WCH-59
Rev. 0

River Corridor
Closure Contract

DQO Summary Report for 324 & 327 Building Hot Cells D4 Project Waste Characterization

January 2006

Washington Closure Hanford

Prepared for the U.S. Department of Energy, Richland Operations Office
Office of Assistant Manager for River Corridor

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DISCLM-5.CHP (11/99)

APPROVAL PAGE

Title: DQO Summary Report for 324 & 327 Building Hot Cells D4 Project Waste Characterization

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EXECUTIVE SUMMARY

This data quality objectives (DQO) summary report provides the results of the DQO process conducted for waste characterization activities for the 324 and 327 Building hot cells decommission, deactivate, decontaminate, and demolish (D4) activities. This DQO summary report addresses the systems and processes related to the hot cells, airlocks, vaults, tanks, piping, basins, air plenums, air ducts, filters, and adjacent elements that have high dose rates, high contamination levels, and/or suspect transuranic waste, which will require nonstandard D4 techniques.

This DQO process uses information from historical files, facility inspection records, process knowledge, and other relevant sources to identify anticipated waste streams from each facility. The approach is to use existing information, as applicable, to develop a list of the contaminants of concern and to establish the bounding contaminant concentrations and waste designation information.

The existing information is used to develop the characterization requirements to support disposition of the waste materials. The characterization requirements include surveys and nondestructive assays and may also include sampling of media. The waste streams are assumed to be disposed at the Environmental Restoration Disposal Facility or other regulator-approved pathways for disposal.

Waste characterization of the areas outside of the 324 and 327 Building hot cells and the surrounding 300 Area buildings and facilities is closely related to this DQO process. There is overlap of some waste streams with the *300 Area D&D Waste Sampling and Analysis Plan* (DOE-RL 2005a). Final closure of the site is outside the scope of these waste characterization efforts and will be performed during subsequent efforts.

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ACRONYMS

AA	alternative action
ACL	above cleanup level
ACM	asbestos-containing material
AEA	alpha energy analysis
BTEX	benzene, toluene, ethylbenzene, and xylene
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
COC	contaminant of concern
COPC	contaminant of potential concern
CWC	Central Waste Complex
D&D	decontamination and decommissioning
D4	decommission, deactivate, decontaminate, and demolish
dpm	disintegrations per minute
DQO	data quality objective
DS	decision statement
EBR-II	Experimental Breeder Reactor
Ecology	Washington State Department of Ecology
EDL	Engineering Development Laboratory
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ETF	Effluent Treatment Facility
FFTF	Fast Flux Test Facility
FRG	Federal Republic of Germany
GEA	gamma energy analysis
GTCC	greater than Class "C"
HEPA	high-efficiency particulate air
HLLW	high-level liquid waste
HLV	high-level vault
HLW	high-level waste
ISOCS	In Situ Object Counting System
IX	ion exchange
LDR	land disposal restriction
LLV	low-level vault
LLW	low-level waste
MDA	minimum detectable activity
MOTA	materials open test assemblies
NDA	nondestructive assay
NOC	notice of construction
NRC	U.S. Nuclear Regulatory Commission
NWVP	Nuclear Waste Vitrification Project
OU	operable unit
PCB	polychlorinated biphenyl
PLM	polarized light microscopy
ppm	parts per million
PSQ	principal study question
PUREX	Plutonium-Uranium Extraction (Plant)
RCRA	*Resource Conservation and Recovery Act of 1976*

Acronyms

RCT	radiological control technician
REC	radiochemical engineering cells
RLFCM	radioactive liquid-fed ceramic melter
RLWS	radioactive liquid waste system
SAP	sampling and analysis plan
SAR	safety analysis report
SERF	Special Environment Radiometallurgy Facility
SMF	Shielded Material Facility
SNF	spent nuclear fuel
SVOA	semi-volatile organic analyte
TCLP	toxicity characteristic leaching procedure
TDS	total dissolved solids
TOC	total organic carbon
TOX	total organic halides
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TSS	total suspended solids
TRU	transuranic
UHC	underlying hazardous constituent
VOA	volatile organic analyte
WAC	*Washington Administrative Code*
WCH	Washington Closure Hanford
WS	waste stream
WSEP	Waste Solidification Engineering Prototype Program
ZVDP	Zeolite Vitrification Demonstration Project

METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If You Know	*Multiply By*	*To Get*	*If You Know*	*Multiply By*	*To Get*
Length			**Length**		
Inches	25.4	millimeters	millimeters	0.039	inches
Inches	2.54	centimeters	centimeters	0.394	inches
Feet	0.305	meters	meters	3.281	feet
Yards	0.914	meters	meters	1.094	yards
Miles	1.609	kilometers	kilometers	0.621	miles
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.093	sq. meters	sq. meters	10.76	sq. feet
sq. yards	0.836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.6	sq. kilometers	sq. kilometers	0.4	sq. miles
Acres	0.405	hectares	hectares	2.47	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	grams	grams	0.035	ounces
pounds	0.454	kilograms	kilograms	2.205	pounds
Ton	0.907	metric ton	metric ton	1.102	ton
Volume			**Volume**		
teaspoons	5	milliliters	milliliters	0.033	fluid ounces
tablespoons	15	milliliters	liters	2.1	pints
fluid ounces	30	milliliters	liters	1.057	quarts
Cups	0.24	liters	liters	0.264	gallons
Pints	0.47	liters	cubic meters	35.315	cubic feet
Quarts	0.95	liters	cubic meters	1.308	cubic yards
Gallons	3.8	liters			
cubic feet	0.028	cubic meters			
cubic yards	0.765	cubic meters			
Temperature			**Temperature**		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius	Celsius	multiply by 9/5, then add 32	Fahrenheit
Radioactivity			**Radioactivity**		
picocuries	37	millibecquerel	millibecquerels	0.027	picocuries

1.0 STEP 1 – STATE THE PROBLEM

The purpose of data quality objective (DQO) Step 1 is to clearly and concisely state the problem and to define the conceptual site model to ensure that the focus of the study will be unambiguous.

1.1 INTRODUCTION

This DQO summary report provides the results of the DQO process conducted for waste characterization activities for the 324 and 327 Building hot cells decommission, deactivate, decontaminate, and demolish (D4) activities. This DQO summary report addresses the systems and processes related to the hot cells, airlocks, vaults, tanks, piping, basins, air plenums, air ducts, filters, and adjacent elements that have high dose rates, high contamination levels, and/or suspect transuranic (TRU) waste, which will require nonstandard D4 activities.

The *300 Area D&D Waste Sampling and Analysis Plan* (D&D SAP) (DOE-RL 2005a), which was designed for waste characterization of the surrounding 300 Area buildings and facilities, is closely related to this DQO process and there is overlap of waste streams (WSs). Final closure of the site will be performed during subsequent efforts.

This DQO process uses information from historical files, facility inspection records, process knowledge, and other relevant sources to identify anticipated WSs from each facility. The approach is to use existing information wherever possible to develop a list of the contaminants of concern (COCs) and to establish the bounding contaminant concentrations and waste designation information.

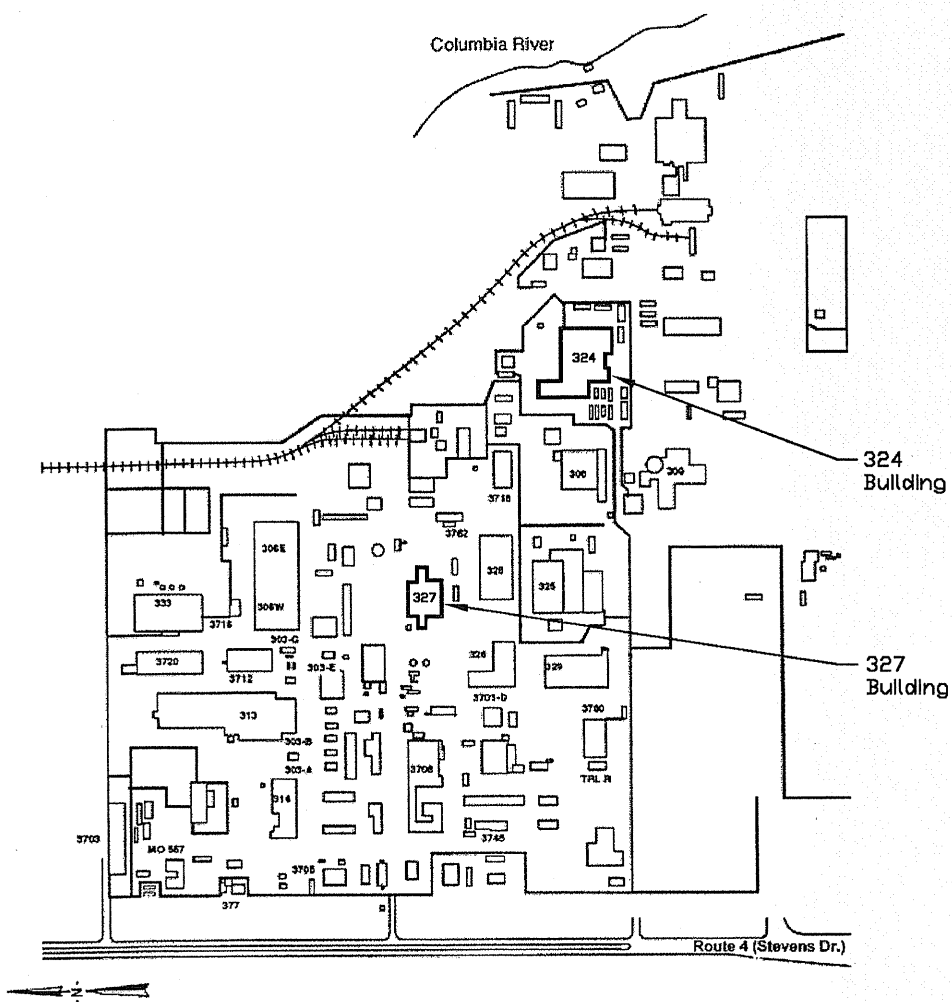
If needed, samples of specific waste media will be collected. Existing information is used to develop focused, anticipated sampling and analysis needs to support disposition of the waste materials. The WSs are assumed to be disposed at the Environmental Restoration Disposal Facility (ERDF), the Effluent Treatment Facility (ETF), or other regulator-approved pathways for disposal.

1.2 OBJECTIVE

This DQO process supports waste disposition associated with D4 activities in the 300 Area (Figure 1-1). This DQO process also supports waste designation and disposal activities of the 324 and 327 Building hot cells, airlocks, vaults, tanks, piping, basins, air plenums, air ducts, filters, and adjacent elements that have high dose rates, high contamination levels, and/or suspect TRU, which will require nonstandard D4 activities at the 324 and 327 Buildings. The primary objective of this DQO process is to develop appropriate information for characterizing the WSs within the scope of the D4 Project and to dispose of the waste in a safe, appropriate, and cost-effective manner.

The primary disposal option for the demolition waste is the Hanford Site's ERDF or other regulatory approved pathway for disposal.

Figure 1-1. 300 Area – Showing the 324 and 327 Buildings.



The information in this DQO summary report identifies the WSs, COCs, existing waste characterization, acceptability of existing data, and additional information needed to properly characterize the waste and to select the appropriate disposal option for waste generated during future activities. If additional information is needed through sampling and analysis, the sampling design and analytical methods are proposed that are needed to characterize the waste materials.

The results presented in this DQO summary report will be used to develop a 324 and 327 Building hot cell sampling and analysis plan (SAP) (hot cell SAP) that will contain the sampling and analysis requirements to characterize the demolition debris and associated wastes. The hot cell SAP may be incorporated as an appendix to the existing D&D SAP (DOE-RL 2005a).

Finally, closure of the facility sites is not within the scope of this DQO summary report or the hot cell SAP. Closure of the facility sites will be handled in subsequent documentation prepared for that purpose.

1.3 PROJECT MILESTONES AND DATA QUALITY OBJECTIVE TEAM MEMBERS

Tables 1-1 and 1-2 identify each of the individual members of the DQO team and the key decision makers. Some DQO members may or may not have participated directly in the planning sessions but offered expertise, behind the scenes, throughout the process. These tables also identify the organization that each DQO team member or key decision maker represents.

Table 1-1. Data Quality Objective Team Members. (2 Pages)

Name	Organization	Role and Responsibility
Brad Smith	WCH	Project Manager
Ralph Wilson	WCH	Senior Technical Lead
Steve Marske	CH2M Hill	Characterization Specialist
Duane Jacques	WCH	D4 Characterization Lead
Jason Adler	WCH	324/327 Characterization Lead
Jim Golden	WCH	Environmental Project Lead
Bill Hoober	WCH	Project Engineering
Dave Jenkins	WCH	Project Engineering
Vince King	EnergX	Project Engineering
Dave Rasmussen	EnergX	Environmental Engineer
Bob Hynes	WCH	Waste Operations
Jan Haan	WCH	Radiological Engineering
Rich Weiss	WCH	Sampling/Data Management

Table 1-1. Data Quality Objective Team Members. (2 Pages)

Name	Organization	Role and Responsibility
Tim Lee	WCH	DQO Support
Roger Ovink	WCH	DQO Facilitator

D4 = decommission, deactivate, decontaminate, and demolish
DQO = data quality objective
CH2M Hill = subcontractor for WCH
EnergX = subcontractor for WCH
WCH = Washington Closure Hanford

Table 1-2. Data Quality Objective Key Decision Makers.

Name	Organization
Rick Bond	Washington State Department of Ecology
Alicia Boyd	U.S. Environmental Protection Agency
Rudy Guercia	U.S. Department of Energy

The project milestones and regulatory drivers for the 324 and 327 Building D4 Project are shown in Table 1-3.

Table 1-3. Project Schedule.

Milestone	Due Date	Regulatory Driver
Data quality objective summary report	February 1, 2006	None
Complete disposition of surplus facilities, including 324 and 327	September 30, 2010	Tri-Party Agreement[a] Milestone M-94-03

[a] *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1989).

1.4 PROJECT ASSUMPTIONS AND ISSUES

The project assumptions and issues described below are based on project team discussions.

1.4.1 Project Assumptions

1. Portions of the 324 Facility will be closed in accordance with the *324 Building Radiochemical Engineering Cells, High-Level Vault, Low-Level Vault, and Associated Areas Closure Plan* (DOE-RL 2005b). The closure activities will be performed in parallel with the complete disposition and demolition of the 324 Building under *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) requirements. The 327 Facility will also be closed under CERCLA requirements. An engineering evaluation/ cost analysis for closure options and an action memorandum for both facilities are currently being prepared and will be completed in the spring of 2006.

2. Initial planning for deactivation of the 324 and 327 Buildings began in 1996. Removal of the 324 Building's radiochemical engineering cells (REC) B-cell mixed waste and excess equipment was completed in 2001 to meet the requirements of *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1989) Milestone M-89-02. The closure of the mixed waste units in the 324 Building covered by Tri-Party Agreement Milestone M-89-00 will be performed by September 30, 2010, in parallel with 324 Building D4 activities covered by Tri-Party Agreement Milestone M-094-03. The 324 and 327 Buildings' past laboratory and research and development activities were phased out in 1997. Equipment and material removal activities and hot cell cleanout deactivation activities have been taking place in portions of the buildings from 1997 through 2005. Surveillance and maintenance activities have continued in parallel with deactivation activities as needed to meet facility safety and regulatory requirements.

3. Wastes from the 324 and 327 Buildings will be disposed at the ERDF or other regulator-approved pathways for disposal.

4. Regulated wastes (e.g., mercury-containing switches, polychlorinated biphenyl [PCB] light ballasts, and asbestos-containing material) may be generated during demolition and will be disposed as required.

5. For the purpose of this DQO summary report, the scope includes all materials and structures associated with the hot cells, airlocks, vaults, tanks, piping, basins, air plenums, air ducts, filters, and adjacent elements that have high dose rates, high contamination levels, and/or suspect TRU. Associated engineered structures, surrounding building, and concrete within the facility footprint not included in this DQO summary report will be characterized and disposed in accordance with the D&D SAP (DOE-RL 2005a).

6. The information generated during the D4 activities will be transferred to the Field Remediation Closure Project for cleanup and final closure. Contaminated soil and debris (including utilities, process lines, and other structures) will be stabilized before transfer to the Field Remediation Closure Project, and data will be provided to aid planning.

7. Extensive historical characterization data associated with the waste materials in the 324 and 327 Buildings are available. The data are adequate to establish the primary sources of contamination.

1.4.2 Global Issues

On December 14, 2005, a global issues meeting was conducted with the U.S. Department of Energy, Richland Operations Office; the Washington State Department of Ecology (Ecology); and EPA. No global issues were identified.

On December 20, 2005, a tour of the 324 and 327 Building hot cells and related elements was conducted with Ecology and EPA. No global issues were identified.

1.4.3 Project-Specific Technical Issues and Resolutions

Several technical issues were identified. The issues and resolutions are as follows:

1. **Boundaries of this DQO process versus boundaries of the 300 Area D&D SAP (DOE-RL 2005a).** Many of the areas around and under facilities within the scope of this DQO summary report overlap parts of the general D&D SAP (DOE-RL 2005a).

   Resolution: On November 14, 2005, members of the project team met to define the boundaries of this DQO scope. In general, this DQO summary report addresses the systems and processes related to the hot cells, airlocks, vaults, tanks, piping, basins, air plenums, air ducts, filters, and adjacent elements that have high dose rates, high contamination levels, and/or suspect TRU waste, which will require nonstandard D4 activities. The specific elements of this boundary are summarized in meeting minutes (WCH 2005). It is satisfactory that the WSs overlap with the existing D&D SAP, but gaps are not acceptable. Also, this DQO process should adopt and be consistent with the WS nomenclature and numbering that was used in the D&D SAP.

2. **Underground utilities and process lines.** The areas around and under facilities may contain utilities, process lines, and contaminated soil that are tied to facilities not included in the scope of this report. To what extent should these materials be included in remediation of the 324 and 327 Facilities, and how will they be characterized?

   Resolution: Utilities and process lines associated with facilities that are outside the scope of this DQO summary report but that are within the 324 and 327 Building footprints will be considered part of the scope of the D&D SAP (DOE-RL 2005a). Utilities, process lines, and contaminated soil associated with facilities outside the scope of D4 Project activities that require removal and disposal will be characterized by the Field Remediation Project.

3. **Painted surfaces containing *Resource Conservation and Recovery Act of 1976* (RCRA) metals and PCBs.** The majority of the cells and equipment surfaces in the 324 and 327 Buildings are finished with paint that may contain regulated amounts of lead, chromium, and/or PCBs.

   Resolution: The characterization process, conducted in accordance with the D&D SAP (DOE-RL 2005a), for the non-hot cell areas addresses dried paints and primers within the 324 and 327 Buildings. Therefore, this DQO summary report does not address dried paint and primer associated with the hot cells. As required, Waste Operations shall use existing site paint characterization data and any new data generated from the D&D SAP characterization process for the characterization of any paints associated with the hot cells.

4. **Used oils, solvents, and liquids with heavy organic content.** Because of the need to dilute liquid sample extract for organics before injecting it into a gas chromatograph or gas chromatograph/mass spectrometer for analysis, problems may occur with respect to detection limits being higher than the target compound regulatory levels. In the event that this occurs, it may not be possible to determine conclusively from the laboratory data alone that a waste is in fact a dangerous waste.

Resolution: No COCs will be eliminated from the target list without adequate process knowledge or other appropriate data or information.

1.5 EXISTING REFERENCES

The documents identified in Table 1-4 were used to support the description, process history, deactivation activities, and previous sampling/analysis results associated with the facilities addressed in this DQO process.

Table 1-4. Existing Historical References. (4 Pages)

Reference	Summary
Waste Designation Process for 324 Building Radiochemistry Engineering Cells and 327 Building Hot Cells, HNF-3590, Rev. 1 (B&W 1999d)	Describes the waste designation approach for the 324/327 Building hot cells special-case waste, including the waste description and designation and basis for waste designations and whether the designation is based on process knowledge or analytical data.
Radiological Profile Methodology for Remote-Handled Transuranic Mixed Waste from 324 Facility B-Cell, HNF-6572, Rev. 1 (FH 2000c)	Covers the profiling of radionuclide constituents present in TRU-M waste generated during deactivation activities in B-cell in the 324 Building. It does not address other issues associated with closure of B-cell.
Radiological Characterization of Waste in the 324 Facility REC Airlock Pipe Trench, HNF-7886, Rev. 1 (FH 2001b)	Radiological characterization of dunnage and residue waste in the 324 Building airlock pipe trench (prior to trench clean out). Includes a process history summary for the REC hot cells.
Data Analysis and Radionuclide Scaling Factor for the B-Cell Waste Stream, HNF-4904, Rev. 0-A (B&W 1999c)	Assessment of the quantitative data on the radionuclide constituents present in rack dunnage waste generated during deactivation activities in B-cell of the 324 Building.
Revised Methodology for Estimating the Radionuclide Profile of HN-200 Grout Containers, HNF-4905, Rev. 1 (FH 2000d)	Covers the profiling of radionuclide constituents present in HN-200 grout containers loaded with rack dunnage waste generated during deactivation activities in B-cell in the 324 Building.
324 Building B-Cell Characterization: Assay of Maximum Dispersible Radioactivity, HNF-4842, Rev. 0 (FDN 1999)	Comparison study of the actual radionuclide inventory with the SAR limits for 324 Building B-cell using radiation scans and a model to be able to convert measured dose rate to a maximum dispersible radionuclide inventory.
324 Building Spent Nuclear Fuel Handling History from Characterization to Packaging for Transfer to Interim Storage Area (OCRWM), HNF-8897, Rev. 0 (FH 2002b)	Evaluation of REC stored spent nuclear fuel prior to it being removed and sent for interim storage. Describes the fuel-handling processes performed in the REC cells.
Radiological Characterization of the Shielded Material Facility (SMF), CP-14484, Rev. 0 (FH 2003c)	Provides an analysis of the radioactive materials present in the 324 Building's SMF
Revised Radiological Characterization Methods for 324 Facility Compacted and Non-Compacted Radioactive Waste, HNF-8906, Rev. 1 (FH 2002e)	Covers multiple topics associated with the compacted and non-compacted LLW and TRU waste from the routine building operations in the 324 Building.
324 Building Technical Safety Requirements, HNF-12465, Rev. 0B (FH 2004)	Use and application of technical safety requirements for the 324 Building.

Table 1-4. Existing Historical References. (4 Pages)

Reference	Summary
324 Building Physical and Radiological Characterization Study, HNF-3434, Rev. 0 (B&W 1998a)	Tables summarizing the radiological residual contamination for specific areas. Provides a resource for quick reference of the known radiological and physical characteristics of the 324 Building that can be useful for deactivation of the building and establishing radiological controls for workers.
Past Practices Technical Characterization Study – 300 Area, Section 45.0, "The 324 Waste Technology Engineering Laboratory," and Section 36.0, "The 327 Radiometallurgy Building," WHC-MR-0388 (WHC 1992)	Brief description of 324 and 327 Buildings, their process histories, and building missions.
Engineering Study for Materials Open Test Assembly (MOTA)/Shielded Materials Facility (SMF) South Cell Waste Removal, PNNL-14034 (PNNL 2002)	Provides information on waste inventories in SMF south cell and path forward options for waste packaging and transport.
Characterization of the 618-11 Solid Waste Burial Ground, Disposed Wastes, and Description of the Waste Generating Facilities, HNF-EP-0649, Rev. 0 (FH 1997)	Describes the solid waste that was generated and disposed from the 324/327 Buildings.
327 Building Physical and Radiological Characterization Study, HNF-3435, Rev. 0 (FH 1998a)	Documented study that created a baseline of physical and radiological conditions in the 327 Building. The intent was to do an annual update to keep data on current conditions available.
Revised Radiological Characterization of 327 Facility Waste, HNF-10707, Rev. 0 (FH 2002f)	Radiological characterization of drum waste generated during routine building operations in the canyon of the 327 Facility.
327 Building Hot Cells Characterization Plan, HNF-10230, Rev. 0 (FH 2002c)	Provides the DQO and a characterization plan to gather sufficient radiological and chemical data to provide a conservative waste designation for the 327 Building hot cells.
327 Building Basis for Interim Operation (BIO), HNF-4667, Rev. 1 (FH 2003a)	Identifies and analyzes hazards associated with the stabilization and deactivation of 327 Building.
Radiological Characterization of the HLV Waste Treatment Skid in the 324 Facility, HNF-7699, Rev. 0 (FH 2001c)	Provides characterization data of the HLV waste treatment skid.
Data Quality Objectives Summary Report for D&D Waste Characterization of the 300 Area Buildings, BHI-01750, Rev. 0 (BHI 2004a)	Provides DQOs for characterizing waste generated during D&D of 300 Area facilities.
324/327 Facilities Special Case Waste Agreement and Disposition Alternatives Analysis, HNF-1730, Rev. 2 (B&W 1999b)	Describes the waste characteristics, packaging, transportation, and special storage requirements for special-case waste streams from the 324/347 Facilities.
324 Building Radiochemical Engineering Cells, High-Level Vault, Low-Level Vault, and Associated Areas Closure Plan, DOE/RL-96-73, Rev. 2 (DOE-RL 2005b)	Provides information and describes closure plan activities and strategies.
A History of Major Hanford Operations Involving Radioactive Material, PNL-6964 (PNL 1989)	Contains historical information on radioactive material operations at the Hanford Site.

Table 1-4. Existing Historical References. (4 Pages)

Reference	Summary
324 Building Basis for Interim Operation (BIO), HNF-12055, Rev. 0C (FH 2005a)	Identifies and analyzes hazards associated with the stabilization and deactivation of 324 Building.
Technical Basis for Internal Dosimetry in the 300 Area Facility Stabilization Project, HNF-3259, Rev. 0 (B&W 1998c)	Describes radiological areas and radionuclide inventory inside areas of the 324 Facility in support of internal dosimetry.
Waste Designation – Sylvania Deluxe GL Fluorescent Lamps, CCN 0518087 (BHI 2000)	Waste designation for fluorescent lights.
Waste Designation – Elemental Mercury, CCN 0551610 (BHI 2003a)	Waste designation for elemental mercury.
Waste Designation – High Pressure Sodium Lamps, CCN 0555637 (BHI 2003b)	Waste designation for high-pressure sodium lamps.
Waste Designation - Maintenance Shop PCB Light Ballasts (PIN #100N-03-0029), CCN 0557038 (BHI 2004b)	Waste designation for light ballasts containing PCBs.
Radioactive Air Emissions Notice of Construction for Deactivation Activities at the 324 Building, DOE/RL-2000-05, Rev. 1 (DOE-RL 2001)	The 324 Building deactivation NOC application.
Radioactive Air Emissions Notice of Construction for Deactivation of the 327 Building, DOE/RL-2002-08, Rev. 1 (DOE-RL 2002)	The 327 Building deactivation NOC application.
Remedial Design Report/Remedial Action Work Plan for the 300 Area, DOE/RL-2001-47, Rev. 1 (DOE-RL 2004b)	Describes the design and the implementation of the required remedial action processes for the 300-FF-2 OU.
300-FF-2 Operable Unit Remedial Action Sampling and Analysis Plan, DOE/RL-2001-48, Rev. 1 (DOE-RL 2004a)	Presents the rationale and strategy for sampling and analysis activities to support remedial actions at a subset of waste sites in the 300-FF-2 OU and 618-4 Burial Ground.
Project Management Plan f or the 300 Area Special-Case Waste, HNF-5068, Rev. 1A (FH 2001a)	Culmination of information developed during disposition analyses for the 324, 325, and 327 Buildings. Satisfies the requirements for the Tri-Party Agreement Interim Milestone M-92-13.
324/327 Building Stabilization/Deactivation Project Work Management Plan, HNF-IP-1289, Rev. 3 (FH 2000b)	Includes Appendix B – 324 Building Closure, Appendix C – 324 Building Engineering Study, Appendix D – 324 Building Characterization Study, Appendix E – 327 Building Characterization Study.
324 Calculation Notebook, HNF-4608, Rev. 0 (FH 2000a)	Provides calculations on the accident analysis for the 324 Building SAR.
324 Building Hazard Baseline Document, HNF-4606, Rev. 0 (B&W 1999a)	Identifies the hazards of the 324 Building.
324 Bldg. Deactivation Project Authorization Agreement, HNF-5810, Rev. 2 (FH 2002a)	This agreement applies to the scope of work authorized by the current 324 Building deactivation authorization envelope, as defined in this document.

Table 1-4. Existing Historical References. (4 Pages)

Reference	Summary
324/327 Facilities Environmental Effluent Specifications, HNF-3444, Rev. 4 (FH 2005b)	Provides technical specifications that address the requirements for the 324/327 Buildings undergoing deactivation activities.
Criteria for Replacing the A-Frame HEPA Filters in the 324 Building, HNF-3623, Rev. 0 (B&W 1998b)	Establishes criteria for performing future A-frame filter replacement.
327 Building Hot Cell Characterization and Waste Designation, HNF-16627, Rev. 0 (FH 2003b)	Characterization and waste designation report that applies specifically to "G" and "H" hot cells in the 327 Building.
327 Building Procedure, HW-29460 (GE 1956)	Provides instructions for safely handling chemicals and hazards in the 327 Building laboratories.

D&D = decontamination and decommissioning
DQO = data quality objective
HLV = high-level vault
LLW = low-level waste
NOC = notice of construction
OU = operable unit
PCB = polychlorinated biphenyl
REC = radiochemical engineering cells
SAR = safety analysis report
SMF = Shielded Material Facility
Tri-Party Agreement = *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989)
TRU = transuranic

1.6 FACILITY DESCRIPTIONS

The following subsections include a description of the 324 and 327 Facilities.

1.6.1 324 Building Description

Construction of the 324 Building began in 1964 and was completed in 1965. The 324 Building is a substantial concrete and steel structure. The building has a partial basement and first, second, and partial third floors surrounding the engineering hot cell complex. The foundation structure is poured-in-place, steel-reinforced concrete. The 324 Building and components are depicted in Figures 1-2, 1-3, 1-4, 1-5, 1-6, and 1-7.

The 324 Building is comprised of four primary work areas: the RECs, the Shielded Material Facility (SMF), the Engineering Development Laboratory (EDL)-101/102, and EDL-146. The REC, SMF, and related equipment are the primary areas addressed in the scope of this DQO summary report.

Figure 1-2. Cut-Away View of the 324 Building Showing the High-Level Vault, Low-Level Vault, and the Radiochemical Engineering Cells.

