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Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

17-AMRP-0206

JUL 10 2017

Ms. Alexandra K. Smith, Program Manager
Nuclear Waste Program
Washington State Department of Ecology
3100 Port of Benton Boulevard
Richland, Washington 99354

Dear Ms. Smith:

CLASS 1 MODIFICATIONS TO THE HANFORD FACILITY RESOURCE CONSERVATION AND RECOVERY ACT PERMIT, QUARTER ENDING JUNE 30, 2017

In accordance with the Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste (Permit) Condition I.C.3, enclosed are Class 1 permit modification documents for the quarter ending June 30, 2017.

The modifications update information in Parts I, II, III, and V of the Permit Revision 8C. The changes in Parts I and II address historical information about closed units. The changes in Parts III and V address the 242-A Evaporator and the Waste Encapsulation and Storage Facility, Hot Cells A through F. The modifications are being made to ensure activities are conducted in compliance with the Permit. A record of the modifications is maintained in the Hanford Facility Operating Record.

The U.S. Department of Energy Richland Operations Office and Washington State Department of Ecology use permit change notices (PCNs) to help track Class 1 permit modifications. This modification package addresses the following PCNs:

PCN Identifier:	Affected Permit Section:
PCN-HFSW-2017-01	Units Retired from the Permit
PCN-242-A-2017-01	OUG-4 Conditions and Chapter 4.0
PCN-WESF-2017-01	CUG-6 Addendum H

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If you have any questions, please contact me, or your staff may contact Joe Franco, Assistant Manager for the River and Plateau on (509) 373-9971.

Sincerely,

Doug S. Shoop
Manager

AMRP:ACM

Enclosure

cc w/encl:
J. L. Cantu, Ecology (CD)
Administrative Record, TSD: H-0-1, D-1-2, T-1-2, H-0-8 (Hard Copy & CD)
S. L. Dahl-Crumpler, Ecology (Hard Copy)
Ecology NWP Library (Hardcopy & CD)
Environmental Portal (CD)
Gonzaga University, Foley Center Library (CD)
HF Operating Record (J. K. Perry, MSA, A3-01) (CD)
Portland State University, Government Information (CD)
U.S. Department of Energy, Public Reading Room, Washington State University, Tri Cities, Consolidated Information Center, (CD)
University of Washington, Suzzallo Library, Govt. Publications Department (CD)

cc w/o encl: See page 3

cc w/o encl:
D. J. Alexander, Ecology
L. E. Borneman, WRPS
R. E. Bullock, CHPRC
A. S. Carlson, Ecology
B. L. Curn, URS
L. J. Cusack, CHPRC
L. R. Hare, CHPRC
M. E. Jones, Ecology
P. W. Martin, CHPRC
S. Murdock, BNI
B. Peck, BNI
E. R. Skinnarland, Ecology
S. A. Thompson, WRPS
H. T. Tilden, PNNL
R. E. Varljen, WRPS
M. B. Wilson, MSA
D. M. Yasek, BNI

ENCLOSURE

CLASS 1 MODIFICATIONS FOR QUARTER ENDING June 30, 2017
Ms. S. L. Dahl-Crumpler, Ecology

Consisting of 134 pages,
including this cover page

Hanford Facility RCRA Permit Modification Notification Forms

Parts I & II, Standard & General Conditions

Index

Reviewed by RL Program Office:

[signature] 5-8-17

Date

Hanford Facility RCRA Permit Modification Notification Form

Unit:	Permit Part
N/A	**Parts I & II, Standard & General Conditions (Unit Retired from the Permit)**

Description of Modification:

Changes are needed to reflect prior retirement of unit-specific permit conditions for the 616 Non-Radioactive Dangerous Waste Storage Facility (Closed 9/5/01) and the 331-C Storage Unit (Closed 7/22/11).

WAC 173-303-830 Modification Class	Class 1	Class '1	Class 2	Class 3
Please mark the Modification Class:	X			

Enter relevant WAC 173-303-830, Appendix I Modification citation number: A.1 (Administrative and informational changes)

Modification Concurrence: ☑ Yes ☐ No (state reason)

Reason for Non-concurrence:

Reviewed by Ecology:

[signature] 5-1-17

S. L. Dahl-Crumpler Date

Revision Instructions:

Revise the Parts I & II (Standard & General Conditions) as shown herein

PART VI UNIT-SPECIFIC CONDITIONS FOR UNITS IN POST-CLOSURE

Post Closure Unit 1, 300 Area Process Trenches

Post Closure Unit 2, 183-H Solar Evaporation Basins

UNITS RETIRED FROM THE PERMIT

100 D Ponds (Closed 8/9/99)

105-DR Large Sodium Fire Facility (Closed 7/1/04)

100-NR-2 Operable Unit (9/30/09)

200 West Area Ash Pit Demolition Site (Closed 11/28/95)

2101-M Pond (Closed 11/28/95)

216-B-3 Expansion Ponds (Closed 7/31/95)

218-E-8 Borrow Pit Demolition Site (Closed 11/28/95)

224-T Transuranic Waste Storage and Assay Facility (Closed 11/12/08)

241-Z Treatment and Storage Tanks (Closed 2/22/07)

2727-S Nonradioactive Dangerous Waste Storage Facility (Closed 7/31/95)

300 Area Solvent Evaporator (Closed 7/31/95)

300 Area Waste Acid Treatment System (Closed 10/30/2005)

303-K Storage Facility (Closed 7/22/02)

303-M Oxide Facility (Closed 6/15/06)

304 Concretion Facility (Closed 1/21/96)

305-B Storage Facility (Closed 7/2/07)

3718-F Alkali Metal Treatment and Storage Facility Closure Plan (Closed 8/4/98)

4843 Alkali Metal Storage Facility Closure Plan (Closed 4/14/97)

Hanford Patrol Academy Demolition Site (Closed 11/28/95)

Plutonium Finishing Plant Treatment Unit (Closed 2/8/05)

Simulated High Level Waste Slurry Treatment and Storage Unit (Closed 10/23/95)

FS-1 Outdoor Container Storage Area (Closed 10/25/2016)

616 Non-Radioactive Dangerous Waste Storage Facility (Closed 9/5/01)

331-C Storage Unit (Closed 7/22/11)

Hanford Facility RCRA Permit Modification Forms

Part III, Operating Unit Group 4

242-A Evaporator

Index

Page	**Permit Section**
Page 2 of 4:	Hanford Facility RCRA Permit III.4, Permit Conditions
Page 3 of 4:	Chapter 4.0 Process Information

Submitted by WRPS Co-Operator: 5/10/17

D. Kent Smith Date

Reviewed by DOE-ORP Program Office: 5-11-17

Glyn D. Trenchard Date

Hanford Facility RCRA Permit Modification Form	
Unit: **242-A Evaporator**	Permit Part **Part III, Operating Unit Group 4**

Description of Modification:

Part III, Operating Unit Group 4 Permit Conditions

CHAPTERS SPECIFIC TO OPERATING UNIT GROUP 4:

Chapter 4.0 Process Information, dated June 30, 2017~~March 31, 2017~~

WAC 173-303-830 Modification Class	Class 1	Class '1	Class 2	Class 3
Please mark the Modification Class:		X		

Enter relevant WAC 173-303-830, Appendix I Modification citation number: A.1

Enter wording of WAC 173-303-830, Appendix I Modification citation: Administrative and informational changes.

SLD Approved

Modification Concurrence: ☑ Yes ☐ No (state reason for denial)

Reason for denial:

Reviewed by Ecology:

S. L. Dahl-Crumpler 5-11-17
Date

Hanford Facility RCRA Permit Modification Form	
Unit: **242-A Evaporator**	Permit Part **Part III, Operating Unit Group 4**

Description of Modification:

Chapter 4.0, Process Information

The purpose of this modification is to update the height of the vessel vent stack height.

Refer to redline/strikeout copy provided for Chapter 4, Process Information.

WAC 173-303-830 Modification Class	Class 1	Class '1	Class 2	Class 3
Please mark the Modification Class:		X		

Enter relevant WAC 173-303-830, Appendix I Modification citation number: -830(4)(d), Other Modifications

Per WAC 173-303-830(4)(d), the Permittee requests that this modification be reviewed and approved as a Class '1.

Approval

Modification Concurrence: ☑ Yes ☐ No (state reason for denial)

Reason for denial:

Reviewed by Ecology:

[signature] 5-11-17

S. L. Dahl-Crumpler Date

Remove and Replace the Following Pages:

Replace:

- Operating Unit Group 4, Permit Conditions
- Chapter 4.0, Process Information

242-A EVAPORATOR

CHANGE CONTROL LOG

Change Control Logs ensure that changes to this unit are performed in a methodical, controlled, coordinated, and transparent manner. Each unit addendum will have a "**Last Modification Date**" which represents the last date the portion of the unit has been modified. The "**Modification Number**" represents Ecology's method for tracking the different versions of the permit. This log will serve as an up to date record of modifications and version history of the unit.

Last modification to 242-A Evaporator **April 26, 2017**

Chapters		Last Modification Date	Modification Number
	Unit-Specific Conditions	04/26/2017	8C.2017.Q1
1.0	Part A Form	03/31/2014	
2.0	Reserved		
3.0	Waste Analysis Plan	03/31/2014	
4.0	Process Information	04/26/2017	8C.2017.Q1
5.0	Reserved		
6.0	Procedures to Prevent Hazards	02/18/2016	8C.2015.Q4
7.0	Contingency Plan	02/18/2016	8C.2015.Q4
8.0	Personnel Training	09/30/2013	
9.0	Reserved		
10.0	Reserved		
11.0	Closure	09/30/2013	

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242-A EVAPORATOR
OPERATING UNIT 4 UNIT-SPECIFIC CONDITIONS
CHANGE CONTROL LOG

Change Control Logs ensure that changes to this unit are performed in a methodical, controlled, coordinated, and transparent manner. Each unit addendum will have its own change control log with a modification history table. The "**Modification Number**" represents Ecology's method for tracking the different versions of the permit. This log will serve as an up to date record of modifications and version history of the unit.

Modification History Table

Modification Date	Modification Number
04/26/2017	8C.2017.Q1
02/18/2016	8C.2015.Q4

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OPERATING UNIT 4 UNIT-SPECIFIC CONDITIONS
242-A EVAPORATOR

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OPERATING UNIT 4 UNIT-SPECIFIC CONDITIONS
242-A EVAPORATOR

UNIT DESCRIPTION

The 242-A Evaporator is a mixed waste treatment and storage unit consisting of a conventional forced-circulation, vacuum evaporation system to concentrate mixed-waste solutions located in the 200 East Area.

This document sets forth the operating conditions for the 242-A Evaporator.

III.4.A COMPLIANCE WITH UNIT SPECIFIC PERMIT CONDITIONS

The Permittees shall comply with all requirements set forth in the Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit (Permit) as specified in Permit Attachment 9, Permit Applicability Matrix, including all approved modifications. All chapters, subsections, figures, tables, and appendices included in the following unit-specific Permit Conditions are enforceable in their entirety.

In the event that the Part III-Unit-Specific Conditions for Operating Unit 4, 242-A Evaporator conflict with the Part I-Standard Conditions and/or Part II-General Facility Conditions of the Permit, the unit-specific conditions for Operating Unit 4, 242-A Evaporator prevail.

CHAPTERS SPECIFIC TO OPERATING UNIT GROUP 4:

Chapter 1.0	Part A Form, dated March 31, 2014
Chapter 3.0	Waste Analysis Plan, dated March 31, 2014
Chapter 4.0	Process Information, dated June 30, 2017~~March 31, 2017~~
Chapter 5.0	Groundwater Monitoring, dated (not applicable)
Chapter 6.0	Procedures to Prevent Hazards, dated December 31, 2015
Chapter 7.0	Contingency Plan, dated December 31, 2015
Chapter 8.0	Personnel Training, dated September 30, 2013
Chapter 11.0	Closure, dated September 30, 2013

III.4.B COMPLIANCE WITH UNIT-SPECIFIC PERMIT CONDITIONS

III.4.B.1 Portions of permit attachment 4 (DOE/RL-94-02) that are not made enforceable by inclusion in the applicability matrix for that document are not made enforceable by reference in this document.

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242-A EVAPORATOR
CHAPTER 4.0
PROCESS INFORMATION
CHANGE CONTROL LOG

Change Control Logs ensure that changes to this unit are performed in a methodical, controlled, coordinated, and transparent manner. Each unit addendum will have its own change control log with a modification history table. The "**Modification Number**" represents Ecology's method for tracking the different versions of the permit. This log will serve as an up to date record of modifications and version history of the unit.

Modification History Table

Modification Date	Modification Number
04/26/2017	8C.2017.Q1
02/18/2016	8C.2015.Q4

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CHAPTER 4.0
PROCESS INFORMATION

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CHAPTER 4.0
PROCESS INFORMATION

TABLE OF CONTENTS

FIGURES

TABLE

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4.0 PROCESS INFORMATION

The 242-A Evaporator receives mixed waste from the Double-Shell Tank (DST) System that contains inorganic and organic constituents and radionuclides. The 242-A Evaporator treatment, storage, and disposal (TSD) unit group boundary for lines running between the 242-A Evaporator and the DST System end at the exterior wall of 242-A building. At this point, these lines (e.g., feed and slurry line piping [SN-269, SN-270, SL-167, and SL-168]) are DST System components. Additional requirements for secondary containment and 242-A Evaporator simplified process flow diagram is given in Figure 4.1. The 242-A Evaporator separates the mixed waste received from the DST System, generating the following waste streams:

- A concentrated aqueous waste stream (slurry) containing the nonvolatile components, including most of the radionuclides, inorganic constituents, and nonvolatile organics such as tri-butyl phosphate.
- A dilute aqueous waste stream (process condensate) containing the volatile components, primarily water with low concentrations of radionuclides, inorganic constituents, and volatile constituents such as ammonia and acetone.

The slurry is routed back to the DST System pending further treatment. The process condensate is transferred to Liquid Effluent Retention Facility (LERF) through the PC-5000 transfer line for storage until processed through the 200 Area Effluent Treatment Facility (ETF). The 242-A Evaporator TSD unit group boundary for the PC-5000 transfer line running between the 242-A Evaporator and LERF end at the LERF TSD unit group boundary.

The 242-A Evaporator process employs a conventional forced circulation, vacuum evaporation system to concentrate the DST System waste solution. The major components of this system include the reboiler (E-A-1), vapor-liquid separator (C-A-1), recirculation pump (P-B-1) and pipe loop, slurry product pump, condenser, jet vacuum system, and condensate collection tank (TK-C-100).

The vapor-liquid separator (C-A-1) also called the evaporator vessel, and the condensate collection tank (TK-C-100), meet the definition of a tank in Washington Administrative Code (WAC) 173-303-040. Other process equipment associated with these tank systems is considered ancillary equipment. Drawings that aid in understanding the systems are provided in Section 4.3.

The 242-A Evaporator receives waste from DST System tank 241-AW-102 that serves as the 242-A Evaporator feed tank. The feed enters the recirculation line and blends with the main process slurry stream, which is pumped to the reboiler.

In the reboiler, the mixture is heated to the specified operating temperature, normally 100 to 155°F, using 3 to 10 pounds per square inch (psig) gauge pressure steam. The low-pressure steam provides adequate heat input, and the resulting low-temperature differential across the reboiler minimizes scale formation on the heat transfer surfaces. The static liquid head of the waste in the reboiler is sufficient to suppress the boiling point so the waste does not boil in the reboiler tubes. Boiling occurs only near or at the liquid surface in the vapor liquid separator (C-A-1), where the static liquid head is zero and the heated waste is at the reduced pressure of the vapor-liquid separator (C-A-1). Slurry may be transferred back to the 242-A Evaporator feed tank through the DST system for one or more passes through the 242-A Evaporator to achieve desired waste volume reduction.

The heated slurry stream is discharged from the reboiler (E-A-1) to the vapor-liquid separator (C-A-1). The vapor-liquid separator (C-A-1) is typically maintained at an absolute pressure of 0.77 to 1.55 psig absolute. Under this reduced pressure, a fraction of the water in the heated slurry flashes to steam and the steam is drawn through two, wire mesh deentrainer pads into a 42-inch diameter vapor line that leads to the primary condenser, leaving behind a more concentrated slurry solution in the vapor-liquid separator (C-A-1).

After a brief residence time in the vapor-liquid separator (C-A-1), the slurry exits from the bottom through the lower portion of the recirculation line and is recirculated by the recirculation pump (P-B-1).

The pump discharges the slurry back to the reboiler via the upper portion of the recirculation line, thus completing the recirculation loop.

Operations monitors the specific gravity of the waste liquid, and adjusts process variables to stay within an acceptable range of the target specific gravity. As part of the campaign planning process, a process control plan is developed to identify the campaign objectives and process controls, including the target specific gravity that is determined before the campaign begins. Slurry is removed from the upper portion of the recirculation line and transferred using slurry pump (P-B-2) or gravity drained through an encased underground pipeline (pipe-within-a-pipe) to a designated slurry receiver tank in the DST System.

The vapors are drawn from the vapor-liquid separator (C-A-1), through a 42-inch diameter vapor line and enter a series of three condensers, where the vapors are condensed using raw water. The condensed vapors, called process condensate, are collected in the condensate collection tank (TK-C-100). Steam jets are used to create a vacuum on the vapor liquid separator drawing the process vapors into and through the condensers. Noncondensable vapors are drawn from the condensers, then through a series of particulate filters and vented to the atmosphere. The air discharges are monitored when the 242-A Evaporator is operating to verify that radionuclide and ammonia emissions standards are met.

The process condensate, a mixed waste, is a dilute aqueous solution with ammonia, volatile organics, and trace quantities of non-volatile constituents. The process condensate is pumped from the condensate collection tank (TK-C-100) through the PC-5000 encased underground pipeline (pipe-within-a-pipe) to the LERF.

During a campaign, the evaporation process is continuous, except when waste is recirculated when new feed is not being received. Typical feed flow rates of 69 to 119 gallons per minute (gpm), process condensate flow rates of 39 to 61 gpm, and slurry flow rates of 29 to 61 gpm. The evaporator process is shutdown when the desired endpoint concentration of the feed is met. Endpoints are established at the beginning of the campaign, based on the target specific gravity of the waste, or allowable waste volume reduction and defined operating limits. If the evaporation rate cannot achieve the desired endpoint, slurry in the DST System serving as the slurry receiver is transferred to the feed tank for one or more passes through the 242-A Evaporator. At the end of processing, the vapor-liquid separator (C-A-1) and recirculation loop are drained, flushed with raw water, and shutdown. The majority of maintenance activities are performed during this shutdown period when waste is not present in the processing equipment with the exception of the condensate collection tank (TK-C-100). The condensate collection tank (TK-C-100) continues to store process condensate from the last campaign.

Other discharges during 242-A Evaporator processing include condensate from the steam used to heat the waste and cooling water used to condense the vapors. The 242-A Evaporator is designed to prevent contamination of these streams, as such the cooling water and steam condensate waste streams do not designate as dangerous waste. The fluids on the uncontaminated side of the heat exchangers are maintained at a higher pressure than the waste stream so that uncontaminated fluid migrates toward the contaminated waste if a leak were to occur. The steam condensate and the cooling water are monitored continuously for radiation, pH, conductivity, and discharged to the Treated Effluent Disposal Facility (TEDF) as long as none of the discharge limits are exceeded. The steam condensate and cooling water streams were assessed in the stream specific reports [WHC-EP-0342-21 (1990), *242-A Evaporator Cooling Water Stream Specific Report, Addendum 21,* and WHC-EP-0342-26 (1996), *242-A Evaporator Steam Condensate Stream Specific Report, Addendum 26*], and are not dangerous waste in accordance with WAC 173-303. The steam condensate and the used raw water waste streams are discharged to the Treated Effluent Disposal Facility (TEDF), under the authority of State Waste Discharge Permit ST0004502.

The 242-A Evaporator process is controlled by operators using the Monitoring Control System (MCS). The MCS computer monitors process parameters and controls the parameters where required. The MCS provides the capability to operate some components (e.g., pumps, valves) in a manual mode. Operations personnel monitor the function of the MCS and process equipment, and operate equipment in a manual mode when required to maintain safe facility operations. Once the configuration parameters and other process control inputs are set, the MCS maintains the process parameters within specified ranges by sending output signals that operate specific pieces of equipment (e.g., control valves). There are redundant MCS components in place that are not used to maintain the integrity of the mixed waste handling system and are not addressed in further detail in this permit.

4.1 Tank Systems

This section discusses information associated with design requirements, integrity assessments, and any additional requirements for tanks used to treat and store mixed waste in the 242-A Evaporator.

The 242-A Evaporator is divided into three major systems that manage mixed wastes. The systems are listed below:

- PC-5000 transfer line
- Vapor-liquid separator (C-A-1) and ancillary equipment
- Condensate collection tank (TK-C-100) and ancillary equipment.

4.1.1 Design Requirements

The following design requirements were addressed in the 242-A Evaporator/Crystallizer Tank System Integrity Assessment Reports (IARs), which are identified in Section 4.1.5:

- Minimum design wall thicknesses and measured wall thicknesses at various points throughout the tank systems.
- Design standards used in construction, including references.
- Waste characteristics.
- Materials of construction and compatibility of materials with the waste being processed.
- Corrosion protection.
- Seismic design basis evaluation.

The conclusion of the latest IARs are that the 242-A Evaporator system and associated PC-5000 transfer line is not leaking and is fit for use. The inspections, tests, and analyses performed provide assurance that the tank system has adequate design, sufficient structural strength, and sufficient compatibility with the waste to not collapse, rupture, or fail during operation. The report also states that a review of construction files indicates that the building structure was designed and constructed to withstand a design-basis earthquake and recommends a frequency of future integrity assessments. The codes and standards applicable to the design, construction, and testing of the 242-A Evaporator tank system are evaluated as part of the fit for use determination [WAC 173-303-640(2)(d)] reached by the latest IARs for the 242-A Evaporator and associated PC-5000 transfer line.

4.1.2 PC-5000 Transfer Line

Process condensate from the 242-A Evaporator is transferred to the LERF using a pump located in the 242-A Evaporator and approximately 5,000 feet of pipe, consisting of a 3-inch carrier pipe within a 6-inch outer containment pipeline. Flow through the pump is controlled through a valve at approximate flow rates from 40 to 80 gpm.

The encased fiberglass transfer line (PC-5000) exits the 242-A Evaporator below grade and remains below grade at a minimum 4-feet depth for freeze protection, until the pipeline emerges at the LERF catch basin, at the corner of each basin. All piping at the catch basin that is less than 4 feet below grade is wrapped with electric heat tracing tape and insulated for protection from freezing. Additional detail including information on secondary containment, leak detection and integrity assessment for this line is provided in Sections 4.1.7.3.3 and 4.1.5.1.

4.1.3 The PC-5000 transfer line leaving the 242-A Evaporator is considered ancillary equipment to the 242-A Evaporator up to LERF and 200 Area ETF Vapor-Liquid Separator (C-A-1) and Ancillary Equipment

The following sections describe the vapor-liquid separator (C-A-1) and ancillary equipment.

Waste Feed System. Feed to the 242-A Evaporator is supplied via a pump located in the DST System 241-AW-102 feed tank. The feed pump transfers the waste to the 242-A Evaporator through a 3-inch diameter carbon steel transfer pipeline encased in a 6-inch diameter carbon steel pipe to provide secondary containment. The feed pipeline is equipped with a leak detection system that is part of the DST System.

Waste feed will be sampled from 241-AW-102 or identified candidate feed tanks as described in the Waste Analysis Plan (Chapter 3.0). The feed sampler (SAMP-F-1) located in a sample enclosure located in the hot equipment storage room has been isolated and blanked, and will be closed in accordance with the approved Closure Plan.

Evaporator Process Loop. The 242-A Evaporator process loop equipment components are as follows:

- Reboiler (E-A-1)
- Vapor-liquid separator (C-A-1)
- Recirculation pump (P-B-1)
- Recirculation loop

Figure 4.2 is a simplified process flow diagram showing the major components of the process loop.

Reboiler (E-A-1). Waste is heated as the waste passes through the reboiler before entering the vapor-liquid separator (C-A-1). The reboiler (E-A-1) is a vertical tube unit with steam on the shell-side and process solution on the tube-side. The 364 tubes in the reboiler (E-A-1) are enclosed in an approximately 40-inch-outside diameter, 15-feet-long stainless steel shell. Both the reboiler shell and tubes are constructed of 304L stainless steel. The shell is 1/4-inch thick and the tubes are 14-gauge steel. The reboiler is designed to distribute steam evenly and to prevent tube damage from water droplets that may be present in the steam.

Vapor-Liquid Separator (C-A-1). Process solution from the reboiler enters the vapor-liquid separator (C-A-1) via the upper recirculation line. Some of the solution flashes into vapor, which exits through a vapor line at the top of the vapor-liquid separator (C-A-1). The remaining solution (slurry) exits through the recirculation line at the bottom.

The vapor-liquid separator (C-A-1) consists of a lower and upper section. The lower (liquid) section is a stainless steel shell 14 feet in diameter having a 22,500 to 26,000 gallon normal operating capacity (including recirculation loop and reboiler). The maximum design capacity is 35,600 gallons. The upper (vapor) section is a stainless steel shell is 11.5 feet in diameter containing two deentrainment pads. These wire mesh pads remove liquids and solids that entrain into the vapor section of the vessel. Spray nozzles, using recycled process condensate or filtered raw water, wash collected solids from the deentrainment pads and vessel walls. Both sections of the vapor-liquid separator (C-A-1) are constructed of 3/8-inch-thick stainless steel.

Operating parameters in the vapor-liquid separator (C-A-1) are monitored to provide an indication of process problems such as slurry foaming, deentrainer flooding, or excessive vapor temperatures. Instrumentation also is available to monitor the liquid levels in the vapor-liquid separator (C-A-1). Interlocks are activated when high pressures or high- or low-liquid levels are detected, shutting down the evaporation process and placing the facility in a safe configuration. Three configurations can be achieved during operation of the 242-A Evaporator:

- Recirculation with vacuum
- Recirculation without vacuum
- Waste in vapor-liquid separator (C-A-1) with no recirculation.

The vapor-liquid separator (C-A-1) and recirculation loop can be drained and flushed to remove any residual solids from the system and/or to reduce radiation levels. The most common flush solution is water, but dilute nitric or citric acid solutions could be used. All acidic flush solutions are chemically adjusted to meet DST acceptance criteria before transfer to the DST System. Antifoam solution is added (at very low flow rates - approximately 0.01 to 0.1 gpm) to the vessel to prevent foaming. The antifoam solution is a noncorrosive, nonregulated silicone-based solution that is compatible with the evaporator components.

242-A Evaporator shutdown is accomplished by performing manual, localized actions such as system isolation, equipment shutdown, etc. The system is designed to drain so that normal practices effectively drain the system. After shutdown, a small volume of liquid may be present in the vapor-liquid separator (C-A-1).

Recirculation Pump. The stainless steel recirculation pump (P-B-1), is constructed as part of the recirculation loop to the reboiler. The 28-inch diameter axial flow pump has nominal flow rate of 13,000 to 16,000 gpm output. The recirculation pump is designed to handle slurry up to 30 percent undissolved solids by volume at specific gravities up to 1.8. The recirculation pump moves waste at high velocities through the reboiler to improve heat transfer, keep solids in suspension, and reduce fouling of the heat transfer surfaces.

The recirculation pump is equipped with shaft seals with high-pressure recycled process condensate (or water) introduced between the seals to prevent the waste solution from leaking out of the system. Seal water pressure and flow are monitored and controlled to shut down the recirculation pump if conditions are not adequate to prevent waste liquid from migrating into the seal water. The used seal water is routed to the feed tank.

Recirculation Loop. The recirculation loop consists of a 28-inch diameter stainless steel pipe that connects the vapor-liquid separator (C-A-1) to the recirculation pump and reboiler. The lower loop runs from the bottom of the vapor-liquid separator (C-A-1) to the recirculation pump inlet. The upper loop connects the pump discharge to the reboiler and the reboiler to the vapor-liquid separator (C-A-1). The feed line from the DST System feed tank and the slurry line to underground storage tanks are connected to the upper recirculation line.

Slurry System. The slurry system draws a portion of the concentrated waste from the upper recirculation loop and transfers it to the DST System.

The major components of the slurry system are the slurry pump and the slurry transfer pipelines. Figure 4.3 shows a simplified flow diagram of the slurry system. These components are described in the following paragraphs.

The slurry pump (P-B-2) is used to transfer slurry from the recirculation loop to the designated DST System tank. The pump is driven by a variable speed motor and is constructed of 304L stainless steel. The slurry pump is designed to generate high pressures to alleviate the possibility of a transfer line plugging.

Interlocks control the operation of the slurry pump. The slurry pump (P-B-2) is shutdown if any of the following occur:

- Excessive pressure is detected in the slurry lines to 241-AW Tank Farm.
- A leak is detected in the slurry transfer lines secondary containment.
- A leak is detected in the 241-AW Tank Farm valve pits (see Section 4.1.7.3.2).

The slurry pump uses a shaft seal with recycled process condensate (or water) and pressure and flow controls similar to the system described above for the recirculation pump.

Compliant transfer pipelines route slurry to a designated DST System tank within the 200 East Area. The detection of any leak by the DST System automated leak detection system is used to shut off the slurry pump. In lieu of the MCS automated shutdown, the slurry pump (P-B-2) can be manually shutdown at the direction of the Shift manager or 242-A Evaporator Control Room operator if a leak occurs.

The flow rate of the slurry transfer to the DST System is monitored and a decrease in flow below a specified value automatically will shut down the slurry pump (P-B-2) and initiate a line flush with water. The objective of flushing the transfer line is to prevent settling of solids, which precludes plugging the slurry transfer lines.

Slurry samples can be taken from the recirculation loop when needed via a sampler (SAMP-F-2) that is located near the feed sampler in the load out and hot equipment storage room.

4.1.4 Condensate Collection Tank (TK-C-100) and Ancillary Equipment

The following section discusses the condensate collection tank (TK-C-100) and ancillary equipment. This equipment collects process condensate via the condensers in the vacuum condenser system, filters the condensate, and pumps the process condensate to LERF. Figure 4.4 provides a simplified process flow diagram showing the major components of the process condensate system. The following major components make up the process condensate system:

- Vacuum condenser system
- Condensate collection tank (TK-C-100)
- Process condensate pump (P-C-100)
- Condensate filters (F-C-1 and F-C-3)
- Process condensate radiation monitoring, sampling system and diversion system (RC3)
- Seal pot
- Process condensate recycle system
- Vessel Vent System

Vacuum Condenser System. Vapors removed from the vapor-liquid separator (C-A-1) flow to a series of three condensers where the vapors are condensed using raw water. Condensate drains to the condensate collection tank (TK-C-100). The vacuum condenser system consists of the following major components:

- Primary condenser (E-C-1)
- Intercondenser (E-C-2)
- Aftercondenser (E-C-3)
- Steam jet ejectors (J-EC1-1 and J-EC2-2)

Figure 4.5 provides a simplified process flow diagram showing the major components of the vacuum condenser system. These system components are discussed in the following sections.

Primary Condenser (E-C-1). Vapors drawn from the vapor-liquid separator flow through the 42-inch vapor line, into the E-C-1 condenser where the majority of the condensation takes place. Noncondensed vapors exit to the intercondenser (E-C-2) while the condensed vapors (process condensate) drain to the condensate collection tank (TK-C-100). Cooling water passes through the cooling tubes and exits to TEDF.

The carbon steel condenser shell measures approximately 17.5 feet long with an 85-inch inside diameter. The condenser consists of 2,950 equally spaced carbon steel tubes that are 11 feet long with a 0.75-inch outside diameter.

Intercondenser (E-C-2). Noncondensed vapors from E-C-1 enter the intercondenser. The vapor stream contacts the cooling tubes in the condenser where cooling water provides additional condensation. The condensate drains to the condensate collection tank (TK-C-100). Noncondensed vapors and cooling water are routed to the after condenser.

The carbon steel intercondenser measures 7.25 feet long with a 15.4-inch inside diameter. This heat exchanger contains 144 tubes that are 66 inches long with a 0.75-inch) outside diameter.

After condenser (E-C-3). Vapor discharged from the intercondenser enters the after condenser. Cooling is supplied to the after condenser by the cooling water from the intercondenser. Condensate is routed to the condensate collection tank (TK-C-100), while the noncondensed vapors are filtered, monitored, and discharged to the atmosphere through the vessel ventilation system. The cooling water is discharged to TEDF.

The carbon steel after condenser measures 7.4 feet long and has an 8-inch inside diameter. This heat exchanger contains 45 tubes that are 6 feet long with a 0.75-inch outside diameter.

Steam Jet Ejectors. The vacuum that draws the vapors from vapor-liquid separator (C-A-1) into the condensers is created by a two-stage steam jet ejector system. The first-stage jet ejector (J-EC1-1) maintains a vacuum on the primary condenser, which in turn creates a vacuum on the vapor-liquid separator. The ejector consists of a steam jet, pressure controller, and air bleed-in valve. Steam and noncondensed vapors from the primary condenser are ejected from J-EC1-1 into the intercondenser. The desired vacuum is obtained by controlling steam pressure and bleeding ambient air as necessary into the vapor header through an air intake filter. The second-stage jet ejector (J-EC2-1) creates the vacuum that moves vapors from the intercondenser through the after condenser.

Condensate Collection Tank (TK-C-100). Process condensate from the primary condenser, intercondenser, after condenser, and the vessel ventilation system drain to the condensate collection tank (TK-C-100). The tank is 14 feet in diameter, 19 feet high, and is constructed of 5/16-inch-thick stainless steel. The tank has a maximum design capacity of 17,800 gallons. Normal operating volume is approximately 50 percent of the tank capacity. A carbon steel base supports the tank. An agitator is installed but not used.

In the event of a tank overflow, the solution is routed through an overflow line to the drain system, which returns waste to the feed tank (241-AW-102). Overflow occurs when the volume exceeds about 16,000 gallons. The overflow line is equipped with a liquid filled trap to isolate the drain system from the tank.

Candidate feed tank waste samples are evaluated for the presence of a separate organic layer as described in the Waste Analysis Plan (Chapter 3.0) and process controls are used to reduce the risk of the condensate collection tank (TK-C-100) to receive small amounts of immiscible organics with the condensed waste. If detected, the organic layer is removed by overflowing the condensate collection tank (TK-C-100) back to the feed tank 241-AW-102. The liquid level in the tank is controlled well above the discharge pump intake point and a controlled overflow is conducted upon completion of each processing cycle (campaign or campaigns) to ensure that an organic layer does not accumulate and cannot be pumped to LERF.

Process Condensate Pump. A pump (P-C-100) moves the process condensate from the condensate collection tank (TK-C-100) through the condensate filter to LERF. The process condensate pump is a centrifugal pump constructed of 316 stainless steel.

Condensate Filters. After leaving the condensate collection tank (TK-C-100), the process condensate is filtered to remove solids. The primary condensate filter (F-C-1) has a welded steel housing. A second filter system (F-C-3), installed downstream is also used to filter the process condensate.

This system has duplex in-line filters in cast iron housing. Both filters employ a filter material that is compatible with the process condensate.

Process Condensate Radiation Monitoring, Sampling, and Diversion System. The process condensate is monitored for radiation during transfer to LERF. If radiation levels exceed established limits, an alarm is received and interlocks immediately divert the stream back to the condensate collection tank (TK-C-100) (or the feed tank) and shut off the process condensate pump. This ensures process condensate containing excessive radionuclides due to an accidental carryover from the vapor-liquid separator (C-A-1) is not transferred to LERF.

Seal Pot. The condensate collection tank (TK-C-100) receives condensed liquids from the vessel ventilation system. A seal pot collects the drainage before discharge into the condensate collection tank (TK-C-100) and isolates the tank from the vessel ventilation system.

