ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

RFCA Standard Operating Protocol for Facility Component Removal, Size Reduction, and Decontamination Activities

Revision 3
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RECORD OF MODIFICATIONS

RSOP Modification #	Effective Date	Description
1	08/30/2002	Addition of language to address "Los Alamos" glovebox windows.
2	11/4/2002	Field modification documented in Contact Record dated 10/16, 2002, between J. Brothers, DOE, C. Gilbreath, K-H, and D. Onyskiw, CDPHE. Change of language to footnote on Table 9 concerning containment.
3	May 27, 2003	Modification to add the use of explosives as a component removal technique. This technique was tested in Building 125 and successfully demonstrated as a safer more cost effective technique for dropping overhead equipment.

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ACRONYMS AND ABBREVIATIONS

AB	authorization basis
ACM	asbestos containing material
ALARA	as low as reasonably achievable
Am	Americium
ANSI	American National Standards Institute
APEN	Air Pollutant Emission Notice
AR	Administrative Record
ARAR	applicable or relevant and appropriate requirement
Be	Beryllium
BIO	Basis for Interim Operation
CBDPP	Chronic Beryllium Disease Prevention Program
CCA	Configuration Control Authority
CDD	closure description document
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHWA	Colorado Hazardous Waste Act
CHWR	Colorado Hazardous Waste Regulations
CID	Cumulative Impacts Document
CO_2	carbon dioxide
COOP	Conduct of Operations
D&D	deactivation and decommissioning
DDCP	Decontamination & Decommissioning Characterization Protocol
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U.S. Department of Energy, Rocky Flats Field Office
DOP	Decommissioning Operations Plan
DOP test	dioctylphthalate test (DOP is the chemical used to test HEPA filtration systems)
DOT	U. S. Department of Transportation
DPP	Decommissioning Program Plan
EAWL	Emergency Action Work Log
EDE	effective dose equivalent
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency

ER	environmental restoration
ES&H	environmental safety & health
ESS	Environmental Systems & Stewardship
FDPM	Facility Disposition Program Manual
FFCAct	Federal Facility Compliance Act
FUD	Facility Use Decision
HAP	hazardous air pollutant
HASP	Health & Safety Plan
HCA	high contamination area
HDIT	Hazard Determination & Identification Tool
HEPA	high efficiency particulate air (filter)
IA SAP	Industrial Area Sampling and Analysis Plan
IGD	Implementation Guidance Document
IHSS	Individual Hazardous Substance Site
IM/IRA	Interim Measure/Interim Remedial Action
IMP	Integrated Monitoring Plan
ISMS	Integrated Safety Management System
ISSRS	In-Situ Size Reduction System
IWCP	Integrated Work Control Program
JCO	Justification for Continued Operation
JHA	Job Hazards Analysis
LDR	Land Disposal Restrictions
LL	low-level (waste)
LLM	low-level mixed (waste)
LRA	Lead Regulatory Agency
mrem	Millirem
MOU	Memorandum of Understanding
NAAQS	National Ambient Air Quality Standards
nCi	Nanocurie
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
NSD	new source detection (monitoring)

NTS	Nevada Test Site
ODS	ozone-depleting substance
ORR	Operational Readiness Review
OSHA	Occupational Safety & Health Act
OS&IH	Occupational Safety & Industrial Hygiene
PAM	Proposed Action Memorandum
PCBs	polychlorinated biphenyls
PDS	pre-demolition survey
PDSP	Pre-Demolition Survey Plan
PDSR	Pre-Demolition Survey Report
PEB	pre-evolution briefing
PM_{10}	particulate matter with an aerodynamic diameter less than or equal to 10 micrometers
$PM_{2.5}$	particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers in diameter
PMP	Project Management Plan
POC	point of contact
POD	plan of the day
POW	plan of the week
PPE	personal protective equipment
ppm	parts per million
psi	pounds per square inch
Pu	Plutonium
QAPM	Quality Assurance Program Manual
RA	Readiness Assessment
RAAMP	Radioactive Ambient Air Monitoring Program
RCRA	Resource Conservation and Recovery Act
RDM	Readiness Determination Manual
rem	radiation equivalent man
RFCA	Rocky Flats Cleanup Agreement
RFCAB	Rocky Flats Citizens Advisory Board
RFCLOG	Rocky Flats Coalition of Local Governments
RFETS	Rocky Flats Environmental Technology Site
RISS	Remediation, Industrial Area D&D, and Site Services (Project)
RLC	reconnaissance level characterization
RLCP	Reconnaissance Level Characterization Plan

RLCR	Reconnaissance Level Characterization Report
ROSRS	Remote Operated Size Reduction System
RSOP	RFCA Standard Operating Protocol
RWP	radiological work permit
SCO	surface-contaminated object
SES	safety evaluation screen
SHPO	State Historic Preservation Officer
Site	Rocky Flats Environmental Technology Site
SME	subject matter expert
SPCC	Spill Prevention, Control, and Countermeasures (Plan)
SRA	Support Regulatory Agency
STP	Site Treatment Plan
Th	Thorium
TPH	total petroleum hydrocarbons
TRM	transuranic mixed (waste)
TRU	transuranic (waste)
TSCA	Toxic Substances Control Act
TSP	total suspended particulate
TU	temporary unit
U	Uranium
UBC	under-building contamination
USQ	Unreviewed Safety Question
USQD	Unreviewed Safety Question Determination
WAC	waste acceptance criteria
WCD	Work Control Document
WIPP	Waste Isolation Pilot Plant
WPF	Work Process Form

EXECUTIVE SUMMARY

A Rocky Flats Cleanup Agreement (RFCA) Standard Operating Protocol (RSOP) is a decision document that applies to a set of routine decommissioning or environmental restoration (ER) activities regulated under RFCA. An RSOP may be referenced in a project-specific decision document or it may be used in lieu of a project-specific decision document. Once approved by the Lead Regulatory Agency (LRA), an RSOP may be used for multiple projects at the Rocky Flats Environmental Technology Site (RFETS or Site). Because decommissioning and ER activities are often similar from facility to facility, RSOPs are an effective way to document work processes while minimizing paperwork at the project level.

This document is the RSOP for decommissioning activities conducted prior to facility demolition, including:

- Physical removal of facility components, both inside and outside a building (e.g., gloveboxes, tanks and ancillary piping, fume hoods, ventilation and filtration systems, other utilities and equipment, interior and exterior walls, ceilings, floors, roofs and other structural members);
- Size reduction of components to meet property reuse, waste management and/or transportation requirements; and
- Decontamination of components in preparation for removal, size reduction, and/or building demolition.

This RSOP presents information on the component removal, size reduction, and decontamination process, including techniques and associated controls, monitoring requirements, waste management requirements, and the closure of hazardous and mixed waste treatment and storage units. The removal, size reduction, and decontamination techniques described in this RSOP have been evaluated and determined to be safe to workers, the public, and the environment; to promote post-closure stewardship by establishing institutional controls and monitoring; and to be implementable and cost effective. In the event a new technique is developed and proposed for use at the Site, the technique will be evaluated as part of the Integrated Safety Management System (ISMS) and National Environmental Policy Act (NEPA) process to determine whether a modification to this RSOP is required. All new techniques will be discussed with the LRA prior to use.

Consistent with the objectives of RFCA, RFETS closure project managers will select removal, size reduction, and decontamination techniques based on a variety of factors, including potential environmental, safety, and health (ES&H) hazards, secondary waste generation, and cost-effectiveness. Performance specifications for all techniques will include meeting the applicable release criteria; minimizing the generation of hazardous, radioactive and secondary wastes; minimizing ES&H impacts; and complying with the applicable or relevant and appropriate requirements (ARARs), U.S. Department of Transportation (DOT) regulations, and the waste acceptance criteria (WAC) of the treatment, storage, and disposal (TSD) facilities that accept RFETS wastes.

Facility component removal, size reduction, and decontamination activities will be performed upon completion of a readiness determination in compliance with Site processes and procedures, including the ISMS, which incorporates the Site Integrated Work Control Program (IWCP), Environmental Management, and Quality Assurance Programs. For example, job hazards analyses will be performed and multi-media environmental reviews will be initiated for each closure activity or group of closure activities via the use of the RFETS Environmental Checklist. Site requirements will be applied based on a graded approach (i.e., more rigorous requirements will be applied to activities with greater hazards). In addition, personnel and environmental monitoring systems will be used, including Site-wide and project-specific air, surface water, and groundwater monitoring systems as described in RFETS Environmental Management Program guidance documents and in the Site Integrated Monitoring Plan (IMP).

While actions taken under this RSOP will affect facilities across the Site, most of the work will be conducted inside the facilities, and will have little or no impact on human health and safety and the environment.

Throughout the course of decommissioning and ER, personnel of the U.S. Department of Energy, Rocky Flats Field Office (DOE), its contractors and subcontractors, and the regulatory/oversight entities (i.e., the Colorado Department of Public Health and Environment [CDPHE] and the Environmental Protection Agency [EPA]) will use the RFCA consultative process to establish and maintain effective working relationships with each other and with the general public.

1.0 INTRODUCTION

Consistent with the objectives of RFCA[1], three alternatives were considered for the near-term and long-term management of the buildings[2] at RFETS:

- Alternative 1 – Decommissioning (i.e., component removal, size reduction, decontamination, and demolition),
- Alternative 2 – No action with safe shutdown maintenance (i.e., "mothballing"), and
- Alternative 3 – Reuse (i.e., made available to the private sector for other economic uses).

As described in the RFCA Standard Operating Protocol (RSOP) for Facility Disposition[3], Alternative 1, Decommissioning, is the selected alternative for all RFETS buildings. The RFCA definition of decommissioning includes facility component removal, size reduction, decontamination, and demolition. This document presents the RSOP for decommissioning activities conducted prior to building demolition, including the physical removal, size reduction, and decontamination of facility components. Facility components include gloveboxes, interior and exterior tanks and ancillary piping, fume hoods, ventilation and filtration systems, other utilities and equipment, interior and exterior walls, ceilings, floors, roofs and other structural members located both inside and outside a building.

The regulatory approach to the decommissioning of RFETS buildings is presented in the RFETS Decommissioning Program Plan (DPP).[4] Various types of buildings will be decommissioned, including those with radiological and chemical contamination. As described in the DPP, buildings are typed based on levels of contamination.[5] The Facility Disposition Program Manual (FDPM) describes the RFETS internal requirements for planning and executing decommissioning activities,[6] including preparation of a Project Management Plan (PMP).[7] The PMP documents deactivation and decommissioning project development and engineering activities for each RFETS closure project.

This RSOP contains information pertaining to the facility component removal, size reduction, and decontamination phase of the decommissioning process. The RSOP for Facility Disposition addresses the demolition phase of decommissioning, and the RSOP for Recycling Concrete[8] addresses the reuse of building rubble (i.e., concrete) as on-Site fill

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1 Final Rocky Flats Cleanup Agreement, Federal Facility Agreement and Consent Order, CERCLA VIII-96-21, RCRA (3008[h]) VIII-96-01, State of Colorado Docket #96-07-19-01, July 19, 1996.

2 The terms "building" and "facility" are used interchangeably in this RSOP.

3 RFCA Standard Operating Protocol (RSOP) for Facility Disposition (latest revision).

4 Rocky Flats Environmental Technology Site Decommissioning Program Plan (DPP), PADC-98-00949 (latest revision).

5 Type 1 buildings are free of contamination; Type 2 buildings are without significant contamination or hazards, but in need of decontamination; and Type 3 buildings are buildings with significant contamination and/or hazards (see Section 2.2 of the DPP).

6 Rocky Flats Environmental Technology Site Facility Disposition Program Manual, MAN-076-FDPM (latest revision).

7 The Project Management Plan (PMP) will replace the Project Execution Plan (PEP) in the next revision to the FDPM.

8 RFCA Standard Operating Protocol (RSOP) for Recycling Concrete (latest revision).

material. RSOPs for the on-Site management of soils and asphalt, and for ER activities are being written to cover activities necessary to characterize, assess, and remediate contamination in soils, asphalt, sediments, surface water, and groundwater.[9]

This RSOP will be applied to individual closure projects by submittal of a notification letter to the LRA, as described in Section 8.3 of this document, or by reference in project-specific RFCA decision documents (e.g., Decommissioning Operations Plan [DOP], Interim Measure/Interim Remedial Action [IM/IRA], Proposed Action Memorandum [PAM]). RFCA decision documents are discussed in Parts 9 and 10 of RFCA. Section 1.1.4 of the DPP provides a screening method for determining when RFCA decision documents, including RSOPs, are required. Section 3.3.1 of the DPP describes the process that will be used to define the scope of activities to be performed under this RSOP, including provisions for consultation with the LRA. As part of the work planning process, the closure project manager (or designee) will complete one or more Facility Component Removal, Size Reduction, and Decontamination Activity Checklists (see Appendix A) to ensure the planned activities are covered by this RSOP. In the event a planned activity falls outside the scope of this RSOP, it will be evaluated through the Site's ISMS and NEPA process to determine whether a modification to this RSOP is required. If the impacts are determined to be different from or greater than those described in Section 6.0 of this RSOP, a modification will be prepared in accordance with the requirements of ¶127 of RFCA. The ISMS is described in Section 2.0 of this RSOP and the NEPA process in Section 6.0.

Activity-specific approaches to component removal, size reduction, and decontamination, and related controls are developed based on thorough building characterization. Characterization performed prior to decommissioning is referred to as "reconnaissance level characterization" (RLC). RLC is conducted in accordance with the RFETS Reconnaissance Level Characterization Plan (RLCP)[10] to provide an initial assessment of the contamination, hazards, and other conditions associated with a building or cluster of buildings. Results are summarized in the Reconnaissance Level Characterization Report (RLCR), which contains the facility type determination.

Additional chemical and radiological characterization may be conducted during component removal, size reduction, and decontamination activities, as facility components are removed and building surfaces are further exposed. This type of characterization is referred to as "in-process characterization." Data from in-process characterization is used to identify additional hazards; refine approaches to component removal, size reduction, and decontamination; revise waste volume estimates; and modify ES&H controls, if necessary. In-process characterization is also conducted to verify that decontamination has achieved the applicable performance specifications, such as release or reuse criteria, and WAC of TSD facilities.

A pre-demolition survey (PDS) is conducted prior to facility demolition to ensure that buildings have been sufficiently decontaminated to meet the applicable release criteria stated in the RSOP notification letter or the project-specific RFCA decision document. The PDS is

[9] See Section 2.3.4 of the DPP.

[10] RFETS Reconnaissance Level Characterization Plan (RLCP), (latest revision).

conducted in accordance with the requirements of the Pre-Demolition Survey Plan (PDSP).[11] The type of data necessary to satisfy the objectives of the PDS include total surface contamination measurements, removable surface contamination measurements, and scan data. Additional information required to design the PDS includes in-process survey and sample data, and updated maps to reflect structural alterations. In-process surveys are performed to assess changing radiological conditions during the course of decommissioning and to confirm that an area is free of gross contamination. Survey data from the PDS are documented in a PDS Report (PDSR). The RFETS Decontamination and Decommissioning Characterization Protocol (DDCP)[12] contains detailed information concerning the characterization process.

The relationships between RFETS closure project documents and drivers, individual closure project characterizations, and RFCA decision documents and reports are summarized in Figure 1. Figure 2 depicts the closure project process flow in more detail. Together, these figures show the work flow and sequence of the major closure activities, including preparation and review of key documents and interfaces between the decommissioning and ER elements of facility closure.

While the regulatory processes and documentation for decommissioning and ER are separate, these two major elements of facility closure interface at various points in the closure process (e.g., they share common elements of the various environmental monitoring programs), and will sometimes occur concurrently in a building or building cluster. The Industrial Area Characterization and Remediation Strategy[13] describes the interface points within the Site's Industrial Area. Before, during, and/or after component removal, size reduction, and decontamination activities, ER personnel will characterize under-building contamination (UBC) and surrounding soil, as appropriate. Characterization activities will be described in the final ER Industrial Area Sampling and Analysis Plan (IA SAP). The integration of the decommissioning and ER elements of facility closure is described in the RSOP for Facility Disposition and in the PMP for each closure project.

DOE is currently considering the long-term stewardship issues associated with decommissioning and ER activities, including long-term monitoring to ensure RFCA objectives are being met. Information on long-term stewardship is available online at www.em.doe.gov/lts.

The remainder of this document is organized into seven sections. Section 2.0 describes the RFETS management systems that will be used to safeguard worker health and safety, protect public health and the environment, and ensure regulatory compliance as work is planned and executed within the scope of this RSOP. The overall approach to component removal, size reduction, and decontamination activities is described in Section 3.0, as are specific techniques, performance specifications, and special requirements for the removal, size reduction, and decontamination of ventilation and filtration systems, interior and exterior

[11] The RFETS Pre-Demolition Survey Plan (PDSP) is in draft form and currently under-going review by the regulators.

[12] Rocky Flats Environmental Technology Site Decontamination and Decommissioning Characterization Protocol, MAN-077-DDCP (latest revision).

[13] Rocky Flats Environmental Technology Site Industrial Area Characterization and Remediation Strategy (latest revision).

walls, ceilings, roofs, and other structural members. Waste management is discussed in Section 4.0, and closure options for RCRA-regulated units are described in Section 5.0. Anticipated environmental consequences are presented in Section 6.0, and ARARs are addressed in Section 7.0. Section 8.0 describes how DOE, its contractor, and subcontractors will establish and maintain effective working relationships with the regulators and the public during Site closure, and it explains how this RSOP will be approved and then implemented for individual closure projects. A glossary of the terms used in this RSOP is provided after Section 8.0.

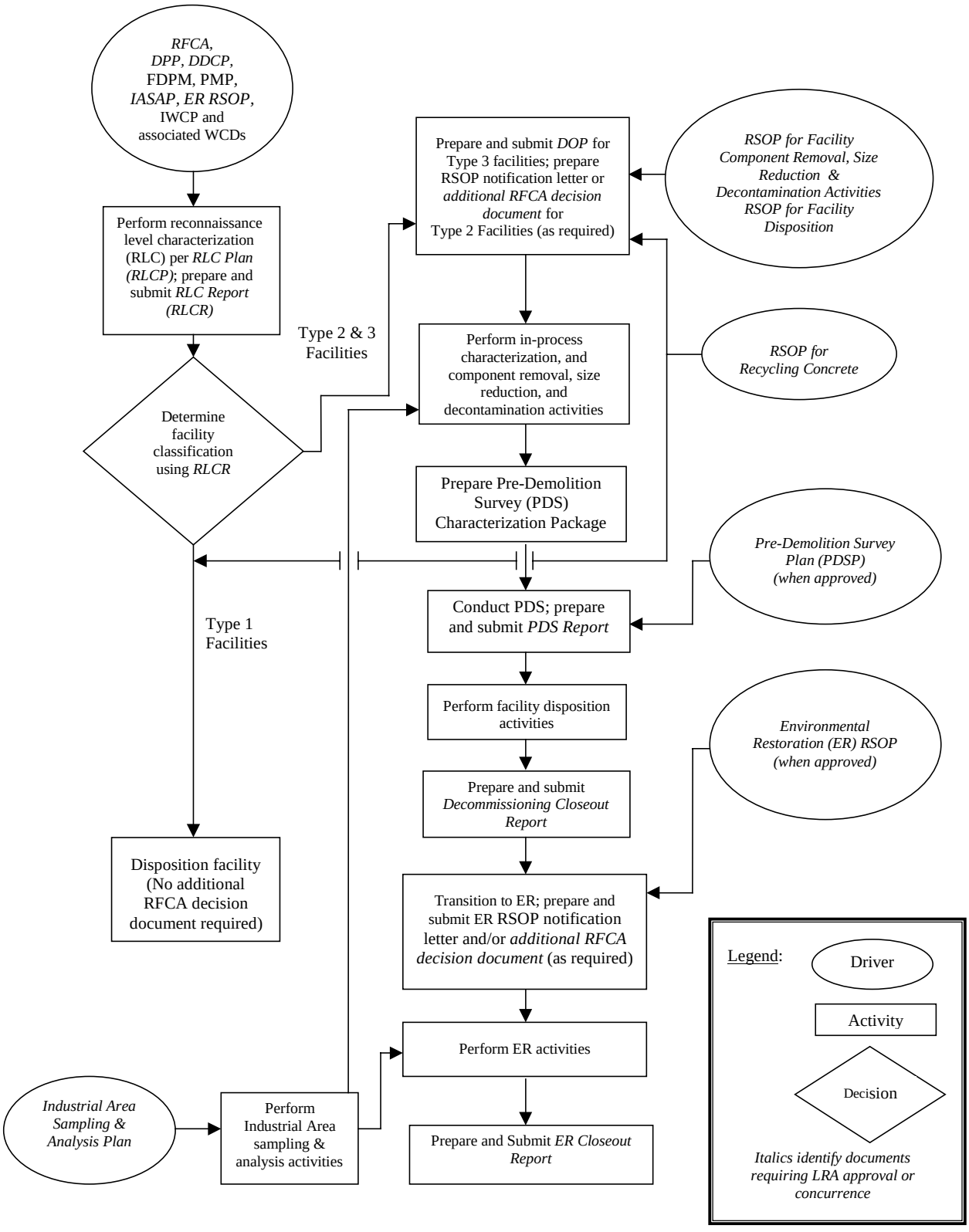

Figure 1. Major Closure Activities and Associated Documents

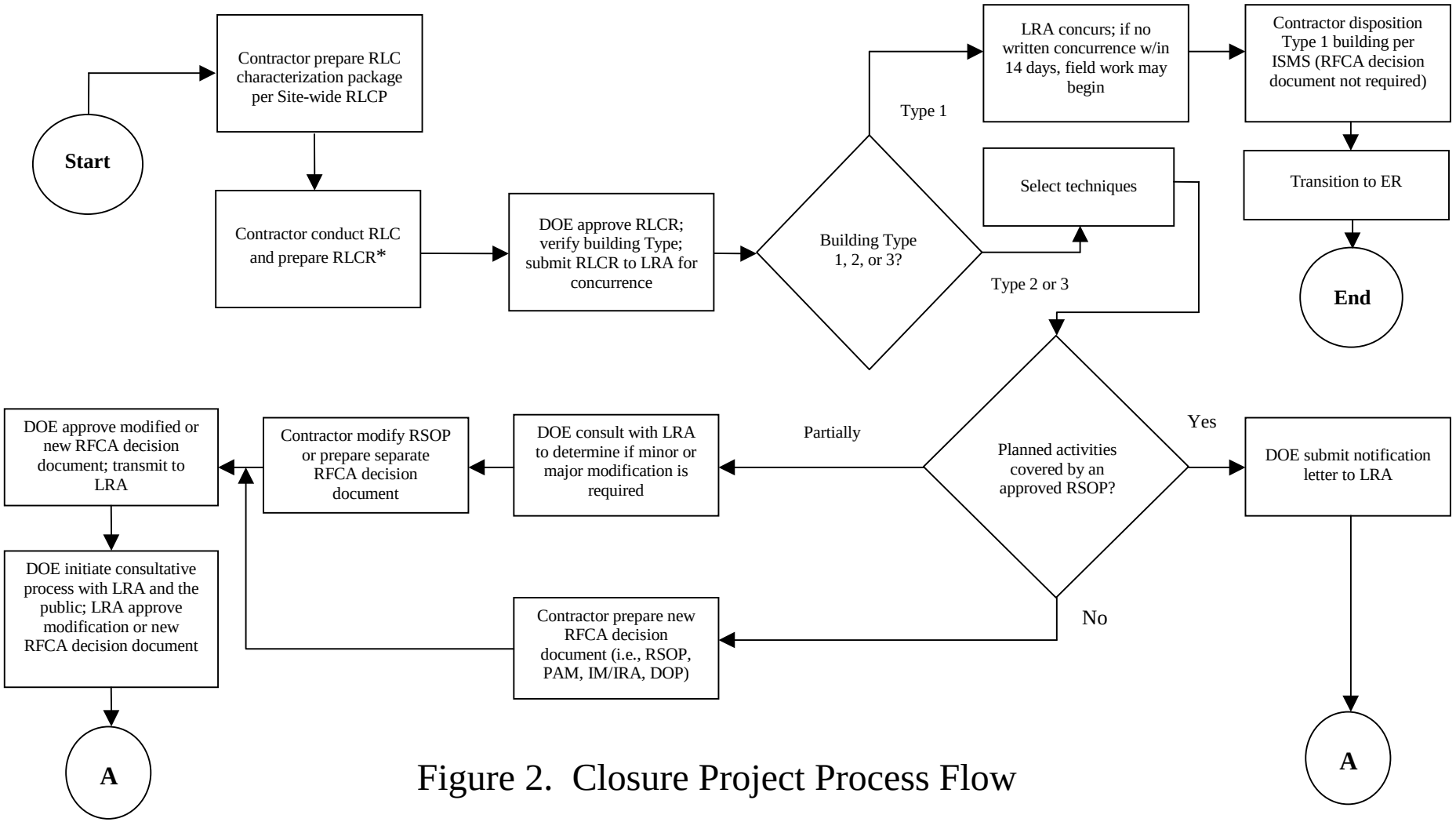

Figure 2. Closure Project Process Flow

* As provided in the DPP, certain decommissioning activities may be conducted prior to the RLC. In such instances, the characterization activities performed during the work planning process may be adequate to perform specific work, as determined in consultation with the LRA.

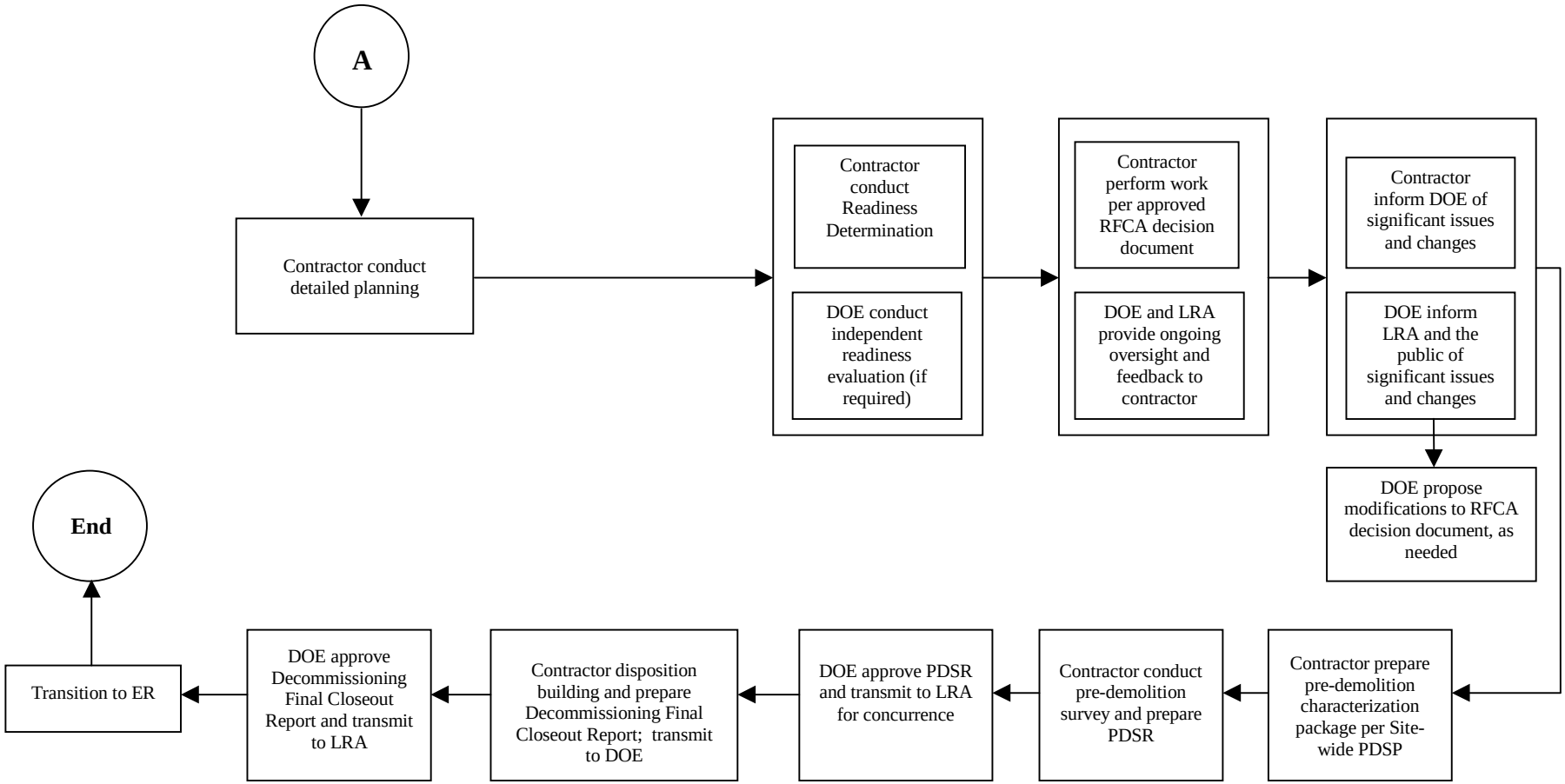

Figure 2. Closure Project Process Flow (continued)

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2.0 WORK PLANNING AND EXECUTION

Building component removal, size reduction, and decontamination activities will be planned and executed in accordance with the ISMS, which provides the framework for mitigating adverse impacts to workers, the public, and the environment. The ISMS is structured around five core principles:

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

As described in the following paragraphs, the ISMS is implemented at RFETS through a variety of existing DOE- and contractor-approved programs.

2.1 Integrated Work Control

The contractor-approved IWCP Manual[14] defines the method by which ISMS is implemented at the activity level. When work is identified, the responsible manager first determines whether an emergency response is required. Emergency work (e.g., fire suppression, cleanup of hazardous material spills) may be performed without prior planning, but must be documented on an Emergency Action Work Log (EAWL). If the activity does not involve emergency work, a Work Process Form (WPF) is completed and the responsible manager initiates the IWCP process to plan and perform the necessary work.

Based on the information contained on the WPF, the responsible manager determines whether the work can be performed by skill-of-the-craft (i.e., whether it is routine work, such as painting or re-lamping, which has already been evaluated for associated hazards). If the work cannot be performed by skill-of-the-craft, a Hazard and Discipline Identification Tool (HDIT) is completed to identify the general hazards involved in the work and to determine the disciplines needed to plan the work in detail.

Following establishment of the planning team, the responsible manager selects the appropriate planning approach, consistent with the uncertainty, complexity, and hazards associated with the work. As described in the IWCP Manual, two planning options are available:

- The high planning approach is applied when there are significant hazards and/or potential environmental impacts or there is significant uncertainty about the hazards, and either there is significant complexity associated with the work or the project team has never performed the work before.
- The standard planning approach is applied if the high planning approach is not needed.

[14] RFETS Integrated Work Control Program (IWCP) Manual (MAN-071-IWCP), (latest revision).

In either case, a Job Hazards Analysis (JHA) is then developed by the planning team to identify specific work hazards and to establish appropriate hazard controls. As depicted in Figure 3, this is an iterative process that is repeated until all controls are identified, then revisited when new hazards are discovered or the scope of work changes.

Upon completion of the JHA, Work Control Documents (WCDs), such as activity-specific procedures and IWCP work packages, are prepared and submitted for nuclear safety screening and independent safety review (if required). Following those reviews, the necessary concurrence and approvals are obtained from the appropriate Site program subject matter experts (SMEs), (e.g., radiological engineering, environmental management, occupational and industrial hygiene [OS&IH]), and the work is performed. As discussed in Section 8.2 of this RSOP, the LRA has a standing invitation to IWCP planning meetings and associated roundtable review sessions.

2.2 Readiness Determination Program

The closure project manager will review individual projects and activities to establish the need for an Operational Readiness Review (ORR) or Readiness Assessment (RA) in accordance with the Site Readiness Determination Manual (RDM).[15] The RDM applies to the startup and restart of nuclear, non-nuclear, radiological, ER, waste management, deactivation, and/or decommissioning activities that are new, complex, or require activity-specific changes to a building's authorization basis (AB). As discussed in Section 8.2 of this RSOP, the LRA has a standing invitation to readiness determinations performed for work conducted within the scope of this RSOP.

2.3 Conduct of Operations

The Conduct of Operations (COOP) Program provides a formal, disciplined approach to building operations. Key elements of the program include the following:

- Work must be performed by appropriately trained personnel using adequate and controlled procedures,
- Work must be properly supervised, and
- Work must be authorized by the Configuration Control Authority (CCA) or Shift Manager.

The COOP Program also provides processes for monitoring building operations through functions such as logkeeping, conduct of rounds, internal surveillances, and requirements for planning and releasing work.

[15] Site Readiness Determination Manual, MAN-040-RDM (latest revision).