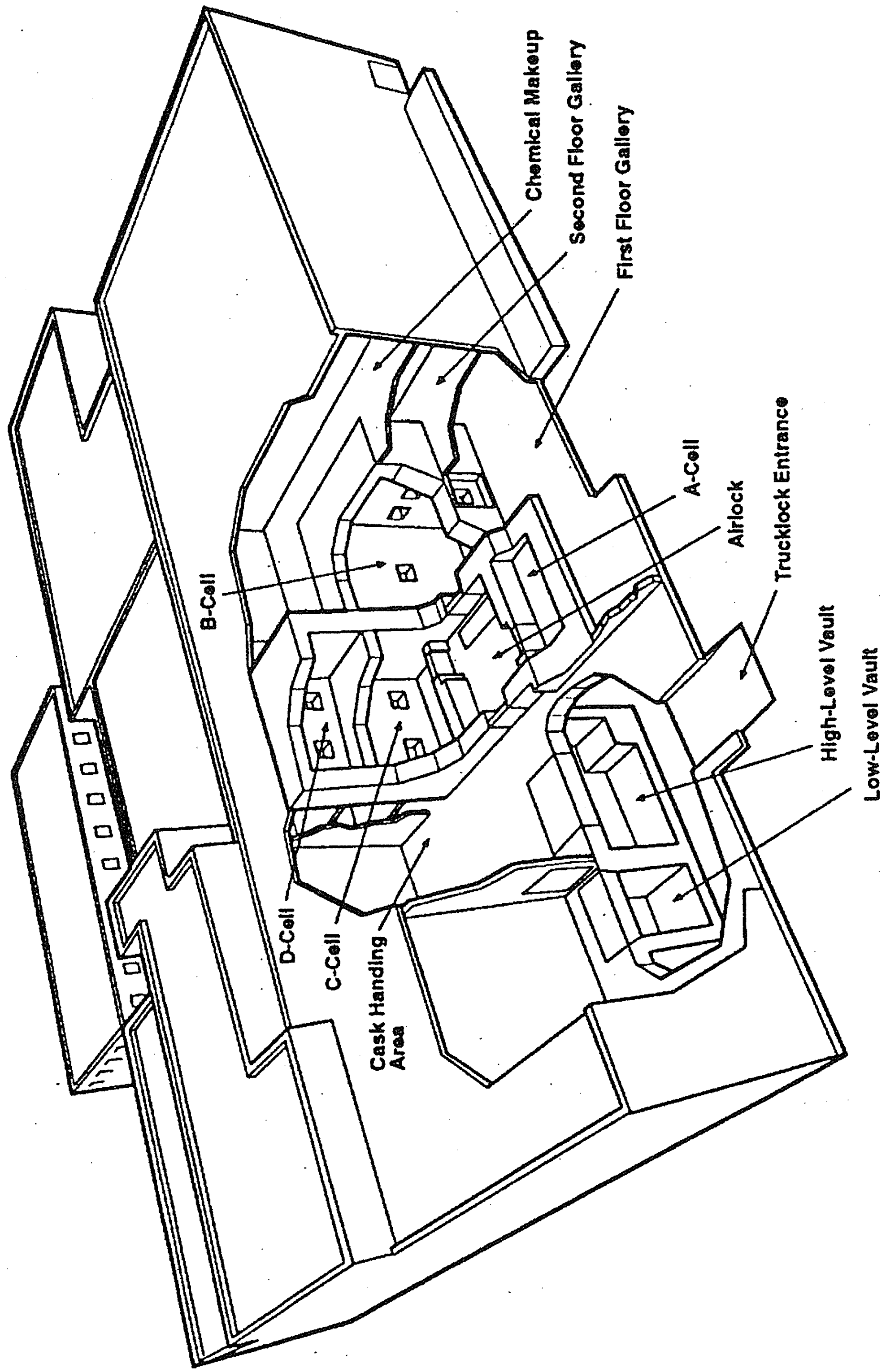


Figure 1-3. 324 Building Basement Floor Plan.

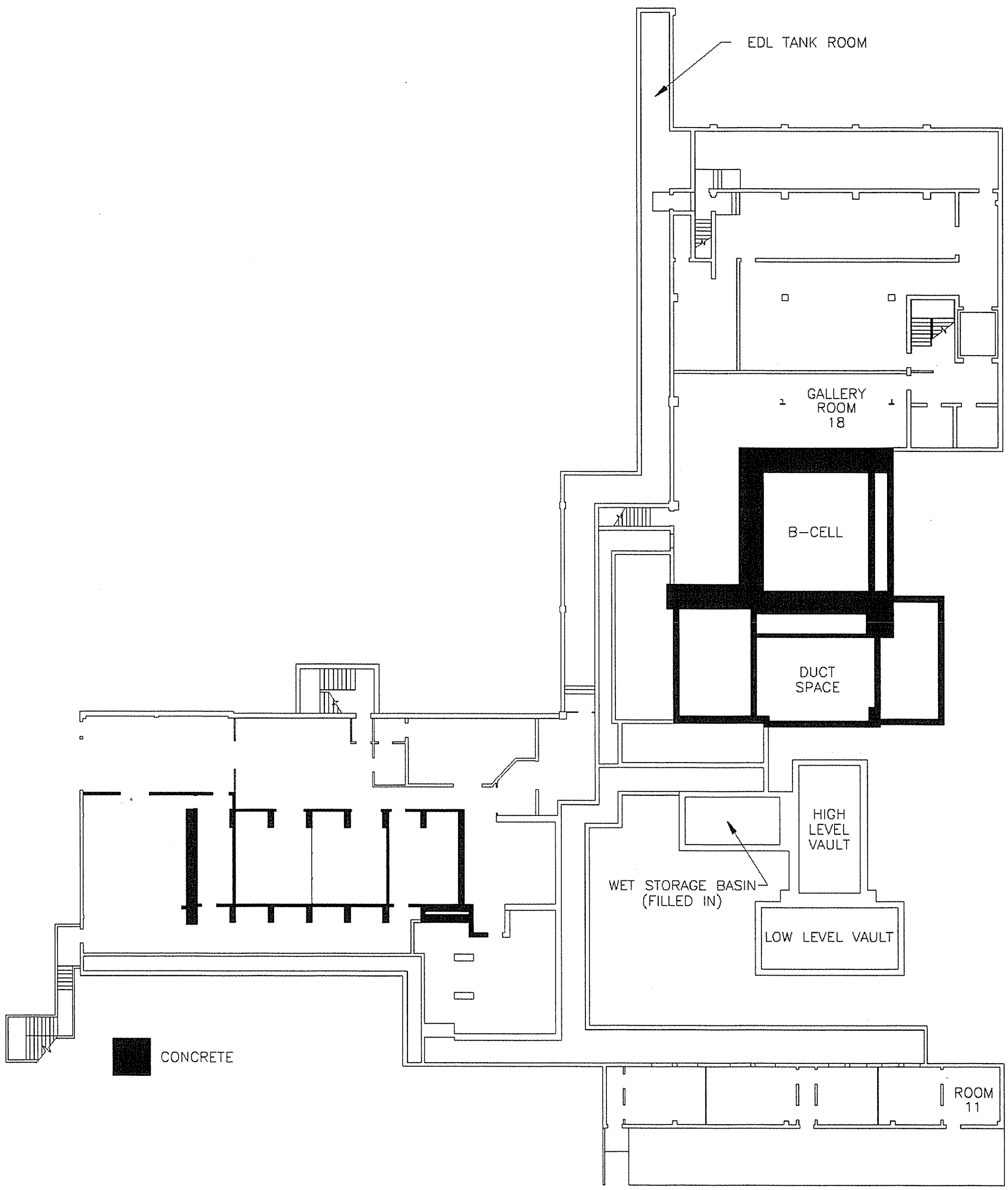


Figure 1-4. 324 Building First Floor Plan.

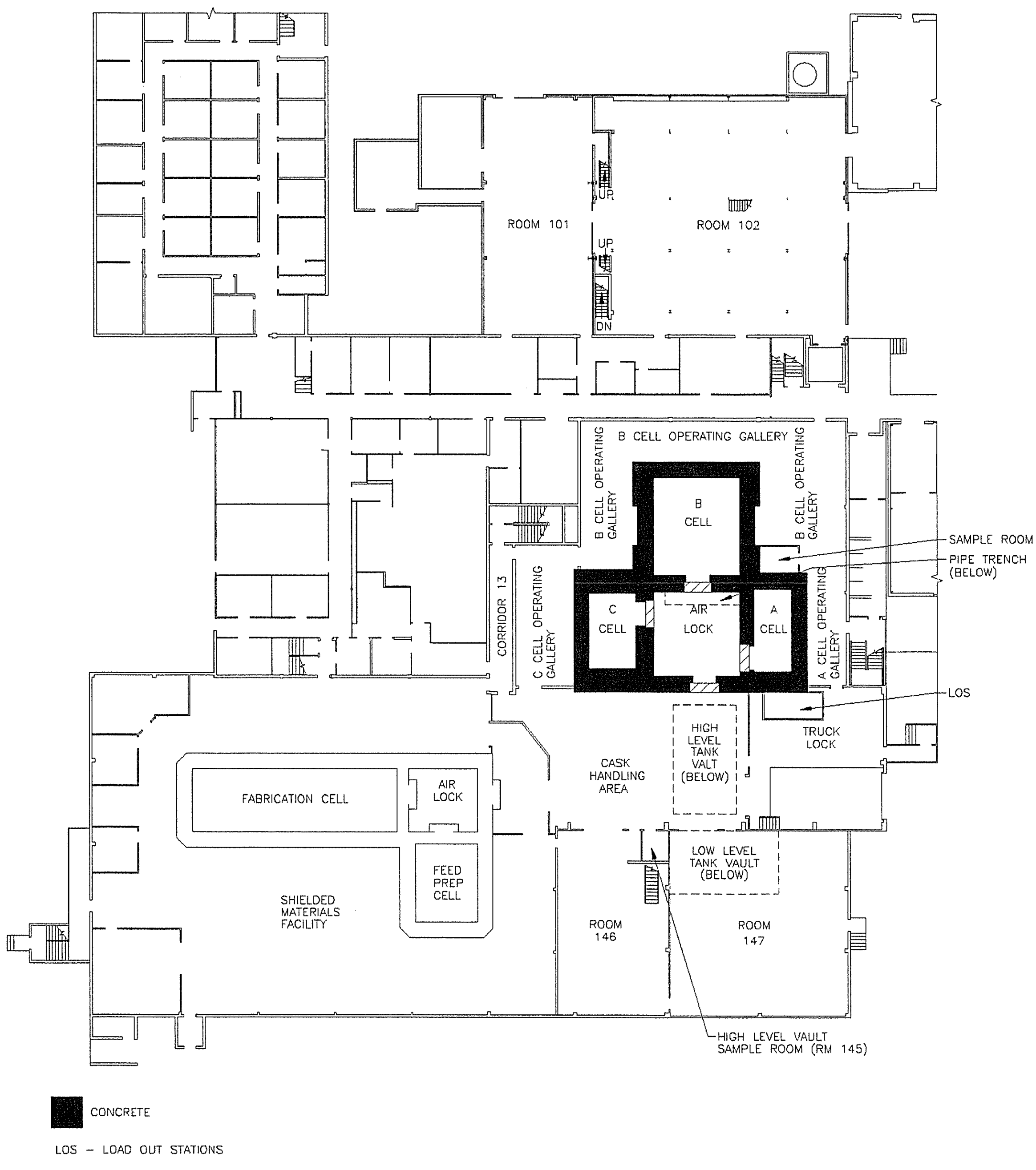


Figure 1-5. 324 Building Second Floor Plan.

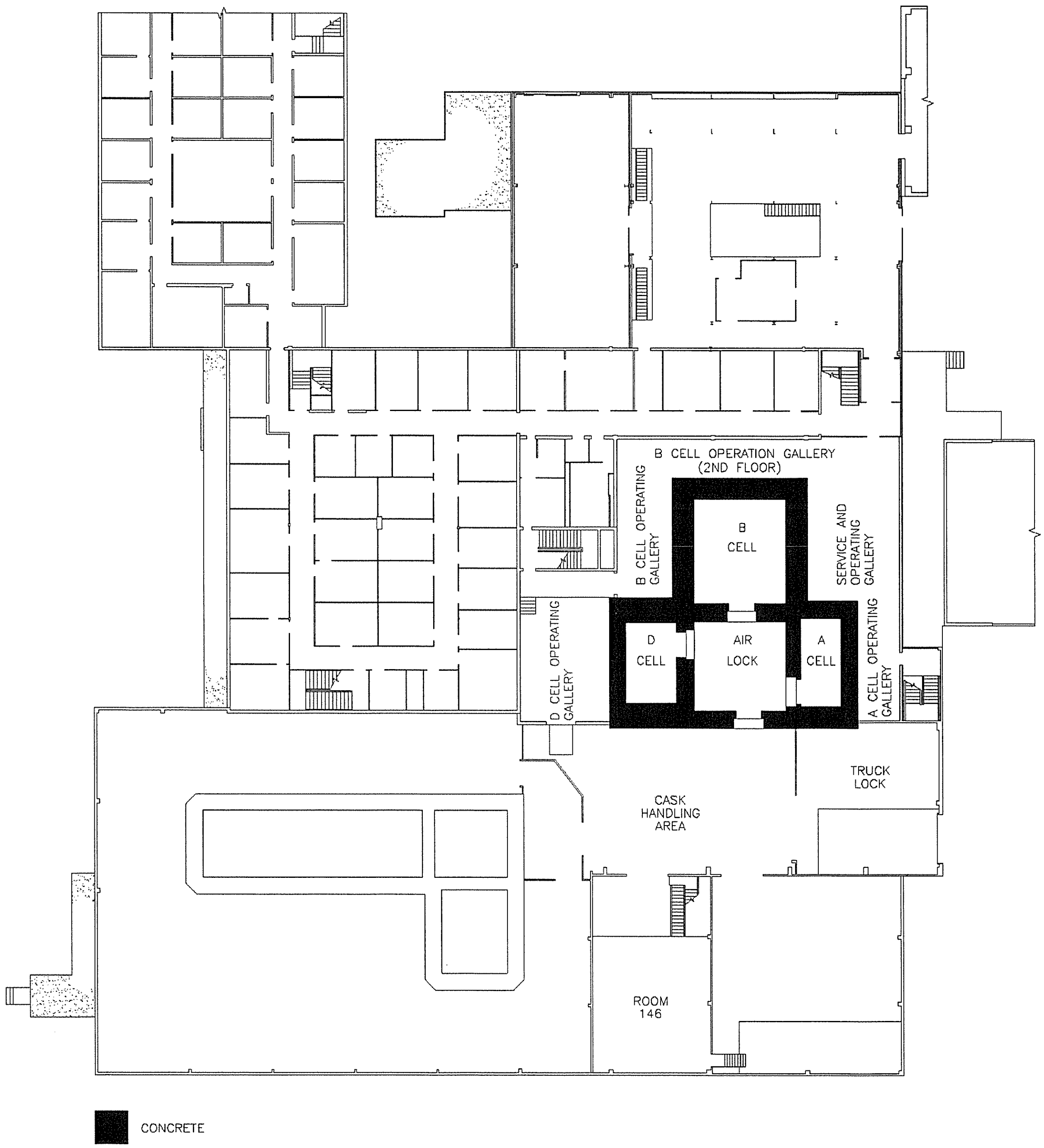


Figure 1-6. 324 Building Third Floor Plan.

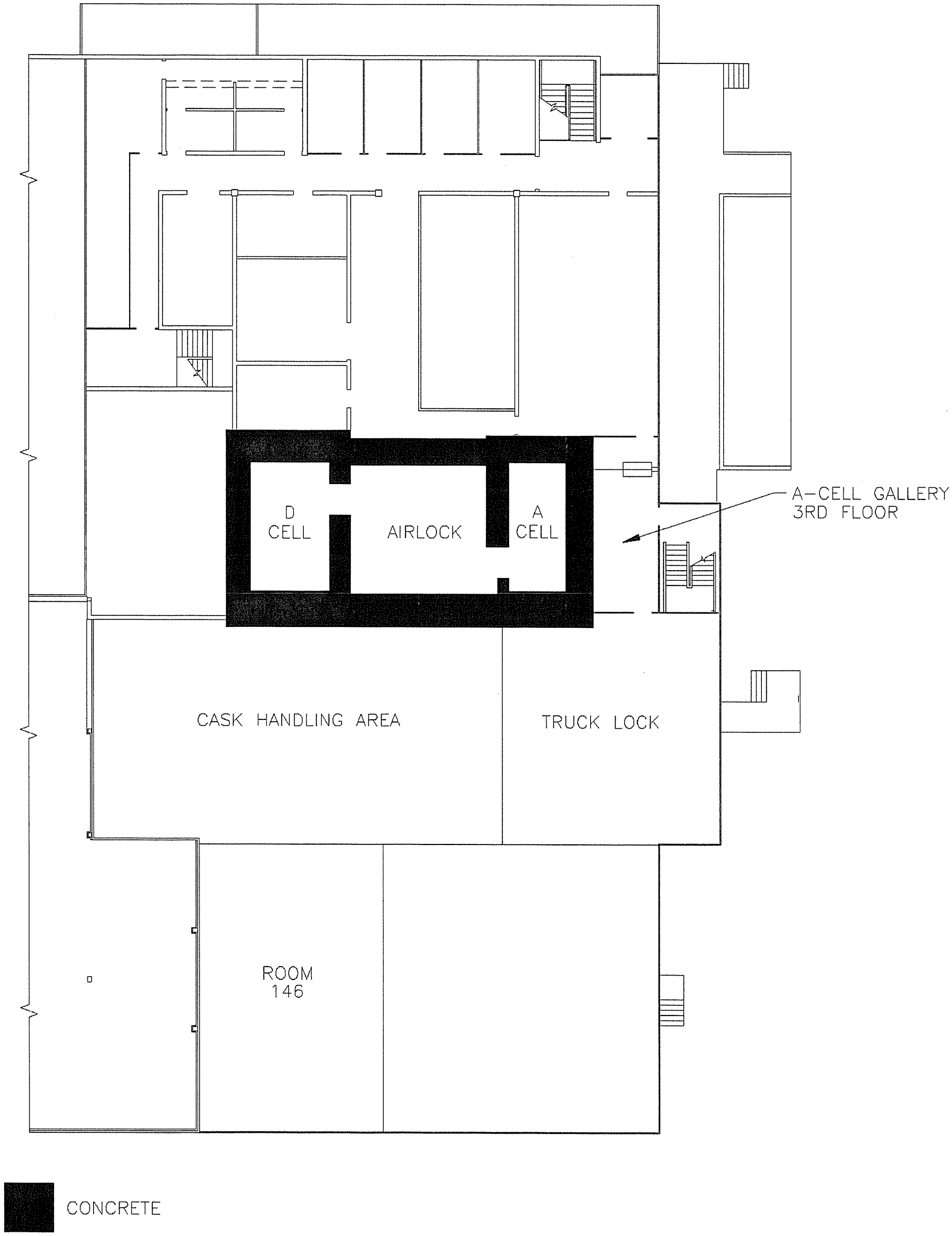
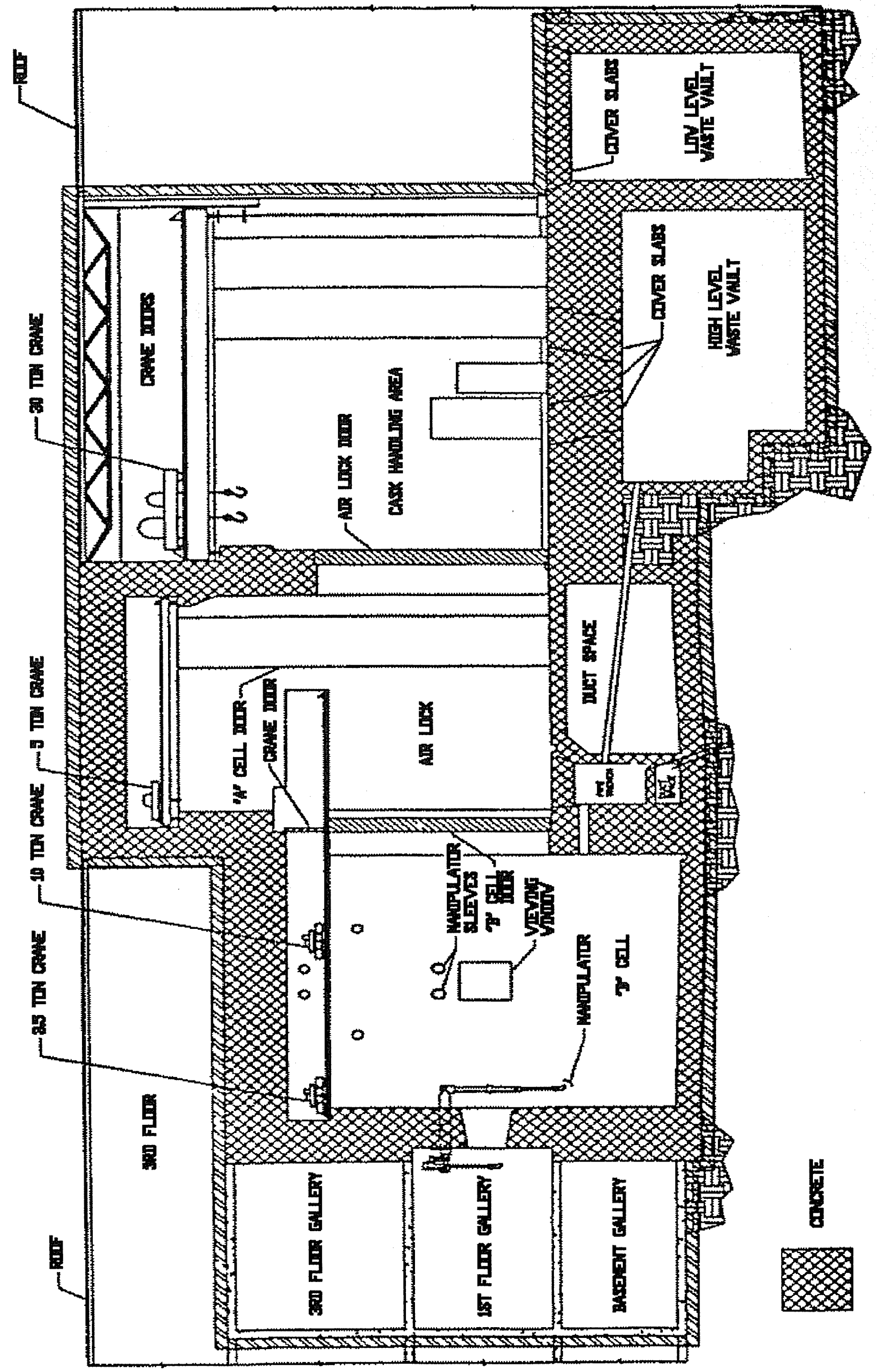


Figure 1-7. 324 Building Cross-Section Through the High-Level Vault, Low-Level Vault, Airlock, and B-Cell.



The four REC hot cells (A-cell, B-cell, C-cell, and D-cell) surround the REC airlock cell, located at the junction of the T-shaped complex. Related facilities to the REC include the high-level vault (HLV), the low-level vault (LLV), an associated sample room, wet basin (filled in), and storage casks. The two SMF hot cells are adjacent to the SMF airlock cell, located at the junction of the L-shaped complex. The airlocks function primarily as a transition zone and a ventilation barrier for movement of radioactive materials in shielded packages between the unshielded areas and the shielded hot cells.

The remainder of the 324 Building consists of offices, a lunchroom, change rooms, and ancillary laboratory spaces.

1.6.1.1 324 Building REC. The REC provided for studies of almost any type of chemical or mechanical process with radiation levels of up to 10^6 R/hr. The REC consists of four operating cells surrounding a common airlock cell. The airlock functions primarily as a transition zone and a ventilation barrier for movement of shielded material between external areas and the four processing cells. The high-efficiency particulate air (HEPA) ventilation system is designed for contamination confinement by managing airflow from noncontaminated areas into increasingly more contaminated areas and the exhaust through double sets of HEPA filters.

The REC cells and the airlock are equipped with overhead crane service, leaded glass windows that are oil-filled to facilitate viewing, and master-slave manipulators to aid remote operation and maintenance of in-cell equipment.

1.6.1.2 324 Building REC A-Cell. The 324 Building REC A-cell is located adjacent to and north of the REC airlock (Figure 1-4). Access into A-cell is through a swinging shield door located in the airlock on the north wall. Penetrations into A-cell include ventilation ducts, manipulator sleeves, and electrical cables. Two leaded-glass, oil-filled shielding windows provide visual access into the cell. Associated with each window is a pair of remote/mechanical manipulators that provide remote handling access into the A-cell. The cell has a 9.1-metric-ton, remote-operated bridge crane.

A-cell is lined with 0.32-cm (0.125-in.) stainless-steel plate that is welded at the seams. Under the floor plate is a 15-cm (5.9-in.)-thick slab of concrete. Under the concrete floor is a crawlspace and packed native soil. Waste transfer piping (from the pipe trench to the HLV tanks) is embedded in the concrete floor. Cell access is through a door into the airlock. Walls are constructed of normal-density concrete and other shielding materials (i.e., steel and concrete blocks). Normal services into A-cell include electricity, water, and compressed air. There are 43 shielded penetrations in the liner to provide for the addition of process accessories.

The REC A-cell is constructed of normal-density concrete. The north wall is constructed of 1.37-m (4.5-ft)-thick, normal-density concrete. The east and west walls are constructed of normal-density concrete, varying from 1.37 to 1.82 m (4.5 to 6 ft) thick. The south wall is constructed of 1.22-m (4 ft)-thick, normal-density concrete. The interior A-cell floor is lined with stainless steel. The walls are lined with 0.6-cm (0.25-in.)-thick, mild-steel plate. The plate is butt-welded and ground to a smooth finish. The stainless-steel floor line is seam welded to the mild-steel plate, approximately 5.1 cm (2 in.) above floor level. The wall liner extends to the height of the crane rails (68.6 cm [27 in.]). The REC cell floors are lined with 0.32-cm (0.125-in.) stainless steel. Under the cell is a solid foundation and a ventilation duct space that houses exhaust ducts carrying air from the cell to the first stage of HEPA filters. The cells are ventilated, and instruments and accessible components are checked daily. Air is drawn through cell wall penetrations and ventilation inlets. Exhaust air passes through at least two stages of HEPA filtration.

The A-cell liner was installed at the time that the REC hot cells were constructed. The liner floor is constructed of 0.32-cm (0.125-in.)-thick, seam-welded, stainless-steel plate. The walls are lined to the ceiling with mild (carbon) steel that is painted. Mild steel was used rather than stainless because the cell was originally designed to test fission gases (i.e., iodine), which are corrosive to stainless steel. The ceiling is painted concrete.

1.6.1.3 324 Building REC B-Cell. B-cell is a 10-m (33-ft)-high cell (Figure 1-4) and is the largest of the four hot cells, measuring 7.6 m (25 ft) long, 6.7 m (22 ft) wide, and 9.3 m (31 ft) high. The floor and the walls are lined up to 8.2 m (27 ft) high with 0.32-cm (0.125-in.) stainless-steel plate that is welded at the seams. Under the floor liner is a slab of concrete varying from 15.2 to 30.5 cm (6 to 12 in.) in thickness, and under the concrete is packed native soil. The cell walls are made of 1.5-m (4.9-ft)-thick, high-density concrete. The east side of the cell adjoins the airlock.

Numerous cell wall penetration sleeves, stepped for shielding purposes, are used to provide piping and electrical services to in-cell equipment. Penetrations for services (e.g., manipulators and electrical cables) are not completely sealed but instead rely on the negative pressure in the cell to prevent escape of contamination. Two cranes service the cell and allow material movement between B-cell and the airlock cell. Three oil-filled, leaded-glass viewing windows are located on the first floor, and two viewing windows are located on the second floor. The first-floor windows each have two adjacent remote/mechanical manipulators that allow remote manipulation and maintenance of the in-cell equipment.

1.6.1.4 324 Building REC C-Cell. The 324 Building C-cell is located directly below D-cell in the south leg of the REC's T-shaped complex (Figure 1-4). C-cell is 5.9 m (19 ft) long, 3.7 m (12 ft) wide, and 4.6 m (15 ft) high. The floor is lined with 0.32-cm (0.125-in.) stainless-steel plate welded at the seams. Under the floor plate is a 15-cm (6-in.)-thick slab of concrete, and under the concrete floor is a crawl space and packed native soil. The cell is adjoined to the north by the airlock. Cell access is provided by a door to the airlock. Shielding walls are constructed of 1.2-m (3.9-ft)-thick, high-density concrete. Normal services into C-cell include electricity, water, and compressed air.

C-cell is adjacent to and south of the REC airlock. Access into C-cell is via the airlock through two openings. A pass-through is capable of handling articles up to 46 cm (18 in.) wide and 46 cm (18 in.) high. It is equipped with hinged 15-cm (6-in.)-thick steel and lead shielding doors on the inside and outside surfaces of the cell wall. Larger articles, up to 1.8 m (6 ft) wide by 2.4 m (8 ft) high, can be moved through the C-cell shield door. In addition, articles can be introduced to, but not removed from C-cell through a small, 10.2-cm (4-in.)-diameter pass-through in the front facing wall. A removable block (0.9 m by 1.2 m [3 ft by 4 ft]) is located in the C-cell ceiling to allow transfers between C-cell and D-cell.

Two leaded-glass, oil-filled shielding windows provide visual access into the cell. Associated with each window is a pair of remote/mechanical manipulators that provide remote-handling capability in the cell. C-cell also is equipped with a 1.8-metric-ton, remote-operated bridge crane and a power-assisted robotic manipulator.

C-cell is constructed of concrete. The ceiling is 0.9-m (3-ft)-thick concrete. The short east and west walls are normal-density concrete varying in thickness from 1.4 to 1.8 m (4.6 to 5.9 ft) thick. The north wall is 1.4-m (4.5-ft)-thick, normal-density concrete. The south wall is 1.2-m (3.9-ft)-thick, high-density concrete. The floor is 0.61-m (2-ft)-thick, high-density concrete. Process lines are embedded in the concrete floor. The interior C-cell floor is lined with stainless-steel, seam-welded plate; the interior walls also are lined from floor to ceiling with stainless-steel, seam-welded plate. The exterior walls are painted concrete.

The C-cell liner was installed at the time that the REC hot cells were constructed. The liner was constructed with 0.32-cm (0.125-in.)-thick, stainless-steel plate that is seam welded and covers the floor, walls, and ceiling. The C-cell liner has 21 engineered penetrations located at a minimum height of 1 m (3.3 ft) and maximum height of 4 m (13 ft).

1.6.1.5 324 Building REC D-Cell. The 324 Building D-cell is located directly above C-cell in the south end of the REC's T-shaped complex (Figure 1-5). The floor of the cell is between the first- and second-floor levels. D-cell is 6.1 m (20 ft) long, 3.7 m (12 ft) wide, and 4.9 m (16 ft) high. The floor is lined with 0.32-cm (0.125-in.)--hick stainless steel, and the walls are lined with mild steel. The cell is adjoined by the airlock and by the second floor service gallery on the south side. There is a door between the cell and the airlock. The walls are constructed of 1.4-m (5-ft)-thick, normal-density concrete and uses other shielding materials (i.e., steel). Normal services into D-cell include electricity, water, and compressed air. Services are provided through embedded piping in the east and west walls of the cell. Piping also includes unused service lines that can be used to provide connection to other REC cells to transfer solutions or for small process ventilation.

Access into D-cell is through a swinging shield door located in the airlock on the south wall or through a transfer port that provided an airlock for a glovebox originally installed in the D-cell gallery area. A small, 7.6-cm (3-in.) pass-through port is available for transfer of materials into or out of the cell. The penetration is shielded with concrete bricks and covered with a steel access plate on the gallery side of the wall.