Condensate Recycle System. For waste minimization, a portion of the process condensate from the condensate collection tank (TK-C-100) is recycled for deentrainment pad sprays and seal water for the recirculation pump (P-B-1) and slurry pump (P-B-2). Use of process condensate instead of raw water results in approximately 10 percent reduction in waste volume generated during continuous operation of the 242-A Evaporator. Filtered raw water also is available as a backup for sprays and seal water. A 2-inch diameter carbon steel line, stainless steel centrifugal pump (P-C-106), and filters (F-C-5 and F-C-4) supply process condensate from condensate collection tank (TK-C-100) to the pad sprays and pump seals. The filters are disposable cartridge filters in carbon steel housings arranged in parallel with one filter in service while the other is in standby.

4.1.5 Integrity Assessments

The IARs are maintained in the Hanford Facility Operating Record, 242-A Evaporator unit-specific portion and discuss:

- The standards used during design and construction of the 242-A Evaporator and the adequacy of those standards.
- The characteristics of the DST System waste processed.
- The adequacy of the materials of construction to provide corrosion protection from the waste processed.
- The age of the tanks and the effect of age on tank integrity.
- The results of the leak tests, visual inspections, and tank wall thickness inspections.
- The frequency and scope of future integrity assessments.
- Deficiencies in secondary containment design. These deficiencies are discussed in the IARs.

An Independent, Qualified, Registered Professional Engineer (IQRPE) certified the integrity assessment.

The inspections, tests, and analyses performed provide assurance that the 242-A Evaporator tank system has adequate design, sufficient structural strength, and sufficient compatibility with the waste to not collapse, rupture, or fail during operation. No evidence of degradation was noted during the visual test, ultrasonic test, or leak test. Both the condensate collection tank (TK-C-100) and the vapor-liquid separator (C-A-1)/reboiler loop passed leak tests. The frequency of subsequent integrity assessments has been established at every 10 years. This frequency is based on the results of the 2008 IARs transmitted to Ecology on May 27, 2008, which include:

- *IQRPE Integrity Assessment Report for the 242-A Evaporator Tank System*, RPP-RPT-33306, Revision 0, 2007.
- *Integrity Assessment Report for the 242-A PC-5000 Transfer Pipeline*, RPP-RPT-33307, Revision 0, 2007.
- *IQRPE Integrity Assessment Report for the 242-A Evaporator Tank System*, RPP-RPT-33306, Revision 0-A.IQRPE, 2008.

4.1.5.1 Transfer Line (PC-5000)

An integrity assessment for the PC-5000 transfer line was performed, including a hydrostatic leak/pressure test at 150 psig. A statement by an IQRPE attesting to the integrity of the piping system is included in the latest IAR, along with the results of the leak/pressure test. The next integrity assessment for the PC-5000 transfer line will be completed on or before May 27, 2018, in accordance with the 2008 IARs. The schedule for conducting integrity assessments will be at a frequency of every 10 years unless otherwise required by an IQRPE or as required for system repairs and upgrades. All integrity assessments will be conducted in accordance with WAC 173-303-640.

4.1.6 Additional Requirements for Existing Tanks

Refer to information in Section 4.1.1 and the IARs, which includes measuring tank wall thicknesses, evaluating corrosion protection, and performing leak tests.

4.1.7 Secondary Containment and Release Detection for Tank Systems

This section describes the design and operation of secondary containment sumps, drain lines, and leak detection systems for the 242-A Evaporator.

4.1.7.1 Requirements for All Tank Systems

The Construction Specification for 242-A Evaporator-Crystallizer Facilities Project B-100 (*Construction Specification for 242-A Evaporator-Crystallizer Facilities Project B-100, B-100-C1, Automated Industries, Vitro Engineering Division, Richland Washington*, Vitro 1974) was used during preparation, design, and construction of the tank and secondary containment systems. The 2008 IARs detail how the construction specification relates to the national codes and standards.

Constructing the building and vessels per this specification ensures that foundations are capable of supporting tank and secondary containment systems and that uneven settling and failures from pressure gradients do not occur. The 2008 IARs state that the "242-A Evaporator has adequate design, sufficient structural strength, and sufficient compatibility with the wastes to not collapse, rupture, or fail during service loads associated with normal operations and that the building structure was designed and constructed to withstand a design basis earthquake".

The 2008 IARs describe the building and secondary containment system. This system is designed to ensure any release is detected within 24 hours.

The secondary containment system also is designed to contain 100 percent of the maximum operating capacity of the vapor-liquid separator (C-A-1)/reboiler loop, and the drain systems are sloped to allow collection of solution and have sufficient capacity to drain this volume in less than the required 24 hours.

The IAR describes the protective coating material and sealant used to protect concrete and joints from attack by leaks to the secondary containment. The materials of construction for the sump and drain lines are also compatible with the waste processed at the 242-A Evaporator.

4.1.7.2 242-A Building Secondary Containment

The 242-A Building serves as a secondary containment vault for the vapor-liquid separator (C-A-1), condensate collection tank (TK-C-100), and ancillary equipment used for transferring mixed waste at the 242-A Evaporator. The concrete for the operating area was poured to form a monolithic structure. Where needed, joints in the concrete were fabricated with preformed filler conforming to the standards of the American Society of Testing and Materials. Joint filler is sealed with a polysulfide sealant per the requirements of the construction specifications (*Construction Specification for 242-A Evaporator-Crystallizer Facilities Project B-100, B-100-C1, Automated Industries, Vitro Engineering Division, Richland Washington*, Vitro 1974).

Before restart in 1994, a new acrylic special protective coating was applied to the concrete in the pump, evaporator, and condenser rooms. The coating meets the requirements of the construction specifications (*Construction Specification for 242-A Evaporator-Crystallizer Facilities Project B-100, B-100-C1,* *Automated Industries, Vitro Engineering Division, Richland Washington*, Vitro 1974), including resistance to very high radiation doses, temperatures of 170°F, and spills of 25 percent caustic solution. The protective coating is maintained.

The following six rooms contain equipment used to process or store* mixed waste:

- Pump room.
- Evaporator room.
- Condenser room.
- Ion exchange room.
- Loading room* (used for temporary storage of mixed waste).
- Loadout and hot equipment storage room.

4.1.7.2.1 Pump Room

The pump room contains the process recirculation loop, recirculation pump (P B 1), and slurry pump (P B 2), and jumpers that transfer feed and slurry solutions between the vapor liquid separator (C-A-1) and the DST System.

The pump room secondary containment walls are 12 to 22-inch thick reinforced concrete. The secondary containment floor is 20-inch-thick reinforced concrete. The pump room floor is lined with 0.25-inch stainless steel and the concrete walls and ceiling cover blocks are painted with a special protective coating. The pump room contains pipe jumpers used to transfer feed and slurry solutions between the vapor-liquid separator and the DST System, and the process recirculation loop, recirculation pump (P-B-1), and slurry pump (P-B-2).

Leaks in the pump room collect in the pump room sump, a 5 x 5 x 6-feet deep sump with a 0.25-inch stainless steel liner. The pump room sump collects spills from various sources for transfer to the feed tank, 241-AW-102. Figure 4.6 provides a simplified process flow schematic of sources, which drain to the pump room sump. Drainage to the sump includes:

- Leaks to the pump room floor from equipment in the pump room.
- Evaporator room floor drain.
- Loadout and hot equipment storage room floor drain.
- Loading room floor drain.
- Raw water backflow preventer drain.

Solution in the pump room sump is transferred to the feed tank (241-AW-102) using a steam jet. A 10-inch secondary containment overflow line is provided for draining large volumes of solution should a catastrophic tank failure occur. Because the overflow line provides a direct path between the air space of feed tank 241-AW-102 and the pump room, a minimum level of water must be maintained in the sump to prevent cross ventilation. A leak into the pump room sump would be detected by a rise in the sump level. Leaks in the pump room are detected by:

- A rise in the sump level resulting in instrumentation alarms on high sump level.
- Inspections of the ancillary equipment and floor in the pump room identified in Chapter 6.0, Procedures to Prevent Hazards.
- Unexplained level increases in feed tank 241-AW-102 because of liquid entering the 242-A Evaporator sump overflow drain line.

The recirculation and slurry pumps in the pump room are equipped with mechanical seals having pressurized water introduced between the seals. The seal water is maintained at a pressure that exceeds the process pressure at the seal to ensure water leaks into the process solution, but waste solution does not leak out. Water from seal leakage is collected in funnels in the pump room and routed to feed tank 241-AW-102 via the 10-inch overflow line described previously.

4.1.7.2.2 Evaporator Room

The evaporator room contains the vapor-liquid separator vessel (C-A-1), part of the recirculation loop, the reboiler, the 42-inch vapor line, and line used to empty the vapor-liquid separator to feed tank 241-AW-102.

The evaporator room secondary containment walls are 0.56-meter (22-inch)-thick reinforced concrete. The secondary containment floor is 0.51-meter (20-inch)-thick reinforced concrete. Leaks in the evaporator room flow to a floor drain that routes through a 3-inch line to the pump room sump described in Section 4.1.7.2.1. A leak in the evaporator room would be detected by a rise in the pump room sump level. The floor of the evaporator room and a portion of the pump room floor are 10 feet below grade to contain the entire contents of the vapor-liquid separator, reboiler, and recirculation loop in the event of a catastrophic failure. The floor and walls of the evaporator room up to an elevation of 6 feet are painted with a special protective coating.

4.1.7.2.3 Condenser Room

The condenser room contains all the components of the process condensate system described in Section 4.1.4 (refer Figure 4.4), including the condensate collection tank TK-C-100.

The condenser room secondary containment walls are 12 to 22-inch-thick reinforced concrete. The secondary containment floor is 20-inch-thick reinforced concrete. Leaks in the condenser room flow to two floor drains that join and route through a 6-inch line to feed tank 241-AW-102. Leaks in the condenser room are detected by the following:

- Unexpected changes in liquid level in the condensate collection tank (TK-C-100). Instrumentation is provided to monitor liquid level in the tank, including high- and low-level alarms.
- Daily visual inspections of process condensate system components and piping.
- Unexplained level increases in feed tank 241-AW-102 because of liquid entering the common drain line from 242-A Evaporator.

The floor and walls of the condenser room up to an elevation of 4 feet are painted with a special protective coating.

4.1.7.2.4 Ion Exchange Room

The ion exchange room is a small room connected to the condenser room. This room previously contained an ion exchange column that has since been removed from the processing unit in 2003. The ion exchange room walls are 12 inches thick reinforced concrete. The floor is 20-inch thick reinforced concrete. The room contains a single pipeline used to transfer process condensate during a campaign if the process condensate is diverted to feed tank 241-AW-102. The pipeline within the ion exchange room does not contain valves or other components that could release waste into the ion exchange room other than by a rupture of the line.

Surveillance of the ion exchange room is only required if the piping is returned to service and dangerous waste is reintroduced to the piping as would be the case for diverting process condensate to feed tank 241-AW-102.

4.1.7.2.5 Loading Room and Loadout and Hot Equipment Storage Rooms

The loading room and the load-out and hot equipment storage rooms are used to support maintenance of pump room equipment and store contaminated reusable equipment. Movement of equipment, waste, personnel and other items in and out of the unit as necessary to support ongoing operations and maintenance activities in contaminated zones can occur in these rooms. A contamination control curtain may also be closed in support of evolutions conducted in the load-out and hot equipment storage room to control the spread of contamination. The load-out and hot equipment storage room contains a slurry sampling system.

The load out and hot equipment storage rooms walls are 12 to 22-inch thick reinforced concrete. The floors are 6-inch thick reinforced concrete. The room contains two recirculation lines and samplers used to sample the feed and slurry streams. The feed sampler has been isolated and is no longer capable of sampling feed. The lines and samplers are located in a shielded enclosure adjacent to the pump room wall.

The load-out and hot equipment storage room contains two sumps: the drain sump and decontamination sump. The sumps are approximately 3 feet in diameter, about 4 feet deep, and lined with stainless steel.

Both sumps drain via a 3-inch drain line to the pump room sump described in Section 4.1.7.2.1. The sumps, floor, and walls of the load out and hot equipment storage room up to an elevation of 12 feet are painted with a special protective coating.

Leaks in the sampler piping, flow into two drains in the sample enclosure that drain via a 2-inch line to the decontamination sump, which drains to the pump room sump (described in Section 4.1.7.2.1). Leak detectors in the sampler enclosures or a rise in the pump room sump level detects leaks in the sampler piping.

4.1.7.2.6 242-A Building Drain Lines

Figure 4.6 provides a simplified process flow schematic of sources routed to the 242-A Building drain lines. The 242-A Evaporator TSD unit group boundary includes these lines up until they exit the 242-A Building. At this point, the lines are considered DST System components. Four lines serve to drain the 242-A Building and equipment to feed tank 241-AW-102:

- Pump room sump drain line (DR-334): 10-inch carbon steel line that transfers process condensate overflow/diverted liquids and empty out of the pump room sump to the feed tank.
- Vapor-liquid separator vessel drain line (DR-335): 10-inch carbon steel line that allows gravity drain of the vessel to the feed tank 241-AW-102.
- Condenser room drain line (DR-343): 6-inch carbon steel line that drains potential leakage from the condenser room.
- Diverted process condensate drain line (DR-338): process condensate liquid drains through DR-338 into sump drain line (DR-334) which drains to feed tank 241-AW-102.

The four lines are sloped to drain about 560 feet to feed tank 241-AW-102 via the drain pit (241-AW-02D). Although WAC 173-303-640(1)(c) exempts systems that serve as secondary containment from requiring secondary containment, drain lines DR-334, DR-335, and DR-338 have outer encasement piping and are part of the DST System.

4.1.7.3 Transfer Line Secondary Containment

This section describes the design and operation of secondary containment and leak detection systems for transfer lines between the DST System and the 242-A Evaporator, and from 242-A Evaporator to LERF. The 242-A Evaporator TSD unit group boundary for lines running between the 242-A Evaporator and the DST System ends at the exterior wall of 242-A building. At this point, these lines (e.g., feed and slurry line piping [SN-269, SN-270, SL-167, and SL-168]) are DST System components.

The PC-5000 transfer line transfers process condensate (Section 4.1.2) from the 242-A building to LERF. The 242-A Evaporator TSD unit boundary includes the PC-5000 transfer line up to the LERF TSD unit group boundary (Part A Form, Chapter 1.0, and Section 4.1.2).

4.1.7.3.1 Feed Line Piping

Waste feed is supplied to the 242-A Evaporator by two feed lines (SN-269 and SN-270) (one in service and one spare), each consist of 3-inch transfer piping within a 6-inch secondary containment encasement piping. Both the transfer and encasement pipes are constructed of Schedule 40 carbon steel. The lines run below grade about 400 feet from pump pit 241-AW-02E (above feed tank 241-AW-102) to the 242-A Building. If the DST System MCS annunciates a leak alarm associated with the DST System transfer, the transfer operator notifies the 242-A Evaporator Control Room operator of the appropriate action regarding processing operations.

4.1.7.3.2 Slurry Line Piping

The slurry pump (P-B-2) transfers mixed waste through one of two transfer lines: SL-167, for transfer to valve pit 241-AW-B (standard configuration), or SL-168 for transfer to valve pit 241-AW-A (alternate configuration). Slurry solution can be routed via double-encased piping from these valve pits to any designated DST System slurry receiver tank. Both slurry transfer lines consist of 2-inch transfer piping within a 4-inch secondary containment encasement piping. Both the transfer and encasement pipes are constructed of Schedule 40 carbon steel. The lines run below grade about 240 feet between the 242-A Building and the valve pits. If the DST System MCS annunciates a leak alarm associated with the DST System transfer, the transfer operator notifies the 242-A Evaporator Control Room operator of the appropriate action regarding processing operations.

4.1.7.3.3 PC-5000 Transfer Line

The process condensate transfer line (PC-5000) from the 242-A Evaporator is centrifugally cast, fiberglass-reinforced epoxy thermoset resin pressure pipe fabricated to meet the requirements of ASME D2997 (ASME 1984). The 3-inch carrier piping is centered and supported within 6-inch containment piping. Pipe supports are fabricated of the same material as the pipe, and meet the strength requirements of ANSI B31.3 (ANSI 1987) for dead weight, thermal, and seismic loads.

Drawing H-2-79604 provides details of the piping from the 242-A Evaporator to LERF.

This permit includes the portion of the PC-5000 transfer line leaving the 242-A Evaporator to the TSD unit group boundary of LERF and 200 Area ETF (Part A Form, Addendum A).

Single-point electronic leak detection elements are installed along the transfer line at 1000-foot intervals. The leak detection elements are located in the bottom of specially designed test risers. Each sensor element employs a conductivity sensor, which provides a signal to the 242-A Evaporator control room when a potential leak is detected. If a leak develops in the primary pipe, fluid will travel down the exterior surface of the primary pipe or the interior of the secondary containment pipe. As moisture contacts a sensor unit, a general alarm sounds in the 242-A Evaporator control room on the MCS. In addition, the zone of the sensor unit causing the general alarm can be determined using the leak detection-monitoring panel. Upon verification of a leak, the pump located in the 242-A Evaporator is shutdown, stopping the flow of aqueous waste through the transfer line. When the transfer line is not in use a low-volume air purge of the annulus between the primary pipe and the secondary containment pipe can be used, if needed to prevent condensation buildup and minimize false alarms by the leak detection elements. If the leak detection system is not available, visual inspection is employed as discussed below. If a leak is detected using visual inspection of the PC-5000 transfer line encasement at the encasement catch tank (TK-PC-101) in the LERF catch basin (242AL-43), the shift manager is notified. The Shift Manger will direct shutdown of the aqueous waste through the PC-5000 transfer line.

4.1.7.4 Additional Requirements for Specific Types of Systems

Addressed in this section are additional requirements in WAC 173-303-640 for vault systems like the 242-A Building to ensure neither buildup of ignitable vapors nor does infiltration of precipitation occur. This section also addresses secondary containment for ancillary equipment and piping associated with the tank systems.

4.1.7.4.1 Vault Systems

The 242-A Building is a vault constructed partially below ground, providing secondary containment for the tank systems. The 242-A Evaporator Part A Form (Chapter 1) contains the ignitable waste number because of the presence of nitrite and nitrate salts, which in sufficient concentrations are considered oxidizers per WAC 173-303-090(5)(a)(iv). Because of their low volatility, these compounds are unlikely to be present in the vapor phase of the tank systems at the 242-A Evaporator. However, to prevent the spread of contamination, the vapor-liquid separator (C-A-1) is ventilated and maintained at lower air pressure than the building air space during operation. This ensures air leakage is from uncontaminated building air space into the tank vapor space. Vapors from the vapor-liquid separator (C-A-1) flow to the vacuum condenser system described in Section 4.0.

The condensate collection tank (TK-C-100), collects process condensate that is not designated ignitable or reactive.

The tank systems and ancillary equipment are located within the 242-A Building, which is completely enclosed to prevent run-on and infiltration of precipitation into the secondary containment system.

4.1.7.4.2 Ancillary Equipment

The 242-A Building provides secondary containment for ancillary equipment. Double containment is provided for the feed and slurry transfer lines between the 242-A Building and the AW Tank Farm by pipe-in-pipe arrangements. Since the ancillary equipment has compliant secondary containment the daily inspection requirements in WAC 173-303-640(4)(f) are not applicable.

4.1.8 Variances from Secondary Containment Requirements

The IARs identified in Section 4.1.5 discuss the following three deficiencies associated with the secondary containment system:

Pump Room Sump. The pump room sump does not comply with secondary containment requirements because liquid must be kept in the sump to provide a seal to prevent airflow between the pump room and feed tank 241-AW-102. Although the sump has a 0.25-inch-thick stainless steel liner to prevent corrosion of the concrete floor, the sump does not have secondary containment.

Routine Discharges through Secondary Containment. The configuration of the 242-A Evaporator process requires routine, batch discharges of dangerous waste through secondary containment drain lines. These routine discharges include the following.

- Steam condensate, cooling water, and process condensate sample stations drain to the feed tank, 241-AW-102, through drain line DR-343. Total discharge is about 10 gallons per month during operation.
- Sample bottle water sprays down in the slurry sample station drains to the decontamination sump in the load out and hot equipment storage room. The decontamination sump then drains to the pump room sump. Total discharge is about 20 gallons per month during operation.

Transfer Piping Wall Penetrations. Three dangerous waste transfer line piping sections passing through the 242-A Building wall are single-walled, i.e., no secondary confinement in the wall (about 22-inch-thick reinforced concrete).

These deficiencies were identified to Ecology, October 28, 1993. Ecology's response stated:

- "No physical revision of the pipe wall penetrations or the floor drains in the evaporator pump room will be required prior to evaporator restart."
- "If at any time leakage is seen or detected from these installations, or if for any reason these installations are repaired or rebuilt, they will be rebuilt or repaired in accordance with regulations."
- "Should a spill occur in the evaporator pump room, the sump and the piping shall be rinsed three times as required in WAC 173-303-160, as appropriate. 'Appropriate' in this case means that the original regulation was written for a free container, not a sump, so that judgment will have to be used in the application of the regulation. The rinsate shall be transferred to the double-shell tanks."

4.1.9 Tank Management Practices

All waste to be processed at the 242-A Evaporator must be sampled to determine if the waste is compatible with the materials of construction at the 242-A Evaporator. Before each campaign, candidate feed tanks are sampled per the requirements of the Waste Analysis Plan (Chapter 3.0). Based on the results, three possible options are implemented.

- The waste is acceptable for processing without further actions.
- The waste is unacceptable for processing as a single batch, but is acceptable if blended with other waste that is going to be processed.
- The waste is unacceptable for processing.

The 242-A Evaporator process is controlled by operators using the MCS. The MCS computer monitors liquid levels in the vapor-liquid separator (C-A-1) and condensate collection tank (TK-C-100). The MCS system manages liquid levels in the vapor-liquid separator (C-A-1) using a control function that controls feed delivery to the vapor-liquid separator (C-A-1). The MCS system also manages liquid levels in the condensate collection tank (TK-C-100) using a control function to maintain the tank level at approximately 50-percent under normal conditions. The MCS has alarms that annunciate on high-liquid levels for both the vapor-liquid separator (C-A-1) and condensate collection tank (TK-C-100) to notify operators that actions must be taken to prevent overfilling of these vessels.

An interlock is activated when high-liquid level in the vapor-liquid separator (C-A-1) is detected, automatically shutting down the feed transfer pump at feed tank 241-AW-102, thereby preventing overfilling of the vessel and carryover of slurry into the process condensate system. The condensate collection tank (TK-C-100) has an overflow line that routes solution to feed tank 241-AW-102 in case of overfilling.

Process and instrumentation drawings are listed in Section 4.3.

The process condensate pump (P-C-100), recirculation pump (P-B-1), and slurry pump (P-B-2) can be shutdown using the MCS or manually at the direction of the Shift Manager or 242-A Evaporator Control Room Operator if a leak occurs.

4.1.10 Labels or Signs

This section identifies how tank labeling practices will be implemented to meet the requirements of WAC 173-303-640(5)(d). Both the condensate collection tank TK-C-100 and ancillary piping is labeled "PROCESS CONDENSATE" to alert trained personnel which pipes in the condenser room contain dangerous waste.

The vapor-liquid separator (C-A-1) is located in the evaporator room, a normally unoccupied area. This area is posted as a radiological area based on current conditions. Access is controlled using as low as reasonably achievable (ALARA) principles and limited to personnel in accordance with Personnel Training (Chapter 8.0). The tank labels are visible from the walls of the tank enclosure rooms, which are less than 50 feet from the tank systems; therefore, label visibility requirements are met.

4.1.11 Air Emissions

Tank systems that contain acutely or chronically toxic waste, by inhalation must be designed to prevent the escape of such vapors as required by WAC 173-303-640(5)(e). For the DST System waste in the vapor-liquid separator (C-A-1), no determination has been performed to determine if the waste is acutely or chronically toxic by inhalation. Most of the toxic compounds in the DST waste are not volatile, but because of the high radioactivity of the waste, controls are included to prevent or mitigate the release of tank vapors. During operation, the vapor-liquid separator (C-A-1) is maintained under vacuum to ensure air leakage is from uncontaminated building air space into the tank vapor space. The vapor in the vapor-liquid separator (C-A-1) then passes through deentrainment pads to prevent liquid and solid carryover into condensers (E-C-1, E-C-2, and E-C-3). The vapor stream passes through the three condensers that remove the condensable components. The noncondensable vapors pass through high efficiency particulate air (HEPA) filters before being discharged to the environment.

4.1.12 Management of Ignitable or Reactive Wastes in Tank Systems

The 242-A Evaporator Part A Form (Chapter 1.0) contains the ignitable waste number because of the presence of oxidizers (nitrates and nitrites). Waste accepted at the 242-A Evaporator does not meet the definition of a combustible or flammable liquid given in National Fire Protection Association (NFPA) code number 30 (NFPA 1996). The buffer zone requirements in NFPA-30, which require tanks containing combustible or flammable solutions be a safe distance from each other and from public way, are not applicable.

Testing is performed on the DST System candidate feed tank waste to be processed to verify the waste does not react exothermically at the elevated temperatures at the 242-A Evaporator. The Waste Analysis Plan (Chapter 3.0) discusses waste acceptance requirements due to the reactive waste number contained on the 242-A Evaporator Part A Form (Chapter 1.0).

4.1.13 Management of Incompatible Wastes in Tank Systems

Waste transferred to the 242-A Evaporator must be compatible before mixing. The Waste Analysis Plan (Chapter 3.0) includes waste compatibility requirements; including waste-to-waste compatibility of multiple candidate feed tanks. Waste stored in the condensate collection tank (TK-C-100) contains low quantities of constituents where compatibility from batch to batch is not a concern.

4.2 Air Emissions Control

This section addresses the requirements of Air Emission Standards for Process Vents, under 40 CFR 264 Subpart AA (incorporated by reference in WAC 173-303-690).

4.2.1 Applicability of Subpart AA Standards

The 242-A Evaporator performs distillation that specifically requires evaluation of process vents for the applicability of 40 CFR 264 Subpart AA.

Waste processed at the 242-A Evaporator routinely contains greater than 10 parts per million organic concentrations; therefore, organic air emissions are subject to 40 CFR 264.1032, which requires organic emissions from all affected vents at the Hanford Facility be less than 3 pounds per hour and 3.1 tons per year, or control devices be installed to reduce organic emissions by 95%.

The 242-A Evaporator has one process ventilation system that vents both the vapor-liquid separator (C-A-1) and the condensate collection tank (TK-C-100). The vent lines from both tanks combine before entering an off-gas system consisting of a deentrainer, a prefilter/demister, HEPA filters, and an exhaust fan. The vessel vent off-gas system is located on the third floor of the condenser room, with the exhaust stack extending horizontally through the east wall of the building at an elevation of approximately 48 feet above ground level. The exhaust stack bends to run vertically with the discharge point approximately ~~61~~111 feet above ground level.

During waste processing, the airflow is about 720 cubic feet per minute, with about 150 cubic feet per minute ventilated from the condensate collection tank (TK-C-100) and the remainder from the vapor-liquid separator (C-A-1) and air in leakage.

Organic emissions occur during waste processing, which is less than 6 months (182 days) each year. This is the maximum annual operating time for the 242-A Evaporator, as shutdowns are required during the year for maintenance outages, candidate feed tank analysis, and establishing transfer routes for staging waste in the DST System.

4.2.2 Process Vents - Demonstrating Compliance

This section outlines how the 242-A Evaporator complies with the requirements of 40 CFR 264, Subpart AA, including a discussion of the basis for meeting the organic emission limits, calculations demonstrating compliance, and conditions for reevaluating compliance.

4.2.2.1 Basis for Meeting Limits/Reductions

The TSD units at the Hanford Facility subject to 40 CFR 264, Subpart AA meet the organic air emission limits of 3 pounds per hour and 3.1 tons per year, established in 40 CFR 264.1032, by the design of the facility. The 242-A Evaporator and the other TSD units collectively can meet these standards without the use of air pollution control devices.

4.2.2.2 Demonstrating Compliance

Process vent organic air emissions are controlled by establishing limits for acceptance of waste at the 242-A Evaporator. Before startup of each campaign, the waste to be processed is sampled in the DST System to determine the organic content. If the concentrations of organic constituents are less than the limits in the Waste Analysis Plan (Chapter 3.0), the waste can be processed, provided the Hanford Facility will not exceed 3 pounds per hour and 3.1 tons per year. The waste acceptance limits in the Waste Analysis Plan (Chapter 3.0) are based on equilibrium calculations and assumptions given in *Organic Emission Calculations for the 242-A Evaporator Vessel Vent System* (WHC-SD-WM-ES-380, 1996). The calculation to determine organic emissions consists of the following steps:

1. Determine the emission rate of each candidate feed tank organic constituent by multiplying the constituent concentration by the corresponding partition factor in *Organic Emission Calculations for the 242-A Evaporator Vessel Vent System* (WHC-SD-WM-ES-380, 1996).
2. Sum the emission rates of all organic constituents to determine the emission rate for the candidate feed tank. The maximum emission rate for the campaign is the rate from the candidate tank with the greatest emission rate.
3. Determine the total amount of emission during the campaign by using operating time and a weighted average emission rate, based on the volume of each candidate feed tank processed.

The organic emission rates and quantity of organics emitted during the campaign are determined using these calculations and are included in the operating record for each campaign, as required by 40 CFR 264.1035. The Hanford Facility has a system to ensure organic emissions from units subject to 40 CFR 264, Subpart AA are less than the limits of 3 pounds per hour and 3.1 tons per year. Records documenting total organic emissions are available for Ecology review on request.

4.2.2.3 Reevaluating Compliance with Subpart AA Standards

Calculations to determine compliance with Subpart AA will be reviewed when any of the following conditions occur at the 242-A Evaporator:

- Changes in the configuration or operation that affect the assumptions in the Organic Emission Calculations for the 242-A Evaporator Vessel Vent System (WHC-SD-WM-ES-380, 1996).
- Annual operating time exceeds 182 days.

4.3 Engineering Drawings

The drawings in Table 4.1 are Process and Instrumentation Diagrams (P&IDs) for the systems at the 242-A Evaporator that contact mixed waste. These drawings are provided for general information, and demonstrate adequacy of the tank systems design.

Table 4.1. Process and Instrumentation Diagrams

System	Drawing Number	Drawing Title
Vapor-Liquid Separator (C-A-1)	H-2-98988 Sheet 1	P&ID Evaporator Recirc System
Reboiler (E-A-1)/Recirculation Line	H-2-98988 Sheet 2	P&ID Evaporator Recirc System
Slurry System	H-2-98989 Sheet 1	P&ID Slurry System
Condensate Collection Tank (TK-C-100)	H-2-98990 Sheet 1	P&ID Process Condensate System
Secondary Containment Drain System	H-2-98995 Sheet 1	P&ID Drain System
Secondary Containment Drain System	H-2-98995 Sheet 2	P&ID Drain System
Condensers	H-2-98999 Sheet 1	P&ID Vacuum Condenser System
Pump Room Sump	H-2-99002 Sheet 1	P&ID Jet Gang Valve System
Condensate Recycle System	H-2-99003 Sheet 1	P&ID Filtered Raw Water System
Process Condensate Line PC-5000	H-2-79604	Piping Plot & Key Plans 242-A Evap Cond Stream

The drawings in Table 4.2 are for secondary containment systems for the 242-A Evaporator. Because secondary containment systems are the final barrier for preventing the release of dangerous waste into the environment, modifications that affect the secondary containment systems will be submitted to the Washington State Department of Ecology, as a Class 1, 2, or 3 Permit modifications, as required by WAC 173-303-830.