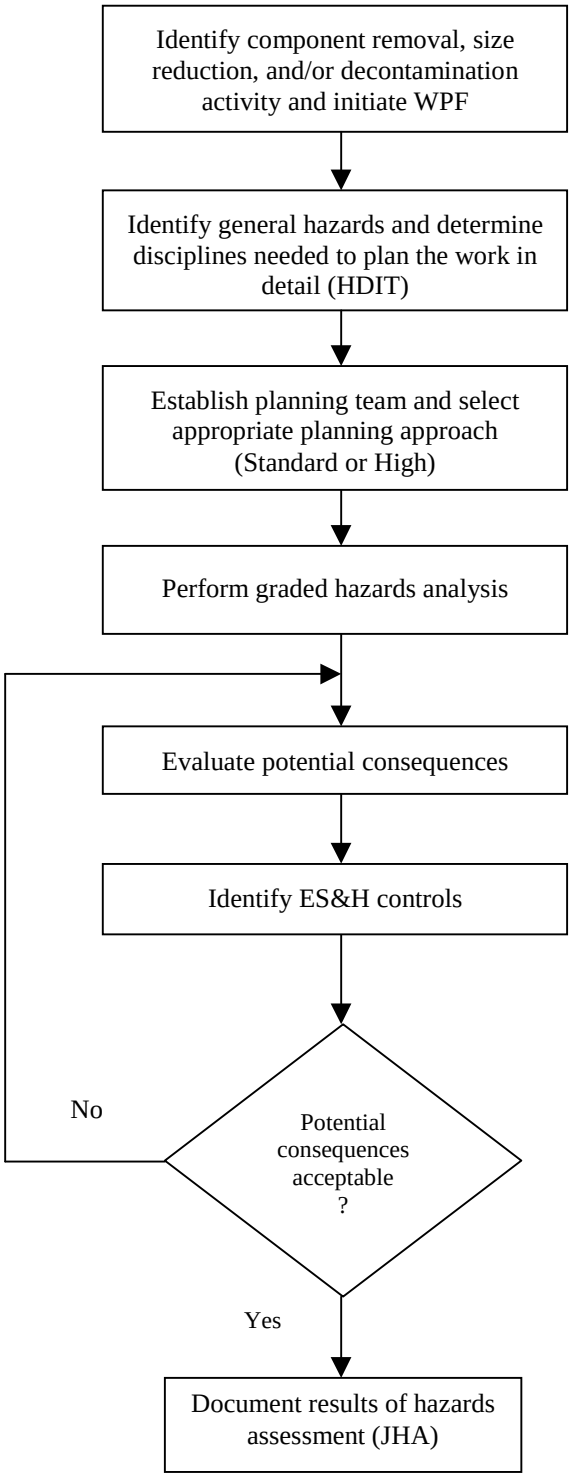


Figure 3. Integrated Work Control Program Hazards Identification and Assessment Process

Building managers use the plan of the week (POW) and plan of the day (POD) meetings to schedule, authorize, and control activities in an RFETS building, and provide a forum for discussing planned activities and resolving scheduling conflicts. Once the POW and POD have been established and approved by building management, a meeting is held early in the shift to release work for the day. The CCA or Shift Manager chairs this meeting, during which he or she describes current building conditions, identifies radiological areas, and ensures work to be performed is supported. Pre-evolution briefings (PEBs) are conducted to ensure that project personnel understand the applicable hazards and controls, and are adequately prepared to perform the scheduled activities. The PEB provides a mechanism for implementing the ISMS at the floor level. As discussed in Section 8.2 of this RSOP, the LRA has a standing invitation to POWs, PODs, and PEBs.

2.4 Nuclear Safety

Nuclear safety SMEs review procedures and work packages, as appropriate, to ensure planned activities are performed within the building's existing AB, and the established radiological controls are adequate to protect the worker, the public, and the environment. The safety evaluation screen (SES) identifies activities that may be outside the AB and therefore may present an unreviewed safety question (USQ). A USQ determination (USQD) is performed to evaluate activities with the potential to challenge the limits of a building's AB. It is a more in-depth review of the activity than is the SES. Activities determined to be USQs are evaluated to determine whether additional building safety controls are required to manage the hazards associated with the activity. If additional controls are required, they are documented as a "page change" to the building's AB or in a Justification for Continued Operation (JCO).

2.5 Criticality Safety

The Criticality Safety Program establishes controls for activities involving fissionable material. This program includes developing engineered and/or administrative criticality safety controls, monitoring compliance status with established controls that include occurrence investigation and reporting, and maintaining and controlling distribution of technical documents. The program ensures the Criticality Safety Program organization approves criticality safety controls either through new evaluations or through the criticality safety limit examination program for all activities involving the storage, relocation, and/or processing of fissionable material. The Criticality Safety Program is implemented through the DOE-approved Site Nuclear Criticality Safety Manual.[16]

2.6 Radiation Protection

The Radiation Protection Program implements standards, limits, and program requirements for protecting workers from exposure to radioactive materials. The DOE-approved program is based on the principle of ALARA (i.e., as low as reasonably achievable) and provides for personnel dosimetry, surveillance and maintenance of engineered radiation protection

[16] Site Nuclear Criticality Safety Manual, MAN-088-NSM (latest revision).

systems, issuance of radiological work permits (RWPs), and area surveillance and posting. Radiological protection for planned activities is ensured through reviews of work control documents, pre-job surveys, and the use of personal protective equipment (PPE). Personnel exposures are formally tracked, recorded, and reported to each individual. Radiological monitoring is performed in accordance with the DOE-approved Radiological Control Manual[17] and Radiological Safety Procedures Manual.[18]

2.7 Occupational Safety & Industrial Hygiene

The OS&IH Program ensures personnel exposures to physical, chemical, and biological hazards in the work environment are controlled by requiring job supervisors and OS&IH personnel to identify OS&IH hazards in the work area and to establish appropriate controls. Program safety and technical reviews are integrated into the IWCP process to ensure non-radiological OS&IH hazards (i.e., physical, chemical, biological) are identified and appropriate measures are instituted to protect the worker (e.g., engineered systems, PPE, monitoring equipment). The OS&IH Program follows the standards defined in 29 CFR Parts 1910 and 1926, DOE regulation 10 CFR 850 (i.e., Chronic Beryllium Disease Prevention Program [CBDPP]), and the DOE-approved Site OS&IH Program Manual.[19]

2.8 Environmental Management

Closure activities are monitored by several RFETS environmental management organizations. Project environmental management staff and the Environmental Systems & Stewardship (ESS) organization use the RFETS Environmental Checklist to identify activities that may impact any of the Site's media-specific environmental programs. The Environmental Media Management Group implements the Site IMP, which specifies monitoring requirements for facility decommissioning and other source removal actions to protect air, water, and ecology. Issues relating to the Site's National Pollutant Discharge and Elimination System (NPDES) permit and incidental waters are administered through the Remediation, Industrial Area Deactivation and Decommissioning (D&D), and Site Services (RISS) Project.

In general, environmental monitoring for individual closure projects is implemented during the decommissioning phase of each closure project and may involve the installation of groundwater, air, and surface water monitoring stations around the facility. Where localized activities for a project generate contamination with the potential to impact air or water quality, personnel from the RISS and ER Projects will characterize the contamination. Following are examples of the Site’s media-specific environmental programs and responsible organizations:

- RFCA Coordination Program (ESS),

[17] Rocky Flats Environmental Technology Site Radiological Control Manual (latest revision).

[18] Rocky Flats Environmental Technology Site Radiological Safety Practices Manual (latest revision).

[19] Occupational Safety & Industrial Hygiene Program Manual, MAN-072-OS&IHPM (latest revision).

- RCRA Program (ESS, as managed by the environmental management group within each closure project),
- Toxic Substances Control Act (TSCA) Program (ESS)
- Air Quality Management Program (ESS),
- Site Water Management Program (ESS),
- Chemical Life Cycle Management Program (ESS),
- NPDES Program (RISS),
- Incidental Waters/Internal Waste Streams (RISS),
- Safe Drinking Water Act Program (ESS),
- Sanitary Waste Disposal Program (Materials Stewardship Project),
- Underground/Aboveground Storage Tank Program (ESS),
- NEPA Program (ESS), and the
- Waste Certification (ESS).

2.9 Transportation

The Site Transportation Program specifies safe and compliant packaging requirements for both on-Site and off-Site transportation of radioactive and hazardous materials to prevent releases and minimize accident consequences. The Transportation Program describes a process for incorporating packaging and labeling requirements into WCDs and defines training requirements for personnel involved in the packaging and shipment of hazardous materials. The RFETS Transportation Program is implemented through the DOE-approved Site Transportation Manual[20] and the Off-Site Transportation Manual.[21]

2.10 Emergency Preparedness

The Emergency Preparedness Program provides the plans, procedures, and resources necessary to respond to Site emergencies. This DOE-approved program is based on a comprehensive understanding of the potential hazards and potential radioactive material and hazardous chemical release mechanisms present in RFETS buildings.

Program elements include management planning; designation of an emergency response organization; and training and drills (Site-wide and building-specific) for possible abnormal events including fires, hazardous material spills, nuclear criticalities, and personnel accountability during building evacuation. The program's trained emergency response personnel ensure worker and public safety during an abnormal event. The Emergency Preparedness Program is implemented through the RFETS Emergency Plan,[22] and augmented by building-specific emergency response operations procedures.

[20] Site Transportation Manual, RF-TSM (latest revision).

[21] Off-Site Transportation Manual, 1-T-95-TRAFFIC-120 (latest revision).

[22] Rocky Flats Environmental Technology Site Emergency Plan, EPLAN-96 (latest revision).

2.11 Quality Assurance

All work performed within the scope of this RSOP will be accomplished in accordance with the requirements of 10 CFR 830.120, Quality Assurance Requirements (the QA rule), the American National Standards Institute/American Society for Quality Control (ANSI/ASQC-E4), and the relevant DOE Order for Quality Assurance. The substantive requirements of the federal regulation, DOE Order, and ANSI/ASQC-E4 are implemented through the DOE-approved Site Quality Assurance Program Manual (QAPM).[23] Table 1 summarizes the 10 criteria of the QA rule (10 CFR 830.120), DOE Order 414.1, and applicable elements of ANSI/ASQC-E4. Future changes to this list of documents will be shared with the LRA as part of the RFCA consultative process.[24]

[23] Quality Assurance Program Manual (MAN-131-QAPM), (latest revision).

[24] As part of the ongoing RFETS Technical Infrastructure Alignment Initiative, the contractor is reviewing, revising, combining, and/or re-writing 15 of the Site's high-level planning documents, including quality documents. As a result, document names and numbers are subject to change.

Table 1. Quality Criteria Applied to RFETS Closure Projects

Quality Criterion	DOE- and/or Contractor-Approved Implementing Documents
1) Quality Programs	Quality Assurance Program Manual (MAN-131-QAPM); Price Anderson Amendments Act Program (1-MAN-022-PAAAPROG); Management Control System (F&A-MCS-001); Preparation of QA Program Plans (1-C40-QAP-02.01)
2) Personnel Training and Qualification	K-H Training User Manual; K-H Training Implementation Manual
3) Quality Improvement	Site Corrective Action Requirements Manual (1-MAN-012-SCARM), Site Integrated Oversight Manual (1-MAN-013-SIOM), Site Lessons Learned/Generic Implications Requirements Manual (1-S27-ADM-16.18), Stop Work Action (1-V10-ADM-15.02), Occurrence Reporting Process (1-D97-ADM-16.01), Performance Indication and Trend Analysis (1-E93-ADM-16.18), Control of Non-Conforming Items (1-A65-ADM-15.01), and Control of Waste Non-Conformances (2-U76-WC-4030)
4) Documents and Records	Site Documents Requirements Manual and Correspondence Control Program (1-L43-IMS-001)
5) Work Processes	Configuration Change Control Program, IWCP Manual, Conduct of Operations Manual (MAN-066-COOP), Site Documents Requirements Manual (1-MAN-013-SDRM), ISM Manual (1-MAN-016-ISM), Radiological Control Manual, Radiological Safety Practices Manual, Environmental Management Program guidance documents, and the Occupational Safety & Industrial Hygiene Program Manual (1-MAN-072-OS&IHPM), including Chapter 28, Chronic Beryllium Disease Prevention Program
6) Design	Configuration Change Control Program Manual
7) Procurement	Procurement System Manual and Acquisition Procedure for Requisitioning Commodities and Services (1-W36-APR-111)
8) Inspection and Acceptance Testing	Inspection and Acceptance Test Process (1-PRO-072-001), Control of Measuring and Test Equipment (1-I97-ADM-12.01), Computer Software Management Manual (1-MAN-004-CSMM)
9) Management Assessment	Site Integrated Oversight Manual (1-MAN-013-SIOM)
10) Independent Assessment	Site Integrated Oversight Manual (1-MAN-013-SIOM), Independent Assessment Program, Planning and Scheduling Independent Assessments, Readiness Determination Manual (1-MAN-040-RDM)

3.0 TECHNICAL APPROACH

Three major activities comprise the facility component removal, size reduction, and decontamination phase of decommissioning:

- Removal of facility components (both inside and outside a facility);
- Size reduction of facility components to meet property reuse, waste management, and/or transportation requirements; and
- Decontamination of facility components.

The sequence of these activities may be as described above or, where necessary, facility components may be size-reduced prior to removal or decontaminated prior to size reduction to improve efficiency and/or reduce worker exposure. For some projects, size reduction and/or decontamination may not be required. Section 3.1 provides additional details on the component removal, size reduction, and decontamination process. Sections 3.2 describes the methods that will be used to determine the most cost-effective path to completion of the component removal, size reduction, and decontamination phase of decommissioning in preparation for building demolition.

A variety of techniques are available to remove, size reduce, and decontaminate facility components. Section 3.3 describes the removal and size reduction techniques that may be used at RFETS, and Section 3.4 describes the decontamination techniques. These techniques have been evaluated and determined to be safe to workers, the public, and the environment; implementable; and cost effective.[25] In the event a new technique is developed and proposed for use at the Site, it will be evaluated through the ISMS and NEPA process to determine whether a modification to this RSOP is required. If the impacts are determined to be different from or greater than those described in Section 6.0 of this RSOP, a modification will be prepared in accordance with the requirements of ¶127 of RFCA. The Closure Project point of contact (POC) and the DOE POC will discuss any new techniques with the LRA POC prior to use. New techniques will also be discussed with stakeholders at the periodic project status briefings.

Performance specifications for selected techniques include the ability to meet the applicable unrestricted release criteria (see Table 2) or other decontamination goals; minimizing the generation of hazardous, radioactive and secondary wastes; minimizing ES&H impacts; and complying with project ARARs.

Sections 3.5 and 3.6 describe the general approach that will be used to remove gloveboxes and tank systems. Sections 3.7 and 3.8 address the circumstances surrounding removal of building ventilation and filtration systems, and contaminated portions of the building shell (e.g., an exterior wall or section of a roof). Included in these sections is a discussion of the hazards and controls that may be implemented to prevent a release of hazardous and/or radioactive materials to the environment.

[25] Rocky Flats Environmental Technology Site Value Engineering Study, August 1998.

Table 2. Unrestricted Release Criteria

Contaminant	Requirement Source	Unrestricted Release Threshold		
		Total Average (dpm/100 $cm^{2)}$	Total Maximum (dpm/100 $cm^{2)}$	Removable (dpm/100 $cm^{2)}$
Radionuclides[a]				
Transuranics	DOE Order 5400.5, Figure IV-1	100	300	20
Th-Natural		1,000	3,000	200
U-Natural		5,000	15,000	1,000
Beta-Gamma emitters	DOE "No-Radioactivity Added" Waste Verification Program	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	The removable contamination level for equipment and other items released from beryllium work areas to the general public or for use in DOE non-beryllium areas is set at 0.2 μg/100 cm^2.[b]		
	10 CFR 850.31, as interpreted by a DOE letter dated January 4, 2001	The unrestricted release limit for building materials is also set at 0.2 μg/100 cm^2.		
Polychlorinated Biphenyls (PCBs)	40 CFR 761	The unrestricted release level for PCBs will be determined for each RFETS closure project based on the 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% by volume).		

[a] The unrestricted release criteria for radionuclides are taken from "Application of Surface Contamination Guidelines for DOE Order 5400.5," DOE, April 23, 1998.

[b] 10 CFR 850.31 imposes restrictions on the release of equipment and other items from beryllium work areas.

3.1 Overview of the Removal, Size Reduction, and Decontamination Process

Typically, component removal, size reduction, and decontamination activities will proceed in the following sequence, although many of the activities may overlap. As activities are planned and executed, the RFCA consultative process (see Section 8.2) will be used to provide opportunities for discussion and exchanges of information with the regulators and the public.

1) Information collected during the RLC will be evaluated to determine the sampling and survey activities required to prepare the necessary work authorization documents, such as RWPs required by the RFETS Radiological Control Program, the Self-Audit Checklist and Beryllium Work Form required by the CBDPP, JHAs required by the IWCP process, and Environmental Checklist required by ESS.

2) Prior to performing activities under this RSOP, closure project personnel will participate in PEBs to discuss the proposed work and to review the applicable safety requirements. The LRA has a standing invitation to PEBs.

3) In-process characterization will be performed to ensure work area hazards are identified, quantified, and controlled.

4) Miscellaneous loose equipment and materials not needed for the decommissioning work will be removed from the work area.

5) Asbestos containing material (ACM) will be identified and abated by a qualified subcontractor. The abatement activity will be coordinated carefully to minimize interference with other activities and controls will be established to avoid disturbance of ACM during other activities.

6) As necessary, equipment and horizontal surfaces within the work area will be vacuumed and/or wiped down to remove any loose radiological and non-radiological contamination. This activity will be performed to minimize personnel exposure to potentially contaminated dust during subsequent decommissioning activities.

7) Electrical power to components will be de-energized, locked out/tagged out, and disconnected. Electrical systems that cannot be de-energized or that are required for continued closure activities will be identified and marked. Temporary power will be used, as necessary.

8) Building floor drains and connections to exterior piping will be sealed and marked.

9) Remaining equipment within the work area will be removed. As a general rule, equipment located at floor level will be removed first to allow better access to overhead areas. Equipment removal may include the disassembly and decontamination of the equipment if it is determined to be cost-effective or necessary to ensure worker safety. Decontamination may be completed in place, or the equipment may be wrapped or coated to prevent the spread of contamination and moved to another area for decontamination and/or size reduction. Specific contamination controls will be detailed in the applicable WCD(s). Facility components slated for unrestricted release or reuse will be surveyed in accordance with applicable Site procedures.

10) Items and loose debris within gloveboxes will be removed. Internal surfaces of gloveboxes may be wiped down, or more aggressive techniques may be used, such as abrasive/grit blasting or other methods described in Section 3.4. Lead shielding may be removed from external surfaces to minimize the generation of mixed waste.

11) Tank systems will be vented, purged, and drained to remove liquids. Ancillary piping will be removed first, using the best available method (e.g., disconnecting at a flanged joint, cutting with a wheel cutter or pipe crimping tool). Containment will be installed around the vacuum/vent lines and the tanks will be disconnected from the exhaust header. Tanks will be size reduced, as necessary to facilitate handling and packaging. Residual liquids and/or sludges in tanks and ancillary piping will be collected, characterized, and managed in accordance with the applicable waste management requirements (see Section 4.0).

12) Based on radiological and/or chemical contamination levels, strippable or fixative coatings may be applied to remove or fix surface contamination during removal and size reduction operations.

13) Prior to the removal of a contaminated glovebox, tank, or other component, radiological and chemical contamination control methods will be implemented to meet ES&H standards. Methods may include enclosing the component in a containment structure (e.g., tent), establishing ventilation control, using fogging or fixative techniques, and/or decontamination. Depending on the layout of the room, the size of the component to be size reduced, and contamination levels, a containment structure may be erected around the equipment in place, or the equipment may be moved to a size reduction facility. In any case, the containment structure will be equipped with high efficiency particulate air (HEPA) filtration systems to control the spread of contamination and minimize worker exposure. Additional details on the removal process are provided in Sections 3.5 and 3.6.

14) Workers may size reduce components using a variety of mechanical and thermal cutting methods, including nibblers, saws, and plasma arc and oxygen burning cutters, as described in Section 3.3 of this RSOP. Size reduction will be performed to minimize waste volume and to provide for packaging. Waste material will be characterized, managed, and packaged in accordance with applicable waste management requirements (see Section 4.0).

15) As facility components are cleared from each work area, workers will remove the remaining utilities, including ventilation and filtration systems, and electrical power within the area. Removal of ventilation and filtration systems is discussed in Section 3.7.

16) In the event it becomes necessary to remove a contaminated portion of the building shell (e.g., a section of an exterior wall or part of a roof), the Closure Project POC and DOE POC will consult with the LRA POC to determine whether the contaminated portion of the shell should be removed prior to demolition.[26] If, after reviewing the applicable survey data and considering relative risks, the Closure Project POC, DOE POC, and LRA POC agree that removal is the safest, most protective option, the work will be planned and executed as described in Sections 3.8 of this RSOP. In addition, the Closure Project POC and DOE POC will conduct special project status meetings as necessary to address stakeholder concerns and to provide a detailed description of the activity, methods to be used, and scheduled date(s).

    The removal activities will be evaluated by a Site air quality SME, water management SME, and beryllium SME (if warranted), and appropriate controls and monitoring requirements will be identified and implemented. A structural evaluation will be conducted by a Colorado registered professional structural engineer (i.e., P.E.) to identify shoring requirements. Structural members will be shored, as necessary, to

[26] This approach is consistent with Objective No. 7 of RFCA, which reads as follows: "All contaminated buildings will be decontaminated as required for future use or demolition. Building demolition or reuse will take place after plutonium, other special nuclear material, transuranic waste, and radioactive hot-spots have been removed. In most cases, contaminated systems (such as gloveboxes, duct-work and piping) will be decontaminated and removed prior to demolition. In a few instances, contaminated systems will be decontaminated and demolished along with the building." (p. 6)

maintain the overall structural integrity of the building. Additional decontamination will be performed, as necessary to meet the applicable release requirements. The area will then be sealed off and cross-contamination controls will be established to prevent re-contamination from activities in other work areas.

17) Groundwater collected in building sumps and/or vaults will be characterized and managed as incidental waters.[27] Details regarding groundwater management are provided in Section 6.3 (also see Table 15).

18) After components have been removed from the work area, interior and exterior building surfaces (i.e., walls, floors, ceilings) will be sampled and surveyed to determine the need for further decontamination and to verify the effectiveness of the decontamination process.

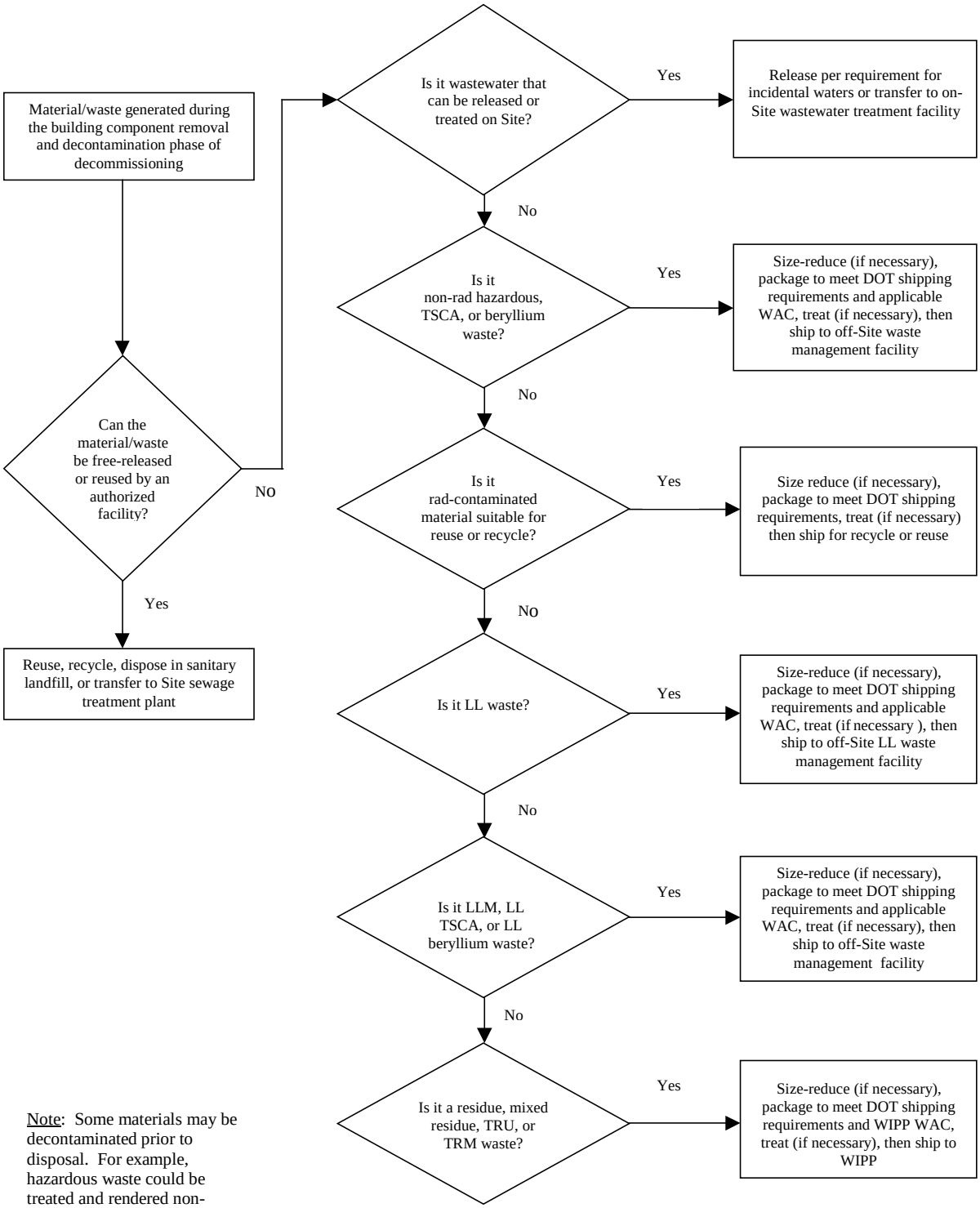
19) Upon completion of the removal and decontamination activities, a PDS will be performed in accordance with the PDSP to verify that the building may be released for demolition. Results will be documented in the PDSR, which will be submitted for review and concurrence by the LRA.

3.2 Overview of the Material and Waste Disposition Process

As depicted in Figure 4, materials and waste generated during the facility component removal, size reduction, and decontamination phase of decommissioning generally fall into seven categories (also see Section 4.0):

- Uncontaminated and/or decontaminated components and chemicals that may be released for reuse or recycle;
- Radiologically or chemically contaminated components that may be released to other DOE facilities or other facilities authorized for reuse or recycle;
- Waste that may be disposed in a sanitary landfill (i.e., sanitary and special sanitary waste);
- Radioactive, hazardous, mixed, or beryllium-contaminated waste that may be treated on Site;
- Radioactive, hazardous, mixed, beryllium-contaminated, or TSCA-regulated waste that is not or cannot be treated on Site and must be treated and/or disposed in an off-Site TSD facility;
- Wastewater that may be treated on Site and released in accordance with the requirements of the Site's NPDES permit; and
- Wastewater that may be managed as incidental waters.

[27] Control and Disposition of Incidental Waters, 1-C91-EPR-SW.01 (latest revision).



Note: Some materials may be decontaminated prior to disposal. For example, hazardous waste could be treated and rendered non-hazardous; LLM waste could be decontaminated and rendered non-rad hazardous waste, and TRU waste may be decontaminated and rendered LL waste.

Figure 4. Material and Waste Disposition Logic Flow

Some materials may be decontaminated and rendered non-radioactive and/or non-hazardous prior to reuse, recycle, or disposal. Consistent with the objectives of RFCA[28], a cost-benefit analysis has been conducted to guide RFETS closure project managers in determining the appropriate level and extent of decontamination and/or size reduction activities for their projects.[29] As part of the cost-benefit analysis, the costs of component removal activities were estimated, both with and without decontamination and/or size reduction. The estimate without decontamination or size reduction included a consideration of costs for component removal, property reuse or recycle, waste management, and PPE and other ES&H controls. The estimate with decontamination and size reduction included costs for component removal, additional costs associated with decontamination and size reduction (e.g., additional equipment, labor, PPE and other ES&H costs), and cost savings associated with decontamination and size reduction (e.g., reduced packaging, storage, shipment, treatment and disposal costs; and lower ES&H costs associated with material handling upon completion of decontamination and size reduction). Results of the analysis indicated that neither additional decontamination above that necessary for worker safety, nor additional size reduction above that necessary to handle and package decommissioning wastes, would be cost effective.

As individual closure projects progress, additional analyses may be required to compare cost impacts of new component removal techniques and approaches. These analyses will be performed as necessary, based on the logic and methodology presented in the referenced evaluations. Results of these analyses will be maintained in the closure project files.

3.3 Component Removal and Size Reduction

For the purposes of this RSOP, component removal refers to the physical disassembly, size reduction (if necessary), and removal of facility components, including:

- Gloveboxes,
- Tanks and ancillary piping[30],
- Water walls,
- Fume hoods;
- Ventilation and filtration systems,

[28] RFCA Objective No. 4, Cleanup Guidelines (p. 4) states that "Cleanup activities will be conducted in a manner that will reduce risk; be cost effective, protect public health; protect reasonably foreseeable land and water uses; prevent adverse impacts to ecological resources, surface water and groundwater; and be consistent with a streamlined regulatory approach." (emphasis added). See also RFCA Part 11, Subpart C, Cost Savings Initiatives and Productivity Improvements (p. 58).

[29] C.M. Brown, "Evaluation of Potential Cost Impacts from Volume Reduction and Decontamination for TRU-Contaminated Systems and Equipment," and "Evaluation of Potential Cost Impacts from Volume Reduction, Decontamination, or Certification to Free-Release for Low Level Waste," September 14, 1998, K-H internal documents.

[30] In accordance with Attachment 13 to RFCA, the Site's 20 petroleum underground storage tanks (USTs) have been drained and filled with polyurethane foam. Although soil and groundwater samples from the required site assessment met the 5,000 ppm total petroleum hydrocarons (TPH) standard, the data will be reviewed during ER 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. In either case, all the petroleum USTs will be dispositioned under an approved ER decision document.

- Other utilities and equipment (located both inside and outside a building), and
- Walls, ceilings, floors, and structural members.

Associated activities may also include removal of:

- Fixed lead from rooms, gloveboxes, and other equipment (e.g. lead sheeting, glove port, and glove port covers);
- Loose lead from rooms, gloveboxes, cabinets, and other equipment (e.g., lead bricks, weights);
- Fixed electronic equipment and circuit boards from rooms and equipment;
- Loose electronic equipment and circuit boards from equipment and cabinets;
- Fixed brass and bronze fittings and hardware from building structures, piping, and equipment;
- Incandescent and fluorescent bulbs from lighting fixtures and cabinets;
- Batteries from equipment and cabinets; and
- Empty aerosol cans from rooms and cabinets.

Component removal, size reduction, and decontamination activities pose potential ES&H hazards, which must be identified and controlled. Tables 3 through 8 present the key removal and size reduction steps by major facility component, the associated environmental hazards, and the environmental controls that may be used to mitigate those hazards. Section 3.3.1 describes the various component removal and size reduction techniques, and Section 3.3.2 presents the ES&H hazards and controls associated with each technique.

Size reduction will be performed to minimize waste volume and to provide for packaging in DOT-approved containers. Depending on the circumstance, size reduction activities may be performed prior to removal or subsequent to removal. Size reduction may also be performed in the area where the removal occurred, in the area where wastes will be packaged, in a central location within the building, or in a separate on-Site size reduction facility. A key step involved in component removal may be decontamination. The various decontamination techniques and associated controls are presented in Section 3.4.

Table 3. Glovebox Removal Activities, Environmental Hazards, and Associated Controls

Key Steps	Environmental Hazards	Environmental Controls
Drain glovebox piping and criticality drains into containers using gravity, pumps, compressed air, and/or vacuum system	Radioactive and/or hazardous liquids and air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Collect liquids in approved containers. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Decontaminate glovebox, if necessary (see Section 3.4)	Radioactive and/or hazardous liquids and air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Collect liquids in approved containers. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Disconnect glovebox from utilities (e.g., electrical, water, ventilation); cap openings and/or lines	Radioactive and/or hazardous liquids and air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Collect liquids in approved containers. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Size reduce glovebox, if necessary (see Section 3.3.1)	Radioactive and/or hazardous air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Use size reduction facility. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Haul away glovebox - may use mechanical lifting and hauling devices such as hoists and cranes and may containerize cut-up components (Section 3.3.1)	Radioactive and/or hazardous air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Seal glovebox openings (if glovebox is not containerized). Use spray fixative and/or stretch-wrapping if exterior is contaminated and exposed (i.e., not containerized). Package property for reuse or recycle in accordance with receiving facility WAC and DOT shipping requirements. Package waste in accordance with disposal facility WAC and DOT shipping requirements.

Table 4. Tank Removal Activities, Environmental Hazards, and Associated Controls

Key Steps	Environmental Hazards	Environmental Controls
Drain tank into containers using gravity, pumps, compressed air, and/or vacuum system; remove raschig rings (if applicable)	Radioactive and/or hazardous liquids and air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Collect liquids in approved containers. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Disconnect tank by detaching ancillary lines; cap openings and/or lines	Radioactive and/or hazardous liquids and air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Collect liquids in approved containers. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Decontaminate tank, if necessary (see Section 3.4)	Radioactive and/or hazardous liquids and air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Collect liquids in approved containers. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Size reduce tank, if necessary (see Section 3.3.1)	Radioactive and/or hazardous air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Use size reduction facility. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Haul away tank – may use mechanical lifting and hauling devices such as hoists and cranes and may containerize cut-up components (Section 3.3.1)	Radioactive and/or hazardous air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Seal tank openings. Use spray fixative and stretch-wrapping if item exterior is contaminated. Package property for reuse or recycle in accordance with receiving facility WAC and DOT shipping requirements. Package waste in accordance with disposal facility WAC and DOT shipping requirements.

Table 5. Piping Removal Activities, Environmental Hazards, and Associated Controls

Key Steps	Environmental Hazards	Environmental Controls
Drain piping into containers using gravity, pumps, compressed air, and/or vacuum system	Radioactive and/or hazardous liquids and air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Collect liquids in approved containers. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Disconnect piping, including tank vents; cap openings and/or lines	Radioactive and/or hazardous liquids and air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Collect liquids in approved containers. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Decontaminate piping, if necessary (see Section 3.4)	Radioactive and/or hazardous liquids and air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Collect liquids in approved containers. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Size reduce piping, if necessary (see Section 3.3.1)	Radioactive and/or hazardous air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Haul away piping – containerize	Radioactive and/or hazardous air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Seal openings (if not containerized). Use spray fixative and/or stretch-wrapping if exterior is contaminated and exposed (i.e., not containerized). Package property for reuse or recycle in accordance with receiving facility WAC and DOT shipping requirements. Package waste in accordance with disposal facility WAC and DOT shipping requirements.

