Central Plateau Cleanup Company

RADIATION PROTECTION TECHNICAL EVALUATION

Title: 324 Building Characterization, Workplace Air Monitoring and Dosimetry Technical Evaluation	**TE Number:** TE-WL-17-001-07 **Periodic Review Date:** 11/09/2026

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Evaluation Summary:

This technical evaluation details the radioactive source term characterization, air monitoring, and dosimetry requirements for the 324 Building, 300-265 Waste Site, and 300-296 Waste Site.

Revision 7 is a complete rewrite to include:

- Updated 324 facility history and description based on information in WHC-MR-0388.
- Added 324 facility area and characterization information missing from previous revisions.
- Added 300-265 Waste Site description and characterization information.
- Omitted workplace air monitoring criterion calculations specified in previous revisions and reverted to simpler 10 CFR 835 and CPCC-00175 requirements for air monitoring.

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Abbreviations and Acronyms

AEA	alpha energy analysis
AEC	United States Atomic Energy Commission
AMW	ALARA Management Worksheet
ASP	alarm setpoint
BWIP	Basalt Waste Isolation Project
CAM	continuous air monitor
CBWS	Crib Waste Sewer
CDMP	completed decision making package
CED	committed effective dose
CHA	Cask Handling Area
CPCC	Central Plateau Remediation Company
CNWVP	Commercial Nuclear Waste Vitrification Project
CRCF	Central Radiological Counting Facility
CTA	Company Technical Authority
CSP	clearance survey plan
DAC	derived air concentration
DAC-h	derived air concentration-hour
EBR	Experimental Breeder Reactor
ED	electronic dosimeter
EDL	Engineering Development Laboratory
ETD	easy-to-detect
FFTF	Fast Flux Test Facility
FMIT	Fusion Materials Irradiation Test
FPTL	Fission Product Transport Loop
FRG	Federal Republic of Germany
FRPP	Fuel Recycle Pilot Plant
GEA	gamma energy analysis
HBE	High Bay Extension
HCA	high contamination area
HEIS	Hanford Environmental Information System
HEPA	high efficiency particulate air
HIDP	Hanford Internal Dosimetry Program
HIEC	Hanford Instrument Evaluation Committee
HLLW	high-level liquid waste
HLV	High-Level Vault

HSD	Hanford Standard Dosimeter
HTD	hard-to-detect
HW	Hanford Works
HWVP	Hanford Waste Vitrification Project
kCi	kilo-curies
LLV	Low-Level Vault
LMFBR	Liquid Metal Fast Breeder Reactor
LSC	liquid scintillation counting
MFP	mixed fission products
MOTA	Materials Open Test Assembly
NDE	Non-destructive Examination
NWVP	Nuclear Waste Vitrification Project
POG	process off-gas
PRTR	Plutonium Recycle Test Reactor
PUREX	Plutonium Uranium Extraction Facility
REC	Radiochemical Engineering Complex
REDOX	Reduction Oxidation Facility
RLFCM	Radioactive Liquid-Fed Ceramic Melter
RLWS	Radioactive Liquid Waste Sewer
RRLWS	Retired Radioactive Liquid Waste Sewer
RPP	Radiation Protection Program
SMF	Shielded Materials Facility
SRDA	Sodium Removal and Decontamination Apparatus
TE	technical evaluation
TRU	transuranic
VV	vessel vent
WAM	Workplace Air Monitoring
WSEP	Waste Solidification Engineering Project
WTEL	Waste Technology Engineering Laboratory

1. PURPOSE

This Technical Evaluation (TE) provides the basis for Radiation Protection Program (RPP) monitoring and controls decisions for Central Plateau Cleanup Company (CPCC) 300 Area End States Project (300 AES) activities, including:

- 324 Building operations, removal, and remedial actions.
- 300-265 waste site remedial actions.
- 300-296 waste site remedial actions.

2. SCOPE

This TE includes:

- 300 AES facility and waste site radionuclide characterization and associated survey requirements.
- Workplace air emissions (WAM) analysis and monitoring requirements.
- Dosimetry requirements analysis and specifications.

3. REQUIREMENTS

This TE implements applicable requirements and guidance from the following:

- 10 CFR Title 835, *Occupational Radiation Protection* (10 CFR 835)
- DOE O 458.1, *Radiation Protection of the Public and the Environment* (DOE O 458.1)
- DOE/RL-2002-12, *Hanford Radiological Health and Safety Document* (HRHSD)
- CPCC-00174, *Central Plateau Cleanup Company Radiation Protection Program* (CPCC-00174)
- CPCC-00175, *Central Plateau Cleanup Company Radiological Control Manual* (CPCC-00175)
- CPCC-PRO-RP-40022, *Preparation, Review, and Approval of Radiation Protection Technical Evaluations and Technical Basis Documents*
- CPCC-PRO-RP-40031, *Workplace Air Monitoring Program*
- 0903-CDMP-0008, *Standard Process for Documenting Facility-Project Radionuclide Characterizations* (CDMP-0008)
- 0904-CDMP-0011, *Workplace Air Monitoring Technical Basis Document* (CDMP-0011)
- 1805-CDMP-0145, *Clearance of Personal Property and Detection Capability of Portable Radiation Detection Instruments* (CDMP-0145)
- 1809-CDMP-0147, *Outdoor Air Emissions Monitoring Technical Basis Document* (CDMP-0147)

4. 324 BUILDING DESCRIPTION[1]

The 324 Waste Technology Engineering Laboratory (WTEL) was constructed in the Hanford 300 Area from 1964 to 1966 as a Fuel Recycle Pilot Plant (FRPP). It was partially designed to support Plutonium Recycle Test Reactor (PRTR) operations by housing chemical processing and metallurgical examination of PRTR fuel elements. As such, it was built as a dual facility with both radiochemical and radiometallurgical hot cells and laboratories. It was also designed to house the Waste Solidification Engineering Project (WSEP), one of the first high-level vitrification demonstration programs in the world. Mission changes caused the

[1] WHC-MR-0388, *Compilation of Historical Information of 300 Area Facilities and Activities*.

facility to become known as the Chemical Materials Engineering Laboratory (CMEL) throughout most of its history. The location of the 324 Building relative to other 300 Area facilities is presented in Figure 1.

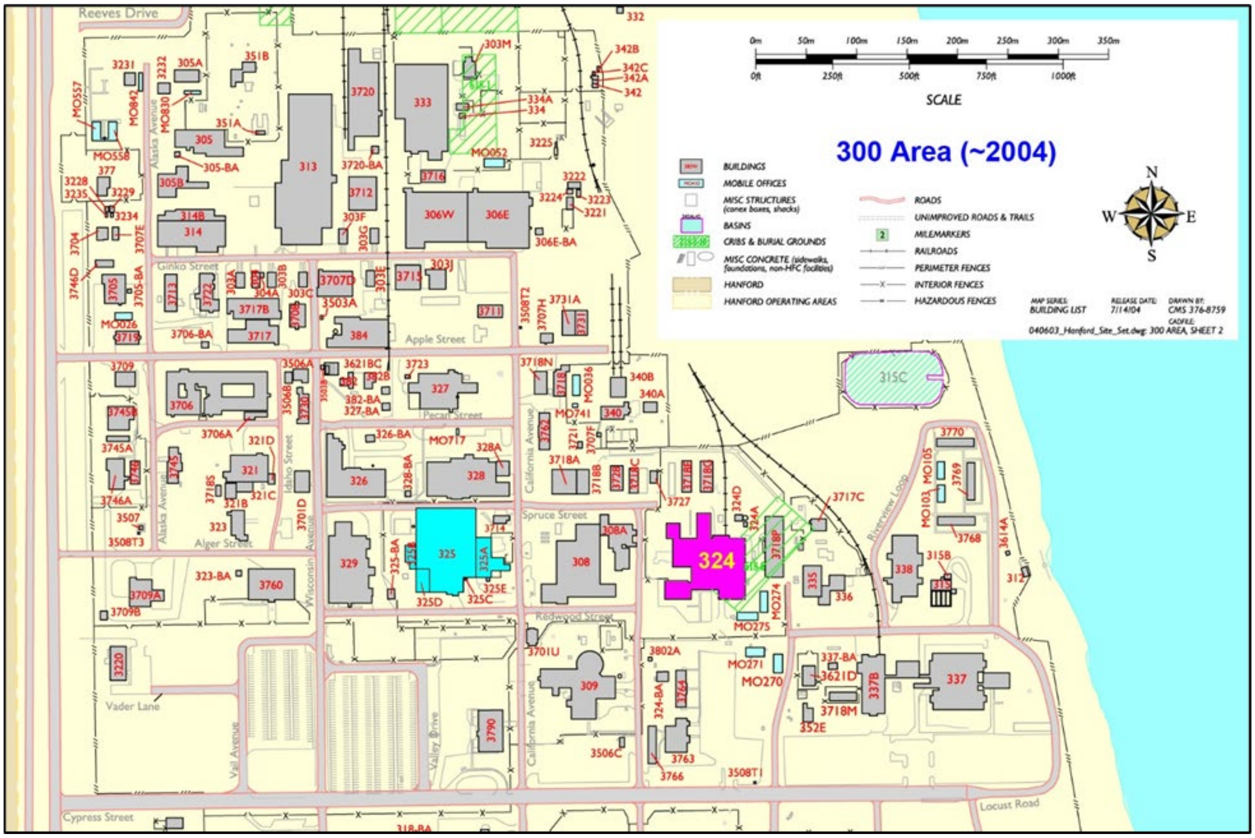

Figure 1. 300 Area and Location of the 324 Building

4.1 Radiochemistry Cells

The radiochemical portion in the north side of the building contains four hot cells (A-, B-, C-, and D-Cells), along with an Airlock Cell. All of these cells are contained by high-density concrete walls and at least partial stainless steel liners. All cells are equipped with high efficiency particulate air (HEPA) filtration. All air pressure within the cells is maintained negative to atmospheric.

4.1.1 A-Cell

A-Cell (Room 136) is 9.25 ft by 21 ft by 29 ft (deep) (two stories), with 54-in.-thick concrete walls, a 1/8-in.-thick stainless steel liner, and a concrete basement underneath. The cell contained the Waste Canister Storage Engineering Test Facility which consisted of 6 cubicles in the north wall, each 3 ft deep with 4-in.-thick steel doors. These cubicles stored canisters containing high-level, solidified radioactive waste in a controlled environment. Some canisters containing cesium-137 heat sources manufactured for the Federal Republic of Germany (FRG) in the late 1980's were also stored in A-Cell, and some decontamination operations for the FRG program were performed in this cell.

4.1.2 B-Cell

B-Cell (Room 133) is 25 ft by 22 ft by 30.5 ft (deep) (three stories) with 48-in. thick concrete walls and a stainless steel liner up to the 27-ft level. There is no concrete basement under B-Cell.

4.1.3 C-Cell

C-Cell (Room 134) is 19.25 ft by 12 ft by 15 ft (deep) (one story), with a basement underneath. The east and west walls of C-Cell are 6.25-ft thick normal concrete, the north wall is 4.5-ft-thick normal concrete, and the south-wall, facing the operating and service galleries, is 4-ft-thick high-density concrete.

4.1.4 D-Cell

D-Cell (Room 246) is 13 ft by 21 ft by 17 ft (deep) (one story) and sits above C-Cell. Its walls are constructed of 4-ft-thick high-density concrete, and its floor is lined with stainless steel.

4.1.5 Airlock and Pipe Trench

The Airlock Cell (Room· 135) is a maintenance, decontamination and transition zone for other radiochemistry cells. It includes a pipe trench located below grade and covered by concrete blocks and a basement that extends as part of the basement below A and C Cells. The pipe trench permitted connections between some equipment pieces and between process lines carrying radioactive materials from cell equipment and tank vaults within the building. In the late 1960's, a shielded load-out port was added to the left of the doorway of the Airlock Cell for use in the Nuclear Waste Vitrification Project (NWVP).

In the 1970's, stainless steel sleeves were added around transfer pipes that carried NWVP materials between the 324 and 325 Buildings and around some floor piping because of the very hot nature of this work.

4.2 Radiometallurgy Cells

The southeast section of the 324 Building contained Radiometallurgy and Materials Testing Laboratories, including three large hot cells known as the Shielded Materials Facility (SMF). Among these, South Cell (Rooms 139 and 140) is the biggest. It is 16 ft by 50 ft and contains five compartments. Compartment 1, located farthest south, has the most negative air pressure gradient and contained materials with the highest levels of radioactivity. Compartment 5 held irradiated fuel pin storage racks until 1991, when these racks and the partition to this compartment were taken down. East Cell (Room 142) is 16 ft by 23 ft. The Airlock Cell (Room 141) is 16 ft by 20 ft. All SMF cells have stainless steel liners. An operating gallery (Room 139) surrounds these three cells, and the basement beneath the SMF contains a critically safe slab tank (TK-177). In case of a fire within the SMF area, this tank could accept the fire quenching water or chemicals, but it was not used to accept ordinary cell effluents.