Table 4.2. 242-A Evaporator Secondary Containment Systems Drawings

System	Drawing Number	Drawing Title
242-A Building	H-2-69277 Sheet 1	Structural Foundation Plan Sections & General Notes - Areas 1 & 2
	H-2-69278 Sheet 1	Structural Foundation Elevations & Details - Areas 1 & 2
	H-2-69279 Sheet 1	Structural First Floor Plan & AMU - Areas 1 & 2
Pump Room Sump Drainage	H-2-69352 Sheet 1	Sections Process Waste Drainage
242-A Building Drainage	H-2-69354 Sheet 1	Plan Process Waste Drainage
Pump Room Sump	H-2-69369 Sheet 1	Pump Room Sump Assembly & Details

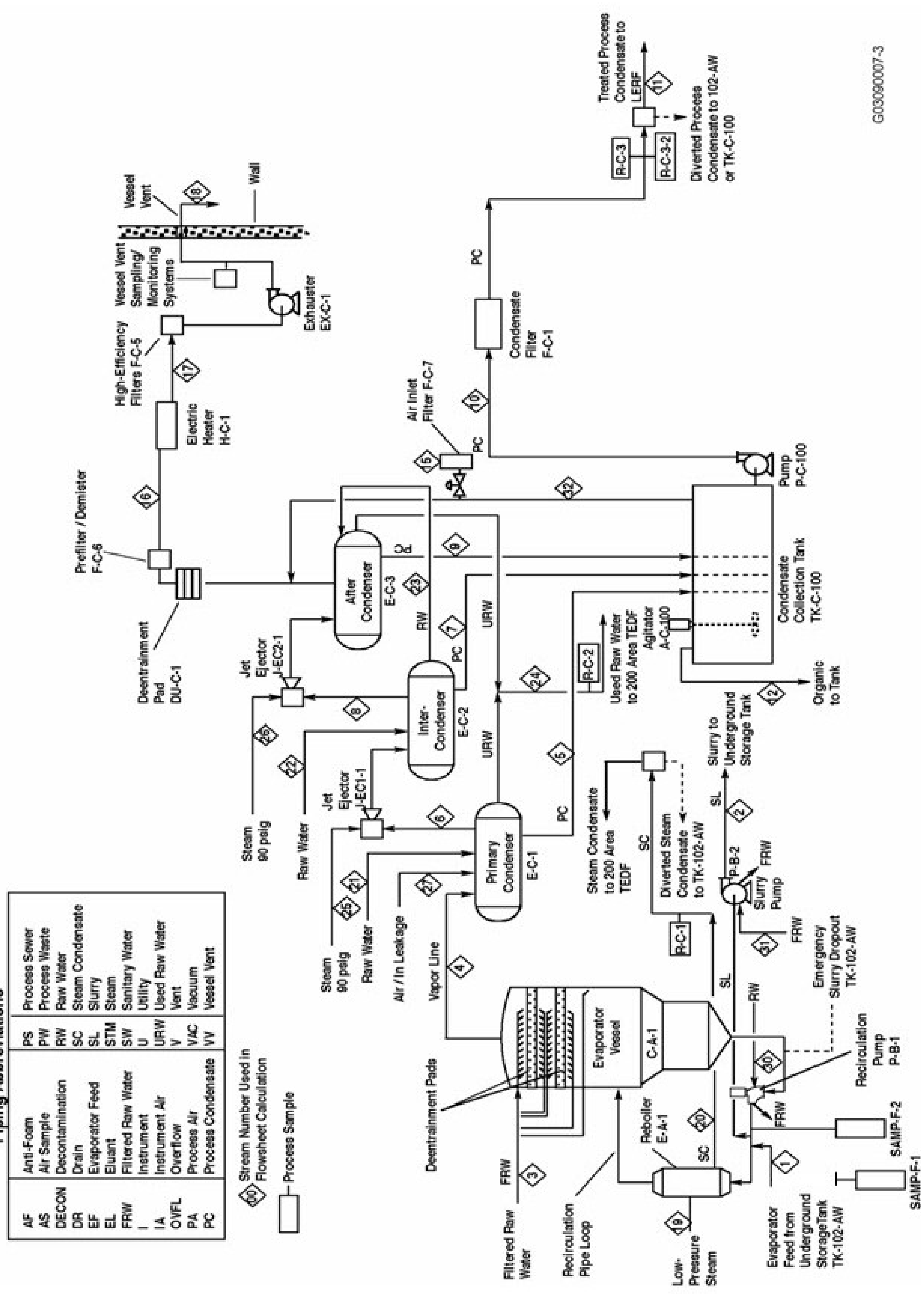
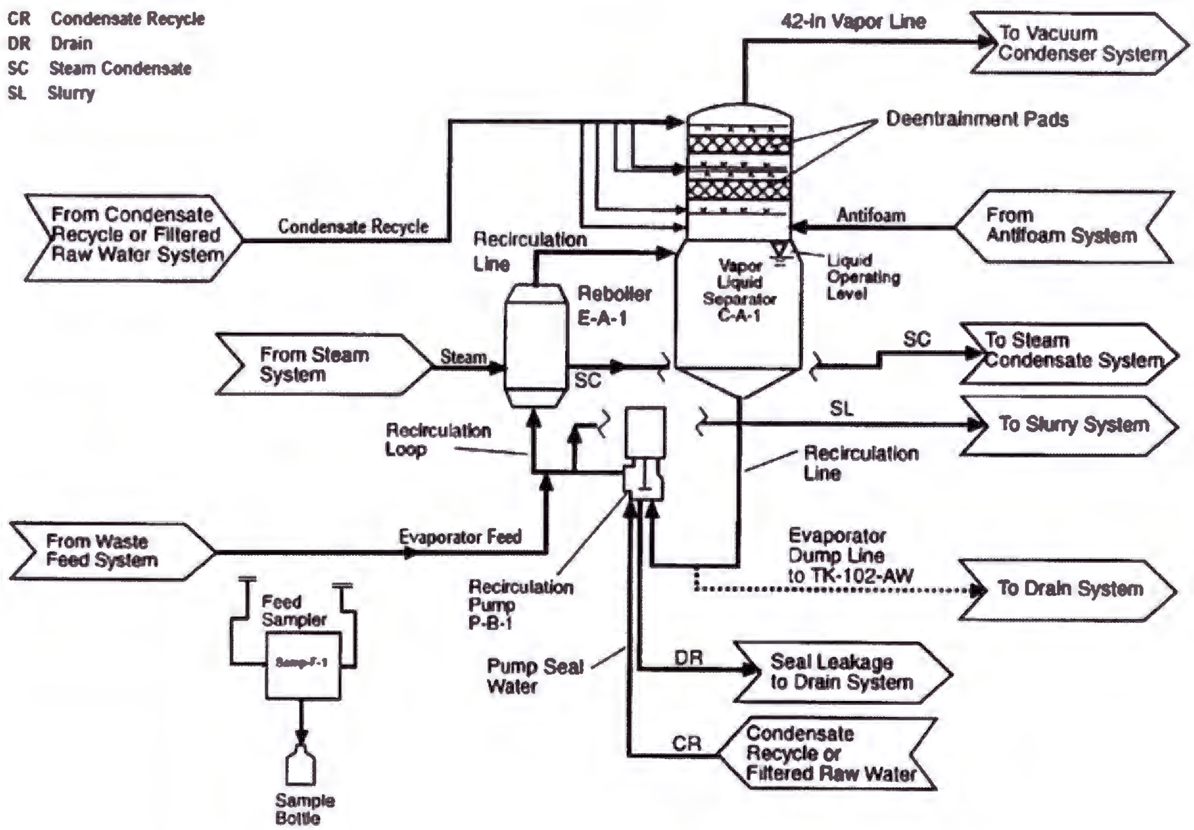


Figure 4.1. 242-A Evaporator Simplified Process Flow Diagram



1
2 **Figure 4.2. 242-A Evaporator Process Loop**

3

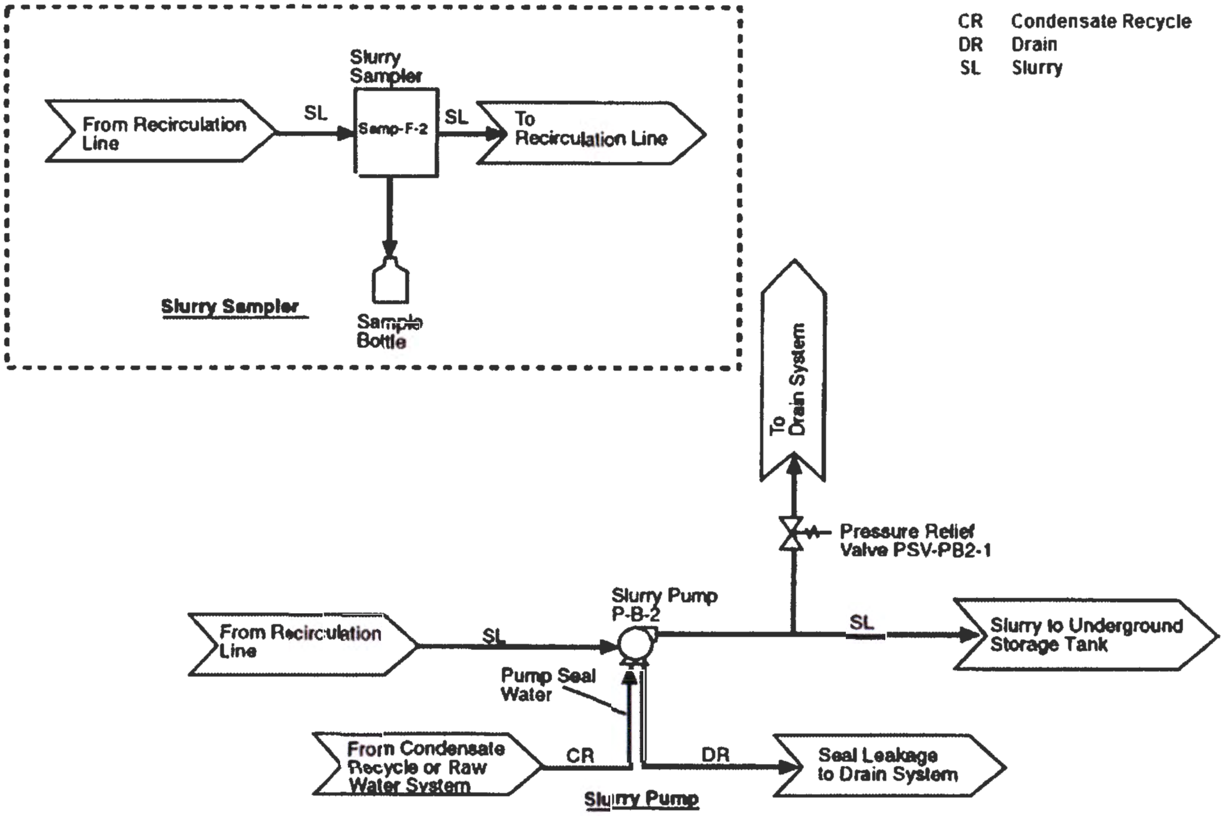


Figure 4.3. 242-A Evaporator Slurry System

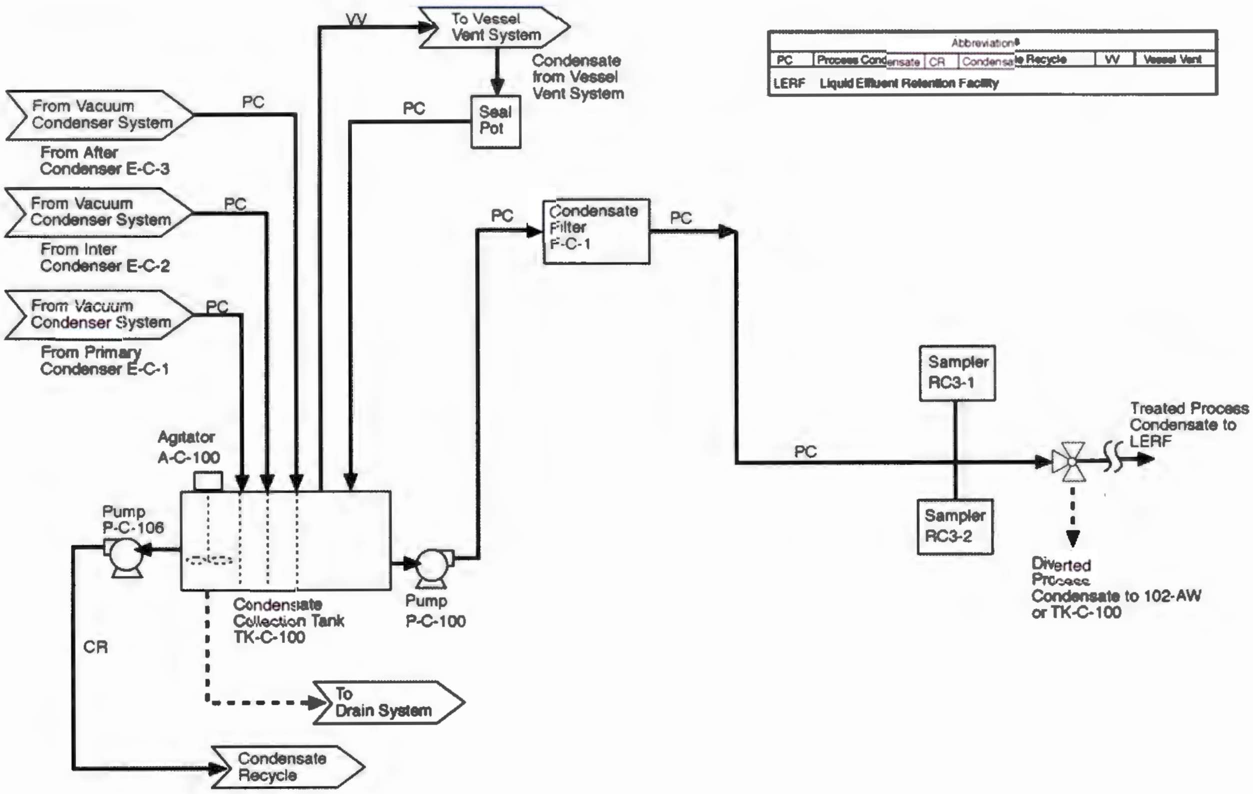
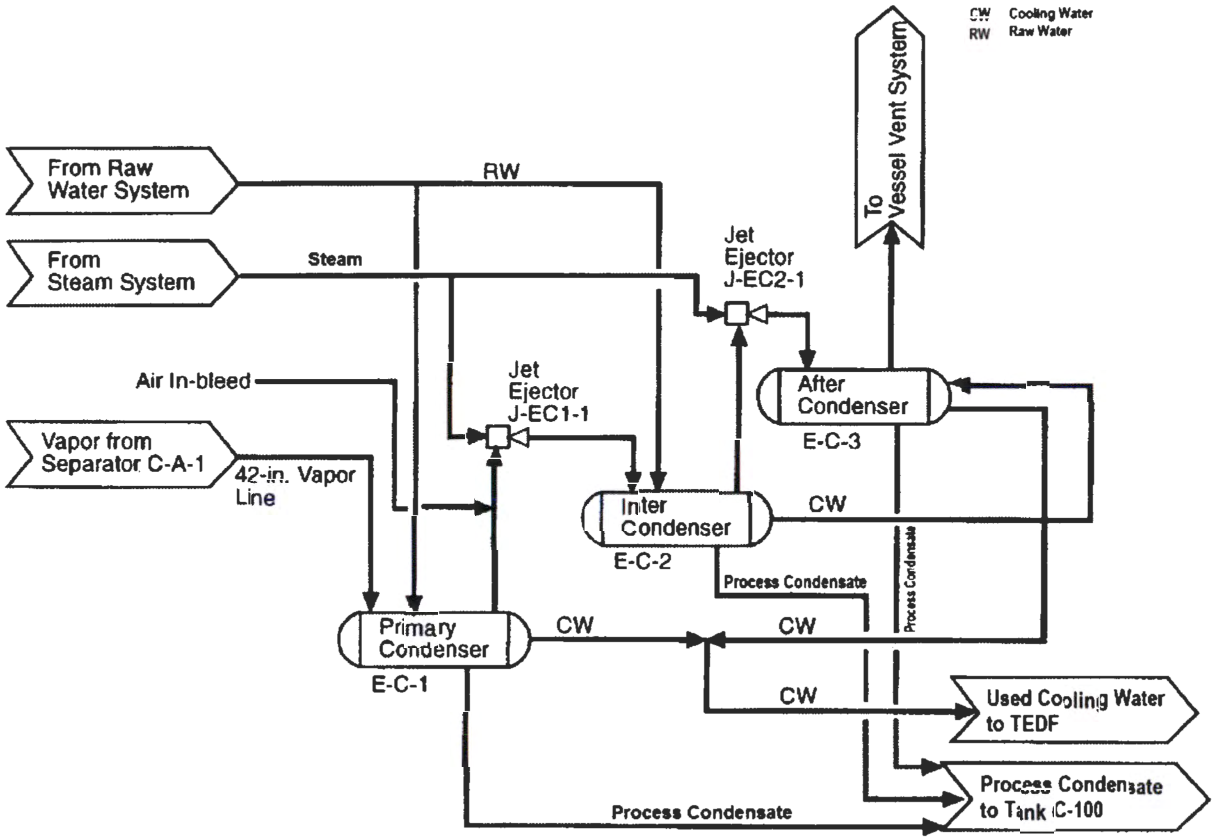
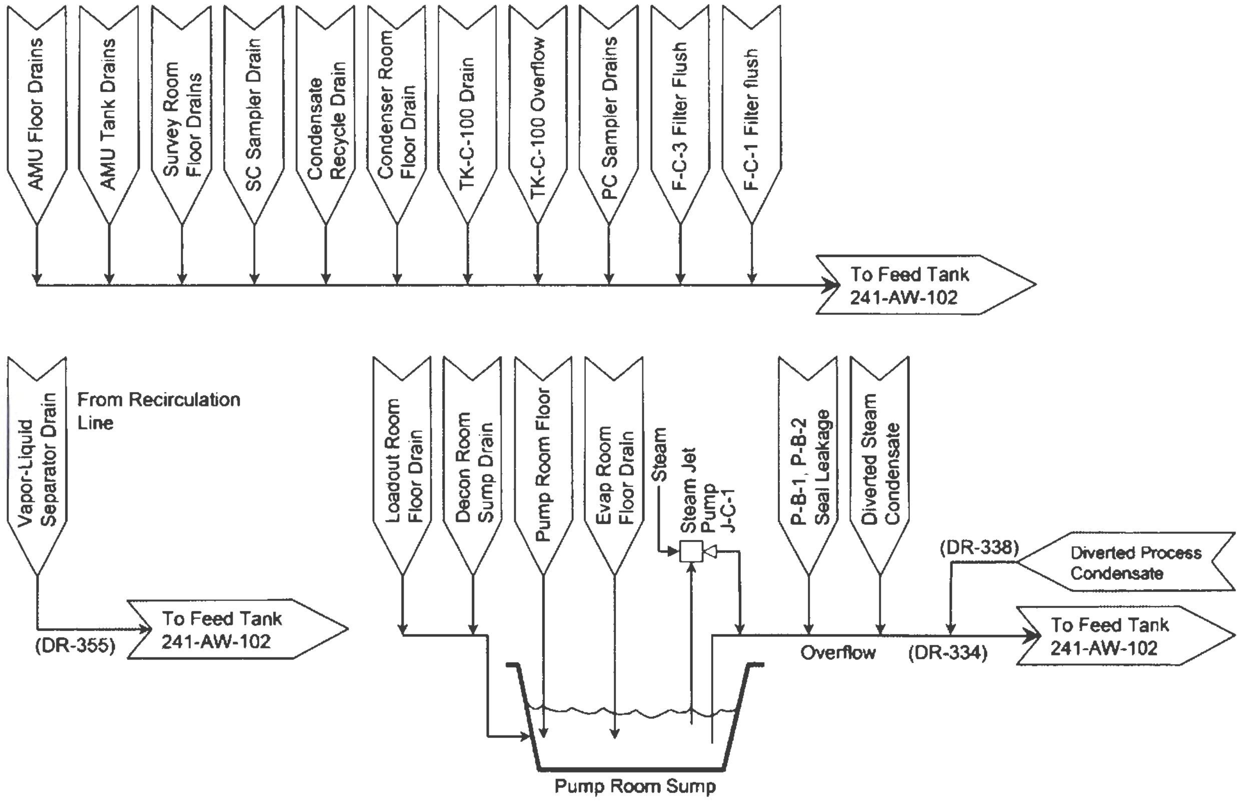


Figure 4.4. 242-A Evaporator Process Condensate System



1
2 **Figure 4.5. 242-A Evaporator Vacuum Condenser System**



1
2 **Figure 4.6. 242-A Evaporator Drain System**

Hanford Facility RCRA Permit Modification Notification Forms

Part V, Closure Unit Group 6

Waste Encapsulation and Storage Facility, Hot Cells A through F

Index

Submitted by Co-Operator: Reviewed by DOE Program Office:

Stephanie H. Johns	04/24/17	Duane B. Carter	4-24-17
Co-Operator Name	Date	DOE Program Office Name	Date

Hanford Facility RCRA Permit Modification Form	
Unit:	Permit Part
Hot Cells A through F	***Part V, Closure Unit Group 6 Closure Plan***

Description of Modification:

Changes to the Closure Plan are needed to extend the schedule for grout stabilization. Table H14 and Figure 18 are being revised to show the new schedule.

WAC 173-303-830 Modification Class	Class 1	Class ¹1	Class 2	Class 3
Please mark the Modification Class:		X		

Enter relevant WAC 173-303-830, Appendix I Modification citation number:

D. (1.b). *Changes in the closure schedule for any unit, changes in the final closure schedule for the facility, or extension of the closure period, with prior approval of the director.*

Modification Approved: [✓] Yes [ ] No (state reason for denial)

Reason for denial:

Reviewed by Ecology:

[signature] 5/3/17

S. L. Dahl-Crumpler Date

Hanford Facility RCRA Permit Modification Form	
Unit: ***Waste Encapsulation and Storage Facility, Hot Cells A through F***	Permit Part ***Part V, Closure Unit Group 6, Closure Plan***

Description of Modification:

Changes to the Closure Plan are needed to:

- Address the movement of a core drill location during grout stabilization and modification made prior to stabilization. Revisions are being made to Section 5.4, 5.5.6, and Figure H13. No revision is being made to Sections 5.5.5 and 5.5.7 since activities described were not affected by the location change for the core drill.
- Include direction for potential unanticipated minor deviations (Section 5.13).

WAC 173-303-830 Modification Class	Class 1	Class 1[1]	Class 2	Class 3
Please mark the Modification Class:		X		

Enter relevant WAC 173-303-830, Appendix I Modification citation number:

-830(4)(d)(i) Other Modifications : *In the case of modifications not explicitly listed in Appendix I of this section, the permittee may ……..request a determination by the director that the modification should be reviewed and approved as a Class 1 or Class 2 modification.*

Modification Approved: [✓] Yes [ ] No (state reason for denial)

Reason for denial:

Reviewed by Ecology:

[signature] 5/3/17

S. L. Dahl-Crumpler Date

Hanford Facility RCRA Permit Modification Form	
Unit: ***Waste Encapsulation and Storage Facility, Hot Cells A through F***	Permit Part ***Part V, Closure Unit Group 6, Closure Plan***

Description of Modification:

Changes to the Closure Plan are needed to update the facility contact information in Section H2.

WAC 173-303-830 Modification Class	Class 1	Class ¹1	Class 2	Class 3
Please mark the Modification Class:	X			

Enter relevant WAC 173-303-830, Appendix I Modification citation number:

A. (1). *Administrative and informational changes.*

Concurred SLD

Modification ~~Approved~~: [✓] Yes [ ] No (state reason for denial)

Reason for denial:

Reviewed by Ecology:

[signature] 5/3/17

S. L. Dahl-Crumpler Date

Revision Instructions:

Revise V.6 Revise (Addendum H) Closure Plan as shown herein

WASTE ENCAPSULATION AND STORAGE FACILITY (WESF) HOT CELLS A THROUGH F ADDENDUM H DANGEROUS WASTE MANAGEMENT UNIT CLOSURE PLAN

CHANGE CONTROL LOG

Change Control Logs ensure that changes to this unit are performed in a methodical, controlled, coordinated, and transparent manner. Each unit addendum will have its own change control log with a modification history table. The "**Modification Number**" represents Ecology's method for tracking the different versions of the permit. This log will serve as an up to date record of modifications and version history of the unit.

Modification History Table

Modification Date	Modification Number
07/01/2016	8C.2016.5F

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ADDENDUM H
WASTE ENCAPSULATION AND STORAGE FACILITY HOT CELL A THROUGH F DANGEROUS WASTE MANAGEMENT UNIT CLOSURE PLAN

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ADDENDUM H
WASTE ENCAPSULATION AND STORAGE FACILITY HOT CELL A THROUGH F DANGEROUS WASTE MANAGEMENT UNIT CLOSURE PLAN

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TERMS

AMU	aqueous makeup
Cs-137	cesium-137
DOE	U.S. Department of Energy
DOE-RL	DOE Richland Operation Office
DQA	data quality assessment
DWMU	dangerous waste management unit
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FWS	Field Work Supervisor
HEIS	Hanford Environmental Information System
HEPA	high-efficiency particulate air
HHE	human health and the environment
IQRPE	Independent Qualified Registered Professional Engineer
LDR	land disposal restriction
LLW	low-level waste
MTCA	"Model Toxics Control Act—Cleanup" (WAC 173-340)
N/A	not applicable
PPE	personal protective equipment
QA	quality assurance
QC	quality control
RCRA	*Resource Conservation and Recovery Act of 1976*
SAP	sampling and analysis plan
Sr-90	strontium-90
TSD	treatment, storage, and/or disposal
VSP	Visual Sample Plan
WESF	Waste Encapsulation and Storage Facility

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H1 INTRODUCTION

This addendum details closure activities for the Waste Encapsulation and Storage Facility (WESF) Closure Unit Group 6 Hot Cell A through Hot Cell F dangerous waste management unit (DWMU).

H2 FACILITY CONTACT INFORMATION

WESF Operator and Property Owner:

~~Stacy L. Charboneau~~Doug S. Shoop, Manager
U.S. Department of Energy, Richland Operations Office
P.O. Box 550
Richland, WA 99352
(509) 376-7395

WESF Co-Operator:

~~John Ciucci~~L. Ty Blackford, President and Chief Executive Officer
CH2M HILL Plateau Remediation Company
P.O. Box 1600
Richland, WA 99352
(509) 376-0556

H3 FACILITY DESCRIPTION

WESF was constructed on the west end of B Plant between 1971 and 1973 to encapsulate and store radioactive cesium-137 (Cs-137) and strontium-90 (Sr-90) that had been separated from plutonium production waste stored in underground storage tanks on the Hanford Facility. Separation of cesium and strontium from tank waste occurred at B Plant.

WESF is a two-story, 1,858 m^2 (20,000 ft^2) building approximately 48 m long, 30 m wide, and 12 m high (160 ft long, 98 ft wide, and 40 ft high), constructed of steel reinforced concrete that is partitioned into seven hot cells, the hot cell service area, operating areas, building service areas, and the pool cell area.

The hot cells, hot cell service area, operating areas, and building service areas supported encapsulation operations. Encapsulation included conversion of Cs-137 to cesium chloride and Sr-90 to strontium fluoride, placement of cesium chloride and strontium fluoride into double walled stainless steel capsules, and seal welding of the capsules. Leak tests were performed to confirm adequacy of the welds.

WESF stores 1,936 capsules: 1,335 of cesium and 601 of strontium. The cesium capsules are double wall stainless steel containers with a length of approximately 53 cm (21 in.) and a diameter of approximately 8 cm (3 in.). Strontium capsules have the same general dimensions but consist of a Hastelloy® inner capsule and a stainless steel outer capsule. Of the cesium capsules, 23 are referred to as Type-W overpacks. Type-W overpacks were fabricated and overpacked at the 324 Building from 1997 to 1999. Of these overpacks, 16 contain degraded cesium capsules. The other seven contain containers of cesium chloride that were packaged during cleanout of the 324 Building. Type-W overpacks are made of stainless steel and have a length of 55.4 cm (21.8 in.) and a diameter of 8.26 cm (3.25 in.). If additional capsules need to be overpacked, a welding process would be developed and implemented in Hot Cell G.

The WESF pool cell area provides the necessary storage capability for cesium and strontium capsules. Underwater storage of the capsules provides both radioactive shielding and heat removal.

® Hastelloy is a registered trademark of Haynes International, Kokomo, Indiana.

H3.1 Facility History, Function, Location, and Layout

Construction of WESF started in 1971 and was complete by 1973. Encapsulation operations at WESF began shortly after completion of construction and were complete by January 1985. By March 1985, WESF completed transition into a standby/surveillance mode.

WESF has stored encapsulated Cs-137 and Sr-90 since encapsulation operations began in 1974. The capsules were initially managed as a commercial product and were used in a number of applications throughout the United States. The primary commercial application was sterilization of medical equipment.

In August 1987, the *Resource Conservation and Recovery Act of 1976* (RCRA) became effective on the Hanford Facility for active management of mixed radioactive and hazardous waste.

On July 14, 1997, the U.S. Department of Energy (DOE) decided to end commercial application of the capsules, and they were reclassified as a mixed waste.

WESF consists of seven hot cells, the hot cell service area, operating areas, building service areas, and the pool cell area. WESF has three DWMUs: two operating and one initiating closure (see Section H3.3 for details of the three DWMUs).

The seven hot cells are identified as Hot Cells A through G. The hot cells provided necessary radioactive shielding and equipment to allow workers to perform encapsulation tasks. Due to the highly radioactive nature of Cs-137 and Sr-90, all handling of Cs-137, Sr-90, and capsules must be performed remotely.

- Hot Cell A provided the capability to package waste generated inside the hot cells into drums and remove the packaged waste from the hot cells for disposal.
- Strontium processing occurred in Hot Cell B and Hot Cell C. Processing included the receipt of strontium solution from B Plant, conversion of the solution to strontium fluoride, drying of strontium fluoride and placement into an inner capsule, and seal welding and leak testing of the inner capsule.
- Cesium processing occurred in Hot Cell D and Hot Cell E. Processing included receipt of cesium solution from B Plant, conversion of the solution to cesium chloride, removal of water from the cesium chloride, melting of the cesium chloride and placement into an inner capsule, and seal welding and leak testing of the inner capsule.
- Hot Cell F provided the capability to decontaminate and store the inner capsules.
- Hot Cell G provided the capability to weld, inspect, and decontaminate the outer capsules.

The service gallery is located on the south side of the hot cells and contained support equipment for the hot cell processes, including utility and auxiliary process piping. The operating gallery is located on the north side of the hot cells. Remote work in the hot cells was performed from the operating gallery using manipulators. Figures H1 through H4 show the WESF layout.

When encapsulation operations were completed in 1985, WESF was transitioned into a standby and surveillance mode. In this mode of operation, only equipment and instruments required for continued safe storage of the capsules remained operational. This included the operation and maintenance of the pool cells and support systems for Hot Cells F and G. The confinement ventilation system remained operable to provide containment of legacy radioactive contamination and to support surveillance operations.

In 2001, water sources to Hot Cells A through F were isolated, and manipulators were removed from Hot Cell A through Hot Cell E. Manipulators in Hot Cell F and Hot Cell G remain active.

In 2014, the WESF Stabilization and Ventilation Project was initiated to stabilize legacy contamination in the hot cells and K3 exhaust ventilation duct and resolve inadequacies in the K3 exhaust system by replacing it with a new system. This project will be used to meet the DOE-Richland Operations Office (RL) commitment to the DOE Office of Environmental Management's Safety, Security, and Quality Programs (EM-40) to complete WESF ventilation upgrades by the end of fiscal year (FY) 2016 (13-NSD-0042, *Revised Schedule for Completion of Waste Encapsulation and Storage Facility (WESF) 2004-2 Ventilation Upgrades*) and is the first step towards placing the capsules into a dry storage configuration.

H3.2 Products and Production Processes

WESF does not generate products or have any production processes. WESF currently acts as a storage facility for stainless steel capsules containing radioactive cesium chloride and strontium fluoride salts. These capsules are stored in the Pool Cells DWMU and can be placed into the Hot Cell G DWMU for inspection or if a capsule is suspected of leaking. The Hot Cell A through Hot Cell F DWMU is not needed for capsule or mixed waste storage (see Section H3.3 for details of the three DWMUs).

H3.3 Dangerous Waste Management and Units

The three DWMUs at WESF are shown in Figure H1. One DWMU consists of the pool cells, and a second consists of Hot Cell G. The Pool Cells and the Hot Cell G DWMUs are operational and necessary for storage of the capsules. The third DWMU consists of Hot Cells A through F. This DWMU is not necessary for storage of capsules at WESF, and it will be undergoing closure.

This plan addresses closure of the Hot Cell A through Hot Cell F DWMU. Closure of the other two operating DWMUs will be addressed in closure plans for each operating DWMU.

The Hot Cell A air lock, hot pipe trench, and K3 duct trench are included in this closure plan but are not part of the Hot Cell A through Hot Cell F DWMU. Even though these areas are not part of the DWMU, they will be grouted along with the hot cells to preclude the spread of contamination from the hot cells.

H3.4 Unit Description

This section provides a detailed description of the WESF Hot Cell A through Hot Cell F DWMU. This is one of three DWMUs at WESF and the DWMU undergoing the closure actions described in this plan.

As discussed in Section H3.1, Hot Cells A through E are deactivated, and no activities are performed in these hot cells. Hot Cells F and G have remained operational to provide the capability to inspect and store the capsules and retain the capability for future removal of the capsules from WESF. The following activities are performed in Hot Cells F and G:

- Capsules may be moved into Hot Cell G to be inspected.
- Capsules suspected of leaking would be moved into Hot Cell G for initial inspection. Leaking capsules would be moved to Hot Cell F for storage out of the pool cell. The capsules could also be stored in Hot Cell G; however, personnel access to the hot cell would be prevented.
- In the future, capsules will be loaded into canisters/casks in Hot Cell G to allow removal of the capsules from WESF.

Following completion of the initial closure activities, as discussed in Section H5.5, Hot Cell F will be no longer be available for use to store capsules. Hot Cell G will remain operational as an operating DWMU. Shielded storage will be provided in Hot Cell G and could be used to store several leaking capsules. This will allow personnel access to the hot cell while capsules are being stored.

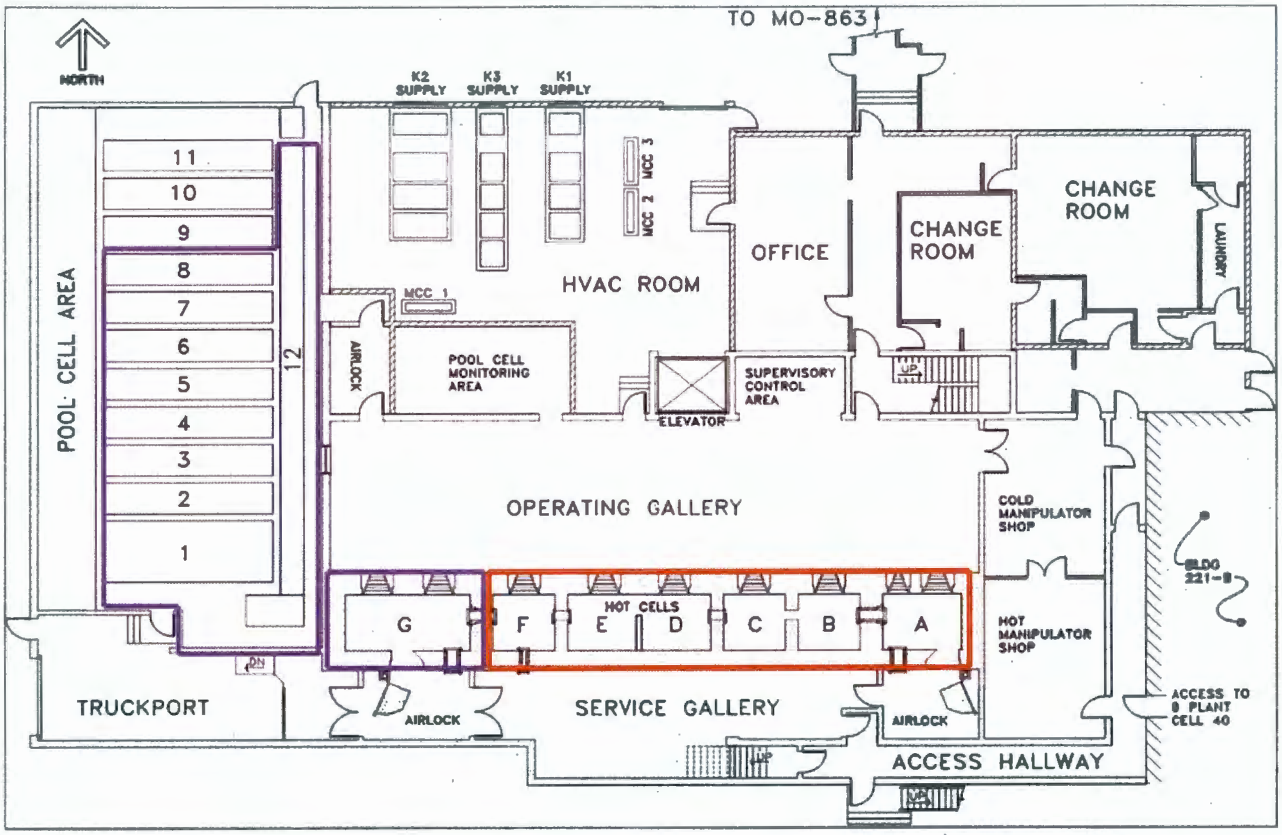


Figure H1. Waste Encapsulation and Storage Facility Pool and Process Cells

A plan view of the hot cells is shown in Figure H1. Removable high-density concrete cover blocks, located at the top of the hot cells (on the floor of the canyon), provide access to the hot cells, pool cell area, and truck port from the canyon. The north and south walls of all the hot cells and both the east and west walls of Hot Cell A and Hot Cell G are 89 cm (35 in.) thick, high-density 3,760 kg/m^3 (235 lb/ft^3), reinforced concrete. Hot Cell A has an 89 cm (35 in.) high-density concrete shielding door for personnel entry from the service gallery.

Process and/or service piping is embedded in the concrete walls of each hot cell. The pipes connect the hot cells to each other, as well as to the hot pipe trench, transmitter rooms, aqueous makeup (AMU) area, service gallery, and operating gallery. Process piping, including in-cell jumpers, was used to convey cesium and strontium solutions between tanks and other processing equipment. Service piping includes utility services such as air, water, and electricity that supported process equipment operation; service piping did not contain cesium or strontium.

All processing activities were completed before 1985, and the hot cells were placed into a standby/surveillance mode. Standby/surveillance actions for the hot cells included process equipment cleanout using a series of demineralized water flushes on all in-cell jumpers and tanks. Chemical flushes were then used to remove residual solids. After the chemical flushes, a final demineralized water flush was used. All jumpers were removed, with the tank nozzles remaining open, and the associated nozzle on the cell wall was capped.

Process feed lines from B Plant to WESF were flushed, as well as the drain lines from WESF to B Plant.

Hot cell piping and tanks were flushed using normal nuclear industry practices to remove any residual feed solutions, processing chemicals, and tank heels. Flushing was completed in 1985 before RCRA enactment.

No processing has occurred in the hot cells since they were placed in standby/surveillance mode. In 2000, high-efficiency particulate air (HEPA) filters within the hot cells were replaced, and the used filters remain in the hot cells. Items remaining in the hot cells are hazardous debris.