Table 6. Fume Hood and Ventilation/Filtration System Removal Activities, Environmental Hazards, and Associated Controls

Key Steps	Environmental Hazards	Environmental Controls
Disconnect system; cap openings and/or lines	Radioactive and/or hazardous air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Collect liquids in approved containers. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Decontaminate system, if necessary (see Section 3.4)	Radioactive and/or hazardous liquids and air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Collect liquids in approved containers. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Size reduce system, if necessary (see Section 3.3.1)	Radioactive and/or hazardous air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Use size reduction facility. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Haul away system using mechanical lifting and hauling devices such as hoists and cranes; may containerize system components (see Section 3.3.1)	Radioactive and/or hazardous air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Seal openings (if not containerized). Use spray fixative and/or stretch-wrapping if item exterior is contaminated and exposed (i.e., not containerized). Package property for reuse or recycle in accordance with receiving facility WAC and DOT shipping requirements. Package waste in accordance with disposal facility WAC and DOT shipping requirements.

Table 7. Equipment Removal Activities, Environmental Hazards, and Associated Controls

Key Steps	Environmental Hazards	Environmental Controls
Drain equipment into containers using gravity, pumps, and/or compressed air	Radioactive and/or hazardous liquids and air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Collect liquids in approved containers. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Disconnect equipment from utilities (i.e., electrical, water, steam, ventilation); cap openings and/or lines	Radioactive and/or hazardous liquids and air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Collect liquids in approved containers. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Decontaminate equipment, if necessary (see Section 3.4)	Radioactive and/or hazardous liquids and air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Collect liquids in approved containers. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Size reduce equipment, if necessary (see Section 3.3.1)	Radioactive and/or hazardous air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Use size reduction facility. Use building or temporary air filtration system, and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Haul away equipment using mechanical lifting and hauling devices such as hoists and cranes; may containerize cut-up components (see Section 3.3.1)	Radioactive and/or hazardous air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Seal equipment openings (if not containerized). Use spray fixative and/or stretch-wrapping if exterior is contaminated and exposed (i.e., not containerized). Package property for reuse or recycle in accordance with receiving facility WAC and DOT shipping requirements. Package waste in accordance with disposal facility WAC and DOT shipping requirements.

Table 8. Wall, Floor, and Ceiling Removal Activities, Environmental Hazards, and Associated Controls

Key Steps	Environmental Hazards	Environmental Controls
Decontaminate wall, floor, and/or ceiling, if necessary (see Section 3.4)	Radioactive and chemical liquids and air emissions released into the building and/or to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Collect liquids in approved containers. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Dismantle wall, floor, and/or ceiling (see Section 3.3.1)	Radioactive air emissions released into the building and/or to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Isolate work area from surrounding environment by sealing cracks and floor drains, placing layers of heavy-duty plastic on floor, and/or using secondary containment. Use building or temporary air filtration system and project-specific and/or Site-wide air monitoring network (see Sections 3.5 and 3.6).
Haul away sections using mechanical lifting and hauling devices such as hoists and cranes (see Section 3.3.1)	Radioactive air emissions released into the building and to the environment	Conduct ES&H reviews prior to activity (see Section 2.0). Package property for reuse or recycle in accordance with receiving facility WAC and DOT shipping requirements. Package waste in accordance with disposal facility WAC and DOT shipping requirements. Conform with the requirements of the RSOP for Recycling Concrete.

3.3.1 Component Removal and Size Reduction Techniques

Techniques used to disassemble and size reduce facility components may be categorized as mechanical disassembly and cutting techniques, thermal cutting techniques, and explosives to disassemble, and/or drop hanging equipment (piping, ductwork and cranes). Mechanical techniques employ manual, electrical, pneumatic, and/or hydraulic forces (e.g., shear forces) and motions (e.g., reciprocating, circular motions) to cut, disassemble, and/or break equipment or systems into pieces. Thermal techniques produce a flame or electrical arc to cut and/or break the equipment or systems by melting them. Explosive techniques produce a linear uniform cutting action at the point of equipment contact. Techniques used to remove facility components may involve the used of common construction equipment, including excavators (e.g., backhoes), hoists, and cranes.

Mechanical techniques include disassembly using hand tools or power saws and shears, circular cutters, abrasive cutters, diamond wire cutters, paving breakers (i.e., jackhammers), pulverizers, grapples, rams, and non-explosive cracking agents. Thermal techniques include plasma arc, oxygen-burning, laser cutters, and arc saws. Explosive techniques may include the use of linear shaped charges, explosive rock bolt cutters, or other explosive techniques

deemed appropriate. In general, mechanical techniques are most appropriate for cutting wood, plastic, glass, concrete, and thin metal (i.e., < 3/8" thickness) systems and components, such as piping. Thermal techniques are most often used

to cut thicker metal, such as gloveboxes, chainveyors, heavy equipment, and tank systems. Explosive techniques will be used on pipe and ductwork hangers or overhead cranes. Most of these mechanical and thermal techniques may be hand-held, stationary, or configured for remote control. Explosive techniques will be configured for remote control.In 1998, the RFETS Technology Steering Committee[31] examined a variety of size reduction techniques for use during decommissioning. Currently, advanced size reduction techniques are being evaluated, including robotics and remote-operated vehicles. Initial efforts were based on soft-sided containment tents in which size reduction activities would be performed. Subsequent efforts have focused on the development and deployment of the hard-sided Inner Tent Demolition Chamber (ITDC). Other size reduction techniques currently under consideration include the Remote Operations Size Reduction System (ROSRS) and In-Situ Size Reduction System (ISSRS), which would use mobile robots to perform mechanical and thermal size reduction operations. Brief descriptions of the size reduction techniques are provided in the following paragraphs and in Table 9.

After facility components have been disconnected and disassembled, they will be packaged for disposal, reuse, or recycle following size reduction and/or decontamination (if necessary). Removal of large items, such as tanks, equipment, and sections of walls and flooring, will be accomplished using mechanical lifting and hauling devices, such as hoists and cranes. Excavators, such as backhoes, will be used to excavate around and access any underground components. Such devices will be inspected and approved for the work, and operated by certified operators. If contaminated, items will be contained (i.e., wrapped, coated, or packaged) prior to removal to prevent the release and spread of contamination. Excavation work will be conducted in accordance with the OS&IH Program Manual, which includes requirements for soil disturbance permits.

3.3.1.1 Mechanical Removal and Size Reduction Techniques

Mechanical techniques include small tools, such as hand-held saws with hardened-steel blades, that cut through construction materials, including wood, plastic, glass, Plexiglas®, Benelex®, lead, and glovebox filters. Hydraulic shears are two-bladed tools that operate on the same principle as a conventional pair of scissors. Shears may be hand-held or mounted on a skid or excavator that provides hydraulic power and a mechanism for manipulating the shears. A shear baler is a device that may be used to reduce an entire glovebox into a high-density bale that will fit into a standard waste box, either without cutting or with a minimum number of cuts.

Split frame pipe and tool cutters are designed to cut in-line piping. These devices are mounted around the outside diameter of a section of pipe and will sever, bevel, and counterbore the material being worked. Diamond wire cutting involves a series of guide

[31] The Rocky Flats Technology Steering Committee is a multi-disciplinary group of engineers and project managers tasked with evaluating new technologies for potential use at RFETS.

Table 9. Examples of Removal and Size Reduction Techniques

Components/Methods	Explosive Charges	Small Tools	Plasma Arc	Oxy-torch	Laser Cutter	Diamond Wire Saw	Wachs Cutter	Hydraulic Shears	Shear Baler	Water with Abrasives	Arc Air Slice	Arbor Press
	A,R,H		A,R,H,F	A,R,H,F	A,H	C,R,S	P	R		A,C,S,H	A,H,F	
Gloveboxes												
Stainless with lead shielding		3	1		2	3		1	1	1	1	1
Stainless without lead shielding		2	1		2	3		3			1	1
Plexiglas® with lead shielding		1				3		2				
Plexiglas® without lead shielding		1				3		2				
Glass		1										
Lead		1										1
Gloves		1										
Filters		1						2				
Glovebox supports		2	1	1	1		1	2		2	1	
Shielding												
Benelex		1										
Plexiglas		1										
Pipe/Ductwork/overhead Cranes	1	2				3						
Machinery												
Tool Steel												
<½ “		3	1	1	2	3		2		1	1	
> ½” but < 3”		3	1	1		3				1	1	
> 3”		3	1	1		3				3	1	
Cast iron			1		2	3				2	1	
Carbon steel equipment bases			1	1	2	3				2	1	
Aluminum		2	2		1	3		1	1	1	1	1
Stainless steel > 3/8” but < 1”		3	1		3	3				1	1	
Granite		2		2		1				1	2	

Adapted from Value Engineering Study, RFETS Building 776/777 Glovebox Size Reduction Final Report (August 1998)

LEGEND:

Blank = Not applicable or not recommended

1 = Most preferred method

2 = Medium preferred method

3 = Least preferred method

Footnotes

A = Can be automated

R = Can utilize remote control

H = Containment as required by Radiological Operations

F = Produces fumes

C = Possible criticality issue

S = Secondary waste issue

P = Applies to pipe only

pulleys that draw a continuous loop of multi-strand wire strung with diamond beads and spacers through the surface to be cut. High-pressure water cutters use water mixed with an abrasive, such as garnet, to cut through steel. Typically, high-pressure water cutters are mounted on an automated, multi-axis system. Arbor presses are devices used to press odd-sized pieces of metal, such as glovebox corners and tubing, into flat pieces that will fit into a waste container.

Non-explosive cracking agents may be used to fracture concrete. The cracking agent is a powder, liquid, or putty that is mixed with water and poured into holes drilled in the concrete. As it hardens, pressures up to 12,000 pounds per square inch (psi) are exerted, causing the concrete to fracture.

3.3.1.2 Thermal Removal and Size Reduction Techniques

Thermal techniques include plasma arc cutters, which operate by establishing a direct current arc in a gas or gas mixture that flows through the cutting torch nozzle to the metal being cut. A stream of positively charged ions and free electrons is ejected from the torch nozzle at a very high velocity, which serves to melt the metal. During cutting, the molten metal is ejected in the form of fine sparks, which are blown away from the torch head. Oxygen-burning cutters use a flowing mixture of fuel gas and oxygen ignited at the torch head to heat metal to high temperatures and "burn" it away. One such system consists of a torch that feeds oxygen and electrical power to an exothermic cutting rod, which is placed in direct contact with the piece to be cut, then dragged in the direction of the cut. Laser cutting systems melt and vaporize the metal.

3.3.1.3 Explosive Removal and Size Reduction Techniques

Explosive techniques include the use of linear shaped charges, explosive rock bolt cutters or other applicable explosive techniques that will be placed on pipe angles, dowel hangers, or other types of hangers used to attach overhead fixtures. The explosives act as a linear shaped directionalized cutting explosive, producing a linear uniform cut. Upon detonation, a high velocity plasma jet is formed and impacts the hanger with pressures exceeding the metal's yield strength, thereby pushing the metal of the hanger to either side of the jet path. During the detonation the only material available for displacement is the plastic, pewter, or copper sheathing surrounding the charge.

Any activities involving explosives will employ the consultative process throughout the work planning to address the specific activities associated with each evolution. In addition, the public will be kept involved and informed of these work activities through the monthly ER/D&D Status meetings or additional meetings, as necessary.

3.3.2 ES&H Controls and Monitoring

Removal and size reduction techniques and activities may present hazards to workers and the environment. Therefore, it is critical to perform removal and size reduction planning as well as detailed area characterization and hazard evaluations prior to using these techniques.

Decontamination will be considered prior to the use of removal and size reduction techniques when elevated levels of contamination are present (see Section 3.4). Engineering and administrative controls (e.g., localized ventilation and RWPs) will be implemented, as necessary, to reduce employee exposure. Robotics may also be employed. Some removal and size reduction techniques will be performed after ventilation and filtration systems have been removed; therefore, personnel and environmental monitoring and other ES&H controls will be implemented commensurate with the risk. Environmental monitoring may include Site-wide and project-specific air and surface water monitoring, especially if activities occur outdoors within an Individual Hazardous Substance Site (IHSS). In addition, removal and size reduction activities will be reviewed by the various Environmental Management Program SMEs (e.g., air and water). For example, run-on controls will be used to divert run-off from excavation sites, especially if they are located within an IHSS, and any accumulated water will be managed in accordance with the stormwater provision of the Site's NPDES permit, the Spill Prevention, Control, and Countermeasures (SPCC) Plan,[32] and the Stormwater Pollution Prevention Plan.[33] Also, radiological engineers will establish project-specific work controls in areas potentially contaminated with radionuclides, including work suspension guide limits based on project-specific hazards. Doses to workers and the public will be calculated, and air monitoring will be performed to meet the applicable regulatory standards (e.g., 40 CFR 61, Subpart H, and Colorado Air Quality Control Commission Regulation No. 8). Table 10 summarizes the hazards and controls associated with each of the component removal techniques described in Section 3.3.1. Controls to protect air and water quality are also discussed in Sections 3.6, 6.2, and 6.3, and in Appendix C of this RSOP.

3.4 Decontamination

Decontamination is the removal or reduction of radioactive or hazardous contamination from facilities, equipment, and/or soils by manual, mechanical, chemical, or other means. The purpose of decontamination is to reduce exposure to radiological and chemical hazards, minimize the generation of radioactive and hazardous waste, and to salvage equipment and materials for future use. Depending on the circumstance, decontamination activities may be performed prior to removal or subsequent to removal. Decontamination may also be performed in the area where the removal occurred, in the area where wastes are to be packaged, in a central location within a building, or in a separate on-Site decontamination facility, depending on operational safety and cost-effectiveness, including ease of implementing ES&H controls. In many cases, the techniques discussed below are effective for both radioactive and chemical contamination. The decision process used to determine the nature and extent of decontamination is summarized in Figure 5. The logic used to select the most appropriate decontamination technique(s) is summarized Figure 6.

3.4.1 Decontamination Techniques

Manual and mechanical decontamination techniques may be classified as either surface cleaning (e.g., vacuuming, wiping, scrubbing, washing, application and removal of strippable

[32] RFETS Spill Prevention, Control, and Countermeasures Plan (RMRS-21000-SPCC), (latest revision).

[33] RFETS Stormwater Pollution Prevention Plan (RMRS-21000-SWPPP), (when approved).

coatings) or surface removal (e.g., abrasive blasting, grinding, spalling, scarifying). Manual and mechanical techniques are most effective on porous and non-porous surfaces that are easily accessible, such as floors and walls. Some of the manual and mechanical decontamination techniques that may be used to decontaminate RFETS facilities are summarized in Table 11.

Chemical decontamination techniques employ concentrated or dilute solutions to erode or flush loose contaminated debris from a surface, or to dissolve the contamination. Chemical decontamination techniques are most effective on non-porous surfaces that are relatively inaccessible, such as interior pipe surfaces. Some of the chemical decontamination techniques that may be used to decontaminate RFETS facilities are summarized in Table 12.

3.4.1.1 Manual and Mechanical Decontamination Techniques

Manual and mechanical decontamination techniques include vacuuming, wiping, scrubbing, and washing, which involve the physical removal of dust, fine particles, and loose debris from building and equipment surfaces using common cleaning techniques. Typically, wiping involves the use of a damp cloth, which may be soaked with water, detergent, or non-hazardous solvent to assist in removing particulates. Washing and scrubbing are similar to wiping except that pressure is applied to assist in removing the contamination. Vacuuming involves the physical removal of particulates or liquids with a suction device. Particulates are removed using a commercial- or industrial-grade vacuum equipped with a HEPA filter. Liquids are removed using a "wet vacuum" equipped with an alternate filtration system. Hydrolasing employs a high-pressure (i.e., several thousand pounds per square inch) water jet to remove contaminated debris from large and/or inaccessible surfaces. System configurations range from a jet tip, which produces a narrow stream, to a fan-shaped tip, which produces a flat stream. Strippable coatings may be applied to contaminated surfaces, and then removed with some of the contamination. Various agents may be used as strippable coatings for contaminated surfaces. Strippable coatings are applied using a mixture of two polymers that chemically react to form the coating. Usually, the contaminated layer is pulled off, containerized, and disposed as contaminated waste. Decontamination factors for the strippable coatings vary with the type of coating used. In general, strippable coating decontamination is only effective on smooth, non-porous surfaces.

Scarifiers are used to abrade coated and uncoated concrete and steel surfaces. The scarification process physically removes contaminated surface layers. For steel surfaces, scarifiers can completely remove contaminated coating systems, leaving a surface of bare metal. A scabbling scarification process may be used to achieve the desired profile and results for contaminated concrete. A needle-scaling scarification process may be used for steel decontamination. Vacuum attachments may be used to reduce the spread of contamination associated with the scarification process.

Paving breakers and chipping hammers are used to remove contamination and surface material by mechanical impact, referred to as spalling. Although paving breakers and chipping hammers are primarily used in demolition activities, they may also be used to remove surface contamination up to six inches thick, resulting in a rough remaining surface.

Grit blasting, also referred to as sand blasting or abrasive jetting, uses abrasive materials suspended in a medium (e.g., compressed air, water, or a combination of air and water) to pulverize and grind out surface contaminants. Typically, blasting results in the uniform abrasion of a surface. Typical abrasives include minerals, steel pellets, glass beads, glass frit, plastic pellets, and natural products, such as sand. Grit blasting systems consist of a blast gun, pressure lines, abrasives, and air compressor.

Carbon dioxide (CO_2) blasting is a variation of grit blasting, where CO_2 pellets are used as the abrasive medium. The pellets shatter as they impact the surface, penetrating the base material and releasing the contaminants. The CO_2 fragments immediately sublimate, adding a lifting force that aids in removing the contaminants. Abraded debris falls to the ground, and the CO_2, now a gas, returns to the atmosphere.

Table 10. Component Removal/Size Reduction Hazards and Controls

Removal Technique	Potential Hazards	Hazard Controls	Comments
Hand tools (e.g., hammers, wood saws, metal saws, screw drivers, pliers, sheet metal cutters, wrenches) and power tools (e.g., drills, circular saws, reciprocating saws, shears)	Cuts, abrasions, punctures, electrocution, and other bodily injury Eye hazards from airborne chips, cuttings and fragments Potential for radiological and chemical exposure and contamination, including wound contamination Potential to spread contamination and cause contaminants to become airborne (e.g., from exhaust and cooling air blowing on contaminated surfaces) Explosive hazard using sparking tools (e.g., drill motors) in areas where volatile chemicals have been used	Training on job-specific hazards, related procedures, and the proper use of tools PPE and personnel monitoring Inspection of tools prior to use Decontamination prior to use if there are elevated contamination levels Use of engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance) Hot work permit (i.e., permit to work on energized equipment)	Alternatives to using power tools in areas of higher contamination will be considered Contamination levels will be identified prior to use (as access allows) Air and personnel monitoring will be performed as appropriate to determine the effectiveness of decontamination and controls and to monitor for potential uptakes, exposure of Site population, and off-Site releases
Paving breakers, jackhammers, and similar tools to break up concrete	Pressurized connections, bodily injury from blade point and flying objects, eye hazard, noise Potential for radiological and chemical exposure and contamination, including wound contamination Potential to spread contamination and cause contaminants to become airborne	Training on job-specific hazards, related procedures, and the proper use of equipment PPE and personnel monitoring Inspection of equipment prior to use Decontamination prior to use if there are elevated contamination levels Use of engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance)	Contamination levels will be identified prior to use (as access allows) Air and personnel monitoring will be performed as appropriate to determine the effectiveness of decontamination and controls and to monitor for potential uptakes, exposure of Site population, and off-Site releases

Table 10. Component Removal/Size Reduction Hazards and Controls

Removal Technique	Potential Hazards	Hazard Controls	Comments
Plasma arc cutters	Bodily injury, including blindness and burns, hearing impairment Potential for radiological and chemical exposure and contamination, including wound contamination Potential to spread contamination and cause contaminants to become airborne	Training on job-specific hazards, related procedures, and the proper use of equipment PPE and personnel monitoring Inspection of equipment prior to use Decontamination prior to use if there are elevated contamination levels Use of engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance) Hot work permit	Contamination levels will be identified prior to use (as access allows) Air and personnel monitoring will be performed as appropriate to determine the effectiveness of decontamination and controls and to monitor for potential uptakes, exposure of Site population, and off-Site releases Relief space behind work piece is required
Oxy-torch cutters	Bodily injury, including blindness and burns, hearing impairment Potential for radiological and chemical exposure and contamination, including wound contamination Potential to spread contamination and cause contaminants to become airborne	Training on job-specific hazards, related procedures, and the proper use of equipment PPE and personnel monitoring Inspection of equipment prior to use Decontamination prior to use if there are elevated contamination levels Use of engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance) Hot work permit	Contamination levels will be identified prior to use (as access allows) Air and personnel monitoring will be performed as appropriate to determine the effectiveness of decontamination and controls and to monitor for potential uptakes, exposure of Site population, and off-Site releases Relief space behind work piece is required

Table 10. Component Removal/Size Reduction Hazards and Controls

Removal Technique	Potential Hazards	Hazard Controls	Comments
Laser cutters	Eye hazard, skin wounds, and electrocution Potential for radiological and chemical exposure and contamination, including wound contamination Potential to spread contamination and cause contaminants to become airborne	Training on job-specific hazards, related procedures, and the proper use of equipment PPE and personnel monitoring Inspection of equipment prior to use Decontamination prior to use if there are elevated contamination levels Use of engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance)	Contamination levels will be identified prior to use (as access allows) Air and personnel monitoring will be performed as appropriate to determine the effectiveness of decontamination and controls and to monitor for potential uptakes, exposure of Site population, and off-Site releases Relief space behind work piece is required
Diamond wire saws	Flying objects if wire breaks and related bodily harm, hearing impairment, and eye hazard Potential for radiological and chemical exposure and contamination, including wound contamination Potential to spread contamination and cause contaminants to become airborne	Training on job-specific hazards, related procedures, and the proper use of equipment PPE and personnel monitoring Inspection of equipment prior to use Decontamination prior to use if there are elevated contamination levels Use of engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance)	Must have access to both sides of the material to be cut Contamination levels will be identified prior to use (as access allows) Air and personnel monitoring will be performed as appropriate to determine the effectiveness of decontamination and controls and to monitor for potential uptakes, exposure of Site population, and off-Site releases Relief space behind work piece is required

Table 10. Component Removal/Size Reduction Hazards and Controls

Removal Technique	Potential Hazards	Hazard Controls	Comments
Wachs cutters	Pressurized connections, bodily injury from cutters and flying objects, eye hazard Potential for radiological and chemical exposure and contamination, including wound contamination Potential to spread contamination and causing contaminants to become airborne	Training on job-specific hazards, related procedures, and the proper use of equipment PPE and personnel monitoring Inspection of equipment prior to use Decontamination prior to use if there are elevated contamination levels Use of engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance)	Contamination levels will be identified prior to use (as access allows) Air and personnel monitoring will be performed as appropriate to determine the effectiveness of decontamination and controls and to monitor for potential uptakes, exposure of Site population, and off-Site releases Relief space behind work piece is required
Hydraulic shears	Pressurized connections, bodily injury from shears and flying objects, eye hazard Potential for radiological and chemical exposure and contamination, including wound contamination Potential to spread contamination and cause contaminants to become airborne	Training on job-specific hazards, related procedures, and the proper use of equipment PPE and personnel monitoring Inspection of equipment prior to use Decontamination prior to use if there are elevated contamination levels Use of engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance)	Contamination levels will be identified prior to use (as access allows) Air and personnel monitoring will be performed as appropriate to determine the effectiveness of decontamination and controls and to monitor for potential uptakes, exposure of Site population, and off-Site releases Relief space behind work piece is required

Table 10. Component Removal/Size Reduction Hazards and Controls

Removal Technique	Potential Hazards	Hazard Controls	Comments
Shear balers	Pressurized connections, bodily injury from shear baler and flying objects, eye hazard Potential for radiological and chemical exposure and contamination, including wound contamination Potential to spread contamination and cause contaminants to become airborne	Training on job-specific hazards, related procedures, and the proper use of equipment PPE and personnel monitoring Inspection of equipment prior to use Decontamination prior to use if there are elevated contamination levels Use of engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance)	Contamination levels will be identified prior to use (as access allows) Air and personnel monitoring will be performed as appropriate to determine the effectiveness of decontamination and controls and to monitor for potential uptakes, exposure of Site population, and off-Site releases Relief space behind work piece is required
Water cutters using abrasives	Flying objects, bodily harm, and hearing impairment; especially if water is pressurized Potential for radiological and chemical exposure and contamination, including wound contamination Potential to spread contamination Potential for contamination to become airborne	Training on job-specific hazards, related procedures, and the proper use of equipment PPE and personnel monitoring Inspection of equipment prior to use Decontamination prior to use if there are elevated contamination levels Use of engineering and administrative controls, including containment and ventilation/filtration systems (liquids and/or air), postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance)	Contamination levels will be identified prior to use (as access allows) Air and personnel monitoring will be performed as appropriate to determine the effectiveness of decontamination and controls and to monitor for potential uptakes, exposure of Site population, and off-Site releases Relief space behind work piece is required

Table 10. Component Removal/Size Reduction Hazards and Controls

Removal Technique	Potential Hazards	Hazard Controls	Comments
Arc air slice	Pressurized connections, bodily injury, and hearing impairment Potential for radiological and chemical exposure and contamination, including wound contamination Potential to spread contamination and cause contaminants to become airborne	Training on job-specific hazards, related procedures, and the proper use of equipment PPE and personnel monitoring Inspection of equipment prior to use Decontamination prior to use if there are elevated contamination levels Use of engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance)	Contamination levels will be identified prior to use (as access allows) Air and personnel monitoring will be performed as appropriate to determine the effectiveness of decontamination and controls and to monitor for potential uptakes, exposure of Site population, and off-Site releases Relief space behind work piece is required
Arbor press	Bodily injury by crushing, pressurized connections, and flying objects Potential for radiological and chemical exposure and contamination, including wound contamination Potential to spread contamination and cause contaminants to become airborne	Training on job-specific hazards, related procedures, and the proper use of equipment PPE and personnel monitoring Inspection of equipment prior to use Decontamination prior to use if there are elevated contamination levels Use of engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance)	Contamination levels will be identified prior to use (as access allows) Air and personnel monitoring will be performed as appropriate to determine the effectiveness of decontamination and controls and to monitor for potential uptakes, exposure of Site population, and off-Site releases Relief space behind work piece is required
Non-explosive cracking agents	Bodily injury, eye hazard (drilling required to create holes into which cracking agent is introduced) Potential release of contamination within building or to the environment	Training on job-specific hazards, related procedures, and the proper use of equipment PPE and personnel monitoring Inspection of equipment prior to use Decontamination prior to use if there are elevated contamination levels	Contamination levels will be identified prior to use (as access allows) Air and personnel monitoring will be performed as appropriate to determine the effectiveness of decontamination and controls and to monitor for potential uptakes,

Table 10. Component Removal/Size Reduction Hazards and Controls

Removal Technique	Potential Hazards	Hazard Controls	Comments
		Use of engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure	exposure of Site population, and off-Site releases
Linear shaped, rock bolt cutter and other applicable explosives	Use on Site of Department of Transportation (DOT) Class 1 explosives Bodily injury Damage to property by flying debris Potential releases of contamination within a building or to the environment	Preparation and use of a Demolition Work Plan, a Justification for Continued Operation, a Special Security Plan, Standing Orders and JHAs as necessary. Use of geotextile, conveyor belting or other material placed over/around the blast area Use of engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure Storage on Site of Department of Transportation (DOT) Class 1 explosives	Contamination levels will be identified prior to use (as access allows) Air and personnel monitoring will be performed as appropriate to determine the effectiveness of decontamination and controls and to monitor for potential uptakes, exposure of Site population, and off-Site releases All individuals handling explosives will be qualified/certified in accordance with OSHA and DOT
Excavators, hoists, and cranes	Bodily injury Damage to property Potential releases of contamination within a building or to the environment, including releases resulting from excavation activities conducted within IHSSs	Preparation and use of an Excavation Plan and/or Lifting Plan Training on job-specific hazards, related procedures, and the proper use of equipment PPE and personnel monitoring Inspection of equipment prior to use Coordination with environmental management SMEs (e.g., air and water quality) and implementation of additional monitoring and other controls as necessary to prevent or minimize contaminant migration	Equipment certifications will be current

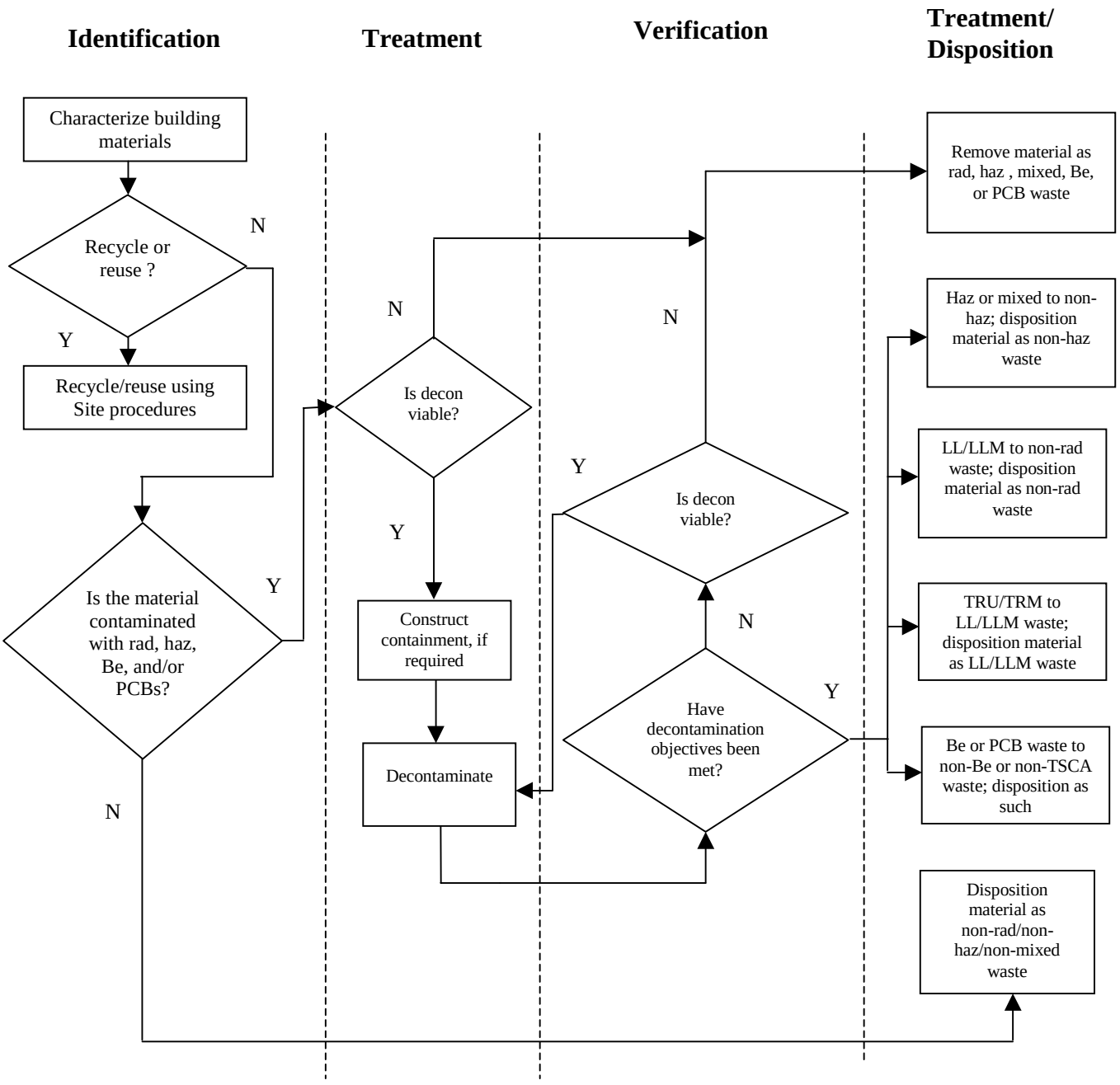


Figure 5. Decontamination Decision Tree

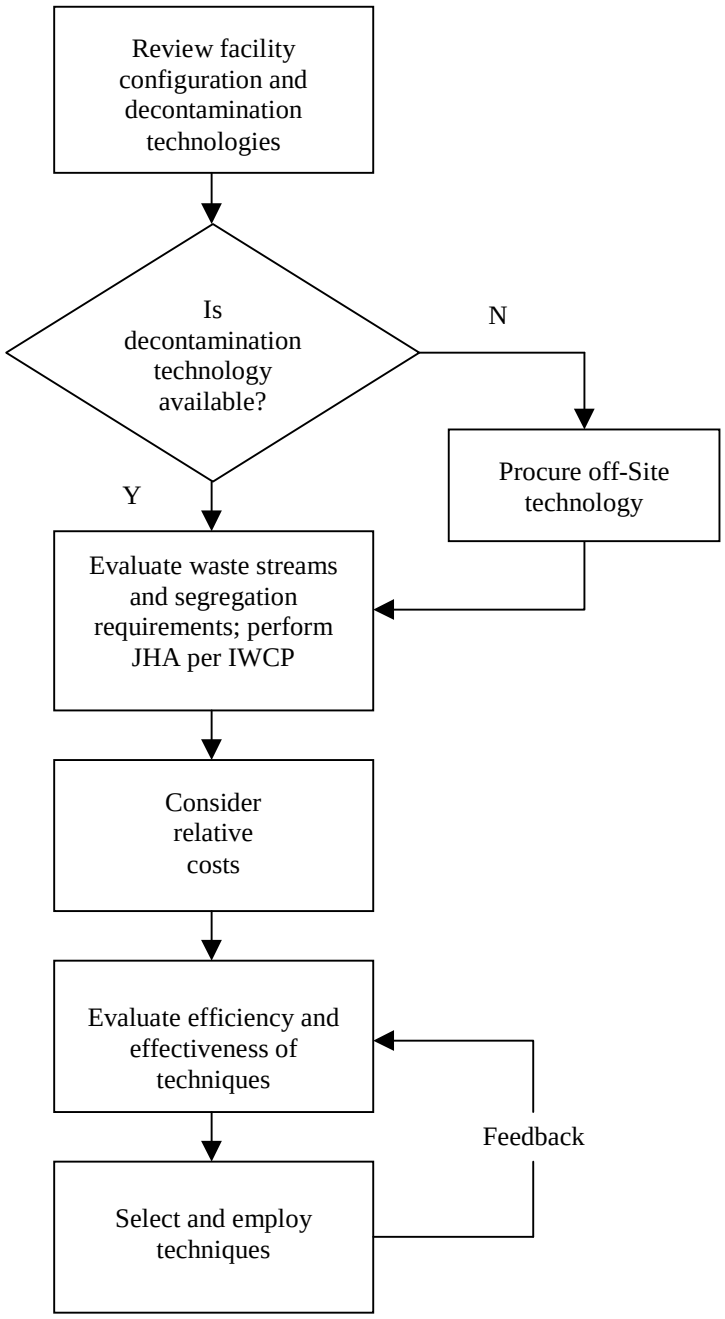


Figure 6. Decontamination Technique Selection Logic

Table 11. Examples of Manual & Mechanical Decontamination Techniques

	TECHNIQUE							
	Wiping/ Scrubbing/ Washing	**Vacuuming**	**Hydrolasing**	**Strippable Coatings**	**Grinding/ Scarifying/ Scabbling**	**Paving Breaker/ Chipping Hammer/ Spalling**	**Abrasive/ Grit Blasting**	**CO_2 Blasting**
APPLICATION								
Loose particulate contamination	1	1	2	1	2	2	2	1
Bare and painted concrete	2	2	1	2	1	1	1	2
Metal surfaces	2	2	1	2	1	-	1	1
Components of all sizes	2	2	1	2	2	-	1	1
Interior surfaces of pipes and tanks	2	-	1	-	-	-	1	-
Embedded material	2	-	1	2	2	1	1	-
Small hand tools	2	-	-	-	-	-	-	-
Special equipment (e.g., motors)	-	1	-	-	-	-	-	1

Source: U.S. Department of Energy, Office of Environmental Restoration, Decommissioning Handbook (March 1994)

LEGEND: Blank = N/A
1 = Highly effective method
2 = Marginally effective method

Table 12. Examples of Chemical Decontamination Techniques for Metallic Materials

CHEMICAL REAGENT	METALLIC MATERIAL					COMMENTS
	Stainless Steel	**Carbon Steel**	**Copper Alloys**	**Iconel**	**Aluminum Alloy**	
Hydrochloric Acid	Corrosive	Corrosive	Non-corrosive	-	-	Very aggressive process
Nitric Acid	Non-corrosive	Attacks base metals	Attacks base metals	-	Non-corrosive	Addition of 0.1% hydrofluoric acid improves effectiveness
Sulfuric Acid	Highly corrosive	Highly corrosive	-	-	-	-
Phosphoric Acid	-	Corrosive	Non-corrosive	-	-	May cause re-deposition if left in system too long
Oxalic Acid	Non-corrosive	Non-corrosive	Attacks base metals	Non-corrosive	Non-corrosive	Mainly used to remove uranium, uranium oxide, and plutonium films
Sulfamic Acid	-	Non-corrosive	Non-corrosive	-	Non-corrosive	Not as active as phosphoric acid, but re-deposition does not occur

Source: U.S. Department of Energy, Office of Environmental Restoration, Decommissioning Handbook (March 1994)

3.4.1.2 Chemical Decontamination Techniques

Water is a universal decontamination agent that acts by dissolving contamination or by eroding and flushing loose debris from the contaminated surface. It is most effective on non-porous surfaces, and may be made more effective by increasing its temperature, adding a detergent or surfactant, or using a water jet.

