accordance with Section 6.11.4.

6.5.2 Onsite Treatment

Two onsite treatment options may be used – thermal desorption and Hydrogen Release Compound (HRC) ®.

Thermal Desorption

Onsite thermal desorption of soil to meet regulatory or receiver site requirements or for backfilling will be considered if it is shown to be expedient, economical, and protective of human health and the environment. Onsite backfilling of soil that has been treated through a thermal desorption process will be considered if the soil meets the criteria in the framework for conducting routine accelerated actions for contaminated soil (Figures 6 and 7). Onsite thermal desorption and offsite disposal may also be considered for VOC- and radionuclide-contaminated

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Figure 14. Detailed Accelerated Action Process

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soil. Onsite thermal desorption was successfully demonstrated at Trenches 3 and 4 (DOE 1996a).

Areas of contaminated soil and debris will be excavated with heavy machinery and transferred to an onsite thermal desorption treatment facility or remediated at the point of excavation. Transfer of soil will be by loader, backhoe, or conveyor belt. Thermal desorption will be used to remove VOCs from the soil. Thermal desorption units used for onsite soil remediation will be portable and transported to the site of waste generation where possible. The appropriate system will be selected to accommodate the specific volumes and types of soil to be remediated. To ensure the contaminants are not combusted (incinerated), Indirect Thermal Desorption will be used because it applies heat in a manner that isolates the flame from contaminated material, raising the contents' temperature above the contaminant's vapor point, then removing the contaminant vapor for condensing.

VOCs will be removed from the soil within a closed system and will be either condensed into a liquid phase and/or collected on granular activated carbon. The closed system results in little to no volatile emissions to the atmosphere. Condensate removed from the system will be further treated by passing the liquid through an oil/water separator to remove dense nonaqueous phase liquids (DNAPLs) and light nonaqueous phase liquids (LNAPLs). DNAPLs and LNAPLs will be treated or disposed in an appropriate offsite facility. Residual liquids will be treated using an onsite water treatment system, or disposed at a K-H-approved offsite disposal facility. Detailed specifications of the selected thermal desorption units will be described in a Notification, when appropriate.

After soil has been treated, it will be sampled and analyzed to determine whether treatment was successful and regulatory and receiver site requirements or backfill criteria have been met. If receiver site requirements have been met, the waste will be packaged in accordance with waste management requirements, managed according to substantive ARARs (Section 5.1.2), and dispositioned offsite. If backfill criteria have been met, soil will be returned to the excavation or used as fill at some other acceptable onsite location. The backfilled excavation will be stabilized and revegetated (Section 6.11.4).

<u>HRC®</u>

HRC® is a proprietary, environmentally safe, food quality, polylactate ester formulated for slow release of lactic acid upon hydration. HRC® stimulates rapid degradation of chlorinated VOCs found in groundwater and soil by making low concentrations of hydrogen available to the resident microbes to use for dechlorination. HRC will be used to enhance VOC degradation where soil excavation is not feasible, practable, or effective.

6.5.3 RCRA Units

There are several types of RCRA Units that ER staff will have the responsibility or partial responsibility for closing. These units are listed in Table 8, illustrated on Figure 15, and consist of waste storage units and NPWL. Detailed drawings and figures of RCRA Units will be included in the Notification. These units were permitted under RFETS RCRA Permit CO-97-05-30-01. The NPWL pipes and valve vaults are part of RCRA Unit 374.3. Closure of waste

Table 8. RCRA-Regulated Units

IHSS Group Number	IHSS/PAC Number	RCRA Unit Number	RCRA Unit Description	ER Responsibility
000-4	PAC 000-504	374.3	NPWL	Close parts of this unit not covered by the RSOP for Facility Component Removal, Size Reduction, and Decontamination Activities (DOE 2001c)
000-4	PAC 000-504	374.3	Valve Vaults 1 – 20	Close unit
500-4	IHSS 117.2	18.03	Asphalt Pad – Parking Area East of Building 551	Remove asphalt, characterize asphalt and soil, remediate soil as necessary
700-8	IHSS 214	750.1/750.2	Asphalt Pads – 750 Pad	Remove asphalt, characterize asphalt and soil, remediate soil as necessary
900-3	IHSS 213	15	Asphalt Pad – 904 Pad	Remove asphalt, characterize asphalt and soil, remediate soil as necessary
N/A	N/A	1	Asphalt Pad, PACS 1 Container Storage	Remove asphalt, characterize asphalt and soil, remediate soil as necessary
N/A	N/A	10	Asphalt Pad, B561 Container Storage	Remove asphalt, characterize asphalt and soil, remediate soil as necessary
N/A	N/A	18.04	Gravel Area, South of Unit 14, Building 906 Waste Storage Facility	Characterize soil, remediate soil as necessary
N/A	N/A	21	Concrete Slabs – Building 788	Remove concrete, characterize concrete and soil, remediate soil as necessary
Interim Status Units				
N/A	N/A	18.01	Concrete Pad Associated with Remedial Action Decontamination Pad (RADP) Tanks	Remove concrete, characterize concrete and soil, remediate soil as necessary
N/A	N/A	48	Former Pondcrete Pump House Concrete Slab 308-A	Remove concrete, characterize concrete and soil, remediate soil as necessary
400-5	IHSS 205	40.13	Building 460 Sump #3 Acid Side	Characterize soil and remediate soil as necessary
300-5	IHSS 206	42.14	Inactive D-836 Hazardous Waste Tank	Remove tank, characterize tank and soil, remediate soil as necessary
Permitted Units				
700-8	IHSS 214	25	750 Pad Pondcrete & Saltcrete Storage	Remove concrete, characterize concrete and soil, remediate soil as necessary

storage units within buildings is the responsibility of the decommissioning staff. Closure of the NPWL not inside buildings is the responsibility of ER. The NPWL (Figure 15) consists of pipelines, tanks, and valve vaults. The NPWL transports LL aqueous waste to the liquid waste

Figure 15. RCRA-Regulated Units

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treatment facility in Building 374. Based on Site utility maps, it is estimated there are approximately 6,300 ft of pipeline.

RCRA-regulated waste is currently stored at the 750 Pad (IHSS Group 700-8), 904 Pad (IHSS Group 900-3), asphalt pads east of Building 551, PACS 1 and the Remedial Action Decontamination Pad (RADP), concrete slabs at Building 788, the Pondcrete Pump House, and the gravel area south of the Building 906 Waste Storage Facility. The waste management organization is responsible for removing the waste at these units. ER staff is responsible for characterizing and remediating asphalt, concrete, soil, and debris beneath the units.

The ER RSOP will be used to document what remediation was completed to support RCRA permit modification. Remediation actions related to waste storage units, NPWL, and associated tanks (in IHSSs, PACs, or under buildings) will be tracked. The strategy is to remediate RCRA-regulated tanks and sections of the NPWL associated with UBC sites and other IHSSs when those sites are remediated, archive the data, and close the RCRA Units when remediation of the units is complete. As tanks and sections of the NPWL are remediated, the specifics will be documented in the annual updates to the HRR.

Closure of RCRA-Regulated Units

RCRA-regulated units governed by this RSOP will be closed in compliance with the closure performance standards described in this section. Unit-specific closure information, in the form of drawings and/or photographs of the unit or units to be closed, a description of the unit boundaries, applicable EPA waste codes, the selected closure option, and disposition of waste generated as a result of unit closure will be included with the Notification. This unit-specific information, combined with the closure performance information provided in the following paragraphs, will serve as the closure description document for units closed under this RSOP.

Portions of an RCRA-regulated unit may be removed prior to submittal of the required unit-specific closure information through the consultative process and concurrence of CDPHE. In such cases, LRA concurrence will be documented in an RFETS Regulatory Contact Record, a copy of which will be placed in the project-specific AR File.

Decommissioning will close RCRA-regulated units located within RFETS buildings prior to facility demolition. Decommissioning personnel will convert portions of units located beneath the building slabs or outside the building footprints (e.g., the valve vaults and underground piping associated with the Building 374 process waste system) to a RCRA-stable configuration in accordance with the RSOP for Facility Component Removal, Size Reduction, and Decontamination Activities (DOE 2001b). RCRA-stable configuration is the first step toward closure of permitted or interim status units, whereby waste is removed from the unit and the possibility of future waste input is eliminated. For tank systems, this means the tank and its ancillary equipment have been drained to the maximum extent possible using readily available means, with the objective of achieving less than 1 percent holdup, and with no significant sludge or risk remaining. Physical means, such as lock out/tag out or blank flanges, must then be used to ensure wastes will not be reintroduced to the system. RCRA-stable requirements are defined in Part X of the Site's RCRA Part B Permit (CDPHE 1997).

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Closure Options

Closure options for RCRA Units include clean closure, removal according to the debris rule, removal without decontamination, and in-situ stabilization. These options are described below.

Clean Closure

RCRA-regulated units may be clean closed by documenting the absence of contamination or by decontaminating the unit.

Clean Closure Option #1: For units having a complete, detailed operating history, clean closure will be demonstrated when the LRA agrees the following criteria are met:

- A review of the RCRA Operating Record and building files indicates hazardous or mixed waste was never spilled in the unit, or complete documentation exists to demonstrate releases were adequately cleaned up (e.g., if a spill did occur, visible residual liquids and solid wastes were removed and the spill area was decontaminated); and

- A visual inspection of the unit and associated ancillary equipment notes the absence of hazardous or mixed waste stains and/or residuals.

Clean Closure Option #2: Units to be clean closed by chemical decontamination will be flushed and washed with a suitable decontamination solution to remove visible waste residuals and COCs, then rinsed with clean water. The final rinsate will be tested to determine whether:

- The pH of the rinsate is between 6 and 9; and

- The concentrations of priority pollutants (those managed in the unit) and heavy metals are below the RFCA Tier II ALs for groundwater, as defined in Attachment 5 of RFCA. Rinsate meeting the RFCA Tier II groundwater ALs for listed waste constituents associated with the unit and the Land Disposal Restriction (LDR) standards for characteristic waste (as required for disposal) will be considered "no longer contained in" and will be managed as nonhazardous waste.

The final rinsate will not exceed a volume of 2 gallons per 100 square feet (ft^2) of surface area rinsed, and for internal surfaces, such as tank systems, the final rinsate will not exceed a volume of 5 percent of the capacity of the system. If test results indicate the standard has been met, the unit will be considered clean closed. Units that cannot be decontaminated to meet the performance standard will be removed prior to building demolition and managed as hazardous or mixed waste. Rinsates and wastewater will be treated onsite if appropriate facilities are available or disposed offsite at a K-H-approved facility.

Unit Removal in Conjunction With "Debris Rule" Treatment

Alternatively, RCRA-regulated units may be closed by removal and treatment according to the "debris rule." The debris rule applies to unit equipment or structures that have no intended use or reuse, and are slated for removal and discard. To meet the debris rule standard, decontamination is conducted using any of the extraction or destruction technologies identified

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in Part 268.45 of 6 Code of Colorado Regulations (CCR) 1007-3 (Table 1, Alternative Treatment Standards for Hazardous Debris).

If, after treatment, ER personnel determine the equipment or structure meets the standard for a clean debris surface and it does not exhibit a hazardous waste characteristic, it will no longer be considered a hazardous waste and will be managed as a solid waste. A "clean debris surface" is defined as a "surface that, when viewed without magnification, is free of all visible contaminated soil or hazardous waste except that residual staining from soil and waste consisting of light shadows, slight streaks, or minor discolorations, and soil and waste in cracks, crevices, and pits may be present provided that such staining and soil and waste in cracks, crevices, and pits is limited to no more than 5 percent of each square inch of surface area" (6 CCR 1007-3, Part 268.45).

In the event the standard is not met, the equipment or structure will be removed and managed as hazardous or mixed remediation waste. Treatment residuals generated from extraction and/or destruction technologies used in the closure of RCRA-regulated units will be characterized in compliance with 6 CCR 1007-3, Part 262.11, managed onsite in accordance with substantive ARARs (Section 5.1.2), and dispositioned offsite.

Unit Removal Without Onsite Treatment

RCRA Units that are not decontaminated to meet the clean closure standard or debris rule standard may be removed, size-reduced (if necessary), and packaged for offsite disposal. After the waste is shipped offsite, it may be stabilized or treated to meet regulatory or receiver site requirements. In the event this waste cannot be immediately shipped directly to an offsite facility, it will be stored in accordance with substantive ARARs (Section 5.1.2), and dispositioned offsite.

Closure Documentation

A closure certification will be prepared for each RCRA Unit by compliance staff. The closure certification will be submitted to CDPHE for review and concurrence within 60 days after completion of the associated closure activities.

RCRA Unit closure activities will be documented in the Closeout Report. Upon final closure of each RCRA-regulated unit, the Site's Master List of RCRA Units will be updated to reflect the new closure status of the unit, and the unit will be removed from the RCRA Part A and Part B Permits in accordance with the applicable hazardous waste regulations (6 CCR 1007-3, Section 100.63, Permit Modification at the Request of the Permittee).

For those units that were closed and included soil remediation, the following language will be included in the Closeout Report: "Soil remediation and RCRA closure for this IHSS was achieved by complying with the RFCA AL determination criteria that is applied to all IHSS, PAC, and UBC Sites at RFETS (RFCA Paragraph 11)." For those units that were closed and no soil remediation was required, the following language will be included in the Data Summary Report: "RCRA closure was achieved by complying with the RFCA AL determination criteria applied to all other IHSS, PAC, and UBC Sites at the RFETS (RFCA Paragraph 11)."

6.5.4 Original Process Waste Lines, Sanitary Sewer System, and Storm Drains

The remediation strategy for OPWL and associated OPWL valve vaults includes characterization and removal of pipelines and soil as specified in RFCA Attachment 14. The remediation strategy for the sanitary sewer system and storm drains is to remove soil when required by the Subsurface Soil Risk Screen.

Original Process Waste Lines

The OPWL, shown on Figure 16, is a network of tanks, underground pipelines, and aboveground pipelines used to transport and temporarily store aqueous chemical and radioactive process wastes. The OPWL potentially transported a variety of wastes, including acids, bases, solvents, radionuclides, metals, oils, PCBs, biohazards, paints, and other chemicals (DOE 1992).

The OPWL network originally consisted of approximately 35,000 ft of pipeline. Parts of the OPWL were converted to NPWL or other systems (e.g., fire plenum deluge system), and will be remediated as part of those systems. The current OPWL system contains approximately 28,638 ft of pipeline. Approximately 13,317 ft of pipeline is included in IA Group 000-2. The remaining 15,321 ft of pipeline is included in other IA Groups.

Sanitary Sewer System

The sanitary sewer system (Figure 17) consists of approximately 36,480 ft of pipeline, and 25 valve vaults, pump vaults, and similar structures. This estimate includes only main pipelines. Remaining pipelines will be remediated with UBC sites or other IHSSs or PACs.

Storm Drains

There are 239 storm drains at RFETS totaling approximately 79,500 ft in length. Of these, 139 are part of IA Group 000-3 (Figure 17). The remaining 100 storm drains are part of other IA Groups. Storm drains may have been exposed to contaminated liquids because of spills, fires, contaminated surface-water runoff, and contaminated sediments. Potential wastes that have been documented in storm drains are silver paints (DOE 1992).

Remediation Strategy

The remediation strategy for the OPWL, sanitary sewer system, and storm drains consists of two approaches:

The sections of OPWL, sanitary sewers, and storm drains associated with IHSSs, PACs, and UBC sites will be remediated along with the respective IHSS Groups. Additionally, sections of pipeline adjacent to or close to an IHSS, PAC, or UBC site will also be included with the IHSS Group remediations wherever possible. This approach will reduce mobilization and operating costs and schedules. Pipeline segments that will be included with IHSS Groups will be documented in the appropriate Notification. Remaining sections of contaminated soil and associated OPWL, sanitary sewers, and storm drains will be remediated as infrastructure constraints are eliminated or reduced.

Figure 16. Original Process Waste Lines

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Figure 17. Sanitary Sewer System and Storm Drains

Original Process Waste Lines

All OPWL, sanitary sewers, and storm drains within 3 ft of the existing grade will be removed within a building footprint or to the nearest junction. All remaining pipelines will be cut off at the building footprint boundary, or the nearest junction outside the building footprint, and sealed with a watertight permanent seal. Pipeline termination points will be surveyed using traditional or Global Positioning System (GPS) surveying methods. A map of all pipeline and other utility terminations will be maintained.

OPWL within 3 ft of the surface, outside of buildings, will be removed. Surrounding soil with Pu and/or Am activities greater than RFCA soil ALs from OPWL leaks within 3 ft of the surface will be removed to a depth of 3 ft.

Soil associated with OPWL between 3 and 6 ft below the surface in areas with reported and suspected leaks will be characterized in accordance with the IASAP (DOE 2001a) at the leak location. Known and suspected OPWL leak and sampling locations are shown on Figure 18.

If the Pu and/or Am activity in soil associated with OPWL is greater than the values listed in Table 4 between 3 and 6 ft, an accelerated action will be triggered. After an accelerated action is triggered, soil will be removed to less than 1 nCi/g. For ALARA and stewardship considerations, limited additional remediation (one equivalent measure of soil) will be removed in an attempt to reduce Pu and/or Am contamination to below RFCA soil ALs.

OPWL left in place will be grouted or foamed to the extent feasible, where safe and practical.

OPWL valve vaults will be removed to a minimum depth of 6 ft below the surface. Valve vaults deeper than 6 ft below the surface will be removed to the extent practicable, in consideration of the following:

- Safety associated with confined spaces and deep excavations;
- Technical feasibility of laybacks and nearby structures; and
- Cost/benefit including whether the benefit to a WRW and environment (ecological receptors) justifies the cost of full removal.

Soil surrounding pipelines requiring excavation will be excavated, treated as necessary, and disposed offsite. Pipelines associated with contaminated soil will also be excavated. Pipelines that are not removed will be disrupted where feasible taking into account health and safety of the workers. Soil requiring remediation will be excavated with heavy machinery, including backhoes, front-end loaders, bulldozers, or vacuum systems. Cranes and other lifting equipment will be used for pipeline removal as necessary. All efforts will be made to eliminate confined space entries. Engineering and administrative controls will be implemented prior to and during excavation activities to control the spread of radiological and hazardous contamination in accordance with job-specific work control documents.