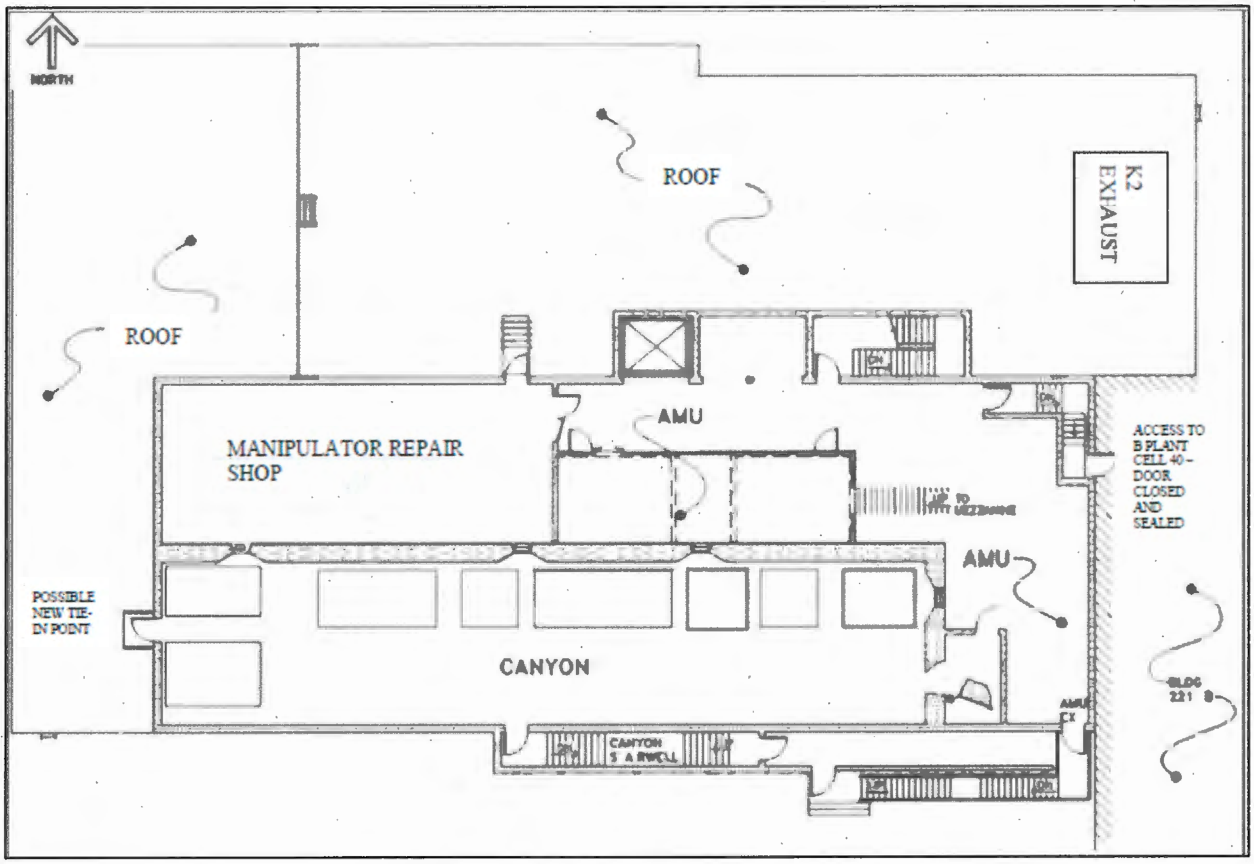


Figure H2. WESF Second Floor Plan

The following subsections provide detailed information on:

- Hot Cells A through F
- Hot cell viewing windows
- Hot cell manipulators
- Hot pipe trench and K3 duct trench
- Tank-100
- WESF ventilation system

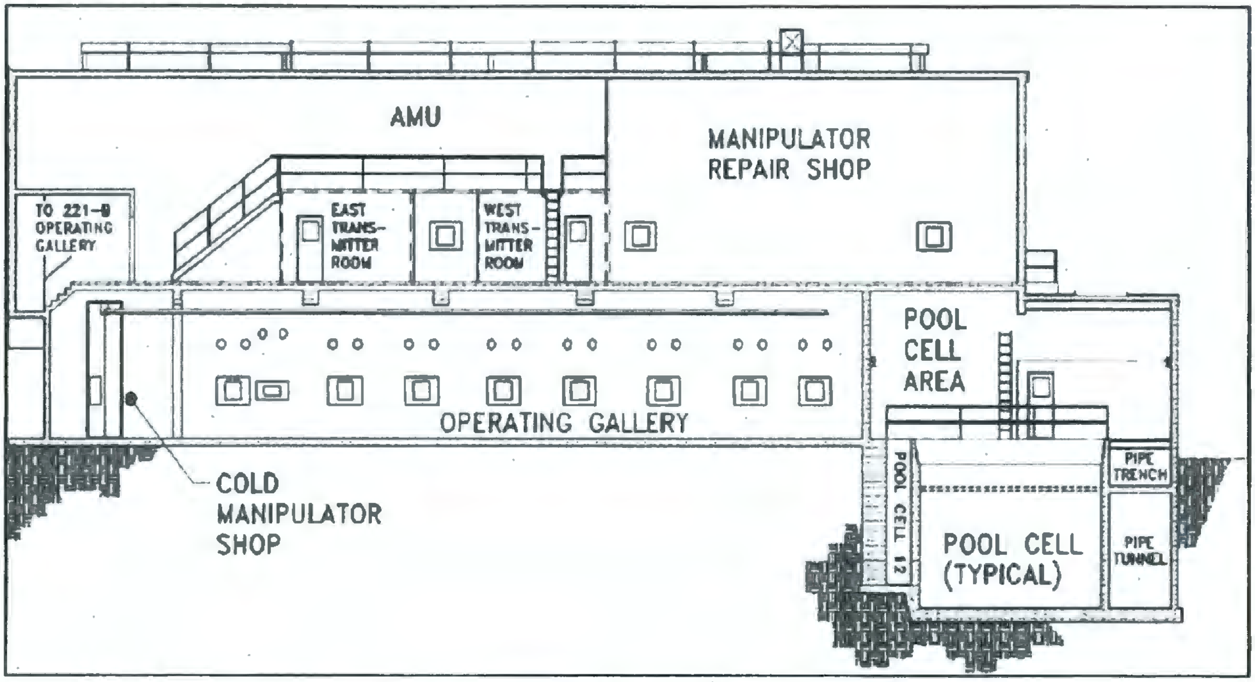


Figure H3. WESF East/West Sectional View

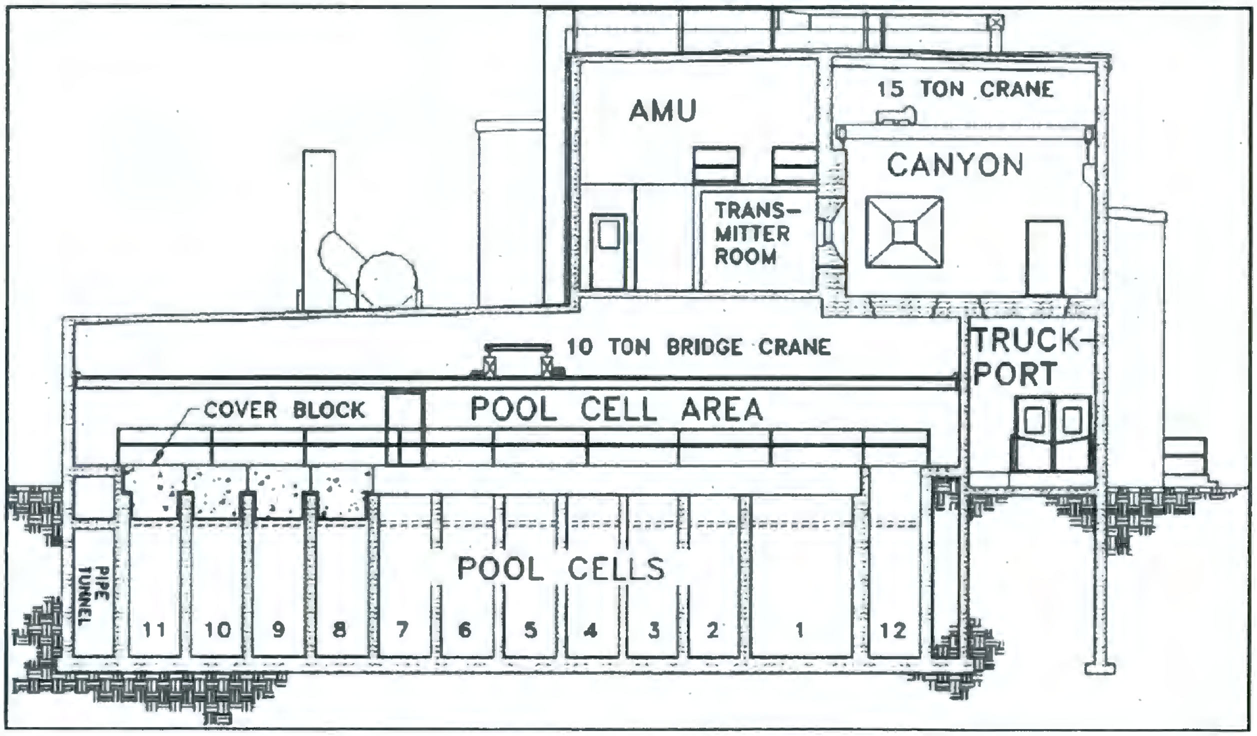


Figure H4. WESF North/South Sectional View

H3.4.1 Hot Cell A

Hot Cell A contains equipment that was required for handling high dose radioactive solid waste from the other hot cells and placing it in 208 L (55 gal) drums. The inside dimensions of Hot Cell A are 3 m (10 ft) long by 2.4 m (8 ft) wide by 4.1 m (13.5 ft) high. The floor and walls are lined with 14-gauge 304L stainless steel. Figure H5 is an illustration of Hot Cell A. It is an elevation looking south. Hot Cell B is located to the west.

The wall between Hot Cell A and the adjacent Hot Cell B contains a 1.2 m (4 ft) by 2.4 m (8 ft) by 1.2 m (4 ft) stainless steel hood for receiving contaminated solid waste. A pass-through with doors is located between the A Cell Hood and Hot Cell B. Pass-throughs were installed to allow solid waste and small equipment to pass between hot cells or other areas. A second pass-through with doors is located between the A Cell Hood and the service gallery (on the south wall of the A Cell Hood). A sump is located along the south wall of the hot cell. It is a small approximately 30 cm by 40 cm by 20 cm deep (12 in. by 16 in. by 8 in. deep) open-topped recess in the floor. A steam eductor (not located in the hot cell) was used to remove liquids that collected in the sump.

Hot Cell A does not contain any process piping. Radioactive contamination in Hot Cell A and the A Cell Hood is the result of the waste packaging process and consists of surface contamination. Contamination remaining within Hot Cell A and the Hot Cell A Hood is less than the contamination within the other hot cells because during WESF operations, Hot Cell A and the Hot Cell A Hood were periodically decontaminated to a level that would allow manned entry.

This hot cell is equipped with a shielded personnel entry door accessible from the Hot Cell A air lock located at the east end of the service gallery. Hot Cell A contains the following equipment:

- Handling equipment for 208 L (55 gal) drums (drum dolly lift runs north and south underneath the A Cell Hood to allow the drum to be positioned for loading and removal from the hot cell).
- Hot Cell A Hood.
- Service piping necessary to support encapsulation operations.
- Two HEPA filters installed in the hot cell exhaust ventilation ducting.
- Two used HEPA filters that were replaced in 2000 and remain on the hot cell floor.

Table H1 provides additional details for each listed item.

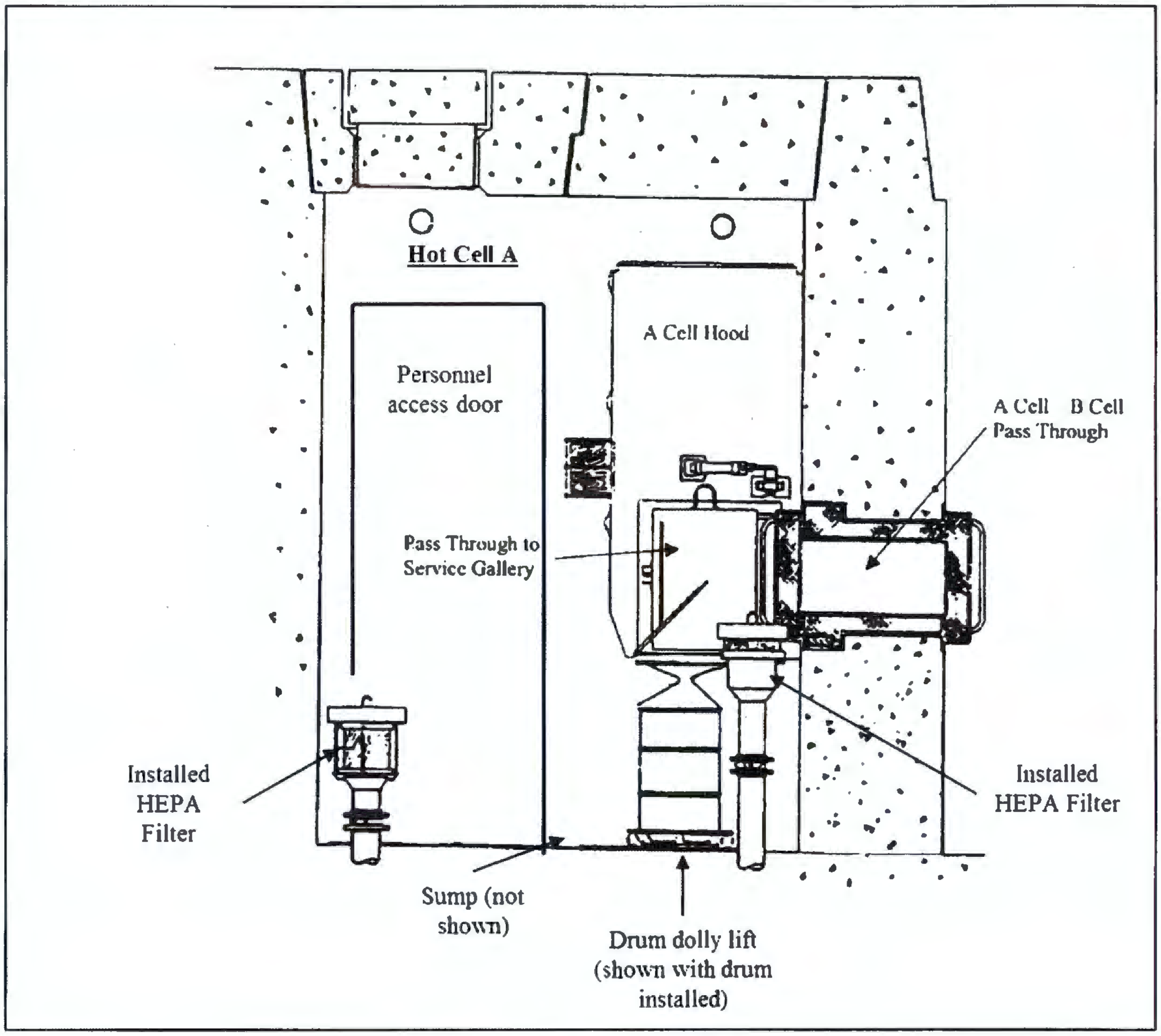


Figure H5. Hot Cell A

H3.4.2 Hot Cell B

Hot Cell B contains equipment that was used for strontium wet chemistry processing. This processing included the receipt of strontium nitrate from B Plant, conversion to strontium fluoride which was a precipitate, filtration to remove the precipitate, removal of the filtrate from the filter, placement of the filtrate into trays, and heating to remove water from the filtrate.

The inside dimensions of Hot Cell B are 2.4 m (8 ft) long by 2.4 m (8 ft) wide by 3.9 m (13 ft) high. The rear half of the Hot Cell B floor is elevated 56 cm (22 in.) and is 1.2 m (4 ft) wide. The wall between Hot Cells A and B is approximately 89 cm (35 in.) thick and is constructed from high-density reinforced structural concrete 3,760 kg/m^3 (235 lb/ft^3). The wall between Hot Cell B and Hot Cell C is approximately 51 cm (20 in.) thick and is constructed from reinforced structural concrete 2,400 kg/m^3 (150 lb/ft^3). The floor and lower portion of the walls are lined with 14-gauge 304L stainless steel. Figure H6 is an illustration of Hot Cell B. It is an isometric looking to the southwest. Hot Cell A is to the east, and Hot Cell C is to the west.

A pass-through with doors is located between the A Cell Hood and Hot Cell B (Figure H5). A pass-through without doors is located between Hot Cells B and C that was used to pass small equipment and solid waste between the hot cells.

A sump is located on the west wall of the hot cell next to the elevated portion of the hot cell. It is a small 30 cm by 40 cm by 20 cm deep (12 in. by 16 in. by 8 in. deep) open-topped recess in the floor. A steam eductor (not located in the hot cell) was used to remove liquids that collected in the sump.

Hot Cell B contains the following equipment:

- Feed metering tank (TK-B-1) located on the south wall.
- Supernate holding tank (TK-B-2) located in the elevated portion of the hot cell.
- Waste holding tank (TK-B-4) located in the wall between Hot Cell B and Hot Cell C.
- Precipitator tank (TK-B-5) located in the elevated portion of the hot cell.
- Strontium filters (F-B6-1 to F-B6-5) located on the floor on the east side of the hot cell.
- Strontium furnace (E-B-8) located in the wall between Hot Cell B and Hot Cell C.
- Process and service piping necessary to support encapsulation operations.
- Two HEPA filters installed in the hot cell exhaust ventilation ducting as well, as two used HEPA filters that were replaced in 2000 and allowed to remain on the hot cell floor.
- Four trays containing floor sweepings located inside the strontium furnace (E-B-8).

Table H1 provides additional details for each listed item.

When the WESF strontium encapsulation mission was completed in 1985, the following tasks were performed to clean out and empty the tanks in Hot Cell B (SD-WM-ER-022, *WESF Strontium Line Standby/Surveillance*):

- All process feed lines and drain lines from B Plant were flushed with demineralized water.
- All in-cell process pipes and tanks (including TK-B-1, TK-B-2, TK-B-4, and TK-B-5) were flushed with demineralized water.
- Sodium bicarbonate and caustic were used to flush TK-B-2, TK-B-4, and TK-B-5.
- Nitric acid was then added to TK-B-2, TK-B-4, and TK-B-5, and the resulting solution was reprocessed.
- All in-cell process pipes and tanks (including TK-B-1, TK-B-2, TK-B-4, and TK-B-5) were again flushed with demineralized water.
- Interiors of electrical conduits were wiped with a damp sponge.
- All in-cell jumpers on the tanks were removed and remained open to allow venting.

As a part of hot cell cleanup activities, loose material remaining on the Hot Cell B and Hot Cell C floors was swept up and placed into trays that were then stored inside the strontium furnace. The trays contain approximately 0.6 kg (1.3 lb) of material. This material in the trays includes strontium fluoride and processing debris, including metal shavings, failed manipulator components, as well as any other debris that was on the floor of the hot cell. Each tray is 26 cm (10.25 in.) by 8 cm (3.125 in.).

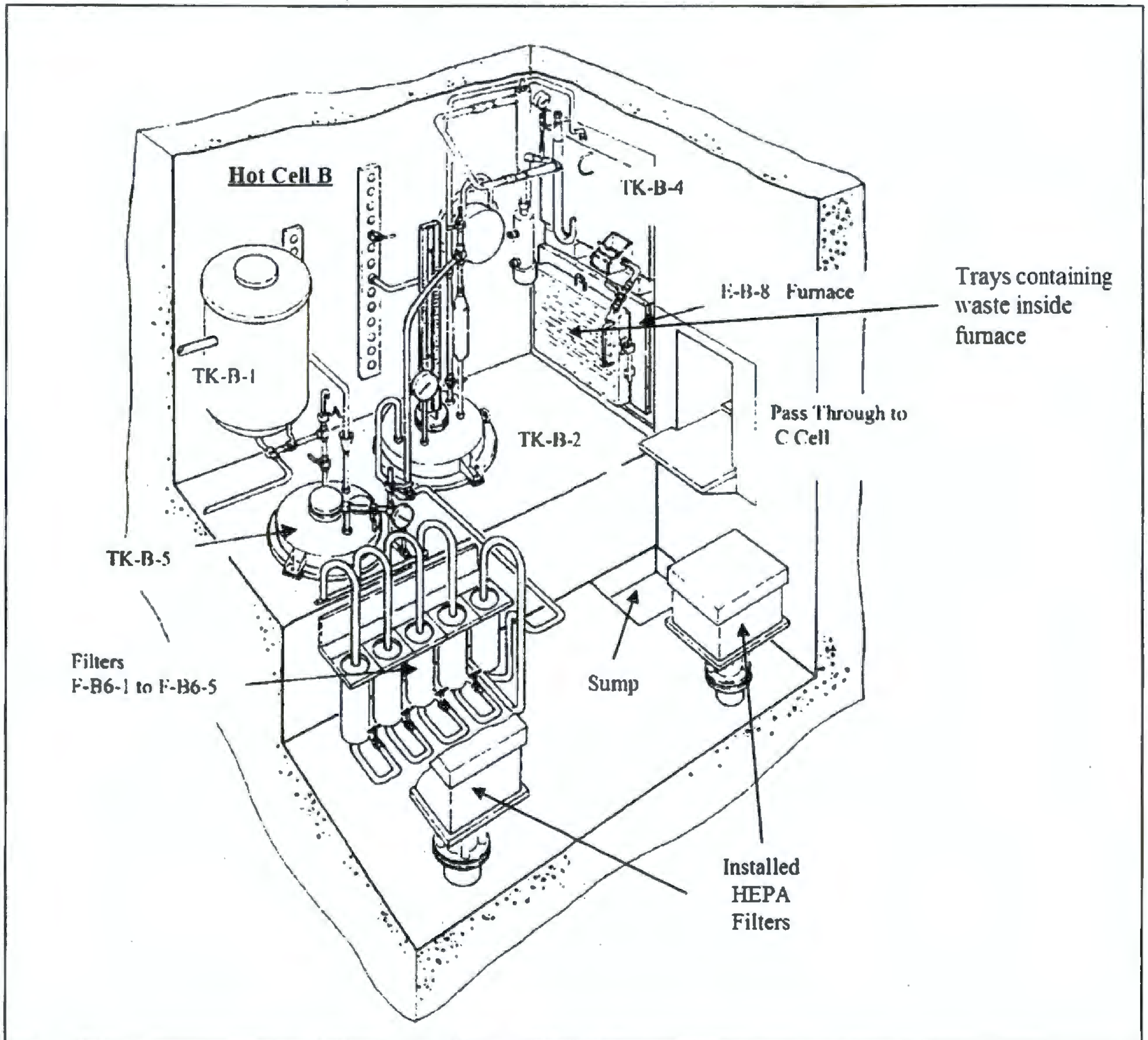


Figure H6. Hot Cell B

H3.4.3 Hot Cell C

Hot Cell C contains equipment that was used for the strontium fluoride encapsulation process. Processing consisted of removing the trays from the furnace, removing strontium fluoride from the trays, placing strontium fluoride in the inner capsule, compacting the material, welding the capsule end cap, and leak testing the inner capsule.

The inside dimensions of Hot Cell C are 2.4 m (8 ft) long by 2.4 m (8 ft) wide by 3.9 m (12.8 ft) high. The rear half of the Hot Cell C floor is elevated 22 in. and is 1.2 m (4 ft) wide. The walls between Hot Cells B and C and between Hot Cells C and D are approximately 51 cm (20 in.) thick and are constructed from reinforced structural concrete 2,400 kg/m^3 (150 lb/ft^3). The floor and lower portion of the walls are lined with 14-gauge 304L stainless steel. Figure H7 is an illustration of Hot Cell C. It is an isometric looking to the southeast. Hot Cell B is to the east, and Hot Cell D is to the west.

The rear half of the hot cell floor is elevated 56 cm (22 in.) to form a bench that contains two shielded storage locations and the compactor foundation. The wall between Hot Cells C and B contains the strontium waste tank (TK-B-4) and strontium furnace (E-B-8).

There are two pass-throughs: one is an open pass-through to Hot Cell B, and the second is a pass-through with doors to Hot Cell D. A sump is located on the east wall of the hot cell next to the elevated portion of the hot cell. It is a small 30 cm by 40 cm by 20 cm deep (12 in. by 16 in. by 8 in. deep) open-topped recess in the floor. A steam eductor (not located in the hot cell) was used to remove liquids that collected in the sump.

Hot Cell C contains the following equipment:

- Shielded storage locations (TK-C-5A and TK-C-5B).
- Strontium compactor (C-C-4).
- Process and service piping necessary to support encapsulation operations.
- Two HEPA filters installed in the hot cell exhaust ventilation ducting, as well as two used HEPA filters that were replaced in 2000 and allowed to remain on the hot cell floor.
- Two 61 cm (24 in.) long threaded capped pipes, containing 1.2 kg (2.6 lb) of floor sweepings, that are located in the southwest corner of the cell on wall brackets above the bench floor.

Table H1 provides additional details for each listed item.

When the WESF strontium encapsulation mission was completed in 1985, the following tasks were performed to clean out Hot Cell C (SD-WM-ER-022):

- All process feed lines and waste lines from B Plant were flushed with demineralized water.
- All in-cell process pipes were flushed with demineralized water.
- Interiors of electrical conduits were wiped with a damp sponge.
- All in-cell jumpers were removed and remained open to allow venting.

As a part of hot cell cleanup activities, loose material remaining on the Hot Cells B and C floors was swept up and placed inside capped pipes. Material in the pipes includes strontium fluoride, as well as any other debris that was on the floor of the hot cell.

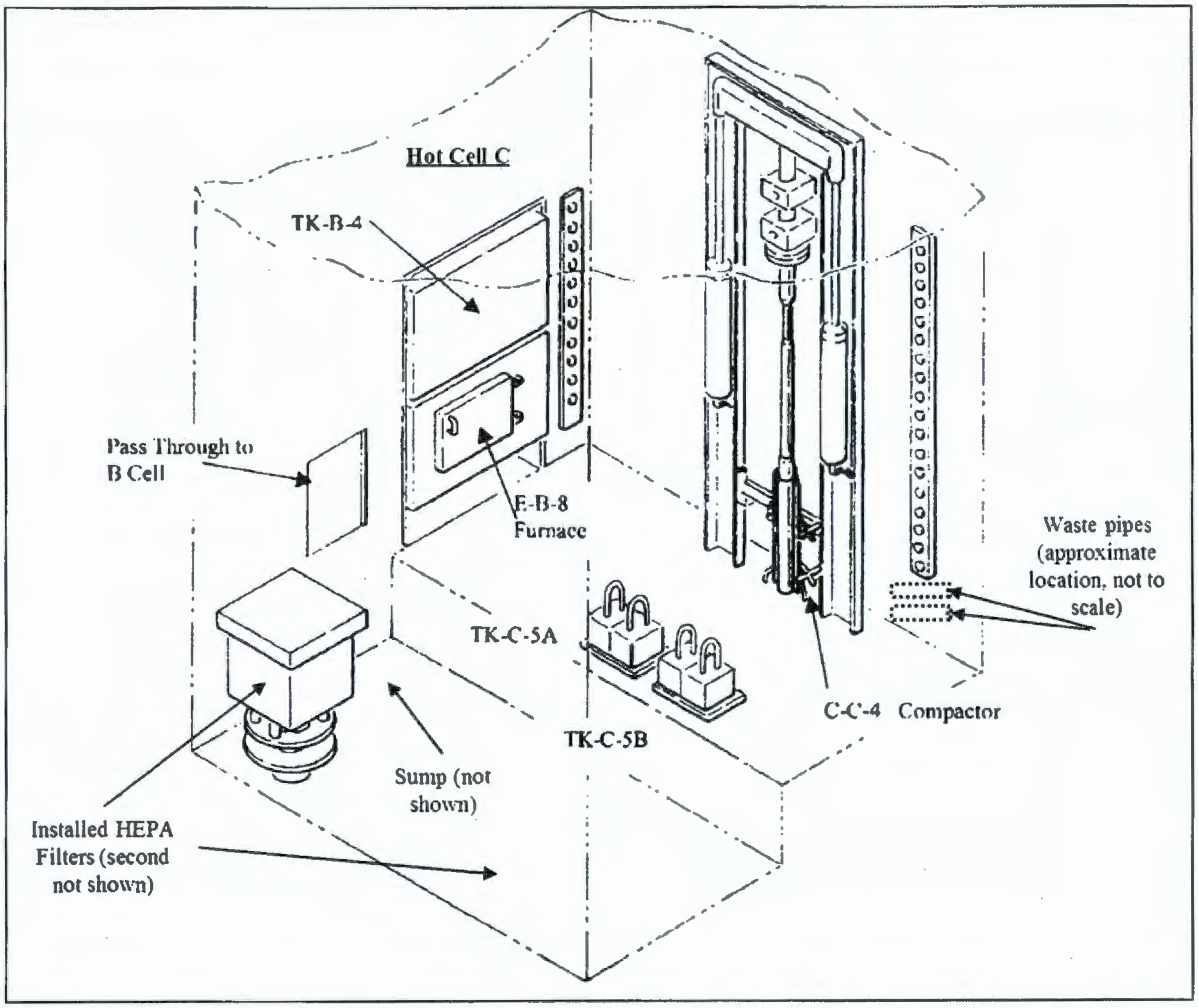


Figure H7. Hot Cell C

H3.4.4 Hot Cell D and Hot Cell E

Hot Cells D and E contain equipment that was used for conversion and encapsulation of cesium chloride. Processing in Hot Cell D consisted of receiving cesium carbonate feed from B Plant and converting it to cesium chloride. Processing performed in Hot Cell E consisted of heating the cesium chloride to remove the water and melt the cesium chloride, pouring the molten salt into the inner capsule, and preparing the capsule for welding. The inner capsule was welded in Hot Cell D, and leak testing was performed in Hot Cell E.

This double hot cell is approximately 5.5 m (18 ft) long by 2.4 m (8 ft) wide by 3.9 m (12.8 ft) high and is partitioned in the middle by a cell parapet wall that is 1.2 m (4 ft) wide by 2.4 m (8 ft) high and 20.3 cm (8 in.) thick. The rear half of the Hot Cell D portion of the floor is elevated approximately 25 cm (10 in.) and is 1.2 m (4 ft) wide. The walls between Hot Cells C and D and between Hot Cells E and F are approximately 51 cm (20 in.) thick and are constructed from reinforced structural concrete 2,400 kg/m^3 (150 lb/ft^3). The floor and lower portion of the walls are lined with 14-gauge Inconel® 600 alloy.

® Inconel is a registered trademark of Special Metals Corporation, New Hartford, New York.

Figure H8 is an illustration of this double hot cell. It is an isometric looking to the southeast. Hot Cell C is to the east, and Hot Cell F is to the west.

A recess in the elevated section of Hot Cell D is provided for placement of the cesium converter tank (TK-D-2). A pass-through with doors is located between Hot Cells C and D and between Hot Cells E and F for passage of small equipment and solid waste. A sump is located on the floor between Hot Cells D and E. It is a small 30 cm by 40 cm by 20 cm deep (12 in. by 16 in. by 8 in. deep) open-topped recess in the floor. A steam eductor (not located in the hot cell) was used to remove liquids that collected in the sump.

Hot Cell D contains the following equipment:

- Feed metering tank (TK-D-1)
- Converter tank (TK-D-2)
- Hydrochloric acid scrubbing equipment (TK-D-5, T-D-5, and T-D-7)
- Vacuum surge tank (TK-D-13)
- Condensers (E-D-4 and E-D-4A)
- Process and service piping necessary to support encapsulation operations
- Two HEPA filters installed in the hot cell exhaust ventilation ducting, as well as two used HEPA filters that were replaced in 2000 and allowed to remain on the hot cell floor

Hot Cell E contains the following equipment:

- Shielded storage location (TK-E-9)
- Helium leak check chamber (TK-E-12)
- Process and service piping necessary to support encapsulation operations
- Two HEPA filters installed in the hot cell exhaust ventilation ducting, as well as two used HEPA filters that were replaced in 2000 and allowed to remain on the hot cell floor

Table H1 provides additional details for each listed item.

When the cesium encapsulation mission was completed, the following tasks were performed (SD-WM-ER-014, *WESF Cesium Line Standby/Surveillance*):

- Demineralized water flush on all in-cell jumpers, tanks, and process piping (including TK-D-1, TK-D-2, TK-D-5, T-D-5, and T-D-7).
- Demineralized water flush on the process feed line between TK-D-1 and B Plant.
- Demineralized water flush on the drain line between TK-D-1 and B Plant.
- Flush of TK-D-2 with nitric acid and caustic solution to remove solids.
- Demineralized water flush on embedded service piping in Hot Cells D and E.
- Wiping of embedded electrical conduits with a damp sponge.
- Removal and opening of all in-cell jumpers on tanks to allow venting.

The shielded storage location (TK-E-9) and helium leak chamber (TK-E-12) contained complete capsules only. This equipment was not flushed as a part of standby/surveillance activities. SD-WM-ER-014 does not directly state how portions of the vessel ventilation system (condensers E-D-4 and E-D-4A and vacuum surge tank TK-D-13) were placed in standby. It is likely but not certain that they were also flushed with demineralized water with the rest of the in-cell jumpers and piping.

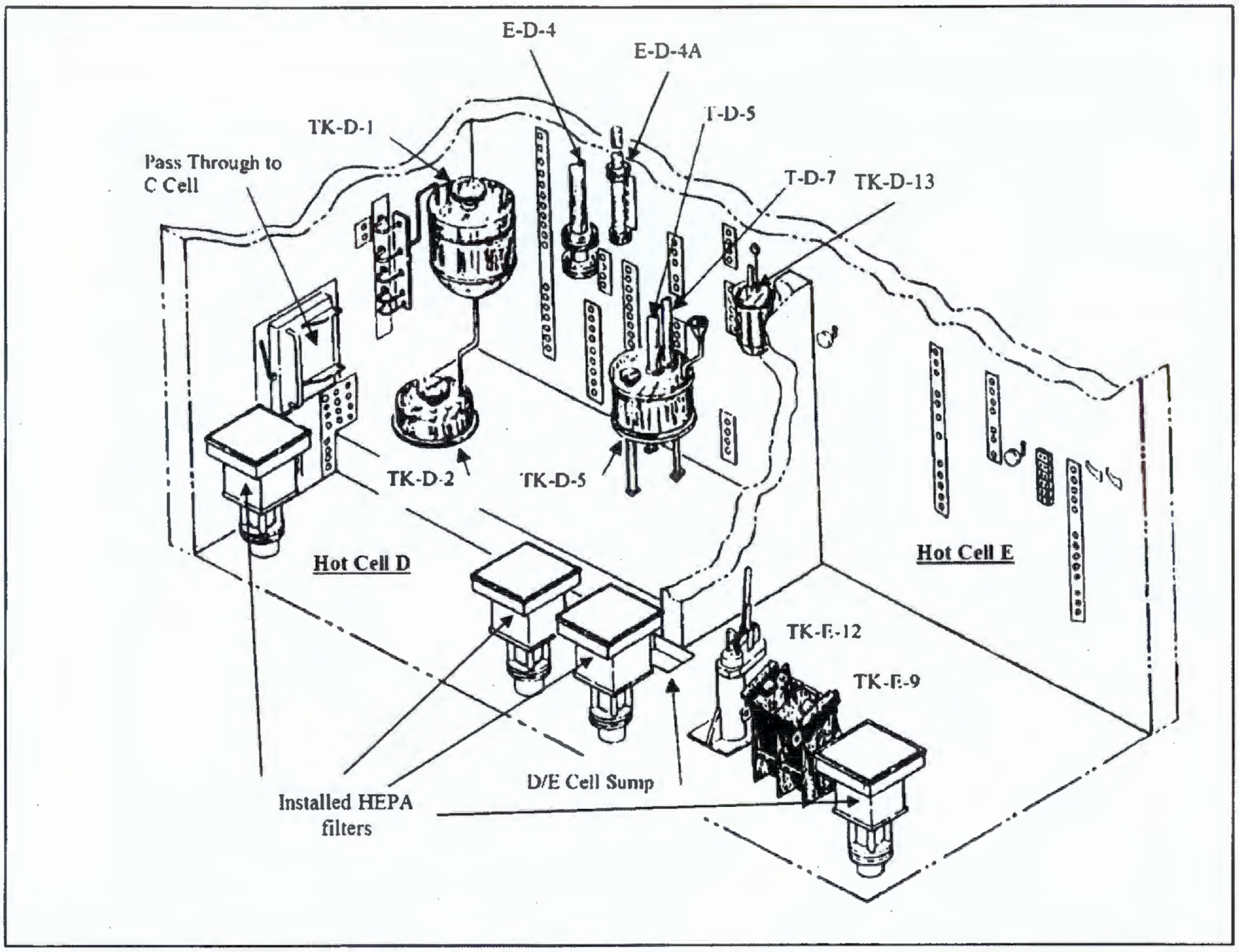


Figure H8. Hot Cell D and Hot Cell E

H3.4.5 Hot Cell F

Hot Cell F contains equipment that was used for storage and decontamination of the inner capsules.