4.3 Engineering Development Laboratories

In addition to hot cells, the 324 Building contains many other laboratory facilities. Among these are four Engineering Development Laboratories (EDL), two designed for work with nonradioactive materials (EDLs 101 and 102) and two designed for hot work (EDLs 146 and 147).

4.3.1 EDL-101

EDL-101 was built as an addition to the 324 Building in the early 1970's as a cold support shop. Sodium loops were added to this 28-ft by 60-ft by 33-ft (high) laboratory during 1974 to 1975 for liquid metal research. The facility was modified again in 1981 with the addition of lithium loops and an associated exhaust scrubber system, to become the Experimental Lithium System (ELS). The ELS provided a test bed for hydrodynamic trials of prototypical target assemblies for the FFTF's Fusion Materials Irradiation Test (FMIT).

4.3.2 EDL-102

The EDL-102, a part of the original 324 Building, is 64 ft by 60 ft by 30 ft (high). This laboratory was divided into eight 2-story modules (numbered 1 through 16), each having 350 ft^2. Each module functioned as a laboratory for the development of cold chemical processes, process equipment, instrumentation and/or mechanical equipment. Extraction columns in EDL-102 performed cold fuel reprocessing verification trials for the REDOX and PUREX plants. Pump development work for 200 Areas processes also was conducted. The Cold Waste Solidification System was installed in EDL-102 in the mid-1980's to demonstrate and test the conversion of nonradioactive liquid wastes to solids.

4.3.3 EDL-146

EDL-146 is a multipurpose laboratory 30 ft by 48 ft by 34 ft (high). Located adjacent to the Cask Handling Area (CHA), this facility performed experiments with radioactive sodium in the 1970's and 1980's.

4.3.4 EDL-147

EDL-147, also adjacent to the CHA, is 28 ft by 45 ft by 34 ft (high). It was known as the Regulated Shop because it performed decontamination and repair of manipulators having high radiation levels. Another facility known as the Regulated Manipulator Shop (Room 139-C) performed decontamination and repair on manipulators having lower levels of radiation.

4.4 Truck Lock and Cask Handling Area

The original construction of the 324 Building included a high-bay truck lock and rail load-out station (Room 138), located on the north side of the building just east of center. This facility, which is 36 ft by 34 ft by 35 ft (high), is separate from a truck ramp that leads down to a basement receiving station on the southeast side of the 324 Building. Adjacent to the north side truck/rail lock is the CHA (Room 137). A stainless steel enclosure 7.5 ft by 5 ft by 10 ft (high) known as the decontamination and load-out stall (LOS) is located within the truck lock. This small facility, equipped with manipulators and a remote viewing window, was used to transfer highly radioactive solutions between shipping casks and shielded facilities casks. In 1981, an Irradiated Pin Storage Facility (Room 137) was emplaced in the CHA. This steel-reinforced concrete facility, which is 17 ft by 15 ft by 8 ft (high), was capable of storing up to 300 eight-ft-long irradiated fuel pins after discharge from the FFTF. However, no fuel pins actually were stored there, and this facility was removed in 1991.

4.5 Safeguards Vault and Laboratory Area

This large basement area within the 324 Building contained four laboratories, three facilities connected with shipping and packaging, various tanks, and the Fissile Materials Storage Vault.

4.5.1 Fissile Materials Storage Vault

The Fissile Materials Storage Vault, a 1970 addition that received extensive modifications in 1975, is a structure 23 ft by 27 ft with 1-ft-thick concrete walls. Located beneath the SMF cells, this vault is topped with 4.5-ft-thick concrete shielding beneath East Cell, except for the area beneath the cell sump. That region has a 2-ft-thick concrete barrier with a 6-in. thick layer of lead (together giving an effective thickness of 4.5 ft of concrete). The vault has a 4-hour fire-rated metal door and contained 12 fissile materials storage cabinets arranged in a diamond array and further separated by two 16-in.-thick concrete pillars. It also held a freezer for the storage of high-exposure plutonium. Before the storage cabinets and freezer were emplaced, the vault served as the location of Hanford Works' (HW) earliest sodium loops to perform corrosion, deposition, and other testing for FFTF development. Hand built, lead brick caves containing portable leaded glass windows were installed for this work, and irradiated iron alloys were exposed to flowing liquid sodium.

4.5.2 Room 1

Room 1, located in the northwest basement area just below EDL-102, was a chemical tank pit that contained 20 tanks. 18 of these tanks have been removed.

4.5.3 Room 3A

Room 3A was an inspection and packaging area where inspections on all sealed, fissionable materials storage cans entering or leaving the 324 Building.

4.5.4 Rooms 3B

Room 3B was a Small Shipping Container and Equipment Storage Area.

4.5.5 Laboratories 3C, 3D, and 3J

Laboratories 3C, 3D, and 3J were used to perform nondestructive examination (NDE) analysis on sealed containers of fissionable materials. Additionally, 3C contains an open-faced hood that was used for the inspection, weighing, and sampling of normal and depleted uranium and thorium.

4.5.6 Laboratory 3E

Laboratory 3E, 8 ft by 22 ft, is now a storage room.

4.5.7 Laboratory 3F

Laboratory 3F, 10 ft by 69 ft, contains two vented hoods and that functioned as a low-level metallography laboratory involved in tritium work. Previously, the two hoods were used for alkali metal processing and for preparing materials involved in Run-Beyond-Clad-Breach deposition sample studies.

4.5.8 Laboratory 3G

Laboratory 3G is 27 ft by 27 ft and contains a shielded (stainless steel and lead) glovebox that handled various fission products, sodium, and up to 15 g of irradiated plutonium oxide fuel. Previously, this laboratory contained the Fission Product Transport Loop (FPTL), a facility that studied the transport behavior of trace amounts of various fission products in flowing sodium. Laboratory 3G also previously held an inert atmosphere glovebox that studied cesium-137 in molten sodium.

4.5.9 Room 3H

Room 3H was used for Shipping, Receiving, and short-term storage of transuranic (TRU) containers. It was also used as a shipping and receiving point for fissionable materials.

4.5.10 Laboratory 3K

Laboratory 3K handled plutonium and is accessed by its own airlock. It contained two gloveboxes having inert nitrogen atmospheres-and separate HEPA filtration, and an open-faced hood. Laboratory 3K was used for the inspection, packaging, mixing, consolidation, weighing, and sampling of all chemical and physical forms of fissionable materials.

4.6 Other 324 Building Facilities

The 324 Building also contained a general-purpose "cold" laboratory in Room 115. This 15-ft by 20-ft facility had a glovebox for handling sodium-wetted hardware for the Liquid Metal Fast Breeder Reactor (LMFBR) program and housed corrosion tests for the Basalt Waste Isolation Project (BWIP) until the mid-1980's.

There were four second-floor chemical engineering laboratories (Rooms 207, 208, 210, and 212) in the 324 Building used for sample preparation, small scale studies of waste solidification processes, mixing studies, and materials performance testing.

A large maintenance and fabrication shop located in the west end of the building has been demolished.

Additionally, the 324 Building has a High-Level Waste Vault (HLV) containing four tanks and a Low-Level Waste Vault (LLV) containing four tanks. These vaults are located below grade on the north side of the building beneath the wall that divides the CHA and EDL-147. The waste in the high-level tanks was removed from the building via casks, and the low-level waste was piped to the 340 Complex for disposal. Previously, the high-level waste tanks served as the receiving vessels for material brought from the 200 Areas and from the 325 Building to be vitrified in 324 Building developmental programs.

A high bay addition known as the HBE was completed on the northwest corner of the 324 Building in 1979. This facility housed the "cold" prototype testing of large components such as melters. The HBE has been demolished.

Fresh chemical storage tanks are located in the 324 Building's central chemical makeup area on the third floor (Room 309).

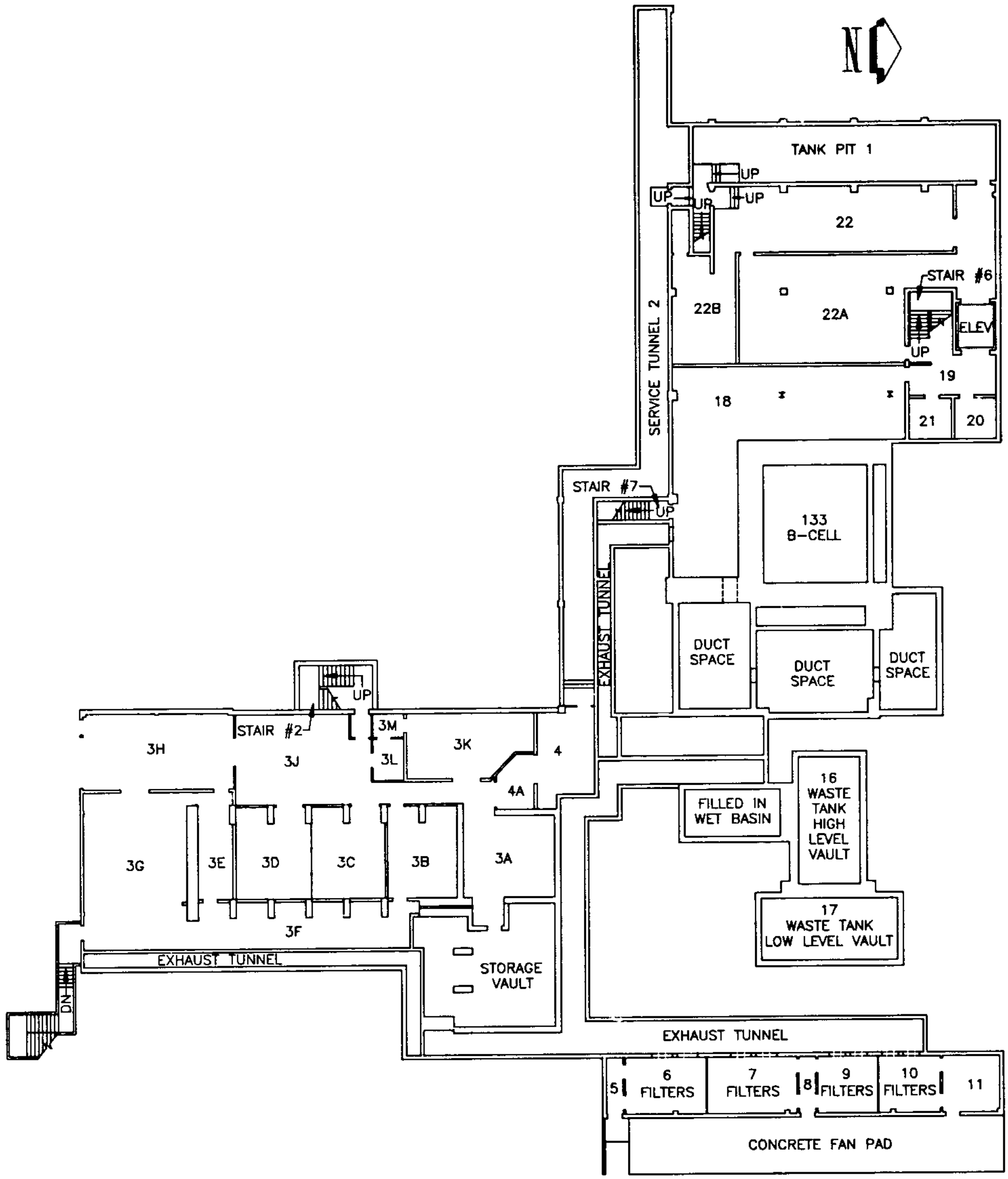

Figure 2. 324 Building Simplified Floor Plan (Basement)