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Figure 18. Known and Suspected OPWL Leak and Sampling Locations

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Excavated soil and pipelines will be segregated by size, material type, and waste type. Soil and pipelines will be evaluated to determine whether treatment is required to meet regulatory requirements and will be characterized in accordance with requirements described in Section 10.0. Soil and pipelines that do not require treatment will be transferred to rolloffs or other waste containers and transferred to the waste management organization for storage and subsequent transportation to a disposal facility. Soil that does require treatment to meet regulatory requirements will be stabilized or treated, then transferred to the waste management organization, managed in accordance with substantive ARARs (Section 5.1.2), and dispositioned offsite. Pipelines will be size-reduced and then transferred to the waste management organization, managed onsite according to substantive ARARs (Section 5.1.2), and dispositioned offsite. Pipelines that are left in place will be sealed and their location will be surveyed.

Based on historical information, it is anticipated that sanitary sewers and storm drains will be significantly less contaminated (if contaminated at all) than the OPWL. They currently have sewage or storm water running through them. These lines will be flushed with water to remove solids. After a thorough flushing, a final rinse will be applied and the rinse water will be analyzed. Pipelines will be grouted to eliminate potential contaminant migration pathways.

6.6 BUILDING FOUNDATION AND SLAB REMOVAL

Structural materials within 3 ft of the existing ground surface will be removed during decommissioning activities, including building slabs and foundations unless otherwise required by ER staff. In the event that decommissioning of a facility with a high potential for UBC occurs well before scheduled soil remediation actions, ER staff may specify that building slabs be left in place to provide continued containment of potentially contaminated soil.

Other structures associated with slabs and foundations (e.g., sumps, source pits) that were not removed by decommissioning may be removed during remediation under this RSOP if the remediation is excavation. This may include structures below the water table or the top of bedrock.

Currently, several building slabs and foundations remain from previous decommissioning activities or will be left in place in advance of soil remediation efforts. ER staff has or will remove the following slabs and foundations:

- Building 123;
- Building 889;
- Building 779;
- Building 690 Area slabs;
- Building 910 and associated slabs;
- Guard shack slabs at inner East and West Gates;

- Building 865; and
- Additional slabs, as necessary.

If slabs and foundations were not characterized during decommissioning, ER will characterize them in accordance with the site procedures in consultation with the regulatory agencies. Slab and foundation characterization will be identified in the Notification. Removal will involve large mechanical equipment that may include excavators and front-end loaders to demolish, break up, segregate, and load concrete, steel, and other slab and foundation materials into waste containers or staging areas. Excavators may be equipped with the following attachments:

- Pulverizers that crush concrete and separate rebar and encased steel beams;
- Shears that sever metal, structural steel, wood, rubber, and plastic;
- Grapples that serve as an all-purpose tool for demolition and material handling; and
- Rams that demolish concrete structures.

Other techniques may be considered and will be documented in the Notification. Concrete may be recycled in accordance with the RSOP for Recycling Concrete (DOE 1999d) or disposed.

6.7 FOUNDATION DRAINS

Foundation drains are associated with many RFETS buildings and include footing drains, building sumps, and subdrains. Foundation drain systems were constructed to intercept and transport groundwater away from building foundations to prevent flooding of building basements. Typically, foundation drains consist of a trench or series of trenches, backfilled with gravel or other free-draining material. A slotted or perforated pipe is generally installed at the bottom of the trench.

Water collected in the foundation drains flows by gravity to an outfall at a lower elevation, while water in sumps is generally pumped to a discharge location. The intercepted water is discharged to a storm sewer, sanitary sewer, building sump, or surface outfall. RFETS foundation drains are listed in Table 9, and the locations are illustrated on Figure 19.

Table 9. Foundation Drains

Station Identification	Description
Foundation Drain (FD)-111-1	Drain in gully outside security fence north of the northwestern corner of Building 111 halfway to Sage Avenue
Building Sump (BS)-111-2	Sump located in southeastern corner of the Building 111 basement
FD-371-1	Southeastern corner of Buildings 371/374
FD-371-2	Drain daylights in the gully southeast of the southeastern corner of Building 374
FD-371-3	East of Building 374

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Station Identification	Description
FD-371-4	Southwest of FD-371-3 on the western side of the access road to the 517/518 substation (buried)
FD-371-5	Northeast of the 517/518 substation (buried)
FD-371-6	Northeast of the 517/518 substation (buried)
FD-371-MC	Metal culvert near outfall FD-371-1
FD-371-COMP	Northeast of FD-371-4,- 5, and -6
FD-444-1 FD-444-460	South of the southwestern corner of Building 444, renamed FD-444-460
BS-444-2	Sump inside Building 444 at the southeastern corner of the "snake pit"
FD-516-1	Southern side of the road into the 516 power substation
FD-559/561	East of Building 561, Door 1, and south of Building 559, Door 6
FD-707-1 750 Culvert	Storm drain outlet across the road from the eastern side of the 750 parking lot
BS-707-2	Sump in a pump pit between the cooling tower and Building 707
BS-707-3	Sump in the old process drain manhole outside Door 3 to Building 778
FD-771-1	Drain located approximately 50 ft southwest of the southwestern corner of the old 773 guard post
BS-771-2	Sump in Room 146, Building 771
BS-771-3	Sump in elevator pit
BS-771-4	Drain located west of FD-771-1
FD-774-1	Drain located east of Building 770
FD-774-2	Located at the northeastern corner of Building 774
FD-774-3	Located on the hillside northeast of Building 774
FD-779-1	Drain line that runs between Ponds 207C and 207A on the hillside north of the SEP
FD-790	Drain located in the manhole on the southwestern corner of Building 790
FD-850-1 FD-860-1	Drain located approximately 50 ft south of Building 860
BS-865-1	Sump in the manhole on western side of Building 865
BS-865-2	Drain located outside Door 1 of Building 865
FD-881-1	Drain on hillside south of the middle of Building 881
BS-881-2	Sump in elevator shaft by the boiler room in Building 881
BS-881-3	Sump under the stairway in the northeastern corner on the first floor of Building 881
BS-883-1, FD-883-1	Located in manhole outside Door 17 on the southwestern corner of Building 883
FD-886-1	Located at the northeastern corner of Building 875
FD-886-2	Located on the western side of Building 886
BS-887-1	Sump in the northwestern corner of the lowest section of Building 887
FD-910	Manhole on the northern side of Building 910
FD-991-1	Drain in gully east of the northeastern corner of Building 991
BS-991-2 FD-991-2	Located in the southeastern corner of the basement of Building 991

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Figure 19. Foundation Drains

In general, Decommissioning staff will remove all foundation drains if they are within 3 ft of the existing grade within a building footprint or to the nearest junction. All remaining drains will be cut off at the building footprint boundary, or the nearest junction outside the building footprint, and sealed with a watertight permanent seal. Drain termination points will be surveyed using traditional or GPS surveying methods. Decommissioning staff will provide a map of all foundation drain terminations to ER. There may be instances where the foundation drains are maintained for groundwater management. The fate of the foundation drains will be decided in consultation with both Decommissioning and ER, taking into account groundwater modeling results. The decommissioning close-out report will annotate that the drains are still functioning.

Accessible foundation drains, associated building sumps, surface outfalls, and surrounding drains, sumps, or outfalls within 3 ft of the surface will be excavated. Accessible foundation drains, associated building sumps, surface outfalls, and surrounding drains, sumps, or outfalls between 3 and 6 ft below the surface with soil contaminant concentrations greater than RFCA soil ALs or as indicated by the Subsurface Soil Risk Screen will also be excavated. To reduce the possibility for potential residual migration through footing drain corridors, the bedding material will be excavated and replaced with compacted fill, or pressure grouted. Associated storm drains and sanitary sewers will be addressed as discussed in Section 6.5.4.

6.8 UNDERGROUND STORAGE TANKS

Underground storage tanks (USTs) at RFETS include petroleum, water, and empty hazardous waste tanks. Existing records will be reviewed to identify the location of all known tanks and the type(s) of materials they contain or contained. Tanks that contained hazardous constituents should be associated with the NPWL and OPWL, and will be remediated in accordance with Section 6.5.3 or 6.5.4, respectively. Water tanks will be drained and either removed or filled with an inert solid material, such as sand or foam.

The Colorado Department of Labor and Employment, Oil Inspection Section (7 CCR 1101-14) regulates the closure of petroleum USTs. Assessment will consist of one Geoprobe® sample collected on each side of each tank, as close to the tank as possible and in the backfill, if accessible. The Geoprobe® will be driven at least to the bottom of the original trench for each tank. One soil sample will be collected at the bottom of the fill, or at an equivalent depth if outside the backfill, or 1 ft above the groundwater (if present above the bottom of the fill material). Soil and groundwater samples will be analyzed for total petroleum hydrocarbons (TPH). Tanks with sample results below 5,000 parts per million (ppm) TPH will be closed in place.

In accordance with Attachment 13 of RFCA, the Site's 20 petroleum USTs have been drained and filled with polyurethane foam. Although soil and groundwater samples from the required site assessment met the 5,000 ppm TPH standard (DOE 1997c, Safe Sites of Colorado 1996), the data will be reviewed during ER characterization IASAP Addenda activities to determine whether this information is sufficient to support a decision to close the tanks in place, or whether additional information is required to make this decision. If additional characterization and/or remediation is indicated, it will be conducted in accordance with the IASAP (DOE 2001a) and the following:

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- The Oil Inspection Section will be notified within 10 days before closure of the tank system.
- When UST remediation is required, a Notification will be sent to the LRA in lieu of a PAM. Accelerated action decisions will be conducted as part of the consultative process.

6.9 PREVIOUSLY UNIDENTIFIED CONTAMINATION

Areas outside of IHSSs, PACs, and UBC sites that may require remediation may be discovered during Site characterization, remediation, construction, decommissioning, and other Site activities. When new areas requiring remediation are found, these areas will be addressed in accordance with the IASAP (DOE 2001a), BZSAP (DOE 2002a), and this RSOP.

Areas requiring remediation that are identified during ER characterization or remediation of IHSS Groups will result in extension of the AOC and will not require additional administrative paperwork. The expanded AOC will be documented in the Closeout Report.

When potential areas are identified by other sources (construction or decommissioning), analytical data from the area will be compared to RFCA soil ALs. Areas with soil contamination above RFCA soil ALs will trigger further evaluation.

If a new area is identified, a PAC number will be assigned and the PAC will be added to the HRR. An IASAP or BZSAP Addendum will be prepared and forwarded to the regulatory agencies. The area will be characterized in accordance with the IASAP (DOE 2001a), BZSAP (DOE 2002a), and this RSOP. After characterization, an accelerated action decision will be made. If remediation is required, a notification of the remediation target will be sent to the LRA. Areas will be remediated, if necessary, in accordance with methods in this RSOP. If a different remedy is required (i.e., groundwater remediation), it will be covered under a separate decision document. The Closeout Report will describe characterization and remediation activities and results.

6.10 CONFIRMATION SAMPLING

Post-remediation confirmation sampling will be conducted at AOCs associated with IHSSs, PACs, and UBC sites. In-process soil samples will be collected and analyzed during remediation to verify cleanup below remediation goals. Post-remediation confirmation samples will also be collected and analyzed. The combination of in-process and confirmation samples will ensure residual contamination levels are below remediation goals. Confirmation sampling procedures are described in the IASAP (DOE 2001a) and BZSAP (DOE 2002a).

6.11 BACKFILLING

Remediated areas requiring backfill will not be backfilled until confirmation sampling indicates remediation goals have been achieved. Processing and placement requirements will be established based on the design requirements for the backfill, as defined in the appropriate project work control documents. To ensure the backfill quality meets compaction requirements, the backfill will be geotechnically tested, as necessary, prior to placement and during backfill operations. After placement of the backfill, soil will be placed on top of the backfill to ensure the backfilled areas blend in with the surrounding topography and support vegetation. The depth and specifications of this layer will be addressed in the final site configuration and remedy documentation.

The three potential backfill materials considered are:

- Recycled concrete (in deep basements);
- Onsite soil; and
- Offsite soil.

6.11.1 Recycled Concrete

The RSOP for Recycling Concrete (DOE 1999d) addresses the post-demolition disposition and placement of concrete. Table 10 lists the concrete free release limits (DOE 1999d). Concrete below the free release limits is considered nonradioactive, nonhazardous, non-beryllium-contaminated, and non-TSCA regulated. Each decommissioning or remediation project that generates concrete for recycling must demonstrate that the free release thresholds are met. Concrete available for recycling will be stockpiled as specified in the RSOP for Concrete Recycling (DOE 1999d).

Table 10. Concrete Free Release Limits Summary

Contaminant	Requirement Source	Unrestricted Release Threshold		
Radionuclides		Total Average disintegrations per minute (dpm)/100 cm^2	Total Maximum dpm/100 cm^2	Removable dpm/100 cm^2
Transuranics	DOE Order 5400.5 (DOE 1998a), Figure IV-1 DOE "No-Radioactivity Added" Waste Verification	100	300	20
Thorium-Natural		1,000	3,000	200
U-Natural		5,000	15,000	1,000
Beta-Gamma Emitters		5,000	15,000	1,000
Tritium		N/A	N/A	10,000
Hazardous Waste	6 CCR 1007-3, Parts 261 through 268	No listed hazardous waste or characteristic hazardous waste is present.		
Beryllium	10 CFR 850.31, as interpreted by a DOE letter dated January 4, 2001	The unrestricted release limit for building materials is set at 0.2 µg/100 cm^2.		
PCBs	40 CFR 761	The release level for PCBs will be determined for each closure project based on applicable regulatory requirements.		
Asbestos-Containing Material (ACM)	40 CFR 763 5 CCR-1001-10	No sample in a sample set representing a homogeneous medium results in a positive detection (i.e., >1 percent by volume).		

Areas proposed and selected for backfilling with recycled concrete must meet the following minimum criteria:

- Backfill is required to meet the final grading requirement.

- There are no impacts to surface water.
- Restoration activities and verification sampling are complete, and the data have been verified and validated (DOE 1999d).

Section 8.4 of the RSOP for Concrete Recycling (DOE 1999d) specifies procedures for using concrete as backfill.

It is anticipated that concrete from ER remediation will be used as backfill for deep building basements and will not be placed within 3 ft of the surface. If concrete from an ER site meets the minimum criteria listed above, the rubble stored in the recycled concrete storage areas will be processed by crushing. The final product will be a well-graded material with all particle sizes represented. The smaller particles tend to fill in the empty spaces around the larger particles, resulting in fewer voids after placement and compaction. Backfill with fewer voids has greater compaction densities, tends to handle greater surface-bearing loads, and has minimal post-placement settling. Final grain size distribution requirements and compaction specifications will be established in the appropriate work control documents (DOE 1999d).

Transport of the backfill material from the stockpile will be performed in accordance with the RSOP for Recycling Concrete (DOE 1999d). The material will be transported from the stockpile area in end-dump trucks or other appropriate vehicles and deposited in the backfill area. The loads will be covered or sprayed with water or surfactant prior to transport to minimize the potential for dust. Roads used to transport the backfill may also require dust control, such as application of surfactant or water, speed reduction, and periodic sweeping (DOE 1999d). A rubber-tired front-end loader or bulldozer will place the material into the backfill area.

6.11.2 Onsite Soil

On site soil meeting the following put-back levels may be used as backfill. Put-back levels apply to soil that contains contaminants at levels that do not trigger an accelerated action, but that are excavated incidental to the conduct of accelerated actions. Put-back levels also apply to soil that has been treated to remove contaminants to below ALs as provided in an accelerated action decision document. DOE is allowed to replace this soil back into the ground if the contaminant concentration prior to excavation does not exceed the ALs listed in Table 3 of RFCA Attachment 5. Soil may be replaced into the ground only in the same IHSS, PAC or AOC in which it originated. DOE may, with LRA approval after appropriate consultation, replace excavated soil with contaminant concentrations greater than the put-back levels[1]. In such cases decision factors to be considered include remedy effectiveness and protectiveness, reasonably anticipated future land uses, contaminant levels in surrounding soil, potential for contaminants to affect surface water quality, and costs. Decisions resulting in soil put-back will be recorded in the appropriate closeout report.

[1] The soil AL for Pu is 50 pCi/g. Soil exceeding this concentration encountered in the top three feet would not be used as backfill. However, soil exceeding that level encountered at depths greater than 3 feet could be used as backfill as long as it was placed at depths greater than 3 feet.

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6.11.3 Offsite Soil

Offsite soil used for backfilling will be characterized to establish that it is comparable to RFETS background (background plus two standard deviations) soil values (DOE 2001a). Soil with analytical results greater than background (background plus two standard deviations) will not be used. Additionally, soil will undergo geotechnical evaluation to ensure stability requirements are met. Soil sources will be chosen from local areas to minimize transportation and air quality impacts. Efforts will be made to choose weed-free backfill material. Offsite soil will be staged onsite as necessary to ensure a consistent supply of backfill material.

6.11.4 Stabilization and Revegetation

Remediated areas will be stabilized, as necessary, to prevent erosion. Stabilization techniques will include grading, compaction, and revegetation. The general revegetation strategy is to revegetate the area as soon as practical and eliminate the need for short-term vegetation. If there is a substantial delay between the grading effort and the final seeding, measures will be taken to minimize erosion during the delay. Temporary measures could include interim vegetation, erosion control mats, application of tackifier and/or crimping the area with straw. Remediated areas in the IA will be stabilized in accordance with the Industrial Area Revegetation Plan contained in Appendix E. Remediated areas in the BZ will be stabilized in accordance with the Annual Vegetation Management Plan for the Rocky Flats Environmental Technology Site (DOE 2001c). Project-specific seeding instructions, including the seed mixture, soil type, soil amendment and soil moisture conditions, will be developed and included in project work controls.

6.12 DECONTAMINATION

Reusable remediation equipment will be decontaminated in accordance with OPS-FO.03, *Field Decontamination Operations*. Decontamination water generated during sampling will be managed in accordance with OPS-PRO.112, *Handling of Field Decontamination Water*. Excavation equipment will be decontaminated between project locations at the Decontamination Pad in accordance with OPS-PRO.070, *Equipment Decontamination at Decontamination Facilities*.

6.13 CLOSEOUT REPORT

A Closeout Report will be written for each IHSS Group remediation in accordance with RFCA and will be submitted to the regulatory agencies for approval. Additionally, each IHSS, PAC, and UBC site will be individually dispositioned through the HRR process. The expected outline for a Closeout Report is shown below. The format may change to meet the needs of the ER Program.