The inside dimensions of Hot Cell F are 2.4 m (8 ft) long by 2.4 m (8 ft) wide by 3.9 m (12.8 ft) high. The rear portion of the hot cell floor is elevated 55.9 cm (22 in.) and is 0.6 m (2 ft) wide. The wall between Hot Cells F and G is approximately 89 cm (35 in.) thick and is constructed from high-density reinforced structural concrete 3,760 kg/m^3 (235 lb/ft^3). The floor and lower portion of the walls are lined with 14-gauge 304L stainless steel. Figure H9 is an illustration of the hot cell. It is an isometric looking southeast. Hot Cell E is to the east, and Hot Cell G is to the west.

A recess in the elevated portion of the hot cell floor is provided for placement of a shielded capsule storage location. A pass-through with doors is located between Hot Cells E and F and between Hot Cells F and G for passage of small equipment and solid waste. There is also a pass-through with doors between Hot Cell F and the service gallery on the south wall. Hot Cell F does not contain any process piping.

A sump is located on the floor on the east wall of the hot cell, next to the elevated area. It is a small 30 cm by 40 cm by 20 cm deep (12 in. by 16 in. by 8 in. deep) open-topped recess in the floor. A steam eductor (not located in the hot cell) was used to remove liquids that collected in the sump. After water sources to the hot cells were isolated in 2001, an air driven sump pump was installed in Hot Cell F for transfer of collected liquids to the radioactive low-level waste (LLW) tank (Tank-100). As part of the closure of Hot Cells A through F, this transfer line will be isolated.

Hot Cell F contains the following equipment:

- Capsule scrubber (TK-F-1)
- Electropolisher (TK-F-2)
- Capsule rinse location (TK-F-4)
- Storage location (TK-F-5)
- Air receiver tank (TK-F-6)
- Modular storage rack
- Service piping necessary to support encapsulation operations
- Two HEPA filters installed in the hot cell exhaust ventilation ducting as well as two used HEPA filters that were replaced in 2000 and allowed to remain on the hot cell floor
- Manipulators that will be removed during closure

Table H1 provides additional details for each listed item.

During processing, the cell was rinsed with water to minimize contamination spread to the capsules, prior to transfer to Hot Cell G. This practice kept the contamination levels in Hot Cell F low. Since the end of encapsulation operations, the hot cell has been swept and vacuumed, and miscellaneous parts/tools have been removed.

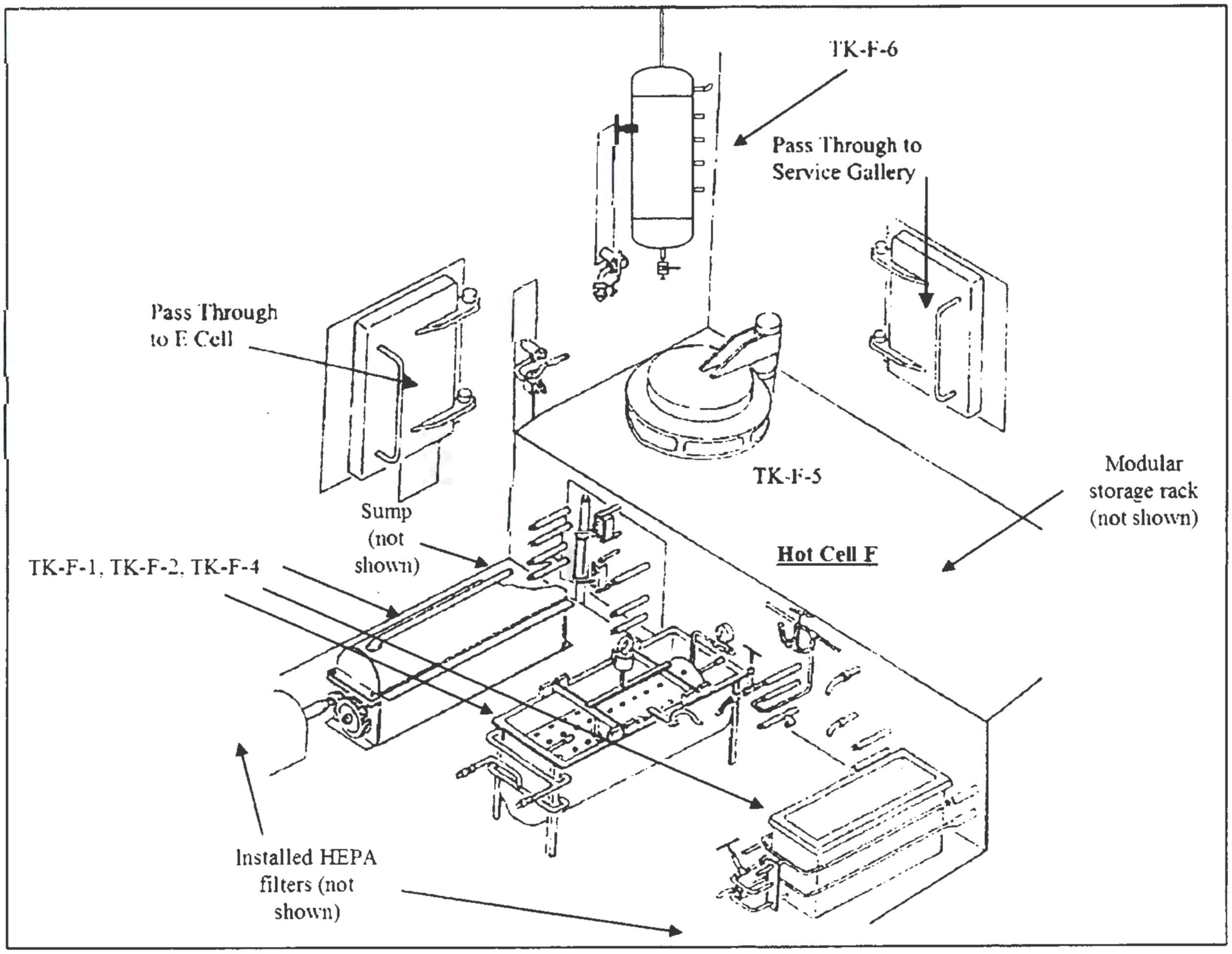


Figure H9. Hot Cell F

Table H1. WESF Hot Cells A through F Contents

Hot Cell	Hot Cell Contents	Content Description	Waste Description
A	Drum Dolly Lift	Equipment required for handling 208 L (55 gal) drums used to package the radioactive solid waste from the other hot cells.	Hazardous Debris
	Hood	1.2 m (4 ft) by 2.4 m (8 ft) by 1.2 m (4 ft) stainless steel hood.	
	HEPA Filters	Filters replaced in 2000; old filters remain on cell floor.	
	Service Piping Associated with Processing	Air and liquid service embedded lines from outside service areas and electrical lines.	
B	Four Trays of Strontium Floor Sweepings Inside the Furnace	Boats are open and contain strontium floor sweepings. Approximately 0.6 kg (1.2 lb) total waste.	Waste/Waste Residues
	Strontium Filter Assembly (F-B6-1 to F-B6-5)	Each filter housing is approximately 27.3 cm (10.8 in.) tall with 10.2 cm (4 in.) diameter; approximately 45% void. The filter housings were opened, and the sintered metal filters were removed. Both the filter housings and the filters were free of obvious material.	Hazardous Debris
	Process and Service Piping Associated with Processing	Process piping used to convey strontium solutions between tanks and processing equipment. Air and liquid service embedded lines from outside service areas and electrical lines. Embedded lines used as electrical conduits during processing were wiped internally with damp sponges to remove internal contamination.	
	HEPA Filters	Filters replaced in 2000; old filters remain on cell floor.	
	Feed Metering Vessel Tank (TK-B-1)	Cylindrical tank, vertical and unbaffled, 68.6 cm (27 in.) tall with 52.7 cm (20.8 in.) diameter. Tank has nozzles open to the cell atmosphere.	
	Supernatant Holding Tank (TK-B-2)	Cylindrical tank, vertical and unbaffled, with a dish shaped bottom with flanged heads; 91.4 cm (36 in.) tall with 61 cm (24 in.) diameter. Tank has nozzles open to the cell atmosphere.	

Table H1. WESF Hot Cells A through F Contents

Hot Cell	Hot Cell Contents	Content Description	Waste Description
	Waste Holding Tank (TK-B-4)	Rectangular tank, vertical and unbaffled. 50.8 cm (20 in.) wide, 76.2 cm (30 in.) long, and 52.1 cm (21 in.) tall. Tank has nozzles open to the cell atmosphere. Located in the wall between B and C cells.	
	Precipitator Tank (TK-B-5)	Cylindrical, vertical, unbaffled tank in the upper section and conical tank in the lower section. Upper section is 43.2 cm (17 in.) high with 61 cm (24 in.) diameter. Lower section is 48.3 cm (19 in.) high and tapers from a diameter of 61 cm (24 in.) to 15.2 cm (6 in.). Tank has nozzles open to the cell atmosphere.	
	Strontium Furnace (E-B-8)	Rectangular, approximately 52.7 cm (21 in.) wide, 76.2 cm (30 in.) long, and 52.1 cm (21 in.) tall. Located in wall between B and C cells.	
C	Process and Service Piping Associated with Processing	Process piping used to convey strontium solutions between tanks and processing equipment. Embedded lines, used as electrical conduits, raw water supply, compressed air, and argon supply.	Hazardous Debris
	HEPA Filters	Filters replaced in 2000; old filters remain on cell floor.	
	Strontium Compactor (C-C-4)	Used to compact strontium fluoride material in the capsule.	
	Shielded Storage Locations (TK-C-5A and TK-C-5B)	Identical shielded storage locations recessed in the C Cell floor. Annular configuration is approximately 45.7 cm (18 in.) long. These locations were used to store inner capsules and did not contain unencapsulated strontium.	
	Two Closed Waste Pipes	Two closed waste pipes with approximately 61 cm (24 in.) long with a pipe cap at each end with material swept from the floor of B Cell or C Cell after it was dried and reduced in volume in the furnace. These containers are stored in the southwest corner of the cell on wall brackets above the bench floor. Total approximate waste volume is 1.2 kg (2.6 lb).	Waste/Waste residues

Table H1. WESF Hot Cells A through F Contents

Hot Cell	Hot Cell Contents	Content Description	Waste Description
D/E	Process and Service Piping Associated with Processing	Process piping used to convey cesium solutions between tanks and processing equipment. Air and liquid service embedded lines from outside service areas and electrical lines.	Hazardous Debris
	Feed Metering Tank (TK-D-1)	Cylindrical tank 68.6 cm (27 in.) tall with 53.34 cm (21 in.) diameter. Tank has nozzles open to the cell atmosphere.	
	Converter Tank (TK-D-2)	Cylindrical tank 54.6 cm (21.5 in.) tall with 50.8 cm (20 in.) diameter. Tank has nozzles open to the cell atmosphere.	
	Hydrochloric Acid Scrubbing Equipment (TK-D-5, T-D-5, and T-D-7)	T-D-5 is 1.4 m (4.75 ft) tall, and T-D-7 is 1.9 m (6.3 ft) tall; both towers are 10.2 cm (4 in.) in diameter and contain 1.2 m (4 ft) of packing (pall rings). Tank has nozzles open to the cell atmosphere.	
	Vacuum Surge Tank (TK-D-13)	Cylindrical tank 16 in. tall with 8 in. diameter. The vacuum surge tank was part of the vessel ventilation system.	
	Condensers (E-D-4 and E-D-4A)	E-D-4 is a cylindrical tank approximately 140 cm (55 in.) tall with 20.3 cm (8 in.) diameter. E-D-4A is a cylindrical tank approximately 74 cm (29 in.) tall with 10.2 cm (4 in.) diameter. The condensers were part of the vessel ventilation system.	
	Shielded Storage Location (TK-E-9)	Rectangular storage location approximately 30.5 cm (12 in.) by 48.3 cm (19 in.) wide and 55.9 cm (22 in.) tall. This location was used to store inner cesium capsules and did not contain unencapsulated material.	
	Helium Leak Check Chamber (TK-E-12)	Outer shell with approximately 11.4 cm (4.5 in.) diameter and approximately 61 cm (24 in.) long. The helium leak chamber only contained completed inner capsules and did not contain unencapsulated material.	
	HEPA Filters	Filters replaced in 2000; old filters remain on cell floor.	
F	HEPA Filters	Filters replaced in 2000; old filters remain on cell floor.	Hazardous Debris
	Manipulators	Manipulators will be removed prior to addition of grout.	

Table H1. WESF Hot Cells A through F Contents

Hot Cell	Hot Cell Contents	Content Description	Waste Description
	Service Piping Associated with Processing	Air and liquid service embedded lines from outside service areas and electrical lines.	
	Capsule Scrubber (TK-F-1)	Open top rectangular tank approximately 78.7 cm (31 in.) long by 35.6 cm (14 in.) wide by 35.6 cm (14 in.) high. Contained complete capsules only.	
	Electropolisher (TK-F-2)	Open top rectangular tank approximately 78.7 cm (31 in.) long by 35.6 cm (14 in.) wide by 35.6 cm (14 in.) high. Contained complete capsules only	
	Capsule Rinse Location (TK-F-4)	Open top rectangular storage location approximately 78.7 cm (31 in.) long by 35.6 cm (14 in.) wide by 35.6 cm (14 in.) high. This equipment contained capsules only.	
	Storage Location (TK-F-5)	Cylindrical storage location approximately 72.4 cm (29 in.) deep with 41.9 cm (17 in.) diameter. This storage location was used for the storage of capsules only.	
	Air Receiver Tank (TK-F-6)	Cylindrical storage location approximately 64.8 cm (26 in.) tall with 20.3 cm (8 in.) diameter. This tank was part of the clean air supply system. It provided clean air at a constant pressure to hot cell equipment.	
	Modular Storage Rack	Rack consists of open tubes used for storage of capsules.	

H3.4.6 Hot Cell Viewing Windows

Lead glass windows are provided for shielding and direct viewing into the hot cells from the operating gallery. The viewing windows are composed of 25.4 cm (10 in.) of 3.3 g/cm^3 lead glass (hot cell side) and 39.6 cm (15.6 in.) of 6.2 g/cm^3 lead glass (operating gallery side).

Oil between the glass sections allows light to pass through the windows. The soft lead glass is protected by cerium stabilized, nonbrowning, tempered glass on the hot cell side and tempered glass on the operating gallery side. The oil will be removed from the Hot Cells A through F windows, before start of closure, using the work package process including waste planning. The oil between the glass sections is a white mineral oil (Chemical Abstracts Service number 8042-47-5) with no hazardous properties. Upon removal, the oil will be containerized and managed as a nondangerous maintenance waste.

Currently, the window in Hot Cell C is not clear enough to allow viewing into the hot cell. Viewing into Hot Cells A, B, D, and E is not possible because lighting inside the cells has failed.

H3.4.7 Hot Cell Manipulators

Hot Cell A has wall ports for four manipulators. Hot Cells B through F each have wall ports for two manipulators that can be installed or removed from the hot cells through 25.4 cm (10 in.) diameter ports in the wall.

Manipulators are removed from Hot Cells A through E, and plugs have been installed in the ports for contamination control.

Manipulators in Hot Cell F will be removed, and the ports will be plugged prior to the start of stabilization activities.

H3.4.8 Hot Pipe Trench and K3 Duct Trench

The hot pipe trench is a concrete channel, 1.5 m (5 ft) wide by 0.6 m (2 ft) deep, that contains the process feed piping that was used to transfer solutions from B Plant to WESF. The hot pipe trench also contains lines for transferring solutions from WESF back to B Plant.

The hot pipe trench is located beneath the floor of the hot cells and extends from Hot Cell G to the west wall of B Plant. At the west wall of B Plant, the hot pipe trench is reduced to a 35.6 cm (14 in.) stainless steel pipe encasement that terminates in Cell 39 at B Plant.

The walls of the hot pipe trench and encasement are constructed of high-density concrete and are lined with lead, where required, to provide shielding. B Plant has been isolated from WESF, and piping in the hot pipe trench is no longer used and is capped in B Plant.

When processing was completed at WESF before 1985, process transfer lines in the hot pipe trench were flushed with demineralized water. These lines have not been used for any processing since the WESF hot cells were placed in standby/surveillance mode. The transfer lines are expected to contain radiological contamination.

Process piping located in the hot pipe trench will not be filled with grout. The largest process feed pipe inside the hot pipe trench that will not be grouted is approximately 7.6 cm to 10.2 cm (3 to 4 in.) and will not cause structural integrity issues due to void space.

The K3 duct trench is approximately 0.6 m (2 ft) wide and 0.9 m (3 ft) deep. It runs underneath the hot cells and contains the K3 exhaust duct. Figure H10 shows the general configuration of the hot pipe trench, hot cells, and K3 duct trench. The elevated area is not present in all hot cells.

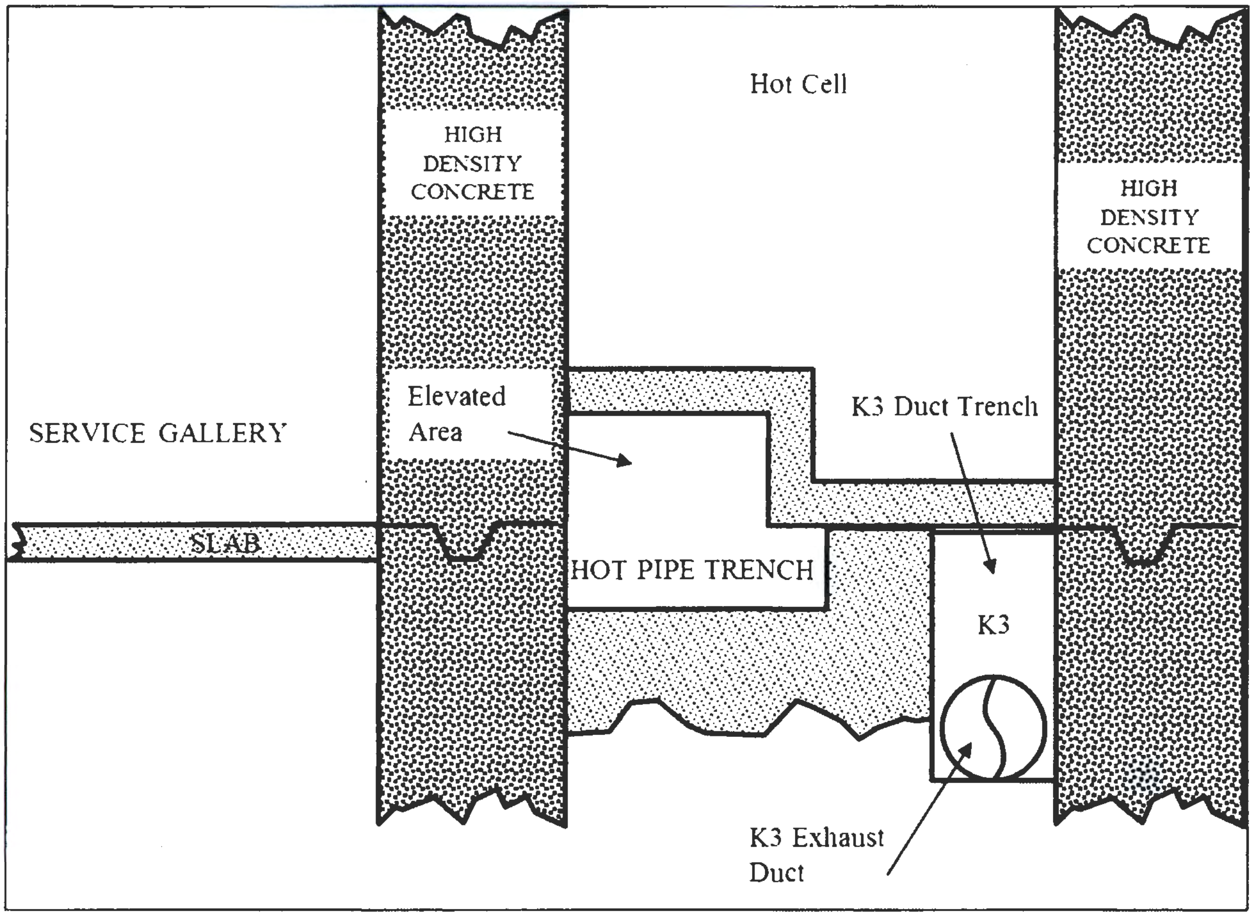


Figure H10. Hot Pipe Trench and K3 Duct Trench

H3.4.9 Tank-100

The WESF LLW collection tank (Tank-100) is an approximately 15,000 L (4,000 gal) stainless steel tank contained in a below-grade reinforced concrete vault with cover blocks. The tank is located on the outside of WESF, on the south side, and is not within a DWMU. The tank is under active ventilation from the K3 exhaust ventilation system and will be ventilated by the new system. Any liquid LLW generated in the hot cells would be transferred to Tank-100. As part of the closure activities, all hot cells (including Hot Cell G) will be isolated from this tank.

Tank-100 was replaced in 1998. Tank contents were sampled to support disposal of the removed tank and found to contain 1,1,1-trichloroethane. The original Tank-100 system, that was replaced in 1998, was clean closed in accordance with WAC 173-303-610, "Dangerous Waste Regulations," "Closure and Post-Closure," as documented by 98-EAP-588, "Closure Certification of the Waste Encapsulation and Storage Facility (WESF) Tank 100 (TK-100) System." 1,1,1-trichloroethane was not used at WESF after closure of Tank-100 in 1998, and no mixed waste management activities have occurred in the hot cells since the tank was replaced.

H3.4.10 WESF Ventilation System

The WESF ventilation system (Figures H11 and H12) is permitted for operation, under a Washington State Department of Health license and the Hanford Air Operating Permit, and is not part of the Hot Cell A through Hot Cell F DWMU. However, information is provided in this closure plan as part of the unit description to provide a complete understanding of the WESF facility.

The ventilation system at WESF is designed to produce pressure boundaries that prevent migration from areas contaminated with radioactive particulates to areas with less potential for contamination to the atmosphere. Contaminated areas are maintained at a negative pressure with respect to uncontaminated areas.

A second major function of the WESF ventilation system is the removal of hydrogen gas generated from the radiolysis of water resulting from the underwater storage of highly radioactive cesium and strontium capsules in the WESF pool cells. Hydrogen removal from the hot cells is not a significant concern, even if capsules are being stored in Hot Cells F or G, because all water sources have been removed from the hot cells.

Four separate supply systems (K1, K2, K3, and K4) and three separate exhaust systems service WESF. K1 and K3 systems are the only two that exhaust potentially contaminated air. The K2 exhaust system ventilates normally clean areas of WESF. K1 and K3 exhaust systems combine after the respective HEPA filters to exhaust air through a single monitored stack (296-B-10). Only portions of the K3 ventilation system that require grouting as part of the closure for the Hot Cell A through Hot Cell F DWMU will be discussed further in this closure plan.

H3.4.11 K3 Exhaust System

The K3 exhaust system ventilates the canyon and hot cells. These are the most contaminated areas of the building and are maintained at the most negative pressure. The K3 exhaust fan draws air from the canyon and hot cells and passes it through the K3 HEPA filters before it exits through the monitored 296-B-10 stack.

Each hot cell has two exhaust paths to a common duct, and each exhaust path has one stage of HEPA filtration. The final K3 HEPA filters consist of two parallel filter housings. Each filter housing unit is located in a separate K3 filter pit.

The underground K3 exhaust duct, filter housings, and filter pit will be filled with grout to stabilize the contamination contained with these areas. A new K3N ventilation system will be installed to replace the function of the K3 exhaust system. The K3N system will consist of a filter housing with two redundant exhaust fans. The filter housing will include two HEPA sections in series, with each HEPA section consisting of six individual HEPA filters. It will ventilate the canyon, Hot Cell G, and Tank-100. The fan will draw air from these spaces through the HEPA filter before it exits through the monitored 296-B-10 stack.

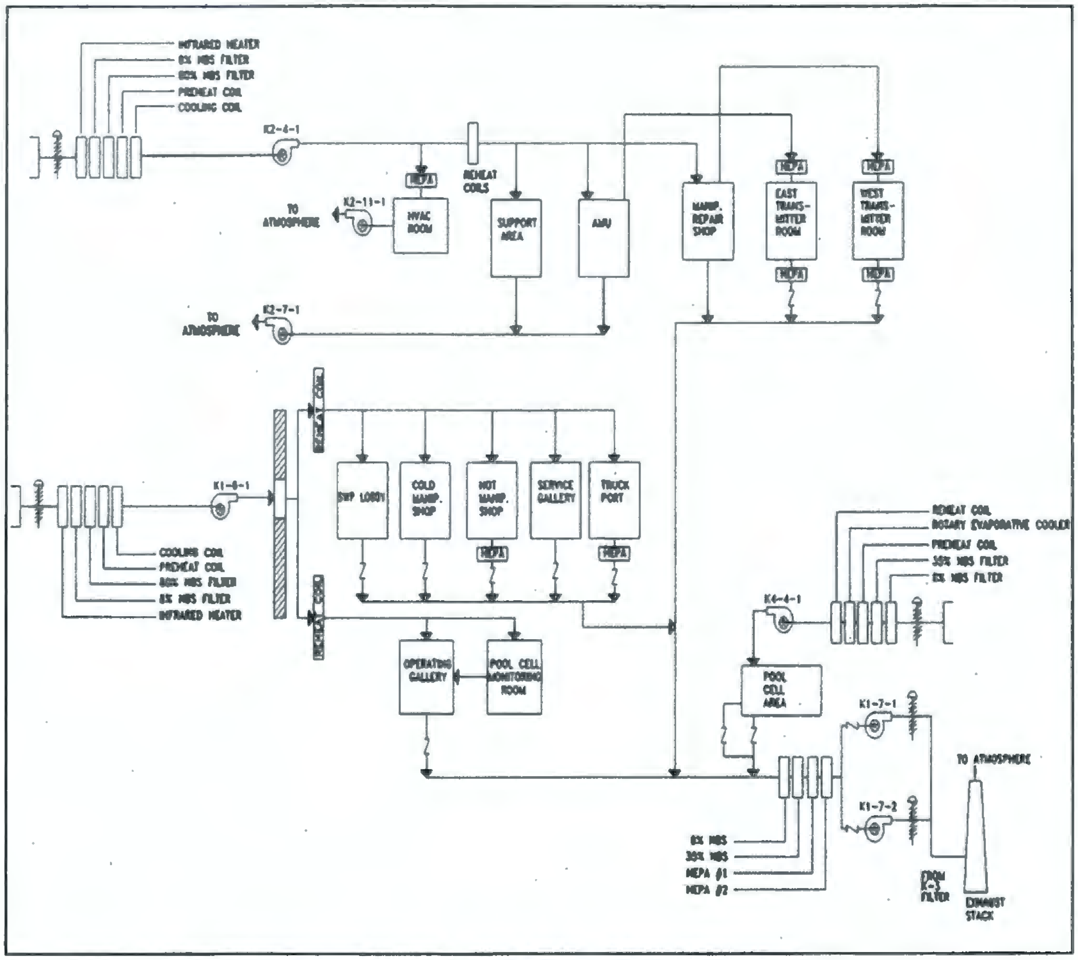


Figure H11. K1, K2, and K4 Ventilation

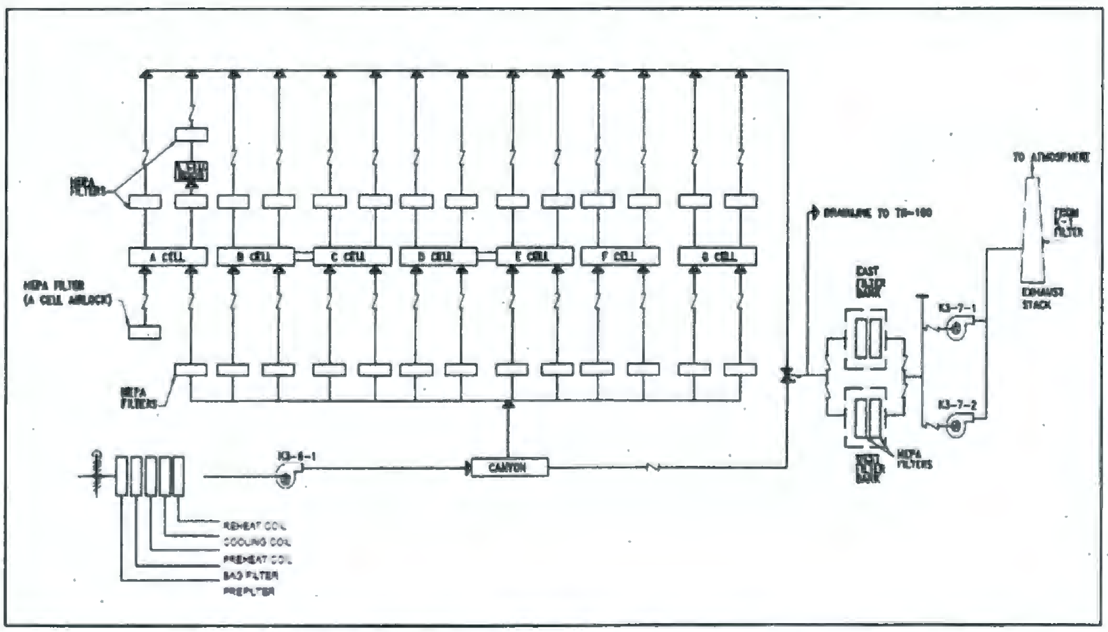


Figure H12. Current K3 Ventilation System

H3.4.12 Maximum Waste Inventory

WESF currently stores 1,936 capsules (the maximum number of capsules that are available to be stored). The waste volume inside each capsule is approximately 1 L (0.264 gal). Therefore, the maximum waste inventory of WESF is approximately 1,936 L (511 gal). Capsules are stored within the two operating DWMUs and will not be impacted by closure activities described in this plan.

Hot Cells A through F do not store any capsules and did not store any waste capsules after the effective date of RCRA at the Hanford Facility in August 1987.

The furnace, located in the wall between Hot Cells B and C, holds approximately 0.6 kg (1.3 lb) of waste in four trays inside the furnace. Hot Cell C holds approximately 1.2 kg (2.6 lb) of waste in two threaded, capped pipes.

The contents of Hot Cells A through F are detailed in Table H1.

H4 CLOSURE PERFORMANCE STANDARD

This closure plan covers initial closure actions for the Hot Cell A through Hot Cell F DWMU. Final clean closure of the Hot Cell A through Hot Cell F DWMU will be completed concurrent with closure activities for the remaining two operating WESF DWMUs. Closure performance standards for final closure of WESF will be based on WAC 173-303-610(2), which requires closure of the facility in a manner that accomplishes the following objectives:

- Minimize the need for further maintenance.
- Control, minimize, or eliminate, to the extent necessary, to protect human health and the environment (HHE), post-closure escape of dangerous waste, dangerous constituents, leachate, contaminated runoff, or dangerous waste decomposition products to the ground, surface water, groundwater, or atmosphere.
- Return the land to the appearance and use of surrounding land areas, to the degree possible, given the nature of the previous dangerous waste activity.

These performance standards are met through Sections H4.1 and H5.11.

Final clean closure of the remaining two DWMUs associated with the WESF Operating Unit Group will be addressed in WA7890008967, *Hanford Facility Dangerous Resource Conservation and Recovery Act Permit*, Revision 9, Part III, Operating Unit Group 14, Waste Encapsulation and Storage Facility.

H4.1 Clean Closure Levels

The Hot Cell A through Hot Cell F DWMU will be clean closed. Once the stabilized hot cells have been removed, the remaining underlying soil will be sampled and must meet clean closure levels. In accordance with WAC 173-303-610(2)(b)(i), clean closure levels for the soil are the numeric cleanup levels calculated using unrestricted use exposure assumptions according to WAC 173-340, "Model Toxics Control Act—Cleanup," hereinafter called MTCA, regulations (WAC 173-340-700, "Overview of Cleanup Standards," through WAC 173-340-760, "Sediment Cleanup Standards," excluding WAC 173-340-745, "Soil Cleanup Standards for Industrial Properties"). These numeric cleanup levels have been calculated according to the requirements of WAC 173-303-610(2)(b)(i) as of the effective date of the permit modification. These cleanup levels consider carcinogens, and noncarcinogens values.

The miscellaneous unit performance standards identified in WAC 173-303-680(2)(b)(i) through (4), as required by WAC 173-303-610(2)(b), are addressed in Table H2.

A null hypothesis is generally assumed to be true until evidence indicates otherwise. The null hypothesis, as defined in WAC 173-340-200, "Definitions," for Hot Cells A through F is that the underlying soil, once the hot cells have been removed, is assumed to be above unrestricted use cleanup levels, commonly called MTCA (WAC 173-340) Method B levels.

Therefore, the site is presumed to be contaminated. Rejection of the null hypothesis means that sampling and analysis results of the site indicated soil contamination below the MTCA Method B levels. Sampling and analysis in accordance with the sampling and analysis plan (SAP) (Section H5.12) will be used to determine whether the null hypothesis can be rejected, thereby confirming that soil meets the closure performance standards (MTCA Method B).

Since the DWMU is anticipated to be clean, should sampling and analysis determine that the null hypothesis can be accepted, indicating that the site is contaminated, such an event will be considered an unexpected event during closure, and the soil would then be identified as contaminated environmental media and managed in accordance with Section H5.10.