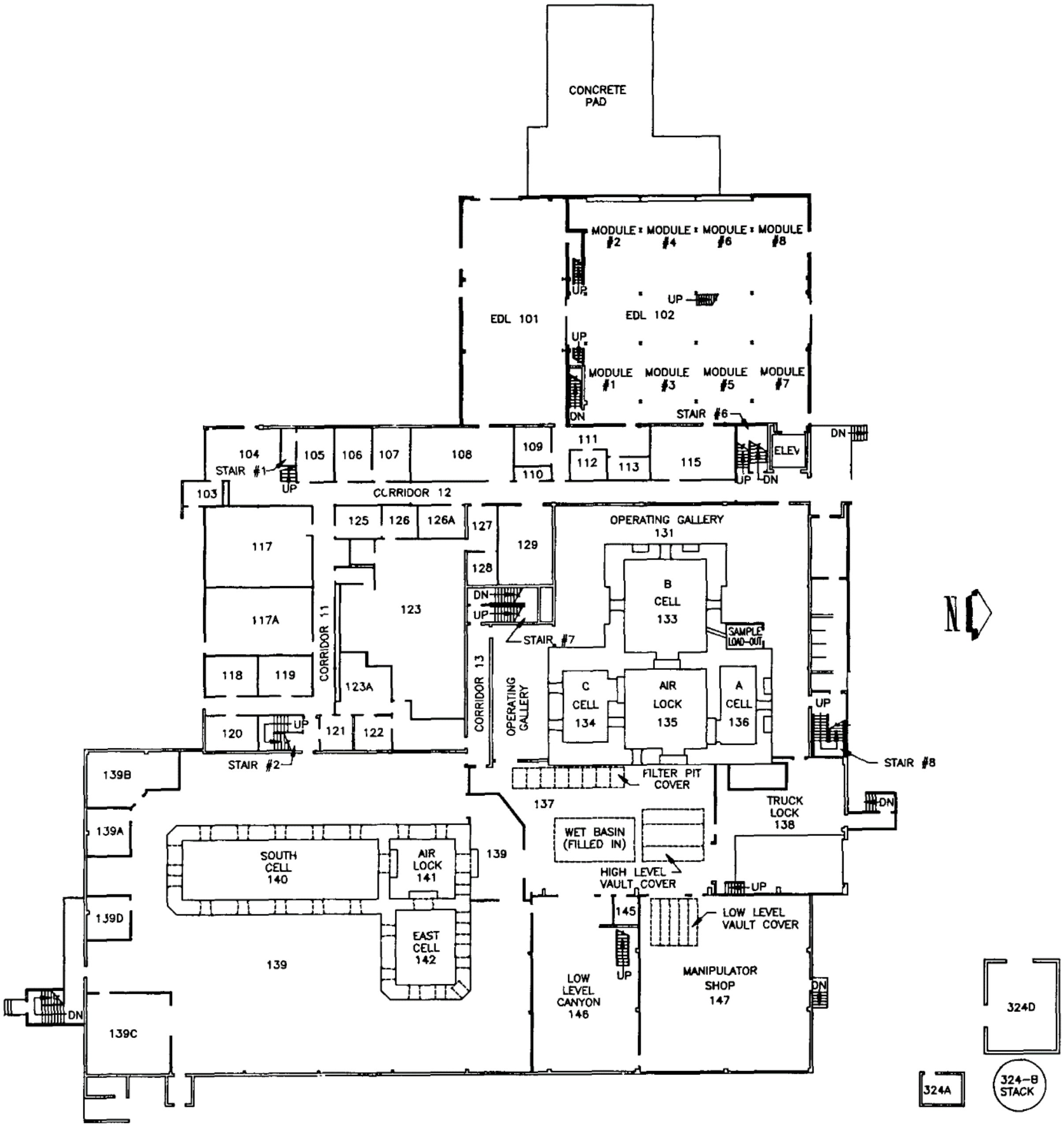

Figure 3. 324 Simplified Floor Plan (First Floor)

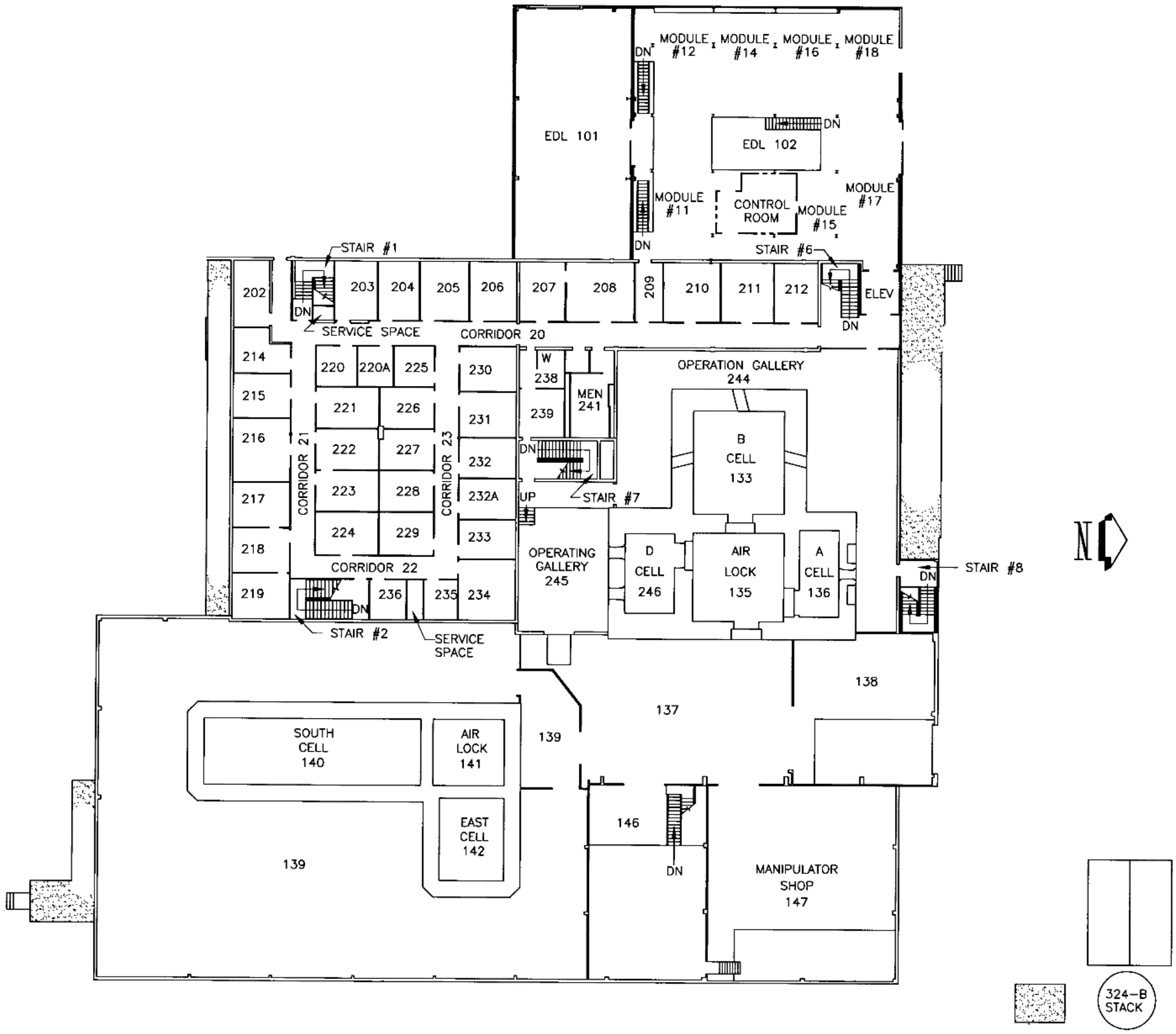

Figure 4. 324 Building Simplified Floor Plan (Second Floor)

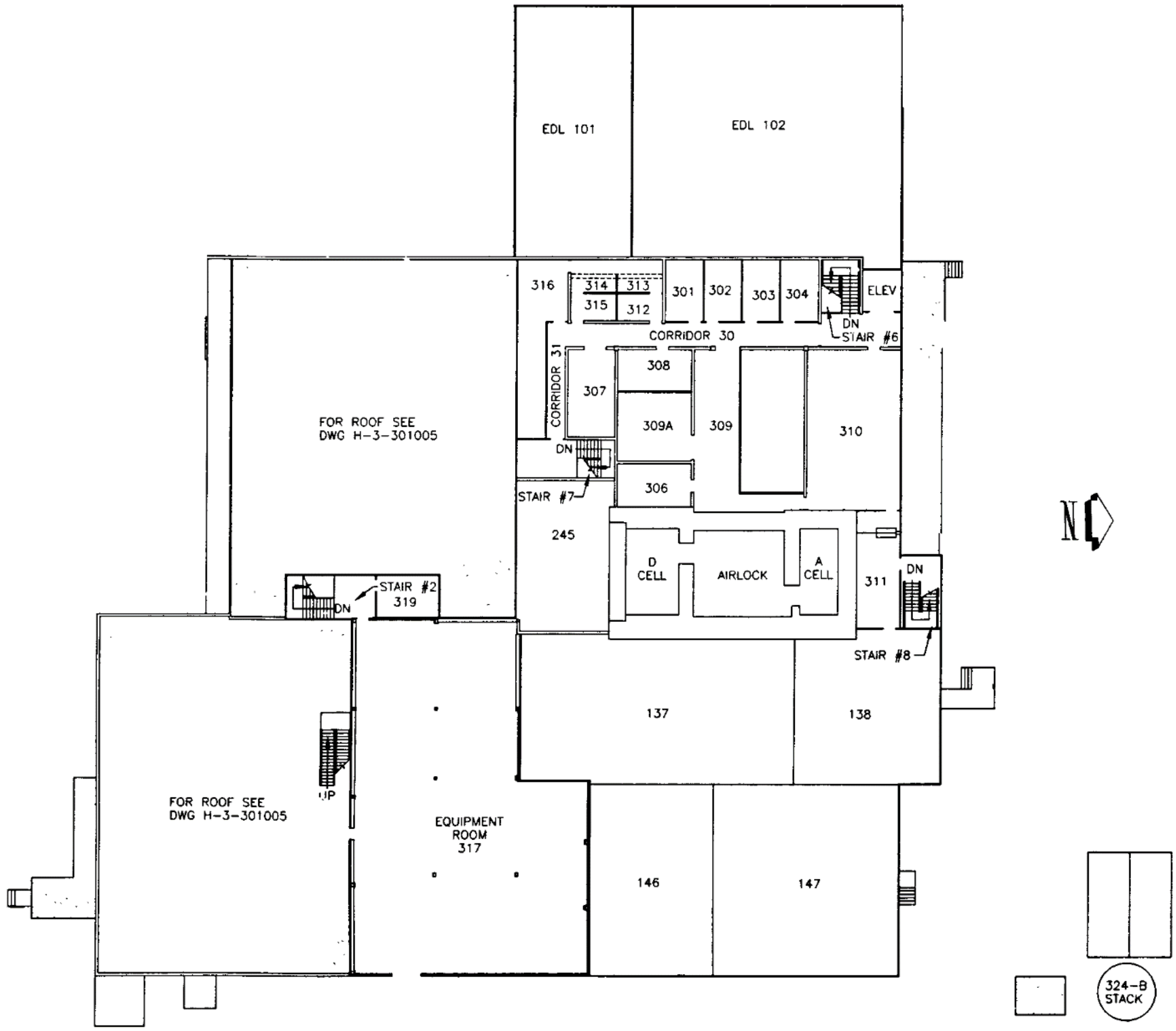

Figure 5. 324 Building Simplified Floor Plan (Third Floor)

5. 324 BUILDING MISSIONS[2]

The 324 Building, originally designed to support PRTR tests and waste solidification work, was completed just after the serious PRTR accident of September 1965. PRTR operating problems, combined with the Atomic Energy Commission (AEC) decision to emphasize LMFBR research and deemphasize the fuels diversification research for which the PRTR had been designed, signaled a nearly immediate end to the 324 Building's PRTR support work. From the time of its completion in 1966 until 1968, the 324 Building performed primarily WSEP work in the radiochemistry cells. During 1968 to 1969, the SMF and other portions of the building attracted much developmental work for the FFTF.

The waste vitrification work was performed largely in "solidification units," including a large platinum melter and a titanium concentrator, located in B-Cell. Glassification pots and much other equipment for this program were made in the 324 Building's own maintenance and fabrication shop. The first waste vitrification programs in the building used neutralized fission product waste (1WW waste) from PUREX or from B Plant (then retrofitted for a large 1968 to 1978 strontium-90 and cesium-137 recovery program). Extremely high-level waste with heavy concentrations of cerium-144/praseodymium, and sometimes "spiked" with extra strontium-90, was used as the feed material until the mid-1970's, when spent commercial reactor fuel began to be used. Vitrification continued as the major radiochemical mission in the 324 Building until 1980. During the early 1980's, radiochemistry work included the solidification, encapsulation, and packaging of spent ion exchange resins from the Three Mile Island (Pennsylvania) reactor, and the pilot testing of Radioactive Liquid-Fed Ceramic Melter (RLFCM) operations. The FRG cesium heat source manufacturing project was the major radiochemistry program underway in the building from 1986 to 1990. Additionally, bioremediation techniques were investigated, and high temperature melters were used to experiment with the treatment of medical and other radioactive wastes.

Radiometallurgical programs in the 324 Building have centered on NDE of irradiated fuel elements and other irradiated structural materials including reactor process tubes. The large capacity of the SMF cells made them capable of handling the longer fuel elements from reactors such as the PRTR (88-in. fuel elements), the EBR II, and the FFTF (8-ft fuel elements). Between 1968 and 1980, gamma scanning, profilometry, and other types of NDE were conducted on fuel elements from these reactors, and some reconstructive work (reassembly of breached fuel pins) also was conducted. The SMF cells have processed Materials Open Test Assembly (MOTA) from the FFTF and have tested, reassembled; and stored many irradiated fuel elements and structural components. Capsules containing cesium chloride for medical uses were pressed and assembled in South Cell for the Nordion Corporation of Canada. This 1991 to 1992 project manufactured several capsules ranging from 500 to 3,000 Ci each. Beginning in the 1980's, a Sodium Ethanol Cleaning System (SECS) was also operated in SMF South Cell to remove sodium from test specimens that had been irradiated in the FFTF.