D-cell is constructed of concrete. The short east and west walls are constructed of 1.7-m (5.6-ft)-thick, normal-density concrete. The west wall has a "soft plug" area, 0.76 m (2.5 ft) wide by 0.91 m (3 ft) high, which is shielded with concrete bricks and covered with a steel access plate on the gallery side. The north wall is constructed of 1.1-m (3.6-ft)-thick, normal-density concrete. The long south wall is constructed of 1.22-m (4-ft)-thick, high-density concrete. The floor is constructed of 0.91-m (3-ft)-thick, high-density concrete. An equipment access hatch 0.91-m (3-ft) by 1.22-m (4-ft) is present on the north side of the cell floor. The hatch allows transfer of equipment to C-cell using the D-cell crane. The interior D-cell floor is lined with stainless steel. The D-cell interior walls are lined from the floor to ceiling with mild (carbon) steel with welded seams. The wall liner is seam welded to the floor liner about 5.08 cm (2 in.) above the floor. The mild-steel liner is epoxy-sealed to the concrete wall at the crane rail height.

The D-cell liner was installed at the time that the REC hot cells were constructed. The liner was constructed with 0.32-cm (0.125-in.)-thick stainless-steel plate, was seam welded, and covers the floor. The walls are lined to the ceiling with mild (carbon) steel welded at the seams. The walls are painted. The ceiling is painted concrete. The D-cell liner has 21 engineered penetrations located at a minimum height of 1 m (3.3 ft) and maximum height of 4 m (13 ft).

1.6.1.6 324 Building REC Airlock. The 324 Building REC airlock is used primarily as a transition area for transferring material and equipment into and out of the adjoining cells (Figure 1-4). The airlock is located at the junction of the arms of the REC's T-shaped complex and is 6.7 m (22 ft) long, 6.6 m (22 ft) wide, and 10 m (33 ft) high. The floor and the walls up to 8.2 m (27 ft) high are lined with stainless-steel plate and welded at the seams. The airlock adjoins A-cell (north), B-cell (west), C-cell/D-cell (south), and the cask-handling area (east). Access to these areas is via large steel doors equipped with interlocks to prevent unintended opening. The airlock is equipped with cranes that facilitate remote installation, maintenance, and operation of equipment. The shielding walls are constructed of 1.4-m (4.6-ft)-thick, normal-density concrete.

Access to the REC airlock is through two swinging doors, hung one above the other, sharing a single opening to the cask-handling area. The doors are constructed of stepped steel that is at least 0.3 m (1 ft) thick; the lower door has a 30-cm (12-in.)-square, leaded-glass shielding window. Large pneumatic cylinders provide the driving force to open and close the doors.

One leaded-glass, oil-filled shielding window is located in the east wall of the airlock. Associated with the window is a pair of remote/mechanical manipulators that provide remote access into the airlock.

Penetrations into the airlock include a cask access port, ventilation duct, manipulator sleeves, and electrical cables. These services are not completely sealed but rely on the negative pressure in the airlock to limit escape of contamination.

The interior airlock floor is lined with stainless steel. The floor outside the airlock (i.e., the cask-handling area floor) is painted concrete. The airlock interior walls are lined from the floor up to 8.2 m (27 ft) with 0.32-cm (0.125-in.) stainless steel.

Air is drawn through cell wall penetrations and ventilation inlets. Airlock pressure is maintained lower than the surrounding galleries to prevent the migration of contamination. Exhaust air passes through at least two stages of HEPA filtration.

A crawl space with a packed native dirt floor is located under the concrete floor of the airlock and allows routing of the airlock exhaust plenums to the first stage of HEPA filtration. The area is used to provide for chaseways for ventilation supply/exhausts from the hot cells and process and waste transfer lines.

1.6.1.7 324 Building REC Pipe Trench and Other REC-Associated Components. The 324 Building pipe trench was used to make utility, process, and waste-handling connections between the cells and the HLV tanks. The pipe trench is located under the floor of the REC airlock, just in front of the B-cell door. The pipe trench is 1.3 m (4.3 ft) wide, 6.4 m (21 ft) long, and varies in depth from approximately 2.4 m (8 ft) on the north end to 2.2 m (7.1 ft) on the south end.

The pipe trench also was designed to collect water used for decontamination in the REC airlock. The pipe trench can be accessed by removing five 0.6-m (2-ft)-thick cover blocks using B-cell's 9.1-metric-ton bridge crane. The pipe trench is used to make process connections for the radioactive liquids being handled by the cells and the vaults.

The pipe trench is lined with 0.32-cm (0.125-in.) stainless-steel plate. The pipe trench contains approximately 7.6 m (25 ft) of 12-mm (0.5-in.) pipe, approximately 210 m (689 ft) of 2.5-cm (1-in.) pipe, approximately 46 m (150 ft) of 5.08-cm (2-in.) pipe, and approximately 29 m (95 ft) of 7.6-cm (3-in.) pipe.

1.6.1.8 324 Building HLV, Tanks, and Piping. The HLV is a shielded underground storage vault in the 324 Building (Figure 1-3). The HLV is equipped with tanks for temporary storage of liquids. The vault contains four stainless-steel tanks that have been used as temporary holding tanks for feed solutions, feedstock tanks for process solutions, or collection tanks for effluents from project activities. The HLV tanks have been used to store mixed waste solutions.

The HLV is a rectangular concrete vault that is set under the floor of the cask-handling area. The HLV is 6.4 m (21 ft) long, 4 m (13 ft) wide, and 4.4 m (14 ft) deep, and is oriented in an east/west direction. The west end of the vault (i.e., the end closest to the REC cells) has a ledge that is approximately 1.4 m (4.6 ft) high that enlarges the upper level of the HLV to 8.2 m (27 ft) long.

The HLV contains four stainless-steel tanks (104, 105, 106, and 107). Tanks 104 and 105 are on the lower level, with tank 104 being the easternmost tank. Tanks 106 and 107 sit on the ledge, with tank 107 being the northernmost tank. The smallest tank has a capacity of approximately 1,700 L (450 gal), and the largest tank has a capacity of approximately 19,000 L (5,019 gal).

The HLV tanks were installed in 1964. The vault is constructed of concrete and is lined with a welded, 0.32-cm (0.125-in.) stainless-steel plate over the floor, ledge, and partially up the wall. The plate, which provides secondary containment, covers the floor and extends 1.1 m (3.6 ft) up the walls. The stainless-steel plate also covers the floor of the ledge and extends 15.2 cm (5.98 in.) up the walls above the ledge. The floor is sloped in the shortest direction toward a trench located along the north wall. The trench, in turn, slopes from both ends of the HLV toward the middle where a 0.6-m (2-ft) by 0.6-m (2-ft) by 0.6-m (2-ft) sump is located. The HLV is covered by concrete that is 1.8 m (6 in.) thick. The HLV can be accessed from above by removal of the cover blocks, which cover about 40% of the vault floor area. Beneath the concrete cover blocks are removable steel plate ventilation barriers.

Tank 104 is 2.7 m (9 ft) in diameter by 2.7 m (9 ft) high, has a capacity of 15,000 L (3,963 gal), and is constructed of 1.27-cm (0.5-in.)-thick, Type 304-L stainless steel. The outer cooling water jacket is 0.48-cm (0.2-in.), Type 304-L stainless steel. Tank 104 rests on 18 Type 304-L stainless-steel legs that are arranged in two concentric circles.

Tank 105 is 2.9 m (9.5 ft) in diameter and 2.7 m (9 ft) high, and has a design capacity of 19,000 L (5,019 gal). The tank is constructed of 1.27-cm (0.5-in.)-thick, Type 309 (25Cr-12Ni) columbium austenitic, stabilized stainless steel. The tank also has a 0.48-cm (0.2-in.)-thick outer jacket constructed of Type 18-8 columbium austenitic stainless steel. Tank 105 rests on 18 Type 304-L stainless-steel legs that are arranged in two concentric circles.

Tank 106 is 1.2 m (4 ft) in diameter (including the cooling jacket) by 1.5 m (5 ft) high and has a capacity of 1,700 L (450 gal). Tank 106 rests on the ledge beside tank 107 and is supported by three Type 304-L stainless-steel legs. The tank walls and bottom are made of 0.64-cm (0.25-in.) Type 309 (25-12) columbium austentic, stabilized stainless-steel plate; the cooling jacket is made of 0.48-cm (0.2-in.), Type 18-8 columbium austenitic, stabilized stainless steel;

and the roof is made of 0.95-cm (0.37-in.), Type 25-12 columbium austenitic, stabilized stainless steel.

Tank 107 is made of 0.64-cm (0.25-in.)-thick, Type 304-L stainless steel. This tank also has a 0.48-cm (0.19-in.)-thick outer jacket of Type 304-L stainless steel. Tank 107 is supported by three Type 304-L stainless-steel legs and rests on the ledge beside tank 106. Tank 107 is 1.7 m (5.5 ft) in diameter (including the cooling jacket) by 1.8 m (6 ft) high and has a capacity of 3,600 L (951 gal). The tank cooling jacket extends 1.1 m (3.6 ft) above the base of the tank.

1.6.1.9 324 Building LLV, Tanks, and Piping. The LLV is a shielded underground storage vault in the 324 Building (Figure 1-3). The LLV is equipped with tanks for temporary storage of liquids. The vault contains four stainless-steel tanks.

The LLV is a rectangular concrete vault that is 8.7 m (29 ft) long, 4 m (13 ft) wide, and 5.6 m (18 ft) deep and is oriented in a north/south direction. The vault is lined with 0.32-cm (0.125-in.) stainless-steel plate over the floor and 1.2 m (3.9 ft) up the wall. The floor is sloped from both ends to the middle and to the west and has a sump in the middle of the vault along the west wall. The trench slopes from both ends toward the 0.6-m (2-ft) by 0.6-m (2-ft) by 0.3-m (1-ft) sump.

The vault is covered by cover blocks (0.6-m [2-ft]-thick concrete). Beneath the cover blocks are removable steel plate ventilation barriers. The LLV is connected via a short tunnel to the HLV near the top of the vaults in the southern interconnecting wall. The vaults share the same air space, which is vented to the low-pressure side of the A-frame air filter bank from the HLV.

The LLV contains four stainless-steel tanks (tanks 101, 102, 103, and 108). All tanks are stainless steel with cooling jackets to enable circumferential heating and cooling of the tanks. The tank tops are flat and the tank bottoms are sloped.

Tank 101 and 103 are 2 m (6.5 ft) in diameter (including cooling jacket) by 4.3 m (14 ft) high and have a capacity of 12,500 L (3,302 gal). Tank 101 is constructed of 1.3-cm (0.5-in.)-thick, Type 309 (25-12) austentic columbium stainless steel. The outer cooling water jacket is 0.32-cm (0.125-in.), Type 18-8 austentic columbium stainless steel.

Tank 102 is 2.4 m (7.9 ft) in diameter (including cooling jacket) by 4.3 m (14 ft) high and has a capacity of 18,500 L (4,887 gal). Tank 102 is constructed of 1.27-cm (0.5-in.)-thick, Type 309 (25-12) austentic columbium stainless steel. The outer cooling water jacket is 0.32-cm (0.125-in.), Type 18-8 austentic columbium stainless steel.

Tank 108 is 2 m (6.5 ft) in diameter (including cooling jacket) by 4.3 m (14 ft) high and has a capacity of 12,000 L (3,170 gal). Tank 108 is constructed of 1.3-cm (0.5-in.)-thick, Type 309 (25-12) austentic columbium stainless steel. The outer cooling water jacket is 0.32-cm (0.125-in.), Type 18-8 austentic columbium stainless steel.

1.6.1.10 324 Building HLV Sampling Room 145. The 324 Building sample room 145 (Figure 1-4) contains shielded sampling equipment for the HLV and LLV tanks. The sample room is a 2.7-m (1-ft) by 1.8-m (0.7-ft) by 2.6-m (1-ft) metal enclosure with a concrete-shielded roof located on the first floor.

Inside the sample room is a shielded stainless-steel sample collection and loadout box that has vacuum sampling lines to the HLV tanks. The sample collection box has viewing ports and covers. A separate Plexiglas sample collection and loadout box for the LLV tanks is located at floor level in the corner of the room.

1.6.1.11 324 Building REC Loadout Station Room and Two Ball Casks. The 324 Building REC loadout station room was used to receive cesium and strontium nitrate solutions from the Hanford Site's B Plant (Figure 1-4). There are two empty 1,136–L (300-gal) ball casks in this room. The room contains piping systems that interface with the HLV and LLV and allowed jet transfers of solutions from the casks. The casks are lead shielded and weigh approximately 17.5 tons each.

1.6.1.12 324 Building REC Exhaust Air Plenums/Ducts, Filter Pits, and Filter Banks. The 324 Building REC exhaust air flows to the particulate filters commonly referred to as the A-frame filters because of the shape of the filter housing. The A-frame filters are not categorized as HEPA filters but are high-efficiency filters.

1.6.1.13 324 Building Wet Storage Basin (Filled In). The wet storage basin was centrally positioned in the cask-handling area for underwater storage of radioactive materials and fuel elements and for the unloading of fuel casks. The wet basin has been decommissioned, filled with sand, and covered with concrete.

1.6.1.14 324 Building SMF. The SMF cells, located in the southeast portion of the 324 Building, consist of the airlock cell, south cell (fabrication cell) and east cell (feed preparation cell). The first 2.3 m (7.5 ft) (from the floor upward) of the cell's shielding wall are constructed of 1.2-m (4-ft)-thick, high-density concrete. The remainder of the cell shielding is constructed of 1.2-m (4-ft)-thick, normal-density concrete. All cells have stainless-steel floors and mild-steel wall liners. The locations of the SMF south cell, airlock, and east cell are shown in Figure 1-4.

1.6.2 327 Building Description

The 327 Building is a single-story structure with a partial basement. Construction began in 1951 and operations began in 1953. The maximum dimensions of the building are 66 m (215 ft) by 42.6 m (140 ft) by 9.8 m (32 ft).

There are four major areas inside the building: the canyon, the storage and transfer area, the northwest storage area, and the basement. The building has a welded-steel framework, and the exterior walls are fluted-steel insulated panels. The canyon is the primary area of interest for this DQO summary report.

The first-floor laboratory is reinforced concrete (or steel decking with concrete) and is finished with paint. Interior partitions are overlapping metal panels with sealed joints. Suspended ceilings in the lower ceiling areas (none in the canyon) are perforated metal sections backed with fiberglass pads.

1.6.2.1 327 Building Hot Cells. The 327 Building canyon contains the 12 hot cells. The I-cell and the Special Environment Radiometallurgy Facility (SERF) cell are constructed of cast iron or steel. Each of the cells is ventilated through the building's radioactive exhaust system. The two density and evaporation cells exhaust into I-cell and B-cell, respectively, and are constructed of lead bricks.

The cast-iron and steel cells are equipped with viewing windows, manipulators, and specialized machinery. These cells rest on a reinforced-concrete floor. The walls and roofs of the cells consist of cast-iron or steel shield blocks that lock together by a groove-and-dowel locking system. Cast iron used in the shield blocks is formulated from a dense material called "meehanite." Special shield blocks have been machined to allow the addition of plugs containing transfer ports, instrument access plugs, and required electrical and water services. The 10 cells are equipped with a water supply line and a drain line. Each drain line, now plugged, was connected to the 300 Area radioactive liquid waste system (RLWS). The floors of these cells are covered with polished stainless-steel trays that slope to the drains. Each of the 10 cells is equipped with an exhaust duct to the HEPA-filtered exhaust system.

The 327 Building hot cells layout is illustrated in Figures 1-8 and 1-9. The 327 Building A-cell interior is 2.9 m (9.5 ft) long by 1.4 m (4.5 ft) wide by 2.5 m (8.17 ft) high. The cell is constructed of meehanite shielding blocks that are 45 cm (18 in.) thick. There are three large shielded windows, three manipulators, and a number of 7.6-cm (3-in.) port windows. Sliding blocks at the corners of the cell allow access into the cell from the canyon area. Fuel samples were transferred between A-cell and the wet storage/transfer basin by means of a chute and shuttle bucket. The waste compactor is located in the east end of A-cell and was used for remote compaction of TRU waste.

The 327 Building B-cell interior is 1.8 m (6 ft) long by 1.3 m (4.3 ft) wide by 1.3 m (4.3 ft) high. The cell is constructed of meehanite shielding blocks that are 38 cm (15 in.) thick, and the north and south ends of the cell are divided by a wall. B-cell has two shielded viewing windows, two manipulators, several 7.6-cm (3-in.) windows, and various service and transfer plugs. The cell is attached to the density cell blister. It was used for irradiated sample preparation (non-fuel) and storage. The density cell is a blister attached to B-cell and it exhausts to B-cell. The density cell's interior dimensions are 0.9 m (3 ft) long by 0.6 m (2 ft) wide by 0.6 m (2 ft) high with 15.2-cm (6-in.)-thick lead brick shielding.

The 327 Building C-cell interior is 18 m (6 ft) long by 1.3 m (4.3 ft) wide by 1.3 m (4.3 ft) high with 26.7 cm (10.5 in.) of meehanite shielding. C-cell has one shielded viewing window, several other port-size windows, two manipulators, a metallography blister, and several service and transfer ports. The cell contains metallography equipment (e.g., grinders and polishers) and was used for metallography material sample preparation for irradiated fuels and structural materials. Photography equipment is associated with the metallography blister. Radioactive waste buckets and hand tools were located in the cell. Waste cans were placed in C-cell for dose-rate measurement prior to transfer to A-cell for compaction.

The 327 Building D-cell interior is 18 m (6 ft) long by 1.3 m (4.3 ft) wide by 1.3 m (4.3 ft) high. D-cell has two manipulators, fiberglass disposable filter, macro-photography equipment, and welding equipment. D-cell cell is constructed of 26.7-cm (10.5-in) meehanite shielding blocks. D-cell has no viewing windows but has two port-size windows with one manipulator at each window port. The cell can be accessed through several ports of various sizes built into the walls of the cell. Work performed in the cell included fuel transient testing and specimen profilometry. The cell was also used as a radioactive waste bucket staging location.

The 327 Building E-cell interior is 18 m (6 ft) by 1.3 m (4.3 ft) by 1.3 m (4.3 ft) with 26.7 cm (10.5 in.) of meehanite shielding. E-cell has two shielded viewing windows, two manipulators (one at each window), fiberglass disposable filter, port-size windows, a metallography blister (on the southeast corner), and transfer and service ports of various sizes. The cell contains metallography equipment (e.g., grinders and polishers) and was used for metallography material sample preparation for irradiated materials and fuels.

The 327 Building F-cell interior is 2.4 m (8 ft) long by 1.5 m (5 ft) wide by 2.5 m (8.2 ft) high with 45.7 cm (18 in.) of meehanite shielding. F-cell has three viewing windows, three manipulators, fiberglass disposable filter, a wall-mounted milling machine and lathe, and sliding blocks for access. The cell was primarily used for general utility, fabrication, machining, and sample preparation for fuels and/or structural materials. The cell was most recently used to size-reduce spent nuclear fuel (SNF) elements prior to handling in G-cell.

The 327 Building G-cell interior is 3.1 m (10 ft) long by 1.9 m (6.2 ft) wide by 2.5 m (8.2 ft) high with 27 cm (10.5 in.) of meehanite shielding. G-cell has five shielded viewing windows, two manipulators, several other port-size windows, service plugs of various sizes, a shielded cell access door, and a small crane. Work performed in this cell included fabrication, machining sample preparation, profilometry of structural irradiated materials, and dissolution of medical sources. G-cell was most recently used to support SNF testing and contains precision sample fabrication equipment and specimen preparation equipment.

The 327 Building H-cell interior is 1.6 m (5.3 ft) long by 1.4 m (4.6 ft) wide by 2.2 m (7.1 ft) high with 27 cm (10.5 in) of meehanite shielding. H-cell features include two shielded viewing windows, two manipulators (one at each window), port-size windows, several variable-size ports, fiberglass disposable filter, a special test blister (on the south side), and a shielded cell access door. The cell is equipped with physical property test equipment and was primarily used for specialized testing to suit customers' needs. The blister is positioned on rails to allow movement of the blister.

The 327 Building I-cell interior is 1.3 m (4.3 ft) long by 1.2 m (4 ft) wide by 1.6 m (5.17 ft) high with 26.7 cm (10.5 in.) of steel shielding. I-cell has two viewing windows, two manipulators, fiberglass disposable filter, port-size windows, several variable-size ports, and access door. I-cell is attached to the evaporator cell (where carbon coating was performed). A blister on the east side of the cell was used for weighing activities. Work performed in this cell included corrosion testing and weighing of commercial spent fuel. The evaporator cell's interior dimensions are 0.8 m (2.5 ft) long by 0.5 m (1.5 ft) wide by 0.5 m (1.5 ft) high, with 15-cm (6-in.)-thick lead brick shielding.

The SERF cell consists of an upper operating area (in the canyon [Figure 1-8]) and a lower storage area (in the basement [Figure 1-9]). The upper operating cell contains multiple manipulators and miscellaneous equipment in storage racks. The sealed enclosure of the upper cell provided an examination and storage building with a nitrogen atmosphere for work with specimens that would be adversely affected by contact with oxygen or water vapor. The operating area's internal dimensions of the cell are 3.7 m (12 ft) long by 1.8 m (6 ft) wide by 2.4 m (8 ft) high. There is 45.7 cm (18 in.) of steel shielding in the walls and ceiling of the upper cell. A detachable shielded enclosure is located at the north end, with access to the operating cell. Two airlocks on the upper cell's south wall provide access to the cell for the introduction or removal of test materials, supplies, equipment, and waste without compromising the integrity of the cell's atmosphere. The cell contains manipulators, humidity monitors, and an oxygen sensor/monitor.

The SERF lower storage area is connected to the SERF cell's upper operating area by a vertical transfer tube. The lower storage area is 1.2 m (4 ft) long by 1.2 m (4 ft) wide by 1.5 m (5 ft) high. The concrete between the ceiling of the SERF storage cell and the floor of the main SERF cell above is 1.8 m (5.75 ft) thick. Shielding for the lower storage area consists of 0.6 m (2 ft) of concrete on all sides, with 10 cm (4 in.) of lead shielding on the north and west sides, and 26.7 cm (10.5 in.) of steel on the operating (east) face. The south side is inaccessible because it is adjacent to a building support wall. A manipulator and small shield window are provided to permit positioning and retrieval of materials in the lower storage area.

1.6.2.2 327 Building Wet Basins, Burst Test Basin (Filled In), Burst Test Instrumentation Pit, and Wet Basin Storage. The 327 Building is equipped with two concrete-walled wet basins located in the canyon area (Figure 1-8). The larger storage basin is linked to the smaller storage/transfer basin by a trench (transfer canal) that is covered by metal plates. The small basin is 15.2 m (6 ft) long by 20.3 m (8 ft) wide by 25.4 m (10 ft) deep. The transfer canal is 3.8 m (1.5 ft) wide by 25.4 m (10 ft) deep and allows for the transfer of material between basins. Several racks are located in the two basins for past storage of fuel and structural materials. A transfer tube connects A-cell and the small basin. A mechanical sample carrier in the tube provides for sample transfers between A-cell and the basin. A 0.25-ton, floor-mounted crane was used to move materials into and out of the small basin.

A deactivated ion-exchange (IX) column is located in the large wet storage basin. The IX system consists of two vessels (cation and anion), each 40.6 cm (16 in.) in outer diameter and 1.8 m (6 ft) long. They are installed with cation above anion in a steel rack vertically in the basin, were once part of the basin water purification system, and were not regenerated completely prior to removal from service (i.e., they still contain resin).

A wet storage basin water purification system consists of a circulation pump, filters, molecular absorption filters, and two mixed-bed deionizers that maintain water purity in order to prevent corrosion of stored materials and to minimize waterborne radioactivity. The two mixed-bed deionizer containers are shielded and are mounted near the decontamination chamber's west wall.

The 327 Building burst test room (Figure 1-8) was historically known as the "burst test basin" because of the presence of a large wet basin used to perform pressure tests of reactor components and fuel assemblies. There is an instrument pit associated with the basin. The basin was linked to the large wet basin, but the portal was grouted closed. The burst test basin was backfilled and overlaid with concrete that was level with the rest of the floor. The burst test basin does not have documented radioactive characterization and is inaccessible as a result of prior backfilling and capping actions. The instrument pit is open with cover blocks in place.

Figure 1-8. 327 Building First Floor Layout.

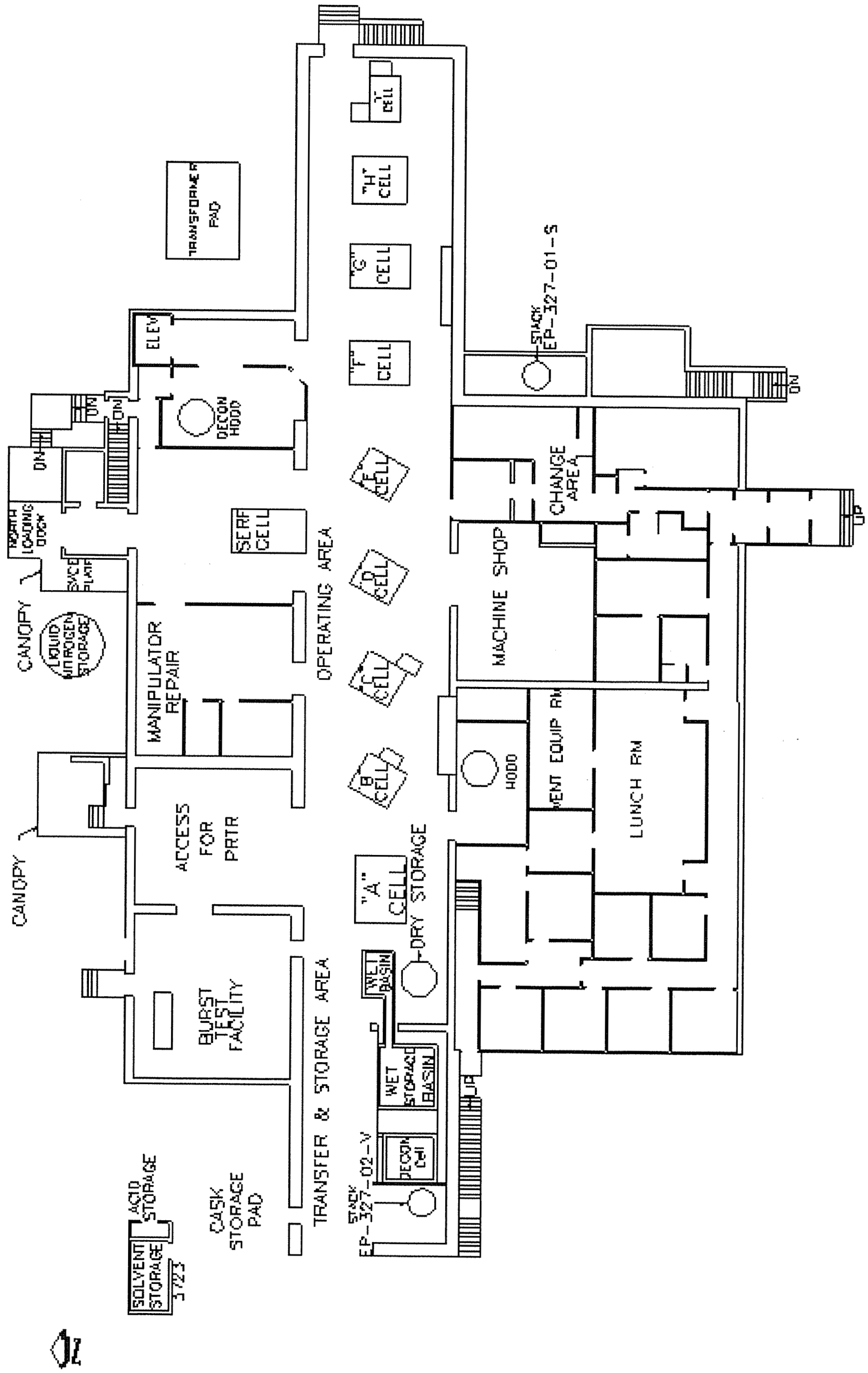
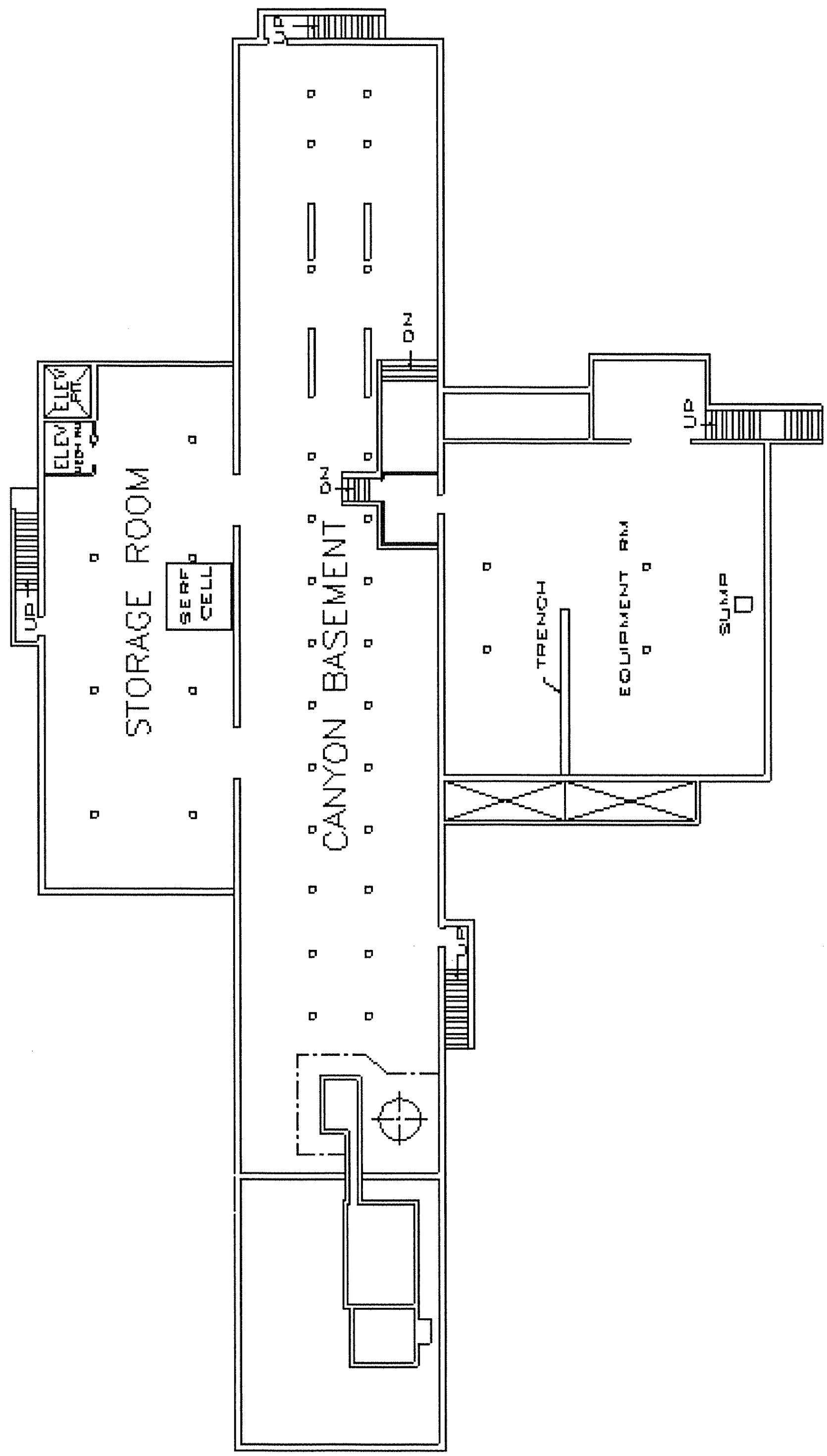


Figure 1-9. 327 Building Basement Layout.