- Introduction;
- Accelerated Action Activities
  - Characterization Data – Will include maps and tables of characterization data and the data quality assessment,

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- Subsurface Soil Risk Screen,
- Remedial Action Description – Will include a description of the remediation, the rationale for the remediation, and a map of the target remediation area,
- Map of Remediation Area – Will include a map of the final remediation area,
- Confirmation Sampling Data – Will include confirmation sampling analysis data and maps, and a comparison to cleanup goals,
- Verification of Treatment Process (if applicable) – Will include a description of the treatment process and analytical results to confirm that treatment was successful,
- Deviations from the ER RSOP – Will include exceptions to the ER RSOP not covered in a modification and the reasons for the exceptions. It is anticipated that these deviations will be field changes,
- Dates and Durations of Specific Activities (approximate) – Will include a history of major remediation activities,
- Site Reclamation – Will include a description of stabilization and revegetation activities,
- Final Disposition of Wastes – Will describe where the waste will be disposed (actual or anticipated); and
- References

- Post-Remediation Conditions
  - Description of Site Condition After Remediation – Will include a map of residual contamination above background plus two standard deviations, method detection limits, and RFCA soil ALs, if any;
  - Table of No Longer Representative Sampling Locations and Sample Numbers – Will include a list of sampling locations that have been remediated. These data will be used to mark database records so they are not used in the CRA or other Site analyses; and
  - Maps of pipes and structures left 3 feet below grade.
- Stewardship Evaluation
  - Near-term stewardship actions and long-term stewardship recommendations.

Upon completion, the Final Closeout Report will be submitted to the LRA for approval and placed in the AR. LRA approval of these reports constitutes agency concurrence with a proposal of No Further Accelerated Action.

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6.14 SCHEDULE

The schedule for remediation of IHSS Groups is shown on Figure 20. This figure illustrates the 2005 Working Schedule for RFETS Closure; however, it may change based on the decommissioning schedule and characterization acceleration opportunities.

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Figure 20. IHSS Group Schedule

7.0 ENVIRONMENTAL PROTECTION AND MONITORING

Environmental impacts will be minimized during implementation of this RSOP by using controls and approaches designed to prevent release of contaminants to air, surface water, groundwater, and the environment. Monitoring activities will be coordinated with compliance staff. The environmental monitoring program includes routine monitoring for air, surface water, groundwater, and ecology. If additional monitoring is necessary for a given project, appropriate media-specific monitoring specifications are developed that complement environmental monitoring. Descriptions of the monitoring programs and requirements and protective measures are discussed in the following sections. Figure 21 illustrates the decision framework for environmental protection actions.

7.1 AIR

Environmental remediation activities have the potential to generate total suspended particulate (TSP), particulate matter (less than 10 microns [PM_{10}]), radionuclide, VOC, hazardous air pollutant (HAP), oxides of nitrogen (NOx), and carbon monoxide (CO) emissions.

7.1.1 Particulate Emissions

Environmental remediation activities will generate dust, including TSP and PM_{10}. Opacity and particulate emission are governed by 5 CCR 1001-3, Regulation No. 1. Section III of Regulation No. 1 addresses the control of particulate emissions and requires that practical, economically reasonable, and technologically feasible work practices are used to control dust emissions. All remediation projects will need to assess the dust generation potential from activities of soil excavation, transport, and handling, and implement dust control measures accordingly.

Radionuclide emission requirements are addressed in the National Emission Standards for Hazardous Air Pollutants (NESHAP) for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities (40 CFR Part 61, Subparts A and H [CCR 5 1001-10, Regulation No. 8, Part A, Subparts A and H]). This regulation requires RFETS to limit radionuclide emissions to an annual public dose (dose to an offsite member of the public) standard of 10 millirems per year (mrem/yr); monitor significant emission points; notify EPA and CDPHE prior to construction or modification of radionuclide sources with emissions exceeding a 0.1-mrem/yr effective dose equivalent (EDE) threshold; and annually report the Site's radionuclide emissions, demonstrating compliance with the 10-millirem (mrem) standard.

The existing Radioactive Ambient Air Monitoring Program (RAAMP) sampler network will be used for ambient air monitoring during environmental remediation. The RAAMP sampler network continuously monitors airborne dispersion of radioactive materials from the Site into the surrounding environment. The RAAMP network consists of 37 samplers, as shown on Figure 22. Fourteen of these samplers are deployed at the Site perimeter and used to confirm Site compliance with the 10-mrem/yr standard. Filters from the 14 perimeter RAAMP samplers are collected and analyzed monthly for U, Pu, and Am isotopes. The radiological NESHAP regulations require that an air quality assessment be conducted to evaluate potential emissions

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Figure 21. Environmental Protection Action and Decision Framework

Figure 22. Air Sampling Location Map

from planned projects. Project-specific ambient monitoring can also be triggered by soil screening measurements performed for radiation worker protection. Enhanced radionuclide ambient air sampling will be performed on an as-needed basis.

7.1.2 Control of Emissions

Some combination of the following methodologies may be used to control fugitive dust:

- Controlled water spraying will be used to minimize fugitive dust emissions during environmental remediation.
- Debris, if encountered during remediation activities, will be loaded into waste rolloff containers (Section 6.5) and covered to control fugitive dust emissions.
- Environmental remediation activities will be terminated during periods of high winds, if necessary to control fugitive dust.
- Dust control devices or shrouds may be used on individual equipment.

All environmental remediation projects will establish a maximum wind velocity AL. All remediation activities will cease when the AL is exceeded. Dust will be predominantly controlled through the application of water. Depending on the location of the remediation, a water truck (or wagon) or hydrant will be used. Water will be applied in a controlled manner to manage dust without resulting in excess ponding or runoff.

Environmental remediation activities may also include operation of heavy equipment, vehicles, and similar equipment. Although emissions from equipment will not generate sufficient criteria emissions to affect National Ambient Air Quality Standards (NAAQSs), temporary stationary fossil fuel-fired equipment use (or fuel use) will need to be tracked to ensure emissions remain within permitted limits, or that appropriate notices or permit modifications are filed. In addition, opacity will be limited to below 20 percent.

7.2 SURFACE WATER

Water erosion of contaminated soil during remediation could adversely impact water quality. Impacts to surface water will be controlled using standard construction methods for stormwater pollution prevention, including silt fences, berms, hay bales, diversion ditches, and BMPs. Table 11 identifies potential BMPs for construction activities that can be used as necessary. The selected controls will be coordinated with compliance staff. It is anticipated that decommissioning projects will already have surface water controls around the majority of the project areas, and only minor modifications may be necessary prior to starting remediation activities.

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Table 11. Best Management Practices

Control/Description	Primary Use	Application	Design Criteria	Limitations/Maintenance
Interceptor Swale – A small, V-shaped or parabolic channel that collects runoff and directs it to a desired location. It can have a natural grass lining or, depending on slope and design velocity, a protective lining of erosion matting, stone, or concrete.	To direct sediment-laden flow from disturbed areas into a controlled outlet or direct clean runoff around disturbed areas. Because a swale is easy to install during early grading operations, it can serve as the first line of defense in reducing runoff across disturbed areas. As a method of reducing runoff across the disturbed construction area, it reduces the requirements of structural measures to capture sediment from runoff because the flow is reduced. By intercepting sediment-laden flow downstream of the disturbed area, runoff can be directed into a sediment basin or other BMP for sedimentation, as opposed to long runs of silt fences, straw bales, or other filtration methods. Based on site topography, swales can be effectively used in combination with diversion dikes.	Common applications for interceptor swales include roadway projects, site development projects with substantial offsite flow impacting the site, and sites with a large area(s) of disturbance. They can be used in conjunction with diversion dikes to intercept flows. Temporary swales can be used throughout the project to direct flows away from staging, storage, and fueling areas, along with specific areas of construction. Note that runoff that crosses disturbed areas or is directed into unstabilized swales must be routed into a treatment BMP, such as a sediment basin. Grass-lined swales are an effective permanent stabilization technique. The grass effectively filters both sediment and other pollutants while reducing velocity.	• Maximum depth of flow in the swale may be 1.5 ft, based on a 2-year design storm peak flow. Positive overflow must be provided to accommodate larger storms. • Side slopes of the swale will be 3:1 or flatter. • Minimum design channel freeboard will be 6 inches. • The minimum required channel stabilization for grades less than 2 percent and velocities less than 6 ft per second (ft/sec) may be grass, erosion control mats, or mulching. For grades in excess of 2 percent or velocities exceeding 6 ft/sec, stabilization in the form of high-velocity erosion control mats, a 3-inch layer of crushed stone, or riprap is required. • Check dams can be used to reduce velocities in steep swales. • Interceptor swales must be designed for flow capacity based on the Manning equation to ensure a proper channel section. Alternate channel sections may be used when properly designed and accepted. • Consideration must be given to the possible impact any swale may have on upstream or downstream conditions. • Swales must maintain positive grade to an acceptable outlet.	Interceptor swales must be stabilized quickly after excavation so they do not contribute to the erosion problem they are addressing. Swales may be unsuitable to the site conditions (too flat or steep). Flow capacity should be limited for temporary swales. *Inspection must be made* weekly and after each significant (≥ 0.5 inch) rain event to locate and repair any damage to the channel or clear debris or other obstructions so they do not diminish flow capacity. Damage from storms or normal construction activities, such as tire ruts or disturbance of swale stabilization, should be repaired as soon as practical.

Control/Description	Primary Use	Application	Design Criteria	Limitations/Maintenance
Diversion Dike/Berm – A compacted soil mound, which redirects runoff to a desired location. The dike/berm is typically stabilized with natural grass for low velocities and stone or erosion control mats for higher velocities.	To intercept offsite flow upstream of the construction area and direct the flow around disturbed soil. It can also be used downstream of the area to direct flow into a sediment reduction device, such as a sediment basin or protected inlet. Alternatively, diversion dikes/berms can be used to contain flow within the construction site if the water is potentially contaminated. The diversion dike/berm serves the same purpose and, based on the topography of the site, can be used in combination with an interceptor swale.	By intercepting runoff before it has the chance to cause erosion, diversion dikes/berms are very effective in reducing erosion at a reasonable cost. They are applicable to a large variety of projects, including site developments and linear projects such as roadways and pipeline construction. Diversion dikes/berms are normally used as perimeter controls for construction sites with large amounts of offsite flow from neighboring properties. Used in combination with swales, diversion dikes/berms can be quickly installed with a minimum of equipment and cost, using the swale excavation as the dike. No sediment removal technique is required if the dike is properly stabilized and runoff is intercepted prior to crossing disturbed areas. Significant savings in structural controls can be realized by using diversion dikes to direct sheet flow to a central area, such as a sediment basin or other sediment reduction structure if runoff crosses disturbed areas.	• The maximum contributing drainage area should be 10 acres or less, depending on site conditions. • Maximum depth of flow at the dike will be 1 ft for a 2-year design storm. • The maximum width of the flow at the dike will be 20 ft. • Side slopes of the diversion dike will be 3:1 or flatter. • Minimum width of the embankment at the top will be 2 ft. • Minimum embankment height will be 18 inches as measured from the toe of the slope on the upgrade side of the berm. • For velocities less than 6 ft/sec, the minimum stabilization for the dike/berm and adjacent flow areas is grass, erosion control mats, or mulch. For velocities greater than 6 ft/sec, stone stabilization or high-velocity erosion control mats should be used. • The dikes will remain in place until disturbed areas protected by the dike/berm are stabilized unless other controls are put into place to protect the disturbed area. • The flow line at the dike will have a positive grade to drain to a controlled outlet.	Compacted earth dikes/berms require stabilization immediately upon placement so they do not contribute to the problem they are addressing. Diversion dikes can be a hindrance to construction equipment moving on the site; therefore, their locations must be carefully planned prior to installation. Dikes/berms must be inspected on a weekly basis and after each significant (> 0.5 inch) rainfall to determine whether silt is building up behind the dike or erosion is occurring on the face of the dike/berm. Silt will be removed in a timely manner. If erosion is occurring on the face of the dike, the slopes of the face will either be stabilized through mulch or seeding, or the slopes of the face will be reduced.

Control/Description	Primary Use	Application	Design Criteria	Limitations/Maintenance
Silt Fence – Consists of geotextile fabric supported by poultry netting or other backing stretched between wooden or metal posts with the lower edge of the fabric securely embedded in soil. The fence is typically located downstream of disturbed areas to intercept runoff in the form of sheet flow. Silt fences provide both filtration and time for sedimentation and reduce the velocity of runoff. Properly designed silt fences are economical because they can be relocated during construction and reused on other projects.	Normally used as perimeter control downstream of disturbed areas. They are only feasible for nonconcentrated, sheet flow conditions.	Silt fences are an economical means to treat overland, nonconcentrated flows for all types of projects. Silt fences are used as perimeter control devices for both site developments and linear (roadway) type projects. They are most effective with coarse to silty soil types. Due to the potential of clogging, silt fences should not be used with clay soil types. To reduce the length of silt fences, they should be placed adjacent to the downslope side of construction activities.	• Fences are to be constructed along a line of constant elevation (along a contour line) where possible. • Maximum slope adjacent to the fence is 1:1. • Maximum distance of flow to the silt fence should be 200 ft or less. • Maximum concentrated flow to the silt fence will be 1 cubic foot per second (cfs) per 20 ft of fence. • If 50 percent or less of soil, by weight, passes the U.S. Standard sieve No. 200, select the equivalent opening size to retain 85 percent of the soil. • Maximum equivalent opening size will be 70 (#70 sieve). • Minimum equivalent opening size will be 100 (#100 sieve). • If 85 percent or more of soil, by weight, passes the U.S. Standard sieve No. 200, silt fences will not be used because of potential clogging. • Sufficient room for the operation of sediment removal equipment will be provided between the silt fence and other obstructions to maintain the fence. • The ends of the fence will be turned upstream to prevent bypass of stormwater.	Minor ponding will likely occur at the upstream side of the silt fence, resulting in minor localized flooding. Fences constructed in swales or low areas subject to concentrated flow may be overtopped, resulting in failure of the filter fence. Silt fences subject to areas of concentrated flow (waterways with flows > 1 cfs) are not acceptable. Silt fences can interfere with construction operations; therefore, planning access routes onto the site is critical. Silt fences can fail structurally under heavy storm flows, creating maintenance problems and reducing the effectiveness of the system. Inspections should be made on a weekly basis, especially after large storm events. If the fabric becomes clogged, it should be cleaned or, if necessary, replaced. Sediment should be removed when it reaches approximately one-half the height of the fence.

Control/Description	Primary Use	Application	Design Criteria	Limitations/Maintenance
Straw Bale Dike – A temporary barrier constructed of straw bales anchored with wood posts, used to intercept sediment-laden runoff generated by small disturbed areas. The straw bales can serve as both a filtration device and dam/dike device to treat and redirect flow. Bales can consist of hay or straw, in which straw is defined as best quality straw from wheat, oats, or barley, and free of weed and grass seed. Hay is defined as straw that includes weed and grass seed.	To trap sediment-laden storm runoff from small drainage areas with relatively level grades, allowing for reduction of velocity, thereby causing sediment to settle out.	Straw bale dikes are used to treat flow after it leaves a disturbed area on a relatively small (1-acre) site. Due to the limited life of the straw bale, it is cost-effective for small projects of a short duration. The limited weight and strength of the straw bale make it suitable for small, flat (< 2 percent slope) contributing drainage areas. Due to the problems with straw degradation and the lack of uniform quality in straw bales, their use is discouraged except for small applications. Straw bales can also be used as check dams for small watercourses, such as interceptor swales and borrow ditches. Due to the problems in securely anchoring the bales, only small watercourses can effectively use straw bale check dams.	• Straw bale dikes are to be constructed along a line of constant elevation (along a contour line). • Straw bale dikes are suitable only for treating sheet flows across grades of 2 percent or flatter. • Maximum contributing drainage areas will be 0.25 acre per 100 linear ft of dike. • Maximum distance of flow to dike should be 100 ft or less. • Dimensions for individual bales will be 30 inches minimum length, 18 inches minimum height, and 24 inches minimum width, and will weigh no less than 50 pounds when dry. • Each straw bale will be placed into an excavated trench having a depth of 4 inches and a width just wide enough to accommodate the bales themselves. • Straw bales will be installed in such a way that there is no space between bales to prevent seepage. • Individual bales will be held in place by at least two wooden stakes driven a minimum distance of 6 inches below the 4-inch excavated trench to undisturbed ground, with the first stake driven at an angle toward the previously installed bale. • The ends of the dike will be turned upgrade to prevent bypass of stormwater. • Place bales on sides such that bindings are not buried.	Due to a short effective life caused by biological decomposition, straw bales must be replaced after a period of no more than 3 months. During the wet and warm seasons, however, they must be replaced more frequently as is determined by periodic inspections for structural integrity. Straw bale dikes are not recommended for use with concentrated flows of any kind except for small check flows in which they can serve as a check dam. The effectiveness of straw bales in reducing sediment is very limited. Improperly maintained, straw bales can have a negative impact on the water quality of the runoff. Straw bales will be replaced if there are signs of degradation, such as straw located downstream from the bales, structural deficiencies due to rotting straw in the bale, or other signs of deterioration. Sediment should be removed from behind the bales when it reaches a height of approximately 6 inches.

Impacts to surface water from environmental remediation will be monitored through the environmental monitoring program. Monitoring of activities within the IA are conducted through new source detection (NSD) and POE monitoring. NSD monitoring provides comprehensive coverage of the entire IA from permanent monitoring locations and focuses on runoff into the two main drainage areas. The NSD objective is to monitor the performance of all remediation activities within the IA with respect to their impact on surface water. POE monitoring allows assessment of RFCA AL adherence. Performance monitoring, as described in the IMP, may be implemented if a project poses a concern for contaminant release. Monitoring activities will target the contaminants of greatest concern for the action being monitored.

7.3 GROUNDWATER

Several groundwater contaminant plumes were identified during previous RFI/RIs and sitewide programs. Groundwater wells, installed to monitor plume extent, are being sampled as part of the routine groundwater monitoring program. When active groundwater wells are located in IHSSs, PACs, UBC sites, or areas being remediated, compliance staff may direct or perform groundwater sampling. Performance monitoring, as described in the IMP, may be implemented if a project poses a concern for contaminant release. Monitoring locations will target the contaminants of greatest concern for the action being monitored.

7.4 ECOLOGY

Environmental remediation under this RSOP may affect ecological resources. Wetlands exist in some portions of the Site, and environmental remediation activities that could impact wetlands must be reviewed prior to initiating an action. Downgradient wildlife habitat could also be damaged if soil or other eroded materials are allowed to flow into the habitats. Measures to prevent siltation, as described in Section 7.2, will be used. To minimize the possibility of adverse effects and ensure regulatory compliance is met, surveys of potential remediation sites by Site ecologists will be conducted prior to any environmental remediation activities. Animal habitats may be temporarily impacted by the environmental remediation; however, the effects will be eliminated after native vegetation is restored. If soil is left exposed for an extended period of time, additional control measures may be necessary.