Hanford Waste Vitrification Plant (HWVP) engineering verification and process verification missions were also part of 324 Building work.

In addition to other missions and functions not previously described, important sodium work has been performed in the 324 Building. After the 337 Building was completed in 1971, the sodium testing loops were removed from the 324 Building's Fissile Materials Storage Vault area. However, a Sodium Removal and Decontamination Apparatus (SRDA) was then installed in EDL-146 to perform sodium decontamination testing on various irradiated metallic coupons. Other liquid metal studies, including

[2] WHC-MR-0388.

caustic stress corrosion testing, electropolishing, and cesium absorption experiments, were also conducted in EDL-146 and in Laboratories 3E, 3F, and 3G. A SRDA-II for the removal of sodium, lithium, and sodium-potassium from equipment by using denatured alcohol or kerosene was installed outside, north of the 324 Building in the 1970's. Both SRDA and SRDA-II now have been removed.

6. 300-265 WASTE SITE DESCRIPTION

An inter-building pipeline, designated as the 300-265 Waste Site, was installed as an integral part of the Commercial Nuclear Waste Vitrification Project (CNWVP) for transfer of solutions and off-gas between the 324 and 325 Buildings. It consists of 3/8-inch and 3/4-inch pipelines within a 2-inch schedule 40 welded stainless steel pipe, surrounded by a 4-inch fiberglass-reinforced epoxy encasement pipe. Overall piping system length is approximately 1,006 ft.

The 3/8-inch pipe was used to transfer commercial nuclear fuel dissolver solution from the 324 Building to the 325 Building where it was processed into high-level liquid waste (HLLW). The HLLW was returned via the 3/4-inch pipe to the 324 Building for vitrification. 325 Building process off-gas (POG) was returned to the 324 building through the encasement pipe where it was treated and emitted out of the 324 stack.

Figure 6. 300-265 Waste Site Location

7. 300-296 WASTE SITE DESCRIPTION

The greatest level of contamination associated with the 324 Building is within contaminated soil under B-Cell, designated as the 300-296 Waste Site, containing several thousand curies of radioactive material. During preparations to demolish the building in 2009-2010, contaminated grout was removed from the B-Cell sump and trench. During this process, a visible breach was identified in the stainless-steel liner of the sump in the hot cell floor. Due to concerns about the possibility that B-Cell constituents had migrated through the breached liner, nonintrusive (closed-ended) characterization tubes were installed laterally into the soil column below B-Cell.

Measurements inside the tubes confirmed the presence of radioactive material with gamma exposure rates up to ~13,000 R/hr in the soil below B-Cell with temperatures up to 142 degrees Fahrenheit. A spatial analysis of the data concluded that the contaminants leaked through the breached liner into the sump and then through a felt expansion joint in the concrete floor to reach subsurface soils. A rectangular "curtain" of contamination appears to exist directly below the felt expansion joint in a 1.5- to 2-m sand layer that lies beneath B Cell. Modeling predicts that the contamination extends below the sand layer into a cobble/sand/silt layer (Figure 10).

The soil contamination may have been associated with a single, large release or a series of smaller releases over time. The only known release of sufficient magnitude was a single spill of concentrated radioactive liquid during the FRG Canister Fabrication Project, known locally as the FRG glass log project. This spill, which took place in October 1986, resulted in an estimated 1,271 kCi (883 kCi Cs-137 and 338 kCi Sr-90) being released to B-Cell.

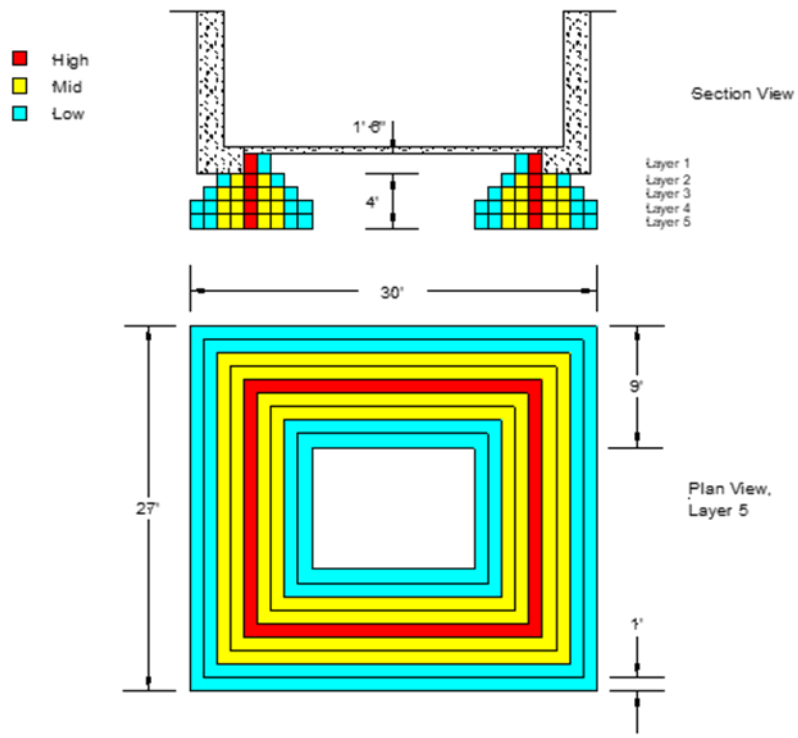

Figure 7. 300-265 Waste Site Location (Simplified)

8. PLANNED WORK ACTIVITIES

Currently planned work activities include:

- 300-265 waste site isolation and remediation activities.
- 300-296 waste site remediation preparation and performance activities.
- 324 Building surveillance and maintenance activities.

Activities may change to address changing 300 AES Project commitments and priorities.

9. RADIONUCLIDE INVENTORY

324 Building, 300-265 and 300-296 radionuclide inventories are large and somewhat varied. Many documents have been generated over the years that define, redefine, or summarize, radionuclide quantities and relative ratios for the various source terms. Total radionuclide inventories are summarized below. Detailed radionuclide inventories are provided in Appendix A.

Table 1 324 Facility, 300-265 Waste Site and 300-296 Waste Site Radioactive Material Inventories

Location	Area/Component	Ci	Location %	References
REC	A-Cell	2.29E+03	12.79%	ECF-324-BLDG-17-0086, Rev. 0, Tables 2 through 5
	B-Cell	1.51E+04	84.27%	ECF-324-BLDG-17-0086, Rev. 0, Table 8
	C-Cell	3.22E+00	0.02%	ECF-324-BLDG-17-0086, Rev. 0, Table 11
	D-Cell	1.81E+02	1.01%	ECF-324-BLDG-17-0086, Rev. 0, Table 14
	Airlock	1.38E+01	0.08%	ECF-324-BLDG-17-0086, Rev. 0, Table 17
	Pipe Trench	2.32E+02	1.29%	ECF-324-BLDG-17-0086, Rev. 0, Table 20
	A-Frame Filter Pit	5.34E+01	0.30%	ECF-324-BLDG-17-0086, Rev. 0, Table 36
	Exhaust Ductwork	4.28E+01	0.24%	ECF-324-BLDG-17-0086, Rev. 0, Table 37
	REC Total	**1.79E+04**	**100.00%**	
HLV	T-104 Tank	3.52E+03	15.81%	ECF-324-BLDG-17-0086, Rev. 0, Table 33
	T-104 Pot	8.43E+02	3.79%	ECF-324-BLDG-17-0086, Rev. 0, Table 33
	T-105 Tank	1.39E+04	62.58%	0300X-CA-N0118, Rev. 1, Table 28
	T-105 Pot	7.23E+02	3.25%	0300X-CA-N0118, Rev. 1, Table 28
	T-106 Tank	1.04E+03	4.68%	ECF-324-BLDG-17-0086, Rev. 0, Table 33
	T-106 Pot	2.69E+02	1.21%	ECF-324-BLDG-17-0086, Rev. 0, Table 33
	T-107	1.61E+03	7.23%	ECF-324-BLDG-17-0086, Rev. 0, Table 33
	T-107 Pot	3.52E+03	15.81%	ECF-324-BLDG-17-0086, Rev. 0, Table 33
	Process Piping	1.96E+02	0.88%	ECF-324-BLDG-17-0086, Rev. 0, Table 48
	HLV Total	**2.23E+04**	**100.00%**	
LLV	T-101 Tank	1.20E+02	11.91%	ECF-324-BLDG-17-0086, Rev. 0, Table 33
	T-101 Pot	4.52E+01	4.48%	ECF-324-BLDG-17-0086, Rev. 0, Table 33
	T-102 Tank	7.30E+01	7.25%	ECF-324-BLDG-17-0086, Rev. 0, Table 33
	T-102 Pot	2.44E+01	2.42%	ECF-324-BLDG-17-0086, Rev. 0, Table 33
	T-103 Tank	4.34E+02	43.08%	0300X-CA-N0118, Rev. 1, Table 26
	T-103 Pot	0.00E+00	0.00%	0300X-CA-N0118, Rev. 1, Table 26
	T-108 Tank	3.11E+02	30.83%	ECF-324-BLDG-17-0086, Rev. 0, Table 33
	Process Piping	3.15E-01	0.03%	ECF-324-BLDG-17-0086, Rev. 0, Table 48
	LLV Total	**1.01E+03**	**100.00%**	
SMF	South Cell	1.52E+03	100.00%	0300X-CA-N0118, Rev. 1, Tables 30, 33, 34, and 36
	East Cell	2.04E-02	0.00%	ECF-324-BLDG-17-0086, Rev. 0, Table 27
	Airlock	2.22E-02	0.00%	ECF-324-BLDG-17-0086, Rev. 0, Table 30
	SMF Total	**1.52E+03**	**100.00%**	

Table 1 324 Facility, 300-265 Waste Site and 300-296 Waste Site Radioactive Material Inventories

Location	Area/Component	Ci	Location %	References
Containments	Zone I	2.30E-01	62.97%	ECF-324-BLDG-17-0086, Rev. 0, Table 40
	Zone II	1.35E-01	37.03%	ECF-324-BLDG-17-0086, Rev. 0, Table 40
	Containment Total	**3.66E-01**	**100.00%**	
HEPA Filters	SMF Basement Rm 3 Exhaust HEPA	3.49E-04	0.00%	ECF-324-BLDG-17-0086, Rev. 0, Table 43
	Rm 3C Hood Exhaust HEPA	1.31E-03	0.00%	ECF-324-BLDG-17-0086, Rev. 0, Table 42
	Rm 6 Zone 2 Exhaust Plenum HEPAs	2.00E-03	0.01%	ECF-324-BLDG-17-0086, Rev. 0, Table 43
	Rm 7 Zone 2 Exhaust Plenum HEPAs	1.69E-02	0.06%	ECF-324-BLDG-17-0086, Rev. 0, Table 43
	Rm 9 Zone 1 Exhaust Plenum HEPAs	1.25E+00	4.53%	ECF-324-BLDG-17-0086, Rev. 0, Table 42
	Rm 10 Zone 1 Exhaust Plenum HEPAs	2.10E+00	7.61%	ECF-324-BLDG-17-0086, Rev. 0, Table 42
	Rm 11 POG & VV Room F-102 HEPA	6.59E+00	23.89%	ECF-324-BLDG-17-0086, Rev. 0, Table 42
	Rm 11 POG & VV Room F-104 HEPA	1.53E+01	55.65%	ECF-324-BLDG-17-0086, Rev. 0, Table 42
	Rm 11 POG & VV Room F-106 HEPA	1.45E+00	5.26%	ECF-324-BLDG-17-0086, Rev. 0, Table 42
	Rm 134 C-Cell Exhaust Plenum Roughing Filter	2.79E-01	1.01%	ECF-324-BLDG-17-0086, Rev. 0, Table 42
	Rm 135 REC Airlock Exhaust Plenum Roughing Filter	5.46E-01	1.98%	ECF-324-BLDG-17-0086, Rev. 0, Table 43
	Rm 309A Hood Exhaust HEPA	1.37E-05	0.00%	ECF-324-BLDG-17-0086, Rev. 0, Table 43
	Rm 316 Filter Room 306/309 VV Exhaust	2.74E-04	0.00%	ECF-324-BLDG-17-0086, Rev. 0, Table 43
	Rm 317 Bldg Vacuum Air Sample Supply HEPA	1.10E-04	0.00%	ECF-324-BLDG-17-0086, Rev. 0, Table 43
	HEPA Filter Total	**2.76E+01**	**100.00%**	
Piping	POG/VV	2.05E+00	99.81%	ECF-324-BLDG-17-0086, Rev. 0, Table 46
	RLWS	1.92E-03	0.09%	ECF-324-BLDG-17-0086, Rev. 0, Table 50
	RRLWS/CBWS	1.92E-03	0.09%	ECF-324-BLDG-17-0086, Rev. 0, Table 50
	Piping Total	**2.06E+00**	**100.00%**	
300-265 Waste Site	3/8" Dissolver Solution Pipe	1.12E+01	42.77%	0300X-CA-N0153, Rev. 0, Table 8
	3/4" High-Level Waste Stream Pipe	1.49E+01	56.98%	0300X-CA-N0153, Rev. 0, Table 8
	Encasement Pipe	6.58E-02	0.25%	0300X-CA-N0153, Rev. 0, Table 8
	300-265 Total	**2.62E+01**	**100.00%**	
300-296 Waste Site	Point Source Zone	2.84E+05	88.40%	ECF-324-BLDG-17-0086, Rev. 0, Table 54
	Fugitive Source Zone	3.73E+04	11.60%	ECF-324-BLDG-17-0086, Rev. 0, Table 55
	300-296 Total	**3.22E+05**	**100.00%**	
Grand Total		**3.64E+05**	**100.00%**	

9.1 324 Master Radionuclide List

A 324 master radionuclide list of alpha and beta-gamma emitting radionuclides comprising 99.99% of the total respective activity is presented below. The list was developed using methods described in CDMP-0008 Section 2.5. Radionuclides comprising less than 0.01% of the total inventory for a given area do not affect TE conclusions and are excluded.