Detergents are used to remove grease, dirt, and some organic materials. Surfactants produce similar results by lowering liquid surface tension and providing better contact between the surface and the liquid.

As shown in previously Table 12, strong mineral acids, such as hydrochloric acid (HCl), nitric acid (HNO_3), sulfuric acid (H_2SO_4), and phosphoric acid (H_3PO_4), and organic or weak acids, such as oxalic acid ($C_2H_2O_4$), citric acid ($C_6H_8O_6$), and sulfamic acid (HSO_3NH_2) may be used to remove contamination by dissolving metal oxide films and increasing the solubility of the metal ions. Additional oxidants, such as cerium (Ce^{+4}) and other similar metals may be added to the acid solutions to enhance the dissolution of metal oxide film.

Organic solvents and other chemicals may be used to remove organic materials, oil, and paint from building and equipment surfaces and for cleaning rubberized articles.

3.4.2 ES&H Controls and Monitoring

Decontamination can often be complex due to the type and form of the contaminant, and the surface characteristics of the material to be decontaminated. As a result, accepted decontamination techniques must be used, and detailed information must be available regarding the contaminants present, the type of contamination (e.g., fixed versus removable, liquid versus solid), the areal extent and levels of contamination, and the properties of the contaminated materials.

Many of the decontamination techniques described in Section 3.4.1 are useful in a broad number of applications, including low levels to very high levels of contamination. Pre-decontamination planning, area characterization, and hazard evaluations will be performed to select the most effective techniques for each application. Areas of highest contamination will be considered for removal or decontamination first, and areas with loose contamination will be decontaminated before areas with fixed contamination. Engineering and administrative controls will be implemented, as necessary, to reduce personnel exposure to contamination, and confirmatory sampling and analysis will be performed to verify the decontamination activities have been successful. Table 13 summarizes the hazards and controls associated with each of the decontamination techniques described in Section 3.4.1.

Table 13. Decontamination Hazards and Controls

Decontamination Technique	Associated Hazards	Hazard Controls	Comments
Wiping, scrubbing, and/or washing with detergent	Potential to spread contamination and cause contaminants to become airborne Potential for personnel contamination when using liquids for decontamination Electrical hazard from energized equipment Potential for nuclear criticality	Provide training on job-specific hazards and related procedures. Use proper PPE to prevent personnel contamination. Use engineering and administrative controls, including containment and ventilation/filtration, postings, RWPs, and other ALARA principles, to control personnel exposure (e.g., shielding, time and distance). De-energize equipment prior to decontamination. Use appropriate system to collect, store, and treat wastewater.	Contamination levels will be identified prior to use (as access allows). These techniques should be used with water or mild detergent; dry decontamination should never be performed. Sanitary drains will be blocked to prevent contaminated water from reaching the sanitary sewer. Air monitoring will be performed.
Vacuuming	Potential for nuclear criticality and/or elevated dose rates from operation of vacuum Potential to spread contamination due to filter failure and/or exhaust ventilation of vacuum in areas of higher contamination	Provide training on job-specific hazards and related procedures. Use proper PPE to prevent personnel contamination. Use engineering and administrative controls, including containment and ventilation/filtration, postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance). Use HEPA-filtered vacuums.	Contamination levels will be identified prior to use (as access allows). Contaminated vacuum control program which identifies maximum material amounts that can be safely decontaminated, survey frequencies for dose rates, DOP testing frequencies, and filter change-out/cleaning frequencies. Air monitoring will be performed.
Strippable coatings	Skin and eye contact hazards; fumes and vapors Potential for elevated dose rates due to build-up in removed paint Potential for elevated contamination levels as coatings are removed Potential for criticality as coatings are removed and containerized	Perform frequent dose rate surveys of stripped material if there is a potential for elevated dose rates. Provide training on job-specific hazards and related procedures. Use proper PPE to prevent personnel contamination.	Air monitoring will be performed. Contamination surveys will be performed on bare materials after paint has been stripped.

Table 13. Decontamination Hazards and Controls

Decontamination Technique	Associated Hazards	Hazard Controls	Comments
	Combustible loading Electrical hazard from energized equipment	Use engineering and administrative controls, including containment and ventilation/filtration, postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance). De-energize equipment prior to decontamination.	
Hydrolasing and/or high-pressure steam cleaning	Potential to spread contamination and cause contaminants to become airborne Potential for personnel contamination Potential for nuclear criticality Potential for electrical hazards if energized equipment is present Eye and noise hazard Potential for bodily harm (e.g., cutting skin/bone, burns from steam)	Provide training on job-specific hazards, related procedures, and equipment. Inspect equipment prior to use. Use proper PPE, including hearing protection. Use engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance). De-energize equipment prior to decontamination. Use appropriate system to collect, store, and treat wastewater.	Contamination levels will be identified prior to use (as access allows). Areas of higher contamination can be wet down prior to using higher pressures. Air monitoring will be performed. Use appropriate amount of pressure to safely decontaminate material. Sanitary drains will be blocked to prevent contaminated water from reaching the sanitary sewer.
Grinders, scarifiers and/or scabblers	Potential to spread contamination and cause contaminants to become airborne Potential for personnel contamination Physical, eye, and noise hazards	Provide training on job-specific hazards, related procedures, and equipment. Inspect equipment prior to use. Use proper PPE, including hearing protection. Use engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure. Take frequent breaks.	Contamination levels will be identified prior to use (as access allows). These techniques have limited use in higher contamination areas unless used in conjunction with engineering controls or containment systems. Air monitoring will be performed.

Table 13. Decontamination Hazards and Controls

Decontamination Technique	Associated Hazards	Hazard Controls	Comments
		Use other decontamination method prior to using scarifiers, or use of vacuum attachments and shrouding devices.	
Paving breakers, chipping hammers, and/or spalling	Potential to spread contamination and cause contaminants to become airborne Potential for personnel contamination Physical, eye and noise hazards	Provide training on job-specific hazards, related procedures, and equipment. Inspect equipment prior to use. Use proper PPE, including hearing protection. Use engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance). Take frequent breaks. Use other decontamination method prior to using paving breakers.	Contamination levels will be identified prior to use (as access allows). These techniques have limited use in higher contamination areas unless used in conjunction with engineering controls or containment systems. Air monitoring will be performed.
Abrasive/grit blasting	Potential to spread contamination and cause contaminants to become airborne Potential for personnel contamination Physical, eye and noise hazards	Provide training on job-specific hazards, related procedures, and equipment. Inspect equipment prior to use. Use proper PPE, including hearing protection. Use engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance).	Contamination levels will be identified prior to use (as access allows). This technique has limited use in higher contamination areas unless used in conjunction with engineering controls or containment systems. Air monitoring will be performed.
Carbon dioxide (CO_2) blasting	Potential to spread contamination and cause contaminants to become airborne Potential for personnel contamination Physical, eye and noise hazards	Provide training on job-specific hazards, related procedures, and equipment. Inspect equipment prior to use. Use proper PPE, including hearing protection.	Contamination levels will be identified prior to use (as access allows). Limited use in higher contamination areas unless used in conjunction with engineering controls or containment

Table 13. Decontamination Hazards and Controls

Decontamination Technique	Associated Hazards	Hazard Controls	Comments
	Potential for carbon dioxide buildup	Use engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance).	systems. Air monitoring will be performed, including CO_2 monitoring.
Strong mineral acids	Potential to spread contamination Potential for contamination to become airborne Potential for personnel contamination Skin and eye contact hazards; fumes and vapor Hazards associated with use of incompatible chemicals Electrical hazard from energized equipment	Provide training on job-specific hazards and related procedures. Use proper PPE. Use engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance) and to prevent use of incompatible chemicals. De-energize equipment prior to decontamination. Use appropriate system to collect, store, and treat wastewater.	Contamination levels will be identified prior to use (as access allows). Type of contaminants and incompatibles must be known. Will use least toxic and/or diluted chemicals that can safely achieve desired level of decontamination. Air monitoring will be performed. Sanitary drains will be blocked to prevent contaminated water from reaching the sanitary sewer.
Organic solvents	Potential to spread contamination Potential for contamination to become airborne Potential for personnel contamination Skin and eye contact hazards; fumes and vapors Electrical hazard from energized equipment	Provide training on job-specific hazards and related procedures. Use proper PPE. Use engineering and administrative controls, including containment and ventilation/filtration systems, postings, RWPs, and other ALARA principles, to control exposure (e.g., shielding, time and distance). De-energize equipment prior to decontamination. Use appropriate system to collect, store, and treat wastewater.	Contamination levels will be identified prior to use (as access allows). Will use least toxic and/or diluted chemicals that can safely achieve desired level of decontamination. Air monitoring will be performed. Sanitary drains will be blocked to prevent contaminated water from reaching the sanitary sewer. Use of solvents may result in the generation of additional haz waste.

3.5 Removal, Size Reduction, and Decontamination of Gloveboxes

Gloveboxes will be removed either in one piece or size reduced into smaller sections. The level of radioactive contamination, glovebox construction, and presence or absence of hazardous constituents will determine the method selected. Disassembly and removal of the gloveboxes in one piece is preferred.[34]

Gloveboxes will be size reduced (if required) and packaged as either low-level (LL), low-level mixed (LLM), transuranic (TRU), or transuranic mixed (TRM) waste. If the glovebox is to be shipped as non-hazardous LL waste, inherently hazardous constituents must be removed from the exterior and interior of the glovebox, allowing the glovebox itself to be characterized as non-hazardous. Examples of hazardous constituents include some leaded glass windows, lead sheeting, and some lead lined gloves.[34A] For gloveboxes that previously stored characteristic waste only, this will occur once waste residuals have been removed. Gloveboxes previously storing listed wastes will be considered non-hazardous once the "clean debris surface" standard has been met following decontamination. In either case, the initial disassembly steps are similar. In general, glovebox units will be emptied, disconnected, removed, size reduced (if required), and packaged as described below.

1) Non-essential external equipment will be removed.
2) Non-fixed equipment, tools, waste containers, debris and other object will be removed from the interior of the glovebox.
3) Non-fixed, inherently hazardous material will be removed from the interior and exterior of the glovebox.
4) Interior glovebox surfaces will be swept and/or wiped down, as necessary. At this point, the glovebox unit will be empty, clean, and dry.
5) Building utilities, except ventilation, will be isolated and disconnected from the glovebox (e.g., instrument air, gas, water, electrical service).
6) Internal plumbing will be disconnected, drained, and removed. Any liquid generated will be collected in bottles, sampled, removed, and stored pending characterization and final disposition.
7) Liquid will be removed from the criticality drain (if applicable).
8) Fixed hazardous materials, such as lead shielding, will be removed if the glovebox is to be shipped as non-hazardous LL waste.
9) If "debris rule" treatment is feasible, internal surfaces will be wiped down and decontaminated to the extent required in accordance with Section 5.1.2 of this

[34] The surface-contaminated object (SCO) criteria allow for packaging in DOT industrial packages and may allow some items to be removed and shipped as its own container. SCO dispositioning is preferred because of the significant potential for reducing worker exposure levels and work hours required for removal.

[34A] The presence of Los Alamos leaded glass windows does not render a removed glovebox a hazardous waste if characterized in accordance with the non-hazardous waste determination approved by CDPHE. (See: CDPHE letter from Fred Dowsett to Jacqueline Berardini dated June 24, 2002.)

RSOP. This may require extensive cleaning using approved methods. Gloveboxes meeting the "clean debris surface" standard[35] will be disposed as non-hazardous debris. Gloveboxes not meeting the "clean debris surface" standard will be disposed as hazardous debris.

10) A final radiological survey will be conducted.

11) A spray fixative may be applied to contaminated surfaces and allowed to solidify, thereby encapsulating most of the loose particulate matter and preventing that particulate from becoming airborne contamination. Some spray equipment used during application of the fixative may be left in the glovebox. After encapsulation, the glovebox will be removed.

12) The glovebox exhaust will be disconnected from the building ventilation system.

13) The glovebox shell will be separated from its legs. Depending on the size of the glovebox and contamination levels, the glovebox will be size reduced (if necessary) and packaged for recycle (if the applicable unrestricted release criteria are met), as SCO, or as hazardous debris.

14) Once inside the size reduction facility, any remaining hazardous waste, including some leaded glass (see note 34A discussion regarding the non-hazardous characterization for Los Alamos leaded glass windows) and some lead-lined glovebox gloves, etc., will be removed from the glovebox using approved techniques.

15) The glovebox will be size reduced, as necessary, and segregated into appropriate waste streams for packaging. These waste streams include, but are not limited to, light metal, composite glovebox materials, combustibles, plastic, glass, leaded glass, leaded gloves, lead sheeting, and HEPA filters.

16) Waste will be characterized and packaged in accordance with the applicable waste management procedures (see Section 4.0; see also Radiological Characterization for Surface Contaminated Objects (PRO-267-RSP-09.05)). Absorbent may be added to the packages to absorb any residual dampness.

Specific details for each glovebox removal activity will be included in the applicable WCD(s).

3.6 Removal, Size Reduction, and Decontamination of Tank Systems

Tanks and ancillary piping may be removed together as part of the same job or separately, depending on the layout of the tanks and extent of the piping. The following paragraphs provide an overview of the removal process. Specific details for each removal activity will be contained in the applicable WCD(s).

[35] 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 such staining and soil and waste in cracks, crevices, and pits is limited to no more than 5% of each square inch of surface area." (6 CCR 1007-3, Part 268.45)

3.6.1 Ancillary Piping

Prior to pipe removal activities, tank systems will be vented, purged, drained and then drained again by tapping into low points, until no additional liquid can be removed. The system should then be free of liquids. However, it is possible that residual liquids may be encountered during piping removal. The removal method employed will include provisions to contain residual liquids and/or sludge, which may be contaminated with hazardous and/or radioactive constituents. Any residual liquids or sludge will be characterized and treated for final disposal in accordance with the applicable WAC.

If a blockage is encountered and cannot be cleared during the tap and drain process, additional taps will be installed to minimize the length of the blocked section. Blocked sections will be removed with provisions to contain trapped liquids that may be present. These sections will be size reduced in a manner that accommodates the possibility that trapped liquids may be released to containment. A drainage path will be established through any remaining blockages to ensure that liquid can be drained from the section. In the event significant blockages are encountered during tap and drain activities, piping may be removed in conjunction with those activities.

Piping removal, size reduction and packaging activities are considered to be dynamic processes, in which improvements in technology will be implemented as a result of newly available methods or lessons learned from prior piping removal operations. The piping removal steps described below may be modified in response to actual operating conditions. Possible modifications include the manner in which the pipe sections are separated, the type of containment used as a pipe section is removed, the manner in which vacuum is applied, and the type of containment used for size reduction. In most cases, piping will be removed in the following manner:

1) A glovebag or plastic sleeve will be installed around the section of piping to be removed.
2) Vacuum may be applied at one or both ends of a pipe section, and removal will proceed toward a vacuum source.
3) At a termination point, the flange will be disconnected or the pipe cut and the remaining pipe stub will be contained by plastic.
4) The pipe sections will be separated using the best available method (e.g., disconnecting at the flanged joint, four-wheel cutter, pipe-crimping tool).
5) After the pipe section ends are separated from the rest of the pipeline, the ends of the glovebag/sleeve will be twisted into a “pigtail," from which the ends of the bag can be cut and taped. The pipe section may then be removed with taped plastic containment at both ends.
6) If any residual liquid or sludge is observed at either end of the removed pipe section, that section will be bagged, size reduced (if necessary), and inspected. The recovered

residual liquid and/or sludge will be collected and stored in accordance with the ARARs. If no residual liquid or sludge is observed at either end of the pipe section, the pipe will be size reduced and managed as either non-hazardous or hazardous waste, as appropriate.

7) Piping sections will be size reduced (if necessary), using an approved cutting method (see Section 3.3).

8) Pipe sections will be allowed to drain in a vertical position.

9) Pipe section ends will be inspected visually to determine whether a blockage is present within the section.

10) Blockages in pipe sections will be penetrated by mechanical means to drain any trapped liquid.

11) Pipe sections will be drained of any remaining liquids or sludge, then placed into waste containers. Residual materials will be sampled and containerized.

The contents and condition of the interior of the pipe section will dictate its disposition as waste. Four typical cases may be encountered:

1) The interior surface is dry and contains no visible sign of hazardous waste holdup, so that the pipe section can be disposed as non-hazardous waste (for tanks previously storing characteristic wastes only).

2) The pipe section contains solid residual material adhering to the interior walls, that cannot be removed readily. The pipe section will be managed as hazardous or non-hazardous waste, based on analytical results from a representative sample of the material (for tanks previously storing characteristic wastes only).

3) A removable blockage or mobile sludge is found, and is removed from the pipe section and sampled. EPA waste codes are assigned to the sludge based on process knowledge or analytical results, and the sludge is treated to meet applicable waste acceptance criteria. The pipe section will be disposed as hazardous or non-hazardous waste, after a hazardous waste determination has been made (for tanks previously storing characteristic wastes only).

4) Piping from tanks containing listed wastes will be disposed as hazardous waste.

In some cases, inaccessible piping may be encountered. Inaccessible piping is typically found aboveground, in areas where ventilation or other piping has yet to be removed, as well as piping embedded in a building slab. Once the piping has been tapped and drained (i.e., vented, purged, and drained at its low point), it will be affixed with a label identifying it as "abandoned pipe" and listing the chemical and/or radiological hazards associated with the system. Such piping will be inspected quarterly to verify that the labeling requirements are being met.

Based on contamination levels, portions of the building slab may be removed prior to demolition. Slab removed with embedded piping that had previously stored only characteristic hazardous waste, will be managed as non-hazardous waste. Slab removed with embedded piping previously storing listed hazardous waste will be managed as hazardous waste unless the piping is segregated or appropriately treated prior to disposal.

The ultimate disposition of piping embedded in the remaining slab, as well as piping located beneath the slab, will occur during ER activities. As a result, final RCRA closure of the remaining piping will be completed in accordance with the ER RSOP or other RFCA decision

document (when approved). To facilitate final disposition, characterization information will be transferred to the ER Project and recorded in the Administrative Record (AR) File for each closure project (see Section 8.4). The AR File will include a description the location of any remaining piping, characterization information (process knowledge and sampling results), and any other information that will aid in the appropriate disposition of the piping.

3.6.2 Tanks

Tanks will be removed in conjunction with process piping. Some residual solid and/or liquid holdup may be present in the tanks. The following methods include provisions for this possibility, incorporating ARARs and precautions to prevent worker exposure and release of holdup to the environment. Typical waste streams generated will include light metal, plastic-lined metal, lead sheeting, combustibles, glass and plastic. Tanks may be packaged in one piece or size reduced. The following paragraphs present the typical steps in the disassembly process, although the sequence may vary based on field conditions.

3.6.2.1 Pencil Tanks, Annular Tanks, and Raschig Ring Tanks

Pencil, annular and raschig ring tanks will be handled in a similar manner with respect to the removal process. In most cases, the tank will be size reduced in situ due to size or other circumstances. The typical removal sequence will occur as follows:

1) Containment will be placed around the vacuum/vent line, and the tank will be disconnected from the exhaust header.
2) The tank will be disconnected from its supports.
3) The tank may be decontaminated.
4) The tank will be cut to facilitate handling and packaging. The ends of the tank will be separated from the tank body, if needed, to facilitate inspection of the interior, and cleaning and removal of residual materials.
5) The tank or tank section may be stood on end to drain residual liquid or mobile sludge. A catch pan or sheet of plastic may be used to contain the liquid.
6) The tank or tank section will be visually inspected. Interior surfaces will be wiped dry. Incidental liquids may be immobilized with absorbent or collected in Kimwipes® as wet combustibles.
7) Additional tank cleaning, if required, will be conducted during size reduction.
8) The tank or tank section will be further size reduced as necessary, then segregated for final waste characterization and packaging. Absorbent will be added to the packaging to absorb any residual dampness. The tank or tank sections will be characterized and packaged in accordance with the applicable waste management procedures (see Section 4.0).

The dual-wall design of annular tanks leads to special considerations and precautions for size reduction and inspection for residual material remaining inside the tank, which are somewhat more complex than for the other types of tanks. The best available technology will be used for

the disassembly and removal of tanks. For example, while relatively small annular tanks may not require size reduction to fit into waste crates, some cutting may be required to facilitate inspection of the tank interior for the presence of residual holdup. Following are some actions that may be performed in addition to those identified above.

1) If no residual material is found, then the tank interior may be sprayed with a fixative before proceeding with size reduction.
2) If residual material is discovered inside the tank, then the tank may be cut into sections to provide access to the residual material.
3) Residual material (e.g., solids, sludge) is removed from tank sections and placed into containers for further characterization and disposal. Incidental liquids may be collected in Kimwipes® as wet combustibles or absorbent may be applied to immobilize the liquid.
4) After the residual material has been removed, the tank interior may be sprayed with a fixative before proceeding with size reduction.

3.6.2.2 Removal of Other Type of Tanks

There are three options for the removal of tanks that do not contain raschig rings or are not annular or pencil tanks:

1) Package the tank in one piece as SCO,
2) Package the tank in one piece because size reduction is not necessary, or
3) Size reduce the tank into sections for packaging.

The option chosen will be based on the level of radioactive contamination, tank construction and the presence of hazardous constituents. The SCO method is desirable because of a significant reduction in both worker exposure levels and time required for size reduction and removal activities.

3.6.2.3 General Conditions for Tank Sections and Residual Materials

The condition of the tank interior and the composition of residual material inside the tank will dictate the disposition of the tank. Four typical cases may be encountered:

1) The interior surface is dry and contains no visible sign of hazardous waste holdup, so that the tank may be disposed as non-hazardous waste (for tanks containing characteristic waste).
2) For tanks previously storing listed wastes, the tank sections will typically be decontaminated and disposed as non-hazardous debris. If decontamination is not feasible, the tanks will be disposed as hazardous or mixed waste.

3) The tank contains solid residual material adhering to the interior walls, which cannot be removed readily. The tank will be managed as hazardous or non-hazardous waste, after a hazardous waste determination has been made on the basis of the analytical results for a representative sample of the material.

4) A mobile sludge is found and is removed from the tank and sampled. EPA waste codes are assigned to the sludge based on process knowledge or analytical results, and the sludge is treated to meet applicable waste acceptance criteria. The tank will be disposed as hazardous or non-hazardous waste, after a hazardous waste determination has been made.

3.7 Removal, Size Reduction, and Decontamination of Building Ventilation and Filtration Systems

As facility components are removed and/or decontaminated, workers will complete the removal of remaining utilities, including building ventilation and filtration systems. Because ventilation and filtration systems are important environmental controls, and because some of these systems may contain radiological and/or chemical contamination, the removal of these systems poses a potential for releases of hazardous and/or radioactive materials to the environment. As a result, the removal sequence is extremely important and will be planned carefully for each building. Typically, the removal sequence will proceed as described below, and depicted in Figure 7.[36]

- Early in the work planning process, project engineers, building stationary operating engineers, and radiological engineers will perform air-flow studies in accordance with the Radiological Safety Practices Manual to identify ventilation requirements for the activity (i.e., whether the existing ventilation is adequate, whether the existing ventilation must be adjusted, and/or whether additional temporary ventilation must be added).

- Zone I plenums and associated filtration systems will be maintained until the gloveboxes and ductwork they service have been stripped out.

- Where possible, gloveboxes will be removed "upstream to downstream" (i.e., towards the filter plenums) to ensure that air continues to flow from areas of least contamination to areas of higher contamination. During this time, radiological engineers will perform additional air-flow studies and will work with the building stationary operating engineers to ensure the zones are balanced and negative pressure is maintained in accordance with applicable AB (e.g., the building's Basis for Interim Operation [BIO]). Air flow will be balanced using the remaining Zone I and Zone II systems and/or temporary ventilation and filtration systems.

- Once all Zone I gloveboxes and ductwork have been removed from the area or rooms they service, and those areas or rooms have been controlled (i.e., contained or

[36] This section describes the removal sequence for Zones I, II, and III ventilation systems. Refer back to Section 3.3 and Table 6 for additional information concerning the removal, size reduction, and decontamination of fume hoods and ventilation and filtration systems.

decontaminated to meet the applicable release criteria stated in the RSOP notification letter or the project-specific decision document), the Zone II and then Zone III plenums and associated ductwork will be removed. During this time, radiological engineers will perform additional air-flow studies and will work with the building stationary operating engineers to ensure the zones are balanced and negative pressure is maintained in accordance with applicable AB requirements. Air flow will be balanced using the remaining Zone II and Zone III systems and/or temporary ventilation and filtration systems.

- Some ductwork may be removed without removing associated holdup to maintain worker exposure ALARA. In such cases, criticality safety reviews will be conducted and controls implemented in accordance with the requirements of the DOE-approved RFETS Nuclear Criticality Safety Manual.

Activity-specific WCDs will be prepared for each project, containing step-by-step instructions for ventilation and filtration system removal work. Work instructions will be based on project-specific hazard analyses and hazard controls. In addition, proposed activities will be reviewed by the various Environmental Management Program SMEs (e.g., air, water). Doses to workers and the public will be calculated, controls will be implemented to meet the applicable regulatory standards (e.g., 40 CFR 61, Subpart H, and Colorado Air Quality Control Commission Regulation No. 8), and the required monitoring will be conducted.

3.8 Removal of Contaminated Portions of the Building Shell

It is the intent of DOE and its contractor to decontaminate all contaminated portions of the building shell (i.e., walls, floors, ceilings, roofs, and other structural members) to meet the applicable criteria for unrestricted release demolition in accordance with the RSOP for Facility Disposition. However, in the event the material disposition analysis shows that decontamination will pose a significant risk to workers and/or public health and safety and the environment, or decontamination is not economically feasible, the Closure Project POC and DOE POC will consult with the LRA POC to determine whether the contaminated portion of the shell should be removed prior to demolition.[37] If, after reviewing applicable survey data and considering relative risks, the Closure Project POC, DOE POC, and LRA POC agree that removal is the safest, most protective option, the work will be planned and executed as described in Sections 3.8.1 and 3.8.2. In addition, the Closure Project POC and DOE POC will conduct special project status meetings as necessary to address stakeholder concerns and provide a detailed description of the activity, methods to be used, and scheduled date(s).

The following paragraphs describe the requirements for performing removal activities in preparation for demolition. Activity-specific WCDs will be prepared for each removal activity, containing step-by-step instructions for the removal work. Work instructions will be based on project-specific hazard analyses and hazard controls.

[37] This approach is consistent with Objective No. 7 of RFCA, which reads as follows: "All contaminated buildings will be decontaminated as required for future use or demolition. Building demolition or reuse will take place after plutonium, other special nuclear material, TRU waste, and radioactive hot-spots have been removed. In most cases, contaminated systems (such as gloveboxes, duct-work and piping) will be decontaminated and removed prior to demolition. In a few instances, contaminated systems will be decontaminated and demolished along with the building." (p. 6)

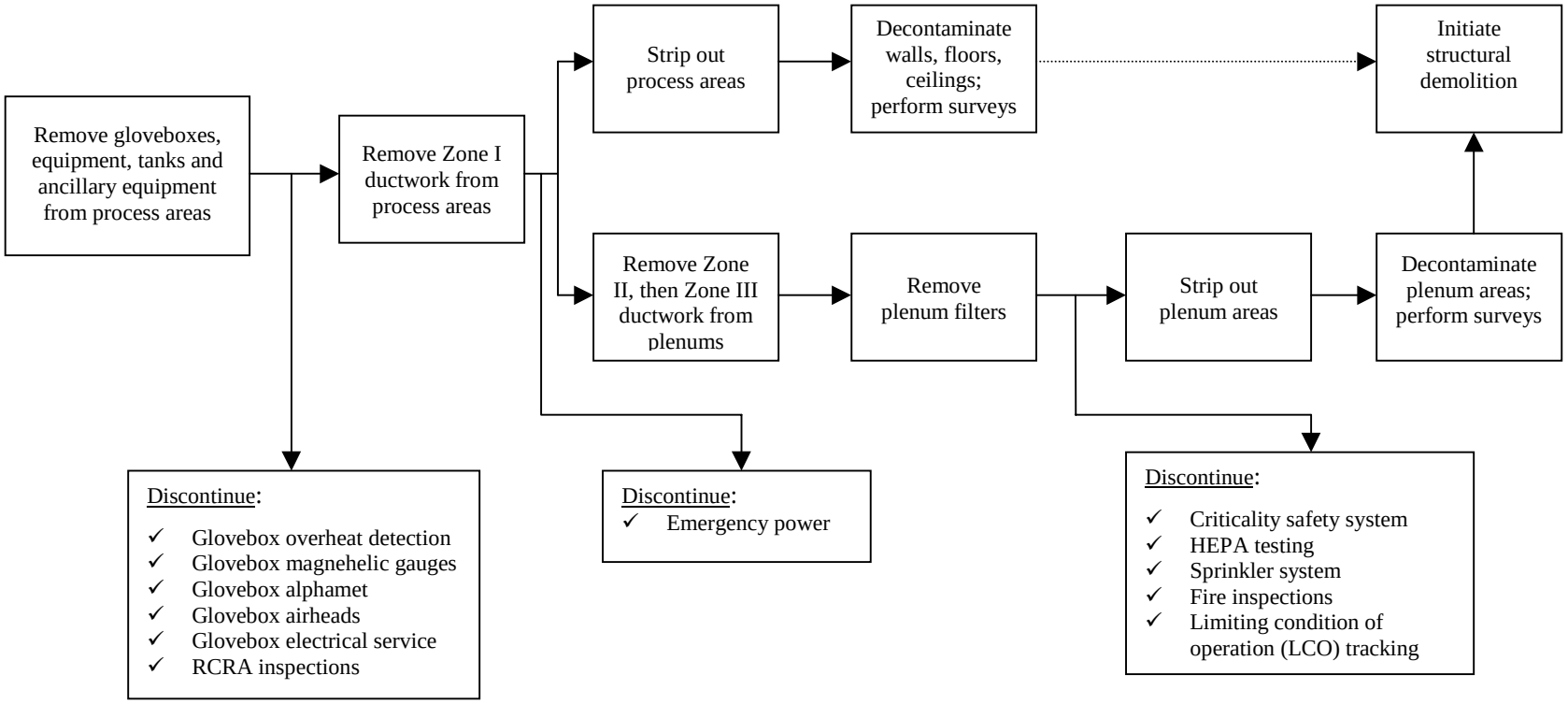


Figure 7. Removal Sequence for Building Ventilation and Filtration Systems

3.8.1 Planning Requirements for Removing Contaminated Portions of the Building Shell

Six analyses will be conducted in preparation for removing contaminated portions of the building shell:

1. Relative Costs: First, the closure project manager will consider relative costs in accordance with Section 3.2 of this RSOP. If it is not feasible to decontaminated the member (e.g., the entire structural member is contaminated and cannot be decontaminated without destroying it), this analysis will not be required; however, the unique circumstances will be documented in the Project Record.