Table H2 WAC 173-303-680(2) through (4) Requirements

Requirement	Method of Compliance
(2) Environmental performance standards. A miscellaneous unit must be located, designed, constructed, operated, maintained, and closed in a manner that will ensure protection of human health and the environment. Permits for miscellaneous units are to contain such terms and provisions as necessary to protect human health and the environment, including, but not limited to, as appropriate, design and operating requirements, detection and monitoring requirements, and requirements for responses to releases of dangerous waste or dangerous constituents from the unit. Permit terms and provisions must include those requirements in WAC 173-303-630 through 173-303-670, 40 CFR. Subparts AA through CC, which are incorporated by reference at WAC 173-303-690 through 173-303-692, WAC 173-303-800 through 173-303-806, part 63 subpart EEE (which is incorporated by reference at WAC 173-400-075 (5)(a)), and 40 CFR, Part 146 that are appropriate for the miscellaneous units being permitted. Protection of human health and the environment includes, but is not limited to:	The Hot Cell A through Hot Cell F DWMU will be closed in a manner that will ensure protection of HHE through the activities identified in this closure plan, which was developed in accordance with and to meet the regulatory requirements of WAC 173-303-610.
(a) Prevention of any releases that may have adverse effects on human health or the environment due to migration of wastes constituents in the groundwater or subsurface environment, considering:	Grouting of Hot Cells A through F will prevent migration of dangerous waste constituents to the groundwater or subsurface environment below WESF.
(i) The volume and physical and chemical characteristics of the waste in the unit, including its potential for migration through soil, liners, or other containing structures;	
(ii) The hydrologic and geologic characteristics of the unit and the surrounding area;	
(iii) The existing quality of groundwater, including other sources of contamination and their cumulative impact on the groundwater;	
(iv) The quantity and direction of groundwater flow;	
(v) The proximity to and withdrawal rates of current and potential groundwater users;	
(vi) The patterns of land use in the region;	
(vii) The potential for deposition or migration of waste constituents into subsurface physical structures, and into the root zone of food-chain crops and other vegetation;	
(viii) The potential for health risks caused by human exposure to waste constituents; and	
(ix) The potential for damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents.	
(b) Prevention of any release that may have adverse effects on human health or the environment due to migration of waste constituents in surface water, or wetlands or on the soil surface considering:	Grouting of Hot Cells A through F will prevent migration of dangerous waste constituents to the soil surface under WESF. There are no surface waters or wetlands in the proximity of WESF.
(i) The volume and physical and chemical characteristics of the waste in the unit;	

Table H2 WAC 173-303-680(2) through (4) Requirements

Requirement	Method of Compliance
(ii) The effectiveness and reliability of containing, confining, and collecting systems and structures in preventing migration;	
(iii) The hydrologic characteristics of the unit and the surrounding area, including the topography of the land around the unit	
(iv) The patterns of precipitation in the region;	
(v) The quantity, quality, and direction of groundwater flow;	
(vi) The proximity of the unit to surface waters;	
(vii) The current and potential uses of nearby surface waters and any water quality standards established for those surface waters;	
(viii) The existing quality of surface waters and surface soils, including other sources of contamination and their cumulative impact on surface waters and surface soils;	
(ix) The patterns of land use in the region;	
(x) The potential for health risks caused by human exposure to waste constituents; and	
(xi) The potential for damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents.	
(c) Prevention of any release that may have adverse effects on human health or the environment due to migration of waste constituents in the air, considering:	Grouting of Hot Cells A through F and the K3 ventilation system will prevent migration of dangerous waste constituents to the air outside of WESF. Contamination control methods, such as glove-bags and portable filtered ventilators, will be used during core drilling to prevent the spread of contamination. As the grout flows into placement locations, air will be displaced by the grout. Displaced air will contain water vapor and will be radioactively contaminated. Portable ventilation systems, which consist of a HEPA filter, heater, and fan, will be used to collect and filter the displaced air.
(i) The volume and physical and chemical characteristics of the waste in the unit, including its potential for the emission and dispersal of gases, aerosols and particulates;	
(ii) The effectiveness and reliability of systems and structures to reduce or prevent emissions of dangerous constituents to the air;	
(iii) The operating characteristics of the unit;	
(iv) The atmospheric, meteorologic, and topographic characteristics of the unit and the surrounding area;	
(v) The existing quality of the air, including other sources of contamination and their cumulative impact on the air;	
(vi) The potential for health risks caused by human exposure to waste constituents; and	

Table H2 WAC 173-303-680(2) through (4) Requirements

Requirement	Method of Compliance
(vii) The potential for damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents.	Portable ventilation systems used to support grouting of the hot cells, hot pipe trench, K3 duct trench, and A Cell airlock will discharge inside the 225B Building, which is an abated air space. The portable ventilation systems used to support grouting of the K3 filter pit will discharge outside, and abatement and monitoring controls will be implemented. This activity will be licensed separately if the existing site license cannot be used.
(3) Monitoring, analysis, inspection, response, reporting, and corrective action. Monitoring, testing, analytical data, inspections, response, and reporting procedures and frequencies must ensure compliance with subsection (2) of this section, WAC 173-303-320, 173-303-340(1), 173-303-390, and 173-303-64620 as well as meet any additional requirements needed to protect human health and the environment as specified in the permit.	The stabilized hot cells will be maintained in a manner that prevents threats to HHE and monitored through routine radiation surveillances, using radiation as an indication of contamination outside the stabilized Hot Cell A through Hot Cell F DWMU.
WAC 173-303-320 Inspections	Inspections of the Hot Cell A through Hot Cell F DWMU are addressed in Section H5.2.
WAC 173-303-340(1)	WESF complies with annual reporting requirements through Hanford Facility Permit, Condition II.B.
WAC 173-303-390 Facility Reporting	
1. Unmanifested Waste Reports	N/A – WESF Hot Cell A through Hot Cell F DWMU will not be receiving additional waste shipments during closure.
2. Annual Reports	WESF complies with annual reporting requirements through Hanford Facility Permit, Condition I.E.22.
3. Additional Reports	
a. Releases of dangerous waste, fires, and explosions	Reports regarding releases of dangerous waste, fires, and explosions are addressed in DOE/RL-94-02, *Hanford Emergency Response Plan.*
b. Interim status groundwater monitoring data	N/A – WESF Hot Cells A through F are not a land disposal unit or surface impoundment, and groundwater monitoring is not required.
c. Facility closures specified in WAC 173-303-610(6)	Closure certification is addressed in Section H5.14 of this closure plan.

Table H2 WAC 173-303-680(2) through (4) Requirements

Requirement	Method of Compliance
d. As otherwise required by WAC 173-303-645 through 173-303-665, WAC 173-303-690 through 173-303-692, and WAC 173-303-400.	There have not been any releases from the Hot Cell A through Hot Cell F DWMU that are subject to the corrective action requirements. Air emission standards are met through the WESF K3 ventilation system.
4. Recordkeeping	WESF maintains a facility operating record in accordance with Hanford Facility Permit, Condition II.I.
WAC 173-303-64620 Corrective Action	There have not been any releases from the Hot Cell A through Hot Cell F DWMU that are subject to corrective action requirements.
(4) Post-closure care. A miscellaneous unit that is a disposal unit must be maintained in a manner that complied with subsection (2) of this section during the post-closure care period. In addition, if a treatment or storage unit has contaminated soils or groundwater that cannot be completely removed or decontaminated during closure, then that unit must also meet the requirements of subsection (2) of this section during post-closure care. The post-closure plan under WAC 173-303-610(8) must specify the procedures that will be used to satisfy this requirement.	The Hot Cell A through Hot Cell F DWMU will be clean closed. No post-closure care is required.

H5 CLOSURE ACTIVITIES

The Hot Cell A through Hot Cell F DWMU does not store capsules and will not be used in future waste management activities at WESF. As a result, Hot Cells A through F will undergo closure to minimize the need for further maintenance and eliminate the potential for the release of dangerous constituents from the DWMU.

As described in Section H3.4 of this closure plan, the hot cells were used to encapsulate Cs-137 and Sr-90 that had been separated from plutonium production waste in B Plant. As a result, the hot cells became contaminated with a significant amount of Cs-137 and Sr-90, along with smaller amounts of dangerous constituents.

The K3 exhaust ventilation system controls the release of contamination from the hot cells. This aging system relies on HEPA filters that have exceeded their operational life and need to be replaced. However, replacement of the filters is impractical due to the high levels of radionuclide contamination.

A project has been initiated to address K3 ventilation system issues. Implementation of this project will include initial closure activities for the Hot Cell A through Hot Cell F DWMU, along with installation of a new ventilation system. Although the ventilation system is not part of the DWMU, it is discussed in this closure plan so the reader can fully understand the approach for initial closure activities of the DWMU.

The integrated approach to complete initial closure activities of the DWMU includes the following tasks:

- Replace the K3 exhaust ventilation system with a new system (K3N). The K3N system will ventilate the Hot Cell A through Hot Cell F DWMU during initial closure activities. The K3N system will also provide ventilation for Hot Cell G, which is one of the two DWMUs that will remain operational at WESF.
- Stabilize legacy contamination in the K3 exhaust ventilation system and in Hot Cells A through F. Stabilization will be accomplished by filling contaminated areas with grout.

Completion of this project will also support eventual removal of cesium and strontium capsules, which are currently in the pool cells at WESF, and subsequent transfer of the capsules to a newly constructed treatment, storage, and/or disposal (TSD) unit.

Significant modifications to hot cells will be performed to enable replacement of the aging ventilation system, including the introduction of grout. Modifications have been analyzed to ensure that the safety functions of the structures are not negatively impacted. These structural evaluations are documented in CHPRC-02270, *Structural Evaluation for Grouting the 225-B Building Hot Cells*; CHPRC-02420, *W-130 Project Building 225B South Wall K3N Duct Penetration Analysis*; and CHPRC-02531, *W-130 Project Structural Evaluation of Vertical Core Drill Through Hot Cell Divider Walls*.

Initial closure activities for the Hot Cell A through Hot Cell F DWMU consists of the following main tasks:

- Site preparation
- Unit modification and evaluation prior to stabilization
- Stabilization of contamination within WESF

Following completion of the initial Hot Cell A through Hot Cell F DWMU closure activities described, an extended closure period will begin prior to completion of final Hot Cell A through Hot Cell F DWMU closure activities. Final closure activities for the Hot Cell A through Hot Cell F DWMU will be completed concurrent with closure activities for the remaining two operating WESF DWMUs. Final clean closure activities for the Hot Cell A through Hot Cell F DWMU consist of the following main tasks:

- Demolition and removal of the Hot Cell A through Hot Cell F DWMU
- Management and disposal of the hazardous debris
- Visual verification of underlying soil
- Sampling and analysis to confirm clean closure

H5.1 Health and Safety Requirements

Closure will be performed in a manner to ensure the safety of personnel and the surrounding environment. Qualified personnel will perform any necessary closure activities in compliance with established safety and environmental procedures. Personnel will be equipped with appropriate personal protective equipment (PPE). Qualified personnel will be trained in applicable safety and environmental procedures and have appropriate training and experience in sampling activities. Field operations will be performed in accordance with applicable health and safety requirements.

The Permittees have instituted training or qualification programs to meet training requirements imposed by regulations, DOE orders, and national standards such as those published by the American National Standards Institute/American Society of Mechanical Engineers. For example, the environmental, safety, and health training program provides workers with the knowledge and skills necessary to execute assigned duties safely. The Hanford Facility RCRA Permit, Attachment 5, describes specific requirements for the Hanford Facility Personnel Training program. The Permittees will comply with the training matrix shown in Table H3, which provides training requirements for Hanford Facility personnel associated with closure activities for the Hot Cell A through Hot Cell F DWMU.

Project-specific safety training addressed explicitly to the project and day's activity will include training to provide the knowledge and skills needed for personnel to perform work safely and in accordance with quality assurance (QA) requirements.

Pre-job briefings will be performed to evaluate activities and associated hazards by considering the following factors:

- Objective of the activities
- Individual tasks to be performed
- Hazards associated with the planned tasks
- Environment in which the job will be performed
- Facility where the job will be performed
- Equipment and material required
- Safety protocols applicable to the job
- Training requirements for individuals assigned to perform the work
- Level of management control
- Emergency contacts

Training records are maintained for each employee in an electronic database. The Permittees' training organization maintains the training records system. A record of training, as required by Table H3, will be kept in the operating record until the Washington State Department of Ecology (Ecology) approves certification of final closure of the three WESF DWMUs.

Table H3. Training Matrix for Hot Cell A through Hot Cell F DWMU

Training Category[a]							
Permit Attachment 5 Training Category	**General Hanford Facility Training**	**Contingency Plan Training**	**Emergency Coordinator Training**	**Operations Training**			
WESF DWTP Implementing Plan	**Orientation Program**	**Operations Program (Emergency Response – Contingency Plan Duties)**	**Emergency Coordinator**	**General Waste Management Duties**	**Awareness Program**	**Container Management**	**Miscellaneous Storage Unit Management**
Job Title/Position							
Nonfacility Personnel	X						
Maintenance Crafts	X				X[b]		
Radiological Control Technician	X				X[b]		
Nuclear Chemical Operator	X	X[b]		X[b]	X[b]	X[b]	X[b]
Shift Operations Manager	X	X[b]	X[b]				
Environmental Compliance Officer	X			X[b]			
Waste Service Provider	X			X[b]		X[b]	

DWMU = dangerous waste management unit
DWTP = dangerous waste training plan

1

[a] Refer to the WESF DWTP for a complete description of coursework in each training category.

[b] Training received is commensurate with the duties performed. Individuals in this category who do not perform these duties are not required to receive this training.

H5.2 Records Review and Visual Inspections

As a miscellaneous unit permitted closely to a container storage area, the clean closure determination for Hot Cell A through Hot Cell F is partially based on review of the operational history and operating records, as detailed in this closure plan, to verify that all items (both debris and waste) remaining in the hot cells during stabilization and closure are identified. Based on these reviews, Hot Cells A through F is a candidate for clean closure under RCRA, and confirmation sampling will be performed. Certain documents (SD-WM-ER-014; SD-WM-ER-022; and HNF-8556, *Estimate of WESF Hot Cell Inventory*) were reviewed to identify activities performed to place Hot Cells A through F into standby/surveillance mode and identify inventory within the hot cells. Information provided in those documents was utilized to develop this closure plan. In addition to reviewing these documents, visual verification of Hot Cell F contents was performed. Contents and conditions in Hot Cells A through E cannot be visually verified due to the unavailability of lighting within the cells.

During the extended closure period for the Hot Cell A through Hot Cell F DWMU, inspections will continue to maintain the facility in a manner that prevents threats to HHE. Once initial closure activities have been completed and the extended closure period begins, annual inspections of the DWMU will be performed in accordance with Table H4. Annual inspections are deemed sufficient because any structural degradation of the DWMU, that could potentially cause a release of dangerous waste constituents to the environment, would occur slowly and can be identified at this inspection frequency.

After Hot Cells A through F have been filled with grout, the DWMUs internal monitoring equipment will be encased within the grout and will be inactive. Annual inspections identified in Table H4 will be performed visually, and no additional monitoring equipment will be used.

Penetration covers are utilized during closure activities to minimize contamination migration. Once the grout has cured, the penetration covers no longer serve a purpose; therefore, inspection is not necessary.

The DWMU is located inside a building and is not accessible for unknowing or unauthorized entry by persons or livestock. The building is protected by locked doors with posted warning signs. Vehicular access to roads leading to the DWMU area are through the Hanford Facility 24-hour controlled access points. The access points are posted with restrictive signage.

Table H4. WAC 173-303-320(2) Inspection Schedule for Hot Cell A through Hot Cell F

Requirement Description	Inspection Frequency	Inspection
Posted Warning Signs	Annually	Verify that signs are posted and legible.
Hot Cell A through Hot Cell F Exterior Surfaces and Surrounding Area	Annually	Check for structural damage to the building. Check outside the building for liquid accumulations or signs of releases of hazardous waste. Verify viewing window plates are sealed.

Inspection documentation must include, at a minimum, the date and time of inspection, observations, corrective actions (if any), and name/signature of inspection personnel. Inspection documentation must be maintained in the WESF facility operating record for a minimum of five years after Ecology clean closure acceptance. Corrective actions taken as a result of inspections must be remedied on a schedule that prevents hazards to the public health and environment.

Once the Hot Cell A through Hot Cell F DWMU has been demolished and removed, visual verification of the underlying soil will be performed to identify any staining or discolored soil, the presence of wet areas, or other signs of potential contamination.

The presence of volatile emissions is unlikely; however, the potential for volatile emissions will be evaluated upon removal of the Hot Cell A through Hot Cell F DWMU. Areas of concern of the underlying soil would be considered a candidate for focused sampling under the SAP.

H5.3 Site Preparation

Site preparation will consist of installation and startup of the new K3N system. Stabilization activities will be performed with the K3N system operational.

H5.4 Unit Modification Prior to Stabilization

Areas to be grouted include Hot Cells A through F, the Hot Cell A air lock, the underground K3 exhaust ventilation system ducting, the hot pipe trench and K3 ventilation duct trench underneath the hot cells, and the K3 filters and filter pit. All of these areas will be isolated from the portions of WESF that will remain operational. Isolation will ensure that grout and contamination do not spread outside of the areas to be grouted and will include the following activities:

- Isolate equipment that connects to the K3 exhaust system ducting.
- Isolate utility lines that remain connected to the hot cells. These utilities include air and electrical services.
- Install covers over and/or seal hot cell penetrations, such as the viewing windows, manipulator ports, and pass-throughs between Hot Cell F to Hot Cell G and from Hot Cell F to the service gallery. Oil will be drained from the viewing windows before the covers are installed.

A prerequisite activity to grouting hot cells is to pour a concrete block over the lead shielding that is against the north service gallery wall. Lead shielding is in place to cover a hot spot that resulted from migration of cesium from Hot Cell D/E through holes in the Hot Cell D/E cell floor liner. The liner was repaired in 1980. The concrete block will ensure that no grout escapes when grouting Hot Cell D/E.

Grout will be added to contaminated spaces through existing piping or penetrations wherever possible. Where this is not possible, core drilling will be performed to provide penetrations into the spaces for the addition of grout. Penetrations will need to be made through the K3 filter pit walls, into the K3 filter housings, through the Hot Cell A airlock ceiling, through the top of the K3 duct trench (through the hot cell divider walls above), and through the top of the hot pipe trench (through the hot cell divider walls, Corridor-130, and Hot Cell A air lock ~~and hot manipulator shop above~~). Figure H13 shows the location of core drills and other grout addition penetrations in the canyon that affect Hot Cells A through F.

Contamination control methods, such as glove-bags and portable filtered ventilators, will be used during core drilling to prevent the spread of contamination. A wet core drill with a vacuum attachment, water collection ring, and wastewater collection system will be used to minimize dust generated during concrete core drilling.

An engineering evaluation has been performed to demonstrate that the addition of grout to the hot cells will not affect the structural integrity of the building (CHPRC-02270).

H5.5 Stabilization

The primary function of stabilization is physical isolation of contamination, so no exposure pathways remain where humans or the environment could be adversely impacted.

H5.5.1 Grout Design

For this application, grout will not perform a structural function for seismic/structural calculation purposes, but it will have sufficient compressive strength to support applicable loads upon completion of grouting activities.

During development of the WESF grout design, documentation related to the U Plant grouting project was reviewed to identify any lessons learned that might be applicable to the WESF activity. Documents reviewed included DOE/RL-2010-127, *90 percent Remedial Design Report for Grouting 221-U Plant Canyon*, and D&D-35827, *Project Experience Report, Canyon Disposition Initiative (221-U Facility)*.

The grout used at WESF will be a flowable, nonaggregate void filling grout formulated to meet the following performance criteria:

- Maximum allowable centerline temperature of 71°C (160°F) during curing
- Minimum flow distance of 18 m (60 ft)
- Minimum allowable compressive strength of approximately 10,300,000 newton/m^2 (1,500 lb/in^2) at 28 days
- Capable of entering and filling openings/voids with a minimum dimension of approximately 1.3 cm (0.5 in.)

A grout testing plan will be developed as part of the QA testing program to ensure that the grout used complies with project specifications. Engineering and laboratory scale testing will be performed to confirm that the grout formulation meets the performance criteria prior to the addition of grout to any areas within WESF. Field inspection and testing will be performed during the grouting operation.

The grout design process included the performance of several evaluations to determine how well the grout will perform under conditions expected at WESF.

Radiolysis occurs when radioactive materials are in the presence of water. Hydrogen gas is generated as a result of radiolysis and, if allowed to accumulate, can present a flammability/explosive hazard. Evaluation has determined that the potential for an accumulation of hydrogen gas of sufficient concentration and under conditions necessary to support combustion is very small.

Over long time periods, concrete structures may degrade as a result of sufficient exposure to ionizing radiation. A very conservative calculation has been performed that shows that the time frame necessary for the recognized cumulative exposure threshold associated with concrete degradation is greater than 110 years. A more realistic, yet still conservative, calculation shows that the time frame necessary to reach a radiation exposure of concern is in excess of 590 years (CHPRC-02499, *W-130 Project Calculation: Estimate of Impacts to Grout as a Result of Radiation Exposure*). Based on review of the grouting design and hot cells, there is not a concern that there will be any degradation of grout or the hot cells concrete structure due to radiation exposure.

Grout can also be affected by exposure to high temperature. The grout design limits temperatures due to heat of hydration to 160°F, which will not negatively affect the grout or structural concrete. Potential impacts to the grout as a result of heat of hydration and decay heat have been evaluated, and there are no deleterious effects (CHPRC-02429, *W-130 Project Calculation: Estimate of Concrete Temperature in WESF Hot Cells From Decay Heat*).

H5.5.2 Grout Delivery

Grout will be prepared offsite and trucked to WESF. The grout will be tested to verify performance before construction begins. Grout samples will be collected and tested during construction.

A grout pump will be placed on the west side of the truck port entrance. Water will be provided from a fire hydrant or building hose connection.

Hose will be routed from the grout pump to locations to be grouted using the following general routing:

- From the grout pump to the K3 filter pit (outside the 225B Building)
- From the grout pump, through the truck port, to the Hot Cell G air lock, and into the service gallery

- From the grout pump, into the truck port, up through the floor opening into the canyon, and along the canyon floor to access the hot cells and the Hot Cell A air lock. Grout will be added to the hot cells through existing penetrations (ventilation inlet ports).

The piping and hose will remain in place for each route only as long as grout placement in the stabilized areas is required.

A temporary washout pit will be set up near the grout pump and truck delivery location to contain rinsate from the delivery trucks and grout pump.

A construction trailer(s) will be located near WESF to provide support for grouting activities. Electric power will be required for the trailer(s) and supplemental lighting. If used, portable generators will be in service for less than 365 days and will not be permitted as stationary sources. The engine used to power the generator set will meet the existing reciprocating internal combustion engine standards (40 CFR, Part 61, "National Emission Standards for Hazardous Air Pollutants") for that engine size.

H5.5.3 Grout Placement

Grouting will begin inside the exhaust duct, downstream of the K3 filter pit, and inside the two HEPA filter units, to stop any contamination from escaping through the exhaust system during subsequent grouting.

The following general sequence is used for stabilization grouting of the Hot Cell A through Hot Cell F DWMU:

- K3 filter pit (not part of TSD)
- K3 duct (not part of TSD)
- Hot Cell A air lock (not part of TSD)
- Hot pipe trench (not part of TSD)
- K3 duct trench (not part of TSD)
- Hot cells

The sequence provided is a general sequence only. The hot cells will be partially filled to provide shielding for the core drilling, which will allow access to the K3 duct trench, and complete the hot pipe trench grout addition. The Hot Cell A air lock does not need to be completely grouted before hot cell grouting starts. The exact sequence will be determined during the final work planning process and documented in the work package that is used to perform the work.

To minimize cracking of the grout, the lift depth will be limited to approximately 0.9 m (3 ft). This limitation will also allow placement of the next lift the following day.

Grout will be distributed from the grout pump set up outside the truck port to the vicinity of the grout fill location. Valves will be used at the fill connections to enable quick shutoff of grout once the volume is filled.

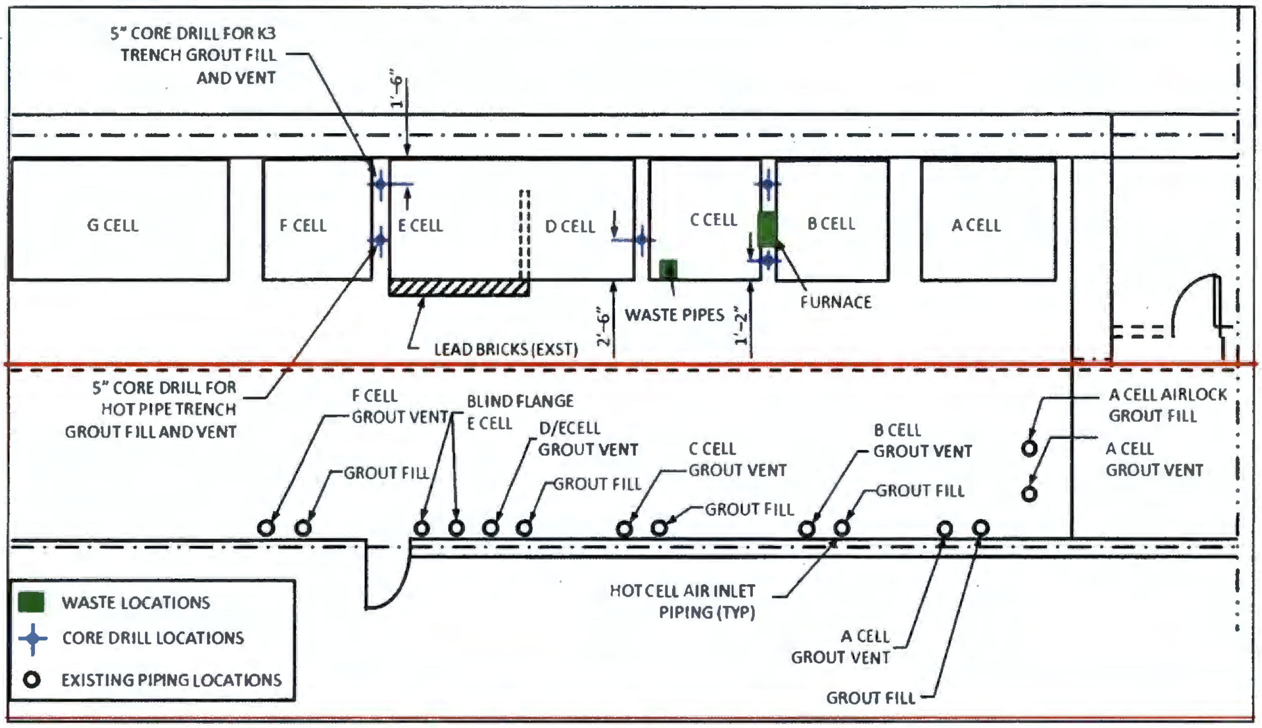
As grout flows into placement locations, air will be displaced by the grout. Displaced air will contain water vapor and will be radioactively contaminated. Portable ventilation systems, which consist of a HEPA filter, heater, and fan, will be used to collect and filter the displaced air. Portable ventilation systems used to support grouting of the hot cells, hot pipe trench, K3 duct trench, and A Cell airlock will discharge inside the 225B Building, which is an abated air space. Portable ventilation systems used to support grouting of the K3 filter pit will discharge outside, and abatement and monitoring controls will be implemented. This activity will be licensed separately if the existing site license cannot be used.

Expected grout volume will be used as an initial indicator to determine when grouting is complete. Design of the grout addition system will include provisions for visual confirmation that the spaces being grouted are filled as much as possible.

H5.5.4 K3 Filter Pit and Filter Housings

K3 filter housings (Figure H14) are located in an underground vault that consists of several chambers. All chambers of the underground vault and filter housings will be filled with grout. Estimated grout volume is 132 m^3 (173 yd^3).

Core drills will be made into each chamber of the filter pit and the filter housings to allow placement of grout. Contamination control methods, such as the use of glovebags and portable ventilators, will be used to prevent the spread of contamination during drilling and grouting.



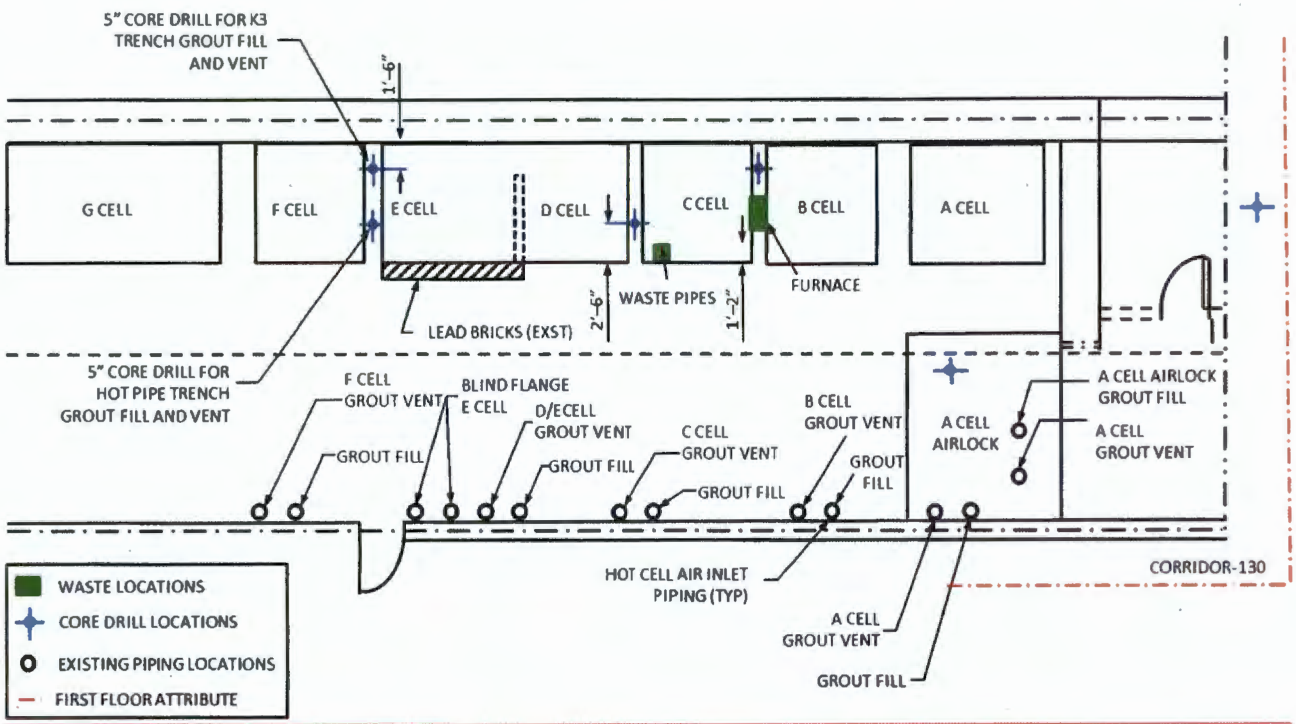


Figure H13 Core Drills and Grout Addition Locations in Canyon

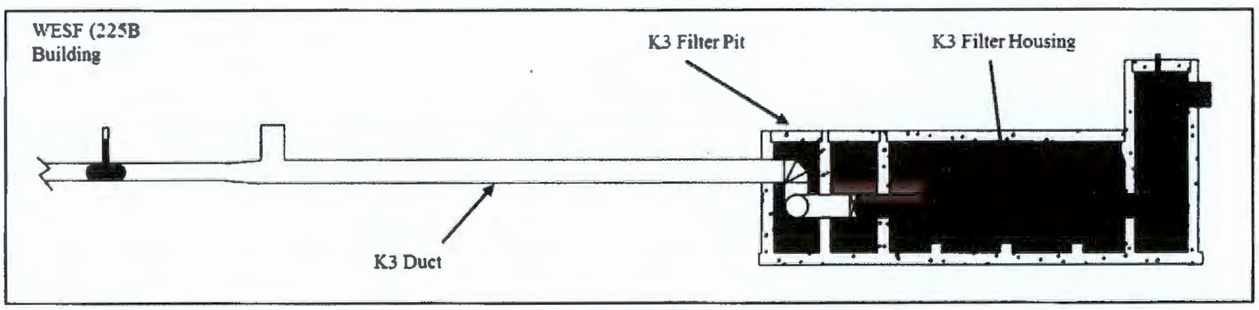


Figure H14. K3 Filter Pit and Duct

H5.5.5 K3 Duct and Trench

The K3 duct extends from the K3 filter pit to the 225B Building. It is located inside a trench and runs underneath the hot cells. Both the K3 duct and K3 duct trench will be filled with grout. The estimated grout volume is 11 m^3 (14 yd^3) for the duct and 13 m^3 (17 yd^3) for the K3 duct trench.

Grout will be added to the K3 duct through access points in the truck port and in Hot Cell G. Access to the K3 duct trench will be via core drills through the divider walls between Hot Cells B and C and between Hot Cells E and F. These divider walls are approximately 50 cm (20 in.) wide and approximately 4.9 m (16 ft) deep. Figure H15 shows how core drills through the divider walls will be performed. Grout will be added through these penetrations until the K3 duct trench is full.

H5.5.6 Hot Pipe Trench

The hot pipe trench runs underneath the hot cells next to the K3 duct trench. The entire hot pipe trench will be filled with grout. Access to the hot pipe trench will be via core drills~~ through the floor of the hot manipulator shop and~~ through the divider walls~~ between Hot Cells B and C~~, between Hot Cells C and D,

~~and~~ between Hot Cells E and F, through Corridor–130, and penetration in Hot Cell A air lock (see Section H5.4 for core drill locations).

Grout will first be added to the Hot Pipe Trench through a penetration made in the floor of Corridor-130 to create an isolation from 221B B-Plant. Grout will then be added to the Hot Pipe Trench through the divider wall at the Hot Cells C and D. Grout will then be added to the Hot Pipe Trench through the penetration in Hot Cell A air lock. The penetration in divider wall at Hot Cells E and F will be used for ventilation. ~~Grout will first be added to the hot pipe trench through a penetration made in the floor of the hot manipulator shop (not shown in Figure H13). Grout will then be added through the Hot Cell B and Hot Cell C divider wall penetrations, and finally through the Hot Cell E and Hot Cell F divider wall penetrations until the hot pipe trench is full. Penetration through the Hot Cell C and Hot Cell D divider wall will be used for venting.~~ The core drill locations were chosen to avoid drilling through obstructions, such as the furnace between Hot Cells B and C.

Due to congested conditions in the hot pipe trench with piping and supports, grout pump discharge pressure will be the indication of complete filling since volume calculations will be inaccurate.

The estimated grout volume for the hot pipe trench is 28 m^3 (36 yd^3).

H5.5.7 Hot Cell A Air Lock

The Hot Cell A air lock will be grouted to stabilize contamination within the air lock and to prevent the Hot Cell A access door from opening when Hot Cell A is grouted. The air lock must receive at least one lift of grout before Hot Cell A stabilization can proceed.

Grout will be added to the Hot Cell A air lock through ceiling penetrations made by core drilling through the canyon floor (canyon is directly above the air lock). Estimated grout volume is 50 m^3 (66 yd^3).

H5.5.8 Hot Cells

Grout will be added to Hot Cells A through F to the underside of the cover blocks. The hot cells will be filled and actively vented during the grouting process using existing ventilation inlet ports.

Each hot cell has a viewing window on the operating gallery side that must be protected to ensure that there is no breach by liquid grout during the placement process. Protection of the windows is addressed in Section H5.5.9.

Numerous penetrations through the hot cell walls into the operating gallery and service gallery must be sealed to prevent leakage of contaminated grout. A combination of cover plates and mastic material will be employed for this purpose. Pass-throughs from Hot Cell F to Hot Cell G and Hot Cell F to the service gallery will be sealed from Hot Cell G and the service gallery sides to contain the grout.