8.0 WORKER HEALTH AND SAFETY

Remediation activities could expose workers to physical, chemical, biological, and low levels of radiological hazards. Physical hazards include those associated with excavation activities, drilling, use of heavy equipment, noise, heat stress, cold stress, and work on uneven surfaces. Physical hazards will be mitigated by appropriate use of engineering and administrative controls and personal protective equipment (PPE). Chemical hazards will be mitigated by use of PPE and administrative controls. Appropriate skin and respiratory PPE will be worn throughout the project.

Because of the anticipated contaminants, remediation activities in accordance with DOE Order 440.1A are required to follow the Occupational Safety and Health Act (OSHA) construction standard for *Hazardous Waste Operations and Emergency Response*, 29 CFR 1926.65. In accordance with this standard, H&S specifications will address the safety and health hazards of each phase of the project and specify the requirements and procedures for employee protection. In addition, the DOE Order for *Construction Project Safety and Health Management*, 5480.9A, applies to these projects. This order requires the preparation of JHAs to identify each task, hazards associated with each task, and cautions necessary to mitigate the hazards. These requirements will be integrated into the HASP wherever appropriate.

A HASP Addendum and JHA will be prepared on an IHSS Group-specific basis to identify and control potential hazards. The HASP Addendum will address both the specific hazards to be encountered and applicable guidance and requirements (e.g., OSHA), as well as specific safety equipment (e.g., hard hats and PPE) required for individual tasks. Implementation of the requirements of these documents will minimize the possibility and potential consequences of accidents and minimize physical hazards. Specific items to be covered in the HASP or HASP Addenda include the following, as applicable:

- Scope of work;
- Personnel responsibilities;
- Site information;
- Description of project-specific tasks;
- Project orientation and training requirements, including medical surveillance, required meetings, and reporting, logbook, and visitor procedures;
- Training requirements;
- PPE requirements;
- Monitoring requirements;
- Hazard assessment of biological, physical, chemical, and radiological hazards;
- Fire protection plans;

- Site access control and work zones;
- HASP bulletin board requirements;
- Sanitation requirements;
- Emergency response procedures, plans, and telephone numbers;
- Spill control procedures; and
- Recordkeeping requirements.

JHAs address specific hazards associated with remediation activities, including hazards for each task step, controls to be used, special equipment requirements, training, and any necessary monitoring. No field work will be performed until a JHA has been written and approved with the exception of walkdowns, general work tasks, surveillance, inspections, and other tasks specified by the project-specific H&S Officer. The project H&S Officer, with radiological personnel, will assess the need for personnel and area monitoring.

Work activities will be stopped if any hazard is encountered or a known or potential hazard is present at a level exceeding established control limits, and appropriate notifications and mitigation of the hazard encountered will be pursued.

H&S data and controls will be continually evaluated. Field radiological screening will be conducted using radiological instruments appropriate to detect surface contamination and airborne radioactivity. As required by 10 CFR 835, *Radiation Protection of Occupational Workers*, all applicable implementing procedures will be followed to ensure protection of workers.

Potential threats to H&S for collocated workers and the general public from the release of airborne materials will be mitigated via implementation of dust suppression techniques, as described in Section 7.1. Use of controls and procedures for worker protection will also protect the public, because work control measures are designed to identify potential hazards and prevent releases (e.g., by using dust controls).

9.0 WORK CONTROLS

Because the complexity of remediation projects will vary, project hold-points and criteria to accommodate varying conditions are routinely used at RFETS to prevent impacts to worker safety and the environment. Field conditions such as differences in contaminant levels and the presence of debris or pipelines may be encountered during remediation activities. Field conditions requiring work controls include incidental water, debris, or unknown utilities; elevated contamination in soil or air; and incidental spills. Emergency response, accidents, injuries, and natural disasters are described in the project-specific work controls.

Field conditions will be evaluated to determine their significance, and whether project work controls are sufficient to address specific field conditions. Based on this initial evaluation, a determination will be made whether to proceed with controls currently in place; isolate the field condition from the project activity, if it can be done safely; or pause operations to address the field condition. If a project pause is required, a revised JHA and work control documents will be prepared. After the revised JHA has been approved, work will proceed according to the appropriate control measures. Data and controls will be continually evaluated during project execution. Work controls ensure all work is performed based on an informed approach with regards to all potential hazards. The following sections describe field conditions and the corresponding response actions.

9.1 INCIDENTAL WATER

Considering the shallow bedrock, groundwater conditions, and possible depth of contamination at the Site, excavations may accumulate incidental water during remediation. If incidental water is encountered, it will be sampled and managed in accordance with the Site's Incidental Water Procedure (1-C91-EPR-SW.01, *The Control and Disposition of Incidental Water*). Incidental water is defined as precipitation, surface water, groundwater, utility water, process water, or wastewater collected in one or more of the following areas:

- Excavation sites, pits, or trenches;
- Secondary containments or berms;
- Valve vaults;
- Electrical vaults;
- Steam pits or other utility pits;
- Utility manholes;
- Other natural or manmade depressions that must be dewatered; or
- Discharges from a fire suppression system that has been breached within a radiological buffer area or a contamination area.

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Incidental water may be sampled to determine whether it may be discharged to the environment or treatment is required. Options for water disposition may include treatment or direct discharge depending on contaminant levels in the water. Process knowledge, field pH, appearance, field nitrate, and field conductivity are the initial screening criteria. Additional sampling and analysis may be conducted when known or suspected contamination is present. These additional samples may be evaluated for gross alpha, gross beta, pH, VOCs, and metals.

Incidental water encountered as a result of stormwater or groundwater entering and collecting in an excavation will be removed if sufficient volume is present. Using a field sump, the water will be transferred to an incidental water holding tank adjacent to the area. This holding tank will be constructed with sufficient secondary containment and labeled appropriately. If the incidental water contains contaminant concentrations equal to or greater than the RFCA Surface Water Standards for Segment 5, the incidental water will be sent to an available onsite treatment facility or disposed offsite.

9.2 UNEXPECTED DEBRIS

Historical data indicate unexpected debris will be encountered during remediation activities. When drums, wood, metal, plastic, rubber, fiberglass, or other debris is found during excavation activities, the following actions will be taken:

- Excavation activities will be immediately suspended and the Project Manager, Field Supervisor, Project H&S Officer, Project Environmental Manager, and Radiological Safety will be notified.
- Information regarding the debris will be gathered. This will include any labels, markings, or other visual clues as to the nature of the debris.
- Upon approval from the Project Manager or Field Supervisor, as well as the Radiological Safety Manager/Radiological Control Technician (RCT) Supervisor and H&S Officer, the debris will be removed from the excavation and placed on plastic sheeting where it can be surveyed for radiological contamination in accordance with 3-PRO-165-RSP-07.02, Contamination Monitoring Requirements, monitored for VOCs, and further characterized as necessary.
- After characterization, the debris will be appropriately segregated and staged for disposal.
- Based on the radiological survey, VOC monitoring results, and other characterization data, the area radiological postings, RWP, controls, and work practices will be reviewed and modified as necessary.
- Upon approval from the K-H Project Manager, excavation activities will resume.

9.3 UNKNOWN UTILITIES

Some utilities installed at RFETS are not shown on existing utility drawings. When encountered during excavation work, these cannot always be readily identified by type and may create potential hazards to workers. The process for dispositioning utilities that are not adequately identified is as follows:

- Suspend all excavation activities and notify the Project Manager, Field Supervisor, Project H&S Officer, Project Environmental Manager, and Site Excavation Specialists.
- Review all utility drawings and contact knowledgeable building personnel to identify the possible range of utilities.
- Trace lines with all available equipment and excavate where feasible.
- Develop a work-around for the unknown utility, if possible.
- Ensure worker safety by protecting the utility from damage.
- Use infrared, radiography, and other nonintrusive techniques to obtain additional information on the utility type and conduit contents. Infrared scanning devices are used by the RFETS Fire Department to determine the presence and level of liquid in pipes. The Rocky Flats Bomb Squad identifies the types of utilities in plastic and metal conduits using a portable x-ray device.
- Mark tested locations and identified features on the conduit.
- Use tap-and-drain techniques where appropriate to collect a sample of contained fluids for analysis if the conduit contains liquid. The sample results will determine the appropriate controls needed to breach the line.
- Make a small opening on the side of the conduit away from the wires to allow additional testing if the conduit contains wires but not liquids, and if the wires can be adequately located.
- Determine the possible hazards and hazard controls after the utility is better identified.
- Develop a specific project work package, including a JHA, or revise the existing package and JHA if the utility must be breached.
- Minimize the potential for spills. If possible, orient the pipe to reduce the volume in the area that will be broken if liquids are suspected to be present.
- Notify the Shift Supervisor prior to cutting the utility.
- Upon approval from the K-H Project Manager, excavation activities will resume.

9.4 SOIL SURFACE FIDLER READINGS GREATER THAN 5,000 COUNTS PER MINUTE

Field Instrument for the Detection of Low Energy Radiation (FIDLER) readings will be taken on the surface of soil removed from an excavation. The ER staff uses the FIDLER to determine

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whether additional work controls need to be considered. The FIDLER measures counts per minute (cpm) over an area. These values cannot be translated into pCi/g of soil. If levels greater than 5,000 cpm are detected, the following actions will be taken:

- Excavation activities will be immediately suspended and the Project Manager or Field Supervisor, Project H&S Officer, Project Environmental Manager, and Radiological Safety will be notified.
- A plastic-lined and -covered soil segregation area will be established at the excavation site for soil above 5,000 cpm.
- Based on the FIDLER readings, the area radiological postings, RWP, controls, and work practices will be reviewed and modified as necessary.
- Upon approval from the K-H Project Manager or their designee, excavation activities will resume.
- A composite sample of the segregated soil will be analyzed using a high-purity germanium (HPGe) detector. Based on the sample results, the area radiological postings, RWP, controls, and work practices will be reviewed and modified as necessary.
- Upon approval from the K-H Project Manager or their designee, the segregated soil will be managed as appropriate. Until soil is removed from the site, the segregated soil will be covered at the end of each day.

9.5 PROJECT PERIMETER RADIOLOGICAL AIR SAMPLE RESULTS GREATER THAN 30 PERCENT DERIVED AIR CONCENTRATION

To protect collocated workers in the Contaminant Reduction Zone/Radiological Buffer Zone (CRZ/RBZ) and project support zone, project perimeter, or work area, high- and low-volume air samples will be collected. A portable alpha analyzer will be used to determine whether an elevated sample result is due to naturally occurring radioactive material or radioactive COCs. If real-time results are required, a continuous air monitor will be used. If a confirmed sample result is greater than 30 percent of the derived air concentration (DAC), the following actions will be taken:

- All activities will be immediately suspended, and the Project Manager or Field Supervisor, Project H&S Officer, Project Environmental Manager, and Radiological Safety will be notified.
- Access to downwind areas will be restricted.
- All personnel in the CRZ/RBZ and support zone will be moved to a safe upwind assembly area.
- Based on sample and monitoring results, potential personal radiological exposures will be reviewed.

- Based on the sample results, the area radiological postings, RWP, controls, and work practices will be reviewed and modified as necessary.
- Upon approval from the K-H Project Manager or their designee, work activities will resume.

9.6 EQUIPMENT RADIOLOGICAL CONTAMINATION GREATER THAN TRANSURANIC RELEASE LIMITS

All material and equipment exiting a radiological control area at the excavation will be surveyed. In the event that survey results indicate contamination levels greater than unrestricted release limits, the following actions will be taken:

- All activities will be immediately suspended, and the Project Manager, Field Supervisor, Project H&S Officer, Project Environmental Manager, and Radiological Safety will be notified.
- The source of the contamination will be identified and controlled.
- The contaminated material or equipment will be contained, handled, and transferred in accordance with the RFETS Radiological Control Manual.
- Based on the survey results, the area radiological postings, RWP, controls, and work practices will be reviewed and modified as necessary.
- Upon approval from the K-H Project Manager or their designee, work activities will resume.

9.7 PROJECT PERIMETER VOLATILE ORGANIC COMPOUND MONITORING GREATER THAN BACKGROUND

To protect collocated workers in the CRZ/RBZ and project support zone, perimeter VOC air monitoring will be conducted. If results indicate the sustained presence of VOCs at levels greater than background, the following actions will be taken:

- All activities will be immediately suspended, and the Project Manager, Field Supervisor, Project Environmental Manager, and Project H&S Officer will be notified.
- All personnel in the CRZ/RBZ and support zone will be moved to a safe upwind location.
- Based on monitoring results, potential personal chemical exposures will be reviewed.
- Based on monitoring results, site control and work practices will be reviewed and modified as necessary.
- Upon approval from the K-H Project Manager or their designee, work activities will resume.

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9.8 HAZARDOUS SUBSTANCE RELEASE

The Site Spill Response Plan is designed to establish a program to optimize a safe response to incidental and emergency situations with the intent of protecting project personnel, collocated workers, the public, the environment, and property in the event of spills, fire, or explosion. All spills will be addressed in accordance with the Emergency Response and Spill Control Program. If applicable, reporting will be conducted in accordance with the Administrative Procedures Manual, 1-D97-ADM-16.01 (*Occurrence Reporting Process)*, the Chemical Management Manual, and regulatory reporting requirements.

9.8.1 Incidental Spills

Incidental spills are those where the substance can be safely absorbed, neutralized, or otherwise controlled by employees in the immediate release area at the time of the release. In addition, the release does not have the potential to become an emergency within a short time frame.

Spills considered incidental include the following:

- Gasoline, diesel, or hydraulic oil spills;
- Contaminated soil spills outside the Exclusion Zone/Soil Containment Area (EZ/SCA); and
- Decontamination or incidental water spills inside secondary containments.

Criteria that must be met prior to incidental release response actions at the project site include:

- The Project Manager, Field Supervisor, Project Environmental Manager, and Project H&S Officer must be notified, and Radiological Safety must also be notified if the spill involves radiological material.
- Chemical hazards of the substance spilled are known and quantified.
- Standard PPE will provide adequate personal protection.
- Decontamination methods are suitable for the substance spilled.
- All materials or equipment used during the response are compatible with the substance spilled.

Post-incidental spill response includes:

- Ensuring proper reporting in accordance with HSP-21.04, ADM-16.01 and the Chemical Management Manual; and
- Conducting a briefing to address the cause of the spill, methods of preventing future spills, and ways to improve readiness and response.

10.0 WASTE MANAGEMENT

This section describes the management of contaminated soil and debris remediation waste, as well as wastewater that may be generated during remediation. Soil and debris remediation waste will be disposed offsite with or without prior treatment or may be used onsite if treated soil meets backfill criteria. Wastewater will be contained, characterized, and treated as necessary. All waste will be managed in accordance with RFETS policies, procedures, and substantive ARARs, and will generally be consistent with protocols in the Asphalt and Soil Management RSOP (DOE 2001d) as necessary.

10.1 WASTE TYPES

Potential remediation waste types include nonroutine sanitary, LL, TRU, hazardous, LLM and TRU mixed waste, PCB and low-level PCB wastes, and friable asbestos-containing material (ACM) and LL ACM wastes.

10.1.1 Soil and Debris

During remediation, contaminated soil and debris will be excavated, and characterized and managed appropriately for the type of waste it represents based on its chemical, physical, and radiological constituents.

Nonroutine Sanitary Waste

Uncontaminated debris, including nonfriable asbestos, generated during remediation activities is managed as nonroutine sanitary waste. Radiological Engineering will perform a waste release evaluation (WRE) in accordance with PRO-141-RSP-09.01, *Unrestricted Release of Property, Material, Equipment, and Waste,* to ensure the waste meets unrestricted release limits.

Low-Level Waste and Low-Level Mixed Waste

LL waste is defined as radioactive waste that is not classified as high-level waste, TRU waste, spent nuclear fuel, or by-product material as defined by DOE Order 435.1, *Radioactive Waste Management*. The activity of radionuclides in LL waste is less than 100 nCi/g, with no specific minimum level of activity. LL mixed waste is LL waste that also contains RCRA hazardous constituents.

TRU Waste and TRU Mixed Waste

TRU waste is radioactive waste that is not defined as high-level waste and contains alpha-emitting TRU radionuclides with atomic numbers greater than 92 and half-lives greater than 20 years with activities greater than 100 nCi/g. TRU mixed waste is TRU waste that also contains RCRA hazardous waste.

Hazardous Waste

Excavated soil and debris will be characterized in accordance with regulatory requirements (40 CFR 261 and 6 CCR 1007-3, Part 261). Soil and debris characterized as RCRA hazardous contain a hazardous waste listed in Subpart D of Part 261 or exhibit a characteristic of hazardous waste as defined in Subpart C of Part 261.

A hazardous waste cannot be radiologically contaminated (or it is considered mixed waste). Soil will require radiological characterization in accordance with 3-PRO-140-RSP-09.03, *Unrestricted Release of Bulk or Volume Material*. Debris will be characterized in accordance with 3-PRO-141-RSP-09.01, and must meet the unrestricted release limits.

PCB and Low-Level PCB Waste

Soil and debris containing PCBs as a result of a spill, release, or other unauthorized disposal may be PCB remediation waste as defined by TSCA and the promulgated regulations in 40 CFR 761. The waste may be classified as LL PCB or TRU PCB remediation waste, depending on the types and activities of radionuclides present. PCB remediation waste may also be contaminated with RCRA constituents.

Friable Asbestos-Containing Material

Friable ACM is any material that contains more than 1 percent asbestos and, when dry, may be crumbled, pulverized, or reduced to a powder by hand pressure. The RFETS Industrial Hygiene organization is responsible for making friability determinations for ACM. As with PCB remediation waste, ACM may be LL or TRU, depending on the types and activities of radionuclides present.

10.1.2 Wastewater

Wastewater may be generated by dewatering groundwater and surface water accumulation in excavations or detention ponds. The wastewater could contain hazardous constituents and/or radionuclides.

10.2 ONSITE MANAGEMENT AND TREATMENT

Soil and debris remediation waste will be placed into rolloffs or other waste containers to prevent erosion and runoff. Alternatively, remediation waste may be stockpiled in the project area in a covered, bermed area, as necessary. Remediation waste will be stored in the project area until the waste is treated onsite, or transferred from the project area to a K-H-approved offsite treatment or disposal facility or an interim storage area prior to offsite shipment. Remediation waste will be managed onsite in accordance with substantive ARARs (Section 5.1.2).