2. Structural Evaluation: Second, a structural evaluation will be performed to identify the engineering controls required to allow for the safe removal of the contaminated portion of the building shell (e.g., shoring, installation of temporary supports, use of a crane or boom truck). This engineering evaluation will be certified by a Colorado registered professional structural engineer (i.e., P.E.).

3. Air Emissions: A third analysis will be conducted to assess the potential for emissions of radionuclides, beryllium, and other hazardous air pollutants to the environment, and to ensure compliance with the applicable air quality requirements.[38] This analysis will be performed by a Site air quality SME, pursuant to Air Quality Management Program requirements, which include characterizing the nature and extent of contamination, calculating related emissions to the atmosphere, calculating ambient concentrations and/or resultant doses to the public, and comparing estimated concentrations and/or doses to the applicable regulatory limits. If warranted, an Enhanced Air Monitoring Plan will be developed to augment the Site-wide monitoring network and provide for continuous monitoring of emissions from the removal activity.[39]

4. Dust Generation: A fourth analysis will be performed by a Site air quality SME to assess the potential for dust generation and to establish required controls in accordance with the contractor-approved Air Quality Management Plan.

5. Impacts to Surface Water: A fifth analysis will be performed by personnel from ESS and the RISS Project to assess potential impacts to surface water, ensure compliance with applicable surface water action levels and standards, and establish controls in accordance with stormwater provisions of the Site's NPDES permit, the RFETS Stormwater Pollution Prevention Plan, and the Site IMP. Groundwater may be a component pathway in this analysis if there is a potential for the activity to impact groundwater.

6. Impacts to Migratory Birds: In addition, a survey will be conducted to ensure the planned removal activities will not impact migratory birds or their nests. Migratory

[38] National Emission Standards for the Emissions of Radionuclides Other Than Radon From Department of Energy Facilities, 40 CFR 61, Subpart H, and Colorado Air Quality Control Commission Regulation No. 8.

[39] Enhanced monitoring is discussed in Section 4 the Site IMP.

birds are protected by the Migratory Bird Treaty Act[40], which prohibits the removal or destruction of bird nests without a permit from the U. S. Fish and Wildlife Service. As a result, during the early stages of project planning and scheduling, the closure project team will work with a Site ecologist to take preventive measures to discourage nesting or to obtain the required nest removal permits.

3.8.2 Shell Removal Sequence

Typically, the removal of a contaminated portion of the building shell will proceed as described below. Project-specific requirements, including ES&H controls, will be described in the applicable WCD(s) and/or other work control documents that will be prepared prior to initiation of shell removal activities.

- Initial surveys will be performed to ensure that contamination located inside the building, behind the contaminated section of the building shell, has been removed.

- Additional surveys will be performed to identify the boundaries of contamination surrounding the contaminated section of the shell, and to develop a safety margin around the contaminated area. A safety margin is a boundary outlined around the contaminated area, up to where mechanical removal methods can be used prior to initiating cutting techniques.

- The contaminated section of the building shell will be removed using one of the removal techniques described in Section 3.3 of this RSOP.

- Emissions from the removal activity will be controlled by shielding the contaminated member from the environment (e.g., a fixative may be applied to the contaminated member, the exposed sections of the member may be wrapped in plastic sheeting, a tent may be erected around the member, and/or a wind wall may be constructed to shield the member). Fugitive dust will be controlled by loading contaminated building debris into covered containers, applying water in a controlled manner, and terminating removal activities during periods of high winds (typically 15 miles per hour).

- The area around the contaminated portion of the building shell will be inspected to identify potential pathways for migration of contaminants, including roof and floor drains, cracks, seams, floor/wall intersections, and foundation drains. Pathways will be closed by covering or filling (e.g., plastic sheeting or grout). Surface water (i.e., stormwater run-on and run-off) will be controlled using standard construction methods, including silt fences, hay bales, and diversion ditches (see Appendix C for details). Surface water controls will be selected and implemented on a project-by-project basis, in accordance with the SPCC Plan and Stormwater Pollution Prevention Plan. As necessary, berms will be designed and installed based on project location, project-specific hazards, and anticipated storm events. Design criteria will include total capacity and freeboard requirements. Water from dust control and/or cutting activities, as well as any accumulated stormwater or groundwater, will be managed in accordance with the surface water provisions of the

[40] Migratory Bird Treaty Act, 16 USC 701 *et seq*.

Site's NPDES permit and Stormwater Pollution Prevention Plan. Surface water monitoring will be conducted in accordance with the Site IMP. Comprehensive monitoring of industrial area decommissioning activities is covered by the new source detection (NSD) monitoring objective. NSD monitoring stations are located at the outflow points of each major industrial area drainage. Contamination detected by an NSD monitoring station cannot be traced back to the source project. As a result, project-specific performance monitoring will be conducted to isolate individual decommissioning activities. The Site IMP performance monitoring objective provides a template to guide the decision process for determining performance monitoring requirements.

- Air monitoring will be performed in accordance with the requirements of the Site IMP. The existing RFETS Radioactive Ambient Air Monitoring Program (RAAMP) sampler network will be used for ambient air monitoring during removal activities. The RAAMP sampler network continuously monitors airborne dispersion of radioactive materials from the Site into the surrounding environment. Thirty-seven samplers comprise the RAAMP network. Fourteen of these samplers are deployed at the Site perimeter and are used to confirm Site compliance with the 10 millirem (mrem) dose standard mandated in 40 CFR 61, Subpart H. Filters from the 14 perimeter RAAMP samplers and from one on-Site sampler near the 903 Pad are collected and analyzed monthly for uranium, plutonium, and americium isotopes. In addition to the perimeter network, enhanced radionuclide ambient air sampling will be performed on an as-needed basis using RAAMP samplers in the immediate vicinity of the individual removal activities. Based on job hazards identified during the IWCP planning process, suspension limits will be established to stop work, evaluate monitoring results, and modify controls (if necessary). Results will be compiled and submitted annually for incorporation into the Radionuclide Air Emissions Annual Report.

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4.0 WASTE MANAGEMENT

Various waste types will be generated as a result of facility component removal, size reduction, and decontamination activities. Waste estimates for these and other RFETS closure project activities are reported in the "Waste Generation, Inventory, and Shipping Forecast," which includes projections for waste volumes to be generated, stored, and shipped from the Site in each fiscal year. As individual closure projects progress, waste volume estimates are refined and updated. Project-specific waste management information is documented in the applicable PMP.

This section describes how the various wastes will be managed as facility components are removed, size-reduced, and decontaminated in preparation for the demolition phase of decommissioning. The ARARs for waste management activities are included in Appendix B.

4.1 Process Waste Versus Remediation Waste

Wastes generated as a result of facility component removal, size reduction, and decontamination activities will be accumulated, staged, stored, and treated in compliance with applicable laws, regulations, and requirements. These may include requirements contained in the Resource Conservation and Recovery Act (RCRA), the Colorado Hazardous Waste Act (CHWA), the Colorado Hazardous Waste Regulations (CHWR), Toxic Substances and Control Act (TSCA), DOE Orders, and the DPP. When determining the appropriate requirements for wastes managed during facility component removal, size reduction, and decontamination activities, an important distinction exists between wastes designated as "process" waste and those designated as "remediation" waste.

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 (no matter when generated).

Remediation waste includes:

- Waste generated from decommissioning activities performed under this RSOP,
- Solid waste chemicals (no matter when generated), and
- Residual liquids or sludges remaining in "RCRA stable"[41] or "physically empty"[42] tanks.

[41] "RCRA stable" is the first step toward closure of permitted or interim status units, whereby wastes are 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 one percent holdup, and with no significant sludge and no significant risk remaining. Physical means, such as lock out/tag out or blank flanges, must then be used to ensure that wastes will not be re-introduced to the system. "RCRA stable" requirements are defined in Part X.E of the Site's RCRA Part B Permit and the Closure Plan for Interim Status Units.

[42] "Physically empty" is the "RCRA stable" counterpart for mixed residue tanks. "Physically empty" is defined in Section 2 of the Mixed Residue Tank Plan as the condition of a tank or ancillary equipment in which no liquid remains after verification from personnel who are familiar with the tank system or by a proven technology (e.g., by draining at low points or by non-destructive testing).

4.1.1 Management Requirements for Process Waste

The distinction between process and remediation waste is significant with respect to wastes regulated under RCRA (i.e., hazardous and mixed wastes). Wastes designated as "process" waste will continue to be managed in compliance with both the substantive and administrative requirements of TSCA, RCRA, CHWA, CHWR, and the Site's RCRA Part B Permit.

4.1.2 Management Requirements for Remediation Waste

Wastes designated as "remediation" waste will be managed in accordance with the ARARs presented in Section 7.0 of this RSOP, and with the remediation waste management requirements described in contractor-approved, building-specific Operations Orders.

4.2 Waste Types

The following paragraphs provide brief descriptions of the various waste types that will be generated during facility component removal, size reduction, and decontamination activities.

4.2.1 Hazardous Waste

Hazardous waste contains hazardous constituents or exhibits hazardous characteristics as defined by RCRA, CHWA, and the CHWR. A variety of hazardous wastes may be generated during facility component removal, size reduction, and decontamination activities, including solids, metals, organics, combustibles, and hazardous liquids. Hazardous waste may be treated on Site in an approved treatment unit or shipped to off-Site commercial facilities for treatment and/or disposal.

4.2.2 Radioactive Waste

A variety of radioactive waste forms are expected from facility component removal, size reduction, and decontamination activities, including solids, metals, organics, combustibles, and liquids. Radioactive waste is categorized as transuranic (TRU) or low-level (LL), depending on the concentration of alpha-emitting radionuclides present in the waste.

4.2.2.1 Transuranic Waste

TRU waste is defined as radioactive waste, not defined as high level waste, contaminated with alpha-emitting transuranic radionuclides with half-lives greater than 20 years, in concentrations greater than or equal to 100 nanocuries per gram (nCi/g). TRU wastes are expected to be generated during dismantlement and removal of various components throughout the building (e.g., (gloveboxes used in the fabrication, testing, assembly, coating, and disassembly of weapons components, and during the removal of Zone 1 ventilation/filtration systems). Although building tank systems will be emptied prior to component removal, size reduction, and

decontamination activities, some liquid TRU waste generation may result from the draining of residual liquids that may remain in tanks and ancillary equipment. Liquid TRU waste may require treatment prior to disposal. TRU waste is destined for disposal at the Waste Isolation Pilot Plant (WIPP) in Carlsbad, NM.

4.2.2.2 Low-Level Waste

LL waste is defined as any radioactive waste that is not classified as TRU waste, high level waste, or spent nuclear fuel. The concentration of alpha-emitting radionuclides in LL waste is less than 100 nCi/g, with no specified minimum level of activity. LL waste forms expected from facility component removal, size reduction, and decontamination activities include debris, combustibles, light metals, and liquids. LL waste is routinely shipped to the Nevada Test Site (NTS) for disposal.

4.2.3 Mixed Waste

Mixed wastes contain both radioactive and hazardous components. These wastes must be managed in accordance with both appropriate radioactive waste requirements and appropriate hazardous waste requirements. LLM and TRM process and remediation wastes that do not have a current treatment path will be managed under the Site Treatment Plan (STP).[43] These wastes may include oils, bypass and legacy sludges and wet slurries, and waste chemicals, including acids and organic solutions. As treatment paths and associated timetables are identified for these wastes, they will be included in the annual STP Report and/or STP Quarterly Progress Report.

4.2.3.1 Transuranic Mixed Waste

TRM waste is TRU waste with a hazardous waste constituent or characteristic. TRM waste types expected are the same as described above in Section 4.2.2.1 for TRU waste. TRM waste is destined for disposal at WIPP. TRM liquids (i.e., sludges and oils) will require treatment prior to shipment.

4.2.3.2 Low-Level Mixed Waste

LLM waste is LL waste with a hazardous waste constituent or characteristic. LLM waste types expected are the same as described above in Section 4.2.2.2 for LL waste. LLM waste is planned for disposal at off-Site waste management facilities that are permitted to LLM waste.

[43] Section 3021(b) of RCRA (42 USC 6901 *et seq*.), as amended by the Federal Facility Compliance Act (FFCAct) of 1992 (42 USC 6961), required DOE to prepare a Site Treatment Plan describing the development of treatment capacities and technologies for LLM wastes.

4.2.4 Waste Containing Polychlorinated Biphenyls

Polychlorinated biphenyls (PCBs) may be found in equipment oils, fluorescent light ballasts, applied dried paints, plastics (e.g., wire insulation; radio, television, and computer casings; vehicle parts, and furniture laminates), pre-formed or molded rubber parts, and capacitors.

Equipment oils will be managed as "PCB liquids"; ballasts, applied dried paints, plastics, and rubber parts containing PCBs will be managed as "PCB bulk product waste"; and capacitors containing PCBs will be managed as "PCB items." PCB waste will be packaged and transferred to on-Site storage pending shipment to an off-Site treatment and/or disposal facility.

PCB waste may either be free of radioactive or hazardous contaminants, or it may also be radioactive and/or hazardous (i.e., it could also be LL, hazardous, or mixed). Disposal options for PCB waste will vary depending on other contaminants present in the waste.

4.2.5 Sanitary Waste

Sanitary waste is classified as routine (e.g., normal office trash), (2) non-routine (e.g., construction debris), and (3) special (e.g., petroleum-contaminated media). Sanitary waste is collected for recycle or disposal at an off-Site landfill, such as the Front Range Landfill, Inc. in Erie, Colorado.

4.2.6 Waste Containing Beryllium

Beryllium-contaminated waste may be generated during facility component removal, size reduction, and decontamination activities. Equipment and other items removed from beryllium work areas will be managed as beryllium waste in accordance with 10 CFR 850.31(a). Building structural material and equipment and items from non-beryllium work areas not regulated under 10 CFR 850.31 may be released as non-beryllium-contaminated sanitary waste or recycled (if the waste is not RCRA listed or characteristic waste) and if beryllium concentrations are < 0.2 $\mu g/100\ cm^2$ based on surface swipes or process knowledge. Characterization of facility components (e.g., building structural material, equipment, and other items) is addressed in the DDCP and PDSP. Components determined to be beryllium waste will be placed in sealed containers, labeled as beryllium waste, and disposed at a contractor-approved disposal facility. Beryllium-contaminated waste may be free of radioactive or hazardous contaminants (i.e., special sanitary waste), or it may be radioactive and/or hazardous (i.e., it could also be LL, LLM, TRU, TRM, or hazardous waste).

4.2.7 Asbestos Containing Material

ACM in the form of pipe and equipment insulation, mastic, and floor and ceiling tiles was used extensively in buildings across the Site. ACM will be removed and packaged for shipment to a solid waste disposal facility. Non-radioactive, non-hazardous ACM is defined as special sanitary waste. Some ACM may also be contaminated with radioactivity and/or hazardous components (i.e., it could also be LL, LLM, TRU, TRM, or hazardous waste).

4.2.8 Wastewater

Consistent with provisions of the RFCA Implementation Guidance Document (IGD)[44], wastewater generated as a result of facility component removal, size reduction, and decontamination activities will be collected and characterized to determine the appropriate management option (e.g., on-Site treatment and release in accordance with the requirements of the Site's NPDES permit, on-Site treatment and/or storage pending off-Site treatment and/or disposal, and release in accordance with the RFETS procedure for the control and disposition of incidental waters[45]).

4.3 Management Requirements for Compliance Order Wastes

The Site's inventories of idle equipment containing hazardous materials inventory, mixed residues contained in tank systems, and certain mixed wastes for which there is no current disposal path are governed by the terms and conditions of compliance orders on consent. The following paragraphs describe the management requirements for these wastes.

4.3.1 "Excluded" Chemicals

To minimize personnel exposure to radioactive contamination, beryllium, and ACM, certain waste chemicals have been identified as "excluded" chemicals in accordance with ¶22 of the Waste Chemical Compliance Order on Consent.[46] Disposition of these chemicals has been deferred to decommissioning.

Excluded chemicals will be managed as follows:

- Areas used to store "excluded chemicals" are posted with signs identifying them as "*CONSENT ORDER EXCLUDED AREAS*" or they are described in a building Operations Order that includes a requirement to notify a named point of contact prior to entry.

- No inspections that require entry into a high contamination area (HCA), airborne radioactivity area, or inoperable glovebox or hood will be performed due to worker radiation exposure concerns and implementation of the radiation exposure principle of ALARA. These are the same reasons that these chemicals are considered to be "excluded chemicals" under the Consent Order. Weekly visual observations will be made of each area used to store "excluded chemicals" by looking through windows into the room, glovebox, or hood. For areas where no windows are available, the inspection will be limited to the exterior of the area. Observations will be performed by building personnel during normal routine building operations. These visual observations will be non-intrusive in nature. Observations are intended to identify issues such as spills, leaks,

[44] Rocky Flats Cleanup Agreement (RFCA), Appendix 3, RFCA Implementation Guidance Document (latest revision).

[45] Control and Disposition of Incidental Waters, 1-C91-EPR-SW.01 (latest revision)

[46] Waste Chemical Compliance Order on Consent (#97-08-21-02), including the Waste Chemical Project Plan (latest revision).

swelling, tipped over containers, or other obvious safety or health problems without actual handling of the containers or opening waste chemical storage cabinets.

Additionally, the documented weekly visual observations for all "excluded chemicals" will include a review of the Consent Order posting, including verification that the point of contact listed on the posting is current, and a review of whether entry has been or is planned to be made to the area. These observations will be documented on a weekly inspection log sheet. Any issues identified will be addressed and corrected in accordance with applicable Site procedures.

- Potentially shock sensitive/explosive waste chemicals will be managed in accordance with the Potentially Shock Sensitive/Explosive Chemical Characterization, Management, and Disposal Plan.[47]
- Safety-related documents allowing entry or work in an area containing "excluded chemicals" take into account the risks associated with the waste chemicals that may be stored in the area.
- No entry shall be made to any “excluded” area without prior notification to CDPHE.
- Liquid waste chemicals will be characterized in accordance with 6 CCR 1007-3, Part 262.11, and managed as process waste under RCRA/CHWA.
- Solid waste chemicals will be characterized to determine the ARARs and managed as remediation waste.
- Waste chemicals will be treated or disposed at off-Site TSD facilities.

4.3.2 Idle Equipment

Idle equipment containing hazardous materials is managed under the Idle Equipment and Hazardous Waste Tank Compliance Order on Consent.[48] Idle equipment containing hazardous materials, both existing and newly identified, will be managed as follows:

- Idle equipment designated as Hazard Category 1, 2, or 3 will be posted with a sign or tag stating the following (or equivalent): *"This idle equipment contains material that, if released, could affect worker safety or the environment. Report any spillage to supervision immediately."*
- Idle equipment will be subject to the following inspection schedule:
  - Hazard Category 1: Monthly
  - Hazard Category 2: Bi-monthly
  - Hazard Category 3 & 4: No inspections required

[47] Potentially Shock Sensitive/Explosive Chemical Characterization, Management, and Disposal Plan (latest revision).

[48] Idle Equipment and Hazardous Waste Tanks Compliance Order on Consent (97-08-21-01), including the RFETS Idle Equipment Management Plan (latest revision).

- Inspections will be conducted by RCRA-qualified waste inspectors, who will ensure the equipment is posted, in good condition, and not leaking. Inspectors will document their inspections in an inspection log, noting any required corrective actions.

- Hazardous waste contained in idle equipment will be drained or removed to the point of being empty. For surfaces of the equipment that are visible and readily accessible, the affected surfaces (i.e., surfaces that may have come into contact with hazardous waste) will be cleaned or wiped visually clean (i.e., no oily surface or sheen) to satisfy the RCRA definition of a "clean debris surface." In the event the clean debris surface standard cannot be met, the equipment will be cleaned or wiped down to remove as much removable contamination as reasonably possible, with the objective of eliminating significant risk from the remaining residuals.

- The hazardous waste will be characterized in accordance with 6 CCR 1007-3, Part 262.11. Sampling methods, if used, will comply with those listed in Appendix I of 6 CCR 1007-3, Part 261. Analytical test methods, if used, will comply with those instructions contained in either EPA Manual SW-846 or RFETS "L-Procedures."

- When empty, the equipment will be characterized and managed in accordance with the ARARs.

4.3.3 Mixed Residues

The Site has an existing inventory of residues and residues mixed with hazardous waste, which are being treated and/or repackaged in preparation for shipment to WIPP. Residues are plutonium-contaminated liquids and solids that were once held in reserve at RFETS because they contain plutonium in sufficient quantities to warrant treatment for recovery of nuclear material. The existing inventory of liquid mixed residues contained in tanks and ancillary equipment will continue to be managed under the terms and conditions of the Mixed Residue Compliance Order on Consent.[49] As part of facility component removal, size reduction, and decontamination activities, these tanks will be physically emptied and/or closed in accordance with individual closure project schedules. During this time, liquids remaining in these tanks may be transferred from tank to tank, drained into four-liter bottles, and stored in gloveboxes for short periods of time, or drained into portable collection carts and staged in various locations, pending transfer to an approved treatment unit (e.g., Buildings 371, 374, 774, or other approved treatment facility). Prior to the transfer or draining of liquids, a request for authorization to temporarily store mixed residue solutions will be submitted to the LRA. The request will identify the tanks, gloveboxes, and portable cart staging locations needed to support liquid removal activities. During liquid transfer and draining activities, appropriate controls will be established to prevent the unauthorized mixing of incompatible wastes, including sampling, if necessary.

[49] Mixed Residue Compliance Order on Consent (#99-09-24-01), including the Mixed Residue Tank Plan (latest revision).

Mixed residue tank inspection frequencies vary, based upon the closure status and particular hazards associated with individual tank systems. Operationally empty tanks[50] are inspected on a daily basis, and physically empty tanks are inspected quarterly. Other inspection frequencies may be determined appropriate on a case-by-case basis. Prior to implementing any change in inspection frequencies, a request for authorization will be submitted to the LRA. Inspection frequencies will be documented in the building Operating Record, along with inspection log sheets for these tanks. Tanks will be inspected to verify the absence of a release and to ensure no new liquid or hazardous waste has been added to the tank system. For physically empty tanks, inspections will also verify physical or administrative controls are in place. In the event additional inventory is discovered in a tank, the responsible building manager will be notified and an action plan will be developed to determine the source of the liquid, or schedule a sampling event or other appropriate action to make a hazardous waste determination. If appropriate, the action plan may include draining the liquid from the system. The DOE or its contractor will notify the LRA of intended corrective actions.

Individual closure project Health and Safety Plans (HASPs) contain pre-planning requirements for responses to possible releases from mixed residue tank systems. Pre-planning activities include identification of vital elements of the tank system, identification of locations of primary shut-off valves capable of isolating feed to a tank, and a pre-release plan, which specifies the recommended method to drain the tank system (e.g., hot tapping at a low spot, draining into bottles, or draining into another tank system). Building operations personnel are trained to implement the pre-release plan and accompanying shut-off procedures. In the event of an actual release from a mixed residue tank system, the Site's RCRA Contingency Plan will be followed.

4.3.4 Site Treatment Plan Wastes

The Compliance Order Requiring Compliance with the STP[51] governs the management of certain mixed wastes for which there is no current treatment or disposal path. These wastes include LLM wastes with actinide activity levels between 10 and 100 nCi/g, and wastes containing hazardous constituents that are prohibited from land disposal under RCRA and the CHWA (i.e., land disposal restricted [LDR] wastes). The STP describes the development of treatment capacities and technologies for these wastes. Progress is tracked through the Annual Progress Report and Work Plan, and Quarterly Progress Update reports, which are submitted for review and approval by CDPHE. STP wastes are tracked on a Site-wide basis, by waste form. The current inventory of STP wastes includes combustibles, acids, lab solutions, filters, glass and ground glass, inorganic sludges, insulation, and salt brine.

[50] A tank is considered to be "operationally empty" when it has been drained using readily available means (e.g., house vacuum system). Such tanks are likely to contain varying amounts of holdup.

[51] The Compliance Order Requiring Compliance with the Site Treatment Plan (95-10-03-01) was issued pursuant to the CHWA and RCRA, as amended by the Federal Facility Compliance Act, which required the development and submittal of a Site Treatment Plan for each facility at which DOE generates or stores mixed wastes.

4.4 Waste Treatment

As necessary, hazardous and/or mixed remediation waste may be treated in existing RCRA-permitted units or under the substantive requirements for temporary units (TUs) established in 6 CCR 1007-3, Part 264.553. Currently, plans are in place to install a drum crusher/compaction unit on the Building 750 Pad, inside the Tent 5 Permacon™. The drum crusher is a self-contained unit, designed to mitigate airborne releases of contaminants. The unit will be used to crush drums contaminated with hazardous and LL waste, originating from various Site locations. The drum crusher will be operated in accordance with a Site-approved procedure, which will include the following requirements:

- A unit-specific information sheet will be posted at the entrance to the unit.
- The drum crusher will be operated by trained workers, who will wear appropriate PPE (as indicated in the JHA).
- The drum crusher will be inspected each operating day.
- Lead-lined drums will be emptied prior to crushing. Crushed lead-lined drums will be managed as LLM waste.

At this time, it is anticipated that the unit will be operated through FY06, during which time several hundred drums will be crushed. Additional drum crushing units may be installed elsewhere on-Site, provided the LRA is notified at least seven days in advance, and provided the notification includes the information required under 6 CCR 1007-3, Part 264.553. In the event it becomes necessary to crush beryllium-contaminated drums in the unit, the Site-approved procedure and applicable JHA will be revised, accordingly.

4.5 Waste Disposal

Wastes generated as a result of facility component removal, size reduction, and decontamination activities will be characterized and packaged in compliance with RFETS waste management procedures[52], which implement TSD facility WAC and DOT packaging requirements. Treatment, storage, and disposal facilities are selected by the contractor based on periodic environmental assessments, which are performed in accordance with the requirements of the Off-Site Waste Management Program[53] and results are documented in Off-Site Waste Management Facility Use Decisions (FUDs).

[52] See the Waste Stream and Residue Identification & Characterization (WSRIC) documents for individual buildings; Waste Characterization, Generation, and Packaging (PRO-079-WGI-001), (latest revision); Solid Radioactive Waste Packaging (4-D99-WO-1100), (latest revision); and Non-Radioactive Waste Packaging (PRO-301-WP-1027/NONRAD), (latest revision).

[53] Off-Site Waste Management Program (1-MAN-037-OWMP), (latest revision).

4.6 Waste Minimization and Recycling

Waste minimization and recycling will be integrated into the planning and management of materials generated during facility component removal, size reduction, and decontamination activities. Unnecessary generation of sanitary, hazardous, LL/LLM, TRU/TRM, and PCB wastes will be controlled using work techniques that prevent the contamination of areas and equipment; preventing unnecessary packaging, tools, and equipment from entering radiologically contaminated areas; and reusing contaminated tools and equipment, when practical.

Standard decontamination 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 on site, off site 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 facility component removal, size reduction, and decontamination activities are listed in Table 14. Materials will be recycled based on availability of appropriate recycle technologies, availability of facilities, and cost effectiveness.

Table 14. Material 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 WAC and licensing requirements, if any.
Radioactively contaminated scrap metal	Recycle by means of metal melt process vendors or contract.	Material must not exceed contamination types and levels identified in the receiving facility's WAC and licensing requirements, if any.[54]
Radioactive mixed scrap material (i.e., radioactively contaminated scrap metal mixed with hazardous constituents)	None	Currently trying to locate and approve facilities that can manage this type of material.
Non-radioactive scrap metal contaminated with beryllium	Decontaminate and recycle through approved commercial facility.	Post-decontamination concentrations will be < 0.2 μg/100 cm^2.
Building rubble meeting the unrestricted release criteria	Reuse on Site 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 WAC 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 WAC and license.
Used lead acid batteries	Recycle through approved commercial recycling facility.	Material must meet receiving facility's WAC and licensing requirements, if any.
Used oil	Recycle through approved commercial fuel blending facility.	Material must meet receiving facility's WAC and licensing requirements, if any.

[54] On January 12, 2000, the Secretary of Energy placed a moratorium on DOE's unrestricted release of scrap metals for recycling, pending a decision by the Nuclear Regulatory Commission (NRC). This was followed by a memorandum to DOE department heads on July 13, 2000, directing further action in four areas: (1) improvement of DOE's release criteria and monitoring practices; (2) expansion of efforts to promote reuse and recycling within the DOE Complex; (3) improvement of DOE's management of information concerning material inventories and releases; and (4) accelerated recovery of sealed sources.

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5.0 CLOSURE OF RCRA-REGULATED UNITS

RCRA-regulated units 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 wastes generated as a result of unit closure, will be included with the RSOP notification letter (see Section 8.3). This unit-specific information, combined with the closure performance information provided in the following paragraphs, will serve as the closure description document (CDD) for units closed under this RSOP. The LRA will have 30 days to review the unit-specific information. During this time, the consultative process will be used (if necessary) to reach agreement on the adequacy of the information provided. Closure activities will proceed with concurrence from the LRA.

All RCRA-regulated units or portions of RCRA-regulated units located within the building will be closed prior to facility demolition. Portions of units located beneath the building slab or outside the building footprint (e.g., the valve vaults and underground piping associated with the Building 374 process waste system) will be taken to a RCRA stable configuration during decommissioning and closed in accordance with the ER RSOP or other RFCA decision document (when approved).

Consistent with Section 1.1.4 of the DPP, portions of a RCRA-regulated unit may be removed prior to submittal of the required unit-specific closure information upon engagement of the consultative process and concurrence of the LRA. 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 (see Section 8.4).

5.1 Closure Options

Closure may be conducted in two stages: first by rendering a unit or portion of a unit "RCRA stable"[55] or "physically empty"[56], then by completing the activities associated with the closure options described below. The RCRA closure process flow is depicted in Figure 8.

[55] "RCRA stable" is the first step toward closure of permitted or interim status units, whereby wastes are 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 one percent holdup, and with no significant sludge and no significant risk remaining. Physical means, such as lock out/tag out or blank flanges, must then be used to ensure that wastes will not be re-introduced to the system. "RCRA stable" requirements are defined in Part X.E of the Site's RCRA Part B Permit and the Closure Plan for Interim Status Units.

[56] "Physically empty" is the "RCRA stable" counterpart for mixed residue tanks. "Physically empty" is defined in Section 2 of the Mixed Residue Tank Plan as the condition of a tank or ancillary equipment in which no liquid remains after verification from personnel who are familiar with the tank system or by a proven technology (e.g., by draining at low points or by non-destructive testing).

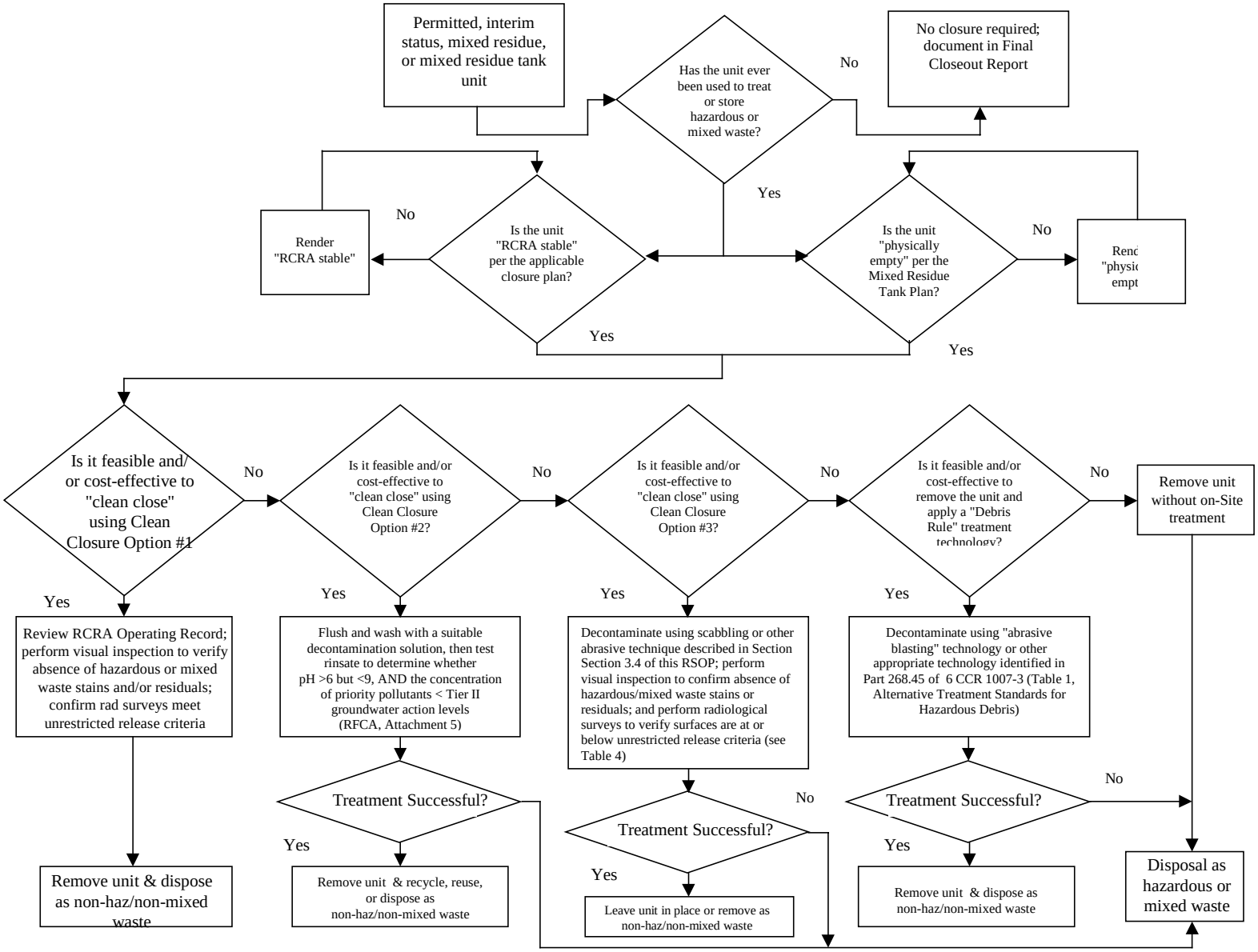

Figure 8. Closure Process Flow for RCRA-Regulated Units

5.1.1 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 that releases were adequately cleaned up (i.e., 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 contaminants of concern, 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 (identified as having been managed in the unit) and heavy metals are below the Tier II action levels for groundwater, as defined in Attachment 5 of RFCA. Rinsate meeting the Tier II groundwater action levels for listed waste constituents associated with the unit and the LDR standards for characteristic waste (as required for disposal) will be deemed to be “no longer contained in” and will be managed as non-hazardous waste.