1.6.2.3 327 Building Dry Storage Including Exhaust Duct and Filter Bank. The 327 Building's dry storage is a reinforced-concrete tank that extends into the basement, with the top mounted flush with the canyon floor (Figure 1-8). The dry storage cell is located next to the wet storage basin. The total diameter of the cell at floor level is 2.3 m (7.7 ft), which is approximately 1.27 cm (0.5 in.) larger than the cover. The actual cell dimensions, which start approximately 25.4 cm (10 in.) below floor level, are 2 m (6.4 ft) in diameter and 1.9 m (6.3 ft) in depth. The cell is has concrete walls with a grouted and bolted-in-place sloping floor pan. The cell is exhausted via a 25.4-cm (10-in.) exhaust riser at the bottom, which is reduced to a 15.2-cm (6-in.)-diameter, 18-gauge stainless-steel duct.

1.6.2.4 327 Building Hot Cell Drains and RLWS. The 327 Building RLWS consists of a piping, sump, and pump system in the basement to collect liquids. The piping has leaded shielding. The RLWS sump is toward the northwest side of the main basement room, below the hot cells. The RLWS drain shut-off valve, diverter station, and an overflow drum are located in the southwest corner of the main basement room, below the hot cells.

1.6.2.5 327 Building Hot Cells Exhaust Plenums/Ducts and First Filter Bank. The 327 Building's hot cells exhaust air system includes HEPA banks. Exhaust air from high-contamination areas (i.e., the hot cells and dry storage area) passes through the radioactive exhaust system's roughing filters and HEPA filtration before release via the main stack. The scope of this DQO summary report includes this exhaust air system, including up to the first HEPA filter bank.

1.6.2.6 327 Building SERF Recirculation System. The 327 Building's nitrogen recirculation system supports the SERF cell (Figure 1-9). Liquid and gaseous nitrogen used in the process areas and the gaseous nitrogen supply to the SERF cell are provided by a nitrogen supply system on the north side of the 327 Building. The nitrogen is stored in a 22,712-L (6,000-gal) liquid nitrogen tank outside the building, which is scheduled for removal under a separate project in the spring of 2006. The SERF recirculation and cooling system is located in the 327 Building basement.

The SERF cell's nitrogen recirculation and cooling system consists of two separate and essentially independent subsystems. The subsystems are mounted one above the other, with the storage cell subsystem on the top and the preparation cell subsystem on the bottom. This system is composed of stainless-steel ductwork of various sizes (mainly 15.2 cm [6 in.] and 20.3 cm [8 in.] diameter), two in-line fans, two filtration enclosures, two cooling coils, and two externally mounted compressor/condensor units. The system includes a standard 0.6-m (2-ft) by 0.6-m (2-ft) by 0.3-m (1-ft) HEPA filter and is constructed of 7.62-cm (3-in.) stainless-steel plate.

1.7 PROCESS KNOWLEDGE

The following sections provide descriptions of the operating systems, processes, and process materials related to the scope of the 324/327 Building hot cells D4 project.

1.7.1 324 Building Process Knowledge

The 324 Building was designed to provide office and laboratory space for scientific and engineering staff conducting multi-disciplinary research in the areas of waste characterization and immobilization, waste remediation and cleanup development, biomass research, spent fuel characterization, tritium development, and cesium chloride encapsulation. Because the 324 Building housed research and development activities, the types of work being conducted changed as programs were concluded and other programs started.

The process knowledge for selected areas of the 324 Building is addressed in the following subsections.

1.7.1.1 324 Building REC Process Knowledge. Liquid and solid radioactive and mixed waste have been generated during the conduct of various programs within the 324 Building REC. The following research and development projects and programs have been conducted in the 324 Building:

- A-cell:
  - Waste Solidification Engineering Prototype Program (WSEP)
  - Nuclear Waste Vitrification Project (NWVP)
  - Federal Republic of Germany (FRG) Program (production of sealed isotopic heat sources)
- B-cell:
  - WSEP
  - NWVP
  - Zeolite Vitrification Demonstration Project (ZVDP)
  - Testing and Operation of the Radioactive Liquid-Fed Ceramic Melter (RLFCM)
  - FRG Program (production of sealed isotopic heat sources)
- C-cell:
  - WSEP
  - Waste Fixation Program
  - Spent Fuel Handling and Packaging Program
  - Waste Isolation Program
- D-cell:
  - WSEP
  - Waste Fixation Program
  - Spent Fuel Handling and Packaging Program
  - Materials Characterization Center Program
  - Commercial Spent Fuel Management Program
  - High-Level Vault Interim Removal Action Project.

Bulk solid waste materials generated in the REC cells have previously been disposed or stored. There are no drains or sumps from the cells, and liquid waste generated was discharged at various times to the HLV and LLV tanks. The waste consisted of solutions generated during research and development activities and solutions from radiological decontamination activities. Solution transfers occurred through piping between various tanks in the HLV and LLV and the REC cells. While the piping system has been designed so solutions can be transferred from the LLV tanks to the HLV tanks, solutions cannot be transferred directly from the HLV tanks to the LLV tanks.

1.7.1.2 324 Building REC A-Cell Process Knowledge. A-cell was designed and constructed as a primary containment structure for highly radioactive waste (i.e., liquid and sludge). Between 1966 and 1972, A-cell was used to perform radiological and physical measurements of glass canisters produced throughout the WSEP program. Wastes generated in the cell were radioactive only and classified as low-level waste (LLW). From 1972 through 1982, the cell was used as a storage area for WSEP glass canisters. In 1982, the cell was used to perform radiological and physical characterization of glass canisters produced during the NWVP. Waste generated during NWVP characterization work was classified as LLW. No work was performed in the cell from 1982 through 1985.

A-cell was cleaned and refurbished in 1985 before installation of the FRG Program's (production of sealed isotopic heat sources) electropolisher and water-cooled FRG canister storage rack. In 1988, a total of 34 FRG canisters were electropolished and stored in the cell. The canisters were stored until 1997, at which time the canisters were repackaged into storage casks and transferred to a dry storage area in the Hanford Site's 200 Area Central Waste Complex (CWC).

Electropolishing was the only activity performed in A-cell that produced dangerous waste. Canisters produced during the FRG Program were electropolished in 85 wt% phosphoric acid. The electropolishing process removed about 1 kg of surface metal and contaminants per canister. The electrolyte, which was phosphoric acid, contained trace amounts of chromium and nonregulated radiological constituents (i.e., cesium-137 and strontium-90). In October 1988, this solution was transferred to LLV tank 102. The tank was triple-rinsed as part of the waste retrieval process, and the electropolishing tank in A-cell was containerized and transferred to the CWC.

1.7.1.3 324 Building REC B-Cell Process Knowledge. B-cell was used to demonstrate chemical engineering pilot-scale processes for radioactive waste management programs. These programs left B-cell filled with equipment that is highly contaminated with radioactive waste, radioactive materials, and materials that have been designated as mixed waste. Additionally, B-cell may contain dispersible (i.e., easily spreadable) material containing mixed waste contaminants such as heavy metals.

The WSEP was the first program to be performed in B-cell. The WSEP began in 1966 and continued through 1972. The program was designed to demonstrate three methods of solidifying highly radioactive waste: pot solidification, spray solidification, and phosphate glass formation.

Two separate processes were considered as pot solidification methods: pot calcination, and rising-level glass. In the pot calcination method, the waste was fed into a heated pot and concentrated into a salt cake by elevating the temperature. The salt cake was then heated to 900°C (1,652°F) to decompose the residual nitrates, which resulted in the final product of a soluble calcine comprised primarily of oxides. Escaping vapors from the process were condensed and collected; noncondensibles were filtered and released as airborne effluents.

The rising-level glass method consisted of feeding a liquid waste along with glass-forming materials into a stainless-steel pot heated to 900°C (1,652°F). A melt took place, creating three layers in the pot: fluid glass, calcine (sinter), and a waste liquid on the top. The feed rate of the liquid waste and glass formers was varied so the resulting liquid and calcine layers were at a minimum. Once the container was full with 100% fluid glass, the pot was cooled to allow solidification. Off-gases from this process were condensed and collected; noncondensibles were filtered and released as airborne effluents.

The basic operations accomplished in spray solidification were (1) conversion of aqueous waste solution to finely divided oxide powder by spray calcination, and (2) formation of a melt (glass) that solidified to a coherent mass that was physically stable and chemically inert. Melting was performed directly in the receiver canister (in-can melting).

The first step of the process was to feed the liquid through a pneumatic atomizing nozzle into the top of the spray calciner. As the spray traveled down the heated portion of the calciner, the solution was dried into a powder. The powder, or calcine, fell directly into the in-pot melter. Flux materials and silicate were added to the in-pot melter to ensure the formation of durable glass. Depending on the types of waste used and the desired characteristics, the following different fluxes were used, either alone or mixed with another: P_2O_5, oxides of Li-Na-Al, CaB_2O_3 (colemite), B_2O_3, and SiO_2. The waste powder, flux material, and silicate were melted at a temperature between 700°C and 1,200°C (1,292°F and 2,192°F). After a canister was full, the canister was cooled and sealed for storage.

The phosphate glass process was carried out in two continuous steps: (1) a low-temperature (120°C to 140°C [248°F to 284°F]) concentration step in which aqueous waste, chemically adjusted by the addition of phosphoric acid together with certain metal salts (when required), was continuously concentrated and partially de-nitrated to a thick slurry; and (2) a high-temperature (1,000°C to 1,200°C [1,832°F to 2,192°F]) glass-forming step in which final removal of water, nitrates, and other volatile constituents was accomplished. When the receiver canister was full, the canister was removed, sealed, and taken to storage.

The WSEP was designed to investigate treatability processes for defense-production waste. The feed material compositions used in the WSEP program were prepared to demonstrate the bounding conditions relative to glass forming for simulated WSs representative of (1) the plutonium-uranium reduction extraction process waste solution that contained a large amount of iron (e.g., resulting when an iron canister is used to transfer nuclear fuel elements and the canister was co-dissolved with the nuclear fuel), and (2) a plutonium-uranium reduction extraction process waste solution optimized to produce a waste containing a minimum quantity of nonfission product material. Several elemental substitutions were made for the fission products. Elements present in the WSEP feed included molybdenum, nickel, cobalt, copper, potassium, rubidium, iron, and aluminum.

The WSEP activities were completed in 1972. From 1972 through 1976, no activities occurred in B-cell.

The NWVP provided a demonstration of the vitrification of high-level liquid waste (HLLW) stream from SNF that was discharged from an operating light-water reactor. The objective of the NWVP was to provide a demonstration of the vitrification of HLLW from spent fuel. The NWVP encompassed two tasks of the Commercial High-Level Waste Immobilization Program: waste preparation, and demonstration of vitrification of high-level waste (HLW). The project was started in April 1976 and was terminated in June 1979. In preparation for the project, some canister inspection equipment was demolished and removed from B-cell as LLW. A dissolver system was installed in B-cell to dissolve the commercial spent fuel, and piping was added to the pipe trench and HLV tanks to allow transport of dissolved spent fuel and reprocessing HLW to and from the neighboring 325 Building.

The NWVP involved equipment in both of the 324 and 325 Buildings. The 324 Building was used for fuel unloading, fuel disassembly, shearing, dissolving, waste calcination, and vitrification.

Commercial fuel assemblies were received in the truck lock and were transferred to B-cell for storage and disassembly. For disassembly and shearing, the fuel pins were withdrawn from the fuel assembly in groups of five and were fed into a hydraulic shear. The cut fuel pieces dropped down a chute into a basket located inside the dissolver vessel (which was removed in 1984). After a period of time to allow for dissolution of spent fuel, the dissolver solution (nitric acid) was transferred to A-cell in the 325 Building through the interbuilding pipeline.

After processing, the resulting dilute HLW feed was transferred back through the interbuilding pipeline to HLV tank 106 in the 324 Building. The HLW was transferred to tank 107, where the chemical composition was adjusted to that of typical waste by adding uranium and nonradioactive chemicals. Inert chemicals added to the HLW in tank 107 were $NaNO_3$, $Fe(NO_3)$-$9H_2O$, $Cr(NO_3)$-$9H_2O$, $Ni(NO_3)$-$6H_2O$, and H_3PO_4 (75%). The waste feed material was transferred to B-cell feed tank 114 and to evaporator tank 113 to adjust the acid concentration and volume for the vitrification process. The concentrated solutions from the waste feed preparation process were used for the two batch operations of the spray calcine/in-can melter system. Glass-forming compounds added to the HLW calcine during the vitrification process were SiO_2, Na_2O, B_2O_3, TiO_2, Li_2O, MgO, ZrO_2, and La_2O_3.

Because of the high radioactivity of the glass logs produced, the logs were designated as special-case waste with no identified disposal path. After modifications to the Hanford Facility RCRA Permit (Ecology 1994), the glass logs were transported for storage to the Plutonium-Uranium Extraction (PUREX) Plant's storage tunnels.

The NWVP activities were completed in 1979. From 1979 through 1981, no activities occurred in B-cell.

The ZVDP was started and completed in 1981. The program was designed to demonstrate that zeolite IX resins could be vitrified as an alternate means to immobilize radionuclides present in the resin for storage. Equipment was fabricated and placed in B-cell to allow the dry zeolite to be mixed with dry glass formers and then fed to a canister inside an in-can melter. Glass formers used in the process were SiO_2, Na_2O, B_2O_3, TiO_2, Li_2O, MgO, ZrO_2, and La_2O_3. A total of five resin beds were received and used in the demonstration, which produced eight glass logs that were transferred to PUREX Plant's storage tunnels.

The RLFCM testing task, including installation and testing of the ceramic melter in B-cell, occurred from 1982 through 1986. Existing equipment in the cell and ZVDP equipment were demolished and shipped to the 200 Area burial grounds to make room for the turntable/melter and auxiliary equipment necessary for the process.

The RLFCM program consisted of a ceramic melter capable of directly handling liquid slurries of waste. Waste slurries were fed into the top of the melter, where liquids in the slurry were flash evaporated. The waste formed a crust of material that floated on top of a layer of molten glass. The crust gradually would melt to fusion temperatures, joining the molten glass beneath. Molten glass was poured into stainless-steel canisters moved beneath the melter discharge by a turntable system. The system allowed continuous production of glass during a melter run.

Testing of the RLFCM included a "cold run" in which no radionuclides were included in the feed and a "hot run" in which depleted uranium and natural thorium oxide were added to the feed. A total of four canisters of glass were produced during RLFCM testing. After testing, the RLFCM was used to produce the heat and radiation sources for the FRG Program.

From 1986 through 1987, the RLFCM task produced 30 isotopic heat sources in canisters for the FRG Program to be used as part of a repository testing program. Canisters were filled using the radioactive liquid-fed ceramic melter to produce a borosilicate glass. Feed materials for these campaigns were cesium-137 and strontium-90 laden nitrate solutions from the B Plant complex. The resulting feed slurry was fed into the RLFCM and melted to form a borosilicate glass.

During 1986, melter feed consisting of a nitric acid solution that contained cesium, strontium, and impurities (including lead, chrome, and plutonium) spilled onto the floor of B-cell and evaporated. The resulting dry material was conservatively assumed to be dispersible.

These 30 canisters, as well as the 4 canisters produced in the earlier RLFCM task, were loaded into storage casks and transferred to a storage area in the CWC.

The plutonium-uranium reduction extraction off-gas handling system in B-cell was in service from 1966 through 1987. Another off-gas scrubber rack occurred between 1984 and 1985 as part of an equipment upgrade to support RLFCM testing task and the FRG Program.

Effluents generated from vitrification (glass-making) processes consisted of volatilized material from the feed, entrained liquid or solid aerosols, and process air. The volatilized materials consisted primarily of water, nitric acid, various oxides of nitrogen, and a small amount of ruthenium tetroxide (RuO_4). Noncondensible constituents in the melter system off-gases were discharged to the atmosphere after treatment by in-cell process off-gas scrubbers and HEPA filtration.

B-cell mixed waste and excess equipment removal were completed during calendar year 2001 in accordance with Tri-Party Agreement Interim Milestone M-89-02. Essential hot cell equipment was retained as necessary to support facility disposition and demolition activities. These essential tools and equipment will be disposed as a part of the B-cell D4 actions.

1.7.1.4 324 Building REC C-Cell Process Knowledge. C-cell has been used since 1968 for material characterization work in support of several programs. Most of the characterization work performed involved leaching studies of glass produced during the WSEP and spent fuel from various commercial reactors. The leaching studies performed centered around characterization of groundwater effects on waste forms. The leachates used were distilled water, onsite groundwater, brines, and some carbonate buffered aqueous solutions.

Equipment in C-cell was removed and the cell was decontaminated in 1989. Since 1989, C-cell has been used for research and development activities for spent fuel and target assemblies. In 1996, equipment was installed to perform treatability studies on waste tank sludge from the 200 Areas. The equipment and materials were removed following completion of the tests.

C-cell is equipped with one sump, which is located in the southwest corner of the cell. A collection trench runs along the south wall of the cell. The floor of the cell is sloped to the sump. In 1995, the sump was cleaned rigorously and completely, and it was then sealed closed by welding a stainless-steel plate to the floor. The collection trench is still functional.

1.7.1.5 324 Building REC D-Cell Process Knowledge. Work activities performed in D-cell include preparation of WSEP glass samples for analysis, characterization, and sectioning; sample preparation of commercial spent fuel samples; and production of glass standards for the Materials Characterization Center Program. Activities also included spent fuel heat and radiation degradation studies for the Commercial Spent Fuel Management Program and the operation of equipment used during the HLV Liquids Interim Action Project. Solid materials were produced during these activities and were transferred to burial grounds in the 200 Areas. Lead used for shielding and counterweights was transferred the CWC.

A radioactive liquid waste leak was detected in 1977 under C-cell. At the time, D-cell operations involved work with strontium-90 fluoride. While performing work in the ventilation duct space under C-cell, liquid containing high levels of radiation was noted as leaking from a crack in the concrete ceiling of the crawl space (which was actually the floor of C-cell). The source of the leak was a transfer line that was used to jet the contents of the D-cell sump to the LLV tanks, which was confirmed through analysis of the leaking solution that showed high levels of strontium-90. The only work occurring with strontium-90 was in D-cell. The line, which is imbedded in the concrete walls of both C-cell and D-cell, failed for unknown reasons. The suspect line was isolated to prevent further use, and another transfer line was designated for use.

D-cell has a sump that is located in the southwest corner of the cell. There is no documentation to indicate accumulation of liquids in the sump.

1.7.1.6 324 Building REC Airlock Process Knowledge. The airlock is used to perform radiological decontamination of cranes and other equipment from the hot cells before maintenance activities. Solutions generated during decontamination, as well as rinse water used to flush the airlock after decontamination activities, flow via gravity to the pipe trench.

The airlock allows for access to the REC (A-, B-, C-, and D-cells) and the pipe trench. It is used primarily as a transition zone for maintenance and for the transfer of material and equipment into and out of those areas. The airlock is used for final radiological decontamination of containers before releasing to the cask-handling area. Decontamination in the airlock is required because of the airborne nature of radiological contaminants within B-cell. The decontamination solutions currently flow via gravity to the pipe trench.

1.7.1.7 324 Building REC Pipe Trench and Other REC-Associated Components Process Knowledge. The pipe trench was used to make utility, process, and waste-handling piping connections between the cells and the HLV tanks. Process and waste-handling piping connects the pipe trench, REC airlock, HLV tanks, LLV tanks, and B-cell. The pipe trench was used as a shielded pipe chase to allow transfer piping from the HLV/LLV tanks to connect to service plugs on B-cell. In addition, residual dust and dirt from the settling of airborne particulates through the airlock and pipe trench have become radiologically contaminated because of decontamination activities carried out in the airlock. Removal of 324 Building REC airlock pipe trench residue was completed in 2002.

In the mid-1970s, a triple-encased interbuilding transfer line (transfer piping with two outer-pipe containments) was installed in the pipe trench to transfer spent fuel dissolved in nitric acid to the 325 Building and to return the processed solution to the 324 Building.

The pipe trench was also designed to contain water used for decontamination in the REC airlock. The liquid collected in the bottom of the trench is transferred to LLV tank 102.

Other REC-associated area components include the HLV/LLV piping and contaminated concrete surrounding B-cell shield plugs, as well as the pass-through ports and service cubicles in B-cell and A-cell. Removal of HLV/LLV piping and contaminated concrete adjacent to the B-cell service plugs is part of planned closure activities due to contamination near the service plugs.

The truck lock provides access into and out of the 324 Building for all radioactive material. The area consists of a loading bay that is accessible by truck or railcar and a radioactive liquid loadout stall used to transfer radioactive liquids into or out of the facility using appropriate transport casks.

The loadout stall is a shielded and ventilated cubicle containing piping connections and valve manifolds that allowed routing of liquids to or from the HLV and LLV tanks. It was last used during the production of sealed isotopic heat sources for the FRG Program in 1986 to transfer radioactive cesium and strontium solutions to HLV tanks 104 and 105. The truck lock and loadout stall were used to transport radioactive solutions contaminated with heavy metals into the building for use during the production of sealed isotopic heat sources for the FRG Program.

1.7.1.8 324 Building HLV, Tanks, and Piping Process Knowledge. Before the cessation of processing activities in 1988, the HLV tanks were used for the storage of highly radioactive process feed solutions, distillates from in-cell vitrification processes, and nitric acid recovery. The HLV tanks also were used to collect liquid effluent from the in-cell sumps and to receive highly radioactive liquids transferred through the loadout stall in the truck lock. Material stored in the HLV tanks is considered to be mixed waste. The HLV Interim Waste Removal Action Project drained and flushed the tanks in 1996.

Tank 104 stored cesium nitrate solution containing trace amounts of heavy metals received from the B Plant complex to support the FRG Program. Tank 104 was able to receive solutions from C-cell, D-cell, A-cell, B-cell, the loadout stall, HLV sump, HLV tanks 105 and 107, and LLV tank 102. The contents of tank 104 were transferred to the loadout stall and tank 105. There are also process connections to and from tank 104 and the pipe trench. Since 1988, transfers have occurred from tank 104 to tank 105, to tank 112, and to tank 107. Periodic additions of water have historically been made to tank 104 to maintain the liquid level above the instrument lines in the tank. Tank 104 was flushed and drained in 1996 as part of the HLV tank waste removal activity, and the tank is currently is empty.

Tank 105 was able to receive solutions from tanks 104 and 106, A-cell, B-cell cubicles B-12 and B-14, the loadout stall, and the REC airlock. The contents of tank 105 were transferred to tank 104 and the loadout stall. There also are process connections to and from tank 105 and the pipe trench. Tank 105 stored strontium nitrate solution containing trace amounts of heavy metals received from the B Plant complex to support the FRG Program. Since 1988, periodic transfers have occurred to tank 105 from the REC airlock, tank 104, and tank 107. Tank 105 currently contains liquid.

Tank 106 was able to receive solutions from tank 107, the loadout stall, B-cell, and D-cell. The contents of tank 106 were transferred to the loadout stall and tanks 105 and 107. There are process connections between tank 106 and the pipe trench. Tank 106 was used to receive dilute HLLW from the 325 Building via the interbuilding pipeline. The interbuilding pipeline was used to transfer dissolver solution to the 325 Building and was used to transfer dilute HLLW from the 325 Building to tank 106. Connections between the interbuilding pipeline and tanks in the building were made in the pipe trench. After receiving the dilute HLLW in tank 106, the diluted HLLW was transferred to tank 107 for processing. As part of the HLV Tank Liquid Waste Interim Removal Project, tank 106 was flushed and drained in 1996 and it currently is empty.

Tank 107 was able to receive solutions from tank 106 and from gravity-fed chemical addition lines originating in the chemical makeup room on the third floor of the building. The contents of tank 107 were transferred to the loadout stall and tanks 104 and 106. Tank 107 also can receive and transfer to the pipe trench. Diluted HLW that was used as feed material for the NWVP was stored in tank 107. Dilute nitric acid was added to tank 107 on January 31, 1989; May 19, 1989; and November 10, 1989, to maintain the liquid level above the instrument lines in the tank and to ensure that products in the material stayed in solution. In January 1990, the solution and subsequent rinse water was transferred to tank 112 in B-cell, leaving tank 107 empty. Tank 112 was a process supplementary tank located in B-cell. The material was transferred to tank 112 as the first step in a potential treatment evaluation process that was not performed. The material and rinse water were returned to tank 107 in November 1992. Periodic additions of water were historically added to tank 107 to maintain the liquid level above the instrument lines in the tank. Tank 107 was flushed and drained in 1996 as part of the HLV tank waste removal activity, and the tank is currently is empty.

Samples of the HLV tanks were taken in 1990. However, the HLV tanks were emptied in 1996 and were flushed to satisfy Tri-Party Agreement Milestone M-89-01.

1.7.1.9 324 Building LLV, Tanks, and Piping Process Knowledge. The LLV tanks were used to accumulate and neutralize various low-activity liquid effluents in preparation for transfer to the 340 Building and for transfer to in the double-shell tank system in the 200 Areas.

Tank 101 was able to receive solutions from tanks 103 and 108; tank 115 within B-cell; the loadout stall, process drains; the pipe trench, the sampler drain in sample room 145; and the room 11 drain. Tank 101 was used during process runs to receive condensate from the fractionator distillate receiver in B-cell. The fractionator distillate condensed vapors coming from the melters. Since 1988, the only solution transfer that occurred to tank 101 was a partial transfer from tank 103 in October 1989. The contents of tank 101 were transferred to tank 102 or to the 340 Building. Tank 101 currently is empty

Tank 102 was able to receive solutions from tanks 101, 103, and 108; the LLV sump; C-cell; D-cell; and the EDL safety showers. The contents of tank 102 were transferred to HLV tank 104, the loadout stall, or the 340 Building. Tank 102 was used to receive condensate from the fractionator distillate receiver in B-cell via a connection in the pipe trench. Throughout the lifetime of the building, tank 102 also was used to collect solutions from decontamination sinks and emergency showers and eyewashes in rooms 146 and 147 and the truck lock sump. In October 1988, tank 102 received a phosphoric acid solution from A-cell, and the material was neutralized and transferred to the 340 Building. In January 1989, tank 102 received solution from tank 103, and the solution was transferred to the 340 Building. In November 1990, tank 102 received C-cell and airlock decontamination water from tank 103, and the solution was transferred to the 340 Building. In May 1991, tank 102 received a nitric acid solution containing chromium from tank 108. The solution was neutralized with sodium hydroxide and transferred to the 340 Building in May 1991, followed by water flush. Tank 102 currently is empty.

Tank 103 was able to receive radiological decontamination solutions from C-cell, the airlock, the loadout stall, and the pipe trench sump. The contents of tank 103 can be transferred to tanks 101 and 102 and to the loadout stall. No documentation of the use of tank 103 during processing is available; however, it is known that tank 103 was used to receive radiological decontamination solutions from the pipe trench before the pipe trench sump jet line ceased operation in 1989. In November and December 1988, tank 103 received C-cell and airlock decontamination water. In January 1989, the contents of tank 103 were transferred to tank 102 and the 340 Building. In January and February 1989, tank 103 again received solution from the pipe trench that originated from C-cell and airlock decontamination activities. In October 1989, a partial transfer of solution from tank 103 was made to tank 101. In November 1990, the remaining contents of tank 103 were transferred to tank 102. Tank 103 is currently empty.

Tank 108 was able to receive solutions from the EDL-146 drains and the pipe trench. During FRG Program canister fabrication, tank 108 was used to receive nitric acid from the acid fractionator in B-cell via a connection in the pipe trench. The solution in tank 108 was sampled and analyzed in June 1990. In May 1991, the solution was transferred to tank 102. A water flush of tank 108 was also sent to tank 102. Tank 108 currently is empty.

Samples of the LLV tanks were taken in 1990. However, the LLV tanks were emptied in 1996 and were flushed to satisfy Tri-Party Agreement Milestone M-89-01.

1.7.1.10 324 Building HLV Sampling Room 145 Process Knowledge. The 324 Building's HLV sampling room 145 was used in the past to obtain samples of solutions from the HLV and LLV. Inside the sample room is a containment box that has vacuum sampling lines to the LLV tanks and HLV tanks. The room was last used in 1990 to sample the tanks. There is no documentation or evidence of leaks from either the HLV or LLV sampling system.

1.7.1.11 324 Building REC Loadout Station Room and Two Ball Casks Process Knowledge. The 324 Building REC loadout station room was used to receive cesium and strontium nitrate solutions from B Plant for the FRG glass log program in the past. There are two empty 1,136-L (300-gal) ball casks in this room. The casks are empty but may be internally contaminated with highly radioactive material remaining after the removal of liquid solutions from the casks. The room contains piping systems that interface with the HLV and LLV that allowed jet transfers of solutions from the casks. The casks are lead shielded and weigh approximately 17.5 tons each.

1.7.1.12 324 Building REC Exhaust Air Plenums/Ducts, Filter Pits, and Filter Bank Process Knowledge. The 324 Building REC A-frame filters are high-efficiency particulate filters. The A-frame filters are difficult to access and are located in an area of high-radiation dose rates.

1.7.1.13 324 Building Wet Storage Basin Process Knowledge. The wet storage basin was used in the past for underwater storage of radioactive materials and fuel elements and for the unloading of fuel casks. Shielded transfer of highly radioactive materials from the wet basin to either cell complex was provided by remotely operated, mechanical transfer conveyors. The wet basin has been previously decommissioned, filled with sand, and covered with concrete. Characterization data are not available.

1.7.1.14 324 Building SMF Process Knowledge. The 324 Building SMF hot cells are contaminated but are not as grossly contaminated as the REC. The SMF was use to support the cesium chloride capsule processing activities using CsCl salt, and contamination is present in varying degrees.

The SMF was use to support the materials open test assemblies (MOTA) testing. From 1983 through 1992, nine MOTA irradiation campaigns were conducted at the Fast Flux Test Facility (FFTF). Thousands of MOTA specimens were produced in various alloy and shape configurations. There are approximately 400 special samples containing a variety of materials (e.g., beryllium or vanadium) and metals. The transmission electron microscope disks and thermal expansion devices contained very small amounts of liquid metals (e.g., sodium and lithium). The liquid metals were used for thermal conductivity purposes.

The SMF also contains lead sheets and lead bricks that were used for shielding. The lead is expected to have some surface contamination.

1.7.2 327 Building Process Knowledge

The 327 Building, also referred to as the Post-Irradiation Test Laboratory, was operated from 1953 to 1996. The 327 Building consists of specially equipped, shielded, and ventilated hot cells and laboratories designed for physical and metallurgical examination and for the testing of irradiated fuels, concentrated fission products, and irradiated structural materials. Process knowledge for the 327 Building selected areas is addressed in the following subsections.