10.2.1 Waste Storage Requirements

Hazardous remediation waste will be managed in accordance with the requirements of 6 CCR 1007-3, Part 264, Subpart I, *Use and Management of Containers*, or stockpiled to ensure the safe and appropriate management of this type of waste. Waste handling and storage during remediation will meet the substantive requirements of 6 CCR 1007-3, 264.553 and 6 CCR 1007-3, Part 264, Subpart I. Storage of PCB remediation waste will meet the applicable, substantive requirements of 40 CFR Part 761. Waste handling and storage of friable ACM will meet the applicable substantive requirements of 6 CCR 101, Regulation 8, Part B.

10.2.2 Waste Treatment Requirements

Contaminated soil may be treated onsite using low-temperature thermal desorption if the treated waste is expected to meet criteria for onsite backfill. In this case the treatment unit will be established as a miscellaneous unit, managed pursuant to the substantive requirements of 6 CCR 1007-3, Part 264, Subpart X. Environmental evaluations required by Subpart X status, such as surface soil, geology, and hydrology, are contained in previously prepared RFI/RI reports. Operation of a miscellaneous unit will be conducted in accordance with the substantive requirements of 6 CCR 1007-3, Part 264, Subparts AA and BB, *Air Emissions Standards for Process Vents and Air Emissions Standards for Equipment Leaks*. The substantive requirements of 6 CCR 1007-3, Part 265, Subpart P, *Thermal Treatment*, will be incorporated to provide operating parameters appropriate for treatment using thermal desorption technology.

10.3 OFFSITE TREATMENT OR DISPOSAL

Remediation waste generated at RFETS and destined for offsite treatment or disposal will be managed onsite in accordance with substantive ARARs (Section 5.1.2). This includes nonroutine sanitary wastes (e.g., trash and debris suitable for disposal in a sanitary landfill). The overall waste characterization, generation, and packaging process for the waste is specified in the *Low-Level/Low-Level Mixed Waste Management Plan,* 94-RWP/EWQA-0014. The waste classification of contaminated soil and debris will determine the type of receiver site and treatment (if any) required.

10.3.1 Nonroutine Sanitary Waste

Nonroutine sanitary waste will be disposed in K-H-approved sanitary landfills. Nonroutine sanitary waste will be characterized and managed in accordance with 1-PRO-573-SWODP, *Sanitary Waste Offsite Disposal Procedure*. Critical to characterization is the WRE, indicating the waste meets RFETS unrestricted release limits. The waste must also be free of prohibited items as defined by receiver site requirements.

10.3.2 Low-Level Waste

LL waste will be treated and/or disposed at a K-H-approved LL waste disposal facility. Excavated soil from each project area will be collected and analyzed to demonstrate it is LL and does not contain hazardous waste. Debris with surface contamination will be characterized as surface-contaminated objects (SCOs) in accordance with PRO-267-RSP-09.05, *Radiological Characterization for Surface Contaminated Objects.* The SCO characterization is required to demonstrate compliance with DOT regulations in 49 CFR 173 and regulatory requirements.

10.3.3 TRU Waste

TRU waste will be disposed at the Waste Isolation Pilot Plant (WIPP). Chemical characterization (chemical analysis or process knowledge) of TRU waste is required. TRU waste will be packaged in accordance with TRUCON codes, which were developed to meet the TRUPACT-II transportation requirements. The TRUCON codes specify the radionuclide activity loading limits (otherwise known as wattage limits) for a given waste Item Description Code (IDC) and packaging configuration (type and number of layers of confinement).

10.3.4 Hazardous, Low-Level Mixed, and TRU Mixed Wastes

Excavated soil that contains hazardous listed waste or exhibits hazardous characteristics must meet the LDR requirements of 6 CCR 1007-3, Part 268 prior to disposal. Soil with hazardous constituent concentrations 10 times the Universal Treatment Standards (6 CCR 1007-3, Part 268.48) will be treated to achieve these standards, or achieve 90 percent reduction in total hazardous constituent concentrations (or 90 percent reduction in extractable concentrations for metals) prior to disposal, whichever is least restrictive (6 CCR 1007-3, Part 268.49[c] and [d]). Treated soil that no longer contains listed waste or exhibits characteristics of hazardous waste can be disposed as nonhazardous waste or used as backfill (Section 6.11). Otherwise, the soil will be disposed in a K-H-approved hazardous waste disposal facility. Debris that is a characteristic hazardous waste will require treatment prior to land disposal (6 CCR 1007-3, Part 268.45).

The disposition of LLM remediation waste will depend on the waste characteristics. Currently, for direct disposal, characterization must show that the waste is solid, LDR-compliant, and contains radionuclides at less than 100 nCi/g activity. Samples of the excavated soil from each project area will be collected and analyzed. LLM remediation waste will be stabilized or treated offsite as necessary and disposed in a K-H-approved disposal facility. Currently, a receiver site does not exist for mixed wastes with radionuclide activities between 10 and 100 nCi/g.

10.3.5 Beryllium Waste

Process knowledge will be used to identify debris that may be contaminated with beryllium. Beryllium remediation waste will be managed in accordance with 10 CFR 850. Debris contaminated with beryllium greater than 0.2 □g/100 cm2 will be disposed offsite at a K-H-approved facility. Generator knowledge or analytical data will be used to identify soil contaminated with beryllium. Soil with beryllium values above RFCA soil ALs, as determined by analysis, will be disposed at a K-H-approved disposal facility.

10.3.6 PCB Waste

Nonradiological PCB remediation waste with PCB concentrations less than 50 ppm will be disposed in a sanitary landfill in accordance with 40 CFR 761.61(a)(5)(i)(B)(2)(ii). PCB remediation waste with PCB concentrations equal to or greater than 50 ppm will be disposed at a RCRA Subtitle C facility or TSCA-permitted receiver site in accordance with 40 CFR 761.61(a)(5)(i)(B)(2)(iii). LL and TRU remediation waste with PCBs will be disposed offsite at an approved facility.

10.3.7 Friable Asbestos

Friable asbestos will be managed in accordance with OSHA (29 CFR 1910.1001 and 29 CFR 1926.1101), NESHAP (40 CFR 61 Subpart M), and 40 CFR 763, *Asbestos*. In general, friable ACM will be wetted and packaged in a plastic bag not less than 6 mils in thickness, a combination of plastic bags equal to at least 6 mils in thickness, or a container lined with plastic of not less than 6 mils in thickness. Friable asbestos, LL friable asbestos, and TRU friable asbestos will be disposed at K-H-approved facilities. Nonfriable, nonradioactively contaminated ACM can be managed as nonroutine sanitary waste.

10.4 WASTEWATER MANAGEMENT

Remediation wastewater will largely consist of infiltrated groundwater and incident precipitation accumulation within excavations. Accumulated water that is removed will be managed in accordance with 1-C91-EPR-SW.01, *Control and Disposition of Incidental Waters*. This procedure includes instructions for the proper characterization, transfer, treatment, and discharge of the water. The project will identify the treatment and disposal process to be used for the wastewater. Contaminated water from pipeline flushing will be treated onsite if appropriate facilities are available or disposed offsite at a K-H-approved facility.

10.5 WASTE MINIMIZATION AND RECYCLING

Waste minimization and recycling will be integrated into the planning and management of materials generated during remediation. Unnecessary generation of wastes will be controlled using work techniques that prevent the contamination of areas and equipment; preventing unnecessary packaging, tools, and equipment from entering contaminated areas; and reusing contaminated tools and equipment, when practical.

Standard operations and processes will be evaluated for waste minimization, and suitable minimization techniques will be implemented. Property with radiological or chemical contamination may be reused or recycled onsite, offsite by other DOE facilities, or by publicly or privately owned facilities having proper authorization to take possession of the property. Recycling options that may be considered for materials generated during remediation are listed in Table 12. Materials will be recycled based on availability of appropriate recycle technologies, availability of facilities, and cost effectiveness.

Table 12. Recycling Options

Material	Recycle Option	Comments
"Clean" scrap metal (not radioactively contaminated and not considered hazardous in accordance with RCRA)	Recycle through approved scrap metal vendors or via contract.	Material must meet receiving facility's requirements and licensing requirements, if any.
Nonradioactive scrap metal contaminated with beryllium	Recycle through approved commercial facility.	Post-decontamination concentrations will be < 0.2 µg/100 cm^2.
Concrete rubble meeting the unrestricted release criteria	Reuse onsite as backfill.	Must meet release criteria established in the RSOP for Recycling Concrete.
Wiring and other electrical components meeting the unrestricted release criteria	Recycle through approved commercial recycling facility.	Material must not exceed contamination types and levels identified in the receiving facility's requirements and license.
Bulk plastics and glass meeting the unrestricted release criteria	Recycle through approved commercial recycling facility.	Material must not exceed contamination types and levels identified in the receiving facility's requirements and license.

11.0 QUALITY ASSURANCE

Quality assurance (QA) requirements relevant to this RSOP are consistent with quality requirements as defined in DOE Order 414.1A, Quality Assurance, and EPA's Requirements for Quality Assurance Project Plans for Environmental Data Operations (1997). These requirements are also consistent with RFETS-specific quality requirements as described in the K-H Team Quality Assurance Program, PADC-1996-00051 (K-H 1999). Activities controlled by this RSOP are not covered under 10 CFR 830.120 (QA) unless inventories of materials, under direct control of the project, become nuclear facilities as defined in DOE Standard 1027-92. Hazardous and radiological risks to project personnel are addressed in the project's HASP or HASP Addendum. The applicable quality control (QC) categories include the following:

Management

- Quality Program;
- Training;
- Quality Improvement; and
- Documents/Records.

Performance

- Work Processes;
- Design;
- Procurement; and
- Inspection/Acceptance Testing.

Assessments

- Management Assessments; and
- Independent Assessments.

The ER Program QAPP will discuss in detail how these criteria will be implemented. The Project Manager will be in direct contact with the QA Manager to identify and correct potential quality-affecting issues. Oversight of field activities will be conducted to ensure compliance with quality requirements.

12.0 DECISION MANAGEMENT

A variety of data types will be generated during remediation to support data analysis and reporting requirements. ER will manage analytical data so the staff can evaluate these data on a daily basis. Field analytical data will be transferred to ASD for archiving.

Data generated during characterization and remediation will include, but not be limited to, the following:

- Sampling location data;
- Field parameters (depth, sample interval, field instrument readings, etc.); and
- Soil analytical data.

Data collected during these activities will meet RFETS data quality requirements and project DQOs. Characterization and remediation data will be used for the following purposes:

- Document Site characterization and remediation activities and decisions;
- Provide final characterization of all residual materials;
- Provide data for the CRA; and
- Support the CAD/ROD and post-closure monitoring.

The data systems used to support characterization and remediation are in common RFETS standard platforms to facilitate integration of data and information among media, and make data easily available to users.

12.1 ENVIRONMENTAL RESTORATION REMEDIAL ACTION DECISION MANAGEMENT SYSTEM

RADMS is intended to allow RFETS staff to manage the collection of samples, verify and validate analytical data, retrieve and analyze project-specific and Sitewide analytical data, and display and generate maps and reports. RADMS will interface with existing site databases, including ASD and SWD, to ensure data consistency and integrity. Figure 23 illustrates the general data flow and system configuration.

ER staff intends to use RADMS to:

- Identify sampling locations;
- Manage the collection of samples;
- Track environmental samples/maintain chains-of-custody;
- Verify and validate analytical data;

Figure 23. Remedial Action Decision Management System Configuration

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- Retrieve project and Sitewide analytical data;
- Integrate historical data with new characterization data for statistics and reports;
- Perform data quality assessments and evaluate project-specific data against predetermined quality objectives;
- Determine characterization sampling locations;
- Determine remediation areas;
- Determine confirmation sampling locations;
- Estimate risks from residual contamination;
- Produce maps and reports; and
- Provide a means to archive project data.

RADMS will include several modules customized for ER program decision making. These modules and their current status are presented in Table 13.

Table 13. RADMS Modules

Module	Description	Status	Production Date
Geospatial	Used to identify sampling locations as required by DQOs	In production	August 2002
Field Data Collection	Used to organize field sampling information and produce sampling-related documentation	In production	September 2002
Verification and Validation	Used to verify and validate analytical sample data	In production	June 2003
Data Manager	Used to retrieve and reduce analytical data to project DQOs	Phase I implemented Phase II implementation expected in September 2003.	September 2003
Environmental Data Transformer	Used to evaluate and transform SWD data into the RADMS data environment	In development	September 2003
Risk Assessment	Used to calculate human health risk	In development	January 2004

Additionally, RADMS will be available to CDPHE and EPA in the onsite ER offices. ER staff will work interactively with the regulatory agencies to:

- View existing data;

- Develop proposed characterization sampling locations;
- Determine remediation areas;
- Determine confirmation sampling locations; and
- Accelerate the review and approval process by working with virtual data and graphics prior to submittal of Closeout Reports.

12.1.1 Sample Identification and Tracking

All characterization and confirmation sampling locations will be identified and tracked through the RADMS Field Data Collection Module (FDCM). Samples will be located in a grid pattern or in biased locations in accordance with the IASAP (DOE 2001a) and BZSAP (DOE 2002a) DQOs. The FDCM will track samples by project and sample purpose through the creation of Project Sampling Plans. The FDCM will generate all project-related sampling documentation including Project Sampling Plans, bottle labels, and chains-of-custody.

12.1.2 Data Analysis

Data will be analyzed using several different modules as described above. The algorithms and data analysis routines are consistent with project DQOs. Data analysis will be performed on verified and/or validated data after characterization is complete, and again after remediation is complete. RADMS will also provide the capability to analyze and aggregate legacy data with characterization data if needed. Sitewide data analysis capabilities will also be available. A variety of statistical routines and tests will be linked to RADMS.

Verification and Validation

All data collected during ER characterization and remediation sampling will be verified and validated in accordance with the IASAP (DOE 2001a), BZSAP (DOE 2002a), and QA requirements. Verification will consist of ensuring all data received from the analytical vendor(s) are complete and correctly formatted. Validation will consist of a systematic comparison of all QC requirements with results reported by the vendor (e.g., relative to laboratory control samples, matrix spikes, matrix spike duplicates, and blanks). The verification and validation process will establish usability of the data by determining, reporting, and archiving the following criteria relative to each measurement set or batch:

- Precision;
- Accuracy;
- Bias;
- Sensitivity; and
- Completeness.

Spatial Analysis

Several data aggregation and evaluation options are available in the RADMS Geospatial Module. Spatial analysis will allow determination of contaminant concentration boundaries and isopleths as defined by RFCA soil ALs and background values. Additional functionality will be available to determine sampling locations and remediation areas, as well as graphical displays of geostatistical confidences in the values and decisions.

Risk Screen

The Risk Screen Module will be used to estimate whether human health risks are acceptable in remediated areas. Algorithms in the risk screening module will be consistent with DQOs in the CRA Methodology (in progress), IASAP (DOE 2001a), and BZSAP (DOE 2002a). The Risk Screen Module will include estimations of external and internal exposures on an IHSS Group basis.

Automated Reporting

RADMS is designed to allow RFETS staff to produce project reports and maps in a routine fashion. Hard-copy reports will typically consist of data tables, sampling location maps, chemical concentration posting maps, isopleth maps, remediation maps, and confirmation sampling location maps. Routine report elements will be available via RADMS workstations. User guides and training are provided to qualified users.

13.0 ENVIRONMENTAL CONSEQUENCES

Paragraph 95 of RFCA mandates incorporation of National Environmental Policy Act (NEPA) values into RFETS decision documents. This section of the RSOP addresses the environmental consequences from ER soil remediation actions, including the remediation, treatment, and disposition of contaminated soil and debris; importing of clean soil for backfilling excavations; and related actions associated with Alternative 2, the preferred alternative. Environmental consequences of other alternatives are compared in Table 5. This section, therefore, satisfies the RFCA requirement for a "NEPA-equivalency" assessment of environmental consequences.

Emphasis in this section is on analyzing short-term impacts associated with remediation activities, and distinguishing them from long-term impacts associated with RFETS closure, including the final configuration. The analysis incorporates several previously completed documents and generally accepted assumptions to evaluate impacts in specific resource areas. Offsite transportation impacts, from implementing offsite treatment and disposal alternatives, are addressed previously in Attachment 3 to the RSOP for Facility Disposition (DOE 2004) (for LL and LLM waste), and in the 2001 Cumulative Impacts Document (CID) Update Report (CID Update) (DOE 2001e). Offsite facilities considered for waste treatment or disposal of RFETS waste (e.g., LL, LLM, and nonradiological waste) are assumed to be in operation, to be properly licensed and permitted to provide such services, and have sufficient capacity to handle RFETS waste. In the case of another DOE facility (Nevada Test Site [NTS]), the facility is assumed to already have NEPA documentation that addresses treatment and disposal of waste from other DOE sites, including RFETS. Specific locations of local offsite treatment and soil/borrow facilities to be used for remediation activities have not yet been identified.

The remediation impact analysis relies heavily on conclusions reached in the CID (DOE 1997d) and CID Update (DOE 2001e), both of which focus on cumulative impacts resulting from onsite activities implemented through RFETS closure. In summary, remediation activities will result in adverse short-term impacts in many resource areas, including air quality, water quality, traffic congestion, and ecological resources. In many instances, the impacts could be intense for a short period of time. However, the impacts are temporary and controllable with mitigation (e.g., monitoring and BMPs). The long-term impacts of soil remediation are minor, and the benefits of removing contamination from RFETS far outweigh these impacts.

To ensure a thorough environmental compliance review of actions that will fall within the scope of the ER RSOP, an environmental review of ER RSOP actions will be conducted. Review of the action will ensure adequate consideration of environmental concerns.

13.1 SOIL AND GEOLOGY

The remediation of a substantial amount of contaminated soil will result in a long-term beneficial impact. However, in the short-term, remediation activities may require significant excavation and soil stockpiling. Potentially adverse impacts include soil disturbance, soil erosion, and subsidence (slumping). In addition, alternatives requiring offsite treatment or disposal of soil may result in substantial soil losses from RFETS.

Subsurface geology is not likely to be affected by remediation activities. Activities will result in limited disturbance of the subsurface, which will, in particular, occur during remediation of OPWL and NPWL areas. These areas have generally been previously disturbed and do not contain mineral resources.

Surface soil has been mixed, compacted, and otherwise disturbed throughout the IA. While ongoing activities will further disturb soil throughout RFETS, most activities will occur in developed areas and will affect previously disturbed soil. However, remediation of some IHSS areas will occur in the BZ.