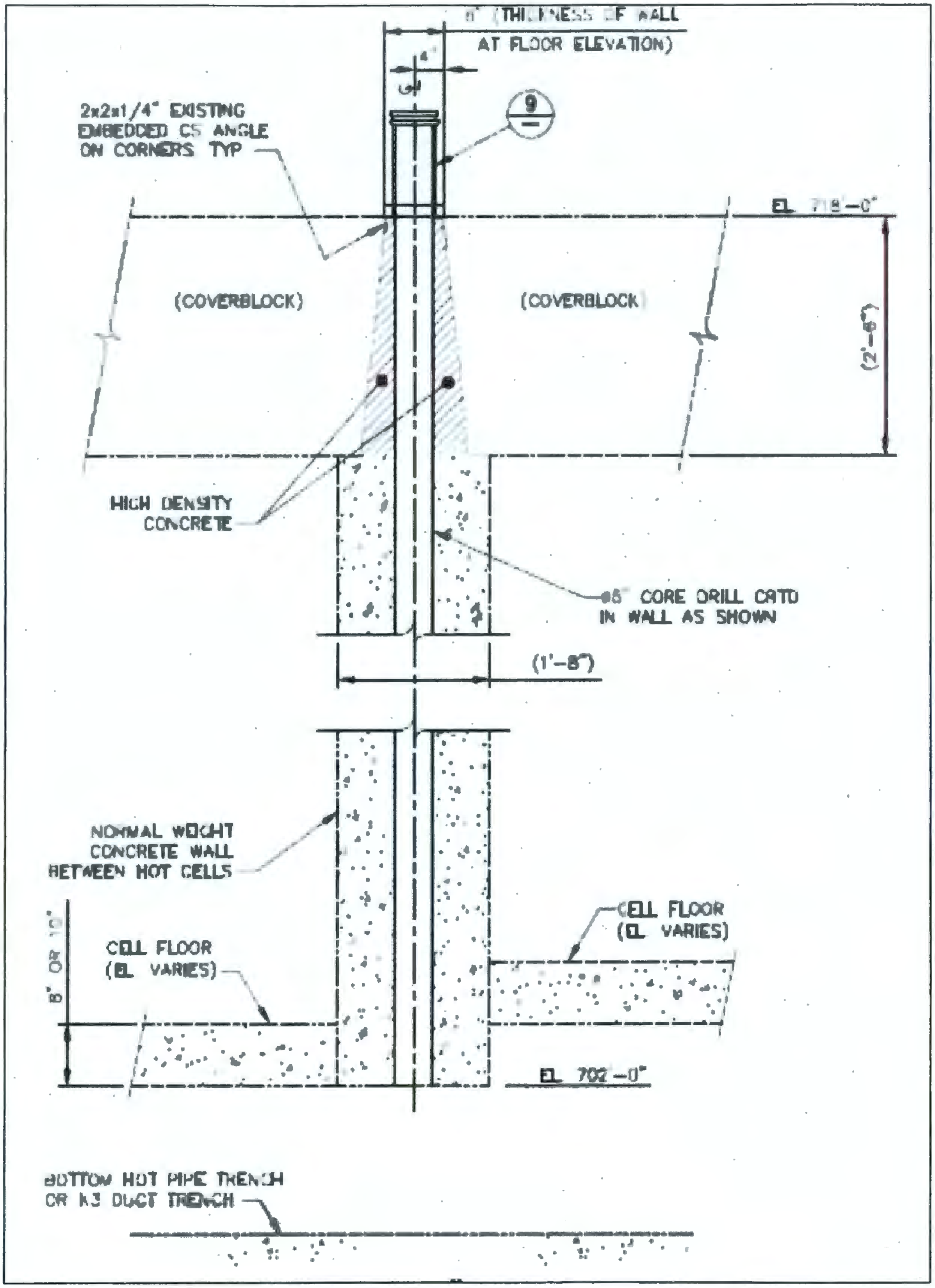


Figure H15. Performance of Core Drills through Divider Wall

Hot cell grouting will be performed in multiple lifts. Sequencing of hot cell stabilization will be finalized with the grouting contractor. Each cell could have a lift placed in turn, or one cell can be filled before moving on to the adjacent one. Because of the flowability of the grout and because no effort is made to seal the hot cells from each other, it is likely that all cells will fill together until the grout level is above the highest common penetration. Estimated grout volumes are listed in Table H5.

Table H5. Estimated Hot Cell Grout Volume

Hot Cell	Total Grout Volume (yd^3)
A	47
B	28
C	28
D and E	62
F	28

Hot cells contain the following tanks, piping, and other equipment:

- Process tanks within the hot cells are connected to the floors, walls, and/or connecting piping and are not expected to be buoyant. Tank drain and vent valves were left open during hot cell cleanout and the grout formula being used is thin, so grout is expected to enter and fill most of the tanks and other equipment left in the hot cells.
- HEPA filters in the ventilation exhaust and between Hot Cell A and the A Cell Hood are expected to fail, so grout will enter all of these spaces.
- Four trays of waste will remain in the furnace between Hot Cells B and C. The furnace has small penetrations, which will remain open during grouting and allow some grout to flow inside. However, macroencapsulation will be accomplished by grout surrounding and encapsulating the furnace. Although grout may not completely fill the furnace to encapsulate the trays directly, it will completely encapsulate the furnace containing the trays, so the statutory requirement of 42 USC 6924(m), "The Public Health and Welfare," "Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," will be met thorough substantial reduction of the migration potential of hazardous constituents from the waste.
- No effort will be made to seal pass-throughs between the hot cells, so grout should be forced into those spaces.
- Gaskets on the hot cell side of the window may or may not fail. If they fail, allowing grout to flow into the spaces around the window, between the window panes, then the seal installed on the operating gallery side of the window will contain the grout.
- Although not expected, items that are not attached to the floor or walls of the hot cells may become buoyant during grouting of the hot cells. These items included HEPA filters, open-top rectangular tanks in Hot Cell F, and miscellaneous loose items within the hot cells.

The approach to grout placement will be to add grout in lifts. The first lift of grout will flow around all fixed objects. This first lift will be allowed sufficient time to harden before placing the next lift. Any objects that float up with the grout will be bonded in the top surface, depending on displacement of the object. Tanks will have enough surface area in contact with the grout to develop a bond that will keep them in place when the next lift is placed. Hoses and HEPA filters will be bonded to the first lift because of their large surface area and light weight.

H5.5.9 Hot Cell Viewing Window Protection

Each hot cell has a viewing window consisting of multiple sections of glass (tempered and leaded) separated by inner sections of oil to provide operator shielding.

The total volume of oil between the panes of glass in each window is approximately 30 L (8 gal). The gap remaining after the oil is removed is approximately 0.64 cm (0.25 in.) between each pane. Removal of the oil is performed through the work package process, which includes the use of a waste planning process before work is performed. Once the oil is removed, it will be managed as identified in Section H3.4.6. Oil removal from the viewing window is performed using the following steps:

- Attach oil filling tubing to a plastic bottle.
- Open the oil inlet line to drain oil from the window into the preapproved container.

A steel plate will be attached to the outside of the shield wall in the operating gallery that covers the entire viewing window. It will extend far enough to use concrete anchors to hold it in place. A seal will be used between the plate and wall to ensure that contaminated grout will not breach the windows.

The grout lift heights inside each hot cell will be adjusted to ensure that the upper elevation of the grout lift occurs near the top of the window to reduce hydrostatic pressure on the window.

H5.5.10 Control of Contamination during Grouting

As the grout flows into placement locations, air, water vapor, and radiological contaminants may be released through the vent locations. Radiological contamination will be controlled by active ventilation with portable exhausters at specified locations. Active ventilation will allow air movement to be controlled throughout all phases of the project.

H5.6 Demolition of the Hot Cell A through Hot Cell F DWMU

Demolition of the Hot Cell A through Hot Cell F DWMU will take place concurrently with demolition of the remaining portions of WESF. The following primary activities are required to complete demolition of the Hot Cell A through Hot Cell F DWMU:

- Location of utilities
- Equipment mobilization
- Demolition and removal of Hot Cell A through Hot Cell F

H5.6.1 Location of Utilities

Prior to demolition, any in-use utilities will be located as well as the underground fire water line. The fire water line supplies water to the fire hydrant, which will be utilized as the water supply for dust suppression during demolition activities.

H5.6.2 Equipment Mobilization

Resources, equipment, and materials (e.g., support trailers, excavators, diamond saw cutters, front loaders, trailers, sand, water fog cannons, and boring machinery) necessary to perform demolition will be staged in designated laydown areas in proximity to WESF.

H5.6.3 Demolition and Removal of Hot Cell A through Hot Cell F

Demolition of the Hot Cell A through Hot Cell F DWMU will be accomplished utilizing cutting and sawing to create monoliths. Water may be used to control dust generated from demolition activities. The amount of water used will be minimized to prevent ponding and runoff. While unlikely, other controls such as portable ventilation filter units, HEPA filtered vacuum cleaners, greenhouses, and/or fogging agents may be used. Additional storm water run-on and run-off controls may be implemented, as needed.

If needed, crusting agents or fixatives will be applied to any disturbed portion of the contamination area, such as exposed soil from the removal of monoliths that will be inactive for more than 24 hours. Material to be disposed at the Environmental Restoration Disposal Facility (ERDF) will also comply with the moisture content and other applicable requirements of WCH-191, *Environmental Restoration Disposal*

Facility Waste Acceptance Criteria. Dust fixative is applied to appropriate portions of the demolition and excavation site at the end of each shift, and if wind arises, to prevent the spread of contamination.

Demolition activities described in the following subsections presume that the waste will be disposed of at ERDF, as discussed in Section H5.9.4.

H5.6.3.1 Cutting and Sawing

Demolition using cutting or diamond wire sawing will be used to create multiple monoliths. Grouting the hot cells stabilizes contamination on the surfaces of the hot cells, waste boats and pipes, and exterior of remaining equipment and debris. To avoid disturbance of the potential surface contamination on the hot cell surfaces, diamond wire sawing will be performed through the walls between the cells, with the exception of the wall between Hot Cells B and C, which contains the boats inside the furnace. Cuts will be made to include the exterior walls of the hot cells. A general depiction of the specific cut locations is identified in Figure H16. Final cut locations will be determined, through the use of engineering drawings and field walkdowns, before the start of demolition.

The exact locations of HEPA filters and other debris on the cell floors are not known. Monolith cuts are designed to take advantage of wall structural integrity for building the exoskeleton and to ensure that remaining tanks are cut, so they are no longer a closed vessel for disposal. Due to the location of TK-B-4 in the wall directly above the furnace, after the monolith containing TK-B-4 and the furnace has been removed, a horizontal cut will be made into the tank so it is no longer a closed vessel; however, the monolith will remain whole. The horizontal cut location is depicted in Figure H16. Care will be taken to avoid breaching the furnace below the tank. If a cut to create a monolith breaches HEPA filters or other debris, the exposed surfaces of debris along the cut line of the monolith will be sealed in accordance with 40 CFR Part 268.45, "Land Disposal Restrictions," "Treatment Standards for Hazardous Debris" (Table 1, "Alternative Treatment Standards for Hazardous Debris").

Sealing is performed by the application of an approved sealing material such as epoxy, silicone, or urethane compounds that must adhere tightly to the debris surface to avoid exposure of the surface to potential leaching media. Sealants must be resistant to degradation by the debris and its contaminants.

During cutting and sawing activities, water is used to cool blades and wires. This water is collected using a vacuum system and reused during the demolition. After cutting and sawing activities are complete, the water is containerized, solidified, and managed as a newly generated waste stream (Section H5.9). Due to the size of the monoliths and the softness of the grout, an exoskeleton may need to be fabricated to support the structure of the monolith. The exoskeleton is made from steel plates bolted to the outside surfaces of the monolith. Once the steel plates are bolted to the surfaces, steel beams are welded to the plates. Depending on the weight of the monolith, it may be necessary to bore under the monolith and install steel beams to support the structural integrity of the monolith from below. Once the exoskeleton is in place, the monolith may be removed with a crane and lifted to the transportation trailer. The other option for removal of the monolith is by using jacks to lift the monolith and then drive the trailer underneath the monolith. Monoliths will then be removed and managed as hazardous debris (Section H5.9.4).

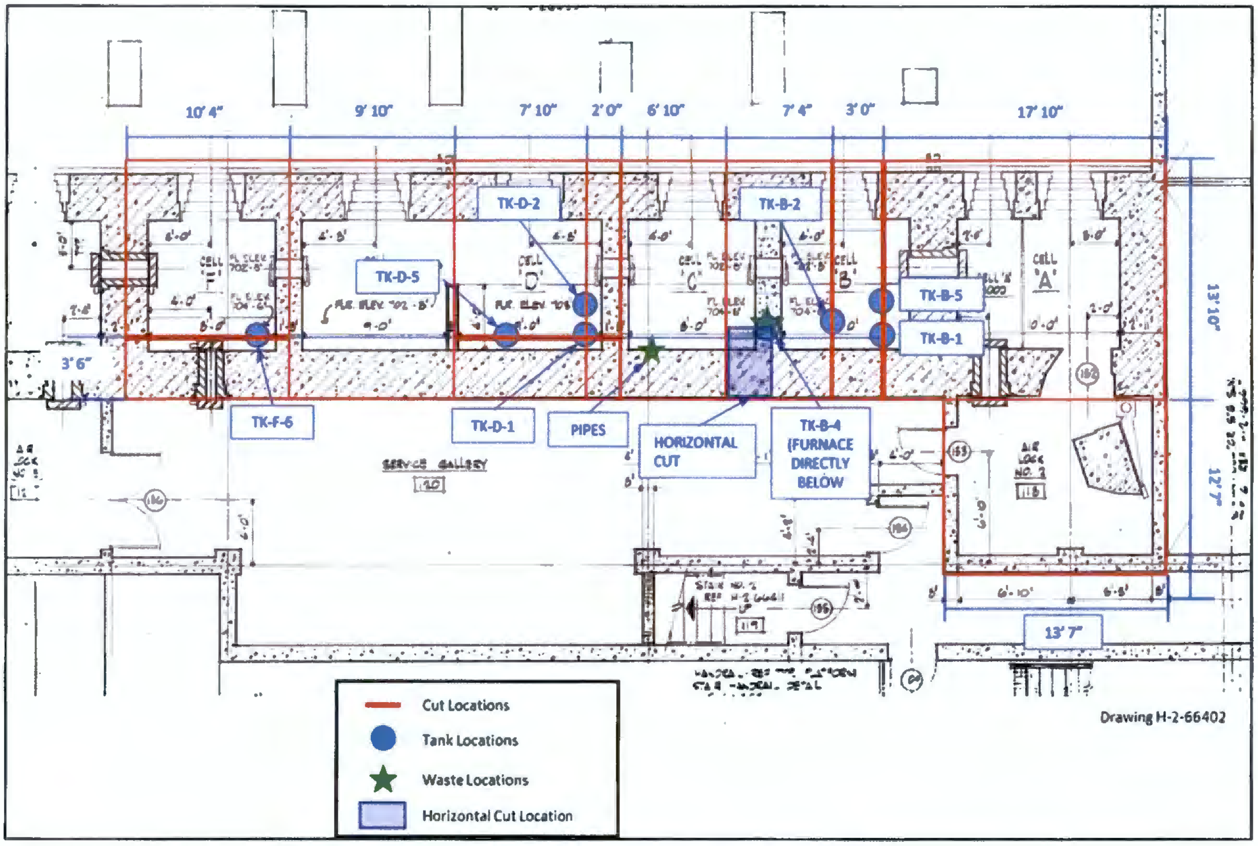


Figure H16. Monolith Cut Locations

H5.7 Removal of Wastes and Waste Residues

Hot Cells A through F contain materials and equipment used during packaging of the cesium and strontium capsules (see Section H3.4 for details of cell contents). In preparation for facility layup, a series of demineralized water flushes was performed in all of the in-cell jumpers and tanks. Chemical flushing was done in an effort to remove residual solids, and the tanks were again flushed with demineralized water.

The tank systems were flushed, removing all waste possible with normal means, with the intention of closing them and never reusing. During demolition of the Hot Cell A through Hot Cell F DWMU, locations of the monoliths have been placed to ensure that intact tanks, listed in Table H1, will be cut (and therefore no longer intact) and conservatively disposed of as hazardous debris. Cut locations for the tanks are shown in Figure H16.

Radiation hazards posed to personnel prevent the sampling and removal of cell contents; therefore, sampling will not be performed to quantify dangerous waste contamination. As a result, material and equipment remaining in the hot cells will be conservatively designated as hazardous debris.

Following facility layup, jumpers were removed from the tanks resulting in tank openings for grout filling.

The Hot Cell B furnace contains four trays with approximately 0.6 kg (1.3 lb) of strontium fluoride floor sweepings. Hot Cell C contains two threaded and capped pipes with approximately 1.2 kg (2.6 lb) of strontium fluoride floor sweepings. The pipes are located on the southwest corner of the cell on wall brackets above the bench floor.

DOE-RL has submitted a petition to Ecology for a site-specific variance from applicable land disposal restriction (LDR) treatment standards in accordance with 40 CFR 268.44(h)(2), "Variance from a

Treatment Standard," for specific waste items in Hot Cells B and C at WESF. These waste items hold 0.6 kg (1.3 lb) and 1.2 kg (2.6 lb) of floor sweepings from past cleanup activities in the cells. The floor sweepings contain strontium fluoride and processing debris, including metal shavings, and other miscellaneous waste material produced during operations of the hot cells. Ordinarily, the treatment standard for these forms of waste is a specific type of stabilization called microencapsulation. Microencapsulation is the stabilization of the waste material itself through the addition of Portland cement or lime/pozzolanic material, which reduces the leachability of contaminants from the waste. Microencapsulation treatment of the waste would then be followed by sampling and analysis of the stabilized waste to determine that LDR treatment standards have been accomplished.

However, treatment by microencapsulation would require intrusive activities, increasing exposure to workers, generation of a significant amount of additional waste requiring treatment, and potential risk of environmental exposure. Radiological and physical characteristics of the waste items prevent them from undergoing final analytical testing to verify that LDR treatment standards have been achieved. Treatment and verification of treatment by the usual methods of microencapsulation would cause potential exposure to workers, provide potential for environmental exposure, and fail to demonstrate LDR treatment.

A variance from the required LDR treatment standards is being requested to allow stabilization via in-cell macroencapsulation during grouting of the hot cells. Macroencapsulation is the application of a surface coating material such as polymeric organics (e.g., resins and plastics) or inert inorganic materials (e.g., Portland cement) that would encase the entire waste items rather than treat the interior waste such as in microencapsulation, substantially reducing surface exposure to potential leaching of contaminants. Portland cement would be used to encase the entire waste items within the cell. Macroencapsulated waste would be left intact at the WESF facility during an initial closure period. By treating the waste via macroencapsulation in WESF cells, leachability of contaminants is reduced, radiological exposure to workers is minimized, and transportation to another facility is not required. The requested petition (15-AMRP-0070, "Petition for Site-Specific Variance from Land Disposal Treatment Standards") outlines the justification and protectiveness of this treatment for waste items at the WESF hot cells.

During final facility removal, stabilized waste and waste residues associated with the Hot Cells A through Hot Cell F DWMU will be removed and managed as newly generated hazardous debris. Grouted Hot Cells A through F can be removed using standard demolition equipment, such as a diamond wire saw and excavators, cranes, and trailers in large monoliths, and transported for disposal in an approved disposal facility. Treatment standards for the newly generated hazardous debris will be the alternative debris standards for hazardous debris (40 CFR 268.45, Table 1) incorporated into WAC 173-303-140, "Land Disposal Restrictions," by reference. Additional detail on the newly generated waste is covered in Section H5.9.

Cesium and strontium salts have been analyzed to estimate impurities. The analysis performed identified possible dangerous waste designations of barium (D005), cadmium (D006), chromium (D007), lead (D008), and silver (D011). These analytical data were used to characterize the salts and will be used to identify constituents of concern for the four trays and two pipes containing floor sweeping. Tables H6 through H8 provide analytical data for the cesium and strontium salts.

Impurities in the cesium salt are estimated as listed in PNL-5170, *A Review of Safety Issues that Pertain to the Use of WESF Cesium Chloride Capsules in an Irradiator*. Table H6 data were taken on cesium feed solution and salt analyzed for corrosion analysis. Concentrations are listed as weight percent solids. The silver concentration was not estimated but was added from process knowledge; therefore, it is not listed in the following tables.

Table H6. Impurities in Cesium Feed Solution and Salt

Element	Cesium Feed Solution (Wt%)	Salt Analysis (Wt%)
Aluminum (Al)	1.7	0.14
Boron (B)	--	0.14
Barium (Ba)	0.94	0.55
Calcium (Ca)	1.0	--
Cadmium (Cd)	--	0.02
Cobalt (Co)	--	0.1
Chromium (Cr)	0.27	1.4
Iron (Fe)	0.38	--
Potassium (K)	0.79	0.68
Magnesium (Mg)	0.25	0.68
Sodium (Na)	0.70	2.8
Nickel (Ni)	0.33	0.1
Lead (Pb)	1.4	0.14
Rubidium (Rb)	0.52	--
Silicon (Si)	7	0.21
Strontium (Sr)	0.18	0.02
Titanium (Ti)	--	0.02
Zinc (Zn)	--	0.03

Impurities in cesium salts wasted at the DOE Oak Ridge Site are listed in HNF-2928, *Certification That CsCl Powder and Pellet Materials Meet WESF Acceptance Criteria*. Concentrations are listed in Table H7 by weight percent.

Encapsulated cesium chloride salt contains dangerous waste chemical impurities from the fractionation process consisting of lead, barium, chromium, cadmium, and silver. Barium is generated continuously as a result of the cesium-137 decay chain.

Impurities in strontium salt are estimated in BNWL-1967, *The Containment of* $^{90}SrF_2$ *at 800°C to 1100°C Preliminary Results*. Table H8 data are estimates based on process flowsheet information; concentrations are listed in weight percent.

The encapsulated strontium fluoride salt contains dangerous waste chemical impurities from the fractionization process consisting of barium, lead, cadmium, chromium, and silver.

Table H7. Impurities in Cesium Salts Wasted at Oak Ridge

Element	Wt%
Aluminum (Al)	0.68
Boron (B)	5.17
Barium (Ba)	2.98
Calcium (Ca)	0.68
Copper (Cu)	0.02
Iron (Fe)	0.04
Potassium (K)	1.21
Magnesium (Mg)	0.04
Molybdenum (Mo)	0.009
Sodium (Na)	7.76
Nickel (Ni)	0.01
Silicon (Si)	2.59
Strontium (Sr)	0.01
Zinc (Zn)	0.03

Table H8. Impurities in Strontium Salt

Element	Probable Concentration (Wt%)
Aluminum (Al)	<0.5
Barium (Ba)	0.1-2.0
Calcium (Ca)	<0.1
Cadmium (Cd)	<0.2
Chromium (Cr)	<0.1
Copper (Cu)	<0.1
Iron (Fe)	<0.01
Hydrogen (H)	<0.1
Potassium (K)	0.05-0.5
Magnesium (Mg)	<0.1
Manganese (Mn)	<0.01
Nitrogen (N)	1-4
Sodium (Na)	<0.1
Nickel (Ni)	<0.05
Lead (Pb)	<0.2
R (as in Rare Earths)	<2.0
Silicon (Si)	<0.02

H5.8 Removal of Unit, Parts, Equipment, Piping, Containment Structure, and Other Ancillary Equipment

In general, equipment will not be removed from Hot Cells A through F. The hot cells contain tanks and equipment that were used during the encapsulation process (Table H1). Process and service piping is embedded in the concrete walls of each hot cell. Pipes connect the cells to each other, as well as to the hot pipe trench, transmitter rooms, AMU area, service gallery, operating gallery, manipulator repair shop, truck port, and Tank-100. Spare piping is provided between all areas and the hot cells. All tanks, equipment, and piping will remain in place.

Upon completion of the surveillance and maintenance mode in 1985, hot cell components not required for storing the capsules or managing the legacy contamination were shutdown. Shutdown involved equipment cleanout, equipment isolation or removal, jumper removal, nozzle blanking, cerium window refurbishment, and instrumentation deactivation.

Water sources to Hot Cells A through F have been isolated, and the manipulators have been removed from Hot Cell A through Hot Cell E. Manipulators will be removed from Hot Cell F prior to grouting. Remaining utility connections, including air piping and electrical connections, will be isolated from the hot cells prior to stabilization.

Section H5.4 provides further discussion of hot cell and K3 exhaust duct isolation activities that will be performed prior to stabilization.

H5.9 Identifying and Managing Waste Generated During Closure

Closure activities for WESF will result in the generation of three waste streams requiring management and disposal: excess grout generated during grouting activities, water collected from sawing and cutting, and hazardous debris resulting from demolition during final closure activities of the Hot Cell A through Hot Cell F DWMU.

H5.9.1 Excess Grout

Grout that does not meet specification requirements (Section H5.5.1), and grout remaining in a delivery truck when a particular grouting operation is completed, will most likely be generated during closure activities. This out-of-specification or excess grout (Section H5.5.1) is anticipated to be a nondangerous solid waste stream and will be managed and disposed at an approved disposal site as newly generated nondangerous waste.

H5.9.2 Grout Rinsate

A temporary washout pit will be set up near the grout pump and truck delivery location to contain rinsate from the delivery trucks and grout pump. The resulting grout rinsate wastewater stream is exempt per Ecology, 2012, *Categorical State Waste Discharge Permit Number ST0004511*, under exemption G12.F. The resulting rinsate wastewater is anticipated to be nondangerous.

H5.9.3 Water Collected from Sawing and Cutting

Water used to cool the blades and cutting wires will be collected using a vacuum system and reused throughout the cutting process. Once demolition activities are complete, the water will be containerized. The waste is anticipated to be nondangerous and is considered a newly generated solid waste stream. Until confirmation of the nondangerous waste designation, waste must be handled in accordance with all applicable requirements of WAC 173-303-170, "Requirements for Generators of Dangerous Waste," through WAC 173-303-230, "Special Conditions." The waste will be labeled, characterized in accordance with requirements in WAC 173-303-070, "Designation of Dangerous Waste," anticipated to be designated as nondangerous waste, stored, and transported to an appropriate disposal facility.

H5.9.4 Hazardous Debris

Hazardous debris generated from demolition will be packaged onsite at WESF and transported to ERDF. Hazardous debris includes, but is not limited to, the following types of wastes resulting from demolition of Hot Cells A through F:

- Concrete and associated debris
- Miscellaneous waste (e.g., rubber, glass, paper, PPE, cloth, plastic, and metal)
- Equipment and construction materials

The preferred management of hazardous debris resulting from demolition of the hot cells is in bulk form. Bulk waste will include monoliths and other debris. Monoliths will be loaded onto trailers for transportation to ERDF. Other miscellaneous bulk debris will be placed into bulk containers, such as roll-off boxes, for ERDF disposal. These transport trailers and bulk containers will be stored/staged in a suitable area in proximity to the hot cell area or may be staged for up to 90 days in another suitable location. Waste must be handled in accordance with all applicable requirements of WAC 173-303-170 through WAC 173-303-230, labeled, characterized in accordance with WAC 173-303-070 requirements, stored, and transported to an appropriate disposal facility. Bulk containers will be covered when waste is not being added or removed. Lightweight material (e.g., plastic and paper) will be bagged, if appropriate, prior to placement in the bulk container, to eliminate the potential for materials blowing out of the bulk container or truck.

H5.10 Identifying and Managing Contaminated Environmental Media

If contaminated environmental media (soil) is identified as a result of clean closure verification sampling activities (i.e., samples indicate contamination above clean closure standards), the nature and extent of contamination will be evaluated. Soil surrounding the sampling node location, which indicated contamination above clean closure levels, will be removed horizontally to the next adjacent node locations where contamination was not identified and to a depth of approximately 3 ft. (0.6 m). Contaminated soil will be removed using equipment capable of removing the quantity of material required to complete removal and clean close the DWMU. Following removal of contaminated soil, additional confirmatory sampling efforts will be conducted in accordance with the approved closure plan SAP (Section H5.12.1), at the same node location(s) where contamination was identified, to demonstrate clean closure levels.

If contaminated soil removal is required from the DWMU, it will be managed as a newly generated waste stream in accordance with WAC 173-303-610(5). Contaminated soil generated during the closure period must be properly disposed. The contaminated soil must be handled in accordance with all applicable requirements of WAC 173-303-170 through WAC 173-303-230, containerized, labeled, characterized in accordance with WAC 173-303-070 requirements, designated as a dangerous or nondangerous waste, stored, and transported to an appropriate disposal facility. It will be treated (if necessary) to meet LDRs in 40 CFR 268, incorporated into WAC 173-303-140(2)(a) by reference, then ultimately disposed. While undergoing final activities to clean close the WESF Operating Unit Group, the Permittees will provide a more detailed evaluation of how contaminated environmental media will be managed in accordance with Ecology clean closure guidance.

H5.11 Confirming Clean Closure

Final clean closure activities for the Hot Cell A through Hot Cell F DWMU will be performed in conjunction with removal of the entire WESF facility. Final clean closure will be accomplished through demolition practices (Section H5.6), to remove Hot Cells A through F, along with the remainder of WESF. Demolition of the remaining two DWMUs within WESF is to be detailed in the closure plans for those two DWMUs.

Once the removal of WESF is complete, confirmation sampling of soil underlying the Hot Cell A through Hot Cell F DWMU will be conducted in accordance with the SAP, detailed in Section H5.12, to confirm that soil unrestricted use cleanup standards (MTCA [WAC 173-340] Method B) have been achieved. If sample results indicate contamination above clean closure levels, contaminated soil will be removed and managed in accordance with Section H5.10. Once analytical results confirm clean closure levels of the target analytes, clean closure certification will be prepared in accordance with Section H5.14.

H5.11.1 Hot Cell A through Hot Cell F Closure Process

Following completion of the initial closure activities described in this plan, the Hot Cell A through Hot Cell F DWMU will be in an extended closure period until final closure activities can take place (Section H6). Final closure activities for the Hot Cell A through Hot Cell F DWMU will be coordinated with final closure of the pool cell and Hot Cell G DWMUs. Final closure activities will occur after the cesium and strontium capsules have been removed from WESF.

When final closure activities for the Hot Cells A through Hot Cell F DWMU are ready to start, mobilization will begin to remove the grouted hot cells (Section H5.6.2). Disassembly of the hot cells is planned and will be performed with the following considerations:

- Hot cells will be cut into monoliths small enough to be safely transported using available means.
- Demolition of the hot cells is planned to avoid cutting through the Hot Cell B/Hot Cell C waste storage locations.
- Contamination control methods will be employed to avoid the spread of radiological contamination or mixed wastes to the environment.

A list of drawings showing the hot cell configuration will be maintained in the operating record to assist in identifying appropriate cut locations.

H5.12 Sampling and Analysis Plan and Constituents to be Analyzed

The SAP summarizes the sampling design used and associated assumptions based on the knowledge of the Hot Cell A through Hot Cell F DWMU. The sampling design includes input parameters that will be used to determine the number and location of samples once demolition of WESF is complete.

Sampling of the underlying soil for Hot Cells A through F will be conducted to confirm that soil unrestricted use cleanup standards (MTCA [WAC 173-340] Method B) have been achieved. If sample results indicate contamination above clean closure levels, the contaminated soil will be removed and managed in accordance with Section H5.10.

Due to the legacy radiological contamination within the hot cells, personnel entrance into the hot cells is not feasible. Therefore, sampling of the remaining equipment, classified as hazardous debris, and the four trays and two pipes, to demonstrate compliance with the concentration based treatment standard in 40 CFR 268.40, "Applicability of Treatment Standards," will not be performed under the closure activities outlined in this closure plan. The treatability variance (15-AMRP-0070) establishes the alternative performance based treatment standard of macroencapsulation, as identified in 40 CFR 268.45.

H5.12.1 Sampling and Analysis Plan

Sampling and analysis of the Hot Cell A through Hot Cell F DWMU underlying soil will be conducted to confirm that clean closure levels have been achieved. All sampling and analysis will be performed in accordance with the sampling and quality standards established in this closure SAP. The closure SAP details sampling and analysis procedures in accordance with SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B*; ASTM International (formerly American Society for Testing and Materials) *Annual Book of ASTM Standards*; and applicable U.S. Environmental Protection Agency (EPA) and Ecology guidance. Sampling and analysis activities will meet applicable requirements of SW-846, ASTM International standards, EPA approved methods, and

DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Document* (HASQARD), at the time of closure. This SAP was also developed using Ecology Publication 94-111, *Guidance for Clean Closure of Dangerous Waste Units and Facilities*, Section 7.0, "Sampling and Analysis for Clean Closure," and EPA/240/R-02/005, *Guidance on Choosing a Sampling Design for Environmental Data Collection* (EPA QA/G-5S).

H5.12.2 Target Analytes

Analysis of cesium/strontium salts identified possible dangerous waste designations of barium (D005), cadmium (D006), chromium (D007), lead (D008), and silver (D011). Section H5.7 provides analytical data of cesium/strontium salts. Table H9 details the target analytes and associated waste codes.

Table H9. Target Analyte List

Target Analyte (Waste Code)	Chemical Abstracts Service Number
Barium (D005)	7440-39-3
Cadmium (D006)	7440-43-9
Chromium (Hexavalent) (D007)	18540-29-9
Lead (D008)	7439-92-1
Silver (D011)	7440-22-4

H5.12.3 Hot Cell A through Hot Cell F SAP Schedule

Confirmation closure sampling and analysis will be performed in accordance with the closure plan schedule in Section H6.

H5.12.4 Hot Cell A through Hot Cell F Project Management

The following subsections address project management and ensure that the project has defined goals, that the participants understand the goals and the approaches used, and that the planned outputs are appropriately documented. Project management roles and responsibilities discussed in this section apply to the major activities covered under the SAP.

The Permittee is responsible for planning, coordinating, sampling, preparing, packaging, and shipping samples to the laboratory. The project organization (regarding sampling and characterization) is described in the following subsections and shown graphically in Figure H17. The Project Manager maintains a list of individuals or organizations as points of contact for each functional element in Figure H17.

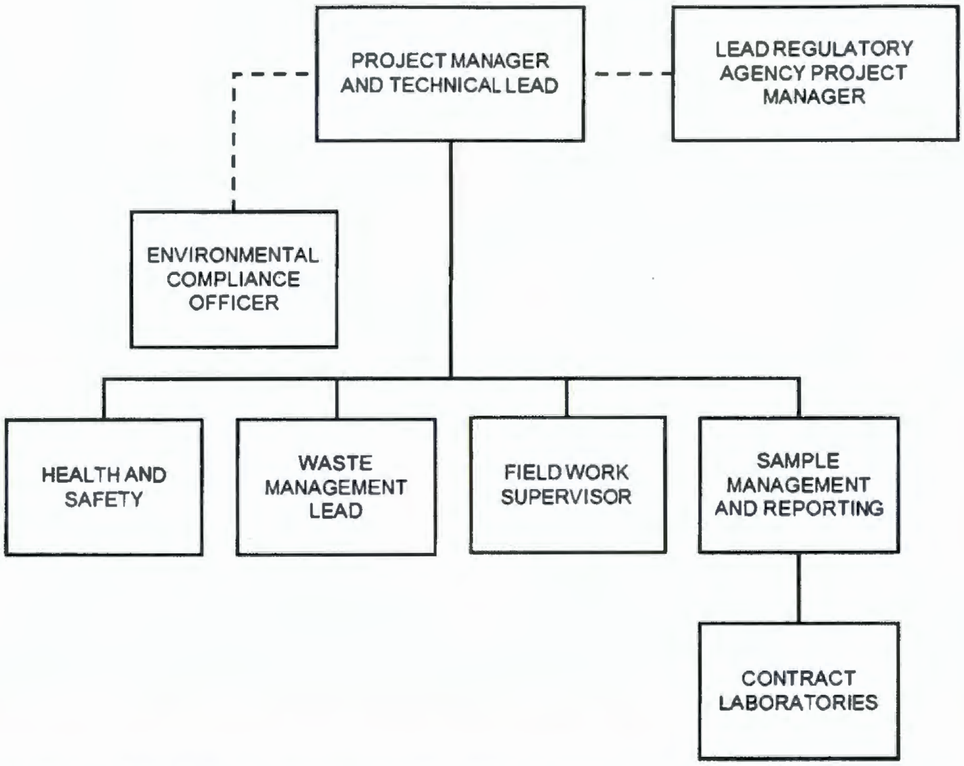


Figure H17. Hot Cell A through Hot Cell F Sampling and Analysis Plan Project Organization

The project has several key positions, including the following:

- **Lead Regulatory Agency Project Manager:** Ecology has assigned Project Managers responsible for closure oversight.
- **Project Manager:** The Project Manager provides oversight for activities and coordinates with DOE-RL, EPA, Ecology, and contract management. The Project Manager (or designee) for the Hot Cell A through Hot Cell F DWMU closure sampling is responsible for direct management of sampling documents and requirements, field activities, and subcontracted tasks. The Project Manager is responsible for ensuring that project personnel are working to the current version of the SAP. The Project Manager works closely with QA, Health and Safety, and the Field Work Supervisor (FWS) to integrate these and other lead disciplines in planning and implementing the work scope. The Project Manager also coordinates with DOE-RL and the primary contractor management on all sampling activities. The Project Manager supports DOE-RL in coordinating sampling activities with the regulators.
- **Environmental Compliance and Quality Assurance:** The Environmental Compliance Officer provides technical oversight, direction, and acceptance of project and subcontracted environmental work and develops appropriate mitigation measures with a goal of minimizing adverse environmental impacts.
- **Health and Safety:** The Health and Safety organization is responsible for coordinating industrial safety and health support within the project, as carried out through health and safety plans, job hazard analyses, and other pertinent safety documents required by federal regulation or by internal primary contractor work requirements.
- **Sample Management and Reporting:** The Permittee's sampling organization coordinates field sampling as well as laboratory analytical work, ensuring that laboratories conform to Hanford Facility internal laboratory QA requirements (or their equivalent), as approved by

DOE-RL, EPA, and Ecology. The sampling organization receives the analytical data from the laboratories, performs data entry into the Hanford Environmental Information System (HEIS) database, and arranges for data validation. The sampling organization is responsible for informing the Project Manager of any issues reported by the analytical laboratory.