1.7.2.1 327 Building Hot Cells Process Knowledge. The 327 Building A-cell was used for visual examination, sectioning and cutting, and packaging for the disposal of waste containing irradiated fuel material.

B-cell was used for structural materials post-irradiation testing, including preliminary preparation for transmission electron microscopy and density measurements. Irradiated materials handled and prepared in B-cell included material from experiments at FFTF, EBR-II, N Reactor, and light-water reactors.

C-cell was used for metallography of irradiated materials and fuels from experiments at FFTF and EBR-II. Fuel/cladding sections from light-water reactor fuel rods and sections of N Reactor fuel elements/process tubes were also examined in C-cell.

D-cell was used for material property testing of fuel pin cladding sections from EBR-II and FFTF experiments. Radio-frequency heating and gas pressurization were used to simulate in-reactor accident conditions. Remote extensionmetry, in-cell welding, and macro-photography were also performed in D-cell. The activities may have resulted in gaseous fission products, including cesium, to be released to the ducts and filters.

E-cell was used for the same functions as described above for C-cell.

F-cell was used to recover test samples from test capsules and to recover fuel from cladding to prepare test specimens for density measurements or cladding tests performed in D-cell. F-cell was also used to rough-cut sections for test specimens.

G-cell was used for precision sample fabrication of material property test specimens (e.g., tensile and fracture toughness). G-cell was maintained free of alpha contamination.

H-cell was used for physical property tests for irradiated fuels and materials. Tests included thermal conductivity, helium leak testing, inerting cell interior for capsule disassembly, lithium reactions (stabilization), gas sampling, and cesium reservoir spark tests of irradiated specimens from experiments in EBR-II and FFTF.

I-cell was used for corrosion tests of irradiated fuel from waste repository studies. The long-term tests exposed fuel specimens to controlled conditions of heat and moisture.

The 327 Building SERF cell was a sealed enclosure that provided for examination and storage with a nitrogen atmosphere for work with specimens that would be adversely affected by contact with oxygen or water vapor. It was used primarily for metallography. Irradiated fuels were prepared for sectioning, gas sampling, photography, and microhardness.

1.7.2.2 327 Building Wet Basins, Burst Test Basin, Burst Test Instrumentation Pit, and Wet Basin Storage Process Knowledge. The wet basin and wet storage basin are currently full of water. The IX column in the large wet basin consists of two vessels (cation and anion), each 40.6 cm (16 in.) in outer diameter and 1.8 m (6 ft) long. They are installed with cation above anion in a steel rack vertically in the basin. They were once part of the basin water purification system and were not regenerated completely prior to removal from service (i.e., they still contain resin). Almost all of the activity is interpreted, from dose rates, to reside in the cation (upper) housing. The column is assumed to have retained some TRU. The IX columns will be removed prior to D4 Project activities.

The 327 Building's burst test basin has been backfilled with rock and dirt and is capped by concrete that is level with the floor. The basin was linked to the large wet storage basin, but that port has been sealed. The outside walls of the basin are not visible from the normally accessed areas of the basement. This area was cleaned out prior to backfilling. The instrumentation pit, located adjacent to and north of the burst test basin, was viewed by facility and Ecology staff in 2001. Water from the instrumentation pit was sampled and analyzed and was found to be slightly radioactive and was designated as nondangerous radioactive wastewater based on chemistry results (WCH 2006).

1.7.2.3 327 Building Dry Storage Including Exhaust Duct and Filter Bank Process Knowledge. The 327 Building dry storage was used for storage of small fuel samples that had been processed and for structural material test specimens removed from irradiated assemblies.

The dry storage cell was used to store materials and items removed from the 327 Facility hot cells. These materials included various irradiated test specimens such as laboratory samples and sectioned fuel rods. These materials were packaged inside approximately 6.35–cm (2.5-in.)-diameter "soup cans," which are very similar to an actual soup can. These storage cans were transferred from the 1-ton laboratory and dry storage cask and were lowered into the storage carousel using a long-reach vacuum transfer pole with a suction cup on the end. The storage cans were placed into the correct location in a storage position liner (i.e. a small cup that rests in each hole or opening of the storage carousel). All steel plates and parts were sandblasted and degreased and given one shop-spray coating of light yellow-green zinc chromate metal primer.

The dry storage exhaust duct is constructed of standard 25.4–cm (10-in.) piping and is welded into the center of the floor pan. This exhaust duct ties into the 327 Building ventilation system.

1.7.2.4 327 Building Hot Cell Drains and RLWS Process Knowledge. The 327 Building RLWS served areas with high potential for contamination, including hot cells and fume hoods. A sump and pump system is provided in the basement's cell filter room to serve areas that are below the level of the RLWS main. These liquids were once released to the 340 Building for collection, which then transferred them to the 200 East Area tank farms; however, the 340 Building is now isolated from the 327 Building RLWS drain system. The RLWS sump is located toward the northwest side of the main basement room, below the hot cells.

The RLWS drain shut-off valve, diverter station, and an overflow drum are located in the southwest corner of the main basement room, below the hot cells.

The RLWS pipe is radiologically contaminated with residual particulate material that settled during gravity transfer of liquids with suspended solids in the past. Water (with suspended solids) from the RLWS pipe was sampled and analyzed in the past and was found to be moderately radioactive. The wastewater was designated as nondangerous radioactive waste based on chemistry results.

1.7.2.5 327 Building Hot Cells Exhaust Plenums/Ducts and First Filter Bank Process Knowledge. The 327 Building hot cells exhaust system plenums/ducts up to the first set of HEPA filters are posted as "very high radiation areas." There are no additional data available.

1.7.2.6 327 Building SERF Cell Recirculation System Process Knowledge. This system was used in the past to filter and cool the nitrogen atmosphere that was maintained in SERF cell. This system, with the exception of the compressors and condensing, is currently isolated behind a temporary lead-shielding barrier due to its extreme dose rates and contamination holdup. It is expected that the major contributor to this radiation field is the holdup on the two filters and potentially on the two sets of cooling coils. The 22,712.5–L (6,000-gal) nitrogen tank will be removed as a part of a separate project in the spring of 2006.

1.7.3 Hot Cell Cleanout Activities

There have been campaigns to cleanout regulated and nonregulated wastes from both 324 and 327 Buildings as part of facility deactivation activities. This has involved residual contamination, waste, and equipment removal. These efforts are in support of Tri-Party Agreement Milestone M-92-13.

Removal of the 324 Building REC B-cell mixed waste and excess equipment was completed in 2001, which fulfilled Tri-Part Agreement Milestone M-89-02. The cleanout activity involved the removal and shipping of both regulated and nonregulated waste from B-cell.

Removal of 324 Building D-cell mixed waste and equipment was completed in 2001. Removal of the 324 Building REC airlock pipe trench residue was completed in 2002. Removal of SNF from the 324 Building's B-cell and D-cell was completed in 2003. As indicated by a letter from the U.S. Department of Energy, Richland Operations Office (DOE-RL 2003), the HLW, SNF, and special nuclear material have all been removed from the 324 Building and transferred to the 200 Area interim storage area.

Table 1-5 summarizes the current best available estimated radionuclide inventory for the areas of interest in the 324 Building that are within the scope of this DQO summary report. Table 1-6 summarizes the current best available estimated radionuclide inventory for the areas of interest in the 327 Building that are within the scope of this DQO summary report.

Table 1-5. Best Available Estimate of Radionuclide Inventory for the 324 Building. (2 Pages)

Area/Cell	Estimated Inventory	Basis
REC/A-cell	Trace	Cell cleaned out (inventory excludes containers with material cleaned out and removed from B-cell).
REC/B-cell	40,000 Ci	Cell cleaned out (inventory includes two large containers of B-cell material, equipment, and tools). Based on information in the 324 Building basis of interim operation (FH 2005a), it is estimated that the remaining activity is less than 20,000 Ci. This activity is increased by 20,000 Ci (100%) to allow for uncertainties in the authorization basis estimation of activity.
REC/C-cell	Trace	Cell cleaned out (inventory includes equipment).
REC/D-cell	300 Ci	1998 smear analysis (inventory before cell was cleaned out in 2003).
REC/airlock pipe trench	500 Ci	FH (2001b); inventory before cleanout that occurred in 2002.
Shielded Materials Facility/cells and airlock	1,000 Ci	PNNL (2002); inventory includes equipment, tools, and material.
High-level vault and low-level vault/tanks	25,000 Ci	Based on information in the 324 Building basis of interim operation (FH 2005a).
Wet basin	Unknown	No characterization data or estimates are available.
A-frame HEPA filters	12 to 15 Ci	Based on Microshield® modeling performed (FH 1998b); calculations based on 50 rem/hr filter-loading changeout criteria.
Total (Ci)	**66,815 Ci**	

Microshield® software is a registered trademark of Grove Software, Inc., Lynchburg, Virginia.
HEPA = high-efficiency particulate air
REC = radiochemical engineering cells

Table 1-6. Best Available Estimate of Radionuclide Inventory for the 327 Building Hot Cells.

Isotope	A-Cell[a] Inventory (µCi)	B-Cell[a] Inventory (µCi)	C-Cell[a] Inventory (µCi)	D-Cell[a] Inventory (µCi)	E-Cell[a] Inventory (µCi)	F-Cell[a] Inventory (µCi)	G-Cell[a] Inventory (µCi)	H-Cell[a] Inventory (µCi)	I-Cell[b] Inventory (µCi)	SERF Cell[b] Inventory (µCi)	Totals (µCi)
Mn-54	1.35	ND	ND	ND	5.27	ND	ND	CDNA	ND	ND	6.62
Co-60	19.7	4.53	0.37	ND	5.99	12.5	18,560	241	0.026	ND	18,800
Sb-125	5.61	ND	6.25	ND	4.2	ND	CDNA	CDNA	CDNA	CDNA	16.1
Cs-134	18.6	0.389	2.17	31.7	7.5	21.8	145.6	32.1	0.503	2188	2,450
Cs-137	21,758	27.0	79	3,780	739	21,710	5,320	1,240	1210	176,440	232,000
Sr-90	24.4	ND	12.9	209	204	8,060	1,238	10.43	366	740	10,900
Eu-154	ND	ND	0.9	ND	6.51	45.9	(44.8)	ND	1.47	158	168
Eu-155	ND	ND	1.7	ND	4.46	26.0	(18.7)	ND	ND	1,153	1,170
Tc-99	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	3.666	0.004858	CDNA	CDNA	3.67
Np-237	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	0.001563	0.000005918	CDNA	CDNA	0.00157
U-233	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	0.001355	0.0004021	CDNA	CDNA	1.36
U-234	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	0.004659	CDNA	CDNA	CDNA	0.00466
U-235	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	0.0001555	0.0000034	CDNA	CDNA	0.000159
U-236	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	0.0003842	CDNA	CDNA	CDNA	0.000384
U-238	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	0.003158	0.000004802	CDNA	CDNA	0.00316
Pu-238	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	ND	CDNA	CDNA	0
Pu-239	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	ND	CDNA	CDNA	0
Pu-240	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	0
Pu-241	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	0
Pu-242	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	CDNA	0
Am-241	15.8	0.194	3.44	53.6	15.7	276	(384)	(0.425)	39.6	1,938	2,730
Cm-242	0.00325	ND	0.0145	0.256	ND	0.384	0.5530	ND	(0.0278)	(2.68)	3.91855
Total (µCi)	**21,843.46**	**32.11**	**106.74**	**4,074.56**	**992.63**	**30,152.58**	**25,591.65**	**1,523.96**	**1,619.89**	**182,623.9**	**42,300**

[a] Values were obtained from characterization performed (FH 1998a). Sample results were analyzed and reported in 1998.

[b] Values obtained from characterization performed (FH 2003b), except where noted with ( ). Sample results were analyzed and reported in 2003.

NOTE: Samples/surveys were not able to be obtained from inaccessible surfaces such as under hot cell pedestals, fixed surface contamination areas on walls floors and ceilings inside hot cells, void space areas between the main floor and the hot cells, and the abandoned burst test pit.

ND = not detected

CDNA = characterization data not available

1.7.4 Airborne Releases

The 324 and 327 Building hot cells had ventilation systems (confinement zones), each served by fan units, and plenums connected to ductwork containing banks of high-efficiency or HEPA filters. A negative pressure has been maintained in the hot cells. The purpose of this system was to prevent the spread of radioactive contamination and to provide a controlled environment. Air exhausted from hot cells was routed through the HEPA filters to remove radioactive particulates from the exhaust air.

Feed material that consisted of a nitric acid solution containing cesium, strontium, and impurities (including lead, chrome, and plutonium) spilled onto the floor of B-cell and evaporated. The resulting dry material was conservatively assumed to be dispersible.

1.7.5 Past Waste Disposal

Hot cell solid wastes generally consisted of reactor components, contaminated equipment, tools, and miscellaneous contaminated items (e.g., construction and repair debris, etc.). The main source of these wastes was research of reactor operations and the most highly radioactive solid wastes. The majority of the solid wastes in the hot cells were packaged and transported to other locations (e.g., CWC) for disposal and/or storage. Since deactivation began in 1996, all solid waste materials not attached to the hot cells were removed and disposed.

Table 1-7 identifies supporting documentation and resources related to waste disposition and handling for the 324 and 327 Buildings that are in the scope of this DQO summary report.

Table 1-7. Supporting Waste Disposition Documentation. (3 Pages)

Waste Profile Data Sheet 324-100/ 120-0001, Rev. 0	Waste profile for LLW (Category I & III) generated at the 324 Building (REC airlock, cask-handling area, room 147). Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 324-100/ 120-0005, Rev. 0	Waste profile for compacted LLW (Category I & III) generated at the 324 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 324-120-0006, Rev. 0	Waste profile for high-radioactivity content LLW (Category III) generated at the 324 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 324-100/ 120-0007, Rev. 0	Waste profile for low-radioactivity LLW (Category I & III) generated at the 324 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 324-100/ 120-0008, Rev. 0	Waste profile for non-RCRA, non-state-regulated LLW (Category I & III) generated at the 324 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 324-120-0010, Rev. 0	Waste profile for B-cell remote-handled waste (Category III), NRC Class C or less, generated at the 324 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 324-120-0011, Rev. 0	Waste profile for SMF south high-activity LLW (Category I & III) generated at the 324 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 324-400-0001, Rev. 0	Waste profile for flammable liquid waste with a flash point <30°C (Category I & III) generated at the 324 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.

Table 1-7. Supporting Waste Disposition Documentation. (3 Pages)

Waste Profile Data Sheet 324-409-0001, Rev. 0	Waste profile for organic/aqueous liquid with a flash point 60°C to 93.3°C waste (Category I & III) generated at the 324 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 324-627-00011, Rev. 0	Waste profile for oil/solvent rag waste (Category I & III) generated at the 324 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 324-646-0001, Rev. 0	Waste profile for low-level miscellaneous waste with lead, solder, batteries, and items containing lead and mercury (Category I & III) generated at the 324 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 324-647-0006, Rev. 0	Waste profile for process off-gas filters waste (Category I & III) generated in room 11 at the 324 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 324-810-0001, Rev. 0	Waste profile for cleanup of spilled mercury waste (miscellaneous low-level) generated at the 324 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 324-930-0001, Rev. 0	Waste profile for Federal and state LDR compliant waste (Category I & III) generated at the 324 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 327-100-0001, Rev. 0	Waste profile for LLW from RLWS generated at the 327 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 327-100-0004, Rev. 0	Waste profile for compacted LLW generated at the 327 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 327-100-0006, Rev. 0	Waste profile for non-RCRA, non-state-regulated LLW generated at the 327 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 327-120-0001, Rev. 0	Waste profile for LLW from RLWS generated at the 327 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 327-120-0004, Rev. 0	Waste profile for compacted LLW generated at the 327 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 327-120-000, Rev. 0	Waste profile for remote-handled low-level hot cell waste generated at the 327 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 327-120-0006, Rev. 0	Waste profile for non-RCRA, non-state-regulated LLW generated at the 327 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 327-400-0001, Rev. 0	Waste profile for mixed low-level FLA waste generated at the 327 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 327-401-0001, Rev. 0	Waste profile for mixed low-level contact-handled waste generated at the 327 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 327-402-0001, Rev. 0	Waste profile for mixed low-level ACI waste generated at the 327 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 327-403-0001, Rev. 0	Waste profile for mixed low-level contamination area waste generated at the 327 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.

Table 1-7. Supporting Waste Disposition Documentation. (3 Pages)

Waste Profile Data Sheet 327-422-0001, Rev. 0	Waste profile for other liquid non-thermal waste generated at the 327 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 327-521-0001, Rev. 0	Waste profile for oxidizer solids non-thermal waste generated at the 327 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 327-902-0001, Rev. 0	Waste profile for state-only inorganic solids waste generated at the 327 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 327-923-0001, Rev. 0	Waste profile for state-only organic solids waste generated at the 327 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.
Waste Profile Data Sheet 327-930-0001, Rev. 0	Waste profile for mixed low-level FED waste generated at the 327 Building. Wastes under this profile would be indicative of the wastes generated during D4 activities.

ACI = ACI DIC
D4 = decommission, deactivate, decontaminate, and demolish
FED = Federal and State LDR compliant
FLA = flammable
LDR = land disposal restricted
LLW = low-level waste
NRC = U.S. Nuclear Regulatory Commission
RCRA = *Resource Conservation and Recovery Act of 1976*
REC = radiochemical engineering cells
RLWS = radioactive liquid waste system
SMF = Shielded Material Facility

1.8 WASTE STREAMS AND SUSPECTED SOURCES

Historical information, process knowledge, existing data, and other information gathered during the scoping phase of this DQO process have been evaluated by the DQO team to identify specific WSs associated with the subject facilities. Table 1-8 summarizes specific WSs that may be generated during D4 Project activities. General suspect sources and contaminants of potential concern (COPCs) for each type of waste generated are shown.

The WS numbering system in Table 1-8 is consistent with the WS numbering system used in the D&D SAP (DOE-RL 2005a). WS #1 through WS #6, WS #11 through WS #14, and WS #17 through WS #20 are taken directly from the D&D SAP. WS #7 through WS #10, WS #15, and WS #16 are address by the D&D SAP but are not applicable to the scope of this hot cell DQO summary report. WS #21 through WS #33 are not part of the D&D SAP but have been identified as new WSs that apply to the scope of this DQO summary report.

WS #1 through WS #6, WS #11 through #14, and WS #17 through WS #20 could potentially be generated but are not expected. They are included to ensure that there are no gaps between this hot cell DQO and the existing D&D SAP (DOE-RL 2005a).

Table 1-8. Waste Streams and Known or Suspected Sources of Contamination. (3 Pages)

WS #[a]	Description	Known or Suspected Source of Contamination
1	Bulk demolition debris (including, but not limited to, poured concrete, meehanite roofing, pumps, piping, steel siding, miscellaneous equipment, coatings, filter pits, concrete plenums, ventilation systems, below-grade drain lines, and sumps)	Radiological contamination corresponding to the hot cells contamination region
		Potential hazardous materials and characteristics from hot cells process chemicals and construction materials
2	Metal cuttings, shavings, filings, and pieces	Potential airborne or waterborne radioactive, heavy metal (e.g., beryllium), and chemical contamination from past operations, cutting oils, solid laboratory waste, and metals
3	Asbestos-containing material (including, but not limited to, cement asbestos board, pipe and building insulation, gaskets, and ventilation gaskets)	Asbestos fibers in building materials
		Potential radiological contamination corresponding to hot cells contamination region
4	Miscellaneous aqueous liquid (including, but not limited to, liquids identified in system pumps, sumps, tanks, piping, drains, and processing equipment) for disposal at ETF and for use in dust suppression	Radiological contamination corresponding to hot cells contamination region
		Potential hazardous materials and characteristics from hot cells process chemicals
5	Miscellaneous bulk solids (including, but not limited to, sludge, sediment and solid materials collected from system pumps, sumps, tanks, piping, drains, and processing equipment)	Radiological contamination corresponding to hot cells contamination region
		Potential hazardous materials and characteristics from hot cells process chemicals
6	Plant equipment and manipulators (lubrication grease, oil, hydraulic oils, mineral oil in windows, and petroleum products)	Potential radiological contamination corresponding to hot cells contamination region
		Residue from metallic parts, lubricants, and chemicals used as additives
10	Refrigerant used for SERF cell recirculation system	Potential radiological contamination corresponding to hot cells contamination region
		Freon
11	Mercury-containing equipment (manometers, vacuum pumps, switches, mercury vapor lights)	Potential radiological contamination corresponding to hot cells contamination region
		Mercury-activated switches, elemental mercury, and mercury residue
12	Lead packing, washers, and shielding	Radiological contamination corresponding to hot cells contamination region
		Shielding materials, packing in pipe joints, lead washers, and fasteners
13	Fluorescent light ballasts	Internals of light ballasts.
14	Fluorescent light tubes and incandescent light bulbs	Internals of bulbs, leaded-base
17	Miscellaneous materials for salvage (e.g., mineral oil in cell windows)	Potential airborne and/or waterborne radioactive and chemical contamination from past operations

Table 1-8. Waste Streams and Known or Suspected Sources of Contamination. (3 Pages)

WS #[a]	Description	Known or Suspected Source of Contamination
18	Soil and sediment	Potential airborne and/or waterborne radioactive and chemical contamination from past operations
		Residue from petroleum products and cleaning materials
		Residue from external application of herbicides and pesticides
19	HEPA filters and filter media	Radiological contamination corresponding to hot cells contamination region
		Potential hazardous materials and characteristics from hot cells process chemicals and operations
20	Unexpected media and waste forms (including solids and liquids)	Potential radiological contamination corresponding to hot cells contamination region
		To be determined using historical information and process knowledge
21	Contaminated waste piping, cable, ducts, and coatings (including RLWS at the 327 Building)	Potential radiological contamination corresponding to hot cells contamination region; drains from hot cells in 327 Building drained into RLWS
		Potential hazardous materials and characteristics from hot cells process chemicals and construction materials
		Asbestos felt wrap
		Lead packing
22	324 Building – A-cell	Radiological contamination corresponding to REC region
		Potential hazardous materials and characteristics from hot cells process chemicals and construction materials
23	324 Building – B-cell	Radiological contamination corresponding to REC region
		Potential hazardous materials and characteristics from Hot Cells process chemicals and construction materials
24	324 Building – C-cell	Radiological contamination corresponding to REC region
		Potential hazardous materials and characteristics from hot cells process chemicals and construction materials
25	324 Building – D-cell	Radiological contamination corresponding to REC region
		Potential hazardous materials and characteristics from hot cells process chemicals and construction materials
26	324 Building – REC airlock	Radiological contamination corresponding to REC region

Table 1-8. Waste Streams and Known or Suspected Sources of Contamination. (3 Pages)

WS #[a]	Description	Known or Suspected Source of Contamination
		Potential hazardous materials and characteristics from hot cells process chemicals and construction materials
27	324 Building – loadout station and contents (including spills and two 17.5-ton ball casks)	Radiological contamination corresponding to REC region
28	324 Building – SMF including the south cell, east cell, and SMF airlock	Radiological contamination corresponding to SMF region
		Potential hazardous materials and characteristics from hot cells process chemicals and construction materials
29	324 Building – HLV (including tanks, piping, and sample room 145)	Radiological contamination corresponding to REC region
		Potential hazardous materials and characteristics from REC process chemicals and construction materials
30	324 Building – LLV (including tanks and piping)	Radiological contamination corresponding to REC region
		Potential hazardous materials and characteristics from REC process chemicals and construction materials
31	324 Building – wet basin (filled in – includes soil and/or fill material)	Radiological contamination corresponding to REC region
		Potential hazardous materials and characteristics from REC process chemicals and construction materials
32	327 Building – hot cells (A through I and SERF cell)	Radiological contamination corresponding to hot cells region
		Potential hazardous materials and characteristics from hot cells process chemicals and construction materials
33	327 Building – burst test basin (filled in – includes soil and/or fill material), burst test instrument pit, wet basin, and wet storage basin	Radiological contamination corresponding to hot cells region
		Potential hazardous materials and characteristics from 327 Building hot cells process chemicals and construction materials

[a] Waste stream (WS) numbering system was modified to match the WS numbering system used in the *300 Area D&D Waste Sampling and Analysis Plan* (DOE-RL 2005a).

ETF = Effluent Treatment Facility
HEPA = high efficiency particulate air
HLV = high-level vault
LLV = low-level vault
REC = radiochemical engineering cells
RLWS = Radioactive Liquid Waste System
SERF = Special Environment Radiometallurgy Facility
SMF = Shielded Material Facility

1.9 CONTAMINANTS OF POTENTIAL CONCERN

Table 1-9 identifies the COPCs that could potentially be associated with the 324 and 327 Building hot cells D4 Project and represents the complete unconstrained set of COPCs. The COPC list was developed from materials known to be used in the processes occurring in the facilities within the scope of this DQO summary report. It was developed from review and evaluation of the historical references presented in Table 1-4. Waste characteristics needed for waste designation were also added to the COPC list.

Table 1-9. Sources of Contamination, Contaminants of Potential Concern, and Affected Media. (2 Pages)

Source of Contamination	Type of Contamination	Affected Media
Research and development processes	Mixed fission products, activation products, transuranics, process chemicals, and characteristics needed for waste designation	Facility structures and equipment

Radioactive COPCs			
Americium-241	Europium-152	Plutonium-242	Thorium-228
Antimony-125	Europium-154	Promethium-147	Thorium-232
Barium-137m	Europium-155	Radium-226	Tritium
Carbon-14	Iodine-129	Rhodium-106	Uranium-233
Cerium-144	Krypton-85	Ruthenium-106	Uranium-234
Cesium-134	Neptunium-237	Samarium-151	Uranium 235
Cesium-137	Managanese-54	Selenium-79	Uranium-236
Cobalt-60	Plutonium-238	Strontium-90	Uranium-238
Curium-242	Plutonium-239/240	Technetium-99	Yttrium-90
Curium-243	Plutonium-241	Tellurium-125m	Zirconium-95
Curium-244			
Inorganic Chemical COPCs			
Aluminum	Cyanide	Nitric acid	Sodium chloride
Antimony	Dyprosium	Osmic acid	Sodium hydroxide
Arsenic	Fluoride	Osmium	Sodium metabisulfite
Asbestos	Halogen acids	Perchloric acid	Sodium phosphate
Barium	Hydrofluoric acid	Phosphoric acid	Sodium thiosulfate
Beryllium	Iron	Phosphorus	Strontium
Boron	Lanthanum	Potassium chloride	Sulfate
Boric acid	Lead	Potassium dichromate	Sulfide
Bromide	Lithium	Potassium iodide	Sulfuric acid
Cadmium	Magnesium	Potassium permanganate	Tellurium
Calcium	Manganese	Potassium phosphate	Titanium
Cesium	Mercury	Rhodium	Uranium
Cobalt	Molybdenum	Rubidium	Vanadium
Chloride	Neodymium	Selenium	Zinc
Chromium	Nickel	Silicon	Zirconium
Copper	Nitrate	Silver	

Table 1-9. Sources of Contamination, Contaminants of Potential Concern, and Affected Media. (2 Pages)

Source of Contamination	Type of Contamination		Affected Media
Organic Chemical COPCs			
Acetone Carbon disulfide Diethylthiourea Diethyl ether Ethyl acetate	Freon Gasoline Herbicides Hexon Kerosene	Mineral oil Naptha Methanol Paint thinner PCBs	Pentane Pesticides Trichloroethene Oil and grease BTEX
Waste Characteristic COPCs			
Conductivity Corrosivity Gross alpha activity	Gross beta activity Flashpoint (ignitability) SVOA	pH Total dissolved solids Total organic carbon	Total organic halogens Total suspended solids VOA

BTEX = benzene, toluene, ethylbenzene, and xylene
COPC = contaminant of potential concern
PCB = polychlorinated biphenyl
SVOA = semi-volatile organics analyte
VOA = volatile organic analyte

1.10 CONTAMINANT OF POTENTIAL CONCERN EXCLUSIONS

Table 1-10 presents a list of the COPCs to be excluded from the investigation. These exclusions are based on physical laws, process knowledge, and/or other mitigating factors. Table 1-10 also provides rationale for the exclusion of the identified COPCs.

Table 1-10. Contaminant of Potential Concern Exclusions. (3 Pages)

COPC	Rationale for Exclusion
Radionuclides	
Barium-137m	Less than 2-year half-life and is in secular equilibrium with parent radionuclide.
Cerium-144	Less than 2-year half-life.
Curium-242	Less than 2-year half-life.
Krypton-85	Gas.
Manganese-54	Less than 2-year half-life.
Rhodium-106	Less than 2-year half-life.
Ruthenium-106	Less than 2-year half-life.
Tellurium-125m	Less than 2-year half-life and is in secular equilibrium with parent radionuclide.
Yttrium-90	Less than 2-year half-life and is in secular equilibrium with parent radionuclide.
Zirconium-95	Less than 2-year half-life.
Metals	
Aluminum	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Boron (from boric acid)	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.

Table 1-10. Contaminant of Potential Concern Exclusions. (3 Pages)

COPC	Rationale for Exclusion
Copper	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Cyanide	Excluded as a solid material.
Dyprosium	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Iron	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Lanthanum	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Lithium	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Neodymium	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Molybdenum	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Nitrates	Excluded as a solid material.
Osmium	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Phosphorus	Excluded as a solid material, as only the elemental form would be regulated. Not expected in elemental form.
Potassium	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2. Used in liquid form only during SMF operations
Rhodium	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Sodium	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2. Used in liquid form only during SMF operations
Titanium	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Inorganics	
Chloride	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Nitrate	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Phosphate	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Sulfate	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Organics	
Diethylthiourea	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.

Table 1-10. Contaminant of Potential Concern Exclusions. (3 Pages)

COPC	Rationale for Exclusion
Herbicides	Not used in the hot cells.

CFR = *Code of Federal Regulations*
COPC = contaminant of potential concern
SMF = Shielded Material Facility
UHC = underlying hazardous constituent

Some inorganic salts, caustics, and acids are included as constituents in the waste sites being evaluated. Because laboratory analyses are generally not compound-specific, the acids, caustics, and inorganic salts were excluded from further consideration. Instead, the readily detected cations and anions (e.g., metals, fluorides, and nitrates) associated with the acids, caustics, and inorganic salts serve as the target constituents for those compounds.

The COPC identified in Table 1-10 were excluded from further consideration for this DQO summary report because they meet at least one of the following criteria for exclusion:

- If the major radionuclide content of a radioactive waste does not meet the conditions from the *Environmental Restoration Disposal Facility Waste Acceptance Criteria* (BHI 2002), then it can be excluded. The four exclusions are (1) short-lived radionuclides with half-lives less than 2 years, (2) present in a concentration less than 1 pCi/g, (3) naturally occurring isotopes at or below background levels, and (4) is in secular equilibrium with parent nuclide.
- Chemicals that exist in a gaseous state under ambient conditions and cannot accumulate.
- Chemicals that are not federally regulated (40 *Code of Federal Regulations* [CFR] 261, 40 CFR 268, or 40 CFR 761) or Washington State regulated (*Washington Administrative Code* 173-303).
- Chemical water-test reagents and standards used in small quantities and diluted during use to levels below designation limits and regulatory concern.
- Chemicals that is not persistent in the environment due to biological degradation or other natural mitigating features.