Remediation will involve the removal of contaminated soil and backfilling excavations. To minimize further contamination of surface soil during remediation activities, the contaminated soil being removed will either be put in rolloff containers and remain at that location, or moved to a new location for temporary storage or treatment, as appropriate, prior to final disposition. The new locations may be onsite or offsite, depending on the treatment alternative selected, and will be set aside for soil with similar concentrations of the same types of constituents. Contaminated soil will not be distributed to undisturbed or "clean" areas.

Soil disturbance may result in siltation due to the large volumes of soil being moved and dispositioned. Exposed areas, especially soil found on sloped portions of RFETS, may be readily eroded and add to surface water runoff and sediment transport. Erosion will be controlled; control methods are discussed in Section 7.0.

Remediated areas will be reclaimed by backfilling, recontouring, adding topsoil, and establishing a vegetative cover for soil stabilization and weed control. In the IA, where projects must be left temporarily in an interim state until all decommissioning and remediation work is completed, this temporary vegetative cover may be needed for several years. Temporary areas will be regraded and permanently revegetated using appropriate native plant species mixtures as the last action in the final configuration.

While efforts will be made to reserve as much available "clean" soil at RFETS as possible, the extent of soil contamination is not yet fully known. Because offsite disposal of soil and debris is anticipated, RFETS may be required to import a significant volume of replacement soil (estimated at 121,718 m3, assuming all contaminated soil is taken offsite for disposal) for backfilling, recontouring, and use in revegetation.

13.2 AIR QUALITY

Remediation activities, including soil excavation, equipment operation, soil treatment, and transportation, will generate air pollutants. Regulated air pollutants include criteria air pollutants (i.e., ozone, CO, NOx, sulfur dioxide, lead, and particulate matter), HAPs, and radiological air emissions. RFETS is located within the metropolitan Denver area that is designated as a "nonattainment" area with respect to NAAQS for PM_{10}, CO, and ozone. This analysis is primarily concerned with fugitive particulate emissions and VOCs, because these are the pollutants most likely to be found in areas where soil is being excavated, transported (fugitive dust), and treated (onsite treatment for VOCs only) onsite. Engineering and administrative controls will be implemented prior to and during excavation activities to control the spread of radiological and hazardous contamination (e.g., dust suppression with water hoses and plastic liners) in accordance with job-specific HASPs, ALARA Job Reviews, and RWPs. An estimated 121,718 m^3 of soil will be excavated and handled during remediation activities, requiring approximately 4,900 shipments for removal, treatment, and offsite disposal.

The pollutant most frequently generated by soil excavation and transport, and in the greatest amounts, will be fugitive dust, which includes TSP and PM_{10}, and particulate matter 2.5 microns ($PM_{2.5}$) in size. It should be noted that $PM_{2.5}$ has only recently been identified as a regulated air pollutant, and requirements are not yet promulgated. The CID (DOE 1997d), which identified TSP as the primary air quality concern for both onsite and offsite receptors, concluded that the estimated TSP emissions will not have a substantial impact. The CID Update (DOE 2001f) focused on TSP and PM_{10}, and revised the original CID (DOE 1997d) analysis to incorporate three new sources (concrete crushing, pavement removal, and building demolition), as well as an accelerated closure schedule. While the updated analysis, therefore, shows that emissions will increase, the ER activities included in this RSOP, and the related impacts, will be less than those reported in the CID Update (DOE 2001f).

Dust emissions from remediation activities will be controlled with practical, economically reasonable, and technologically feasible work practices, as required by the Colorado Air Quality Control Commission (CAQCC) Regulation No. 1. Specifically, onsite dust will be controlled through dust minimization techniques, such as the use of water sprays to minimize suspension of particulates, and stopping earthmoving operations during periods of high wind. In addition, TSP and PM_{10} (as well as other criteria pollutants) will be monitored consistent with the RFETS IMP to ensure air emissions remain within acceptable levels. Opacity rules, limiting opacity below a 20-percent standard, will also be followed. Particulate emissions will be short-term and controllable, and emissions are not expected to be above enforceable NAAQSs at the RFETS perimeter. In addition, RFETS air quality staff calculates project emissions on an ongoing basis to determine additional regulatory reporting requirements. Therefore, potential impacts to workers and the public from proposed soil disturbances will not be significant.

Remediation activities will also include operation of vehicles, heavy machinery, and other equipment that generate other criteria pollutants. Estimated concentrations of other criteria and HAPs provided in the CID (DOE 1997d) were well below the most restrictive occupational exposure limit, with the exceptions of sulfur dioxide, nitrogen dioxide, and CO, which approached 50 percent of the most restrictive occupational exposure limit. The CID (DOE 1997d) identified the primary sources of these pollutants as diesel-powered emergency generators used to supply backup power at RFETS. According to the CID Update (DOE 2001e), maximum daily emissions will remain about the same as forecast in the CID (DOE 1997d). Equipment emissions from remediation activities are expected to be substantially less than the CID (DOE 1997d) and CID Update (DOE 2001e) estimates; therefore, impacts to workers and the public are not a concern in this RSOP. In addition, temporary fossil-fuel-fired equipment use and fuel use will be tracked to ensure that emissions remain within the regulatory limits, or that appropriate notices or permit modifications are filed.

Organic air pollutants (i.e., VOCs) may be released during soil excavation. Organic air pollutants released during excavation activities were not modeled in the CID (DOE 1997d) because of their short-term nature, the limited availability of soil concentration data, and the uncertainties in estimation. The CID Update (DOE 2001e) analysis did not project a substantial impact (or change from the CID) (DOE 1997d) regarding organic air emissions. For purposes of this RSOP, the same assumptions made in the CID (DOE 1997d) are applied to remediation activities. In addition, a bounding assumption has been made that less than 1 ton of VOCs will be emitted from excavation and soil handling activities. Based on this assumption, reasonably available control technology (RACT) will be attained without implementing specific VOC controls for soil excavation, staging, and replacement during remediation, and estimated emissions are not expected to exceed inventory reporting thresholds. If thresholds are exceeded, necessary controls specified by RFETS air quality staff will be instituted, and an Air Pollution Emission Notice (APEN) will be submitted to CDPHE. Therefore, impacts are not expected to be substantial.

Contaminated soil may be treated onsite using thermal desorption to remove VOCs. Because there is no existing treatment facility onsite, a vendor will supply a mobile unit for onsite treatment, and units will be relocated by truck to the site of waste generation. Organic contaminants will be removed from the soil within a closed system and condensed into a liquid phase. Air emission standards will be incorporated into the design of process vents associated with thermal desorption operations that will manage hazardous wastes with organic concentrations equal to or greater than 10 ppm (by weight). Because treatment will be within a closed system, volatile emissions will be limited and controlled; emissions will also be monitored. For the transfer and storage of VOCs, storage tanks and related equipment will be maintained to prevent detectable vapor loss to the maximum extent practicable.

Radiological concerns associated with dust emissions are triggered at an ALs of 0.1 mrem/yr EDE to the most impacted member of the public. A 0.1 mrem/yr EDE typically warrants regulatory agency notification, and monitoring will be conducted as needed. Measures to control emissions from hazardous or radioactive areas will be identified to ensure compliance with applicable air quality regulations. These and other measures will be designed to protect the health of workers, the public, and the environment.

The CID (DOE 1997d) analysis presented radiological impacts in terms of annual doses to three receptors based on emissions from six point sources and two area sources at RFETS. Four of the six point sources included emissions from both operations and remediation activities, while emissions from the two other point sources and two area sources were a result of remediation activities only. The three receptors included a collocated worker, a maximally exposed individual at the Site boundary, and the local population within a 50-mile radius (assumed to be 2.7 million people). The annual dose for these three receptors was estimated in the CID (DOE 1997d) to be 5.3 mrem, 0.23 mrem, and 22.9 person-rem, respectively. Although the CID (DOE 1997d) did not provide sufficient detail to allow estimated doses in the CID Update (DOE 2001e) to be directly correlated to the CID (DOE 1997d), some bounding risk characterizations were derived in the CID Update (DOE 2001e). The upper-bound collocated worker dose was well within the administrative site limit of 750 mrem, exclusive of decommissioning, and the maximum exposed individual doses were substantially lower than the maximum annual allowable radiation dose of 10 mrem for a member of the public from DOE-operated nuclear facilities (also exclusive of decommissioning activities). These doses do not indicate a substantial radiological air quality impact from remediation activities.

General air conformity studies for nonattainment and maintenance areas are performed for most federal actions that exceed threshold quantities. However, CERCLA-related activities, such as the activities discussed in this RSOP, are exempted from air conformity requirements, a long as emissions meet the substantive requirements of the Prevention of Significant Deterioration (PSD) and New Source Review (NSR) permitting programs. Because emissions from the activities will meet PSD/NSR requirements, general conformity needs have been met.

13.3 WATER QUANTITY AND QUALITY

Remediation actions will affect water resources through excavation of contaminated soil. The goal of environmental remediation is to decrease the amount of contamination onsite and facilitate closure of RFETS. Consequently, long-term impacts to surface water and groundwater are projected to be beneficial.

Water impacts evaluated in the CID (DOE 1997d) included altering flow rates or flow paths, negative changes in floodplain capacities, and degradation of surface water quality or groundwater quality. Water quantity could be affected by excavation of soil (decreasing the depth to the water table and the net rate of aquifer recharge), alteration of topography that can affect drainage pathways, and the removal and plugging of pipelines which could affect seeps and habitats. Surface water quality impacts include increased surface water erosion and turbidity from excavation and stockpiling.

According to the CID (DOE 1997d), large-scale excavations may impact surface water flow paths and infiltration to an extent that causes measurable localized differences in groundwater saturated thickness and flows. These groundwater impacts will be most noticeable in areas of shallow depths to the water table and small, saturated thickness. However, CID (DOE 1997d) conclusions for both the alluvial aquifer and the deeper aquifers are that contributions from the area to the regional groundwater basin are minimal. Therefore, remediation activities are expected to have negligible impact on regional hydrogeology.

Remediation activities will have the potential to adversely affect surface water quality through the release of runoff or other contaminants during excavation and soil stockpiling. Soil remediation involves excavations that could cause erosion and siltation of nearby surface water. However, the removal of contaminant sources is beneficial in the long term because contaminant migration to groundwater and surface water is prevented.

Following excavation and other soil disturbances, the type of fill and soil management practices will also influence groundwater infiltration and surface water runoff. According to the CID (DOE 1997d), excavation of contaminated soil is expected to locally increase runoff and erosion over the short term; however, the impacts should be minimal with proper mitigation. Prompt revegetation of open areas, especially sloped areas, will also reduce impacts to water quality.

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13.4 HUMAN HEALTH AND SAFETY

Potential human health impacts to the public and collocated workers from remediation activities include fugitive dust, exposure to radioactive and hazardous materials, and traffic associated with onsite and offsite transportation of soil for treatment and disposal. Workers involved in remediation operations will also be subject to risks of operating heavy machinery, and, for some alternatives, operating treatment facilities.

As a measure of impacts to the public from remediation activities, the CID (DOE 1997d) reports the following estimated annual radiological doses from RFETS closure air emissions: maximally exposed collocated worker, 5.4 mrem; maximally exposed member of the public 0.23 mrem; and population dose, 23 person-rem. The population dose will be expected to produce 0.012 latent cancer fatalities in the region of interest with a population of 2.7 million. Because these estimates include all RFETS closure activities, impacts from activities addressed in this RSOP will be a small fraction of those reported above.

Worker radiological dose estimates for all closure activities are presented in the CID (DOE 1997d), grouped by activity and building cluster. A total worker dose of 383 rem is reported for decommissioning and remediation activities for the 371, 707, 771, 776/777, 779, 881, 886, and 991 building clusters. An additional worker dose of approximately 12 rem is predicted for miscellaneous production zones, TRU cluster, and IA and BZ decommissioning and remediation activities. The total reported dose to workers for these closure activities is approximately 395 rem. Because doses from decommissioning will dominate these exposures, remediation activities are expected to be a small fraction of the 395 rem reported in the CID (DOE 1997d).

In practice, remediation activities, which address soil with potential radiological contamination, will be subject to RFETS's radiation protection program, which includes administrative controls limiting the dose to any involved worker to a maximum of 500 mrem/yr. Doses resulting from activities addressed in this RSOP are expected to comply with this limit. In addition, worker radiation protection for these activities will be governed by the ALARA principle, which mandates that worker exposures be further minimized on a cost-effective basis, consistent with the activities being conducted.

Risks to involved workers will be dominated by standard industrial hazards associated with heavy equipment operations associated with excavation, earthmoving, and transportation equipment. A project-specific HASP Addendum and JHA will be prepared as described in Section 8.0.

Environmental impacts of transportation of LL and LLM waste from RFETS closure activities to disposal facilities is addressed in Attachment 3 of the Facility Disposition RSOP (DOE 2004). The analysis includes transportation for disposal of all LL and LLM waste generated during RFETS closure and concluded that:

> "... impacts of shipping LLMW and LLW from RFETS to disposal sites on air quality, human health and safety, traffic, and environmental justice would be minimal" (DOE 2004)."

The Facility Disposition RSOP (DOE 2004) transportation analysis does not directly address transportation of remediation-derived soil to offsite disposal or treatment facilities. However, because remediation waste is a component of LL and LLM waste that is shipped offsite, transportation impacts are expected to be similar to those for disposal alone.

13.5 ECOLOGICAL RESOURCES

Given the nature of remediation activities (e.g., earthmoving), this analysis focuses primarily on the assessment of potential physical impacts to ecological resources. The analysis of physical impacts, as taken from the CID (DOE 1997d), is based on a comparison of the location of activities to the location of ecological resources. The primary potential impacts include loss of productivity, injury or mortality, and loss or modification of habitat. In general, the CID (DOE 1997d) found impacts to ecological resources from RFETS closure to be high in the short term, but low in the long term, based on the use of adequate controls for revegetation and weed control. It should be noted that the CID (DOE 1997d) also analyzed chemical impacts to ecological resources. However, the general findings were that, based on screening-level risk characterizations, ecological components (e.g., vegetation and soil) in several source areas contained contaminants at levels that represent low or negligible risk to wildlife.

Because the majority of areas impacted by remediation activities will occur in previously disturbed areas in the IA and reclaimed grasslands, impacts on vegetation will be considered low. The disturbance to wildlife and sensitive habitats from remediation activities could be substantial, although the impacts will be short-term. Coordinating activities with RFETS ecologists to avoid or minimize disturbance to habitats (through BMPs) and successful reclamation of RFETS will result in low long-term impacts.

RFETS provides habitat for several species of concern and at least one rare plant community (i.e., xeric tall grass prairie). Special-concern species are a particular class of wildlife and plants that are of special interest at RFETS because of their protected status or rarity (as identified by the U.S. Fish and Wildlife Service, Colorado Division of Wildlife, Colorado Natural Heritage Program, and other interested groups). Rare plant communities likely include special-concern species as well as unique combinations of plants and animals. RFETS is also home to one federally listed threatened species, the Preble's meadow jumping mouse (PMJM). Remediation activities within the BZ may disturb areas supporting or potentially supporting these species. This disturbance could represent a substantial short-term physical impact to these species and their habitats. As in the IA, however, BMPs will be implemented to avoid and minimize impacts to these habitats. Particular care will be taken with the PMJM, including the implementation of special mitigation measures identified by RFETS ecologists (e.g., work shutdowns in certain areas of the BZ from spring to fall to avoid impacting the PMJM). In addition, remediation activities include reclamation of the BZ. If soil restoration is suitable for an adequate re-establishment of native plant species, and if weeds are controlled, remediation activities will ultimately result in positive impacts to RFETS's ecological resources.

Remediated areas will be reclaimed by recontouring, adding topsoil, and revegetating as necessary. All areas will be reclaimed (e.g., topsoil added and blended with mulch and fertilizer) in accordance with revegetation procedures described in Section 6.11. Revegetation in the IA will be considered temporary until the final RFETS configuration. However, because of the size of the IA, even partial restoration will have a positive effect on plant and animal species at RFETS.

In addition to the direct physical impacts, remediation activities could also have indirect effects on RFETS's ecological resources. For example, soil erosion from disturbed areas or stockpiles could have an adverse impact on plants and animals. However, as discussed in Section 7.0, erosion control measures will be implemented.

13.6 CULTURAL RESOURCES

Because the history of RFETS, including all 64 buildings within the Historic District, has been properly documented in the Historic American Engineering Record (DOE 1998b), environmental remediation activities will have no adverse effect on historic resources. This documentation meets the requirements of the Programmatic Agreement signed by the DOE RFFO, Colorado State Historic Preservation Officer, and Advisory Council on Historic Preservation.

With respect to paleontological resources, the CID (DOE 1997d) indicates rock exposures at RFETS are not fossil-bearing. Therefore, it is unlikely that remediation activities will uncover paleontological resources. Undertakings at RFETS are unlikely to result in the deterioration or loss of any substantial paleontological resources.

Prehistoric resources at RFETS, according to the CID (DOE 1997d), are not considered substantial to the region's archaeological record. Therefore, undertakings at RFETS will be unlikely to result in the deterioration or loss of prehistoric resources. Mitigation will be recommended only in the event that new prehistoric or archaeological resources are uncovered during remediation activities. Procedures for emergency treatment of archeological resources in the BZ are addressed in the Cultural Resources Management Plan (DOE 1997e).

13.7 VISUAL CHANGES

Remediation activities will result in temporary and minor visual impacts during RFETS closure. However, the long-term visual changes to topography and vegetation cover resulting from remediation activities will be more notable. Remediation activities include the revegetation of soil to a native grassland appearance. In the BZ, the disturbed areas will be backfilled with clean subsoil and topsoil, regraded as necessary, and revegetated with a permanent cover using an appropriate native plant species mixture. In the IA, the vegetation cover will be temporary for interim stabilization of excavations and other areas to prevent erosion and weed invasion until completion of end-state revegetation during the final configuration. Temporary revegetation areas will be regraded and permanently revegetated using the appropriate native plant species mixture as the last action during the final configuration.

The long-term effects of restoration activities will result in a significant change in RFETS's appearance and visibility to the public (from public roads and areas around RFETS) at closure. In particular, the RFETS IA will be reclaimed to a native grassland environment. As long as erosion and noxious weeds are controlled during remediation activities, the long-term visual effects will be increasingly beneficial as more and more of RFETS is restored to its natural landscape and appearance.