Table 2. 324 Master Radionuclide List

Nuclide	Group	Primary Emission	Class
Pu-238	2	α	ETD
Pu-239	2	α	ETD
Pu-240	2	α	ETD
Pu-242	2	α	ETD
Am-241	2	α	ETD
Cm-243	2	α	ETD
Cm-244	2	α	ETD
Co-60	4	βγ	ETD
Sr-90	4	βγ	ETD
Y-90	4	βγ	ETD
Mo-93	4	βγ	HTD
Nb-93m	4	βγ	HTD
Te-125m	4	βγ	HTD
Sb-125	4	βγ	ETD
Cs-137	4	βγ	ETD
Ba-137m	4	βγ	ETD
Eu-154	4	βγ	ETD
Pu-241	4	βγ	HTD
Fe-55	6	βγ	HTD
Tc-99	6	βγ	ETD
Eu-155	6	βγ	HTD

10. RADIONUCLIDE CHARACTERIZATION

CDMP-0008 governs the process for determining project/facility radiological source term characterizations for posting, controls, and radiological clearance during facility activities. It also establishes a standard protocol for determining the presence and quantity of hard-to-detect (HTD) and easy-to-detect (ETD) alpha and beta-gamma emitting radionuclides in facilities and documenting facility-specific characterization summaries. ETD radionuclides are all alpha emitting radionuclides and any beta-gamma emitting radionuclide for which the efficiency of portable field instruments used for surveys is 10% or greater. Beta-gamma radionuclides with a maximum beta energy less than that of Tc-99 (i.e., less than 0.294 MeV) are considered HTD.

The characterization process involves grouping radionuclide inventories based on CDMP-0008, Table A-1 *CPCC Surface Contamination Values for Identification, Posting and Control, for Compliance with 10 CFR 835 (dpm/100 cm^2)* criteria, primary emissions, and whether radionuclides are ETD or HTD. Group ratios are then analyzed to determine the following:

- If radiological surveys for ETD radionuclides alone are sufficient to ensure compliance with established radionuclide group limits for posting, control, and radiological clearance.
- If surveys for HTD radionuclides are required to ensure compliance.
- If alpha to beta-gamma radionuclide ratios are such that exemption from dual surveys may be considered.
- If standard contamination survey instrument efficiencies and correction factors apply.

Radiological characterization methods and examples are detailed in CDMP-0008, Appendices A, B and C. Applicable methods were used in preparation of this TE.

10.1 Sr-90 Limits Evaluation

CDMP-0008, Appendix A requires an evaluation of ^{90}Sr/^{90}Y activity in relation to Group 4 activity to establish applicable survey criteria from 10 CFR 835, Appendix D. Survey criteria are:

- Where the ^{90}Sr/^{90}Y fraction is ≤50 percent of the total Group 4 activity, the Group 4 values apply.
- Where ^{90}Sr/^{90}Y fraction is >50 percent and ≤90 percent of the total Group 4 activity, surface radioactivity values should be 3,000 dpm/100 cm^2 total and 600 dpm/100 cm^2 removable.
- Where the ^{90}Sr/^{90}Y fraction is >90 percent of the total Group 4 activity, the Group 3 Sr-90 values apply.

This evaluation was performed for each source term. Results are summarized in Table 4.

^{90}Sr has the potential to constitute >90% of the total beta-gamma emitting radioactivity present during facility stabilization activities that impact the 300-296 Fugitive Source zone, as well as HEPA filter replacement/removal (other than A-Frame Filters). As such, ^{90}Sr surface contamination limits in CPCC-00175, Table 4-1 are conservatively applied to all source terms:

- **200 dpm/100 cm^2 removable beta-gamma**
- **1,000 dpm/100 cm^2 total (fixed + removable) beta-gamma.**

Table 3. Radionuclide Characterization Summary

		REC Total	HLV	LLV	SMF Total	Zone 1 & Zone 2 Containments	HEPA Filters	324 Piping Total	300-265	300-296 Point Source	300-296 Fugitive Source
% Sr-90/Y-90											
		36.1%	34.9%	34.9%	1.0%	35.0%	**96.7%**	35.0%	39.0%	23.3%	**100.0%**
Group Limits		4	4	4	4	4	**3**	4	4	4	**3**
Group/Detect		**Group Activity (Ci)**									
Group 2 ETD (α)		1.88E+01	2.84E+01	1.29E+00	6.35E-02	1.27E-03	1.16E-02	2.46E-03	5.85E-01	1.58E+01	0.00E+00
Group 2 HTD (β)		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Group 4 ETD		1.79E+04	2.22E+04	1.01E+03	1.24E+03	3.64E-01	2.75E+01	2.05E+00	2.45E+01	2.84E+05	3.73E+04
Group 4 HTD		1.63E+01	1.72E+01	7.80E-01	2.47E+02	3.07E-04	3.82E-03	1.73E-03	1.11E+00	0.00E+00	0.00E+00
Group 4 ETD+HTD		1.79E+04	2.22E+04	1.01E+03	1.49E+03	3.64E-01	2.76E+01	2.06E+00	2.56E+01	2.84E+05	3.73E+04
Group 5 HTD		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Group 6 HTD		1.11E+00	4.51E-01	2.04E-02	1.36E+01	1.05E-05	0.00E+00	5.94E-05	1.87E-03	0.00E+00	0.00E+00
Ratio	**Target Ratio**	**Target Ratio Values**									
Group 2 HTD (beta):Group 4 ETD	≤0.02	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Group 5 HTD:Group 4 ETD	>10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Group 6 HTD:Group 4 ETD	>10	0.000	0.000	0.000	0.011	0.000	0.000	0.000	0.000	0.000	0.000
Group 4 MFP ETD+HTD:Group 2 ETD (α)	>50:1	953	782	783	23,502	286	2,368	837	**44**	18,040	--
HTD Exemption		**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
α Exemption (Group 4 MFP beta limits)		**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Instrument		**Composite Beta-Gamma Efficiency**									
43-93		19.0%	19.0%	19.0%	**15.2%**	19.0%	19.9%	19.0%	**18.3%**	18.8%	20.0%
43-10-1		32.3%	32.3%	32.3%	**26.2%**	32.3%	33.0%	32.3%	31.0%	32.2%	33.0%
Instrument		**Correction Factor (dpm/cpm)**									
43-93		5	5	5	**7**	5	5	5	5	5	5
43-10-1		3	3	3	**4**	3	3	3	3	3	3

10.2 Group Target Ratios

CDMP-0008, Appendix C provides methods for evaluating radionuclide group activities against group target ratios that ensure compliance with posting, controls, and radiological clearance criteria when alpha emitting and HTD radionuclides are present. Evaluated group target ratios and values include:

Group 2 HTD (beta): Group 4 ETD Target Ratio

> If Group 2 HTD:Group 4 ETD ratio is less than or equal to 0.02, then compliance with criteria can be based on ETD measurements alone.

Group 5: Group 4 ETD Target Ratio

> Group 5: Group 4 ETD ratio exceeding 10 will require surveys and liquid scintillation analysis for tritium.

Group 6: Group 4 ETD Target Ratio

> Group 6: Group 4 ETD ratio exceeding 10 will typically require surveys and liquid scintillation analysis for Group 6 HTDs.

Alpha : Beta Ratio

> When Sr-90 limits apply, if alpha activity is less than 10% of the beta gamma activity then elimination of initial alpha surveys may be considered (dual survey exemption). However, if beta gamma activity is detected during the initial survey, a second survey for alpha is required.

Radionuclide inventories in Appendix A were sorted by group, then by emission, then by detection class and arranged in order of descending percent of total group activity. Cumulative group activity was also determined. Results are included in Appendix B. Source term group activities were evaluated against target ratio criteria and are summarized in Table 4.

10.3 Composite Beta-Gamma Efficiency

To be compliant with 10 CFR 835, Appendix D, the sum of the Group 4 HTD activities and Group 4 ETD activities must not exceed applicable limits. CDMP-0008, Appendix C includes three methods for evaluating compliance. The method for evaluating composite beta-gamma survey efficiencies relative to default detection efficiencies was used for this TE. When the calculated composite efficiency for the source term is at least 10%, no surveys and/or analysis for HTD radionuclides is necessary.

Composite efficiency for each source term were determined assuming minimum calibration efficiencies for Ludlum 43-93 and 43-10-1 detectors from CDMP-0145. Results are included in Appendix C and summarized in Table 4. Correction factors for converting counts per minute to disintegration per minute (dpm/cpm) are also included in Table 4.

10.4 HTD Survey Exemption

Since applicable group activity values meet the target ratio criteria for a HTD survey exemption and all composite beta-gamma survey efficiencies are >10% for all radionuclide source terms:

Surveys/analysis for HTD radionuclides are not required.

10.5 Dual Survey Exemption

The method for determining if exemptions from dual surveys are permitted is described in 0903-CDMP-0008, Appendix C. In many cases, this only eliminates the dual survey for the initial survey. If radioactivity is detected during the initial survey, a second survey for the other radiation type is then required to quantify the radioactivity present (e.g., if contamination is found during a required beta-gamma survey, an alpha survey is also required). A full dual survey exemption can be established if the facility can demonstrate that there is an insufficient source term (alpha or beta-gamma) in the facility to exceed clearance or 10 CFR 835 posting criteria.

For elimination of alpha surveys, the common approach is to ratio the clearance limit for total beta-gamma to the clearance limit for total alpha. That ratio is 10:1 when Sr-90 beta-gamma limits apply and 50:1 when standard mixed fission product (MFP) beta-gamma limits apply:

$$\frac{^{90}Sr\ clearance\ limit}{alpha\ clearance\ limit} = \frac{1{,}000\ dpm/100cm^2}{100\ dpm/100cm^2} = 10:1$$

$$\frac{MFP\ clearance\ limit}{alpha\ clearance\ limit} = \frac{5{,}000\ dpm/100cm^2}{100\ dpm/100cm^2} = 50:1$$

If the beta-gamma:alpha ratio is greater than the applicable ratio, then elimination of initial alpha surveys may be considered. The more conservative MFP:alpha clearance limit ratio is used in this TE to determine if an alpha survey exemption should be considered.

Except for the 300-265 waste site where the beta-gamma:alpha ratio is less than 50:1, the various radionuclide inventories and ratios presented in Table 4 suggest that an alpha survey exemption is generally appropriate for the facility. However, beta-gamma:alpha contamination ratios from radiological survey data contained in WCH-412 *324 Building Baseline Radiological Characterization* is less than 50:1 in the following locations:

- REC Airlock
- C-Cell
- D-Cell
- 300-265
- Room 146 Hoods
- Room 3C Hood
- Room 3F Hoods
- Room 3K Hood

As such, an alpha survey exemption is not appropriate for these areas. Ratios from radiological surveys from the REC Airlock and C-Cell performed in 2017 and 2018 draw the same conclusions for those specific areas.

Remote remediation of the 300-296 waste site point source zone from within B-Cell involves movement and placement of remediated material in various locations throughout the REC, including the REC Airlock, C-Cell, and D-Cell. Some materials may also be packaged and removed from the REC Airlock on a case-by-case basis. As such, an alpha survey exemption for activities associated with remote remediation of the 300-296 waste site is not provided.

After radioactive material from the 300-296 waste site point source zone has been excavated and moved from beneath B-Cell, the radionuclide inventories will be effectively comingled, such that calculations and recommendations presented in Table 4 will be the most appropriate guidance. Under those conditions, the exemption from initial alpha surveys may be considered based on the estimated ratio of 18,456:1, which is significantly greater than 10:1. To simplify field decisions on whether or not an alpha survey exemption is appropriate for a given location, the project will conservatively use the most restrictive conditions until 300-296 fugitive source zone remediation commences.