The final rinsate will not exceed a volume of two gallons per 100 ft^2 of surface area rinsed, and for internal surfaces, such as tank systems, the final rinsate will not exceed a volume of 5% 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.

Clean Closure Option #3: For most floor and/or foundation areas within RCRA-regulated units, scabbling, hydrolasing, or other abrasive technique will be used to decontaminate contaminated surfaces. Following decontamination using an abrasive technique, floor surfaces meeting the following criteria will be considered "clean closed":

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

- Radiological surveys verify surfaces are at or below the unrestricted release criteria listed in Table 2.

Areas that do not meet the visual inspection criteria will be removed as hazardous or mixed debris. Residuals will be collected, characterized, packaged, and disposed in accordance with the applicable waste management procedures and requirements.

5.1.2 Unit Removal in Conjunction with "Debris Rule" Treatment

Alternatively, RCRA-regulated units may be closed by removal and treatment under 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 will be conducted using any of the extraction or destruction technologies identified in Part 268.45 of 6 CCR 1007-3 (Table 1, Alternative Treatment Standards for Hazardous Debris).

For example, tanks and gloveboxes containing hazardous constituents and high levels of radiological contamination may be decontaminated by chemical extraction, using a solution of cerium (IV) and nitric acid (i.e., cerium nitrate). Cerium (IV) is a powerful oxidizing agent that, when applied to radioactively contaminated stainless steel surfaces, serves to decontaminate the surfaces to significantly lower levels and, in some instances, to unrestricted release levels. The cerium (IV) is combined with .5 to 7 molar nitric acid to remove several microns of the stainless steel surface, thus releasing and dissolving embedded plutonium, uranium, and americium, as well as surface scale. The resulting surface has the appearance of new stainless steel. After applying the cerium wash, the waste liquid will be collected and treated with ferrous sulfate to reduce the cerium (IV) to cerium (III). As a side benefit, this process also reduces chromium (IV) to chromium (III).

The cerium nitrate will be introduced, (i.e., "fogged") into a contaminated tank or glovebox through a prefabricated port that has been secured to the tank or glovebox. A spray header (i.e., the cerium nitrate delivery system) will then be affixed to the prefabricated port and the cerium nitrate will be applied to the internal surfaces of the tank or glovebox. In addition, the tank or glovebox may be fogged with water to rinse residual acid from the equipment. The resulting aqueous waste stream will then be transferred to the caustic waste treatment system in Building 374, to another approved on-Site treatment unit, or to an off-Site treatment facility for final processing. Since the cerium nitrate and water will be fogged into the tank or glovebox system, very little liquid waste will be generated. The spray header will then be removed and the tank or glovebox will be inspected to confirm the absence of hazardous or mixed waste stains. As a final step, the equipment will be sealed, pending final disposition as non-hazardous debris.

If, after "debris rule" treatment by cerium rinse or other “debris rule” technology, the equipment or structure meets the standard for a “clean debris surface,” [57] 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. In the event the standard is not met, the equipment or structure will be removed and managed as hazardous or mixed 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, and managed accordingly.

5.1.3 Unit Removal without On-Site Treatment

RCRA units that are not decontaminated to meet the "clean closure by decontamination" standard will be removed, size-reduced (if necessary), and packaged to meet the waste acceptance criteria (WAC) of the off-Site disposal facility. In the event this waste cannot be shipped directly to a disposal facility, it will be stored in compliance with the remediation waste management requirements identified in individual building operations orders and with the ARARs identified in Appendix B.

5.2 Closure Documentation

RCRA unit closure activities will be documented in the PDSR, which will be completed prior to building demolition. 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.[58]

[57] 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% of each square inch of surface area." (6 CCR 1007-3, Part 268.45)

[58] Code of Colorado Regulations, 6 CCR 1007-3, Section 100.63, Permit Modification at the Request of the Permittee.

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6.0 ENVIRONMENTAL CONSEQUENCES

¶95 of RFCA mandates incorporation of NEPA values into RFETS decision documents. This RSOP applies to the removal, size reduction, and decontamination of facility components. Accordingly, this section provides a description of potential environmental impacts that may be associated with component removal, size reduction, and decontamination activities. The assessment applies to all RFETS facilities and it satisfies the RFCA requirement for a "NEPA-equivalency" assessment of environmental consequences.

6.1 Soils and Geology

Most component removal, size reduction, and decontamination activities will occur inside Site facilities, and will not affect soils or subsurface geology. However, actions will also include removing tanks, disconnecting associated piping, and other similar activities that may occur outside or between buildings. Therefore, soils throughout the industrial portion of the Site could be disturbed by the proposed activities. At each building, equipment will be operated in and around the structure, and may be used to dig or otherwise disturb soils in the surrounding area.

Soils at the Site have been sampled and studied as part of the background soil characterization study and the remedial investigations of various operable units. Soils have also been mapped by the U.S. Soil Conservation Service. Most soils in the developed portion of the Site are identified as Flatirons, very cobbly to very stony sandy loams, which have a low permeability, slow runoff potential, and a slight erosion potential. Less common soils include Nederland and Denver-Kutch-Midway, which have a severe water erosion potential. Note, however, that most soils in the Site's Industrial Area have been heavily modified or covered with paved surfaces and do not retain their original soil properties.

The greatest concern about soils at the Site is contamination. In the past, some soils have been contaminated through waste disposal practices, accidental releases, and spills. Potential contaminants include radionuclides, solvents, metals, acids, PCBs, and fuel hydrocarbons. Uncontaminated soils may also be of concern, by contributing to air quality problems (as dust) or water pollution (from erosion into surface waters).

Component removal, size reduction, and decontamination activities will be managed to avoid the disturbance of contaminated soils, or to contain and prevent further distribution of contaminated soils. Although some additional compaction may occur, uncontaminated soils will not be altered significantly during component removal, size reduction, and decontamination activities. Erosion control from disturbed areas may also be necessary. Areas with surface contamination on the Site are well defined, and procedure for soil disturbance will be followed.[59] Use of these procedures will mitigate the effects of soil disturbances. All removal, size reduction, and/or decontamination activities that may result in impacts to surrounding soils will be coordinated with both ESS and the ER Project.

[59] Excavations and Soil Disturbances, 4-04C-COEM-CMG-404 (latest revision).

Subsurface geology will not be affected by the proposed activities. Although activities to remove components, such as digging, trenching, removing subsurface systems (e.g., fuel tanks and associated piping), and cutting and blind-flanging or plugging below-grade openings may be conducted, these locations were disturbed during the initial installation of the components. Although fuels, oils, and other liquid or solid materials will be used during component removal, size reduction, and decontamination activities and could be spilled, the soils are not highly permeable; paved areas are largely impervious; and the SPCC Plan and Stormwater Pollution Prevention Plan would be implemented, if necessary. Therefore, surface and subsurface soils are not likely to be substantially affected by the component removal, size reduction, and decontamination activities.

6.2 Air Quality

The analysis of air quality impacts includes consideration of "criteria" pollutants, ozone-depleting substances (ODSs), and radiological and other hazardous air pollutants (HAPs). This analysis is primarily concerned with radiological releases and particulate emissions because these are the pollutants that are most likely to be found in areas being decommissioned, and most likely to be released to the environment during facility component removal, size reduction, and decontamination activities. However, the average annual background dose for Denver area residents is about 418 mrem (more than 1 mrem per day) and the highest dose to any member of the public from the Site during 1998 was less than 0.14 mrem, which was principally from naturally-occurring uranium isotopes released from soils.[60] As mandated by 40 CFR 61, Subpart H, the Site standard is a maximum 10 mrem per year effective dose equivalent (EDE) to any member of the public.

Radionuclide air emissions are monitored continuously by building air monitoring systems at significant point source locations, and by the RAAMP sampling network. Fourteen of the network samplers, deployed at the Site perimeter, are used to demonstrate Site compliance with the standard. Filters from the perimeter samplers are collected and analyzed monthly for uranium, plutonium, and americium isotopes. In addition to the perimeter network, enhanced radionuclide ambient air sampling will be performed on an as-needed basis, using RAAMP samplers in the immediate vicinity of the Site's industrial area.

The EPA also regulates six “criteria” pollutants: ozone, carbon monoxide, nitrogen oxides, sulfur dioxide, lead, particulate matter less than 10 micrometers in diameter (PM_{10}) and particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$). In addition, CDPHE regulates total suspended particulate (TSP). The Site is located within the metropolitan Denver area in Air Quality Control Region No. 36, which is designated as a “non-attainment” area with respect to the National Ambient Air Quality Standards (NAAQS) for PM_{10} and carbon monoxide.[61]

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[60] U.S. Department of Energy, Radionuclide Air Emissions Annual Report, Rocky Flats Environmental Technology Site, 1998.

[61] U.S. Environmental Protection Agency, The Green Book, Nonattainment Areas for Criteria Pollutants, May 1999 (http://www.epa.govoar/oaqps/greenbk).

Concentrations of TSP and PM_{10} are determined by five air monitoring stations at the Site property boundary operated by CDPHE. These stations monitor for TSP and PM_{10} as well as other criteria pollutants. Two of these stations are located just off site at the northeast and southeast Site boundary along Indiana Street. These samplers are operated for 24-hour periods on a rotating, every-sixth-day schedule to match the national EPA particulate sampling schedule. These sampling locations are downwind of the Site and are thus representative of Site impacts on surrounding areas. Maximum concentrations of PM_{10} and TSP recorded at the CDPHE stations are considered as the ambient off-Site concentrations of these two criteria pollutants. Monitoring by the stations will provide an ongoing record of ambient air quality, and identify whether cumulative Site activities are impacting air quality, as related to particulate matter.

Facility component removal, size reduction, and decontamination activities will include operation of vehicles, generators, and other equipment. Several pieces of equipment may be used at a building, with operational hours limited according to the size and type of building, contaminant levels, and amount and types of components to be removed. The equipment will not generate sufficient criteria emissions to affect NAAQS. 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. In addition, opacity rules, limiting opacity below a 20 percent standard, will be followed. Decontamination activities may generate dust, including both TSP and PM_{10}. These emissions will not affect the NAAQS, but will be principally of concern to workers, since most activities will occur inside the building.

HAPs include a wide range of materials and chemicals (e.g., beryllium, solvents, radiological contaminants) that are toxic or potentially harmful to human health. Most HAPs are released in very small quantities and typically pose the greatest threat to workers. Although most sources of HAPs have been drained or removed from facilities, some residual materials (e.g., solvents in the bottom of a process waste line, radiological contaminants inside a duct) may be found during component removal, size reduction, and decontamination activities. These materials will be drained into covered containers or otherwise removed to minimize losses within the building or to the atmosphere. The use of explosives will be restricted to indoor locations, and potential releases of contamination managed through both administrative controls (e.g., Demolition Work Plans, RWPs, postings) and engineering controls (e.g., containment, filtration). A yearly release of 250 pounds of the most hazardous regulated air pollutant is a regulatory reporting threshold. However, it is unlikely that total HAP amounts from decommissioning activities will reach this quantity, as potential losses of a material would be a small fraction of the total volume of material.

Refrigerants (i.e., ODSs) contained by equipment will be removed in accordance with Site procedures.[62] Removal of HAPs and ODSs will be performed inside each building and will pose the greatest potential impact to workers. The potential effects of HAP and ODS emissions will be minimal.

6.3 Water Quality

[62] RFETS Stratospheric Ozone Protection Compliance Manual (latest revision).

During component removal, size reduction, and decontamination activities, surface water quality could be adversely affected by the release of dust or other contaminants. Decontamination activities and RCRA closure operations occurring within buildings could release dust or contaminated waters through openings in the building shell (e.g., if sections of contaminated walls are removed). If dust or contaminated waters are released, and especially if rain or snow events follow the release, contaminants may be washed into surface waters. However, most activities will be restricted to building interiors and drains will be sealed. The removal of portions of a building (e.g., part of a wall) that will create an exterior opening will be conducted in a manner that will prevent or contain contaminant releases (see Section 3.6). If openings remain after decontamination is complete, and the building is not directly dispositioned (i.e., demolished), measures will be taken to seal the openings, as necessary. As a result, water quality at the Site is not likely to be affected by the proposed activities.

Activities to remove exterior components may generate debris or dust, which will need to be controlled. Most of the developed areas on Site are on relatively level ground, with an average slope of less than four percent; however, some ground slopes are more severe (i.e., up to about 10 percent near portions of the 700 Area and 900 Area). Therefore, controls such as berms, silt fences, or similar erosion control devices will be used to prevent debris from being washed into surface water drainages. Drains and other subsurface openings will be sealed prior to decontamination activities, and debris will be loaded into covered roll-off containers to prevent the release of dust and debris. If water control techniques such as berms or sediment basins are used, the waters will be sampled and analyzed to ensure they meet applicable release requirements.[63] Interior work using water (e.g., steam blasting, scrubbing, rinsing) will generate wastewater. Before work is initiated, drains and other openings will be sealed and/or closed, and low and high levels alarms set, as appropriate. Wastewater will be managed in accordance with Section 4.2.8 of this RSOP.

In the event facility component removal activities involve groundwater intrusion (e.g., groundwater has collected in sumps and/or vaults), RISS personnel will take samples to determine whether the groundwater is contaminated. If the groundwater is contaminated, Water Operations personnel will assess whether the groundwater could impact surface water. If the groundwater is contaminated, but there is no threat to surface water, the groundwater will be left in the subsurface structure with appropriate controls to protect the health and safety of workers, the public, and the environment until remediation during ER. If the groundwater is contaminated and may impact surface water, the groundwater water will be pumped to a treatment facility until remediated during ER. Table 15 presents some potential situations involving groundwater and surface and the associated protective measures that may be taken during facility component removal activities. Project-specific controls will be detailed in the WCD for the removal activity. ER actions, details, and requirements will be described in the ER RSOP or other RFCA decision document (when approved).

63 Applicable release requirements are specified in Control and Disposition of Incidental Waters, 1-C91-EPR-SW.01 (latest revision).

Table 15. Groundwater and Surface Water Conditions and Associated Actions

Condition	Action
Prior to decommissioning activities, water is collecting in sumps, vaults, or other below ground structures and pumped to Site treatment facilities.	This water will continue to be collected and treated in on-Site facilities as required to protect surface water and to maintain appropriate work environments until decommissioning is completed.
Prior to decommissioning activities, water is collecting in sumps, vaults, or other below ground structures but is not pumped or treated.	Water will not be collected, removed, or treated during decommissioning unless required to protect workers and/or surface water quality, as required to allow proper characterization and decontamination of the below ground structures. However, water thus accumulated will be removed, characterized, and/or treated prior to completion of decommissioning activities.
During decommissioning activities, groundwater, surface water, utility water or precipitation is collecting in the excavation or work areas during decommissioning, and it must be managed to ensure safe work areas and protection of the environment.	As required, manage as "incidental waters" or "internal waste streams" during decommissioning activities.
There are potential future surface water impacts where decommissioning activities are conducted in areas or in ways that allow contact with surface waters.	Pathways to surface water from decommissioning activities will be monitored by the Environmental Media Management Group, as required by the Site IMP.

6.4 Human Health and Safety

Physical hazards to workers involved in component removal, size reduction, and decontamination are similar to the hazards found in comparable industrial activities. The Rocky Flats Cumulative Impacts Document (CID)[64] reports a projection of 584 worker injury and illness cases in the year of highest closure activity at RFETS. Cases specifically associated with component removal, size reduction, and decontamination activities would be a fraction of the Site total.

A HASP and JHA will be prepared on a building- or project-specific basis to identify and control potential hazards. The HASP will address both the specific hazards to be encountered and applicable guidance and requirements (e.g., Occupational Safety and Health Act [OSHA] requirements, 10 CFR 850 requirements, DOE Orders), as well as specific safety equipment required for individual tasks. Implementation of the HASP will minimize the potential for accidents and other adverse consequences.

[64] Rocky Flats Cumulative Impacts Document, June 10, 1997.

Potential threats to the health and safety of collocated workers and the general public from the release of airborne materials will be mitigated via implementation of dust suppression and other techniques, as described in Section 3.0. The use of controls and procedures for worker protection will also protect the public, since work control measures are designed to identify potential hazards and prevent releases of hazardous materials.

Activities conducted in areas with potential radiological contamination will be subject to the dose limits prescribed by regulation and the Site's Radiation Protection Program and Air Quality Management Program. In addition, radiation protection for these activities will be governed by the radiation exposure principle of ALARA, which mandates that personnel exposures be further minimized on a cost-effective basis, consistent with the purpose and objectives of the activities being conducted.

The CID reports the following estimated annual radiological doses from Site closure activities: maximally exposed collocated worker – 5.4 mrem; maximally exposed member of the public – 0.23 mrem; population dose – 23 person-rem. The population dose would be expected to produce 0.012 latent cancer fatalities in the region of interest (for a population of 2.7 million). Since these estimates include all Site closure activities, impacts from activities addressed in this RSOP are only a small fraction of those reported above.

The average radiation dose to Site workers who received any dose on their dosimeters of record over the past four calendar quarters (i.e., October 1999 through September 2000) was 56.1 mrem/quarter, or 224.4 mrem for four quarters. This dose may be compared to the federal radiation worker dose limit of 5 rem (i.e., 5,000 mrem) per year.

6.5 Ecological Resources

While actions taken under this RSOP will affect facilities across the Site, most of the work will be conducted inside the facilities, and will have no impact on ecological resources. The facilities are located in the Industrial Area, and few animals are found in the vicinity of buildings. Mammals such as deer, rabbits, and mice do use the developed portion of the Site at times. The buildings and adjacent areas do not support or provide habitat for threatened or endangered plant or animal species, or species of concern, nor do they contain unique or unusual biological resources. However, various bird species use buildings for nesting or roosting, and wetland areas exist in various portions of the Site. Prior to disturbing nesting birds, or potentially affecting a wetland, a survey of the proposed actions by Site ecologists will be conducted, and appropriate controls will be implemented.

6.6 Historic Resources

Potential impacts related to historical resources are the loss of historic structures eligible for the National Register of Historic Places, and a secondary contributor to a potential Historic District comprised of Cold War Era facilities. Sixty-four buildings within the Site's Industrial Area were identified by the State Historic Preservation Officer (SHPO) as important to the historic role of the Site in manufacturing nuclear weapons components during the Cold War.

The history of the Rocky Flats Plant has recently been documented in the Historic American Engineering Record for the Rocky Flats Plant Historic District.[65] This documentation, consisting of a narrative report, engineering drawings, and photographs, meets the requirements of the programmatic agreement and has been accepted by all responsible parties. Since this documentation has been approved, it effectively mitigates any adverse impacts the Rocky Flats Closure Project may have on historic resources.

6.7 Visual Resources

Most visual changes related to component removal, size reduction, and decontamination activities will occur inside buildings. Some exterior components will be removed, but the landscape at the Site will not notably change. Changes will not be visible from public roads and areas around the Site, and activities will not affect visibility (see also Section 6.2).

6.8 Noise

Proposed activities will result in a temporary increase in local noise levels. The increased noise will result from the operation of heavy equipment, the operation of noise-intensive equipment (e.g. jackhammers), decontamination operations, and the loading and hauling of materials and debris. The noise will be consistent with prior operational noise and typical construction activities. Most activities will also occur inside facilities and will not affect other workers at the Site. Activities that generate high noise levels will be identified in the project HASP. Noise generated by the project will be effectively confined to the Site. Public receptors will not be affected.

6.9 Transportation

Component removal, size reduction, and decontamination activities may produce wastes requiring disposal at off-Site facilities. Transportation of RFETS wastes has been analyzed from a NEPA perspective in other documents (e.g., TRU/TRM in the WIPP Disposal Phase Supplemental Environmental Impact Statement (EIS); legacy LL/LLM waste in the Waste Management Programmatic EIS for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste). These studies have found that impacts of waste shipments are small, and that the shipments themselves contribute to an overall reduction of risk at the Site.

6.10 Cumulative Effects

In general, component removal, size reduction, and decontamination activities will not have notable adverse cumulative effects on other Site projects or projects in the vicinity of RFETS. The adverse effects resulting from the project are expected to be minimal and temporary. The cumulative effects would include air emissions (i.e., fugitive dust and exhaust emissions), waste generation, and noise. These impacts would add slightly to total emissions generated from other

[65] Historic American Engineering Record for the Rocky Flats Plant, HAER-CO-83-T, 1999.

activities at the Site, as well as from off-Site activities. Other effects, such as health and safety, are independent of other projects.

The activities proposed in this RSOP support the overall mission to clean up the Site and make it safe for future uses. The cumulative effects of this broader, Site-wide effort are presented in the CID, which describes the short- and long-term effects from the overall Site clean-up mission.

6.11 Unavoidable Adverse Effects

Some temporary, adverse effects will necessarily occur as a result of component removal, size reduction, and decontamination activities. Minor quantities of air pollutants may be released to the atmosphere. In addition, workers may experience health and safety risks that are typical of construction projects. Noise levels will temporarily increase slightly. Fuels and other resources will be consumed during the project activities.

Adverse effects will occur during the performance of specific closure project activities, and all effects will conclude when all component removal, size reduction, and decontamination activities are completed. Environmental, safety, and health risks will be managed per industry practices, DOE policy, and Site programs.

6.12 Short-Term Uses Versus Long-Term Productivity

Facility component and removal activities will not result in a change in land or resource use. Changes in long-term productivity will be related to subsequent activities (i.e., facility demolition and ER).

6.13 Irreversible and Irretrievable Commitments of Resources

Facility component removal, size reduction, and decontamination activities will result in the irretrievable consumption of fuels, small quantities of other materials, water, money, and labor. Some resources will be recovered (e.g., uncontaminated materials).

7.0 COMPLIANCE WITH ARARS

As required by ¶10 of RFCA, facility component removal, size reduction, and decontamination activities will be performed in compliance with the ARARs under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Pursuant to RFCA, actions taken under an approved RFCA decision document are exempted from the procedural requirement to obtain federal, state, or local permits. For activities performed within the scope of this RSOP, certain hazardous and mixed waste management activities are exempted from permitting requirements of RCRA and CHWA, as discussed in Sections 4.0 and 5.0 of this RSOP.

The following paragraphs provide a brief summary of how the ARARs will be applied to activities performed under this RSOP. Appendix B contains a master list of the ARARs that have been identified for the entire scope of the RFETS Closure Project.[66] As individual closure projects are planned and scheduled to be performed under this RSOP, the consultative process will be used to tailor the list of ARARs to each project. Project-specific ARARs will be detailed in the RSOP notification letter for each project.

7.1 Air Quality

Facility component removal, size reduction, and decontamination activities have the potential to generate emissions of regulated air pollutants. Subpart H of 40 CFR 61 contains the requirements for monitoring and reporting activities within DOE facilities that have the potential to emit radionuclides other than radon. Some RFETS buildings are subject to effluent monitoring of radionuclides due to holdup in ducts and gloveboxes. 5 CCR 1001-3, Regulation No. 1, governs opacity and particulate emissions. Fugitive particulate emissions will be generated from decommissioning and related transportation activities. Control methods for fugitive particulate emissions should be practical, economically reasonable and technologically feasible. The substantive requirements will be incorporated into project-specific control plans and WCDs that define the required level of air monitoring and particulate control.

5 CCR 1001-5, Regulation No. 3, provides CDPHE with the authority to inventory emissions. Part A describes Air Pollutant Emission Notice (APEN) requirements. If applicable, RFETS will prepare an APEN to facilitate the CDPHE inventory process.

7.2 Water Quality

Remediation wastewater will be collected and transferred to an approved treatment unit for processing (e.g., Building 374, the Site sewage treatment plant or other approved treatment facility). Wastewater will also be managed consistent with provisions of the RFCA IGD. In

[66] Certain Colorado Radiation Control Regulations pertaining to decommissioning and environmental releases may be relevant and appropriate to building decommissioning and environmental restoration activities, particularly the cleanup of soils. The parties to RFCA are in the process of negotiating a final list. Appendix B will be modified, as appropriate, when the reach agreement on the final list.

addition, all connections to the sanitary collection system will be identified and protected pursuant to 40 CFR 125, and all discharges of stormwater and treated wastewater into surface water bodies will meet the applicable substantive requirements.

7.3 Waste Management

Hazardous and mixed process waste will be managed in compliance with substantive and administrative requirements of RCRA/CHWA and the associated implementing regulations (6 CCR 1007-3, Parts 260 through 279). All other hazardous and mixed wastes (i.e., remediation wastes) will be managed in accordance with the substantive requirements of RCRA/CHWA (i.e., with the ARARs listed in Appendix B). Sections 268.3, 268.7, and 268.9 (a-c) of 6 CCR 1007-3 will be used to make an LDR determination for remediation waste. Both the administrative and substantive requirements of 6 CCR 1007-3, Part 268 will apply to off-Site shipment and disposal of hazardous waste.

As necessary, remediation waste may be treated under the substantive requirements for temporary units (TUs) established in 6 CCR 1007-3, Part 264.553. Incompatible waste, if encountered, will be segregated within established TUs. For each TU, an assessment will be performed to determine the need for secondary containment. Secondary containment will be provided, as appropriate, when liquid waste is stored or treated in tanks or containers. Wastes will be characterized, as appropriate, in accordance with the substantive requirements of 6 CCR 1007-3, Part 261, and 40 CFR 761. When tanks are physically empty, berms providing secondary containment may be removed to facilitate equipment removal.

Non-radioactive, non-hazardous wastes will be managed and disposed in compliance with the substantive requirements of CDPHE's solid waste regulations (6 CCR 1007-2).

ACM will be managed in accordance with 5 CCR 1001-10, Regulation 8. Specifically, Section III, C.7.6, provides maximum allowable airborne asbestos levels and Sections C.8.2(b), (d) and (f) provide requirements for handling asbestos waste materials.

PCBs, including those that are radiologically contaminated, will be managed in accordance with the substantive requirements of 40 CFR Part 761, PCB Manufacturing, Processing, and Distribution in Commerce.

Equipment and other items removed from beryllium work areas will be managed as beryllium waste in accordance with 10 CFR 850.31(a). Building structural material and equipment and items from non-beryllium work areas not regulated under 10 CFR 850.31 may be released as non-beryllium-contaminated sanitary waste or recycled (if the waste is not RCRA listed or characteristic waste) and if beryllium concentrations are < 0.2 μg/100 cm^2 based on surface swipes or process knowledge.

7.4 Migratory Birds

Facility component removal, size reduction, and decontamination activities may impact migratory birds protected by the Migratory Bird Treaty Act[67], and the Fish and Wildlife Conservation Act.[68] Due to the variations in potential impacts depending upon the season and the nesting schedules for migratory birds, the substantive requirements of these federal statutes will be evaluated by ecology SMEs prior to conducting the actions associated with decommissioning. The substantive requirements identified during the evaluation will be implemented throughout decommissioning.

[67] Migratory Bird Treaty Act, 16 USC 701 *et seq*.

[68] Fish and Wildlife Conservation Act, 16 USC 661 *et seq*.

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8.0 RSOP ADMINISTRATION

This section contains information associated with the approval, implementation, and documentation of this RSOP.

8.1 Project Team Interfaces

As owner of the Site, DOE oversees closure operations; provides input to the contractor regarding funding and overall direction; and communicates with the regulators and the public (e.g., the Rocky Flats Citizens Advisory Board [RFCAB], the Rocky Flats Coalition of Local Governments [RFCLOG]) regarding the status of individual RFETS closure projects. In addition, DOE is responsible for the enforcement of health and safety provisions of certain federal regulations.

CDPHE is the LRA for the Industrial Area, and thus is the LRA for decommissioning activities conducted pursuant to RFCA. EPA is the Support Regulatory Agency (SRA) in the Industrial Area. As a result, both CDPHE and EPA participate in oversight of decommissioning activities at RFETS. The Defense Nuclear Facilities Safety Board (DNFSB) oversees the storage of source, SNM, and byproduct material and radioactive wastes not subject to CDPHE/EPA regulation. CDPHE, EPA, and the DNFSB have executed a Memorandum of Understanding (MOU) with DOE to define their respective roles and responsibilities for oversight of activities conducted in the Industrial Area.[69]

8.2 Working Relationships

DOE, its contractor and subcontractors, and the regulators (i.e., CDPHE, EPA) will use the consultative process described in ¶¶s 51 through 61 of RFCA, and articulated in Appendix 2 of RFCA and in Section 1.1.1 of the DPP, to establish and maintain effective working relationships with each other and with the general public throughout the decommissioning process. The principal aspects of the consultative process include:

- Timely sharing of information – Information sharing efforts may include but need not be limited to: updates of the overall Site closure baseline, briefings on the development of work plans; briefings on changes to approved baselines, periodic project status meetings, and consultations on decommissioning strategy.

- Collaborative discussions of program changes – The goal of these collaborative discussions is to raise and resolve issues without delaying building disposition activities.

[69] Memorandum of Understanding Governing Regulation and Oversight of Department of Energy Activities in the Rocky Flats Environmental Technology Site Industrial Area, executed February 15, 1996.

- Designation and use of project points of contact for information exchange and resolution of issues – The LRA and DOE will designate POCs for each closure project to facilitate open communication and resolution of issues. In addition, DOE will provide POC designations for its contractor.
- Respect for the roles and responsibilities of the parties – The LRA and DOE have distinct roles and independent decision-making responsibilities. In general, the role of DOE is to oversee program and project planning, approve project baselines and baseline changes, and to oversee its contractors. The role of the LRA is to, approve RFCA decision documents, oversee the planning and implementation of work, ensure the protection of human health and the environment, monitor compliance with RFCA and project ARARs.
- Training - The LRA and DOE may develop and provide training to their respective staff and to the contractor and interested members of the public to facilitate the consultative process.

Per ¶70 of RFCA, CDPHE regulates decommissioning activities under CERCLA. To expedite the decommissioning process, the parties have agreed that CDPHE may exercise authority by participating in the IWCP process. For the purposes of this RSOP, "participation in the IWCP process" means the LRA has an opportunity to discuss issues and ask questions, but it does not mean the LRA has approval authority for WCDs. DOE and its contractor will advise CDPHE of IWCP meetings and roundtable review sessions, and will provide relevant information in a timely manner. CDPHE, DOE, and the contractor or subcontractors may use the roundtable review sessions as a forum for RFCA consultation. If this process does not address CDPHE's concerns, and CDPHE believes the planned activities meet the criteria for issuing a "stop work order" under RFCA, CDPHE may issue a "stop work" order pursuant to Part 14 of RFCA (¶¶ 176 through 180).

8.3 Notification Requirements

Subsequent to final approval of this RSOP, it may be implemented for individual decommissioning projects upon written notification to the LRA. The RSOP notification letter will contain the following information:

- The scope of the project, to include a brief building description and discussion of planned decommissioning activities,
- RCRA unit-specific closure information (if applicable),
- Deviations or exceptions to the RSOP,
- A reference to the RLCR,
- Contents of the project-specific AR File,
- A level one schedule for project implementation,
- Points of contact for the project, and
- An indication whether an additional RFCA decision document will be prepared.

If the notification letter contains RCRA unit-specific information, the LRA will have 30 days to review the RSOP notification letter and provide feedback, including a definitive reason for not proceeding with the project. If no feedback is received within 30 days, the project will proceed as planned.

If the notification letter does not contain RCRA unit-specific information, the LRA will have 14 days to review the RSOP notification letter and provide feedback, including a definitive reason for not proceeding with the project. If no feedback is received within 14 days, the project will proceed as planned.

8.4 Records Disposition

Upon completion of the public comment period for this draft RSOP, all 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 and copies of the RFETS documents referenced in this document.

For each closure project that implements this RSOP, the AR File will contain the RSOP notification letter, including scoping meeting minutes, the completed Facility Component Removal, Size Reduction, and Decontamination Activity Checklist(s), unit-specific information for RCRA-regulated units undergoing closure, and the Decommissioning Final Closeout Report for the project. In addition, project-specific information, such as characterization data, project correspondence, WCDs, and other information generated as a direct result of each closure project will be filed in the Project Record, and RCRA records and closure documents will be maintained with the RCRA Operating Record for each closure project. Both the Project Record files and the RCRA Operating Record files will be transferred to Site Records Management upon completion of the Decommissioning Final Closeout Report for each closure 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) 293-1807

CDPHE
Information Center, Building A
4300 Cherry Creek Drive South
Denver, Colorado 80220-1530
(303) 692-3312

Rocky Flats Citizens Advisory Board (RFCAB)
9035 Wadsworth Parkway
Suite 2250
Westminster, Colorado 80021
(303) 420-7855

Rocky Flats Public Reading Room
FRCC Library
3645 West 112th Avenue, Level B
Westminster, Colorado 80030
(303) 469-4435

8.5 Comment Responsiveness Summary

Responses to comments received during the formal public comment period, including comments from the regulatory agencies, are documented in Appendix D of this RSOP.

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GLOSSARY

Administrative Requirements. Administrative requirements are those mechanisms that facilitate the implementation of the substantive requirements of a statute or regulation. Administrative requirements include the approval of administrative bodies, consultation, issuance of permits, documentation, reporting, recordkeeping, and enforcement. In general, administrative requirements prescribe methods and procedures by which substantive requirements are made effective for purposes of a particular environmental or public health program.

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 to ensure 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 that are 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 that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable. (40 CFR 300.5)

Asbestos. Asbestiform varieties of chrysolite, amosite (cummintonite-grunerite), crocidolite, anthophyllite, tremolite, and actinolite.

Asbestos Containing Material. Material containing more than 1% friable asbestos.