13.8 NOISE

Remediation activities include a temporary increase in local noise levels from the operation of heavy equipment, operation of onsite treatment facilities, and the loading and hauling of contaminated soil for offsite treatment and disposal. The CID (DOE 1997d) found that noise levels from industrial activities within the RFETS boundary were not distinguishable from background traffic noise levels. Noise levels from onsite construction, environmental restoration, waste disposal, demolition, and other activities were not expected to be perceptible at offsite locations. Therefore, noise levels from onsite remediation activities alone are not expected to be perceptible at offsite locations.

The primary source of noise to nearby residential areas is traffic movement along local streets and state routes. Remediation activities will result in higher public noise levels due to the increased number of trips for fill and waste transport. However, the effects will be short-term, occurring intermittently during daylight hours, and lasting for several years. The CID Update (DOE 2001f) identified increased offsite traffic relative to the CID (DOE 1997d) due to the shorter closure time, but found that the additional traffic noise will not cause a doubling of noise levels. It indicated that most public reviews of traffic noise by federal and state agencies consider a doubling of sound (10 decibels or greater) to be a moderate to substantial increase. Because traffic, including truck traffic, is already prevalent along the proposed trucking routes, it was concluded in the CID Update (DOE 2001e) that the potential impact is considered low. Given that the CID (DOE 1997d) and CID Update (DOE 2001e) analyses considered offsite waste management transport (LL, LLM, and sanitary waste) and work force commuters, in addition to remediation waste transport, offsite noise impacts from remediation activities alone will be considerably less.

Conclusions in the CID Update (DOE 2001e) indicated that higher worker noise levels will result from remediation and other closure activities because of the accelerated closure schedule; however, the overall impact will be low. Therefore, the impacts from remediation activities alone will be considered even lower.

13.9 TRANSPORTATION

Environmental remediation activities will produce soil waste that requires onsite transportation for treatment or interim storage, reuse of treated ("clean") RFETS soil, treatment and disposal of RFETS contaminated soil at offsite facilities, and importing of clean soil from offsite locations. Potential transportation impacts include increased air emissions, increased traffic congestion, and transportation accidents. Tailpipe emissions and airborne particulate matter generated by the anticipated truck traffic is projected to be well below regulatory standards and will not reach a level of concern. Because of stringent DOT packaging and shipping standards, cargo-related accidents will pose minimal concern to human H&S. The CID Update (DOE 2001e) analyzed traffic in terms of increased highway and road congestion resulting from RFETS-related traffic. The analysis found that, despite the accelerated schedule, onsite and offsite traffic levels will actually decrease relative to those analyzed in the CID (DOE 1997d). Scheduling shipments during off-peak hours will further minimize the number of shipments made during morning and evening rush hours when commuters will add to the congestion.

Because transportation impacts from remediation activities will be derived primarily from material shipping, they are the focus of this analysis. Current nonradiological, LL, and LLM waste volumes projected for storage and disposal between 2001 and 2006 total 121,718 m^3 (8,328 m^3 of nonradiological waste, 81,818 m^3 of LL waste, and 31,572 m^3 of LLM waste), with the highest volume in 2006 of 41,168 m^3. While the waste will likely be stored onsite in rolloff containers and shipped offsite in metal crates, this analysis assumes the most conservative packaging (soil shipped in intermodal containers weight-limited at 8.5 m^3/shipment). In addition, offsite treatment and disposal will result in the greatest number of trips. It is assumed that an equal number of shipments is required to import replacement soil as is used to transport the waste offsite. Given these assumptions, the projected number of shipments for LL, LLM, and hazardous waste for remediation activities is as follows:

Total Shipments

121,718 m^3/8.5 m^3 per shipment = 14,320 shipments (total)

14,320 shipments offsite + 14,320 shipments onsite = 28,640 shipments total

Peak Year Shipments (2006)

41,168 m^3/8.5 m^3 per shipment = 4,843 shipments (peak year 2006)

4,843 shipments + 4,843 shipments = 9,686 shipments total(peak year 2006)

In comparison, the CID (DOE 1997d) projected a total of 94,480 waste shipments of LL and LLM waste alone over a 10-year period, while the CID Update (DOE 2001e) projected a reduced number of shipments (24,928 shipments of LL and LLM waste between FY00 and FY06). The CID analysis serves as a bounding analysis and projected a substantially greater number of shipments than calculated above. The CID Update found that annual impacts on traffic will be of smaller magnitude than originally estimated in the CID, and traffic associated with RFETS operations will be eliminated earlier. The CID noted that the effects of increased traffic entering and leaving RFETS will intensify. However, the increased materials shipments will be offset by the eventual decreases in commuter traffic. Overall, the effects were not projected to be substantial. Given that the CID Update (DOE 2001e) projected lower traffic impacts than the CID (DOE 1997d), and remediation activities will contribute only a fraction of shipments to the overall traffic levels expected on and in the vicinity of RFETS, traffic impacts from remediation activities are not expected to be substantial.

In addition to being analyzed in the CID (DOE 1997d) and CID Update (DOE 2001f), transportation of RFETS wastes has been analyzed from a NEPA perspective in the following NEPA documents: Final Waste Management Programmatic Environmental Impact Statement for Managing, Treatment, Storage, and Disposal of Radioactive and Hazardous Waste (DOE 1997f); Environmental Assessment Finding of No Significant Impact for Temporary Storage of Transuranic and Transuranic Mixed Waste (DOE 1999e); Attachment 3 of the Facility Disposition RSOP (DOE 2004); and the Final Environmental Impact Statement for the Nevada Test Site and Offsite Locations in the State of Nevada (DOE 1996b). These documents analyzed impacts of offsite shipment of RFETS waste to potential treatment and disposal locations including NTS, Envirocare, and Hanford. The Facility Disposition RSOP, in particular, addressed remediation waste. These studies have found that impacts of waste shipments are small, and the shipments themselves contribute to an overall reduction of risk at RFETS.

13.10 SOCIOECONOMICS/ENVIRONMENTAL JUSTICE

The primary socioeconomic factors considered in the CID (DOE 1997d) and reexamined in the CID Update (DOE 2001e) were employment, local economy, population and housing, and quality of life. Potential socioeconomic impacts from remediation activities relate primarily to the change in direct RFETS workforce and other direct employment (related to RFETS activities) during the period of performance.

The CID Update (DOE 2001e) used an assumed 1999 workforce of 5,750, which included direct employees (DOE, K-H, and the first-tier team of subcontractors) and other direct employees. The CID Update projected a steady decline in direct RFETS employment to approximately 4,000 workers in 2004, followed by a sharper decline to 1,000 workers or less in 2006, and 0 workers at the time of RFETS closure. In comparison, ER activities will increase in 2002 and 2003 and again in 2005 and 2006 when the majority of work areas will be remediated and the largest volumes of soil will be handled. Remediation workers will represent an increasing percentage of RFETS workers as closure approaches, accounting for the highest percentage in 2006. In some respects, this contribution is positive in that it helps to offset workforce reductions in other areas, and reduces, to some extent, the significant decline in employment that will occur in the last 2 years of RFETS closure.

Overall, the impacts of remediation activities on RFETS employment are smaller in size, but are one component of the overall impacts of RFETS closure that will ultimately result in an RFETS workforce of zero by 2007. The CID (DOE 1997d) and CID Update (DOE 2001e) both identified negative short-term, localized impacts from the workforce reductions. However, they also indicated that the negative changes to RFETS employment would be counterbalanced by projected growth in other segments of the local economy. In particular, the overall socioeconomic impacts to the Denver Metropolitan Area and to Colorado are not expected to be substantial. It is also important to note that the remediation of environmental contamination, a direct result of remediation activities, will result in a positive impact to the public's perceived "quality of life."

With respect to potential environmental justice impacts, there are no minority (i.e., populations greater than 50 percent minority) or low-income neighborhoods within a 10-mile radius of RFETS (DOE 2001f). Therefore, no environmental justice impacts are anticipated from remediation activities within 10 miles of RFETS. Human health impacts from radiological and nonradiological air emissions and offsite transportation from remediation activities are addressed in Sections 13.2 and 13.9 of this RSOP. Because the level of increased risk to the maximally exposed individual was determined to be small, no adverse human health impacts are anticipated for any segment of the population, including minority and low-income populations. Therefore, no environmental justice impacts could occur.

13.11 CUMULATIVE EFFECTS

The activities proposed in this RSOP support the overall mission to clean up RFETS and make it safe for future uses. The cumulative effects of this broader, sitewide effort are presented in the CID (DOE 1997d) and CID Update (DOE 2001e), which describe the short- and long-term effects from the overall cleanup mission. This section incorporates analyses from the CID Update to identify activities and time frames that are cumulative. Potential cumulative effects from proposed remediation activities include air emissions, visual impacts, noise, and traffic impacts.

The primary focus of the CID (DOE 1997d) was on cumulative impacts resulting from onsite activities implemented through RFETS closure. Cumulative impacts result from the proposed RFETS activities and the effects of other actions taken during the same time in the same geographic area, including offsite activities, regardless of what agency or person undertakes such other action. The CID Update (DOE 2001e) analysis included updated onsite and offsite transportation requirements, as well as several new offsite activities, although the future non-DOE projects are relatively uncertain. Increased traffic congestion will be the most noticeable impact according to the CID Update (DOE 2001e), resulting from increased RFETS traffic and other planned or proposed construction projects near RFETS. Air pollutants and noise will also have adverse impacts; however, the impacts are expected to be short-term in nature, with staggered project start and completion dates. Most people will perceive a positive, long-term visual and "quality of life" benefit, as RFETS infrastructure and remediation equipment is removed, returning RFETS to a more natural appearance.

13.12 UNAVOIDABLE ADVERSE EFFECTS

Some temporary adverse effects will occur as a result of remediation activities. Surface and subsurface soil conditions will change; most conditions will be improved, but some changes will be adverse. Minor quantities of pollutants may be released to the atmosphere and surface water. Workers will experience H&S risks typical of construction projects and potential chemical and radiation exposures. Noise levels will increase slightly, as will traffic and associated congestion. Most effects will be temporary; some changes to surface and subsurface soil will be permanent. Activities will be planned and executed such that no effects exceed regulatory limits. All environmental, safety, and health risks will be managed in accordance with industry practices, DOE policy, and RFETS programs.

13.13 SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

The purpose of remediating contaminated soil at RFETS is to improve the long-term productivity of RFETS. The ultimate goal at the end-state configuration is to restore the entire IA, as well as those portions of the BZ that have been previously disturbed or contaminated, to their natural state. Remediation activities will make significant advances in reaching this goal. Specifically, they will result in the permanent restoration of the BZ to its natural state, and the temporary restoration of the IA to provide interim stabilization until final remediation of this area. Ultimately, the IA will be regraded and permanently revegetated using appropriate native plant species mixtures as the last action in the final RFETS configuration. In the long-term, the improved productivity will help to support a range of potential future uses of RFETS.

13.14 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Remediation activities will result in the irretrievable consumption of funds, labor, equipment, fuel, tools, water, PPE, waste storage containers, and small quantities of other materials.

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14.0 RECORDS DISPOSITION

Upon completion of the public comment period for the Draft ER RSOP Modification 1, comments received from the public (including the regulatory agencies), the comment responsiveness summary, and the LRA approval letter will be incorporated into the RSOP AR File, along with a copy of the approved RSOP Modification 1 and copies of the RFETS documents referenced in this RSOP Modification, in addition to those already contained in the AR.

For each ER project that implements this RSOP, the AR File will contain the RSOP Notification, including scoping meeting minutes, unit-specific information for RCRA-regulated units undergoing closure, and the ER Final Closeout Report for the project. In addition, project-specific information, such as characterization data, project correspondence, work control documents, and other information generated as a direct result of each ER project, will be filed in the Project Record and the AR, and RCRA records and closure documents will be maintained with the RCRA Operating Record. Electronic data will be archived in SWD. Both the Project Record files and the RCRA Operating Record files will be transferred to Site Records Management upon completion of the ER Final Closeout Report for each ER project.

The following information repositories have been established to provide public access to the AR Files for the Rocky Flats Closure Project:

EPA Region VIII
Superfund Records Center
999 18th Street, Suite 500
Denver, Colorado 80202-2466
(303) 312-6312

CDPHE
Information Center, Building A
4300 Cherry Creek Drive South
Denver, Colorado 80220-1530
(303) 692-2037

DOE Rocky Flats Public Reading Room
Front Range Community College
College Hill Library
3705 West 112th Avenue
Westminster, Colorado 80030
(303) 469-4435

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15.0 REFERENCES

CDPHE, 1997, Rocky Flats Environmental Technology Site, RCRA Part B Permit #CO-97-05-30-01.

DOE Order 414.1, Quality Assurance.

DOE Order 435.1, Radioactive Waste Management.

DOE Order 5400.1, General Environmental Protection Program.

DOE Order 5400.5, Radiation Protection of the Public and the Environment.

DOE, 1992, Historical Release Report, Rocky Flats Environmental Technology Site, Golden, Colorado.

DOE, 1993 - 2000, Quarterly and Yearly Historical Release Report Updates, Rocky Flats Environmental Technology Site, Golden, Colorado.

DOE, 1996a, Completion Report for the Source Removal at Trenches T-3 and T-4 (IHSSs 110 and 111.1), Rocky Flats Environmental Technology Site, Golden, Colorado, September.

DOE, 1996b, Final Environmental Impact Statement for the Nevada Test Site and Offsite Locations in the State of Nevada, Las Vegas, Nevada, August.

DOE, 1997a, Closeout Report for the Remediation of Individual Hazardous Substance Site 109, Ryan's Pit, Rocky Flats Environmental Technology Site, Golden, Colorado, July.

DOE, 1997b, Closeout Report for the Source Removal at the Mound Site IHSS 113, Rocky Flats Environmental Technology Site, Golden, Colorado, October.

DOE, 1997c, Closure Report Design-Build Underground Storage Tank Replacement Project, Rocky Flats Environmental Technology Site, Golden, Colorado, October.

DOE, 1997d, Cumulative Impacts Document, Rocky Flats Environmental Technology Site, Golden, Colorado.

DOE, 1997e, Cultural Resources Management Plan, Rocky Flats Environmental Technology Site.

DOE, 1997f, Final Waste Management Programmatic Environmental Impact Statement for Managing, Treatment, Storage, and Disposal of Radioactive and Hazardous Waste, Washington, D.C., May.

DOE, 1998a, Application of Surface Contamination Guidelines for DOE Order 5400.5, April.

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DOE, 1998b, Historic American Engineering Record, Rocky Flats Environmental Technology Site, Golden, Colorado.

DOE, 1999a, Industrial Area Characterization and Remediation Strategy, Rocky Flats Environmental Technology Site, Golden, Colorado, September.

DOE, 1999b, Air Transport and Deposition of Actinides at the Rocky Flats Environmental Technology Site, Golden, Colorado.

DOE, 1999c, Closeout Report for the Source Removal at Trench 1 Site IHSS 108, Rocky Flats Environmental Technology Site, Golden, Colorado, June.

DOE, 1999d, RFCA Standard Operating Protocol for Recycling Concrete, Rocky Flats Environmental Technology Site, Golden, Colorado, September.

DOE, 1999e, Environmental Assessment Finding of No Significant Impact for Temporary Storage of Transuranic and Transuranic Mixed Waste, Rocky Flats Field Office, Golden, Colorado, August.

DOE, 2000a, Integrated Monitoring Plan Background Document, Rocky Flats Environmental Technology Site, Golden, Colorado.

DOE, 2000b, Preliminary Data Quality Objectives, Industrial Area Sampling and Analysis Plan, Rocky Flats Environmental Technology Site, Golden, Colorado, July.

DOE, 2000c, Report on Soil Erosion and Surface Water Sediment Transport Modeling for the Actinide Migration Evaluations at the Rocky Flats Environmental Technology Site, Golden, Colorado.

DOE, 2000d, Final Report on Phase Speciation of Pu and Am for Actinide Migration Studies, Rocky Flats Environmental Technology Site, Golden, Colorado.

DOE, 2001a, Industrial Area Sampling and Analysis Plan, Rocky Flats Environmental Technology Site, Golden, Colorado.

DOE, 2001b, RFCA Standard Operating Protocol for Facility Component Removal, Size Reduction, and Decontamination Activities, Rocky Flats Environmental Technology Site, Golden, Colorado, February.

DOE, 2001c, 2001 Annual Vegetation Management Plan for the Rocky Flats Environmental Technology Site, Golden, Colorado.

DOE, 2001d, Asphalt and Soil Management RSOP, Rocky Flats Environmental Technology Site, Golden, Colorado, August.

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DOE, 2001e, Cumulative Impacts Document Update Report, Rocky Flats Environmental Technology Site, Golden, Colorado, October.

DOE, 2002, Buffer Zone Sampling and Analysis Plan, Rocky Flats Environmental Technology Site, Golden, Colorado, June.

DOE, 2004, RFCA Standard Operating Protocol for Facility Disposition, Rocky Flats Environmental Technology Site, Golden, Colorado, March.

DOE, CDPHE, and EPA, 1996, Rocky Flats Cleanup Agreement, Rocky Flats Environmental Technology Site, Golden, Colorado, July.

DOE, CDPHE, and EPA, 2003, Modifications to the Rocky Flats Cleanup Agreement Attachments, Rocky Flats Environmental Technology Site, Golden, Colorado, June.

DOE, CDPHE, EPA, Kaiser-Hill, and RMRS, 1999, Rocky Flats Cleanup Agreement, Appendix 3 RFCA Implementation Guidance Document, July.

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EG&G, 1995b, Hydrogeologic Characterization Report for the Rocky Flats Environmental Technology Site, Volume II of the Sitewide Geoscience Characterization Study, Golden, Colorado, March.

EPA, 1997, Requirements for Quality Assurance Project Plans for Environmental Data Operations, QA/R-5.

EPA, 1999, Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents, OSWER 9200.1-23P.

Gilbert, R.O., 1987, Statistical Methods for Environmental Pollution Monitoring, New York: Van Nostrand Reinhold.

K-H, 1999, Kaiser-Hill Team Quality Assurance Program, PADC-1996-00051.

Safe Sites of Colorado, 1996, Tank Closure Report Building 771, UST No. 20 Rocky Flats Environmental Technology Site, Golden, Colorado, August.

Glossary

Accelerated Action: Accelerated actions are expedited response actions approved as a PAM, IM/IRA, or RSOP.

Accelerated Action Remediation Goals: Accelerated action remediation goals are based on RFCA soil ALs as modified by stewardship and ALARA considerations.