1.11 CONTAMINANT OF CONCERN CONCENTRATIONS ESTIMATED BY CALCULATION

Table 1-11 identifies the COPCs that will not require laboratory analysis for quantification but will be estimated.

Table 1-11. Contaminants of Potential Concern to Be Determined by Calculation.

COC	Rationale for Determination by Calculation
Radionuclides	
Iodine-129	Calculated based on estimates from fission yields. If a trigger level is reached, specific analysis will be requested. 324 Building operations only, not used at 327 Building.
Plutonium-241	Calculated based on estimates from fission yields. If a trigger level is reached, specific analysis will be requested.
Plutonium-242	Calculated based on estimates from fission yields. If a trigger level is reached, specific analysis will be requested.
Promethium-147	Calculated based on estimates from fission yields. If a trigger level is reached, specific analysis will be requested. 324 Building operations only, not used at 327 Building.
Samarium-151	Calculated based on estimates from fission yields. If a trigger level is reached, specific analysis will be requested. 324 Building operations only, not used at 327 Building.
Selenium-79	Calculated based on estimates from fission yields. If a trigger level is reached, specific analysis will be requested. 324 Building operations only, not used at 327 Building.
Metals	
Metals associated with paint	Addressed by the characterization process conducted under the D&D SAP (DOE-RL 2005a).

COC = contaminant of concern
D&D = decontamination and decommissioning
SAP = sampling and analysis plan

1.12 FINAL LIST OF CONTAMINANTS OF CONCERN

This section identifies the final list of COCs and the rationale of inclusion. Table 1-12 identifies the COCs for which laboratory analysis may be conducted.

Table 1-12. Final Contaminant of Concern List. (4 Pages)

Final COC	Rationale for Inclusion
Radiological Constituents	
Americium-241	Known product of hot cell operations.
Antimony-125	Known fission product.
Carbon-14	324 Building operations only, not used at 327 Building. Known product of hot cell operations.
Cesium-134	Known fission product.
Cesium-137	Known fission product.
Cobalt-60	Known activation product.
Curium-243	Known product of hot cell operations.
Curium-244	Known product of hot cell operations.
Europium-152	Known activation product.

Table 1-12. Final Contaminant of Concern List. (4 Pages)

Final COC	Rationale for Inclusion
Europium-154	Known activation and fission product.
Europium-155	Known activation and fission product.
Neptunium-237	Known production from neutron reaction.
Plutonium-238	Known production from neutron reaction.
Plutonium-239/240	Known production from neutron reaction.
Radium-226	Needed for waste designation.
Radium-228	Needed for waste designation.
Strontium-90	Known fission product. Analyzed as total radioactive strontium.
Technetium-99	Known fission product.
Thorium-228	Reactor fuel/target component.
Thorium-232	Reactor fuel/target component.
Tritium	324 Building operations only, not used at 327 Building. Known product of hot cell operations.
Uranium-233	Reactor fuel component.
Uranium-234	Reactor fuel component.
Uranium-235	Reactor fuel component.
Uranium-236	Reactor fuel component.
Uranium-238	Reactor fuel component.
Nonradiological Constituents – Metals	
Aluminum	Needed only for liquids going to ETF.
Antimony	Suspected to be present in materials (hot cell components) and .needed for liquids going to ETF.
Arsenic	Suspected to be present in materials (LLV).
Barium	Suspected to be present in materials (HLV and LLV).
Beryllium	Suspected to be present in materials (hot cell components) and needed for liquids going to ETF.
Cadmium	Suspected to be present in materials (hot cell components).
Calcium	Needed only for liquids going to ETF.
Chromium	Suspected to be present in materials (paint, stainless steel corrosion product, hot cell components, HLV, and LLV).
Copper	Needed only for liquids going to ETF.
Iron	Needed only for liquids going to ETF.
Lead	Suspected to be present in building materials (paint, shielding, plumbing packing, B-cell components, HLV, and LLV).
Magnesium	Suspected to be present in materials (hot cell components) and needed for liquids going to ETF.
Manganese	Suspected to be present in materials (hot cell components) and needed for liquids going to ETF.
Mercury	Suspected to be present in building materials (paint, electrical switches, and instruments).
Nickel	Suspected to be present in building materials (stainless-steel corrosion product).

Table 1-12. Final Contaminant of Concern List. (4 Pages)

Final COC	Rationale for Inclusion
Potassium	Needed only for liquids going to ETF.
Selenium	Suspected to be present in electrical components.
Silicon	Aqueous liquids only; needed for liquids to ETF.
Silver	Suspected to be present in electrical components.
Sodium	Needed only for liquids going to ETF.
Vanadium	Suspected to be present in materials (hot cell components) and needed for liquids going to ETF.
Zinc	Suspected to be present in materials (hot cell components) and needed for liquids going to ETF.
Nonradiological Constituents – General Inorganics	
Asbestos	Suspected to be present in building materials.
Bromide	Needed only for liquids going to ETF.
Chloride	Needed only for liquids going to ETF.
Cyanide	Needed for liquids going to ETF.
Fluoride	Needed only for liquids going to ETF.
Nitrate (from nitric acid)	Needed only for liquids going to ETF.
Nitrite	Needed only for liquids going to ETF.
Phosphate (from phosphoric acid)	Needed only for liquids going to ETF.
Sulfide	Needed only for liquids going to ETF.
Sulfate (from sulfuric acid)	Needed only for liquids going to ETF.
Volatile Organic Compounds	
Acetone	Liquids and sludge only, used as a degreaser, assessed via VOA target analyte list.
Carbon disulfide	Assessed via VOA target analyte list.
Diethyl ether	Assessed via VOA target analyte list.
Ethyl acetate	Assessed via VOA target analyte list.
Freon	Assessed via VOA target analyte list.
Hexone	Assessed via VOA target analyte list.
Methanol	No basis for exclusion.
Paint thinner	Containerized liquids only, assessed via VOA target analyte list.
Pentane	Assessed via VOA target analyte list.
Trichloroethene	Liquids and sludge only, used as a degreaser, assessed via VOA target analyte list.
BTEX (gasoline, kerosene, naptha)	Containerized liquids only, assessed via VOA target analyte list.
Organic Compounds	
Polynuclear aromatic hydrocarbon	No basis for exclusion, assessed via SVOA target analytes.

Table 1-12. Final Contaminant of Concern List. (4 Pages)

Final COC	Rationale for Inclusion
Oil and grease (mineral oil)	No basis for exclusion, assessed via SVOA target analytes.
PCBs	No basis for exclusion.
Pesticides	Sludge only, no basis for exclusion.
Waste Characteristics	
Conductivity	Needed only for liquids going to ETF.
Corrosivity	Needed for waste designation, assessed via pH.
Gross alpha activity	Needed only for liquids going to ETF.
Gross beta activity	Needed only for liquids going to ETF.
Ignitability	Needed for waste designation.
SVOA target analytes	Needed for waste designation.
Total dissolved solids	Needed only for liquids going to ETF.
Total organic carbon	Needed only for liquids going to ETF.
Total organic halogens	Needed only for liquids going to ETF.
Total suspended solids	Needed only for liquids going to ETF.
VOA target analytes	Needed for waste designation.

BTEX = benzene, toluene, ethylbenzene, and xylene
COC = contaminant of concern
ETF = Effluent Treatment Facility
HLV = high-level vault
LLV = low-level vault
PCB = polychlorinated biphenyl
SVOA = semi-volatile organic analyte
VOA = volatile organic analyte

1.13 FINAL WASTE STREAM AND CONTAMINANT OF CONCERN LIST

Table 1-13 shows the WSs and specific COC identified for each WS of the 324 and 327 Building hot cells D4 Project.

1.14 UNEXPECTED WASTE MATERIALS

This waste category includes any unplanned or unexpected material discovered during D4 activities. The unexpected waste category is provided to allow field decision making based on “as-found” conditions discovered during demolition. Waste Operations will support the final determination that is required on a case-by-case basis.

1.15 WASTE DISPOSITION OPTIONS

The primary disposal option for the WSs described in this DQO summary report is ERDF. The ERDF waste acceptance criteria (BHI 2002) address the radiological, chemical, and physical forms of waste.

Liquid waste will either be sent to the ETF or will be treated to meet ERDF waste acceptance criteria. Waste acceptance criteria for the ETF are established after submittal of WS analytical data.

The project will evaluate salvageable materials that may have the potential for reuse. At this time, the only items that will be considered for release or reuse will be those items that are not volumetrically contaminated (e.g., light fixtures and chairs). It is recognized that oil (e.g., mineral oil in the windows) has the potential for volumetric contamination; however, these items will be evaluated for recycling using established criteria.

1.15.1 Transuranic Waste

The ERDF cannot accept TRU waste or TRU-mixed waste. If TRU or TRU-mixed waste is encountered, storage is allowed at the CWC on a case-by-case basis. The CWC will not accept nonradioactive waste. Mixed waste shipped to the CWC must meet the acceptance and packaging criteria outlined in *Hanford Site Solid Waste Acceptance Criteria* (FH 2002d).

Table 1-13. Waste Streams and Final Contaminants of Concern. (5 Pages)

WS[a] #	Description	Specific Media	COCs
1	Bulk demolition debris (including, but not limited to, poured concrete, meehanite roofing, pumps, piping, steel siding, miscellaneous equipment, coatings, filter pits, concrete plenums, ventilation systems, below-grade drain lines, and sumps)	Exposed surfaces	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
			Metals from Table 1-12 (Sb, Be, Mn, Mg, V, and Zn) and RCRA TCLP metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag)
2	Metal cuttings, shavings, filings, and pieces	Exposed surfaces, solids, and oils	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
			Metals from Table 1-12 (Sb, Be, Mn, Mg, V, and Zn) and RCRA TCLP metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag)
			VOA target analytes, SVOA target analytes
3	Asbestos-containing material (including, but not limited to, cement asbestos board, pipe and building insulation, gaskets, and ventilation gaskets)	Exposed surfaces	See COCs specified for WS #1
		Building materials and structures	Asbestos fibers
			SVOA target analytes
4	Miscellaneous aqueous liquid (including, but not limited to, liquids identified in system pumps, sumps, tanks, piping, drains, and processing equipment)	For ETF disposal, liquids collected from facility systems, pipes, sumps, drainage, or other sources of accumulation	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
			Total metals from Table 1-12 (liquids only): Al, Sb, As, Ba, Be, Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Hg, Ni, P, Se, Si, Ag, Na, V, and Zn
			Ammonium, anions from Table 1-12: bromide, chloride, cyanide, fluoride, nitrate, nitrite, phosphate, and sulfate
			VOA target analytes
			Conductivity, pH, TDS, TOC, and TSS
		Liquids collected from facility systems and used for dust suppression	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
			Total metals: As, Ba, Cd, Cr, Pb, Hg, Se, and Ag
			VOA target analytes and SVOA target analytes
			pH and PCBs

Table 1-13. Waste Streams and Final Contaminants of Concern. (5 Pages)

WS[a] #	Description	Specific Media	COCs
5	Miscellaneous bulk solids (including, but not limited to, sludge, sediment and solid materials collected from system pumps, sumps, tanks, piping, drains, and processing equipment)	Bulk solids collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
			Metals from Table 1-12 (Sb, Be, Mn, Mg, V, and Zn) and RCRA TCLP metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag)
			Cyanide, sulfide, ignitability, and pH
			SVOA target analytes
6	Plant equipment and manipulators (lubrication grease, oil, hydraulic oils, mineral oil in windows, and petroleum products)	Bulk oils, greases, and other organic liquids collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
			RCRA TCLP metals (COCs for solids only): As, Ba, Cd, Cr, Pb, Hg, Se, and Ag
			Cyanide, sulfide, and ignitability
			VOA target analytes, SVOA target analytes
			PCBs and TOX
10	Refrigerated systems (SERF cell recirculation system)	Refrigerants and soldered systems	RCRA TCLP metals (COCs for solids only): As, Ba, Cd, Cr, Pb, Hg, Se, and Ag
			Freon and VOA target analytes
11	Mercury-containing equipment (manometers, vacuum pumps, switches, and mercury vapor lights)	Mercury-activated switches and mercury residue	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
			Hg
12	Lead packing, washers, and shielding	Shielding materials, packing in pipe joints, lead washers, and fasteners	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
			Pb
13	Fluorescent light ballasts	Internals of light ballasts	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
			SVOA target analytes and PCBs
14	Fluorescent light tubes and incandescent light bulbs	Internals of bulbs, lead-base	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
			RCRA TCLP metals (COCs for solids only): As, Ba, Cd, Cr, Pb, Hg, Se, and Ag

Table 1-13. Waste Streams and Final Contaminants of Concern. (5 Pages)

WS[a] #	Description	Specific Media	COCs
17	Miscellaneous materials for salvage (e.g., mineral oil in cell windows)	Mineral oil from cell windows	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
			RCRA TCLP metals (COCs for solids only): As, Ba, Cd, Cr, Pb, Hg, Se, and Ag
18	Soil and sediment	Potentially contaminated soil and sediment	Gross alpha activity, gross beta activity, and radionuclide COCs listed in T Table 1-12
			Metals from Table 1-12 (Sb, Be, Mn, Mg, V, and Zn) and RCRA TCLP metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag)
			Cyanide, sulfide, ignitability, and pH
			SVOA target analytes
19	HEPA filters and filter media	Potentially contaminated filter media from vacuums, exhausters, filter beds, and other similar sources	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
			Metals from Table 1-12 (Sb, Be, Mn, Mg, V, and Zn) and RCRA TCLP metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag)
			Asbestos
			SVOA target analytes
20	Unexpected media and waste forms (including solids and liquids)	Unexpected demolition debris and waste forms	Gross alpha activity, gross beta activity, and radionuclide COC listed in Table 1-12
			To be determined
21	Contaminated waste piping, cable, ducts, and coatings (including RLWS at 327 Building)	Exposed surfaces, buildings materials and structures, and potentially contaminated soil	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
			Metals from Table 1-12 (Sb, Be, Mn, Mg, V, and Zn) and RCRA TCLP metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag)
			Cyanide and sulfide
			VOA target analytes and SVOA target analytes
			PCBs

Table 1-13. Waste Streams and Final Contaminants of Concern. (5 Pages)

WS[a] #	Description	Specific Media	COCs
22	324 Building – A-cell	Exposed surfaces	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
23	324 Building – B-cell	Exposed surfaces	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
24	324 Building – C-cell	Exposed surfaces	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
25	324 Building – D-cell	Exposed surfaces	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
26	324 Building – REC airlock	Exposed surfaces	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
27	324 Building – loadout station and contents (including spills and two 17.5-ton ball casks)	Exposed surfaces	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
28	324 Building – SMF, including the south cell, east cell, and SMF airlock	Exposed surfaces	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
29	324 Building – HLV (including tanks, piping, and sample room 145)	Exposed surfaces, solids, sediment collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
			Metals from Table 1-12 (Sb, Be, Mn, Mg, V, and Zn) and RCRA TCLP metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag)
			Cyanide, sulfide, ignitability, and pH
			SVOA target analytes
30	324 Building – LLV (including tanks and piping)	Exposed surfaces, solids, sediment collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
			Metals from Table 1-12 (Sb, Be, Mn, Mg, V, and Zn) and RCRA TCLP metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag)
			Cyanide, sulfide, ignitability, and pH
			SVOA target analytes
31	324 Building – wet basin (filled in – includes soil and/or fill material)	Exposed surfaces, solids, sediment collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
			RCRA TCLP metals (COCs for solids only): As, Ba, Cd, Cr, Pb, Hg, Se, and Ag
			Cyanide, sulfide, ignitability, and pH
			SVOA target analytes

Table 1-13. Waste Streams and Final Contaminants of Concern. (5 Pages)

WS[a] #	Description	Specific Media	COCs
32	327 Building – hot cells (A through I and SERF cell)	Exposed surfaces	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
33	327 Building – burst test basin (filled in – includes soil and/or fill material), burst test instrument pit, wet basin, and wet storage basin	Exposed surfaces, solids, sediment collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-12
			Metals from Table 1-12 (Sb, Be, Mn, Mg, V, and Zn) and RCRA TCLP metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag)
			Cyanide, sulfide, ignitability, and pH
			SVOA target analytes

[a] Waste stream (WS) numbering system was modified to match the WS numbering system used in the *300 Area D&D Waste Sampling and Analysis Plan* (DOE-RL 2005a).

COC = contaminant of concern
ETF = Effluent Treatment Facility
HEPA = high-efficiency particulate air
HLV = high-level vault
LLV = low-level vault
PCB = polychlorinated biphenyl
RCRA = *Resource Conservation and Recovery Act of 1976*
REC = radiochemical engineering cells
RLWS = radioactive liquid waste system
SERF = Special Environment Radiometallurgy Facility
SMF = Shielded Material Facility
SVOA = semi-volatile organic analyte
TCLP = toxicity characteristic leaching procedure
TDS = total dissolved solids
TOC = total organic carbon
TOX = total organic halides
TSS = total suspended solids
VOA = volatile organic analyte

2.0 STEP 2 – IDENTIFY THE DECISION

The purpose of DQO Step 2 is to define the principal study questions (PSQs) that need to be resolved to address the problem identified in DQO Step 1 and to define the alternative actions (AAs) that would result from the resolution of the PSQs. The PSQs and AAs are then combined into decision statements (DSs) that identify AAs that may be used.

2.1 PRINCIPAL STUDY QUESTIONS, ALTERNATIVE ACTIONS, AND DECISION STATEMENTS

Table 2-1 presents the task-specific PSQs, AAs, and resulting DSs for each PSQ. This table also provides a qualitative assessment of the severity of the consequences of taking an AA if it is incorrect. This assessment takes into consideration human health and the environment (i.e., flora/fauna) and political, economic, and legal ramifications. The qualitative assessment is expressed as severity of the consequences (low or severe).

Table 2-1. Principal Study Questions, Alternative Actions, and Decision Statements. (3 Pages)

AA#	Alternative Action	Description of Consequences of Implementing the Wrong Alternative Action	Severity of Consequences (Low/Severe)
PSQ #1 – Does the waste material exceed the radiological criteria for the disposal facility?			
1-1	The affected media exceeds the waste acceptance criteria for radionuclides.	Waste is improperly managed and disposed at an inappropriate facility.	Severe
1-2	The affected media does not exceed the waste acceptance criteria for radionuclides.	Additional project cost incurred as a result of using alternative disposal facilities.	Low
DS #1 – Determine if the radionuclides present in the waste material exceed the disposal facility's waste acceptance criteria.			
PSQ #2 – Do the chemical and/or physical properties of the waste material exceed the disposal facility's waste acceptance criteria limits?			
2-1	The chemical and/or physical properties of the waste material exceed the disposal facility's waste acceptance criteria limits.	Waste is managed as a nonhazardous waste and improperly disposed.	Severe
2-2	The chemical and/or physical properties do not exceed the disposal facility's waste acceptance criteria limits.	Waste is managed as a hazardous waste.	Low
DS #2 – Determine if the chemical and/or physical properties of the waste material exceed the disposal facility's waste acceptance criteria limits.			
PSQ #3 – Is the waste material a listed dangerous waste?			
3-1	The waste material is a listed dangerous waste and receives a listed waste code.	Waste is managed as a nonlisted dangerous waste and improperly disposed.	Severe

Table 2-1. Principal Study Questions, Alternative Actions, and Decision Statements. (3 Pages)

AA#	Alternative Action	Description of Consequences of Implementing the Wrong Alternative Action	Severity of Consequences (Low/Severe)
3-2	The waste material is not a listed dangerous waste and is not regulated as such.	Waste is unnecessarily managed as a listed dangerous waste. Additional project costs incurred.	Low
DS #3 – Determine if the waste material is regulated as listed dangerous waste.			
PSQ #4 – Is the waste material a characteristic dangerous waste (e.g., ignitable, corrosive, reactive, or toxic)?			
4-1	The waste material is a characteristic dangerous waste (e.g., corrosive, ignitable, reactive, and/or toxic) and receives a characteristic waste code.	Waste is managed as a noncharacteristic dangerous waste and improperly disposed.	Severe
4-2	The waste material is not a characteristic dangerous waste (e.g., corrosive, ignitable, reactive, and/or toxic) and is not regulated as such.	Waste is unnecessarily managed as a characteristic dangerous waste. Additional project costs incurred.	Low
DS #4 – Determine if the characteristic dangerous waste codes (e.g., corrosivity, ignitability, reactivity, and toxicity) apply to the waste material.			
PSQ #5 – Is the waste material a toxic dangerous waste per Washington State criteria?			
5-1	The waste material is a toxic dangerous waste per Washington State criteria and receives a toxic dangerous waste code.	Waste is managed as a nontoxic dangerous waste and improperly disposed.	Severe
5-2	The waste material is not a toxic dangerous waste per Washington State criteria and is not regulated as such.	Waste is unnecessarily managed as a toxic dangerous waste. Additional project costs incurred.	Low
DS #5 – Determine if the waste material meets the definition of a toxic dangerous waste in accordance with Washington State criteria.			
PSQ #6 – Is the waste material a persistent dangerous waste in accordance with Washington State criteria?			
6-1	The waste material meets the definition of a persistent dangerous waste in accordance with Washington State criteria.	Waste is managed as a nonpersistent dangerous waste and improperly disposed.	Severe
6-2	The waste material does not meet the definition of a persistent dangerous waste in accordance with Washington State criteria.	Waste is unnecessarily managed as a persistent dangerous waste. Additional project cost incurred.	Low
DS #6 – Determine if the waste material meets the definition of a persistent dangerous waste in accordance with Washington State criteria.			

Table 2-1. Principal Study Questions, Alternative Actions, and Decision Statements. (3 Pages)

AA#	Alternative Action	Description of Consequences of Implementing the Wrong Alternative Action	Severity of Consequences (Low/Severe)
PSQ #7 – Is the waste material a PCB waste?			
7-1	The waste material is regulated due to PCB concentrations.	Waste is managed as a non-PCB regulated waste and improperly disposed.	Severe
7-2	The waste material is not regulated due to PCB concentrations	Waste is unnecessarily managed as a PCB regulated waste.	Low
DS #7 – Determine if the waste material is regulated due to PCB concentrations.			
PSQ #8– Is the waste material ACM?			
8-1	The waste material is regulated due to asbestos content.	Waste is managed as non-ACM and improperly disposed.	Severe
8-2	The waste material is not regulated due to asbestos content.	Waste is unnecessarily managed as an ACM. Additional project cost incurred.	Low
DS #8 – Determine if the waste material is regulated due to asbestos content.			
PSQ #9 – Is the waste material LDR?			
9-1	The waste material is LDR. Treatment is imposed on the debris prior to disposal.	Waste is managed and disposed as non-LDR waste when it should have been treated.	Severe
9-2	The waste material is not LDR. Treatment is not required for the debris prior to disposal. The debris will be disposed in an onsite facility without treatment.	Waste is unnecessarily managed as LDR waste. Additional project costs incurred.	Low
DS #9 – Determine if LDR requirements impose treatment for waste material.			
PSQ #10 – Does the material meet the requirements for recycling?			
10-1	The affected media meets the requirements for recycling.	Waste is disposed when it could have been recycled. Additional project costs incurred.	Low
10-2	The affected media does not meet the requirements for recycling.	Waste is improperly recycled when it should have been disposed.	Severe
DS #10 – Determine if the affected media meets the recycling requirements.			

AA = alternative action
ACM = asbestos-containing material
DS = decision statement
LDR = land disposal restriction
PCB = polychlorinated biphenyl
PSQ = principal study questions

3.0 STEP 3 – IDENTIFY INPUTS TO THE DECISION

The purpose of DQO Step 3 is to identify the type of information needed to resolve each of the DSs identified in DQO Step 2. The information may already exist or may be derived from computational, surveying, or sampling and analysis methods. Analytical performance requirements (e.g., practical quantitation limit, precision, and accuracy) are also provided in this step for any new data that needs to be collected.

3.1 INFORMATION REQUIRED TO RESOLVE DECISION STATEMENTS

Table 3-1 identifies each DS, as well as the information and required data needed to resolve the DS for each WS identified in Step 1 of this DQO summary report. Table 3-2 summarizes the WS and media, identifies if there are existing data that may be used to resolve the DS, and identifies where existing data are available (if it is of sufficient quality to resolve the DS). For those cases where data do not exist or are insufficient to resolve the DS, the table identifies the computational, surveying, or sampling information needed to resolve the DS.

As noted in Table 3-2, sufficient information may be based on process knowledge (provided that such knowledge can be demonstrated to be sufficient for proper designation) and existing environmental measurements.

If a waste is designated as dangerous, compliance with land disposal restrictions (LDRs) must be demonstrated based on testing. Process knowledge is not sufficient to demonstrate compliance with LDR standards prior to disposal (40 CFR 268).

Sampling the wastes after treatment is beyond the scope of the sampling design presented in this DQO summary report, as the final waste forms (and volume) of treated wastes (if any) are unknown at this time. This is also noted in DQO Step 5.

3.2 ENGINEERING CALCULATIONS

Estimated radiological waste inventories have been prepared for the 324 and 327 Building hot cells (Tables 1-5 and 1-6). These inventories have been used to prepare the exiting waste profiles (Table 1-7). With the reduction in the radionuclide content in the cells due to past cleanout activities, new engineering calculations are needed to developed up-to-date waste inventories to support the information needed (Table 3-1) to support waste disposal. The engineering calculations my use existing data but are expected to used new data collected based on this DQO process and the hot cell SAP (to be developed). These waste calculations will assist in the determination of final designation and packaging and will be used by Waste Operations to meet the waste acceptance criteria of the disposal facility.

Table 3-1. Decision Statements, Information Need, and Required Data.

DS #	Information Need	Required Data
1	Radionuclides	Radiological activity in the waste material
2	Chemical contaminants	Chemical concentration and/or physical properties of waste materials
3	Listed dangerous waste status	Process knowledge about materials of waste materials
4	Characteristic dangerous waste code status	Chemical and/or physical properties of waste materials
5	Toxic dangerous waste code status	Chemical and/or physical properties of waste materials
6	Persistent dangerous waste code status	Chemical and/or physical properties of waste materials
7	Polychlorinated biphenyl concentrations	Chemical and/or physical properties of waste materials
8	Asbestos-containing material	Percent of asbestos in the waste material
9	Land disposal restrictions	Chemical concentration and/or physical properties of waste materials
10	Radionuclides and chemical contaminants	Radiological activity and chemical concentration and/or physical properties of waste materials

DS = decision statement

3.3 DANGEROUS WASTE EVALUATION

The WSs that are being evaluated for dangerous waste regulation and LDR standards include those WSs with used oils and grease, filters media, and sludges.

The oils, greases, and other liquid will be characterized. No engineering calculations will be required in support of final disposition. The information (e.g., material safety data sheets and process knowledge) and/or applicable data will be used to confirm contamination levels in the WS materials and to determine appropriate disposition of the waste materials. The mineral oil in the windows may be evaluated for reuse or recycling.

The accumulation of target compound metals in the HEPA filters and filter media needs to be determined. Samples will need to be collected and sent to the laboratory for analysis to determine the concentration of RCRA metals in the material. The laboratory data will need to be evaluated to support final disposition of this WS.

The accumulation of target compound metals in the sludge and sediment from sumps, drain elbows, and traps needs to be determined. Samples will need to be collected and sent to the laboratory for analysis to determine the concentration of RCRA metals in the material.