CERCLA. The Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §9601 *et seq.*, as amended by the Superfund Amendments and Reauthorization Act of 1986, Pub. L. 99-499, and the Community Environmental Response Facilitation Act, Pub. L. No. 102-26; and the National Contingency Plan and other implementing regulations. (RFCA ¶25[m])

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])

Deactivation. The process of placing a building, a 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 de-energizing of non-essential systems, removal of stored radioactive and hazardous materials, and related actions. As the bridge between operations and decommissioning, based upon Decommissioning Operations Plans (DOPs) or the Decommissioning Program Plan (DPP), deactivation can accomplish operations-like activities such as final process runs, and also 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 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])

Decommissioning. Decommissioning means, for those buildings, portion 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. The removal or reduction of radioactive or hazardous contamination from facilities, equipment, or soils by manual, mechanical, chemical, or other means.

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

Facilities. 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.

Facility Component. For the purposes of this RSOP, the term "facility component" refers to gloveboxes, tanks and ancillary piping, fume hoods, ventilation/filtration systems, other utilities and equipment, as well as building walls, ceilings, floors, and structural members.

Facility Disposition Process. The sequence of activities required to take a facility from its existing condition to final disposition. The goal of disposition is for the Site to accomplish all of the activities necessary either to demolish the building and dispose of the resulting waste or to release the building for reuse.

As discussed in RFCA Attachment 9, unless building specific conditions otherwise warrant, the following activities are typical, but not all inclusive, of those that will be performed for a building: (a) containerized waste and materials removed; (b) Liquid waste and processing systems drained; (c) RCRA units closed or have a closure plan integrated with building disposition plan; (d) all TRUM, defined as materials in excess of 100 nCi per gram, removed; (e) equipment, piping, ducts, gloveboxes, and major electrical components removed (e.g., strip out), (f) radioactive hot spots and hazardous substances removed; and (g) easily removed contamination removed. (DPP, Section 2.1)

Hazard. 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 the 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.

Interim Measure. 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. 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.

Job Hazard Analysis. 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. A type of hazard analysis

process, which 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.

Lead Regulatory Agency (LRA). The LRA is that regulatory agency (EPA or CDPHE) which is assigned approval responsibility with respect to actions under RFCA and at a particular Operable Unit 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 (SRA) and consolidate comments, assuring technical and regulatory consistency, and assuring that all regulatory requirements are addressed. (RFCA ¶25[aq])

Low-Level (LL) Waste. LL waste is any radioactive waste that is not classified as transuranic 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 low-level mixed (LLM) waste.

Operable Unit (OU). OU means a grouping of IHSSs into a single management unit.

Operationally Empty. A tank is considered to be "operationally empty" when it has been drained using readily available means (e.g., house vacuum system). Such tanks are likely to contain varying amounts of holdup.

PCB Bulk Product Waste. Waste derived from manufactured products containing PCBs in a non-liquid state, at any concentration where the concentration at the time of designation for disposal was $\geq$50 ppm PCBs. PCB bulk product waste excludes PCBs or PCB Items; but includes: 1) non-liquid 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; 4) fluorescent light ballasts containing PCBs in the potting material.

PCB Item. Any PCB Article, Article Container, PCB Container, or PCB Equipment, that deliberately or unintentionally contains, or has as a part of it, any PCB or PCBs. This category includes electrical equipment such as transformers, capacitors and switches.

PCB Remediation Waste. 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 $\geq$ 50 ppm PCBs, regardless of the concentration of the original spill; (2) materials which are currently at any volume or concentration where the original source was $\geq$ 500 ppm PCB beginning on April 18, 1978, or $\geq$ 50 ppm beginning on July 2, 1979; and (3) materials which are currently at any concentration if the PCBs are from a source not authorized for use under 40 CFR Part 761.

PCB remediation waste means 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 <50 ppm PCBs and not in use according to §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 non-porous surfaces.

Physically Empty. The condition of a tank or ancillary equipment in which no liquid remains after verification by personnel who are familiar with the tank system or a by proven technology. For example, verification may be performed by draining at low points or by non-destructive testing.

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 (no matter when generated).

Radiological Contamination. Radioactive material present in a location where it should not be present.

RCRA Stable. A step toward RCRA closure, whereby wastes are removed from a RCRA-regulated unit and the possibility of future waste input is eliminated. 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 one percent holdup, and with no significant sludge and no significant risk remaining. Physical means must then be used to ensure no waste is re-introduced to the system (e.g. lock out/tag out, blank flanges). (RCRA Part B Permit and Interim Status Closure Plan, Part X.E)

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 (no matter 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). The Resource Conservation and Recovery Act, 42 U.S.C. §6901 *et seq.*, as amended by the Hazardous and Solid Waste Amendments of 1984, the Federal Facility Compliance Act of 1992, and implementing regulations. (RFCA ¶25[ay])

Residues. Pu-contaminated liquids and solids that were once held in reserve at Rocky Flats because they contain Pu in sufficient quantities to warrant treatment for recovery of nuclear material. Residues mixed with hazardous waste are referred to as mixed residues.

RFCA Standard Operating Protocol (RSOP). Approved protocol applicable to a set of routine environmental remediation and/or decommissioning activities regulated under RFCA that DOE may repeat without re-obtaining 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 interim measure/interim remedial action process.

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 required a Radiological Waste Release Evaluation prior to generation or disposal into dumpsters. Typical routine sanitary waste includes: packaging and general office refuse; food waste from cafeteria or offices; non-recyclable 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 off site. Special sanitary waste includes asbestos and beryllium waste that is not hazardous waste.

Set. Small, manageable groupings of similar systems, equipment, and areas or rooms that may be worked independently. Sets serve as the foundation for prioritizing and scheduling building component removal, size reduction, and decontamination activities within a building or building cluster.

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 to

types of hazardous substances (e.g., maximum contaminant levels [MCLs] establishing drinking water standards 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).

Support Regulatory Agency (SRA). Support Regulatory Agency means the regulatory agency (EPA or CDPHE) that, for purposes of streamlining implementation of RFCA, where applicable, shall defer exercise of its regulatory authority at one or more particular operable units until the completion of all accelerated actions. The SRA may, however, provide comments to the LRA regarding proposed documents and work. (RFCA ¶25[br])

To-Be-Considered (TBCs). TBCs are non-promulgated advisories or guidance issued by federal or state government that are not legally binding and do not have the status of potential ARARs. However, in many circumstances, TBCs will be considered with ARARs as part of the Site risk assessment and may be used in determining the necessary cleanup levels for protection of public health and the environment.

Transuranic (TRU) Waste. TRU waste is any waste that is contaminated with alpha-emitting transuranic radionuclides with half-lives greater than 20 years, in concentrations greater than or equal to 100 nCi/gram at the time of assay. TRU waste mixed with hazardous waste is referred to as TRU mixed waste (TRM).

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APPENDIX A

FACILITY COMPONENT REMOVAL, SIZE REDUCTION, AND DECONTAMINATION ACTIVITY CHECKLIST

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FACILITY COMPONENT REMOVAL, SIZE REDUCTION, AND DECONTAMINATION ACTIVITY CHECKLIST

The Facility Component Removal, Size Reduction, and Decontamination Checklist will be used by RFETS closure project managers to identify the component removal, size reduction, and/or decontamination activities planned for each project, and to compare the planned activities against activities approved under this RSOP. A checklist will be completed for each activity or group of activities, for each Set[1] or group of Sets, or for the entire facility. The number of checklists required for a given project will be based on the complexity and sequence of the activities being conducted. For instance, if a room is scheduled for decommissioning before the rest of the facility, the checklist will only address the activities to be performed in that room. Completed checklists will become part of the AR File for each project.

This checklist describes the approved activities by component type and removal, size reduction, and decontamination technique. Approved removal and size reduction techniques are described in detail in Section 3.3 of this RSOP, and decontamination techniques are described in Section 3.4.

In the event a planned activity falls outside the scope of this RSOP, the closure project manager will consult with DOE and the LRA to determine whether this RSOP should be modified to include the activity, or whether a separate decision document should be written.

[1] Sets are small, manageable groupings of similar systems, equipment, and areas or rooms that may be worked independently. Sets serve as the foundation for prioritizing and scheduling building component removal, size reduction, and decontamination activities within a building or building cluster.

FACILITY COMPONENT REMOVAL, SIZE REDUCTION, AND DECONTAMINATION ACTIVITY CHECKLIST

Building: _____

Closure Project Manager: _____

COMPONENT REMOVAL/SIZE REDUCTION

Component Type	✔
Gloveboxes	
Tanks and ancillary equipment (located both inside and outside the facility)	
Fume hoods	
Ventilation/filtration systems (both inside and outside the facility)	
Utilities and other equipment (both inside and outside the facility; including electrical, steam, and fire suppression systems)	
Walls	
Floors	
Ceilings	
Roofs	
Other structural members	
Other*	

Removal/Size Reduction Technique	✔
Small tools	
Paving breaker, jackhammer and/or similar tools used to break up concrete	
Excavators, such as backhoes, to excavate underground components, such as tanks and ancillary equipment	
Hoists and cranes	
Plasma arc cutter	
Diamond wire saw	
Wachs cutter	
Laser cutter	
Oxy-torch cutter	
Hydraulic shears	
Shear baler	
Water cutter using abrasives	
Arc air slice	
Arbor press	
Non-explosive cracking agent	
Other *	

***** Describe "Other" Component Type(s) and/or Removal/Size Reduction Technique(s):

_____

_____

FACILITY COMPONENT REMOVAL, SIZE REDUCTION, AND DECONTAMINATION ACTIVITY CHECKLIST

DECONTAMINATION

Component Type	✔
Gloveboxes	
Tanks and ancillary equipment (located both inside and outside the facility)	
Fume hoods	
Ventilation/filtration systems (both inside and outside the facility)	
Utilities and other equipment (both inside and outside the facility; including electrical, steam, and fire suppression systems)	
Walls	
Floors	
Ceilings	
Roofs	
Other structural members	
Other*	

Decontamination Technique	✔
Wiping/scrubbing/washing with water or detergents	
Vacuuming	
Strippable Coating	
Grinding	
Scarifying	
Scabbling	
Paving breaker/chipping hammer	
Spalling	
Abrasive/grit blasting	
CO_2 blasting	
Hydrolasing	
Strong mineral acids	
Organic or weak acids	
Additional oxidants, such as cerium and other similar metals	
Other *	

***** Describe "Other" Component(s) and/or Decontamination Technique(s):

_____

_____

_____

Note: In the event a planned activity falls outside the scope of this RSOP, the closure project manager will consult with DOE and the LRA to determine whether this RSOP should be modified to include the activity, or whether a separate decision document should be written.

Prepared by: _____ **Date:** _____

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APPENDIX B

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

FOR

FACILITY COMPONENT REMOVAL, SIZE REDUCTION, AND DECONTAMINATION ACTIVITIES

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APPENDIX B – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REQUIREMENT	CITATION	TYPE	COMMENT
CLEAN AIR ACT (CAA), 42 USC 7401 *et seq*.			
NATIONAL AMBIENT AIR QUALITY STANDARDS • Sulfur Dioxide • Particulate Matter (PM-10 & PM-2.5) • Carbon Monoxide • Ozone • Nitrogen Dioxide • Lead	5 CCR 1001-14 [40 CFR 50]	C	National Ambient Air Quality Standards (NAAQS) define levels of air quality that are deemed necessary, with an adequate margin of safety, to protect the public health. The standards are the basis for air quality regulations that are designed to improve and protect air quality. The Denver metro area is currently considered to be in non-attainment for the PM-10 and carbon monoxide standards. Ambient air quality standards are not effluent discharge limitations; they are used in conjunction with air dispersion modeling to establish emission limits that are protective of air quality.
COLORADO AIR QUALITY CONTROL COMMISSION (CAQCC) REGULATIONS	5 CCR 1001 [40 CFR 52, Subpart G]		
• Emission Control Regulations for Particulates, Smokes, Carbon Monoxide, and Sulfur Oxides	5 CCR 1001-3 (CAQCC Reg. No. 1)		
➢ Smoke and Opacity	Section II.A.1	C	Air pollutant emissions from stationary sources (e.g., fuel-fired pumps, generators, and compressors, process vents/stacks) shall not exceed 20% opacity.
➢ Fugitive Particulate Emissions	Section III.D	A	Technologically feasible and economically reasonable control measures and operating procedures will be employed to reduce, prevent, and control particulate emissions. This will probably not apply until the demolition phase of decommissioning.
▪ Construction Activities	III.D.2(b)		
▪ Storage and Handling of Material	III.D.2(c)		
▪ Haul Roads	III.D.2(e)		
▪ Haul Trucks	III.D.2(f)		
▪ Demolition Activities	III.D.2(h)		
▪ Sandblasting Operations	III.D.2(j)		
• Odor Emissions	5 CCR 1001-4 (CAQCC Reg. No. 2)	C	Regulation No. 2 prohibits the emission of detectable odors from any single source in excess of the air standards.

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• Air Pollutant Emission Notices (APEN), Construction Permits and Fees, Operating Permits, and Including the Prevention of Significant Deterioration	5 CCR 1001-5 (CAQCC Reg. No. 3)		
➢ APEN Requirements	Part A, Section II	C	An APEN shall be filed with CDPHE prior to construction, modification, or alteration of, or allowing emissions of air pollutants from, any activity. Certain activities are exempted from APEN requirements per specific exemptions listed in the regulation.
➢ Construction Permits, Including Regulations for the Prevention of Significant Deterioration (PDS)	Part B		
▪ Construction Permits	Section III	C	Construction permits are not required for CERCLA activities; however, substantive requirements that would normally be associated with construction permits will apply. Also, fuel-fired equipment (e.g., generators, compressors) associated with these activities may require permitting.
▪ Non-Attainment Area Requirements	Section IV.D.2	A/C/L	Even though CERCLA activities are exempt from construction permit requirements, non-attainment area requirements may apply if emissions of certain pollutants exceed certain threshold limits. The requirements include emissions reductions or offsets, and strict emission control requirements.
▪ Prevention of Significant Deterioration Requirements	Section IV.D.3	A/C/L	Even though CERCLA activities are exempt from construction permit requirements, PSD requirements may apply if emissions of certain pollutants exceed certain threshold limits. The requirements include strict emission control requirements, source impact modeling, and pre-construction and post-construction monitoring.
• Standards of Performance for New Stationary Sources	5 CCR 1001-8 (CAQCC Reg. No. 6)	A	New Source Performance Standards exist for various types of stationary sources. Currently, no standards exist for demolition activities.
• Emissions of Volatile Organic Compounds (VOCs)	5 CCR 1001-9 (CAQCC Reg. No. 7)		
➢ General Requirements for Storage and	Section III.B	A	Applies to the transfer of VOCs to a tank larger than 56 gallons. In such cases,

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Transfer of VOCs			submerged-fill or bottom-fill techniques must be used.
➢ Disposal of VOCs	Section V	A	Prohibits the disposal of VOCs by evaporation or spillage.
➢ Storage and Transfer of Petroleum Liquid	Section VI	A	Regulated storage and transfer of petroleum liquids.
• Control of Hazardous Air Pollutants	5 CCR 1001-10 (CAQCC Reg. No. 8)		
➢ General Provisions (CAQCC regulation incorporates CFR by reference)	Part A, Subpart A (40 CFR Part 61)	C	Details general provisions that apply to sources subject to National Emission Standards for Hazardous Air Pollutants (NESHAPs). The provisions will apply to all decommissioning activities that are subject to a NESHAP.
➢ National Emission Standard for Beryllium (CAQCC regulation incorporates CFR by reference)	Part A, Subpart C (40 CFR Part 61)	C	Details the regulatory requirements for emissions of beryllium from specific stationary source categories, such as machine shops or incinerators that process beryllium. The requirements may apply to decommissioning activities that include size-reduction of beryllium-containing equipment.
➢ Control of Asbestos	Part B, Section II (40 CFR 61, Subpart M)	C	Applies to asbestos abatement activities. Compliance requires that asbestos inspectors, abatement workers, and abatement project managers are certified in accordance with the regulations.
	Section III	C	Details project requirements including notification, permitting, and asbestos abatement work practices.
	Section III.B.1.a(i)	C	Requires written notice of demolition activities, regardless of whether asbestos is involved. Notice must be submitted to CDPHE at least 10 working days prior to initiation of demolition activities (form supplied by CDPHE).
➢ Part C, Lead	Section I	C	Applies to activities involving lead emissions (e.g., glovebox size reduction). The emission standard is 1.5 microns per cubic meter of air, averaged over a one-month period.

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• Control of Emissions of Ozone-Depleting Compounds (ODCs)	5 CCR 1001-19 (CAQCC Reg. No. 15)	C	Applies to activities involving the disassembly or disposal of any refrigeration system or appliance that contains a regulated ozone-depleting compound (ODC). Compliance requirements include having registered and certified technicians recover all regulated ODCs in an approved vessel, by an approved method, prior to disassembly or disposal.

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NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS • National Emission Standards for Emissions of Radionuclides Other than Radon from DOE Facilities	40 CFR 61, Subpart H [5 CCR 1001-10, Subpart H]		
➢ Standard	61.92	C/L	Establishes a radionuclide emission standard equal to those emissions that yield an effective dose equivalent (EDE) of 10 mrem/year to any member of the public. The Site complies by using stack effluent discharge data and empirically estimated fugitive emissions in the dose model CAP88-PC for calculating the EDE to the most impacted member of the public to ensure that it does not exceed 10 mrem/year. Also, the perimeter samplers in the Radioactive Ambient Air Monitoring Program (RAAMP) sampler network are utilized to verify compliance with the standard.
➢ Emission Monitoring and Test Procedures	61.93	C/A	Establishes emission monitoring and testing protocols required to measure radionuclide emissions and calculate EDEs. This section also requires that radionuclide emissions measurements (i.e., stack monitoring) be made at all release points that have a potential to discharge radionuclides into the air which could cause an EDE to the most impacted member of the public in excess of 1% of the standard (i.e., 0.1 mrem/year).
➢ Compliance Monitoring and Reporting	61.96	C/L	Requires the Site to perform radionuclide air emission assessments of all new and modified sources. For sources that exceed the 0.1 mrem/year EDE threshold (controlled), the appropriate applications for approval must be submitted to EPA and CDPHE. Additional substantive requirements may be imposed by EPA and/or CDPHE.

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FEDERAL WATER POLLUTION CONTROL ACT (aka Clean Water Act [CWA]), 33 USC 1251 *et seq*.			
WATER QUALITY CRITERIA – GOLD BOOK	33 USC 1314 (Clean Water Act, Section 304)	C	The "Gold Book" presents guidelines with respect to water quality criteria for toxic pollutants. Criteria are published for aquatic and human health. The water quality criteria are not promulgated standards; however, they are established guidelines used for developing NPDES permits and may be considered potentially relevant and appropriate. The water quality criteria should not be used as effluent limits, rather discharge limits should be established either through the National Pollutant Discharge Elimination System (NPDES) or underground injection control (UIC) permitting process. Although water criteria are non-promulgated and non-enforceable standards, Section 121(d)(2)(B)(I) of CERCLA as implemented by the National Contingency Plan (NCP), (40 CFR 300.430(e)(2)(I)(E)) specifies that water quality criteria established under Sections 303 and 304 of the Clean Water Act (CWA) shall be attained where relevant and appropriate under the circumstances of the release. The designated or potential use of the surface or groundwater, the environmental media affected, the purpose for which the water quality criteria were developed, and the latest information are to be considered in determining the relevance and appropriateness of the water quality criteria to the response action. Therefore, the need to comply with water quality criteria as a relevant and appropriate requirement needs to be determined on a case-by-case basis using the factors listed above.
COLORADO BASIC STANDARDS AND METHODOLOGIES FOR SURFACE WATER	5 CCR 1002-31	C	Refer to RFCA Attachment 5 for surface water action levels and standards.
COLORADO BASIC STANDARDS FOR GROUNDWATER	5 CCR 1002-41	C	Refer to RFCA Attachment 5 for ground water action levels.
TOXIC POLLUTANT EFFLUENT STANDARDS		C	If the permitted point is used, the NPDES permit discharge standards will be met.
• Toxic Pollutants	40 CFR 129.4		

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FEDERAL WATER POLLUTION CONTROL ACT (aka Clean Water Act [CWA]), 33 USC 1251 *et seq*.			
• Compliance	40 CFR 129.5		
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM REGULATION		A	These subparts apply to the storage and use of products that contain toxic and hazardous pollutants above reportable quantity limitations, at a facility covered by an NPDES permit. In decision documents, identify and protect all connections to the sanitary collection system.
• Designation of Hazardous Substances	40 CFR 116		
• Determination of Reportable Quantities for Hazardous Substances	40 CFR 117		
• Applicability of Best Management Practices	40 CFR 125.102		
• Best Management Practices Programs	40 CFR 125.104		
DISCHARGES OF DREDGED OR FILL MATERIAL INTO WATERS OF THE UNITED STATES	33 USC 1344 33 CFR 3233.3		
• Discharges Requiring Permits	33 CFR 323.3	A/L	
DOE COMPLIANCE WITH FLOODPLAIN/WETLANDS ENVIRONMENTAL REVIEW REQUIREMENTS	10 CFR 1022	A/L	
	.11		
• Floodplain/Wetlands Determination	.12		
• Floodplain/Wetlands Assessment	.13		
• Applicant Responsibilities			

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MIGRATORY BIRD TREATY ACT, 16 USC 701 to 715			
TAKING, POSSESSION, TRANSPORTATION, SALE, PURCHASE, BARTER, EXPORTATION, AND IMPORTATION OF WILDLIFE AND PLANTS	50 CFR 10	A/L	Principally focuses on the taking and possession of birds protected under this regulation. Enforcement is predicated on location of the project and time of the year. Current list of protected birds is kept with the Ecology group.

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SAFE DRINKING WATER ACT (SDWA), 42 USC 300 *et seq*.			
COLORADO PRIMARY DRINKING WATER REGULATIONS	5 CCR 1003-1,	C	Refer to RFCA Attachment 5 for surface water action levels and standards and groundwater action levels.
MAXIMUM CONTAMINANT LEVEL GOALS	40 CFR 141	C	Refer to RFCA Attachment 5 for surface water action levels and standards and groundwater action levels.
SOLID WASTE DISPOSAL ACT (aka: Resource Conservation and Recovery Act [RCRA]), 42 USC 6901 *et seq*.; SUBTITLE C: HAZARDOUS WASTE MANAGEMENT (Colorado Hazardous Waste Act, CRS 25-15-101 to -217)			
The State of Colorado is authorized to administer portions of the hazardous waste management program (e.g., RCRA) to regulate the generation, treatment, storage, and disposal of hazardous waste within Colorado. As such, the Colorado regulations that are more stringent than the federal counterparts would be applicable to the management of hazardous waste. These regulations may also be relevant and appropriate in situations where a remediation waste is "sufficiently similar" to a RCRA-listed waste (e.g., waste which was generated and disposed of prior to the effective date of regulation) or when the proposed remedial action is similar to a RCRA-regulated activity and would be appropriate to ensure that the activity is protective of human health and the environment. Although the Colorado hazardous waste management regulations are similar to the federal requirements, both the federal and state regulatory citations are provided for reference purposes and to denote that both federal and state requirements were considered in establishing the identifying the ARAR requirement adopted for the remediation of the RFETS. Only substantive portions of the regulations are required under CERCLA actions for onsite activities. The State has not verified that these are the only substantive standards. The final determination is predicated upon an analysis for a specific action.			
SOLID WASTE DISPOSAL SITES AND FACILITIES • Definitions	6 CCR 1007-2 Section 1.2	A	"Recyclable materials" means any type of discarded or waste material that is not regulated under Section 25-8-205(1)(e), C.R.S., and can be reused, remanufactured, reclaimed, or recycled.
IDENTIFICATION AND LISTING OF HAZARDOUS WASTES	6 CCR 1007-3, 261 [40 CFR 261]	A	
GENERATOR STANDARDS	6 CCR 1007-3 Part 262 (40 CFR Part 262)		

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• Hazardous Waste Determinations	.11	A/C	Persons who generate solid wastes are required to determine if the wastes are hazardous according to 6 CCR 1007-3 Parts 261, 267, 279 [40 CFR Parts 261, 266, and 279].
• Hazardous Waste Accumulation Areas	.34 (a)(1)(i),(ii),(iv, excluding A & B); (a)(3); (a)(4); (c)(1)	A	Persons who accumulate hazardous waste in containers or tanks must manage the waste in a manner that protects human health and the environment.
GENERAL FACILITY STANDARDS	6 CCR 1007-3 Part 264, Subpart B [40 CFR Part 264, Subpart B]		
• Waste Analysis	.13(a)	A	The owner/operator of a facility that stores, treats, or disposes of waste must verify the waste has been characterized adequately.
• Security	.14	A/L	The owner/operator of a facility must prevent unauthorized access.
• General Inspection Requirements	.15 (a), (c)	A/L	The owner/operator of a facility must inspect for malfunctions, deteriorations, and releases, and must remedy deficiencies.
• Personnel Training Requirements	.16 (a), (b), (c)	A/C	Personnel must be trained.
• General Requirements for Ignitable, Reactive, or Incompatible Wastes	.17 (a), (b)	A/C	Wastes will be managed to prevent accidental ignition of ignitable or reactive wastes, or the mixing of incompatible wastes.
PREPAREDNESS AND PREVENTION	6 CCR 1007-3 Part 264, Subpart C [40 CFR 264, Subpart C]		

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• Design and Operation of a Facility	.31	A/C	Facilities must be designed to minimize the potential for fire, explosion, or release of hazardous waste.
• Required Equipment	.32	A/C	Facilities must be equipped with specified equipment to mitigate accidents, should they occur.
• Testing and Maintenance of Equipment	.33	A/C	Equipment must be maintained.
• Access to Communications or Alarm System	.34	A/L	Employees must have access to emergency communications when managing hazardous waste.
• Required Aisle Space	.35	A	Aisle space must be maintained to allow unobstructed access to emergency personnel and emergency equipment.
• Arrangements with Local Authorities	.37	A/L	The owner/operator must make arrangements with specified local emergency personnel.
CONTINGENCY PLAN AND EMERGENCY PROCEDURES	6 CCR 1007-3 Part 264, Subpart D [40 CFR Part 264, Subpart D]		
• Purpose and Implementation	.51 (b)	A/C	The RFETS Emergency Response Plan incorporates the substantive requirements of the Contingency Plan in the Site's Part B Hazardous Waste Permit. Emergencies such as fire, explosion, or release of hazardous waste must be mitigated immediately.
• Emergency Coordinator	.55	A	A designated employee is responsible for coordinating emergency response actions.
• Emergency Procedures	.56 (a-i)	A	
MANIFEST SYSTEM, RECORDKEEPING, AND REPORTING	6 CCR 1007-3 Part 264, Subpart E [40 CFR Part 264, Subpart E]	A	This subpart contains requirements recordkeeping and maintaining the RCRA operating record

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GROUNDWATER MONITORING	6 CCR 1007-3 Part 264, Subpart F [40 CFR Part 264, Subpart F]	A	The substantive portions of the groundwater monitoring ARARs for each CERCLA action will be incorporated into the Integrated Monitoring Plan (IMP).
CLOSURE AND POST-CLOSURE	6 CCR 1007-3 Part 264, Subpart G [40 CFR Part 264, Subpart G]		
• Closure Performance Standards	.111	A	The owner/operator must close the facility in a manner that protects human health and the environment.
• Disposal or Decontamination of Equipment, Structures, or Soils	.114	A/C	All hazardous wastes and residues of hazardous waste must be disposed or decontaminated.
• Post-Closure Care and Use of Property	.117	A/C	Human health and the environment must be protected after closure is complete if hazardous waste remains at the facility.
USE AND MANAGEMENT OF CONTAINERS	6 CCR 1007-3 Part 264, Subpart I [40 CFR Part 264, Subpart I]		
• Condition of Containers	.171	A	Containers must be maintained in good condition.
• Compatibility of Waste in Containers	.172	A	Wastes must be compatible with containers.
• Management of Containers	.173	A	Containers must be closed except when adding or removing waste.

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• Inspections	.174	A	Containers must be inspected weekly.
• Containment ➢ System Design and Operation ➢ Ignitable and Reactive Wastes ➢ Incompatible Wastes	 .175 .176 .177	 A A A	
• Closure	.178	A	Hazardous wastes and residues of hazardous waste must be removed or decontaminated from the unit and soils.
• Air Emission Standards	.179	A/C	Hazardous wastes must be managed in accordance with Subparts AA, BB, CC, as appropriate.
TANK SYSTEMS	6 CCR 1007-3 Part 264, Subpart J [40 CFR Part 264, Subpart J]		
• Design and Installation of New Tank Systems or Components	.192 (a-f)	A	Tank systems must be designed to maintain their integrity when storing or treating hazardous waste.
• Containment and Detection of Releases	.193 (a)(i)(1, 2, 3, 5)	A	Secondary containment must be designed to contain and detect any releases from the tank system.
• General Operating Requirements	.194 (a-c)	A	Tank systems must be maintained in good condition to prevent releases to the environment.
• Inspections	.195(a-c)	A	Inspections must be conducted to identify any tank system integrity concern.
• Response to Leaks or Spills and Disposition of Leaking or Unfit-for-Use Tank Systems	.196 (a-c), (e)	A	
• Closure and Post-Closure Care	.197 (a, b)	A	During closure, hazardous waste and hazardous waste residues must be removed from the tank system.

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• Special Requirements for Ignitable and Reactive Wastes	.198	A/C	Ignitable or reactive wastes must be managed as specified in this section.
• Special Requirements for Incompatible Wastes	.199	A/C	Incompatible wastes must not be introduced into a tank system unless the requirements of 264.17(b) are met.
• Air Emission Standards	.200	A/C	All hazardous waste must be managed in accordance with Subparts AA, BB, CC, as appropriate.
CORRECTIVE ACTION FOR SOLID WASTE MANAGEMENT UNITS	6 CCR 1007-3 Part 264, Subpart S, [40 CFR Part 264, Subpart S]		
• Temporary Units	.553 (a-c)	A	Temporary units allow flexibility. Justification for alternative compliance must be included in the RFCA decision document.
MISCELLANEOUS UNITS	6 CCR 1007-3 Part 264, Subpart X [40 CFR Part 264, Subpart X]		
• Environmental Performance Standards	.601	A	Miscellaneous units must be designed, constructed, operated, and maintained in a manner that protects groundwater, surface water, wetlands, soils, and air.
➢ Monitoring, Analysis, Inspection, Response, Reporting, and Corrective Action	.602	A	Miscellaneous units must be managed to ensure compliance with 264.15 (inspections), 264.33 (testing and monitoring), 264.101 (corrective action for releases).
➢ Post-Closure Care	.603	A	Miscellaneous units that are disposal units must meet post-closure care requirements.
AIR EMISSION STANDARDS FOR PROCESS VENTS	6 CCR 1007-3 Part 264, Subpart AA [40 CFR Part 264, Subpart AA]		Air emission standards contained in these sections must be incorporated into the design of equipment that contains or contacts hazardous waste with organic concentrations equal to or greater than 10 ppm (by weight)

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• Standards: Process Vents	.1032	A	
• Standards: Closed-Vent Systems and Control Devices	.1033	A	
• Test Methods and Procedures	.1034	A	
AIR EMISSION STANDARDS FOR EQUIPMENT LEAKS	6 CCR 1007-3 Part 264, Subpart BB [40 CFR Part 264, Subpart BB]	A	Air emission standards for equipment leaks must be incorporated into the design of equipment that contains or contacts hazardous waste with organic concentrations equal to or greater than 10 ppm (by weight) according to these sections.
• Standards: Pumps in Light Liquid Service	.1052	A	
• Standards: Compressors	.1053	A	
• Standards: Pressure Relief Devices in Gas/Vapor Service	.1054	A	
• Standards: Sampling Connecting Systems	.1055	A	
• Standards: Open-Ended Valves or Lines	.1056	A	
• Standards: Valves in Gas/Vapor or Light Liquid Service	.1057	A	
• Standards: Pumps and Valves in Heavy Liquid Service, Flanges, Other	.1058	A	

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• Standards: Delay of Repair	.1059	A	
• Standards: Closed Vent Systems and Control Devices	.1060	A	
• Alternative Standards for Valves in Gas/Vapor Service or in Light Liquid Service: Percentage of Valves Allowed to Leak	.1061	A	
• Alternative Standards for Valves in Gas/Vapor Service or in Light Liquid Service: Skip Period Leak Detection and Repair	.1062	A	
• Test Methods and Procedures	.1063	A	

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AIR EMISSION STANDARDS FOR TANKS, SURFACE IMPOUNDMENTS, AND CONTAINERS	6 CCR 1007-3 Part 264, Subpart CC [40 CFR Part 264, Subpart CC]		Air emission standards must be incorporated into the design of tanks, surface impoundments, and container facilities that store or treat hazardous waste with organic concentrations equal to or greater than 10 ppm (by weight).
• Standards: General	.1082	A	
• Waste Determination Procedures	.1083	A	
• Standards: Tanks	.1084	A	
• Standards: Surface Impoundments	.1085	A	
• Standards: Containers	.1086	A	
• Standards: Closed-Vent Systems and Control Devices	.1087	A	
• Inspection and Monitoring Requirements	.1088	A	
CONTAINMENT BUILDINGS	6 CCR 1007-3 Part 264, Subpart DD [40 CFR Part 264, Subpart DD]		
• Design and Operating Standards	.1101(a); (b); (c)(1, 3 (excluding i-iii), and 4); (d); (e)	A	Containment buildings must be designed and operated to prevent releases to the environment.
• Closure and Post-Closure Care	.1102	A	

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LAND DISPOSAL RESTRICTIONS	6 CCR 1007-3 Part 268 [40 CFR Part 268]		LDR determinations must be completed for hazardous waste generated. LDRs apply primarily to off-Site disposal actions proposed as part of the remedial activity.
• Dilution Prohibited as a Substitute for Treatment	.3	A	
• LDR Determination (Determination if Hazardous Waste Meets the LDR Treatment Standards)	.7	A	
• Special Rules for Wastes that Exhibit a Characteristic	.9 (a-c)	A	
MANAGEMENT OF UNIVERSAL WASTE	6 CCR 1007-3 Part 273 [40 CFR Part 273]		
• Disposal, Dilution, and Treatment Prohibitions	.31	A	A large quantity handler of universal waste is prohibited from disposing, diluting, or treating universal waste, except during responses to releases.
• Waste Management	.33	A	
• Labeling and Marking	.34	A	Universal waste and the associated accumulation areas must be labeled and marked as defined in this section.
• Employee Training	.36	A	Employees must be trained about waste management requirements and on the emergency procedures according to their responsibilities.
• Response to Releases	.37	A	Universal waste handlers must contain releases of universal wastes, and must manage the resulting waste, as appropriate, in accordance with the hazardous waste regulations.