- **Contract Laboratories:** The contract laboratories analyze samples in accordance with established procedures and provide necessary sample reports and explanation of results in support of data validation.
- **Waste Management:** The Waste Management organization communicates policies and protocols and ensures project compliance for storage, transportation, disposal, and waste tracking.
- **Field Work Supervisor:** The FWS is responsible for planning and coordinating field sampling resources. The FWS ensures that samplers are appropriately trained and available. Additional related responsibilities include ensuring that the sampling design is understood and can be performed as specified.

H5.12.5 Sampling Design

The primary purpose of sampling the underlying soil of the Hot Cell A through Hot Cell F DWMU is to determine if analytical data values exceed MTCA (WAC 173-340) Method B clean closure performance standards.

This SAP utilized Ecology Publication 94-111, Section 7.0, "*Sampling and Analysis for Clean Closure*," to determine the type of sampling design that will be utilized to demonstrate clean closure. When designing the sampling plan, both focused and area wide (grid) sampling methods were considered. Ecology Publication 94-111, Section 7.2.1, identifies area wide sampling as appropriate when the spatial distribution of contamination at or from the closure unit is uncertain. Ecology Publication 94-111, Section 7.3, "*Sampling to Determine or Confirm Clean Closure*," identifies the area wide sampling approach as generally appropriate to determine or confirm that clean closure levels are achieved. Focused sampling, as identified in Section 7.2.2 of Ecology Publication 94-111, is selective sampling of areas where contamination is expected or releases have been documented. Based on information provided in Section H5.4 for contamination in Hot Cells D and E, judgmental (focused) sampling of the soil will take place in the soil underlying those cells. Drawings in the operating record will be used to identify the location of underlying focused sampling. The remainder of the Hot Cell A through Hot Cell F DWMU underlying soil will include the area wide sampling approach. Both area wide and focused sampling are further defined in the following paragraphs.

Area-Wide (Grid) Sampling. Samples are collected at regularly spaced intervals over space or time. An initial location or time is chosen at random, and the remaining sampling locations are defined so that locations are at regular intervals over an area (grid). Grid sampling is used to search for hot spots and infer means, percentiles, or other parameters. It is useful for estimating spatial patterns or trends over time. This design provides a practical method for designating sample locations and ensures uniform coverage of a site, unit, or process.

Judgmental (Focused) Sampling. Selection of sampling units (i.e., the number and location and/or timing of collecting samples) is based on knowledge of the feature or condition under investigation and professional judgment. Focused sampling is distinguished from probability based sampling in that inferences are based on professional judgment, not statistical scientific theory. Therefore, conclusions about the target population are limited and depend entirely on the validity and accuracy of professional judgment. Probabilistic statements about parameters are not possible.

Once WESF has been removed, the remaining area will be measured, and the dimensions will be documented. Using measurements for the underlying soil area, the quantity and location of area wide samples will be determined utilizing the Visual Sample Plan (VSP) software. VSP is a tool, used throughout Washington State and nationally, that statistically determines the quantity of samples required to accept or reject the null hypothesis. Parameters specific to the Hot Cell A through Hot Cell F DWMU will be used as input to VSP for purposes of developing the sampling plan for this closure plan.

Both parametric and nonparametric equations rely on assumptions about the data population. Typically, however, nonparametric equations require fewer assumptions and allow for more uncertainty about the distribution of data. Alternatively, if the parametric assumptions are valid, the required number of samples is usually less than if a nonparametric equation was used. For Hot Cells A through F, data assumptions are largely based on information obtained from a grouping of similar waste sites. Parameters from the 200-MG-1 waste sites were approved by Ecology in the SAP (DOE/RL-2009-60, *Sampling and Analysis Plan for Selected 200-MG-1 Operable Unit Waste Sites*), evaluated, deemed appropriate, and utilized as input parameters for Hot Cells A through F. VSP parameter inputs, and the basis for those inputs, are detailed in Table H10.

The decision rule for demonstrating compliance with the MTCA (WAC 173-340) Method B clean closure level has three parts:

- The upper 95 percent confidence limit on the true data mean must be less than the MTCA B clean closure level.
- No sample concentration can be more than twice the cleanup level.
- Less than 10 percent of the samples can exceed the cleanup level.

For the purpose of utilizing VSP software, the null hypothesis will be that the site is considered contaminated until proven clean, and it will be tested by comparing a site mean to a fixed threshold. However, in addition to ensuring the site mean does not exceed the MTCA B clean closure performance standards, data will be evaluated to ensure that less than 10 percent of the individual values exceed MTCA (WAC 173-340) Method B clean closure performance standards and that no values are more than twice the cleanup level.

Area-wide sample locations will be determined using the area-wide grid with a random start sampling method run in VSP. Statistical analysis of systematically collected data are valid if a random start to the grid is used. The first node location will be chosen at random by VSP, and subsequent sample locations will be assigned by VSP using a grid sampling layout. The dimensions of the sample area (area under Hot Cell A through Hot Cell F DWMU once removed or if combined, under the three WESF DWMUs) will be entered into VSP to determine the locations of samples. The triangular grid sampling layout will provide an even distribution of sample locations over the Hot Cell A through Hot Cell F DWMU. The samples will be taken from the node locations indicated by VSP and will be assigned sample location identifications and sample numbers using HEIS.

H5.12.6 Sampling Methods and Handling

A grab sample matrix will consist of soil collected in EPA Level 1 precleaned sampling containers meeting the specifications in EPA 540/R-93/051, *Specifications and Guidance for Contaminant-Free Sample Containers*, taken at a depth of 0 to 15.24 cm (0 to 6 in.) below ground surface. For the purpose of this SAP, ground surface is defined as the exposed surface layer once the WESF structure has been removed. Subsurface sampling was evaluated however, there have been no documented releases of free liquid waste to the underlying soil so subsurface sampling was not deemed necessary.

Table H10. Visual Sample Plan Parameter Inputs

Parameter	Value	Basis
Primary Objective of the Sampling Design	Compare a site mean or median to a fixed threshold	Reject the null hypothesis.
Type of Sampling Design	Nonparametric	Data are not assumed to be normally distributed.
Working Null Hypothesis	The mean value at the site exceeds the threshold (MTCA B closure performance standards)	The null hypothesis assumes that the site is dirty requiring the sampling and analysis to demonstrate through statistical analysis that the site is clean.
Area Wide Grid Sampling Pattern	Triangular (assumed)	A triangular pattern will most likely provide an even distribution of sample locations over the Hot Cell A through Hot Cell F DWMU.
Standard Deviation (S)	0.45	This is the assumed standard deviation value relative to a unit action level for the sampling area. The value of 0.45 is conservative, based on consideration of past verification sampling. MARSSIM suggests 0.30 as a starting point; however, 0.45 has been selected to be more conservative. (Number of samples calculated increases with higher standard deviation values relative to a unit action level.)
Delta (Δ)	0.40	This is the width of the gray region. It is a user defined value relative to a unit action level. The value of 0.40 balances unnecessary remediation cost with sampling cost.
Alpha (α)	5%	This is the acceptable error of deciding a dirty site is clean when the true mean is equal to the action level. It is a maximum error rate since dirty sites with a true mean above the action level will be easier to detect. A value of 5% was chosen as a practical balance between health risks and sampling cost.
Beta (β)	20%	This is the acceptable error of deciding a clean site is dirty when the true mean is at the lower bound of the gray region. A value of 20% was chosen during the data quality objectives process as a practical balance between unnecessary remediation cost and sampling cost.
MARSSIM Sampling Overage	20%	MARSSIM suggests that the number of samples should be increased by at least 20% to account for missing or unusable data and uncertainty in the calculated value of *n*.

Reference: EPA 402-R-97-016, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*.

Once the soil is sampled, the sampled media will be screened to remove material larger than approximately 2 mm (0.08 in.) in diameter. Removal of material larger than approximately 2 mm (0.08 in.) in diameter will allow for a larger surface area to volume ratio and be more likely to identify any potential contamination in the sample and will be in compliance with WAC 173-340-740(7)(a), "Unrestricted Land Use Soil Cleanup Standards." Grab samples will be collected into containers at the chosen node sample locations. To ensure sample and data usability, sampling will be performed in accordance with established sampling practices, procedures, and requirements pertaining to sample collection, collection equipment, and sample handling. Soil sampling includes the following activities:

- Review of sampling request documentation
- Sample container and equipment preparation
- Field walkdown of sample area (includes marking sample locations)
- Sample collection and labeling
- Sample packaging, transporting, and shipping

Sample container, preservation, and holding time requirements are specified in Table H11 for soil samples. These requirements are in accordance with the analytical method specified. The final container type and volumes will be identified on the Sampling Authorization Form (SAF) and chain-of-custody form.

Table H11. Preservation, Container, and Holding Time Requirements for Soil Samples

Method	Analysis/Analytes	Preservation Requirement	Holding Time	Bottle Type	Minimum Sample Size
EPA 6010	Metals by ICP-OES	Cool ≤6°C	180 days	G/P	20 g
EPA 7196	Chromium (Hexavalent)	Cool ≤6°C	30 days prior to extraction; 24 hours after extraction	G/P	20 g

Note: For the four-digit EPA methods, see SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update V.*

EPA	= U.S. Environmental Protection Agency	ICP	= inductively coupled plasma
		OES	= optical emission spectrometry
G	= glass	P	= plastic

To prevent potential contamination of the samples, decontaminated equipment will be used for each sampling activity.

EPA Level 1 precleaned sample containers will be used for samples collected for chemical analysis. Container sizes may vary depending on laboratory-specific volumes/requirements for meeting analytical detection limits.

The sample location, depth, and corresponding HEIS numbers will be documented in the sampler's field logbook. A custody seal (e.g., evidence tape) will be affixed to each sample container and/or sample collection package in such a way as to indicate potential tampering.

Each sample container will be labeled with the following information on firmly affixed, water resistant labels:

- SAF and form number
- HEIS number
- Sample collection date and time

- Sampler identification
- Analysis required
- Preservation method (if applicable)

Sample records must include the following information:

- Analysis required
- Sample location
- Matrix (e.g., water or soil)

Sample custody will be maintained in accordance with existing Hanford Facility protocols to ensure maintenance of sample integrity throughout the analytical process. Chain-of-custody protocols will be followed throughout sample collection, transfer, analysis, and disposal to ensure that sample integrity is maintained.

All waste (including unexpected waste) generated by sampling activities will be containerized, labeled, characterized, designated as a dangerous or non-dangerous waste, stored, and transported offsite where it will be treated (if necessary) to meet the LDRs in 40 CFR 268, incorporated into WAC 173-303-140(2)(a) by reference, then ultimately disposed of in an approved waste disposal facility in accordance with WAC 173-303-610(5).

H5.12.7 Analytical Methods

All analyses and testing will be performed consistent with this closure plan, laboratory analytical procedures, and HASQARD (DOE/RL-96-68). Accreditation of environmental laboratories ensures a lab is capable of providing accurate and defensible analytical data. The selected laboratory must be accredited by Ecology for the parameters and methods used. The approved laboratory must ensure that data satisfy all the project specific data acceptance criteria in this SAP. If a target analyte is detected at or above the clean closure level but less than the practical quantitation limit of the analytical method, Ecology will be notified and alternatives will be discussed to demonstrate clean closure levels.

Analytical methods and performance requirements associated with the target analytes are outlined in Table H12.

H5.12.8 Quality Control

Quality control (QC) procedures must be followed in the field and laboratory to ensure that reliable data are obtained. Field QC samples will be collected to evaluate the potential for cross-contamination and provide information pertinent to field sampling variability. Field QC sampling will include:

- Collection of full trip blank
- Field transfer blank
- Equipment rinsate blank
- Field duplicate
- Field split samples

Laboratory QC samples estimate the precision and bias of the analytical data. Field and laboratory QC samples are summarized in Table H13.

A data quality assessment (DQA) will be performed utilizing the guidance in EPA/600/R-96/084, *Guidance for Data Quality Assessment: Practical Methods for Data Analysis* (EPA QA/G-9), and implementing the specific requirements in Section H5.12.9 through Section H5.12.11.

Data verification, data validation, and DQA will include both primary samples and QC samples.

H5.12.9 Data Verification

Analytical results will be received from the laboratory, loaded into a database (e.g., HEIS), and verified. Verification includes, but is not limited to, the following activities:

- Amount of data requested matches the amount of data received (number of samples for requested methods of analytes).
- Procedures/methods are used.
- Documentation/deliverables are complete.
- Hard copy and electronic versions of the data are identical.
- Data seem reasonable based on analytical methodologies.

H5.12.10 Data Validation

Data validation is performed by a third party. The laboratory supplies contract laboratory program (CLP) equivalent analytical data packages intended to support data validation by the third party. The laboratory submits data packages that are supported by quality control test results and raw data.

Controls are in place to preserve the data sent to the validators and allow only additions to be made, not changes to the raw data.

The format and requirements for data validation activities are based upon the most current version of USEPA-540-R-08-01, *National Functional Guidelines for Superfund Organic Methods Data Review* (OSWER 9240.1-48), and, USEPA-540-R-10-011, *National Functional Guidelines for Inorganic Superfund Data Review* (OSWER 9240.1-51). As defined by the validation guidelines, 5 percent of the results will undergo Level C validation.

In accordance with Table H10, at least 80 percent of the sample results must be acceptable (data not rejected during the data validation process).

H5.12.11 Verification of VSP Input Parameters

Analytical data will be entered back into VSP software. If all the analytical data for a particular analyte is nondetect, verification of VSP input parameters will not be required for that analyte. VSP software uses the analytical data to determine if the user input parameters were estimated appropriately. Once analytical data are entered into VSP, the software will calculate the true standard deviation and if the null hypothesis can be rejected. If the calculated standard deviation is smaller than the estimated user input standard deviation, no additional sampling will be required. If the calculated standard deviation is larger than the estimated standard deviation, additional sampling may be required. Comparison of the maximum data value for each analyte to the clean closure standards will ensure all individual analytes are below the action levels. Verification of the null hypothesis through VSP will determine if the mean value of the site analytical data supports rejection of the null hypothesis (Section H4.1).

H5.12.12 Documents and Records

The Project Manager is responsible for ensuring that the current version of the SAP is being used and providing any updates to field personnel. The current version of the SAP is maintained by Ecology. Changes to the SAP affecting the data will be submitted as a permit modification in accordance with WAC 173-303-610(3)(b) by the permittees to Ecology.

Table H12. Soil Analytical Performance Requirements

Chemical Abstracts Service Number	Analyte[a]	Analytical Method	Closure Performance Standard (mg/kg)		Practical Quantitation Limit (mg/kg)	Accuracy Req't (% Recovery)[c]	Precision Req't (RPD)[c]
			Carcinogen	Noncarcinogen			
7440-39-3	Barium	SW-846 Method 6010	--	1.60E+04	2.00E+00	±30	≤30
7440-43-9	Cadmium	SW-846 Method 6010	--	8.00E+01	5.00E-01	±30	≤30
18540-29-9	Chromium (Hexavalent)	SW-846 Method 7196	--	2.40E+02	1.00E+00	±30	≤30
7439-92-1	Lead[b]	SW-846 Method 6010	--	2.50E+02	5.00E+00	±30	≤30
7440-22-4	Silver	SW-846 Method 6010	--	4.00E+02	1.00E+00	±30	≤30

a. Unless otherwise noted, closure performance standards are the numeric cleanup levels calculated using unrestricted use exposure assumptions according to MTCA (WAC 173-340) Method B (unrestricted use standards). Where both carcinogen and noncarcinogen performance standards are available, the most conservative value will be used.

b. Closure performance standards are the numeric cleanup levels calculated using unrestricted use exposure assumptions according to MTCA (WAC 173-340) Method A (unrestricted use standards). MTCA Method A values were used when MTCA Method B values were not available.

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

CAS	=	chemical abstract service	Req't	=	requirement
CFC	=	chlorinated fluorocarbon	WAC	=	Washington Administrative Code
MTCA	=	Model Toxics Control Act			

Table H13. Project Quality Control Sampling Summary

Quality Control Sample Type	Frequency	Characteristics Evaluated
Field Quality Control		
Trip Blanks	One per 20 samples per media sampled One per cooler for VOCs	Contamination from containers or transportation
Equipment Rinsate Blanks	If only disposable equipment is used, then an equipment blank is not required Otherwise, one per 20 samples per analytical method per media sampled, or one per day[a]	Adequacy of sampling equipment decontamination and contamination from non-dedicated equipment
Field Duplicates	One per batch[g], 20 samples maximum of each media sampled (soil samples)	Precision, including sampling and analytical variability
Field Split Samples	When needed, the minimum is one per analytical method, per media sampled, for analyses performed where detection limit and precision and accuracy criteria have been defined in the Performance Requirements tables[h]	Precision, including sampling, analytical, and interlaboratory
Laboratory Quality Control		
Method Blanks	1 per batch[g]	Laboratory contamination
Lab Duplicates	[b]	Laboratory reproducibility and precision
Matrix Spikes	[b]	Matrix effect/laboratory accuracy
Matrix Spike Duplicates	[b]	Laboratory reproducibility, accuracy, and precision
Surrogates	[b]	Recovery/yield
Tracers	[b]	Recovery/yield
Laboratory Control Samples	1 per batch[g]	Evaluate laboratory accuracy
Performance Evaluation Programs[c]	Annual	Evaluate laboratory accuracy
Double-Blind Standards	Quarterly[d]	Evaluate laboratory accuracy
Audit/Assessment	Annually[e] or every 3 years[f]	Evaluate overall laboratory performance and operations

Table H13. Project Quality Control Sampling Summary

Quality Control Sample Type	Frequency	Characteristics Evaluated

a. Whenever a new type of nondedicated equipment is used, an equipment blank shall be collected every time sampling occurs until it can be shown that less frequent collection of equipment blanks is adequate to monitor the decontamination procedure for the nondedicated equipment.

b. As defined in the laboratory contract or quality assurance plan and/or analysis procedures.

c. Nationally recognized program, such as DOE Mixed Analyte Performance Evaluation Program or Environmental Resource Associates.

d. Soil matrix double-blind standards are submitted by request of Analytical Services.

e. DOE Quality Systems for Analytical Services requires annual audit of commercial laboratories.

f. DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Document* (HASQARD), does not define a frequency for assessment of onsite laboratories. Three year evaluated supplier list requirement is typically applied.

g. Batching across projects is allowing for similar matrices.

h. Field split samples are generally used for interlaboratory comparison as periodic checks in large sample sets or when a particular method or laboratory has been producing unexpected results. Field splits are not required for small, discrete sample sets undergoing routing analyses using methods for which splits have been submitted as part of larger sample sets.

DOE = U.S. Department of Energy

Logbooks are required for field activities. A logbook must be identified with a unique project name and number. The individual(s) responsible for logbooks will be identified in the front of the logbook, and only authorized persons may make entries in logbooks. Logbooks will be signed by the field manager, supervisor, cognizant scientist/engineer, or other responsible individual. Logbooks will be permanently bound, waterproof, and ruled with sequentially numbered pages. Pages will not be removed from logbooks for any reason. Entries will be made in indelible ink. Corrections will be made by marking through the erroneous data with a single line, entering the correct data, and initialing and dating the changes.

The Project Manager is responsible for ensuring that a project file is properly maintained. The project file will contain the records or references to their storage locations. The following items will be included in the project file:

- Field logbooks or operational records
- Data forms
- Global positioning system data
- Chain-of-custody forms
- Sample receipt records
- Inspection or assessment reports and corrective action reports
- Interim progress reports
- Final reports
- Laboratory data packages
- Verification and validation reports

The laboratory is responsible for maintaining, and having available upon request, the following items:

- Analytical logbooks
- Raw data and QC sample records
- Standard reference material and/or proficiency test sample data
- Instrument calibration information

Records may be stored in either electronic or hard copy format. Documentation and records, regardless of medium or format, are controlled in accordance with internal work requirements and processes to ensure the accuracy and retrievability of stored records. Records generated during closure will be maintained in the facility operating record for a minimum of 5 years after the clean closure certification has been accepted by Ecology.

H5.12.13 Sampling and Analysis Requirements to Address Removal of Contaminated Soil

In the event that sample results based on the MTCA (WAC 173-340) Method B three-part test (Section H5.12.5) indicate contamination above clean closure levels, the contaminated soil will be removed in accordance with Section H5.10. Following removal of contaminated soil, additional samples will be taken at the same grid location as identified by VSP. Additional focused sampling may be added in areas where contamination is identified (Section H5.12.5). Additional focused samples will be documented, as required in Section H5.12.12, and provided with the closure certification upon request by Ecology. These samples will be analyzed in accordance with the methods specified in Table H12, with accompanying QC samples as discussed in Section H5.12.8.

H5.12.14 Revisions to the Sampling and Analysis Plan and Constituents to Be Analyzed

If changes to the SAP are necessary due to unexpected events during closure that will affect sampling, a revision to this SAP will be submitted no later than 30 days after the unexpected event as a permit modification as required in WAC 173-303-610(3)(b)(iii) and WAC 173-303-830, "Permit Changes."

H5.13 Role of the Independent, Qualified, Registered Professional Engineer

An independent, qualified, registered professional engineer (IQRPE) will be retained to provide certification of the clean closure activities described in this closure plan, as required by WAC 173-303-610(6). The engineer will be responsible for reviewing completed field activities and documents associated with these initial closure activities. At a minimum, field activities and documents reviewed for certification of these closure plan activities would include the following:

- Review of the final design and grout testing plan
- Review of project documentation created during initial closure activities
- Review of documentation or inspection of the stabilized Hot Cells A through F
- Review of the grout testing report
- Observe and/or review demolition activities
- Observe and/or review hazardous waste disposal documentation
- Review sampling procedures and results
- Observe and/or review sampling activities
- Observe and/or review contaminated environmental media removal (as applicable)
- Verify that locations of samples are as specified in the SAP

The engineer will record observations and reviews in a written report that will be retained in the operating record. The resulting report will be used to support the clean closure certification of the Hot Cell A through Hot Cell F DWMU. Final clean closure certification will be conducted after closure activities are completed for the Hot Cell A through Hot Cell F DWMU and in coordination with closure certification of the Pool Cells and Hot Cell G DWMUs.

Should unanticipated minor deviations from the approved closure plan occur during stabilization activities, Ecology will be promptly notified. Ecology will determine if a permit modification is required to address the changes to the closure plan. A description of minor deviations will be included in the status report submitted to Ecology within one month of completing stabilization activities.

H5.14 Certification of Clean Closure

In accordance with WAC 173-303-610(6), within 60 days of completion of the final closure activities for the Hot Cell A through Hot Cell F DWMU, certification that closure activities have been completed in accordance with the specifications in the approved closure plan will be submitted to Ecology by registered mail. The certification will be signed by the owner or operator and signed and stamped by an IQRPE.

Upon request by Ecology, the following information will be submitted to support closure certification:

- All field notes and photographs related to closure activities.
- Description of any minor deviations from the approved closure plan and justification for these deviations.
- Documentation of the final disposition of all dangerous wastes and dangerous waste residues (if applicable), including contaminated environmental media.
- Verification of hot cell isolation activities.
- Verification that grouting of Hot Cells A through F occurred as planned in the described in work documents.
- Verification of demolition.
- All laboratory and/or field data, including sampling procedures, sampling locations, QA/QC samples, and chain-of-custody procedures for all samples and measurements, including samples and measurements taken to determine or confirm clean closure.
- Summary report that identifies and describes the data reviewed by the IQRPE and tabulates the analytical results of samples taken to determine and confirm clean closure.
- Description of what the DWMU area looks like at completion of closure, including a description of the former unit after closure.
- Additional data, as required, by final clean closure of the Pool Cells and Hot Cell G DWMU closure plans.

The final clean closure activity for the Hot Cell A through Hot Cell F DWMU will be accomplished through removal of the DWMU, which will be addressed in the closure plan for the other two operating DWMUs. The Hot Cells A through Hot Cell F DWMU clean closure certification will be provided in conjunction with clean closure certification of the Pool Cells and Hot Cell G DWMU and the entire WESF OUG.

H5.15 Conditions that Will Be Achieved When Closure is Complete

Upon completion of the initial and final closure activities outlined within this closure plan, the Hot Cell A through Hot Cell F DWMU will be isolated and stabilized with grout, demolished, removed, and disposed of at ERDF.

Final clean closure conditions will be demonstrated in conjunction with the other two operating DWMU closures.

H6 CLOSURE SCHEDULE AND TIME FRAME

Final clean closure activities will take place in conjunction with final closure for the WESF Operating Unit Group. Stabilization via grout of Hot Cells A through F is a necessary step to prevent threats to HHE and support final closure of the WESF Operating Unit Group.

The Hanford Facility has an ongoing need to store cesium and strontium capsules safely and compliantly until a disposal alternative is available. While efforts are underway to implement an alternative method, it is anticipated to be a number of years before the capsules can be safely transferred from WESF to an alternative storage.

Continued storage of WESF capsules requires the Pool Cells and Hot Cell G DWMUs to remain operational until alternative storage capability is available.

Continued capsule storage will necessitate an extension to the 180 days to complete final clean closure activities for the Hot Cell A through Hot Cell F DWMU required in WAC 173-303-610(4)(b). This extension is being requested in accordance with WAC 173-303-610(4)(b)(i).

Hot Cells A through F contain a significant amount of legacy radioactive contamination. Stabilization of this contamination with grout will eliminate the potential for a release of this contamination while the cesium and strontium capsules are stored in the WESF pool cells. Additionally, stabilization of the legacy contamination will eliminate the potential for a release of dangerous waste constituents to the environment or to workers when the capsules are transferred out of WESF.

Approval of this closure plan will grant the Hanford Facility an extended closure period for performance of final clean closure activities, in accordance with WAC 173-303-610(4)(b), and a separate extension request will not be filed.

During this extended closure period, the Hanford Facility will comply with all applicable requirements of the permit. Additionally, the stabilized hot cells will be maintained in a manner that prevents threats to HHE and monitored through routine radiation surveillances, using radiation as an indication of contamination outside the stabilized Hot Cell A through Hot Cell F DWMU.

Closure activities and extended closure period expected durations are outlined in the closure activities schedule for the Hot Cell A through Hot Cell F (Table H14).

Table H14. Waste Encapsulation and Stabilization Facility Hot Cell A through Hot Cell F Closure Activities Schedule

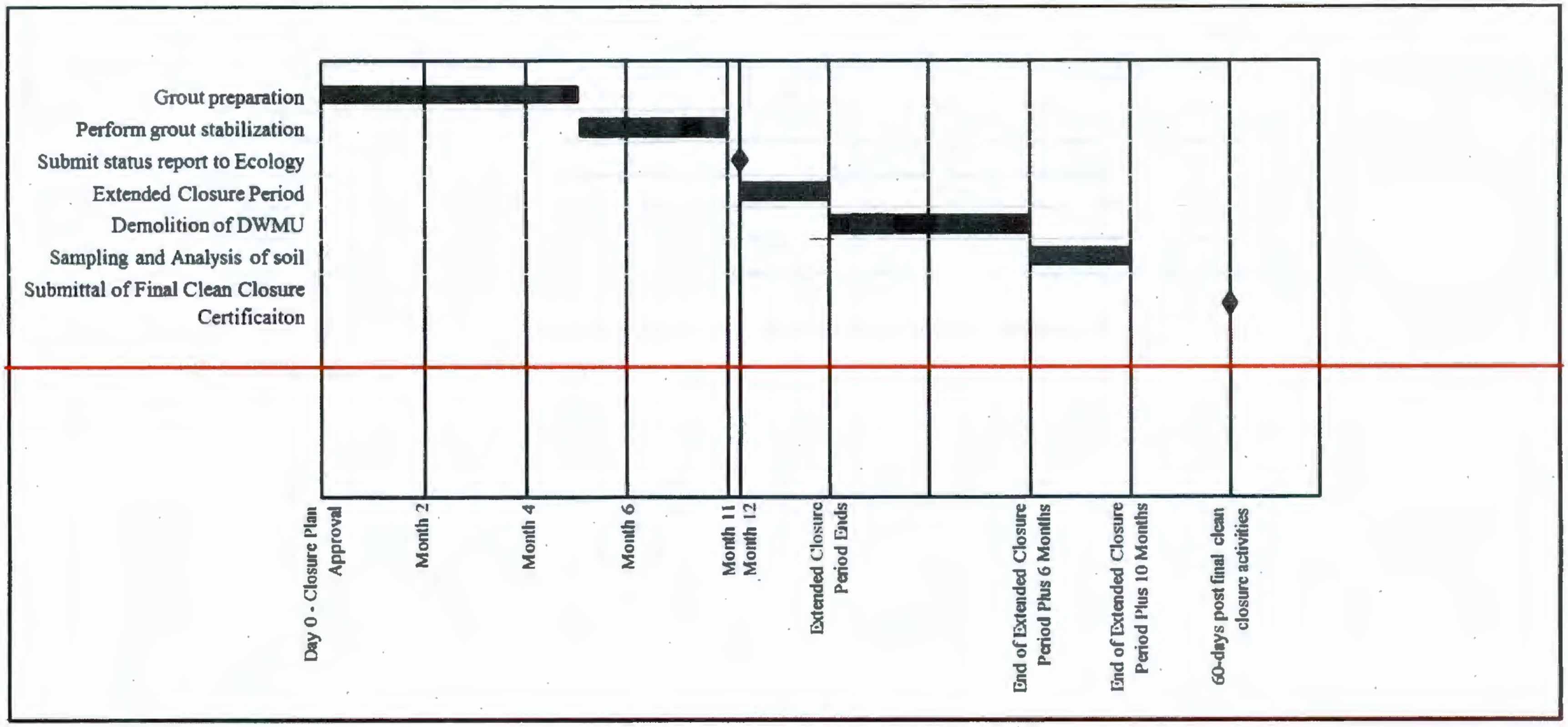
Closure Activity Description		Expected Duration
Primary Activity	**Secondary Activity**	**Duration**
Preclosure Preparation Activities		
Prepare WESF • Isolating equipment that connects to the K3 exhaust system ducting • Isolating utility lines that remain connected to the hot cells. These utilities include air and electrical services	Isolate equipment that connects the K3 exhaust system ducting	N/A
	Isolate utility lines that remain connected to the hot cells, including air and electrical services	
	Install covers over/seal viewing windows, manipulator ports, and pass-throughs (drain window oil prior to cover installation)	
	Pour concrete block over Hot Cell D/E hot spot in service gallery	
Closure Activities		
Grout preparation	Core Drilling into DWMU	5 months
Perform grout stabilization	Grout K3 Filter Pit	126 months
	Grout K3 Duct and Trench	
	Grout Hot Pipe Trench	

Table H14. Waste Encapsulation and Stabilization Facility Hot Cell A through Hot Cell F Closure Activities Schedule

Closure Activity Description		Expected Duration
	Grout Hot Cell A through Hot Cell F	
	Grout Hot Cell A Air Lock	
Submit to Ecology a status report of the Hot Cell A through Hot Cell F stabilization project	N/A	1 month after stabilization complete
Extended Closure Activities		
Extended closure period to coincide with clean closure of the Pool Cells and Hot Cell G DWMU activities	Continued surveillances and inspections	To be determined
Demolition of the Hot Cell A through Hot Cell F DWMU	Equipment mobilization	10 days
	Demolition and removal of waste generated	6 months
Sampling and analysis of underlying soil (includes data verification and data validation)	N/A	4 months
Closure Activities Complete		
Submit final clean closure certification	N/A	60 days after final clean closure activities complete
N/A = not applicable		

H7 COST OF CLOSURE

A detailed written estimate outlining updated projections of anticipated closure costs for the Hanford Facility TSD units having final status is not required per Permit Condition II.H.

1 
Grout preparation
Perform grout stabilization
Submit status report to Ecology
Extended Closure Period
Demolition of DWMU
Sampling and Analysis of soil
Submittal of Final Clean Closure Certificaiton
Day 0 - Closure Plan Approval
Month 2
Month 4
Month 6
Month 11
Month 12
Extended Closure Period Ends
End of Extended Closure Period Plus 6 Months
End of Extended Closure Period Plus 10 Months
60-days post final clean closure activities

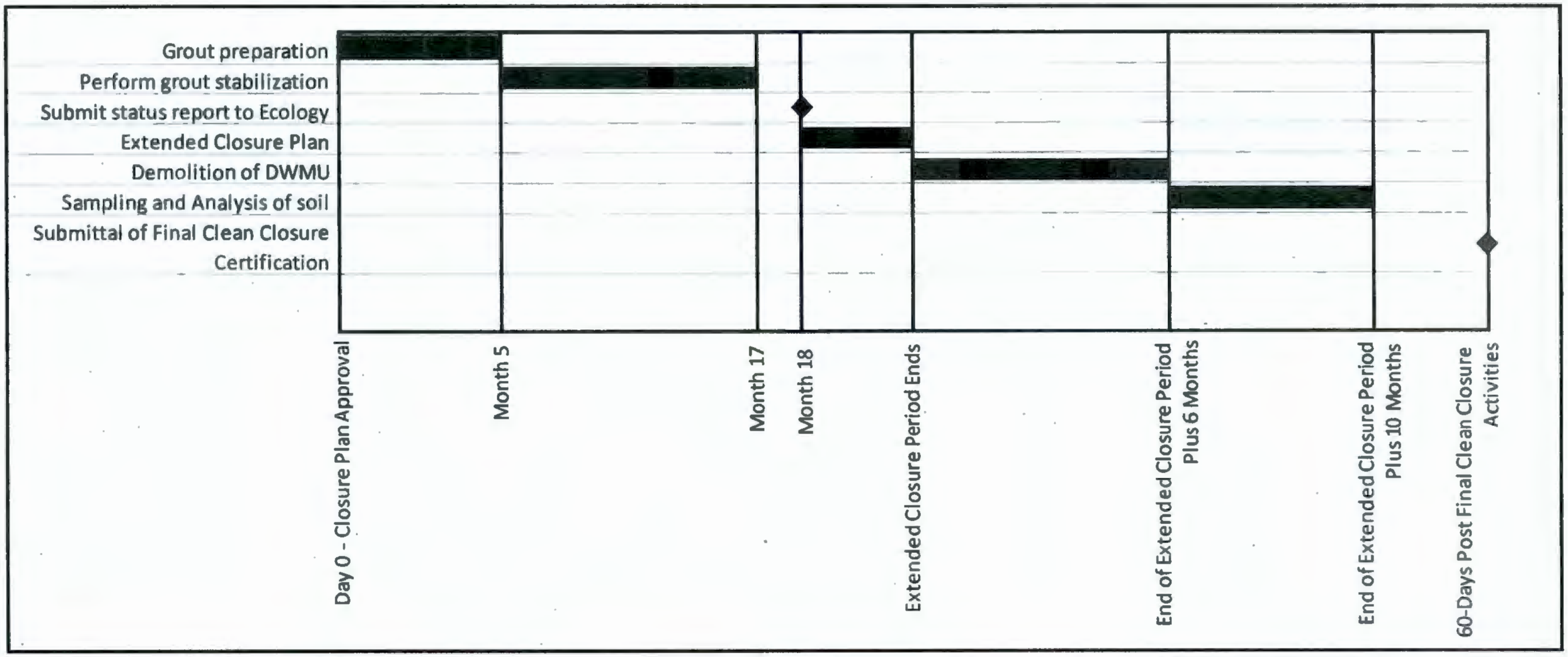


Figure H18. Waste Encapsulation and Stabilization Facility Hot Cell A through Hot Cell F Closure Plan Schedule

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