- **An alpha survey exemption is not provided for the 324 Facility during remote 300-296 point source zone remediation or facility removal action activities.**
- **An alpha survey exemption may be considered for 300-296 fugitive source zone remedial action activities.**
- **An alpha survey exemption is not provided for 300-265 waste site remedial action activities.**

10.6 Compliance with Applicable Limits for Clearance

This part of the evaluation primarily supports the clearance survey requirements of CPCC-PRO-RP-40026, *Standard Clearance Surveys for Personal Property,* and CPCC-PRO-RP-40028, *Radiological Clearance Survey Plans for Personal Property*. Personal property is evaluated for unconditional clearance from radiological controls based upon the clearance limits and authorized limits of CPCC-00175, *Central Plateau Cleanup Company Radiological Control Manual*, Table 4-1. CPCC-00174, *Central Plateau Cleanup Company Radiation Protection Program*, contains the exemption from 10 CFR 835, Appendix D for specific hard-to-detect (HTD) beta-gamma emitting radionuclides, which allows for the implementation of authorized limits reflected in Table 4-1 of CPCC-00175. CPCC-00175 also includes information supporting posting and control of radiological areas.

For clearance purposes the radionuclides of concern are conservatively categorized as <u>>90% ^{90}Sr/^{90}Y with the potential for alpha emitting transuranic nuclides for all source terms</u>.

The monitoring protocols at the 324 Facility are designed around a minimum Cs-137 efficiency of 18.5% for instruments used in establishing removable and total contamination levels to ensure clearance and posting criteria are satisfied, with the exception of bench top counters, which will use their calibrated efficiencies.

Direct clearance surveys for easy-to-detect (ETD) radionuclides are conducted with a Ludlum 2000 series ratemeter/scaler coupled with a 43-93 dual phosphor alpha-beta probe, or equivalent portable rate meter. The ETD component of removable contamination can be measured using a bench top scaler counter, like the Ludlum 2929, or a Ludlum 2000 series ratemeter/scaler with 43-93 probe, or equivalent, in the scaler mode. Alpha and gamma spectroscopy are available for isotopic analysis of various sample media through the Central Radiological Count Facility (CRCF).

All clearance surveys performed at the 324 Building for personal property or equipment will be performed as directed by CPCC-PRO-RP-40026, or a Clearance Survey Plan (CSP) written in accordance with CPCC-PRO-RP-40028.

10.7 Survey Instruments

Standard Hanford Instrument Evaluation Committee (HIEC) approved bench top and hand-held instruments will be used for direct and removable gross alpha/beta ETD contamination surveys, clearance surveys, and counting of air monitoring sample media. Quantification and documentation of data will be in accordance with existing procedures.

- Default efficiencies listed in hand-held instrument procedures are more conservative than those in Table 4 and will be used unless specific direction is given by Radiological Engineering to do otherwise.
- Bench top counters will use the efficiencies listed on their calibration stickers.

Additional sample analysis equipment available at the CPCC Central Radiological Counting Facility (CRCF) includes:

- Gas flow proportional counting systems that may be used for batch gross alpha/beta sample analysis (e.g., Tennelec),
- Alpha spectroscopy / Alpha Energy Analysis (AEA) equipment,
- Gamma spectroscopy/Gamma Energy Analysis (GEA) equipment.
- Liquid scintillation counting (LSC) equipment to determine presence of HTD and pure beta-emitters.

Radiochemical separation and radionuclide analysis is available from other Hanford contractors and off-site laboratories.

11. WORKPLACE EMISSIONS MONITORING

11.1 Air Monitoring Requirements

Requirements for air monitoring include:

10 CFR Part 835 ***Occupational Radiation Protection***

§ 835.403 Air Monitoring

(a) Monitoring of airborne radioactivity shall be performed:

(1) Where an individual is likely to receive an exposure of 40 or more DAC-hours in a year; or

(2) As necessary to characterize the airborne radioactivity hazard where respiratory protective devices for protection against airborne radionuclides is prescribed.

(b) Real-time air monitoring shall be performed as necessary to detect and provide warning of airborne radioactivity concentrations that warrant immediate action to terminate inhalation of airborne radioactive material.

CPCC-00175 ***Central Plateau Remediation Company Radiological Control Manual***

§ 555 Airborne Radioactivity Monitoring (in part)

1. ...air monitoring equipment should be used in situations where airborne radioactivity levels can fluctuate and early detection of airborne radioactivity could prevent or minimize inhalation of radioactivity by personnel...

2. Monitoring of airborne radioactivity shall [835.403(a)] be performed:

a. Where an individual is likely to receive an exposure of 40 or more DAC-hours in a year,...or

b. As necessary to characterize the airborne radioactivity hazard where respiratory protective devices for protection against airborne radionuclides have been prescribed...

3. Real-time air monitoring shall [835.403(b)] be performed as necessary to detect and provide warning of airborne radioactivity concentrations that warrant immediate action to terminate inhalation of airborne radioactive material...

   a. Real-time air monitoring equipment should be installed where unexpected increases in airborne radioactivity levels, should they occur, are likely to result in an exposure exceeding 40 DAC-hours in one week. Such exposures could result from a breakdown of engineered controls or improper establishment of boundaries during work that creates airborne radioactivity.

4. Air sampling equipment should be positioned to measure air concentrations to which persons are exposed. If this cannot be achieved, a program of personal breathing-zone air sampling should be initiated.

11.2 Historical Air Monitoring Results

Historical workplace grab, real-time, and lapel air monitoring results for calendar years 2017 through 2022 are considered representative of airborne radioactivity levels that may be encountered during normal and upset conditions (e.g., conditions where elevated airborne radioactivity has been identified, contamination has spread beyond established boundaries, or worker clothing/skin contamination has occurred).

Table 4. Grab & CAM Air Sample Statistics

Parameter	REC Airlock Entry	No REC Airlock Entry
Number of Air Samples	234	1,223
Number of Air Samples > 1 DAC	32 (13.7%)	7 (0.6%)
Number of Air Samples > 0.2 DAC	91 (38.9%)	26 (2.1%)
Number of Air Samples > 0.02 DAC	210 (89.7%)	356 (29.1%)
Maximum Final DAC Value	183.23	54.27
Average Final DAC Value	2.37	0.04
Median Final DAC Value	0.15	0.01

Table 5. Lapel Air Sample Statistics

Parameter	Value
Number of Lapel Samples	1,695
Number of Lapel Samples > 1 DAC-h	1 (0.06%)
Maximum DAC-h Value	6.99
Average DAC-h Value	0.01
Median DAC-h Value	0.00

Historical measurements demonstrate that air monitoring is warranted, and real-time beta air monitoring should be performed during REC Airlock entries. Exceeding 40 DAC-hours in a week from airborne alpha contamination is unlikely. As such, the need for real-time alpha monitoring is not warranted and calculations specified in CDMP-0011 and CDMP-0147 to determine the need for an air sampling program and real-time air monitoring are not performed.

11.3 Implementation

Conservatively, assuming continuous worker occupancy (2,000 hours per year; 40 hours per week), workplace air monitoring shall be performed when the estimated airborne radioactivity concentration is ≥ 0.02 DAC [2 percent of annual limit on intake (ALI)].

$$\frac{40\ DAC-hours}{year} \times \frac{year}{2{,}000\ hours} = 0.02\ DAC$$

Real-time air monitoring should be performed when the estimated airborne radioactivity concentration is > 1 DAC:

$$\frac{40\ DAC-hours}{week} \times \frac{week}{40\ hours} = 1\ DAC$$

Respiratory protection factors may be considered when determining the need for real-time air monitoring.

Occupational Radiation Protection Program workplace emissions monitoring requirements are implemented via the following documents and procedures:

- CPCC-GD-RP-40501, *Performing Air Flow Studies*
- CPCC-PRO-RP-40031, *Workplace Air Monitoring Program*
- CPCC-PRO-RP-40032, *Radiation Protection Workplace Air Sampling*
- CPCC-PRO-RP-40033, *Continuous Air Monitor Performance Testing*
- CPCC-PRO-RP-40034, *Derived Air Concentration-Hour Tracking*
- CPCC-PRO-RP-40035, *Analyzing Smear, Air and Lapel Samples*

- CPCC-PRO-RP-40037, *Lapel Air Samplers*
- CPCC-PRO-RP-40129, *Operation of the ThermoFisher/Eberline AMS-4 Beta Air Monitor*

11.3.1 Air Monitoring Equipment Placement

Air sampling equipment should be positioned to measure air concentrations to which persons are exposed. If this cannot be achieved (e.g., on elevated platforms with limited space for workers and equipment), a program of personal breathing-zone air sampling should be initiated.[3] See CPCC-PRO-RP-40037 for personal breathing-zone/lapel air sampling requirements.

Additional air sample/monitor equipment guidance is provided in CPCC-PRO-RP-40031.

11.3.2 Airflow Considerations

CDMP-0011 provides the following additional guidance on placement of air monitoring equipment:

> *When selecting locations for air sampling and real-time air monitoring equipment, consideration should be given to the locations of possible release points and workers, the purpose of the sample, room airflow patterns, and potential for collection of a non-representative sample. Airflow studies are useful to determine the placement of fixed location air samplers and CAMs. The DOE "Radiation Protection Programs Guide", DOE G 441.1-1C (DOE 2008c) states that air flow patterns in a given area should be reevaluated at a minimum of every 36 months...*

This method of evaluating air flow patterns is appropriate for facilities where steady state conditions exist over a long period of time, which was generally true for the active production facilities operated at Hanford in the past. However, facilities undergoing active decommissioning efforts are likely to experience frequent configuration changes that render air flow evaluations performed on an annual or 36-month frequency ineffective.

A more practical approach is to verify the air flow patterns for each work activity, that is likely to generate airborne radioactivity, for the existing facility configuration at the beginning of the work activity. A pen smoker, or similar device, is used to verify the direction of air flow at the work site, relative to worker positioning, to ensure proper air sample collection. Air flow patterns need not be verified for subsequent performance of the work activity if the facility configuration and the physical configuration of the work activity have not changed.

Additional air sample/monitor placement guidance is provided in CPCC-PRO-RP-40031 and CPCC-PRO-RP-40032.

Outdoor airflow is wind direction and speed dependent, and airflow studies are not appropriate. Anticipated dispersion is based on historical weather data obtained from the nearby Hanford Meteorological Station, Station #11, at a height of 10 ft for from January 2017 through December 2021. The historical wind pattern is assumed to represent conditions that will occur during future outdoor activities in the Hanford 300 Area. Typical wind rose data is presented in Figure 11 below.

[3] CPCC-00175, Article 555.4.

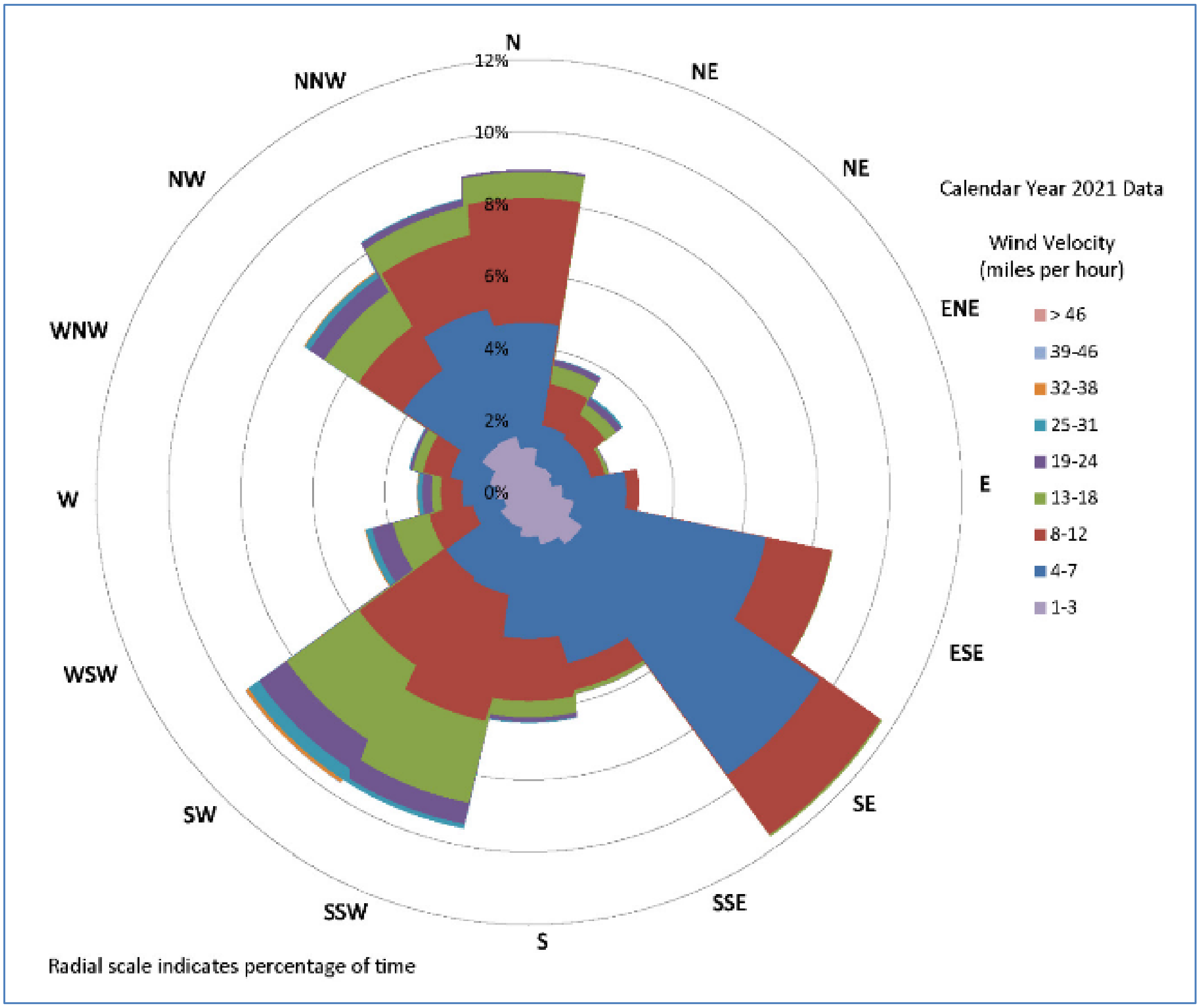

Figure 8. Typical 324 Wind Data

The need to restrict outdoor operations for radiological purposes is based on several factors including but not limited to:

- Isotopes of concern and concentration
- Dispersibility of radioactive material being handled
- Whether or not dust suppression and/or fixative is applied
- Wind speed and direction
- Material handling methods
- Industrial safety considerations

Restriction of outdoor radioactive material handling activities should not be based on wind speed alone. Airborne radioactivity concentration in the work area decreases with increasing wind speed. However, movement of contaminated soil near the ground surface will increase with increasing wind speed via surface creep and saltation soil transport mechanisms and may result in contamination spreading beyond established boundaries. CDMP-0147 suggests that surface creep and saltation soil transport begin to occur at about 15 miles per hour (mph).

Outdoor handling of dispersible radioactive material should be restricted if the sustained wind speed is greater than 15 mph to limit contamination transport via surface creep and saltation mechanisms.

See CDMP-0127 *Radiological Engineering Methods Technical Basis Document* and CDMP-0147 for additional guidance on outdoor radioactive emissions estimating methods, monitoring, and controls.

11.3.3 CAM Alarm Setpoints

Real-time air monitors should be capable of measuring 1 DAC when averaged over 8 hours (8 DAC-h) under laboratory conditions. Alarm setpoints (ASPs) for real-time air monitors should be set at the lowest practical level to accurately indicate loss of containment or the need for corrective action without causing a significant number of false alarms. Having ASPs up to 24 DAC-h is acceptable if Radon/Thoron is an issue. If real-time monitors are used during work requiring the use of respiratory protective devices, the ASP can be adjusted to provide an early warning that the applicable respiratory protection factor may be exceeded.

The general equation used to determine CAM ASPs is:

$$\mathrm{ASP(cpm)} = \frac{(\mathrm{DAC})*(\mathrm{hr})*\left(60\,\frac{\mathrm{min}}{\mathrm{hr}}\right)*(\mathrm{E})*(\mathrm{F})*(\mathrm{PF})}{1.6\mathrm{E}\text{-}11}$$

Where:

DAC	=	Derived Air Concentration for the isotope of concern (µCi/ml) from 10CFR835, App. A. Typical default values are ^{239}Pu/^{241}Am at 5E-12 and ^{90}Sr/^{90}Y at 1E-8.
hr	=	Ideally 8 or less; no greater than 24.
60 min/hr	=	Conversion factor.
E	=	CAM counting efficiency in decimal form.
F	=	CAM flow rate in ft^3/min (as measured on the CAM OR the flow rate that will be used when the instrument is placed into service).
1.6E-11	=	Conversion constant (µCi•ft^3/dpm•ml).
PF	=	Respiratory protection factor (1 if not wearing respirators).

AMS-4 Beta Particulate Air Monitors are currently used by the 324 Project. AMS-4 CAM ASPs are provided in Table 7.

Table 6. AMS-4 Beta CAM Setpoints

Parameter	Respirator Protection Factor		
	PF=1	PF=50	PF=1,000
Slow Alarm Interval	30 min		
Slow Alarm Setpoint	6E-07 µCi/mL		
Fast Alarm Interval	60 sec		
Fast Alarm Setpoint	1E-06 µCi/mL		
Net Alarm Interval	Not Used		
Net Alarm Setpoint	Not Used		
DAC-hr Setpoint	8	8	160
Sample Flow Rate	2 cfm		
Min Flow Rate	1.7 cfm		
Max Flow Rate	2.3 cfm		
DAC Value	629 dpm/ft^3 (1E-08 µCi/mL)		

For radiological work planning purposes, concentrations and exposure durations equivalent to 40 DAC-h/year for various exposure scenarios are presented in CDMP-0011, Table 2.5. Unmitigated removable surface contamination values that may result in 2%, 20%, and 30% of the alpha and beta derived air concentrations are presented CDMP-0011, Table 2.7 and 2.8, respectively. Values are conservative in that they account for relatively stable contamination forms (e.g., wet, greasy) or confinement (e.g., glovebag, negative ventilation).

11.4 Exceptions to Air Sampling and Real-Time Air Monitoring Requirements

Air sampling equipment should be positioned to measure air concentrations to which persons are exposed. If this cannot be achieved, personal breathing-zone sampling is required.[4]

There are no exceptions to real-time air monitoring requirements.

11.5 Air Sample Counting

Air sample counting protocols are contained in procedure CPCC-PRO-RP-40035, *Analyzing Smear, Air and Lapel Samples*. Analysis of air sample data is performed at intervals that consider the biokinetic excretion rate of potentially inhaled radioactive particles as well as the decay rate of radon and thoron progeny. Sample analysis data provides the results necessary for management and technical staff to determine the need for special internal dosimetry bioassay. If action levels are exceeded the need for special bioassay for affected workers is evaluated. This protocol is in line with the counting protocol provisions of CDMP-0011.

Calculation of the decision level (DL), minimum detectable activity (MDA) and minimum detectable

[4] CPCC-00175, Article 555.4.

concentration (MDC) for sampling/counting configurations are performed utilizing formulas in CPCC-PRO-RP-40035.

Annual calibration of counting equipment is performed using National Institute of Science and Technology (NIST) traceable sources to assure system functionality. These procedures include detailed instructions for performing function and source checks, counting samples, operating counting systems, and recording data obtained from sample counting activities.

12. DOSIMETRY

12.1 External Dosimetry

CPCC-PRO-RP-379, *External Dosimetry Program*, establishes the criteria for external dosimetry. Beta and gamma emissions are the primary source of external exposure to personnel at the 324 facility. Detectable neutron exposure from spontaneous fission of transuranic radionuclides is possible when dealing with high activity sources from within the 324 REC and 300-296 soil. However, neutron exposure at levels requiring neutron monitoring is insignificant compared to beta-gamma exposure. A review of record dosimetry data for REC Airlock entrants during CY2022 identified zero (0) mrem of neutron exposure. As such, neutron dosimetry is not prescribed.

Radiological workers will be issued a Hanford Standard Dosimeter (HSD) on an annual basis for normal work activities. The dosimeter exchange frequency, number of dosimeters worn (multiple dosimetry), and extremity monitoring may be modified based on anticipated worker exposure, in accordance with CPCC-PRO-RP-379 and will be documented in radiological work planning documents.

12.2 Internal Dosimetry

HNF-55719, *Hanford Internal Dosimetry Program Manual* (HIDP manual) and CPCC-PRO-RP-380, *Internal Dosimetry Program* recommends workers participate in periodic bioassay monitoring if one or more of the following conditions applies:

- Work requires use of a respiratory protection device for radiological protection.
- Work in a High Contamination Area (HCA) that involves contact with or disturbance of contamination.
- Work with unencapsulated radioactive material at or exceeding 2 percent of the annual limit on intake (ALI) values listed in HNF-5719, Table 5.2 or values derived by other methods described in HNF-55719.
- Work with contaminated soil at or exceeding the values listed in HNF-5719, Table 5.3 and CPCC-00175, Table 5-2.
- Exposure to low-level airborne activity (below posting requirements) such that the total exposure for a year would exceed 40 DAC-hours.

HNF-55719 and CPCC-PRO-RP-380 state that any radionuclide or mixture of radionuclides present that may contribute to more than 25% to the 100-mrem committed effective dose (CED) criterion should be included in the bioassay monitoring program. Isotope ratios presented in HNF-55719, Table 5.1 are also used to determine appropriate bioassay protocols.

12.2.1 Assumptions

Internal bioassay evaluation assumptions:

- Radiological characteristics associated with maximum removable contamination levels documented in WCH-412, *324 Baseline Radiological Characterization* are assumed for the following areas:
    - REC Airlock, B-Cell, C-Cell, and D-Cell. Equipment and debris from B-Cell was moved into A-Cell subsequent to WCH-412 being published. As such, B-Cell radiological characteristics are appropriate for A-Cell.
    - SMF South Cell, East Cell and Airlock
    - Room 147 Hoods
- Radiological characteristics of the upper soil sample beneath the B-Cell sump (HEIS sample ID J1JD50) are assumed for 300-296 remote excavation activities. The REC will take on these characteristic as remote excavation and movement of material within the REC cells progresses.
- Radiological characteristics of the lower soil sample beneath the B-Cell sump (HEIS sample ID J1JD49) are assumed for 300-296 facility stabilization activities (e.g., horizontal stabilization, Room 18 & 131 stabilization).
- Radiological characteristics of RLWS sump sediment (HEIS sample ID J1C2W1) are representative of RLWS, RRLWS, and CBWS piping.
- Radiological characteristics from ECF-324-BLDG-17-0086 are assumed for other 324 Building areas where sample results have not been identified but radioactive material inventory estimates are available. This includes:
    - REC Pipe Trench
    - REC A-Frame Filters
    - REC Exhaust Ducts
    - HLV
    - LLV
    - Zone 1 and 2 Containments (e.g., hoods other than those in Room 147)
    - HEPA filters (other than REC A-Frame Filters)
    - POG/VV Piping
- Radiological characteristics of the 300-265 waste site from 0300X-CA-N0153 are assumed.
- All assumed source terms have been decay corrected to January 1, 2026.
- Due to their relatively high activity fractions compared to other radionuclides in a given mixture, Cs-137 and/or Sr-90 may be used as indicators for other radionuclides in the mixture that have bioassay methods that are more difficult to implement and execute, where appropriate.
- Inhalation Type F is assumed for Sr-90, per HNF-55720, *Methods and Models of the Hanford Internal Dosimetry Program*.
- Legacy dry inhalation Type S is assumed for Pu-238, Pu-239, Pu-240, Pu-241, and Pu-242, per HNF-55719.

12.2.2 Internal Dosimetry Summary

Minimum internal dosimetry recommendations when work activities are likely to involve direct handling of unencapsulated radioactive material are summarized in Table 8. Detailed internal dosimetry analysis is included in Appendix D.

Table 7. Minimum Internal Dosimetry Requirements

Location	Whole Body Count (Annual)	Strontium Bioassay (Biennial)	Isotopic Plutonium Bioassay (Annual)	Am-241 Bioassay (Annual)	Curium Bioassay (Annual)
REC (Except C-Cell)	X			X	
C-Cell	X			X	X
300-296 (Facility Stabilization / Open Air Excavation)	X	X			
SMF South Cell & Airlock	X				
SMF East Cell	X	X			
Rm 147 Hoods	X	X		X	
Zone 1 & 2 Hoods (excluding Rm 147)	X			X	
POG/VV Piping	X			X	
HEPA Filters (excluding REC A-Frame filters)	X	X			
RLWS/RRLWS/CBWS Piping	X	X			
300-265 Waste Site	X		X	X	

12.2.3 Additional Bioassay Protocols

The diagnosis of an intake involves a combination of workplace monitoring to identify on-the-job potential intakes and bioassay measurements to confirm and quantify internal contamination. The primary method of identifying potential intakes is by workplace monitoring, such as personal contamination surveys, nasal smear analyses, air sample results, or workers' identifications of unusual conditions.

For activities involving waste streams requiring deviation from minimum bioassay requirements, bioassay based on workplace monitoring indicators is preferred.