Action Level (AL): Numeric levels based on risk that, when exceeded, trigger an evaluation, remedial action, or management action are referred to as ALs. The soil ALs were developed to be protective of a wildlife refuge worker and ecological resources. The soil ALs are contained in Attachment 5 Table 3 of RFCA.

Agreed-Upon Cleanup Level: Agreed-upon cleanup levels are cleanup levels negotiated by the RFCA Parties that may take the place of RFCA ALs.

Analytical Services Division (ASD): The ASD of K-H is responsible for managing offsite laboratory contracts, data validation, and archiving analytical data.

Applicable or Relevant and Appropriate Requirements (ARARs): ARARs are promulgated standards, requirements, criteria, or limitations that will be met during closure activities to ensure the protection of human health and the environment and the proper management of waste. A requirement under environmental laws may be either "applicable" or "relevant and appropriate."

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Only those standards identified by a state in a timely manner and that are more stringent than federal requirements may be applicable. (40 CFR 300.5)

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, their use is well suited to the particular site. Only those standards identified by a state in a timely manner and that are more stringent than federal requirements may be applicable.
(40 CFR 300.5)

Area of Concern (AOC): An AOC is an area that has soil with concentrations greater than background plus two standard deviations for metals or radionuclides or greater than detection limits for organics. An AOC is the area over which data will be evaluated to make accelerated action decisions.

Asbestos: The term asbestos includes asbestiform varieties of chrysolite, amosite (cummintonite-grunerite), crocidolite, anthophyllite, tremolite, and actinolite.

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Asbestos-Containing Material (ACM): ACM is material containing more than 1 percent friable asbestos.

Closure: In the context of RCRA/CHWA hazardous waste management units, closure means actions taken by an owner or operator of a treatment, storage, or disposal unit to discontinue operation of the unit in accordance with the performance standards specified in 6 CCR 1007, §264.11 or §265.111, as appropriate. (RFCA ¶25[p])

Closure Project Baseline: The current baseline scheduled scope of work for RFETS is referred to as the Closure Project Baseline. It includes cost, schedule, and technical performance for activities.

Compliance Monitoring: Compliance monitoring is the ongoing environmental monitoring of air, surface water, and groundwater conducted at RFETS in accordance with the IMP.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): CERCLA, 42 U.S.C. §9601 *et seq.*, enacted in 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986, Pub. L. 99-499, the Community Environmental Response Facilitation Act, Pub. L. No. 102-26, and the National Contingency Plan (NCP) and other implementing regulations (RFCA ¶25[m]), provides EPA with the authority to respond to releases or threatened releases of hazardous substances, pollutants, or contaminants that may endanger human health or the environment. The regulations implemented pursuant to CERCLA are defined in the NCP.

Confidence Level: The confidence level is the quantity $(1-\alpha)100\%$ associated with the confidence interval. It is a quantitative measure of the limit about the true mean at a given level of probability. For example, it is the precision level at which the sample mean estimate is the population mean.

Contamination Reduction Zone (CRZ): The CRZ is the area at a hazardous waste site that has been set aside for the decontamination of equipment and personnel.

Deactivation: Deactivation is the process of placing a building, portion of a building, or building component (as used in the rest of this paragraph "building") in a safe and stable condition to minimize the long-term cost of a surveillance and maintenance program in a manner that is protective of workers, the public, and the environment. Actions during deactivation could include the removal of fuel, draining and/or deenergizing of nonessential systems, removal of stored radioactive and hazardous materials, and related actions. As the bridge between operations and decommissioning, based upon Decommissioning Operations Plans or the Decommissioning Program Plan, deactivation can accomplish operations-like activities such as final process runs, and decontamination activities aimed at placing the facility in a safe and stable condition. Deactivation does not include decontamination necessary for the dismantlement and demolition phase of decommissioning (i.e., removal of contamination remaining in fixed structures and equipment after deactivation). Deactivation does not include removal of contaminated systems or equipment except for the purpose of accountability of special nuclear material (SNM) and nuclear safety. It also does not include removal of contamination except as incidental to other deactivation or for the purposes of accountability of SNM and nuclear safety. (RFCA ¶25[y])

Debris: All nonsoil material found during ER remediation is referred to as debris.

Decommissioning: Decommissioning means, for those buildings, portions of buildings, or building components (as used in the rest of this paragraph "building") in which deactivation occurs, all activities that occur after the deactivation. It includes surveillance, maintenance, component removal, decontamination and/or dismantlement, and size reduction for the purpose of retiring the building from service with adequate regard for the health and safety of workers and the public and protection of the environment. For those buildings in which no deactivation occurs, the term includes characterization, surveillance, maintenance, component removal, decontamination and/or dismantlement, and size reduction for the purpose of retiring the building from service with adequate regard for the health and safety of workers and the public and protection of the environment. (RFCA ¶25[z])

Decontamination: Decontamination is the removal or reduction of radioactive or hazardous contamination from facilities, equipment, or soil by manual, mechanical, chemical, or other means.

Dense Nonaqueous Phase Liquid (DNAPL): A DNAPL is an organic liquid, composed of one or more contaminants that is heavier than water and does not mix with water (e.g., chlorinated solvents).

Derived Air Concentration (DAC): The DAC is used to: (1) estimate the potential dose from inhalation of workers exposed to airborne radioactive material; (2) determine the appropriate level of PPE required in an area; (3) evaluate the efficacy of engineering controls; and (4) evaluate the need to perform a dose assessment.

The DAC is the concentration of a given radionuclide in air which, if breathed by reference man for 2,000 hours (assumed to be 1 working year), under conditions of light work (assumed air inhalation rate of 1.2 m^3/h), results in an intake of 1 annual limit of intake.

Dismantlement: Dismantlement is the demolition and removal of any building or structure or a part thereof during decommissioning. (RFCA ¶25[ab])

Equivalent Measure: The term "equivalent measure" refers to the amount of soil gathered by using a removal mechanism to take approximately the same volume with each scoop. Examples include a backhoe bucketful or shovel scoop. Thus, when soil removal is conducted using a backhoe, an equivalent measure is one additional backhoe scoop.

Facilities: Facilities include buildings and other structures, their functional systems and equipment, and other fixed systems and equipment installed therein; outside plant, including site development features such as landscaping, roads, walks, and parking areas; outside lighting and communication systems; central utility plants; utilities supply and distribution systems; and other physical plant features.

Geostatistical Spatial Correlation: The relationship between spatial measurements is referred to as the geostatistical spatial correlation. The concept of spatial correlation is that nearby sampling points are alike. Spatial correlation can be characterized through use of the semi-variogram model, which provides a measure of variance as a function of distance between data points. This measure is defined as one-half of the average squared difference between two values separated by vector h.

Global Positioning System (GPS): The GPS is a constellation of 24 satellites used for navigation and precise geodetic position measurements. The U.S. Department of Defense operates GPS satellites. GPS provides specially coded satellite signals that can be processed in a GPS receiver, enabling the receiver to compute position, velocity, and time. Four GPS satellite signals are used to compute positions in three dimensions and the time offset in the receiver clock.

Hazard: A hazard is a source of danger (i.e., material, energy source, or operation) with the potential to cause illness, injury, or death to personnel, or damage to a facility or the environment without regard for the likelihood or credibility of accident scenarios or consequence mitigation.

Hazardous Waste: Hazardous waste is any solid waste that either exhibits a hazardous characteristic (i.e., ignitability, corrosivity, reactivity, or toxicity) or is named on one of three lists published by EPA in 40 CFR 261, *Identification and Listing of Hazardous Waste*. To be considered hazardous, a waste must first meet EPA's definition of "solid waste," which includes liquids.

Histogram: A histogram is a multiple-bar diagram showing relative abundance of material or quantitative determinations (contaminant concentration) divided into a number of regulatory arranged groups.

Interim Measure (IM): IM is the RCRA/CHWA term for a short-term action to respond to imminent threats, or other actions to abate or mitigate actual or potential releases of hazardous wastes or constituents.

Interim Remedial Action (IRA): IRA is the CERCLA term for an expedited response action performed in accordance with remedial action authorities to abate or mitigate an actual or potential threat to public health, welfare, or the environment from the release or threat of a hazardous substance from RFETS.

Isopleth: A line on a map or chart drawn through points of equal size or abundance is referred to as an isopleth.

Job Hazard Analysis (JHA): A JHA is an analysis of procedurally controlled activities that uses developed procedures as a guide to address and consider the hazards due to any exposures present during implementation of (job) procedures, the use and possible misuse of tools, and other support equipment required by the procedures. It is a type of hazard analysis process that breaks down a job or task into steps, examines each step to determine what hazard(s) exist or might occur, and establishes actions to eliminate or control the hazard.

Kriging: The spatial correlation model derived from the variogram analysis is used in a kriging simulation. Kriging is the process of simulating predicted values in unsampled areas by calculating a weighted least-squares mean of the surrounding data points. The weighted values account for not only the distance between known observations and points of predicted values, but also the correlation of clustered observations. For example, clustered data may provide redundancy and are weighted less than a single observation at an equal distance in a different direction. The kriging simulations are processed to produce maps defining the spatial distribution of the contaminants and uncertainty in the spatial distribution.

Probability kriging is based on multiple simulations of the contaminant concentration. The outcome of each simulation reflects the actual observations within the area. The multiple simulations of the concentrations provide the basis for determining the relative uncertainty so the probability of exceeding a specified threshold value (e.g., RFCA soil AL) at any point within the area can be estimated. The simulations are processed to produce maps defining the spatial distribution of the contaminants and the inherent uncertainty in spatial distribution.

Lead Regulatory Agency (LRA): The LRA is the regulatory agency (EPA or CDPHE) that is assigned approval responsibility with respect to actions under RFCA and at a particular OU pursuant to Part 8 of RFCA. In addition to its approval role, the LRA will function as the primary communication and correspondence point of contact. The LRA will coordinate technical reviews with the Support Regulatory Agency and consolidate comments, ensuring technical and regulatory consistency and that all regulatory requirements are addressed. (RFCA ¶25[aq])

Light Nonaqueous Phase Liquid (LNAPL): LNAPLs are liquids that do not mix with water and are lighter than water (e.g., gasoline and fuel oil).

Low-Level (LL) Waste: LL waste is any radioactive waste that is not classified as TRU waste, high-level waste, or spent nuclear fuel. No minimum level of radioactivity has been specified for LL waste. LL waste mixed with hazardous waste is referred to as LLM waste.

Metadata: Metadata is information that describes other primary data used within the decision management system (e.g., a description field within an ACCESS database).

No Further Action/No Further Accelerated Action (NFA/NFAA): An NFAA is the determination that remedial actions (or further accelerated actions) are not currently warranted: however, NFA/NFAA decisions are subject to revisitation at the time of the CAD/ROD and are also subject to paragraph 238 (Reservation of Rights) and to the CERCLA § 121(c) mandate for five-year review of remedial actions that result in hazardous substances, pollutants or contaminants remaining at the Site. (RFCA Part 5 [av])

Nonroutine Actions: Nonroutine actions, for the purpose of this RSOP, are those remedial actions that are a different remedy than excavation.

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Operable Unit (OU): OU refers to a grouping of IHSSs into a single management unit.

PCB Bulk Product Waste: Waste derived from manufactured products containing PCBs in a nonliquid state, at any concentration where the concentration at the time of designation for disposal was equal to or greater than 50 ppm PCBs is referred to as PCB bulk product waste. PCB bulk product waste excludes PCBs or PCB items, but includes: (1) nonliquid bulk waste or debris from the demolition of buildings and other man-made structures; (2) PCB-containing waste from the shredding of automobiles, household appliances, or industrial appliances; (3) plastics, preformed or molded rubber parts and components, applied dried paints, varnishes, waxes, or other similar coatings or sealants, caulking, adhesives, paper, Galbestos, sound-deadening or other types of insulation, and felt or fabric products such as gaskets; and (4) fluorescent light ballasts containing PCBs in the potting material.

PCB Item: A PCB item is any PCB article, article container, PCB container, or PCB equipment that deliberately or unintentionally contains, or has as a part of, any PCB or PCBs. This category includes electrical equipment such as transformers, capacitors, and switches.

PCB Remediation Waste: PCB remediation waste is waste containing PCBs as a result of a spill, release, or other unauthorized disposal, at the following concentrations: (1) materials disposed prior to April 18, 1978, that are currently at concentrations greater than or equal to 50 ppm PCBs, regardless of the concentration of the original spill; (2) materials that are currently at any volume or concentration where the original source was greater than or equal to 500 ppm PCB beginning on April 18, 1978, or greater than or equal to 50 ppm beginning on July 2, 1979; and (3) materials that are currently at any concentration if the PCBs are from a source not authorized for use under 40 CFR Part 761.

PCB remediation waste includes soil, rags, and other debris generated as a result of any PCB spill cleanup, including, but not limited to, the following: (1) environmental media containing PCBs, such as soil and gravel; dredged materials, such as sediments; settled sediment fines; and decanted aqueous liquid from sediment; (2) sewage sludge containing less than 50 ppm PCBs and not in use in accordance with §760.20(a) (relating to uses of sewage sludge regulated under Parts 257, 258, and 503 of 40 CFR); (3) PCB sewage sludge, commercial or industrial sludge contaminated as a result of a spill of PCBs, including sludge located in or removed from any pollution control device, and decanted aqueous liquid from an industrial sludge; and (4) buildings and other man-made structures, such as concrete or wood floors or walls contaminated from a leaking PCB or PCB-contaminated transformer; porous surfaces; and nonporous surfaces.

Performance Monitoring: Performance monitoring is air, surface water, or groundwater monitoring performed around decommissioning and remediation projects.

Process Waste: Process waste is solid, hazardous, and mixed waste generated as a result of normal building operations and deactivation activities. Process waste includes mixed residues; liquids, sludges, and oils in tanks and ancillary equipment; containerized waste generated prior to approval of this RSOP; and liquid waste chemicals (regardless of when generated).

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Process Waste Line: Process waste lines are pipelines that carry process waste from the process system to the waste treatment system. At RFETS, the NPWL system is currently in operation. The OPWL was replaced by the NPWL.

Radiological Buffer Zone (RBZ): The RBZ is an intermediate area established to prevent the spread of radioactive contamination and protect personnel from radiation exposure. The area surrounds or is contiguous with Contamination Areas, High Contamination Areas, Airborne Radioactivity Areas, Radiation Areas, or High Radiation Areas.

Radiological Contamination: Radioactive material present in a location where it should not be present is referred to as radiological contamination.

RCRA-Regulated Units: RCRA-regulated units are treatment, storage, or disposal areas that are regulated under RCRA.

RCRA Stable: RCRA stable is a step toward RCRA closure, whereby wastes are removed from a RCRA-regulated unit thereby eliminating the possibility of future waste input. For tank systems, this means a tank and its ancillary equipment have been drained to the maximum extent possible using readily available means, with the objective of achieving less than 1 percent holdup, and with no significant sludge or significant risk remaining. Physical means must then be used to ensure no waste is reintroduced to the system (e.g., lock out/tag out or blank flanges).

Release Site: A release site is a site where a hazardous or radioactive waste, hazardous constituent, or radionuclide was released to the environment.

Remedial Action Objectives (RAOs): RAOs are contaminant- and medium-specific goals designed to protect human health and the environment and are used to guide the accelerated actions.

Remediation: In this RSOP, any reference to remediation refers to an accelerated action under this RSOP and not a final CERCLA action.

Remediation Waste: Remediation waste includes all solid, hazardous, and mixed waste; all media and debris containing hazardous substances or listed hazardous or mixed wastes, or exhibiting a hazardous characteristic; and all hazardous substances generated from activities regulated under RFCA as RCRA corrective actions or CERCLA response actions, including decommissioning under an approved decision document. Remediation waste includes waste generated from decommissioning activities performed under this RSOP, solid waste chemicals (regardless of when generated), and residual liquids or sludges remaining in "RCRA stable" or "physically empty" tanks. Remediation waste does not include waste generated from other activities (e.g., normal building operations and deactivation activities).

Resource Conservation and Recovery Act (RCRA): RCRA, 42 U.S.C. §6901 *et seq.*, enacted in 1976, as amended by the Hazardous and Solid Waste Amendments of 1984, the Federal Facility Compliance Act of 1992 (RFCA ¶25[ay]), and implementing regulations ensures solid

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and hazardous waste are managed in a manner that is protective of human health and the environment by focusing on improving waste disposal methods with the goal of preventing future CERCLA releases.

RFCA Standard Operating Protocol (RSOP): An RSOP is an approved protocol applicable to a set of routine environmental remediation and/or decommissioning activities regulated under RFCA that DOE may repeat without reobtaining approval after the initial approval because of the substantially similar nature of the work to be completed. Initial approval of an RSOP will be accomplished through an IM/IRA process.

Routine Actions: For the purpose of this RSOP, routine actions are those remediations that include excavation of contaminated soil and debris. Work controls may be used to control hazards at these remediations.

Sanitary Waste:

Routine Sanitary Waste: This type of sanitary waste is collected in dumpsters located throughout RFETS. Typically these wastes consist of soft or compactable items generated by office/administrative and cafeteria areas and do not require a radiological WRE prior to generation or disposal into dumpsters. Typical routine sanitary waste includes packaging and general office refuse; food waste from cafeteria or offices; nonrecyclable paper, cardboard, and miscellaneous glass; metal; rubber; and plastic items from routine office/administrative operations.

Special Sanitary Waste: Special sanitary waste is sanitary waste that requires specific treatment, analysis, certification, and/or packaging prior to disposal offsite. Special sanitary waste includes asbestos and beryllium waste that is not hazardous waste.

Spatial Variability: Spatial variability is the measure of the differences between sampling points. It is defined by the semivariogram model.

Substantive Requirements: Substantive requirements are those requirements that pertain directly to actions or conditions in the environment. Examples include quantitative health- or risk-based restrictions upon exposure (for particular contaminants), technology-based requirements for actions taken upon hazardous substances (e.g., incinerator standards requiring particular destruction and removal efficiency), and restrictions upon activities in certain special locations (e.g., standards prohibiting certain types of facilities in a floodplain).

Triangulation: The laying out and accurate measurement of a network of triangles is referred to as triangulation.

Upper Confidence Limit (UCL): The UCL is a random interval based on the upper bound of random variables that are computed from sample statistics. That is, prior to collecting a single sample, the UCL is the probability that the confidence interval will contain that particular sample measurement.

Variogram: A variogram is a fundamental geostatistical tool used to define the spatial correlation structure of spatial data sets. It is used to compare paired sample data at different locations at given separation distances. The semi-variogram model is used to define the nugget, sill, and range, which are imperative kriging parameters.