Table 3-2. Waste Stream, Media, Existing Information, and Evaluation of Decision Statements. (6 Pages)

WS #	Description	Media	Does Data Exist? (Y/N)	Existing Available Information	Is Existing Information Sufficient for DS?									
					DS #1	DS #2	DS #3	DS #4	DS #5	DS #6	DS #7	DS #8	DS #9	DS #10
1	Bulk demolition debris (including, but not limited to, poured concrete, meehanite roofing, pumps, piping, steel siding, miscellaneous equipment, coatings, filter pits, concrete plenums, ventilation systems, below-grade drain lines, and sumps)	Exposed surfaces	Y	Existing historical laboratory data (Table 1-4), existing inventory estimates (Tables 1-5 and 1-6), process knowledge, and waste disposition documentation (Table 1-7)	N	Y	Y	Y	Y	Y	Y	N	Y/N	N
2	Metal cuttings, shavings, filings, and pieces	Exposed surfaces, solids, and oils	Y	Existing historical laboratory data (Table 1-4), existing inventory estimates (Tables 1-5 and 1-6), process knowledge, and waste disposition documentation (Table 1-7)	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
3	Asbestos containing material (including, but not limited to, cement asbestos board, pipe and building insulation, gaskets, and ventilation gaskets)	Exposed surfaces Building materials and structures	Y	Existing historical laboratory data (Table 1-4), process knowledge, and waste disposition documentation (Table 1-7)	N	Y	Y	Y	Y	Y	Y	N	Y	Y
4	Miscellaneous aqueous liquid (including, but not limited to, liquids identified in system pumps, sumps, tanks, piping, drains, and processing equipment)	For ETF disposal, liquids collected from facility systems, pipes, sumps, drainage, or other sources of accumulation Liquids collected from facility systems and used for dust suppression	Y	Existing historical laboratory data (Table 1-4), process knowledge, and waste disposition documentation (Table 1-7)	N	N	Y	N	N	N	N	Y	Y	N

Table 3-2. Waste Stream, Media, Existing Information, and Evaluation of Decision Statements. (6 Pages)

WS #	Description	Media	Does Data Exist? (Y/N)	Existing Available Information	Is Existing Information Sufficient for DS?									
					DS #1	DS #2	DS #3	DS #4	DS #5	DS #6	DS #7	DS #8	DS #9	DS #10
5	Miscellaneous bulk solids (including, but not limited to, sludge, sediment and solid materials collected from system pumps, sumps, tanks, piping, drains, and processing equipment)	Bulk solids collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	Y	Existing historical laboratory data (Table 1-4), existing inventory estimates (Tables 1-5 and 1-6), process knowledge, and waste disposition documentation (Table 1-7)	N	N	Y	N	N	N	N	Y	N	N
6	Plant equipment and manipulators (lubrication grease, oil, hydraulic oils, mineral oil in windows, and petroleum products)	Bulk oils, greases, and other organic liquids collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	Y	Existing historical laboratory data (Table 1-4), process knowledge, and waste disposition documentation (Table 1-7)	N	N	Y	N	N	N	N	Y	N	N
10	Refrigerated systems (SERF cell recirculation system)	Refrigerants and soldered systems	Y	Existing historical laboratory data (Table 1-4), process knowledge, and waste disposition documentation (Table 1-7)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
11	Mercury-containing equipment (manometers, vacuum pumps, switches, and mercury vapor lights)	Mercury-activated switches and mercury residue	Y	Existing historical laboratory data (Table 1-4), process knowledge, and waste disposition documentation (Table 1-7)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
12	Lead packing, washers, and shielding	Shielding materials, packing in pipe joints, lead washers, and fasteners	Y	Existing historical laboratory data (Table 1-4), process knowledge, and waste disposition documentation (Table 1-7)	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
13	Fluorescent light ballasts	Internals of light ballasts	Y	Existing historical laboratory data (Table 1-4), process knowledge, and waste disposition documentation (Table 1-7)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 3-2. Waste Stream, Media, Existing Information, and Evaluation of Decision Statements. (6 Pages)

WS #	Description	Media	Does Data Exist? (Y/N)	Existing Available Information	Is Existing Information Sufficient for DS?									
					DS #1	DS #2	DS #3	DS #4	DS #5	DS #6	DS #7	DS #8	DS #9	DS #10
14	Fluorescent light tubes and incandescent light bulbs	Internals of bulbs, lead-base	Y	Existing historical laboratory data (Table 1-4), process knowledge, and waste disposition documentation (Table 1-7)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
17	Miscellaneous materials for salvage (e.g., mineral oil in cell windows)	Mineral oil from cell windows	Y	Existing historical laboratory data (Table 1-4), process knowledge, and waste disposition documentation (Table 1-7)	N	N	Y	N	N	N	N	Y	N	N
18	Soil and sediment	Potentially contaminated soil and sediment	Y	Existing historical laboratory data (Table 1-4), process knowledge, and waste disposition documentation (Table 1-7)	N	N	N	N	N	N	N	Y	N	N
19	HEPA filters and filter media	Potentially contaminated filter media from vacuums, exhausters, filter beds, and other similar sources	Y	Existing historical laboratory data (Table 1-4), process knowledge, and waste disposition documentation (Table 1-7)	N	N	Y	N	N	N	N	N	N	N
20	Unexpected media and waste forms (including solids and liquids)	Unexpected demolition debris and waste forms	N	None	N	N	N	N	N	N	N	N	N	N
21	Contaminated waste piping, cable, ducts, and coatings (including RLWS at 327 Building)	Exposed surfaces, buildings materials and structures, and potentially contaminated soil	Y	Existing historical laboratory data (Table 1-4), process knowledge, and waste disposition documentation (Table 1-7)	N	N	Y	N	N	N	N	Y	N	N

Table 3-2. Waste Stream, Media, Existing Information, and Evaluation of Decision Statements. (6 Pages)

WS #	Description	Media	Does Data Exist? (Y/N)	Existing Available Information	Is Existing Information Sufficient for DS?									
					DS #1	DS #2	DS #3	DS #4	DS #5	DS #6	DS #7	DS #8	DS #9	DS #10
22	324 Building – A-cell	Exposed surfaces	Y	Existing historical laboratory data (Table 1-4), existing inventory estimates (Tables 1-5 and 1-6), process knowledge, and waste disposition documentation (Table 1-7)	N	Y	Y	Y	Y	Y	Y	Y	Y	N
23	324 Building – B-cell	Exposed surfaces	Y	Existing historical laboratory data (Table 1-4), existing inventory estimates (Tables 1-5 and 1-6), process knowledge, and waste disposition documentation (Table 1-7)	N	Y	Y	Y	Y	Y	Y	Y	Y	N
24	324 Building – C-cell	Exposed surfaces	Y	Existing historical laboratory data (Table 1-4), existing inventory estimates (Tables 1-5 and 1-6), process knowledge, and waste disposition documentation (Table 1-7)	N	Y	Y	Y	Y	Y	Y	Y	Y	N
25	324 Building – D-cell	Exposed surfaces	Y	Existing historical laboratory data (Table 1-4), existing inventory estimates (Tables 1-5 and 1-6), process knowledge, and waste disposition documentation (Table 1-7)	N	Y	Y	Y	Y	Y	Y	Y	Y	N
26	324 Building – REC airlock	Exposed surfaces	Y	Existing historical laboratory data (Table 1-4), process knowledge, and waste disposition documentation (Table 1-7)	N	Y	Y	Y	Y	Y	Y	Y	Y	N
27	324 Building – loadout station and contents (including spills and two 17.5-ton ball casks)	Exposed surfaces	Y	Existing historical laboratory data (Table 1-4), process knowledge, and waste disposition documentation (Table 1-7)	N	Y	Y	Y	Y	Y	Y	Y	N	N

Table 3-2. Waste Stream, Media, Existing Information, and Evaluation of Decision Statements. (6 Pages)

WS #	Description	Media	Does Data Exist? (Y/N)	Existing Available Information	Is Existing Information Sufficient for DS?									
					DS #1	DS #2	DS #3	DS #4	DS #5	DS #6	DS #7	DS #8	DS #9	DS #10
28	324 Building – SMF including the south cell, east cell, and SMF airlock	Exposed surfaces	Y	Existing historical laboratory data (Table 1-4), existing inventory estimates (Tables 1-5 and 1-6), process knowledge, and waste disposition documentation (Table 1-7)	N	Y	Y	Y	Y	Y	Y	Y	Y	N
29	324 Building – HLV (including tanks, piping, and sample room 145)	Exposed surfaces, solids, sediment collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	Y	Existing historical laboratory data (Table 1-4), existing inventory estimates (Tables 1-5 and 1-6), process knowledge, and waste disposition documentation (Table 1-7)	N	N	Y	N	N	N	N	Y	N	N
30	324 Building – LLV (including tanks and piping)	Exposed surfaces, solids, sediment collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	Y	Existing historical laboratory data (Table 1-4), existing inventory estimates (Tables 1-5 and 1-6), process knowledge, and waste disposition documentation (Table 1-7)	N	N	Y	N	N	N	N	Y	N	N
31	324 Building – wet basin (filled in – includes soil and/or fill material)	Exposed surfaces, solids, sediment collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	Y	Existing historical laboratory data (Table 1-4), process knowledge, and waste disposition documentation (Table 1-7)	N	N	Y	N	N	N	N	Y	N	N
32	327 Building – hot cells (A through I and SERF cell)	Exposed surfaces	Y	Existing historical laboratory data (Table 1-4), existing inventory estimates (Tables 1-5 and 1-6), process knowledge, and waste disposition documentation (Table 1-7)	N	Y	Y	Y	Y	Y	Y	Y	Y	N

Table 3-2. Waste Stream, Media, Existing Information, and Evaluation of Decision Statements. (6 Pages)

WS #	Description	Media	Does Data Exist? (Y/N)	Existing Available Information	Is Existing Information Sufficient for DS?									
					DS #1	DS #2	DS #3	DS #4	DS #5	DS #6	DS #7	DS #8	DS #9	DS #10
33	327 Building – burst test basin (filled in – includes soil and/or fill material), burst test instrument pit, wet basin, and wet storage basin	Exposed surfaces, solids, sediment collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	Y	Existing historical laboratory data (Table 1-4), process knowledge, and waste disposition documentation (Table 1-7)	N	N	Y	N	N	N	N	Y	N	N

DS = decision statement
ETF = Effluent Treatment Facility
HEPA = high-efficiency particulate air
HLV = high-level vault
LLV = low-level vault
REC = radiochemical engineering cell
RLWS = radioactive liquid waste system
SERF = Special Environment Radiometallurgy Facility
SMF = Shielded Material Facility
WS = waste stream

3.4 ISOTOPIC EVALUATION

Process history, existing data (Table 1-4), and existing inventory calculations (Tables 1-5 and 1-6) show that the 324 Building hot cells (REC B-cell [WS #23], REC D-cell [WS #25], REC airlock [WS #26], SMF cells and airlock [WS #28]); the HLV (WS #29); the LLV (WS #30); and the A-frame HEPA Filter (WS #19) may encounter materials that exceed ERDF radiological waste acceptance criteria. The 327 Building hot cells (WS #32) may also exceed ERDF radiological waste acceptance criteria. The existing laboratory data are sufficient to perform additional evaluation to assist with the final removal design for appropriate waste disposition and packaging but are currently not sufficient to designate the waste. Specifically, the action levels to determine the TRU waste definition (activities of all TRU alpha-emitting isotopes with a half-life of greater than 20 years must be less than 100 nCi/g in total) and the "greater than Class C" waste definition (defined in 10 CFR 61.55).

Nondestructive assay (NDA) may be used as needed to detect gamma-emitting radionuclides in WSs. Not all of the radionuclides of interest that are present in these WSs can be directly measured; therefore, isotopic ratios or scaling factors must be provided for the nondetectable nuclides. The isotopic ratios and scaling factors can be obtained with engineering calculations. The information used in the engineering calculations will be based on existing data (Table 1-4) and inventory calculations (Tables 1-5 and 1-6). The NDA information will be used in correlation with existing laboratory data and engineering calculations to support optimum removal and the final disposal approach.

3.5 UNEXPECTED MEDIA AND WASTE FORMS

As described in Section 1.0, the unexpected waste category (WS #20) includes unplanned or unexpected material discovered that may require additional sampling and analysis to support waste designation. The unexpected waste category is provided to allow field decision making based on "as-found" conditions discovered during demolition. Waste Operations will support the final determination by using process knowledge, historical information, and required sample analysis on a case-by-case basis.

3.6 FIELD MEASUREMENT METHODS AND ANALYTICAL PERFORMANCE REQUIREMENTS

Table 3-3 defines the analytical performance requirements for the data that need to be collected to resolve each of the DSs for the solids and oils that require additional analytical data. Table 3-4 defines the analytical performance requirements for the data that need to be collected to resolve each of the DSs for aqueous liquids. These tables also reflect additional analyses that are associated with anomalous media (i.e., liquids and solids) that may be found during D4 activities and must meet ETF and/or ERDF analytical criteria, as well as analysis requirements to determine if waste can be recycled. The specific methods (e.g., EPA Method 6010B [EPA 1997]), based on contracts with the standard fixed laboratory, will be identified in the SAP. The action level and performance requirements include the required detection limit, and precision and accuracy requirements.

Table 3-3. Analytical Performance Requirements for Solid/Other Materials. (3 Pages)

Analyte	Analytical Method	Action Level	RDL Requirement	Accuracy (% Recovery)	Precision (% RPD)
Radiological Constituents					
Americium-241	AmAEA	2 pCi/g	1 pCi/g	70-130[a]	±30[a]
Antimony-125	GEA	10 pCi/g	0.2 pCi/g	70-130[a]	±30[a]
Carbon-14	Liquid scintillation	50 pCi/g	50 pCi/g	70-130[a]	±30[a]
Cesium-134	GEA	10 pCi/g	0.1 pCi/g	70-130[a]	±30[a]
Cesium-137	GEA	10 pCi/g	0.1 pCi/g	70-130[a]	±30[a]
Cobalt-60	GEA	10 pCi/g	0.05 pCi/g	70-130[a]	±30[a]
Curium-234/244	AmAEA	2 pCi/g	1 pCi/g	70-130[a]	±30[a]
Europium-152	GEA	10 pCi/g	0.1 pCi/g	70-130[a]	±30[a]
Europium-154	GEA	10 pCi/g	0.1 pCi/g	70-130[a]	±30[a]
Europium-155	GEA	2 pCi/g	0.1 pCi/g	70-130[a]	±30[a]
Neptunium-237	NpAEA	2 pCi/g	1 pCi/g	70-130[a]	±30[a]
Plutonium-238	PuAEA	2 pCi/g	1 pCi/g	70-130[a]	±30[a]
Plutonium-239/240	PuAEA	2 pCi/g	1 pCi/g	70-130[a]	±30[a]
Radium-226	GEA	2 pCi/g	0.1 pCi/g	70-130[a]	±30[a]
Radium-228	GEA	2 pCi/g	0.2 pCi/g	70-130[a]	±30[a]
Total strontium	Rad-Sr	10 pCi/g	1 pCi/g	70-130[a]	±30[a]
Technetium-99	Proportional counting	30 pCi/g	15 pCi/g	70-130[a]	±30[a]
Thorium-228	ThAEA	2 pCi/g	1 pCi/g	70-130[a]	±30[a]
Thorium-232	ThAEA	2 pCi/g	1 pCi/g	70-130[a]	±30[a]
Tritium	Liquid scintillation	30 pCi/g	400 pCi/g	70-130[a]	±30[a]
Uranium-233/234	UAEA	2 pCi/g	1 pCi/g	70-130[a]	±30[a]
Uranium-235/236	UAEA	2 pCi/g	1 pCi/g	70-130[a]	±30[a]
Uranium-238	UAEA	2 pCi/g	1 pCi/g	70-130[a]	±30[a]
Nonradiological Constituents – Metals					
Arsenic	EPA Method 6010	100 mg/kg	10 mg/kg	70-130[b]	±30[b]
	EPA Method 1311/6010	5.0 mg/L[c]	0.5 mg/L	70-130[b]	±30[b]
Antimony	EPA Method 6010	23 mg/kg[g]	6 mg/kg	70-130[b]	±30[b]
	EPA Method 1311/6010	1.15 mg/L[c]	0.1 mg/L	70-130[b]	±30[b]
Barium	EPA Method 6010	2,000 mg/kg[g]	2 mg/kg	70-130[b]	±30[b]
	EPA Method 1311/6010	21 mg/L[c]	10 mg/L	70-130[b]	±30[b]
Beryllium	EPA Method 6010	24 mg/kg[g]	2 mg/kg	70-130[b]	±30[b]
	EPA Method 1311/6010	1.22 mg/L[c]	0.1 mg/L	70-130[b]	±30[b]
Cadmium	EPA Method 6010	20 mg/kg[g]	0.5 mg/kg	70-130[b]	±30[b]
	EPA Method 1311/6010	0.11 mg/L[c]	0.01 mg/L	70-130[b]	±30[b]

Table 3-3. Analytical Performance Requirements for Solid/Other Materials. (3 Pages)

Analyte	Analytical Method	Action Level	RDL Requirement	Accuracy (% Recovery)	Precision (% RPD)
Chromium	EPA Method 6010	100 mg/kg[g]	10 mg/kg	70-130[b]	±30[b]
	EPA Method 1311/6010	0.6 mg/L[c]	0.06 mg/L	70-130[b]	±30[b]
Lead	EPA Method 6010	100 mg/kg[g]	5 mg/kg	70-130[b]	±30[b]
	EPA Method 1311/6010	0.75 mg/L[c]	0.075 mg/L	70-130[b]	±30[b]
Magnesium	EPA Method 6010	None	75 mg/kg	70-130[b]	±30[b]
Manganese	EPA Method 6010	440,000 mg/kg	5 mg/kg	70-130[b]	±30[b]
Mercury	EPA Method 7471	4.0 mg/kg[g]	0.2 mg/kg	70-130[b]	±30[b]
	EPA Method 1311/7471	0.2 mg/L[c]	0.02 mg/L	70-130[b]	±30[b]
Selenium	EPA Method 6010	20 mg/kg[g]	10 mg/kg	70-130[b]	±30[b]
	EPA Method 1311/6010	5.7 mg/L[c]	0.5 mg/L	70-130[b]	±30[b]
Silver	EPA Method 6010	100 mg/kg[g]	1 mg/kg	70-130[b]	±30[b]
	EPA Method 1311/6010	0.14 mg/L[c]	0.01 mg/L	70-130[b]	±30[b]
Vanadium	EPA Method 6010	330,000 mg/kg	2.5 mg/kg	70-130[b]	±30[b]
Zinc	EPA Method 6010	None	1 mg/kg	70-130[b]	±30[b]
Nonradiological Constituents – General Inorganics					
Asbestos	PLM	1 wt%	<1 wt%	N/A	N/A
Organic Compounds					
PCBs	EPA Method 8082	2 mg/kg	0.017 mg/kg	50-150[f]	±30[f]
Pesticides	EPA Method 8081	Compound-specific[d]	0.005 to 0.020 mg/kg[e]	50-150[f]	±30[f]
Waste Characteristics					
Corrosivity	EPA Method 9045 (pH)	pH ≤ 2.0 or ≥ 12.5	0.1 pH unit	70-130[b]	±30[b]
Ignitability (flash point)	EPA Method 1010	<140°F[h]	N/A	N/A	N/A
SVOAs	EPA Method 8270	Compound-specific[d]	0.33 to 0.85 mg/kg[e]	50-150[f]	±30[f]
VOAs	EPA Method 8260	Compound-specific[d]	0.005 to 0.05 mg/kg[e]	50-150[f]	±30[f]

[a] Accuracy criteria for associated batch laboratory control sample percent recoveries. With the exception of GEA, additional analysis-specific evaluations also performed for matrix spikes, tracers, and carriers, as appropriate to the method. Precision criteria for batch laboratory replicate sample analyses.
[b] Accuracy criteria for associated batch matrix spike percent recoveries. Evaluation based on statistical control of laboratory control samples also performed. Precision criteria for batch laboratory replicate matrix sample analyses or replicate sample analyses.
[c] Lower action level may be needed to determine land disposal treatment requirements.
[d] No action levels are specified for general groupings of compounds; action levels are compound-specific.
[e] Values show shown are "nominal" compound-specific minimums and maximums. Most constituents will be within the given range, and a limited number will have higher detection limits. Individual compounds will be evaluated against established laboratory contractual agreements (based on EPA guidance documents).

Table 3-3. Analytical Performance Requirements for Solid/Other Materials. (3 Pages)

Analyte	Analytical Method	Action Level	RDL Requirement	Accuracy (% Recovery)	Precision (% RPD)

[f] Accuracy criteria are the minimum for associated batch laboratory control sample percent recoveries. Laboratories must meet statistically based control if more stringent. Additional analyte-specific evaluations also performed for matrix spikes and surrogates as appropriate to the method. Precision criteria for batch laboratory replicate matrix sample analyses.
[g] Action levels apply to waste with no free liquid component.
[h] Ignitable non-liquids are defined as wastes that are not liquids and which are capable of, under standard temperature and pressure, of causing fire through friction, absorption of moisture, or spontaneous chemical changes, and when ignited, burn so rigorously and persistently that they create a hazard in accordance with WAC 173-303-090(5)(a)(ii).

NOTE: EPA test methods from *Test Methods for Evaluating Solid Waste: Physical and Chemical Methods,* SW-846 (EPA 1997), except for Methods 300.0 and 418.1, which are from EPA's *Methods for Chemical Analysis of Water and Wastes* (EPA 1983). Analytical laboratories are contractually obligated to meet the current methodology required by regulatory agencies.

AEA = alpha energy analysis
EPA = U.S. Environmental Protection Agency
GEA = gamma energy analysis
N/A = not applicable
PCB = polychlorinated biphenyl
PLM = polarized light microscopy
RDL = required detection limit
RPD = relative percent difference
SVOA = semi-volatile organic analyte
VOA = volatile organic analyte
WAC = *Washington Administrative Code*

Table 3-4. Analytical Performance Requirements for Liquid Materials. (4 Pages)

Analyte	Analytical Method	Action Level	RDL Requirement	Accuracy (% Recovery)	Precision (% RPD)
Radiological Constituents					
Americium-241	AmAEA	None	1 pCi/L	80-120[a]	±20[a]
Antimony-125	GEA	None	50 pCi/L	80-120[a]	±20[a]
Carbon-14	Liquid scintillation	None	200 pCi/L	80-120[a]	±20[a]
Cesium-134	GEA	None	15 pCi/L	80-120[a]	±20[a]
Cesium-137	GEA	None	15 pCi/L	80-120[a]	±20[a]
Cobalt-60	GEA	None	25 pCi/L	80-120[a]	±20[a]
Curium-243/244	AmAEA	None	1 pCi/L	80-120[a]	±20[a]
Europium-152	GEA	None	50 pCi/L	80-120[a]	±20[a]
Europium-154	GEA	None	50 pCi/L	80-120[a]	±20[a]
Europium-155	GEA	None	50 pCi/L	80-120[a]	±20[a]
Neptunium-237	NpAEA	None	1 pCi/L	80-120[a]	±20[a]
Plutonium-238	PuAEA	None	1 pCi/L	80-120[a]	±20[a]
Plutonium-239/240	PuAEA	None	1 pCi/L	80-120[a]	±20[a]
Radium-226	EPA Method 903.1	None	1 pCi/L	80-120[a]	±20[a]

Table 3-4. Analytical Performance Requirements for Liquid Materials. (4 Pages)

Analyte	Analytical Method	Action Level	RDL Requirement	Accuracy (% Recovery)	Precision (% RPD)
Radium-228	EPA Method 904.0	None	1 pCi/L	80-120[a]	±20[a]
Total strontium	Rad-Sr	None	2 pCi/L	80-120[a]	±20[a]
Technetium-99	Proportional counting	None	15 pCi/L	80-120[a]	±20[a]
Thorium-228	ThAEA	None	1 pCi/L	80-120[a]	±20[a]
Thorium-232	ThAEA	None	1 pCi/L	80-120[a]	±20[a]
Tritium	Liquid scintillation	None	400 pCi/L	80-120[a]	±20[a]
Uranium-233/234	UAEA	None	1 pCi/L	80-120[a]	±20[a]
Uranium-235/236	UAEA	None	1 pCi/L	80-120[a]	±20[a]
Uranium-238	UAEA	None	1 pCi/L	80-120[a]	±20[a]
Nonradiological Constituents – Metals					
Aluminum	EPA Method 6010	None	50 µg/L	80-120[b]	±20[b]
Antimony	EPA Method 6010	1,900 µg/L	60 µg/L	80-120[b]	±20[b]
Arsenic	EPA Method 6010	1,400 µg/L	100 µg/L	80-120[b]	±20[b]
Barium	EPA Method 6010	1,200 µg/L	20 µg/L	80-120[b]	±20[b]
Beryllium	EPA Method 6010	820 µg/L	5 µg/L	80-120[b]	±20[b]
Cadmium	EPA Method 6010	690 µg/L	5 µg/L	80-120[b]	±20[b]
Calcium	EPA Method 6010	None	1,000 µg/L	80-120[b]	±20[b]
Chromium	EPA Method 6010	2,770 µg/L	10 µg/L	80-120[b]	±20[b]
Copper	EPA Method 6010	None	10 µg/L	80-120[b]	±20[b]
Iron	EPA Method 6010	None	50 µg/L	80-120[b]	±20[b]
Lead	EPA Method 6010	690 µg/L	50 µg/L	80-120[b]	±20[b]
Magnesium	EPA Method 7470	None	750 µg/L	80-120[b]	±20[b]
Manganese	EPA Method 7470	None	5 µg/L	80-120[b]	±20[b]
Mercury	EPA Method 7470	150 µg/L	0.5 µg/L	80-120[b]	±20[b]
Nickel	EPA Method 6010	3,980 µg/L	40 µg/L	80-120[b]	±20[b]
Potassium	EPA Method 6010	None	4,000 µg/L	80-120[b]	±20[b]
Selenium	EPA Method 6010	820 µg/L	100 µg/L	80-120[b]	±20[b]
Silicon	EPA Method 6010	None	20 µg/L	80-120[b]	±20[b]
Silver	EPA Method 6010	430 µg/L	10 µg/L	80-120[b]	±20[b]
Sodium	EPA Method 6010	None	500 µg/L	80-120[b]	±20[b]
Vanadium	EPA Method 7470	None	25 µg/L	80-120[b]	±20[b]
Zinc	EPA Method 6010	2,610 µg/L	10 µg/L	80-120[b]	±20[b]

Table 3-4. Analytical Performance Requirements for Liquid Materials. (4 Pages)

Analyte	Analytical Method	Action Level	RDL Requirement	Accuracy (% Recovery)	Precision (% RPD)
Nonradiological Constituents – General Inorganics					
Bromide	EPA Method 300.0	None	250 µg/L	80-120[b]	±20[b]
Chloride	EPA Method 300.0	None	200 µg/L	80-120[b]	±20[b]
Cyanide	EPA Method 9010	860 µg/L	5 µg/L	80-120[b]	±20[b]
Fluoride	EPA Method 300.0	None	500 µg/L	80-120[b]	±20[b]
Nitrate	EPA Method 300.0	None	250 µg/L	80-120[b]	±20[b]
Nitrite	EPA Method 300.0	None	250 µg/L	80-120[b]	±20[b]
Phosphate	EPA Method 300.0	None	500 µg/L	80-120[b]	±20[b]
Sulfide	EPA Method 9030	None	100 µg/L	80-120[b]	±20[b]
Sulfate	EPA Method 300.0	None	500 µg/L	80-120[b]	±20[b]
Waste Characteristics					
Conductivity	EPA Method 120.1	None	1 µmho/cm^3	80-120[b]	±20[b]
Corrosivity	EPA Method 150.1 (pH)	pH ≤ 0.5 or ≥ 13	0.1 pH unit	80-120[b]	±20[b]
Gross alpha	Proportional counting	None	3 pCi/L	80-120[a]	±20[a]
Gross beta	Proportional counting	None	4 pCi/L	80-120[a]	±20[a]
Ignitability	EPA 1010	60°C/140°F	1°C	NA	NA
SVOAs	EPA Method 8270	Compound-specific[c]	10 to 50 µg/L[e]	50-150[d]	±20[d]
TDS	EPA Method 160.1	None	10 mg/L	80-120[b]	±20[b]
TOC	EPA Method 415 or 9060	None	1 mg/L	80-120[b]	±20[b]
TSS	EPA Method 160.2	None	5 mg/L	80-120[b]	±20[b]
TOX	EPA Method 9020	None	20 mg/L	80-120[b]	±20[b]
VOAs	EPA Method 8260	Compound-specific[c]	5 to 50 µg/L[e]	50-150[d]	±20[d]

[a] Accuracy criteria for associated batch laboratory control sample percent recoveries. With the exception of GEA, additional analysis-specific evaluations also performed for matrix spikes, tracers, and carriers, as appropriate to the method. Precision criteria for batch laboratory replicate sample analyses.

[b] Accuracy criteria for associated batch matrix spike percent recoveries. Evaluation based on statistical control of laboratory control samples also performed. Precision criteria for batch laboratory replicate matrix sample analyses or replicate sample analyses.

[c] No action levels are specified for general groupings of compounds; action levels are compound-specific.

[d] Accuracy criteria are the minimum for associated batch laboratory control sample percent recoveries. Laboratories must meet statistically based control if more stringent. Additional analyte-specific evaluations also performed for matrix spikes and surrogates as appropriate to the method. Precision criteria for batch laboratory replicate matrix sample analyses.

[e] Values show shown are "nominal" compound-specific minimums and maximums. Most constituents will be within the given range, and a limited number will have higher detection limits. Individual compounds will be evaluated against established laboratory contractual agreements (based on EPA guidance documents).

Table 3-4. Analytical Performance Requirements for Liquid Materials. (4 Pages)

Analyte	Analytical Method	Action Level	RDL Requirement	Accuracy (% Recovery)	Precision (% RPD)

NOTE: EPA test methods are from *Test Methods for Evaluating Solid Waste: Physical and Chemical Methods* , SW-846 (EPA 1997), except for Methods 300.0 and 418.1, which are from EPA's *Methods for Chemical Analysis of Water and Wastes* (EPA1983). Analytical laboratories are contractually obligated to meet the current methodology required by regulatory agencies.
AEA = alpha energy analysis
EPA = U.S. Environmental Protection Agency
GEA = gamma energy analysis
RDL = required detection limit
RPD = relative percent difference
SVOA = semi-volatile organic analyte
TDS = total dissolved solids
TOC = total organic carbon
TSS = total suspended solids
TOX = total organic halides
VOA = volatile organic analyte

3.7 RADIOLOGICAL SURVEY PERFORMANCE REQUIREMENTS

Table 3-5 defines the radiological survey instrument performance requirements for the data that need to be collected to resolve each of the DSs. Table 3-6 provides the methods for obtaining the concentration of each radionuclide using NDA equipment and the action levels that would be unacceptable for disposal at ERDF.

Table 3-5. Radiological Survey Instrument Performance Requirements. (2 Pages)

Analyte	Analytical Method	Action Level/ Detection Limit	Accuracy Requirement	Precision Requirement
Standard Survey Instruments				
Dose rate	Portable sodium iodide detector or Bicron[a] μrem meter or ion chamber	0.1 mR/h	[b]	[b]
Removable alpha	Bench-top scaler for removable alpha Portable radiation detector	20 dpm/ 100 cm^2	[b]	[b]
Total (fixed + removable) alpha		100 dpm/ 100 cm^2	[b]	
Removable beta-gamma		1,000 dpm/ 100 cm^2	[b]	
Total (fixed + removable) beta-gamma		5,000 dpm/ 100 cm^2	[b]	
Tritium	Liquid scintillation	10,000 dpm/ 100 cm^2	[b]	[b]

Table 3-5. Radiological Survey Instrument Performance Requirements. (2 Pages)

Analyte	Analytical Method	Action Level/ Detection Limit	Accuracy Requirement	Precision Requirement
Other Advanced Radionuclide Characterization				
Removable alpha	Electra Plus survey instrument with DP-8B 600-cm^2 probe[c]	20 dpm/100 cm^2	[b]	[b]
Total (fixed + removable) alpha		100 dpm/100 cm^2	[b]	
Removable beta-gamma		1,000 dpm/ 100 cm^2	[b]	
Total (fixed + removable) beta-gamma		5,000 dpm/ 100 cm^2	[b]	
Am-241	ISOCS, or equivalent	2 pCi/g	[b]	[b]
Co-60		10 pCi/g	[b]	
Cs-137		10 pCi/g	[b]	
Eu-152		10 pCi/g	[b]	
Eu-154		10 pCi/g	[b]	
Eu-155		2 pCi/g	[b]	

[a] Bicron/NE, Solon, Ohio.
[b] In accordance with manufacturer's specifications.
[c] Written direction will be provided to address the data, procedures, and quality requirements prior to using this equipment for waste designation.

dpm = disintegrations per minute
ISOCS = In Situ Object Counting System, Canberra Industries, Meriden, Connecticut

Table 3-6. Analytical Performance Requirements for Nondestructive Assay.

Measurable Radionuclides[a]	Analytical Method	Action Level	MDA (Expected)
Am-241	NDA	TRU/GTCC	≈20 nCi/g
Pu-239		TRU/GTCC	≈30 nCi/g
Np-237		TRU/GTCC	≈10^{-2} nCi/g
Cs-137		2.7E+7 pCi/g	≈10^{-1} nCi/g
Co-60		3.81E+6 pCi/g	≈10^{-1} nCi/g

[a] Not all of the radionuclides of interest can be directly measured through gamma spectroscopy; therefore, isotopic ratios or scaling factors must be provided for the nondetectable nuclides (Section 3.4).

NOTES:

In cases where both TRU and GTCC are listed as action levels, the isotope is subject to both limits and the more limiting of the two will be considered to be the action level.

The action level of "TRU" indicates the TRU waste definition is the limiting factor. The activities of all TRU alpha-emitting isotopes with a half-life of greater than 20 years must be less than 100 nCi/g in total.

The action level of "GTCC" indicates that the "greater than Class C" waste definition is the limiting factor (defined in 10 CFR 61.55).

GTCC = greater than Class C
MDA = minimum detectable activity
NDA = nondestructive assay
TRU = transuranic

4.0 STEP 4 – DEFINE THE BOUNDARIES OF THE STUDY

The primary objective of DQO Step 4 is to identify the population of interest, define the spatial and temporal boundaries that apply to each DS, define the scale of decision making, and identify any practical constraints (i.e., hindrances or obstacles) that must be taken into consideration for the sampling design. Implementing this step ensures that the sampling design will result in the collection of data that accurately reflect the true condition of the facility under investigation.

4.1 POPULATION OF INTEREST

Prior to defining the spatial and temporal boundaries of the area under investigation, it is first necessary to clearly define the populations of interest that apply for each DS (Table 4-1). The intent of Table 4-1 is to clearly define the attributes that make up each population of interest by stating them in a way that makes the focus of the study unambiguous.