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STANDARDS FOR THE MANAGEMENT OF USED OIL	6 CCR 1007-3 Part 279 [40 CFR Part 279]		
• Used Oil Specifications	.11	A	Used oil burned for energy recovery must meet the specifications of this section.
• Prohibitions	.12	A	Used oil must not be stored in surface impoundments, be used as a dust suppressant, or burned in unapproved units.
• Hazardous Waste Mixing	.21	A	Used oil must be characterized and managed in accordance with 269.10 of this section.
• Used Oil Storage	.22	A	Used oil must be managed in containers or tanks in a manner that protects human health and the environment. Releases must be cleaned up and steps must be taken to prevent recurrence.
• On-Site Burning in Space Heaters	.23	A	Used oil may be used as a fuel for space heaters if the gases are vented to ambient air and the maximum capacity of the space heater is not more than 0.5 million Btu per hour.
SOIL REMEDIATION POLICY DOCUMENT			
• Colorado Soil Remediation Objectives Policy Document	Published by CDPHE in December 1997	TBC	Cost effective, site-specific risk-based approach to establishing soil remediation objectives. Would be considered in manner compatible with ALF and RFCA Attachment 10.

APPENDIX B – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REQUIREMENT	CITATION	TYPE	COMMENT
SOLID WASTE DISPOSAL ACT (aka: Resource Conservation and Recovery Act [RCRA]), 42 USC 6901 *et seq*.; SUBTITLE I: UNDERGROUND STORAGE TANKS (CRS 20.5-101 TO 20.5-407)			
UNDERGROUND STORAGE TANKS	7 CCR 1101-14 [40 CFR Part 280]		
• Performance Standards for New USTs	3.20; [.20]	A	USTs must be designed, maintained, and operated to prevent releases from the tank system to the environment.
• General Operating Requirements	4.30-4.33; [.30-.33]	A	
• Release Detection	5.40-5.44; [.40-.44]	A	Releases that impact soils or groundwater will be identified as "potential areas of concern," will be added to the ER Ranking List, and will be incorporated into the integrated Site remediation program.
• Cleanup of Spills and Overfills	6.53; [.53]	A	Coordination efforts within CDPHE and the Department of Labor and Employment, Oil Inspection Section, will be accomplished through communication with the LRA.
• Initial Response to Spills and Overfills	7.61 (b-c); [.61 (b-c)]	A	
• Initial Abatement Measures	7.62(a); [.62(a)]	A	
• Initial Site Characterization	7.63(a); [.63(a)]	A	
• Free Product Removal	7.64 (a-c); [.64 (a-c)]	A	
• Investigations for Soil and Groundwater Cleanup	7.65(a); [.65(a)]	A	
• Temporary Closure	8.70 (a-b); [.70 (a-b)]	A	
• Permanent Closure and Changes-in-Service	8.71(b-c); [.71(b-c)]	A	
• Assessing the Site at Closure or Change-in-Service	8.72; [.72]	A	

APPENDIX B – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REQUIREMENT	CITATION	TYPE	COMMENT
SOLID WASTE DISPOSAL ACT (aka: Resource Conservation and Recovery Act [RCRA]), 42 USC 6901 *et seq*.; SUBTITLE I: UNDERGROUND STORAGE TANKS (CRS 20.5-101 TO 20.5-407)			
• Applicability to Previously Closed UST Systems	8.73; [.73]	A	
ABOVEGROUND STORAGE TANKS (CRS, Title 8, Article 20, Parts 7 and 2; Title 18, Article 25, Part 1)			
PERFORMANCE STANDARDS FOR TANKS			
• Design and Construction of Tanks	AST.31.2	A	ASTs must be designed, maintained, and operated to prevent releases to the environment.
• Location and Installation of Outside ASTs	AST.31.3	A	
• Location and Installation of ASTs in Vaults	AST.31.4	A	
• Normal Venting for ASTs	AST.31.5	A	
• Emergency Relief Venting for Fire Exposure for ASTs	AST.31.6	A	
• Vent Piping for ASTs	AST.31.7	A	
• Tank Openings Other Than Vents for ASTs	AST.31.8	A	
• Installation of Tanks Inside Buildings	AST.31.9	A	
• Standards for Piping, Valves, and Fittings	AST.32	A	
OPERATING REQUIREMENTS	7 CCR 1101-14, Part 4		
• Collision Protection			
• Spill and Overfill Control, Remote Impounding, Secondary Containment	AST.41 (excluding AST.41.1[e])	A	
• Operation and Maintenance of Corrosion	AST.42	A	

APPENDIX B – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REQUIREMENT	CITATION	TYPE	COMMENT
ABOVEGROUND STORAGE TANKS (CRS, Title 8, Article 20, Parts 7 and 2; Title 18, Article 25, Part 1)			
Protection • Compatibility Requirements for All Tanks • Static Protection for All Tanks • Repairs Allowed • Out-of-Service, Closure or Change-in-Service	 AST.43 AST.44 AST.45 (excluding AST.45[b][4]) AST.46 (1-5)	 A A A	
RELEASE DETECTION	7 CCR 1101-14, Part 5, AST.5	A	
RELEASE RESPONSE AND CORRECTIVE ACTION • Initial Response • Initial Abatement Measures • Repair or Closure Required	7 CCR 1101-14, Part 7 AST.72(b), (c) AST.73 AST.74	 A A A	
OIL POLLUTION PREVENTION	7 CCR 1101-14, Part 11		

APPENDIX B – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REQUIREMENT	CITATION	TYPE	COMMENT
ABOVEGROUND STORAGE TANKS (CRS, Title 8, Article 20, Parts 7 and 2; Title 18, Article 25, Part 1)			
• Oil Pollution Prevention: Oil Pollution Prevention SPCC Plan Requirements	AST.112.7 (c), (d), (e)(1-2), and (e)(4-5)	A	A Spill Prevention, Control, and Countermeasures (SPCC) Plan would not be specifically required as an ARAR; however, the substantive requirements that are incorporated into and implemented as part of the SPCC plan would be required as an ARAR (e.g., prediction of the direction, rate, and flow of a release from a tank system need not be included in a plan; however, it must be known by facility personnel and management and be available to emergency responders at the facility).

APPENDIX B – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REQUIREMENT	CITATION	TYPE	COMMENT
TOXIC SUBSTANCES CONTROL ACT (TSCA), 15 USC 2601 *et seq*. (relating to PCBs)			
PCB USE AUTHORIZATION	40 CFR 761.30	A	Lists authorized uses and use restrictions for PCBs.
MARKING REQUIREMENTS	40 CFR 761.40 and .45	A	Contains requirements for labeling PCBs and PCB storage areas.
DISPOSAL REQUIREMENTS • Applicability • Disposal Requirements • PCB Remediation Waste • PCB Bulk Product Waste • Disposal of R&D and Chemical Analyses Wastes	 761.50 761.60 761.61 761.62 761.64	A	 General PCB disposal requirements Disposal requirements.
STORAGE REQUIREMENTS FOR PCBs • Facility Criteria • Temporary Storage • Inspections • Container Specifications • PCB Radioactive Waste • Marking • Laboratory Sample Exemption from Manifesting	40 CFR 761.65	A	
INCINERATION • Liquid PCBs • Non-Liquid PCBs	40 CFR 761.70	A	These regulations would only be ARARs for the construction and operation of an on-Site PCB incinerator. It is envisioned that this will not occur.
HIGH EFFICIENCY BOILERS • Operating Requirements	40 CFR 761.71	A	These regulations would only be ARARs for on-Site burning of PCB mineral oil dielectric fluid in a boiler. It is envisioned that this will not occur.

APPENDIX B – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REQUIREMENT	CITATION	TYPE	COMMENT
TOXIC SUBSTANCES CONTROL ACT (TSCA), 15 USC 2601 *et seq*. (relating to PCBs)			
SCRAP METAL RECOVERY OVENS AND SMELTERS • Operating Requirements	40 CFR 761.72	A	These regulations would only be ARARs for on-Site scrap metal recovery or smelting. It is envisioned that this will not occur.
TSCA COORDINATED APPROVAL	40 CFR 761.77	A	Institutionalizes EPA approval of PCB activities under TSCA when activities are being conducted under another waste management permit or other decision document issued by EPA or pursuant to a State PCB waste management program.
DECONTAMINATION STANDARDS AND PROCEDURES • Self-Implementing Decontamination • Measurement-Based Decontamination	40 CFR 761.79	A	
PCB SPILL CLEANUP POLICY	40 CFR 761, Subpart G	TBC	
PCB SAMPLING AND ANALYSIS • Cleanup site characterization sampling for PCB remediation waste.	40 CFR Subpart N	A	Characterization requirements for cleanup of PCB remediation waste.
• Sampling to verify completion of self-implementing cleanup and on-site disposal of bulk PCB remediation waste and porous surfaces.	40 CFR Subpart O	A	Not an ARAR unless conducting self-implementing cleanup of PCB remediation waste.
• Sampling non-porous surfaces for measurement-based use, reuse, and on-site or off-Site disposal under 761.361(a)(6) and determination under 761.79 (b)(3).	40 CFR Subpart P	A	
• Self-implementing alternative dextraction and chemical analysis procedures for non-liquid PCB remediation waste samples.	40 CFR Subpart Q	A	Applicable procedures when using alternatives to required analytical methodology.

APPENDIX B – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REQUIREMENT	CITATION	TYPE	COMMENT
TOXIC SUBSTANCES CONTROL ACT (TSCA), 15 USC 2601 *et seq*. (relating to PCBs)			
• Sampling non-liquid, non-metal PCB bulk product waste for purposes of characterization for PCB disposal in accordance with 761.62, and sampling PCB remediation waste destined for off-Site disposal in accordance with 761.61.	40 CFR Subpart R	A	
DECONTAMINATION OF NON-POROUS SURFACES • Double wash/rinse method for decontaminating non-porous surfaces	40 CFR Subpart S	A	Referenced procedure from 761.79.

BERYLLIUM			
CHRONIC BERYLLIUM DISEASE PREVENTION PROGRAM • Definitions • Release criteria • Waste disposal • Warning labels	10 CFR 850 .3 .31 .32 .38 (b-c)	A	Establishes a program to reduce the number of worker currently exposed to beryllium in the course of their work at DOE facilities. The cited sections are followed in relation to determinations of beryllium contamination and release to the public.

APPENDIX C

SURFACE WATER MANAGEMENT PRACTICES

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This appendix will be used by individual closure project teams to develop activity-specific surface water management controls for their projects. The selected controls will be coordinated with the Environmental Management Program.

INTERCEPTOR SWALE

Description

An interceptor swale is a small v-shaped or parabolic channel, which collects runoff and directs it to a desired location. It can either have a natural grass lining or, depending on slope and design velocity, a protective lining of erosion matting, stone, or concrete.

Primary Use

The interceptor swale can either be used to direct sediment-laden flow from disturbed areas into a controlled outlet or to direct clean runoff around disturbed areas. Since the 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 since 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 fence, straw bales, or other filtration methods. Based on site topography, swales can be effectively used in combination with diversion dikes.

Applications

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. It 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 which 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.

Design Criteria

- Maximum depth of flow in the swale may be 1.5 feet 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 feet per second may be grass, erosion control mats or mulching. For grades in excess of 2 percent or velocities exceeding 6 feet per second, stabilization in the form of high velocity erosion control mats, a three inch layer of crushed stone or rip rap is required. Velocities greater than 8 feet per second will require approval by the local jurisdiction and is discouraged.
- Check dams can be used to reduce velocities in steep swales. See check dam BMP fact sheet for design criteria.
- 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 that any swale may have on upstream or downstream conditions.
- Swales must maintain positive grade to an acceptable outlet.

Limitations

Interceptor swales must be stabilized quickly after excavation so as not to 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. For permanent swales, the 1.5 feet maximum depth can be increased as long as provisions for public safety are implemented.

Maintenance Requirements

Inspection must be made weekly and after each significant (0.5 inch or greater) rain event to locate and repair any damage to the channel or to clear debris or other obstructions so as not to 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.

DIVERSION DIKE/BERM

Description

A diversion dike/berm is a compacted soil mound, which redirects runoff to a desired location. The dike/berm is typically stabilized with natural grass for low velocities and with stone or erosion control mats for higher velocities.

Primary Use

The diversion dike/berm is normally used to intercept offsite flow upstream of the construction area and direct the flow around the disturbed soils. It can also be used downstream of the construction area to direct flow into a sediment reduction device such as a sediment basin or protected inlet. Alternatively, the diversion dike/berm can be used to contain flow within the construction site if the water is suspected to be 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.

Applications

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, the diversion dike/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 the 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 the runoff crosses disturbed areas.

Design Criteria

- 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 foot for 2-year design storm.
- The maximum width of the flow at the dike will be 20 feet.

- Side slopes of the diversion dike will be 3:1 or flatter.
- Minimum width of the embankment at the top will be 2 feet.
- Minimum embankment height will be 18 inches as measured from the toe of slope on the upgrade side of the berm.
- For velocities less than 6 feet per second, the minimum stabilization for the dike/berm and adjacent flow areas is grass, erosion control mats or mulch. For velocities greater than 6 feet per second, stone stabilization or high velocity erosion control mats should be used. Velocities greater than 8 feet per second must be approved by the local jurisdiction.
- The dikes will remain in place until all disturbed areas that are protected by the dike/berm are permanently stabilized unless other controls are put into place to protect the disturbed area.
- Flow line at dike will have a positive grade to drain to a controlled outlet.

Limitations

Compacted earth dikes/berms require stabilization immediately upon placement so as not to contribute to the problem they are addressing. The diversion dikes can be a hindrance to construction equipment moving on the site, therefore their locations must be carefully planned prior to installation.

Maintenance Requirements

Dikes/berms must be inspected on a weekly basis and after each significant (>0.5 inch) rainfall to determine if silt is building up behind the dike, or if 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.

SILT FENCE

Description

A silt fence consists of geotextile fabric supported by poultry netting or other backing stretched between either wooden or metal posts with the lower edge of the fabric securely embedded in the soil. The fence is typically located downstream of disturbed areas to intercept runoff in the form of sheet flow. Silt fence provides both filtration and time for sedimentation to reduce sediment and it reduces the velocity of the runoff. Properly designed silt fence is economical since it can be re-located during construction and re-used on other projects.

Primary Use

Silt fence is normally used as perimeter control located downstream of disturbed areas. It is only feasible for non-concentrated, sheet flow conditions.

Applications

Silt fence is an economical means to treat overland, non-concentrated 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 fence should not be used with clay soil types. In order to reduce the length of silt fence, it should be placed adjacent to the down slope side of the construction activities.

Design Criteria

- 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 silt fence should be 200 feet or less.
- Maximum concentrated flow to silt fence will be 1 CFS per 20 feet of fence.
- If 50% or less of soil, by weight, passes the U.S. Standard sieve No. 200, select the equivalent opening size (E.O.S.) to retain 85% of the soil.
- Maximum equivalent opening size will be 70 (#70 sieve).
- Minimum equivalent opening size will be 100 (#100 sieve)
- If 85% or more of soil, by weight, passes the U.S. Standard sieve No. 200, silt fences will not be used due to 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.

Limitations

Minor ponding will likely occur at the upstream side of the silt fence resulting in minor localized flooding. Fences, which are 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 fence can interfere with construction operations; therefore planning of access routes onto the site is critical. Silt fence can fail structurally under heavy storm flows, creating maintenance problems and reducing the effectiveness of the system.

Maintenance Requirements

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.

STRAW BALE DIKE

Description

A straw bale dike is a temporary barrier constructed of straw bales anchored with wood posts, which is used to intercept sediment-laden runoff generated by small-disturbed areas. The straw bales can serve as both a filtration device and a 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, free of weed and grass seed and hay is defined as straw which includes weed and grass seed.

Primary Use

A straw bale dike is used 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.

Applications

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 makes 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 may 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.

Design Criteria

- 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% or flatter.
- Maximum contributing drainage area will be 0.25 acre per 100 linear feet of dike.
- Maximum distance of flow to dike should be 100 feet or less.
- Dimensions for individual bales will be 30 inches minimum length, 18 inches minimum height, 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.

Limitations

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.

Maintenance Requirements

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 depth of approximately 6 inches.

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APPENDIX D

COMMENT RESPONSIVENESS SUMMARY

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Appendix D
Comment Responsiveness Summary for the Final Draft of the RSOP for Facility Component Removal, Size Reduction, and Decontamination Activities

Reviewer	Comment No.	Sec./Page/ Para.	Comment Description	Comment Resolution
				The consultative process is described in the Decommissioning Program Plan (DPP) and summarized in Section 8.2 of the RSOP. Due to LRA and stakeholder concerns associated with activities involving removal of contaminated portions of the building shell, Section 3.8 has been revised to state that "the closure project point of contact (POC) and DOE POC will consult with the LRA POC to determine whether the contaminated portion of the shell should be removed prior to demolition. If, after reviewing the applicable survey data and considering relative risks, the closure project POC, DOE POC, and LRA POC agree that removal is the safest, most protective option, the work will be planned and executed as described in Sections 3.8.1 and 3.8.2 of this RSOP. In addition, the closure project POC and DOE POC will conduct special project status meetings as necessary to address stakeholder concerns provide the a detailed description of the activity, methods to be used, and scheduled date(s)."
CDPHE	1	Section 1.0, page 4	The discussion of the notification process appears to be less well developed than for the Facility Disposition RSOP. Given the intricacies of this document, we believe the consultation on its application will be even more intense that suggested for the other RSOP. The notification process should be expanded and more detail provided, such as included in the Facility Disposition RSOP, Section 4, page 7, paragraph 4.	The LRA will have 30 days to review the RSOP notification letter and request information with respect to work planning. If the LRA is uncomfortable with the level of planning or the response to the request for information, the LRA may provide written feedback indicating that additional information is needed prior to implementing the RSOP.
CDPHE	2	Section 1.0, page 5, para. 2	Note that the entire project and the integration of D&D and ER activities is described in the Project Management Plan, as well as the Disposition RSOP.	Text has been added to include a reference to project-specific Project Management Plans (PMPs).

Appendix D
Comment Responsiveness Summary for the Final Draft of the RSOP for Facility Component Removal, Size Reduction, and Decontamination Activities

Reviewer	Comment No.	Sec./Page/ Para.	Comment Description	Comment Resolution
CDPHE	3	Figures 1 & 2, pages 6 & 7	Although it may not be specifically necessary, there does not appear to be any driver or activity presented in Figures 1 or 2 that provides for earlier interaction between D&D and ER to characterize and remove UBC prior to building demolition (as proposed in B771), or slab removal. It should be recognized that these types of issues will be identified and dealt with utilizing the consultative process to generate the appropriate activities and documentation.	As shown in Figure 1, early interaction between D&D and ER is driven by the Industrial Area Sampling & Analysis Plan and may occur early in the decommissioning process.
CDPHE	4	Figure 2, pages 7 & 8	Since the PMP represents the higher level planning for the building, it seems unlikely that an RSOP or DOP approval would be granted without this degree of planning. The PMP should precede the RLC, with modification likely after the typing.	A PMP is prepared for each closure project. Information for individual buildings will be provided in the RSOP notification letter. Additional information may be obtained through the consultative process. The LRA will have 30 days to review the RSOP notification letter and request information with respect to work planning. If the LRA is uncomfortable with the level of planning or the response to the request for information, the LRA may provide written feedback indicating that additional information is needed prior to implementing the RSOP.
CDPHE	5	Section 2.1	The IWCP Hazards Identification and Assessment process must include appropriate IH personnel and the CBDPP, especially in areas with potential beryllium contamination. This is in addition to the SMEs listed (air, water, waste, rad, and environmental). Need to add Beryllium to the list of SMEs.	Occupational Safety & Industrial Hygiene (OS&IH) has been added to the list of SMEs.
CDPHE	6	Section 2.7	Considering the concerns for Beryllium at RFETS, this section needs to be expanded or a section added discussing Beryllium Safety and Protection issues, the CBDPP, and requirements that will be followed.	Section 2.7 has been expanded to include 10 CFR 850. The Chronic Beryllium Disease Prevention Program (CBDPP) is contained in Chapter 28 of the OS&IH Program Manual, which is already referenced in this section of the RSOP.
CDPHE	7	Sections 2.8, 2.11, and Table 1	Include appropriate documentation or documents for Beryllium concerns.	Section 2.0 is a high-level discussion of the Site's programs and is not intended to be contaminant-specific. Beryllium is addressed in the documents listed in Section 2.8 and in the OS&IH Program Plan described in Section 2.7.

Appendix D
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Reviewer	Comment No.	Sec./Page/ Para.	Comment Description	Comment Resolution
CDPHE	8	Table 2, page 18	Provide appropriate references for the "unrestricted release threshold" for beryllium. 0.2 micrograms/100 cm2 is not supported in 10 CFR 850 as the unrestricted release criteria for beryllium. As such, beryllium needs to be removed from this Table or an appropriate limit and reference provided. Currently, the unrestricted release criteria for beryllium appears to be non-detect, utilizing direct sampling techniques.	The release threshold has been revised to include the 10 CFR 850 language and a footnote has been added to reference release restrictions and requirements.
CDPHE	9	Section 3.1, page 19	It is indicated in item (1) that RWPs are required to perform work. Please indicate if there are Beryllium Work Permits (BWPs) that are also going to be required to perform work. If not, why not, and provide the appropriate/relevant Be requirements.	Item #1 has been expanded to address beryllium and other hazardous air pollutants so that the discussion does not focus only on radionuclides and related doses.
CDPHE	10	Section 3.2 (the actual section is Section 3.1), pages 20 & 21, Item #16	At the end of the first sentence, add "after consultation with the LRA."	Item #16 has been revised to include a provision for consultation with the LRA.
CDPHE	11	Section 3.2, page 21, fifth bullet	Delete "TSD." TSD is a RCRA term not applicable to radioactive waste disposal.	The acronym has been deleted.
CDPHE	12	Tables 3-7 and 10	The section of air monitoring techniques is specified but is not clear where this is documented or discussed.	References have been added to the applicable sections of the RSOP (i.e., Sections 3.5 and 3.6).
CDPHE	13	Section 3.4.2, page 36	There is apparently a typo in the first sentence. The last work looks it should be decontaminated rather than contaminated.	The typographical error has been corrected.
CDPHE	14	Section 3.5, page 51	If this section is intended to cover internal building vacuum/filtration systems such as the machine vacuum system in B865, then it should be modified to do so.	This section is intended to address Zones I, IA, III, III, and IV ventilation systems; therefore no modification is required.
CDPHE	15	Sections 3.6, 4, and 5	The header in these sections refers to the B707 DOP.	The header has been corrected.

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Comment Responsiveness Summary for the Final Draft of the RSOP for Facility Component Removal, Size Reduction, and Decontamination Activities

Reviewer	Comment No.	Sec./Page/ Para.	Comment Description	Comment Resolution
CDPHE	16	Section 3.6, page 53	Analysis #3 must also include concerns related to Beryllium as applicable. Air monitoring for Beryllium within and adjacent to known Beryllium buildings needs to be included as necessary during D&D and especially demolition activities.	The text has been expanded to address beryllium and other hazardous air pollutants, so that the discussion does not focus only on radionuclides and related doses.
CDPHE	17	Section 3.6, page 53	The consultative process should be explicitly defined for this activity.	The consultative process is described in the Decommissioning Program Plan (DPP) and summarized in Section 8.2 of the RSOP. Due to CDPHE and stakeholder concerns associated with activities involving removal of contaminated portions of the building shell, Section 3.8 has been revised to state that "the closure project point of contact (POC) and DOE POC will consult with the LRA POC to determine whether the contaminated portion of the shell should be removed prior to demolition. If, after reviewing the applicable survey data and considering relative risks, the closure project POC, DOE POC, and LRA POC agree that removal is the safest, most protective option, the work will be planned and executed as described in Sections 3.8.1 and 3.8.2 of this RSOP. In addition, the closure project POC and DOE POC will conduct special project status meetings as necessary to address stakeholder concerns provide the a detailed description of the activity, methods to be used, and scheduled date(s)."
CDPHE	18	Section 4.0	This section needs to specify/reference the RFETS waste management procedures that will be used, including procedures for characterizing wastes (e.g., waste analysis plan).	The applicable RFETS waste management procedures are provided in Section 4.4.
CDPHE	19	Sections 4.2.3.1 and 4.2.3.2	These sections have incorrect references to other sections of the RSOP.	The incorrect references have been corrected.

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CDPHE	20	Section 4.2.6	Please indicate if all Be suspected equipment and articles removed from suspected or known Be contaminated areas will be identified as Be waste. If sampling is to be performed to determine the appropriate disposal of equipment and articles, please provide the specific criteria and protocols for determining the difference between Be and non-Be contaminated equipment and articles, and the appropriate disposal for each. As written, this section does not provide enough information to make a proper determination. One sample does not provide sufficient information regarding possible contamination or non-contamination. The identified level of Be contamination, 0.2 micrograms/100 cm2, is not an appropriate level to identify Be vs. non-Be contamination for disposal purposes.	This section has been re-written to address the management of equipment and other items from beryllium work areas, equipment from non-beryllium work areas, and building structural material. Equipment and other items from beryllium areas will be managed as beryllium waste. Equipment and other items from non-beryllium areas, and structural material (i.e., items not regulated under 10 CFR 850) will be managed as sanitary waste if the waste is not RCRA listed or characteristic, and if beryllium concentrations are < 0.2 micrograms/100 cm2. Waste characterization is not specifically addressed in this subsection of Section 4.0 or in any other subsection. References to the D&D Characterization Protocol (DDCP) and Pre-Demolition Survey Plan (PDSP) have been added to the end of this section. These documents specify characterization requirements.
CDPHE	21	Table 14, page 65	Please provide the specific release criteria provided in 10 CFR 850 that addresses scrap metal contaminated with Beryllium. Otherwise this is not an appropriate reference for Be release criteria and should be removed, and an appropriate release criteria provided for recycling.	Since 10 CFR 850 does not regulate scrap metal, the reference to 10 CFR 850 has been removed. This table now states that the post-decontamination concentrations will be < 0.2 micrograms/100 cm2.
CDPHE	22	Section 5.0, page 67, first para.	This sentence needs to be fixed so that the unit-specific closure information "will be submitted with the closure notification letter." The unit-specific closure information needs to be submitted 30 days prior to implementation of the related closure activities, and RFETS must obtain CDPHE concurrence prior to implementing such activities.	The following text has been added to the end of the first paragraph of Section 5.0: "The LRA will have 30 days to review the unit-specific information. During this time, the consultative process will be used, as necessary, to reach agreement on the adequacy of the information provided. Closure activities will proceed with concurrence from the LRA."

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CDPHE	23	Section 5.0, page 67, second para.	It is not now appropriate to propose an option other than complete RCRA closure of units prior to building demolition. RCRA units need to be closed prior to building demolition so that the resulting demolition wastes can be characterized and managed appropriately. Demolishing a building containing an unclosed RCRA unit could potentially spread contamination and could result in the unnecessary generation of additional RCRA hazardous/mixed wastes.	Section 5.0 has been revised, as follows: "All RCRA-regulated units or portions of RCRA-regulated units located within the building footprint will be closed prior to facility demolition. Portions of units located outside the building footprint (e.g., the valve vaults and underground piping associated with the Building 374 aqueous waste treatment system) will be taken to a RCRA stable configuration during decommissioning and closed in accordance with the ER RSOP (when approved)."
CDPHE	24	Section 5.0, page 67	RFETS needs to be aware that any portions of the RCRA unit that are removed prior to submittal of required unit-specific closure information will have to meet one of the closure performance standards in order to obtain our concurrence.	Noted.
CDPHE	25	Figure 8	The first decision point must also consider whether or not the unit has treated hazardous or mixed waste.	The decision point has been revised, as requested.
CDPHE	26	Section 5.1, page 68, Clean Closure Option #1	Language in the first bullet needs to be revised as follows to be consistent with what has been approved in the B776 DOP: ". . . or if a spill did occur, it was clean up and the area was decontaminated." Additionally, verification of such decontamination will be necessary.	Clean Closure Option #1 has been revised as follows: "For units having a complete, detailed operating history, clean closure will be demonstrated when the LRA agrees that the following criteria have been 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 that releases were adequately cleaned up (i.e., 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."

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CDPHE	27	Section 5.1, page 69, Clean Closure Option #3	Verification sampling may be required (in addition to radiological surveys) for some units depending on the contaminants involved and the condition of the floor (e.g., amount of cracks, potential migration pathways, etc.). Additionally, this option needs to describe how to characterize and manage the residuals resulting from the use of abrasive techniques.	The following text has been added to Clean Closure Option #3: "Areas that do not meet the visual inspection criteria will be removed as hazardous or mixed debris. Areas that do not meet the unrestricted release criteria will be disposed of as non-hazardous radioactive waste. Residuals will be collected, characterized, packaged, and disposed in accordance with the applicable waste management procedures and requirements."
CDPHE	28	Section 6.4, page 76	Paragraph 3 states: "The CID reports the following estimated annual radiation doses from site closure activities: maximally exposed collocated worker 5.4 mrem . . ." What actual exposures have resulted to actual D&D workers? Do they exceed the CID report estimated maximum?	Section 6.4 has been expanded to include the average radiation dose to workers over the last four calendar quarters, along with the corresponding radiation dose limit.
CDPHE	29	Section 6.2, page 73	Releases to air might also include beryllium from Be contaminated buildings. This should be recognized, and included as a possibility requiring monitoring if warranted. EPA has set the community permissible exposure limit (24-hour ambient air limit) for Be at 0.01 micrograms/m3.	Section 6.2 has been expanded to include beryllium.
CDPHE	30	Section 6.3 and Table 15	Water in sumps, vaults, basements, etc. should be removed as necessary to allow completion of D&D activities to properly characterize and/or remove contamination on interior surfaces even if the water is collected prior to D&D activities, not waiting for ER to mitigate these impacts from occurring. As such, this description needs to indicate that actions will be performed immediately to prevent surface water impacts.	Table 15 has been revised to reflect CDPHE's concerns. Water will not be collected, removed, or treated during decommissioning unless required to protect workers or surface water quality. However, accumulated water will be removed, characterized, and treated (if necessary) prior to completion of decommissioning activities.
CDPHE	31	Section 6.4, page 75	This section also needs to include the worker health protective levels for Beryllium identified in 10 CFR 850 and the CBDPP, which are lower and more protective than OSHA requirements.	Section 6.4 has been expanded to include DOE Orders and 10 CFR 850 requirements.

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CDPHE	32	Section 7.0, page 79 and App. B	ARARs are still being resolved by the attorneys for the RFCA Parties, and comments on ARARs will be withheld until final ARARs are completed. This section should note the lack of agreement among the RFCA parties.	The following footnote has been added to Section 7.0: "Certain State of Colorado Radiation Control Regulations pertaining to decommissioning and environmental releases may be relevant and appropriate to building decommissioning and environmental restoration activities, particularly the cleanup of soils. The parties to RFCA are in the process of negotiating a final list. Appendix B will be modified, as appropriate, when the reach agreement on the final list."
CDPHE	33	Appendix A, page A-1	In order for the checklists to be of value, they should be completed on a set or smaller activity basis. Notification will require a detailed description of which specific activities will be addressed through an RSOP, and which would require other authorization.	The checklist provided in Appendix A will be prepared for each each activity, area, or facility, as necessary, based on the complexity and sequence of planned activities. Planned activities will be described in the notification letter.
BRMFLD	1	Global	The document lacks sufficient detail in the process of removal of subsurface components.	Sections 3.3.1, 3.3.2, and 3.6 have been expanded to address issues associated with the removal of subsurface components (e.g., run-on and run-off controls to prevent releases from IHSSs, monitoring, and related work suspension limits.
BRMFLD	2	Global	The water management section is not specific enough for identified activities.	Surface water controls will be selected and more specifically developed for individual projects in accordance with the Stormwater Pollution Prevention Plan (i.e., controls will be project-specific). As necessary, berms will be designed and inspected based on specific project hazards, location, and anticipated storm events. Design criteria will include total capacity and freeboard requirements.
BRMFLD	3	Appendix A	The Component Removal/Size Reduction Checklist and Decontamination Checklist are excellent additions to the document. The checklists will be valuable tools to track and document D&D activities. For the checklists to be all inclusive, RCRA activities should be added to the checklists.	RCRA closure activities are embodied in the component removal, size reduction, and decontamination activities described in the checklists (e.g., cerium nitrate may be used to decontaminate a tank). RCRA unit-specific closure information will be included in the notification letter.

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BRMFLD	4	Global	Broomfield's remaining concern is the exclusion of long-term stewardship from this document and other RSOP documents.	The following paragraph has been added to Section 1.0 of the RSOP: "DOE is currently considering the long-term stewardship issues associated with decommissioning and ER activities, including long-term monitoring to ensure RFCA objectives are being met."
ENVIRO-CARE	1	Global	In order to fully realize the goal of cost effectiveness for cleanup activities, it is suggested that project managers involve the disposal facility at an early stage as part of the RSOP. Such involvement should result in an overall, more cost effective cleanup. Where components are removed and material size-reduced and decontaminated in preparation for disposal, a program involving coordination with the disposal facility would likely result in cost savings for both transportation and disposal. Where situations involving decontamination versus disposal are considered, the disposal facility may also provide valuable input resulting in project cost savings.	Section 4.4 has been revised to read as follows: "Wastes generated as a result of facility component removal, size reduction, and decontamination activities will be characterized and packaged in compliance with RFETS waste management procedures, which implement treatment, storage, and disposal facility WAC and DOT packaging requirements. Treatment, storage, and disposal facilities are selected by the contractor based on periodic environmental assessments, which are performed in accordance with the requirements of the Off-Site Waste Management Program and results are documented in Off-Site Waste Management Facility Use Decisions (FUDs)."