Table 4-1. Characteristics that Define the Population of Interest.

DS #	Population of Interest
1	Radiological contamination in the waste material
2	Chemical contamination levels and/or physical properties of the waste material
3, 4, 5, and 6	Waste designation codes for the building waste materials
7	PCB contamination in the waste materials
8	Asbestos contamination levels of building waste materials
9	LDR evaluation of waste materials
10	Materials intended for recycling or reuse

DS = decision statement
LDR = land disposal restriction
PCB = polychlorinated biphenyl

4.2 ZONES WITH HOMOGENOUS CHARACTERISTICS

The elements of the population are segregated into zones or subsets that exhibit relatively homogenous characteristics in DQO Step 4. This distinction has already been made by the identification of WSs in Table 1-13. See Table 1-13 for the identification of homogeneous characteristics.

4.3 SPATIAL SCALE OF DECISION MAKING

The spatial scale of decision making for this DQO process is the individual WSs identified in Table 1-13.

4.4 TEMPORAL BOUNDARIES

Table 4-2 identifies temporal boundaries that may apply to each DS. The temporal boundary refers to both the timeframe over which each DS applies (e.g., number of years) and when (e.g., season, time of day, and weather conditions) the data should optimally be collected.

Table 4-2. Temporal Boundaries of the Investigation.

DS #	WS #	Timeframe	When to Collect Data
All	All	Before September 30, 2010 (due date for Tri-Party Agreement Milestone M-94-03: Complete Disposition of Surplus Facilities, Including 324 and 327)	Data need to be collected between mid-FY06 and before the end of FY07
		Before shipment and disposal of the waste materials associated with WS #21 to WS #33 with sufficient time to allow for development of waste profile documents	

D4 = decommission, deactivate, decontaminate, and demolish
DS = decision statement
FY = fiscal year
WS = waste stream

4.5 PRACTICAL CONSTRAINTS

Table 4-3 identifies the practical constraints that may impact the data collection effort. These constraints include physical barriers, difficult sample matrices, or any other condition that will need to be taken into consideration in the design and scheduling of the sampling program.

Table 4-3. Practical Constraints on Data Collection.

- Underground-contaminated pipelines are not accessible until after the building is demolished.
- Some materials are not accessible (e.g., liquids, pipes, sludge in sumps, etc.) until D4 actions have occurred.
- There is limited ability to collect representative samples inside of the hot cells or vaults due to high radiation levels. Collecting samples may not be feasible. Inventory estimates will be limited to process knowledge, existing data, and measuring radiation dose rates on exposed surfaces.

D4 = decommission, deactivate, decontaminate, and demolish

5.0 STEP 5 – DEVELOP DECISION RULES

The preceding sections present the basis for making decisions for characterization and final disposition of the WSs identified in Table 1-13. Step 5 of the DQO process develops the decision rules, which establish specific criteria for these determinations.

5.1 PARAMETER OF INTEREST

A sampling design (based on professional judgment) and worst-case (authoritative) sampling will be used to determine the maximum levels of contamination. The parameter of interest (e.g., maximum concentration) will be compared with the waste acceptance criteria decision levels.

5.2 FINAL ACTION LEVELS

The concentration or action levels for disposal/recycling/reuse options are described in Tables 5-1 through 5-5. The most restrictive concentration limits or action levels for the disposal/recycling/reuse options are used for the materials included in this DQO summary report. By meeting the analytical requirements for the most restrictive disposal/recycling/reuse options, the data will be adequate for other less restrictive options. These tables also reflect analysis that may be associated with the anomalous media (i.e., liquids and solids) that may be found during D4 activities and must meet ETF and/or ERDF analytical criteria.

Table 5-1. Concentration Limits – Environmental Restoration Disposal Facility. (3 Pages)

COCs	Concentration Limits
Semi-Volatile Organic Compounds [a]	
Benzo(a)pyrene	25,000 mg/kg
Benzo(k)fluoranthene	25,000 mg/kg
Pesticides/PCBs [a]	
4,4'DDD	760,000 mg/kg
4,4'DDE	540,000 mg/kg
PCBs	500 mg/kg [i]
Metals [a]	
Antimony	19,000 mg/kg
Arsenic	3,000 mg/kg
Barium	940,000 mg/kg
Cadmium	39,000 mg/kg
Chromium (total)	59,000 mg/kg
Manganese	440,000 mg/kg

Table 5-1. Concentration Limits – Environmental Restoration Disposal Facility. (3 Pages)

COCs	Concentration Limits
Selenium	400,000 mg/kg
Silver	350,000 mg/kg
Thallium	5,600 mg/kg
Vanadium	330,000 mg/kg
Radionuclides[b]	
Americium-241	0.050 Ci/m^3 (c, d)
Americium-243	0.057 Ci/m^3 (d, e)
Carbon-14	5.1 Ci/m^3 (e)
Cesium-134	Unlimited
Cesium-135	8.8 Ci/m^3 (e)
Cesium-137	32 Ci/m^3 (c)
Cobalt-60	Unlimited
Curium-243	85 Ci/m^3 (d, e)
Curium-244	40 Ci/m^3 (d, e)
Europium-152	21,000,000 Ci/m^3 (c)
Europium-154	Unlimited
Iodine-129	0.080 Ci/m^3 (f)
Neptunium-237	0.0015 Ci/m^3 (c, d)
Nickel-59	210 Ci/m^3 (e)
Nickel-63	700 Ci/m^3 (f)
Niobium-94	0.012 Ci/m^3 (e)
Palladium-107	830 Ci/m^3 (e)
Plutonium-238	1.5 Ci/m^3 (c, d)
Plutonium-239	0.029 Ci/m^3 (c, d)
Plutonium-240	0.029 Ci/m^3 (c, d)
Plutonium-241	6.2 Ci/m^3 (c, d)
Plutonium-242	0.11 Ci/m^3 (d, e)
Radium-226	0.00014 Ci/m^3 (c)
Radium-228	0.00022 Ci/m^3 (c)
Samarium-151	53,000 Ci/m^3 (e)
Selenium-79	28 Ci/m^3 (e)
Strontium-90	7,000 Ci/m^3 (f)
Technetium-99	1.3 Ci/m^3 (e)
Thorium-232	0.0060 Ci/m^3 (e)
Tritium	Unlimited
Uranium-233/234	0.074 Ci/m^3 (c)
Uranium-235	0.0027 Ci/m^3 (c)

Table 5-1. Concentration Limits – Environmental Restoration Disposal Facility. (3 Pages)

COCs	Concentration Limits
Uranium-238 + daughters	0.012 Ci/m^3 [(c)]
Zirconium-93	140 Ci/m^3 [(e)]
Waste Characteristics	
Ignitability (flash point)	60°C/140°F[g]
pH	pH ≤ 2.0 or ≥ 12.5
Moisture content	Fail[h]

[a] Public exposure is limiting (DOE-RL 1994).
[b] Radioactive waste Class C limits also apply (10 CFR 61).
[c] *Remedial Investigation and Feasibility Study Report for the Environmental Restoration Disposal Facility* (DOE-RL 1994).
[d] ERDF limit is lower of indicated value and transuranic limit of 100 nCi/g.
[e] *Environmental Restoration Disposal Facility Performance Assessment* (BHI 1995).
[f] Class C limit in accordance with 10 CFR 61.
[g] Ignitable non-liquids in accordance with WAC 173-303-090(5)(a)(ii). Capable under standard temperature and pressure of causing fire through friction, absorption of moisture, or spontaneous chemical changes, and when ignited, burns so vigorously and persistently that it creates a hazard.
[h] The free liquids are not accepted at ERDF.
[i] ERDF cannot accept liquid PCB waste (even if solidified prior to disposal) if the liquid contains greater than 50 ppm of PCBs at the point of origin.

CFR = *Code of Federal Regulations*
COC = contaminant of concern
ERDF = Environmental Restoration Disposal Facility
PCB = polychlorinated biphenyl
ppm = parts per million

Table 5-2. Action Levels – Dangerous Waste Limits.[a] (2 Pages)

COCs	Action Levels[b]	
	Totals[c]	TCLP
Silver	100 mg/kg	0.14 mg/L
Arsenic	100 mg/kg	5 mg/L
Barium	2,000 mg/kg	21 mg/L
Cadmium	20 mg/kg	0.11 mg/L
Chromium	100 mg/kg	0.6 mg/L
Mercury	4.0 mg/kg	0.2 mg/L
Lead	100 mg/kg	0.75 mg/L
Selenium	20 mg/kg	5.7 mg/L
PCBs	2 mg/kg	
VOAs	Chemical-specific	
SVOAs	Chemical-specific	

Table 5-2. Action Levels – Dangerous Waste Limits.[a] (2 Pages)

COCs	Action Levels[b]	
	Totals[c]	TCLP
Ignitability	<140°F [d]	
pH	pH ≤ 2.0 or ≥ 12.5	

[a] WAC 173-303, "Dangerous Waste Regulations."
[b] Underlying hazardous constituents may require lower limits in accordance with 40 CFR 268.48.
[c] Action levels shown apply to waste with no free liquid component.
[d] Ignitable non-liquids are defined as wastes that are not liquids and which are capable of, under standard temperature and pressure, of causing fire through friction, absorption of moisture, or spontaneous chemical changes, and when ignited, burn so rigorously and persistently that they create a hazard in accordance with WAC 173-303-090(5)(a)(ii).

COC = contaminant of concern
PCB = polychlorinated biphenyl
SVOA= semi-volatile organic analyte
TCLP = toxicity characteristic leaching procedure
UHC = underlying hazardous constituent
VOA = volatile organic analyte

Table 5-3. Analytical Requirements – Effluent Treatment Facility. (3 Pages)

COCs	Concentration Limits
Volatile Organic Compounds	
EPA VOA target analyte list	Compound- or chemical family-specific.
Semi-Volatile Organic Compounds	
EPA SVOA target analyte list	Compound- or chemical family-specific.
Metals	
Aluminum	No specific limits. The LDRs establish treatment limits for hazardous wastes containing underlying hazardous constituents, which includes several of the metal COCs. Information needed for development of ETF waste profile.
Antimony	
Arsenic	
Barium	
Beryllium	
Cadmium	
Calcium	
Chromium	
Copper	
Iron	
Lead	
Magnesium	
Manganese	
Mercury	
Nickel	
Potassium	

Table 5-3. Analytical Requirements – Effluent Treatment Facility. (3 Pages)

COCs	Concentration Limits
Selenium	
Silicon	
Silver	
Sodium	
Uranium	
Vanadium	
Zinc	
Nonmetals	
Ammonia	100,000 mg/L
Bromide	No specific limits. The LDRs establish treatment limits for hazardous wastes containing underlying hazardous constituents, which includes several of the metal COCs. Information needed for development of ETF waste profile.
Chloride	
Cyanide	
Fluoride	
Nitrate	
Nitrite	
Phosphate	
Sulphate	
Radionuclides	
Americium-241	No specific limits. Information needed for development of ETF waste profile.
Antimony-125	
Carbon-14	
Cerium-144	
Cesium-134	
Cesium-137	
Cobalt-60	
Curium-244	
Europium-154	
Europium-155	
Iodine-129	
Neptunium-237	
Niobium-94	
Plutonium-238	
Plutonium-239/240	
Radium-226	
Ruthenium-106	
Selenium-79	
Strontium-90	
Technetium-99	

Table 5-3. Analytical Requirements – Effluent Treatment Facility. (3 Pages)

COCs	Concentration Limits
Tritium	
Zinc-65	
Waste Characteristics	
pH	pH ≤ 0.5 or ≥ 13.0
Gross alpha	No specific limits. Information needed for development of ETF waste profile.
Gross beta	
TSS	
TDS	
TOC	
Conductivity	

COC = contaminant of concern
EPA = U.S. Environmental Protection Agency
ETF = Effluent Treatment Facility
LDR = land disposal restricted
SVOA = semi-volatile organic analyte
TDS = total dissolved solids
TOC = total organic carbon
TSS = total suspended solids
VOA = volatile organic analyte

Table 5-4. Action Limits – Recycling Requirements for Used Oil.

COCs	Preliminary Action Levels
PCBs	2 mg/kg
TOX	1,000 mg/kg
Chemical constituents and characteristics	See Table 5-5
Radiological constituents	See Table 5-6

COC = contaminant of concern
PCB = polychlorinated biphenyl
TOX = total organic halides

Table 5-5. Action Levels – BHI-EE-10 Radiological Release Limits.[a]

WS #	COCs	Action Levels for Water	Action Levels for Soil, Other
All	Total uranium	0.2 µg/L	2 µg/g
	Gross alpha	3 pCi/L	5 pCi/g
	Gross beta	4 pCi/L	10 pCi/g
	Americium-241	2 pCi/L	2 pCi/g
	Carbon-14	200 pCi/L	50 pCi/g
	Cesium-137	50 pCi/L	10 pCi/g
	Cobalt-60	50 pCi/L	10 pCi/g
	Europium-152	50 pCi/L	10 pCi/g
	Europium-154	50 pCi/L	10 pCi/g
	Europium-155	50 pCi/L	10 pCi/g
	Neptunium-237	2 pCi/L	2 pCi/g
	Nickel-63	30 pCi/L	30 pCi/g
	Plutonium-238	2 pCi/L	2 pCi/g
	Plutonium-239/240	2 pCi/L	2 pCi/g
	Radium-226	2 pCi/L	by GEA
	Radium-228	3 pCi/L	by GEA
	Strontium-90	2 pCi/L	10 pCi/g
	Technetium-99	30 pCi/L	30 pCi/g
	Thorium-232	2 pCi/L	2 pCi/g
	Tritium	400 pCi/L	400 pCi/g
	Uranium-234	2 pCi/L	2 pCi/g
	Uranium-235	2 pCi/L	2 pCi/g
	Uranium-238	2 pCi/L	2 pCi/g
	Removable alpha	N/A	20 (dpm/100 cm^2)
	Total (fixed + removable) alpha	N/A	100 (dpm/100 cm^2)
	Removable beta-gamma	N/A	1,000 (dpm/100 cm^2)
	Total (fixed + removable) beta-gamma	N/A	5,000 (dpm/100 cm^2)

[a] BHI-EE-10, *Waste Management Plan*.
dpm = disintegrations per minute
COC = contaminant of concern
GEA = gamma energy analysis
N/A = not applicable
WS = waste stream

Table 5-6 provides the methods for obtaining the concentration of each radionuclide using NDA equipment and the action levels that would be unacceptable for disposal at ERDF.

Table 5-6. Analytical Methods and Action Levels for Nondestructive Assay.[a]

COCs	Action Levels	Basis	Analytical Method
Americium-241	TRU/GTCC	ERDF waste acceptance criteria (BHI 2002)	GEA by portable NDA or ratio compared to detected isotopes
Cesium-137	2.7E+7 pCi/g	ERDF safety analysis (BHI 2001)	GEA by portable NDA or ratio compared to detected isotopes
Cobalt-60	3.81E+6 pCi/g	ERDF safety analysis (BHI 2001)	GEA by portable NDA or ratio compared to detected isotopes
Neptunium-237	TRU/GTCC	ERDF waste acceptance criteria (BHI 2002)	GEA by portable NDA or ratio compared to detected isotopes
Plutonium-239	TRU/GTCC	ERDF waste acceptance criteria (BHI 2002)	GEA by portable NDA or ratio compared to detected isotopes

[a] Not all of the radionuclides of interest can be directly measured through gamma spectroscopy; therefore, isotopic ratios or scaling factors must be provided for the nondetectable nuclides. The isotopic ratios and scaling factors can be obtained with engineering calculations.

NOTES:

In cases where both TRU and GTCC are listed as action levels, the isotope is subject to both limits and the more limiting of the two will be considered to be the action level.

The action level of "TRU" indicates the TRU waste definition is the limiting factor. The activities of all TRU alpha-emitting isotopes with a half-life of greater than 20 years must be less than 100 nCi/g in total.

The action level of "GTCC" indicates that the "greater than Class C" waste definition is the limiting factor (defined in 10 CFR 61.55).

COC = contaminant of concern
ERDF = Environmental Restoration Disposal Facility
GEA = gamma energy analysis
GTCC = greater than Class C
NDA = nondestructive assay
TRU = transuranic

6.0 STEP 6 – SPECIFY TOLERABLE LIMITS ON DECISION ERRORS

One of the primary objectives normally accomplished in DQO Step 6 is the selection of a statistical or judgmental sample design. Characterization of the WSs identified in this DQO process does not require statistically based sampling, as it deals with individual waste components.

The evaluation of the need for statistical and/or judgmental sampling also considers the potential consequences of erroneous decisions. The potential consequences for waste disposed at ERDF are generally acknowledged to have a low degree of severity (Table 2-1) because the matrix will reside in an engineered facility remote from human population centers; in addition, the waste is retrievable if necessary. Therefore, a focused sampling design is suited for obtaining waste characterization information for all of the WSs identified as needing additional data for final disposition. Discrete samples will be collected from selected areas to determine the upper-bounding level of each contaminant of interest.

6.1 DECISION ERRORS

In general, two types of decision errors are associated with this project. The first is treating (i.e., managing and disposing) clean waste material as if it was contaminated. The second decision error is treating contaminated waste material as if it were clean. The second decision error, treating contaminated waste material as if it were clean, has the more severe consequence as the error could result in human health and/or ecological impacts.

6.2 NULL HYPOTHESIS

Table 6-1 identifies the null hypothesis that applies to the waste materials under investigation. The term "null hypothesis" refers to the baseline condition of the site, which has been defined based on historical data process knowledge and existing analytical data.

Table 6-1. Defining the Null Hypothesis.

WS #	Null Hypothesis Statement	Indicate Selection
All	Waste materials are assumed to be radioactively and chemically contaminated until shown clean.	X
	Waste materials are assumed to be clean until shown to be radioactively and chemically contaminated.	

WS = waste stream

7.0 STEP 7 – OPTIMIZE THE DESIGN

The objective of DQO Step 7 is to present data collection designs that meet the minimum data quality requirements specified in DQO Steps 1 through 6.

7.1 FOCUSED SAMPLE DESIGN

A focused sampling design is suited to provide waste characterization information that will meet the DSs for all of the WSs identified in this project. The sample design will incorporate historical information, process knowledge, and facility inspections, together with radiation surveys and discrete samples (if needed) of selected waste materials, in order to determine the upper-bounding level of each COC in each WS. The following sections provide information on each part of the proposed sample design.

7.2 SPECIFIC MEDIA SAMPLING

As needed, discrete samples of specific media will be collected from biased locations from those WSs that have been identified as needing additional sampling/analytical data (Table 3-1) for final disposition. The laboratory data will be used to establish contamination levels in each of the materials. The data will be used in engineering calculations and waste profiles. This sampling and analysis process will occur prior to and during facility demolition.

Table 7-1 identifies the specific media sample design for all of the WSs identified in this DQO process to resolve the DS for each WS. In some cases, existing data and process knowledge will be used to resolve the DS and provide adequate characterization information.

7.3 NONDESTRUCTIVE ASSAY

Advanced radionuclide characterization (Table 3-4) may be used to obtain information on gamma-emitting radionuclide concentrations. The project radiological engineer will determine the use and application of the other advanced radionuclide characterization techniques and the scaling of this data for determining radionuclides, as appropriate. Trained technicians will perform the other advanced radionuclide characterization techniques in accordance with appropriate procedures, task instructions, and/or subcontract documents.

The use of NDA may be required if waste has been identified as anomalous. The NDA equipment and techniques shall be quantitative and capable of addressing DS #1. The NDA equipment shall be commercial systems, use proven technologies, and have verified and validated data analysis software for this application. Proposed techniques shall have been previously demonstrated for similar in situ measurements. A specific work plan will be developed and reviewed by Waste Operations to ensure that the proposed process provides acceptable data for waste designation and to determine whether the waste will comply with ERDF waste acceptance criteria.

Table 7-1. Waste Streams, Specific Media, Existing Data, and Data Collection Design. (6 Pages)

WS #	Description	Media	Are Existing Data Sufficient for DQO?	Additional Computational Methods Needed	Additional Survey/Sampling Information Needed	Methods and COCs
1	Bulk demolition debris (including, but not limited to, poured concrete, meehanite roofing, pumps, piping, steel siding, miscellaneous equipment, coatings, filter pits, concrete plenums, ventilation systems, below-grade drain lines, and sumps)	Exposed surfaces	No	Engineering calculations	Isotopic radionuclides to determine TRU/GTCC	Field radiation surveys or NDA, as needed See Table 1-13 for COCs
2	Metal cuttings, shavings, filings, and pieces	Exposed surfaces, solids, and oils	Yes	Engineering calculations	LDR	Field radiation surveys or NDA, as needed Media sampling and analysis, as needed See Table 1-13 for COCs
3	Asbestos-containing material (including, but not limited to, cement asbestos board, pipe and building insulation, gaskets, and ventilation gaskets)	Exposed surfaces, building materials, and structures	Yes	Engineering calculations	Asbestos	Field radiation surveys or NDA, as needed Media sampling and analysis, as needed See Table 1-13 for COCs
4	Miscellaneous aqueous liquid (including, but not limited to, liquids identified in system pumps, sumps, tanks, piping, drains, and processing equipment)	For ETF disposal, liquids collected from facility systems, pipes, sumps, drainage, or other sources of accumulation Liquids collected from facility systems and used for dust suppression	No	None	Radiological and chemical/physical properties 327 Building wet basin water Tank 105 contents	One representative sample per container or batch of compatible material from the same source

Table 7-1. Waste Streams, Specific Media, Existing Data, and Data Collection Design. (6 Pages)

WS #	Description	Media	Are Existing Data Sufficient for DQO?	Additional Computational Methods Needed	Additional Survey/Sampling Information Needed	Methods and COCs
5	Miscellaneous bulk solids (including, but not limited to, sludge, sediment and solid materials collected from system pumps, sumps, tanks, piping, drains, and processing equipment)	Bulk solids collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	No	None	Radiological and chemical/physical properties	Field radiation surveys or NDA, as needed Media sampling and analysis, as needed See Table 1-13 for COCs
6	Plant equipment and manipulators (lubrication grease, oil, hydraulic oils, mineral oil in windows, and petroleum products)	Bulk oils, greases, and other organic liquids collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	No	None	Radiological and chemical/physical properties	One representative sample per container or batch of compatible material from the same source
10	Refrigerated systems (SERF cell recirculation system)	Refrigerants and soldered systems	Yes	None	Surface radiological contamination	Field radiation surveys or NDA, as needed See Table 1-13 for COCs
11	Mercury-containing equipment (manometers, vacuum pumps, switches, and mercury vapor lights)	Mercury-activated switches and mercury residue	Yes	None	Surface radiological contamination	Field radiation surveys or NDA, as needed See Table 1-13 for COCs
12	Lead packing, washers, and shielding	Shielding materials, packing in pipe joints, lead washers, and fasteners	Yes	None	Surface radiological contamination	Field radiation surveys or NDA, as needed See Table 1-13 for COCs
13	Fluorescent light ballasts	Internals of light ballasts	Yes	None	Surface radiological contamination	Field radiation surveys or NDA, as needed See Table 1-13 for COCs

Table 7-1. Waste Streams, Specific Media, Existing Data, and Data Collection Design. (6 Pages)

WS #	Description	Media	Are Existing Data Sufficient for DQO?	Additional Computational Methods Needed	Additional Survey/Sampling Information Needed	Methods and COCs
14	Fluorescent light tubes and incandescent light bulbs	Internals of bulbs, lead-base	Yes	None	Surface radiological contamination	Field radiation surveys or NDA, as needed See Table 1-13 for COCs
17	Miscellaneous materials for salvage (e.g., mineral oil in cell windows)	Mineral oil from cell windows	No	None	Radiological and chemical/physical properties	Field radiation surveys or NDA, as needed Media sampling and analysis, one representative sample of compatible material See Table 1-13 for COCs
18	Soil and sediment	Potentially contaminated soil and sediment	No	None	Radiological and chemical/physical properties	Field radiation surveys or NDA, as needed Media sampling and analysis, one representative sample of compatible material See Table 1-13 for COCs
19	HEPA filters and filter media	Potentially contaminated filter media from vacuums, exhausters, filter beds, and other similar sources	No	Engineering calculations	Radiological and chemical/physical properties 324 Building A-frame 327 Building filters	Field radiation surveys or NDA, as needed Media sampling and analysis, one representative sample of compatible material See Table 1-13 for COCs
20	Unexpected media and waste forms (including solids and liquids)	Unexpected demolition debris and waste forms	No	To be determined	To be determined	To be determined

Table 7-1. Waste Streams, Specific Media, Existing Data, and Data Collection Design. (6 Pages)

WS #	Description	Media	Are Existing Data Sufficient for DQO?	Additional Computational Methods Needed	Additional Survey/Sampling Information Needed	Methods and COCs
21	Contaminated waste piping, cable, ducts, and coatings (including RLWS at 327 Building)	Exposed surfaces, buildings materials and structures, and potentially contaminated soil	No	Engineering calculations	Radiological and chemical/physical properties Pipeline from HLV to the 325 Building Solids/sludge/liquids from 327 Building RLWS	Field radiation surveys or NDA, as needed Media sampling and analysis, one representative sample of compatible material See Table 1-13 for COCs
22	324 Building – A-cell	Exposed surfaces	No	Engineering calculations	Isotopic radionuclides to determine TRU/GTCC Containers of material removed from B-cell	Field radiation surveys or NDA, as needed See Table 1-13 for COCs
23	324 Building – B-cell	Exposed surfaces	No	Engineering calculations	Isotopic radionuclides to determine TRU/GTCC Is there dispersable material on the floor (Pb, Cr, or Pu)? Containers that contain material, tools and equipment that is not yet characterized	Field radiation surveys or NDA, as needed See Table 1-13 for COCs
24	324 Building – C-cell	Exposed surfaces	No	Engineering calculations	Isotopic radionuclides to determine TRU/GTCC Material in sump and collection trench	Field radiation surveys or NDA, as needed See Table 1-13 for COCs
25	324 Building – D-cell	Exposed surfaces	No	Engineering calculations	Isotopic radionuclides to determine TRU/GTCC	Field radiation surveys or NDA, as needed See Table 1-13 for COCs

Table 7-1. Waste Streams, Specific Media, Existing Data, and Data Collection Design. (6 Pages)

WS #	Description	Media	Are Existing Data Sufficient for DQO?	Additional Computational Methods Needed	Additional Survey/Sampling Information Needed	Methods and COCs
26	324 Building – REC airlock	Exposed surfaces	No	Engineering calculations	Isotopic radionuclides to determine TRU/GTCC	Field radiation surveys or NDA, as needed See Table 1-13 for COCs
27	324 Building – loadout station and contents (including spills and two 300-gal ball casks)	Exposed surfaces	No	Engineering calculations	Isotopic radionuclides to determine TRU/GTCC LDR	Field radiation surveys or NDA, as needed Media sampling and analysis, one representative sample of compatible material See Table 1-13 for COCs
28	324 Building – SMF including the south cell, east cell, and SMF airlock	Exposed surfaces	No	Engineering calculations	Isotopic radionuclides to determine TRU/GTCC	Field radiation surveys or NDA, as needed See Table 1-13 for COCs
29	324 Building – HLV (including tanks, piping, and sample room 145)	Exposed surfaces, solids, sediment collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	No	Engineering calculations	Isotopic radionuclides to determine TRU/GTCC Pipeline from HLV to 325 Building Tank 105 contents (see WS #4)	Field radiation surveys or NDA, as needed See Table 1-13 for COCs
30	324 Building – LLV (including tanks and piping)	Exposed surfaces, solids, sediment collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	No	Engineering calculations	Isotopic radionuclides to determine TRU/GTCC	Field radiation surveys or NDA, as needed See Table 1-13 for COCs

Table 7-1. Waste Streams, Specific Media, Existing Data, and Data Collection Design. (6 Pages)

WS #	Description	Media	Are Existing Data Sufficient for DQO?	Additional Computational Methods Needed	Additional Survey/Sampling Information Needed	Methods and COCs
31	324 Building – wet basin (filled in – includes soil and/or fill material)	Exposed surfaces, solids, sediment collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	No	Engineering calculations	Isotopic radionuclides to determine TRU/GTCC Chemical and physical properties	Field radiation surveys or NDA, as needed Media sampling and analysis, as needed See Table 1-13 for COCs
32	327 Building – hot cells (A through I and SERF cell)	Exposed surfaces	No	Engineering calculations	Isotopic radionuclides to determine TRU/GTCC SERF recirculation cooling coils, condenser, and filters	Field radiation surveys or NDA, as needed See Table 1-13 for COCs
33	327 Building – burst test basin (filled in – includes soil and/or fill material), burst test instrument pit, wet basin, and wet storage basin	Exposed surfaces, solids, sediment collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	No	Engineering calculations	Isotopic radionuclides to determine TRU/GTCC Chemical and physical properties	Field radiation surveys or NDA, as needed Media sampling and analysis, as needed See Table 1-13 for COCs

COC = contaminant of concern
DQO = data quality objective
ETF = Effluent Treatment Facility
GTCC = greater than Class C
HEPA = high-efficiency particulate air
HLV = high-level vault
LDR = land disposal restriction
LLV = low-level vault
NDA = nondestructive assay
REC = radiochemical engineering cells
RLWS = radioactive liquid waste system
SERF = Special Environment Radiometallurgy Facility
SMF = Shielded Material Facility
TRU = transuranic
WS = waste stream

The subcontractor's quality control procedures shall be compatible with specifications in the *Hanford Analytical Services Quality Assurance Requirements Document* (DOE-RL 1998).

Applicable quality assurance procedures shall be followed in the field to ensure that reliable data are obtained.

7.4 RADIOLOGICAL SURVEYS

7.4.1 Radiological Surveys

Radiological surveys may be required to support waste characterization activities. These radiological surveys will consist of alpha and beta-gamma contamination surveys of accessible surfaces of the waste media and will be conducted by project radiological control technicians (RCTs). Dose-rate surveys may also be required. Additional uniformly distributed and/or biased measurements may be collected, as required, at the discretion of the project radiological engineer or project characterization lead. Information obtained from these surveys will be used to determine the extent of contamination in the facility and to support worker health and safety during activities. These surveys will be conducted in accordance with the appropriate requirements, as specified in the SAP.

7.4.2 Percent Profile Verification Surveys

Prior to waste disposition, radiological surveys may be required for waste materials in the scope of this project. These surveys will involve environmental radiological surveys of shipping containers and will be conducted by project RCTs in accordance with the appropriate requirements, as specified in the SAP. The profile verification surveys will be used to document the activity per volume (pCi/L) or activity per mass (pCi/g) of waste profile for the waste materials.

7.4.3 Material Release Surveys for Reuse

Salvageable materials that have no potential for volumetric, matrixed, or inaccessible contamination may be surveyed for release. The material release surveys will involve radiological surveys of accessible surfaces of the waste materials and will be conducted by project RCTs in accordance with appropriate radiological control procedures or survey plans.

Additional surveys for offsite release may be conducted as needed in accordance with appropriate release requirements and meet the requirements of BHI-EE-10, *Waste Management Plan*, Procedure 21, "Release of Waste Not Controlled as Radioactive."

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