Recommendations for bioassay based on workplace monitoring indicators will be made by HIDP, with the concurrence from the CPCC CTA for internal dosimetry or designated alternate. The type and extent of special bioassay measurements depend on the significance and complexity of the case.

12.2.4 Bioassay Exceptions

Exceptions to bioassay may be granted on a case-by-case basis by Radiological Engineering if internal exposure criteria warranting bioassay are not likely to be exceeded.

12.3 Area Dosimetry

Procedure CPCC-PRO-RP-40024, *Area Dosimetry Program*, provides an acceptable method for establishing an area dosimetry program including how to determine which facilities are to be monitored, the number and type of dosimeters, the frequency of dosimeter change out, and the evaluation of the data obtained from the dosimeters. The procedure applies specifically to all facilities and areas where <u>unmonitored</u> employees work at least 20 hours a week and are within 15 m (50 ft) of the following radiologically posted areas:

- Radiological Buffer Areas established for dose control
- Radioactive Material Areas
- Radiation Areas
- High Radiation Areas
- Very High Radiation Areas

All 300 AES where unmonitored employees have the potential to work at least 20 hours a week exhibit one or more of the following characteristics:

- They are greater than 50 ft from the types of radiologically posted areas described above
- Measurements indicate that no potential exists to approach 100 mrem/y due to radiation levels from existing posted radiological areas.

Therefore, an Area Dosimetry program is not warranted. This decision will be re-evaluated if conditions change such that the above characteristics may be impacted.

13. INFORMATION FOR RWP PREPARERS

1. Primary Radionuclides:

   Sr-90 (>90%), Cs-137, Mixed Fission Products (MFP), Pu and Am-241.

2. Internal Dosimetry:

   See Table 8.

3. External Dosimetry:
   a. Hanford Standard Dosimeter (HSD)
   b. Electronic Dosimeter (ED).

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[26] CPCC-PRO-RP-40026, *Standard Clearance Surveys for Personal Property.*
[27] CPCC-PRO-RP-40028 *Radiological Clearance Survey Plans for Personal Property.*
[28] CPCC-PRO-RP-40031, *Workplace Air Monitoring Program*.
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APPENDIX A
RADIONUCLIDE INVENTORIES

Table A-1. 324 REC Baseline Radionuclide Inventory (Ci), decayed to January 1, 2026

Nuclide	A-Cell (a)	B-Cell (b)	C-Cell (c)	D-Cell (d)	Airlock (e)	Pipe Trench (f)	A-Frame HEPA Filters (g, i)	REC Exhaust Ductwork (h, i)	REC Total
Sr-90	5.07E+02	2.65E+03	5.60E-01	1.51E+01	2.42E+00	4.04E+01	9.35E+00	7.48E+00	3.23E+03
Y-90	5.07E+02	2.65E+03	5.61E-01	1.51E+01	2.42E+00	4.04E+01	9.35E+00	7.48E+00	3.23E+03
Cs-137	6.54E+02	5.01E+03	1.07E+00	7.76E+01	4.60E+00	7.74E+01	1.78E+01	1.43E+01	5.86E+03
Ba-137m	6.18E+02	4.73E+03	1.01E+00	7.32E+01	4.34E+00	7.30E+01	1.68E+01	1.35E+01	5.53E+03
Eu-154	3.02E-01	4.01E+00	4.65E-04	9.35E-02	2.42E-03	3.35E-02	1.07E-02	8.53E-03	4.46E+00
Eu-155	4.08E-03	1.10E+00	6.52E-05	0.00E+00	4.20E-04	4.69E-03	2.15E-03	1.72E-03	1.11E+00
Pu-238	1.05E-01	1.96E+00	4.97E-04	1.60E-02	2.02E-03	3.58E-02	7.55E-03	6.04E-03	2.13E+00
Pu-239	4.67E-02	6.77E-01	1.87E-04	8.12E-03	7.39E-04	1.35E-02	2.72E-03	2.17E-03	7.51E-01
Pu-240	4.14E-02	6.69E-01	1.85E-04	8.25E-03	7.32E-04	1.33E-02	2.70E-03	2.17E-03	7.37E-01
Pu-241	5.83E-01	1.53E+01	2.49E-03	1.08E-01	1.16E-02	1.79E-01	4.76E-02	3.81E-02	1.63E+01
Am-241	1.92E+00	1.01E+01	2.81E-03	9.35E-02	1.11E-02	2.02E-01	4.09E-02	3.27E-02	1.24E+01
Cm-244	2.76E-01	2.33E+00	4.22E-04	6.23E-02	1.91E-03	3.05E-02	7.65E-03	6.12E-03	2.72E+00
Total	2.29E+03	1.51E+04	3.22E+00	1.81E+02	1.38E+01	2.32E+02	5.34E+01	4.28E+01	1.79E+04
% of REC Total	**12.79%**	**84.27%**	**0.02%**	**1.01%**	**0.08%**	**1.29%**	**0.30%**	**0.24%**	**100.00%**

(a) From ECF-324-BLDG-17-0086, Rev. 0, Tables 2, 3, 4, and 5.
(b) From ECF-324-BLDG-17-0086, Rev. 0, Table 8.
(c) From ECF-324-BLDG-17-0086, Rev. 0, Table 11.
(d) From ECF-324-BLDG-17-0086, Rev. 0, Table 14.
(e) From ECF-324-BLDG-17-0086, Rev. 0, Table 17.
(f) From ECF-324-BLDG-17-0086, Rev. 0, Table 20.
(g) From ECF-324-BLDG-17-0086, Rev. 0, Table 36.
(h) From ECF-324-BLDG-17-0086, Rev. 0, Table 37.
(i) REC A-Frame HEPA filters and exhaust ductwork are operational. Listed inventories are subject to change due to loading over time and filter changes.

Table A-2. 324 HLV Baseline Radionuclide Inventory (Ci), decayed to January 1, 2026

Nuclide	T-104 Tank (a)	T-104 Pot (a)	T-105 Tank (b)	T-105 Pot (b)	T-106 Tank (a)	T-106 Pot (a)	T-107 Tank (a)	T-107 Pot (a)	HLV Process Piping (c)	HLV Total
Sr-90	6.14E+02	1.47E+02	2.43E+03	1.26E+02	1.82E+02	4.69E+01	2.80E+02	2.21E+01	3.42E+01	3.88E+03
Y-90	6.14E+02	1.47E+02	2.43E+03	1.26E+02	1.82E+02	4.70E+01	2.80E+02	2.21E+01	3.42E+01	3.88E+03
Cs-137	1.18E+03	2.81E+02	4.65E+03	2.41E+02	3.48E+02	8.99E+01	5.38E+02	4.23E+01	6.56E+01	7.43E+03
Ba-137m	1.11E+03	2.66E+02	4.39E+03	2.28E+02	3.29E+02	8.48E+01	5.08E+02	3.99E+01	6.19E+01	7.02E+03
Eu-154	5.09E-01	1.22E-01	2.02E+00	1.05E-01	1.51E-01	3.91E-02	2.33E-01	1.84E-02	2.83E-02	3.22E+00
Pu-238	5.43E-01	1.30E-01	2.15E+00	1.11E-01	1.60E-01	4.15E-02	2.49E-01	1.96E-02	3.03E-02	3.43E+00
Pu-239	2.04E-01	4.88E-02	8.08E-01	4.18E-02	6.05E-02	1.56E-02	9.33E-02	7.35E-03	1.14E-02	1.29E+00
Pu-240	2.03E-01	4.86E-02	8.04E-01	4.17E-02	6.02E-02	1.56E-02	9.29E-02	7.32E-03	1.13E-02	1.28E+00
Pu-241	2.72E+00	6.50E-01	1.08E+01	5.58E-01	8.07E-01	2.09E-01	1.25E+00	9.78E-02	1.52E-01	1.72E+01
Am-241	3.08E+00	7.34E-01	1.22E+01	6.30E-01	9.10E-01	2.35E-01	1.40E+00	1.11E-01	1.72E-01	1.95E+01
Cm-244	4.63E-01	1.11E-01	1.83E+00	9.51E-02	1.37E-01	3.54E-02	2.12E-01	1.67E-02	2.58E-02	2.93E+00
Total	**3.52E+03**	**8.43E+02**	**1.39E+04**	**7.23E+02**	**1.04E+03**	**2.69E+02**	**1.61E+03**	**3.52E+03**	**1.96E+02**	**2.23E+04**
% of HLV Total	**15.81%**	**3.79%**	**62.58%**	**3.25%**	**4.68%**	**1.21%**	**7.23%**	**15.81%**	**0.88%**	**100.00%**

(a) From ECF-324-BLDG-17-0086, Rev. 0, Table 33.
(b) From 0300X-CA-N0118, Rev. 1, Table 28.
(c) From ECF-324-BLDG-17-0086, Rev. 0, Table 48.

Table A-3. 324 LLV Baseline Radionuclide Inventory (Ci), decayed to January 1, 2026

Nuclide	T-101 Tank (a)	T-101 Pot (a)	T-102 Tank (a)	T-102 Pot (a)	T-103 Tank (b)	T-103 Pot (b)	T-108 Tank (a)	LLV Process Piping (c)	LLV Total
Sr-90	2.09E+01	7.89E+00	1.27E+01	4.24E+00	7.55E+01	0.00E+00	5.42E+01	5.48E-02	1.76E+02
Y-90	2.09E+01	7.89E+00	1.27E+01	4.24E+00	7.55E+01	0.00E+00	5.42E+01	5.49E-02	1.76E+02
Cs-137	4.01E+01	1.51E+01	2.44E+01	8.16E+00	1.45E+02	0.00E+00	1.04E+02	1.05E-01	3.37E+02
Ba-137m	3.79E+01	1.42E+01	2.30E+01	7.70E+00	1.37E+02	0.00E+00	9.79E+01	9.92E-02	3.18E+02
Eu-154	1.74E-02	6.55E-03	1.06E-02	3.52E-03	6.30E-02	0.00E+00	4.51E-02	4.57E-05	1.46E-01
Eu-155	2.42E-03	9.15E-04	1.47E-03	4.93E-04	8.80E-03	0.00E+00	6.30E-03	6.37E-06	2.04E-02
Pu-238	1.85E-02	6.97E-03	1.13E-02	3.75E-03	6.70E-02	0.00E+00	4.79E-02	4.85E-05	1.55E-01
Pu-239	6.96E-03	2.62E-03	4.23E-03	1.41E-03	2.52E-02	0.00E+00	1.80E-02	1.82E-05	5.84E-02
Pu-240	6.93E-03	2.61E-03	4.22E-03	1.41E-03	2.51E-02	0.00E+00	1.80E-02	1.82E-05	5.82E-02
Pu-241	9.27E-02	3.50E-02	5.63E-02	1.88E-02	3.36E-01	0.00E+00	2.41E-01	2.44E-04	7.80E-01
Am-241	1.05E-01	3.94E-02	6.38E-02	2.13E-02	3.79E-01	0.00E+00	2.71E-01	2.74E-04	8.80E-01
Cm-244	1.58E-02	5.94E-03	9.61E-03	3.20E-03	5.72E-02	0.00E+00	4.09E-02	4.14E-05	1.33E-01
Total	**1.20E+02**	**4.52E+01**	**7.30E+01**	**2.44E+01**	**4.34E+02**	**0.00E+00**	**3.11E+02**	**3.15E-01**	**1.01E+03**
% of LLV Total	**11.91%**	**4.48%**	**7.25%**	**2.42%**	**43.08%**	**0.00%**	**30.83%**	**0.03%**	**100.00%**

(a) From ECF-324-BLDG-17-0086, Rev. 0, Table 33.
(b) From 0300X-CA-N0118, Rev. 1, Table 26.
(c) From ECF-324-BLDG-17-0086, Rev. 0, Table 48.

Table A-4. 324 SMF Baseline Radionuclide Inventory (Ci), decayed to January 1, 2026

Nuclide	South Cell Total (a)	East Cell Total (b)	Airlock Total (c)	SMF Total
Fe-55	1.35E+01	--	--	1.35E+01
Co-60	1.26E+01	4.12E-05	4.50E-05	1.26E+01
Sr-90	7.82E+00	2.40E-04	2.63E-04	7.82E+00
Y-90	7.82E+00	2.40E-04	2.63E-04	7.82E+00
Nb-93m	7.52E+01	--	--	7.52E+01
Mo-93	1.72E+02	--	--	1.72E+02
Tc-99	1.80E+01	--	--	1.80E+01
Sb-125	2.34E+00	7.16E-05	7.81E-05	2.34E+00
Te-125m	5.54E-01	1.70E-05	1.85E-05	5.54E-01
Cs-137	6.24E+02	1.02E-02	1.11E-02	6.24E+02
Ba-137m	5.89E+02	9.59E-03	1.05E-02	5.89E+02
Eu-154	1.71E-01	5.25E-06	5.76E-06	1.71E-01
Eu-155	6.03E-02	1.85E-06	2.03E-06	6.03E-02
Pu-241	2.43E-02	7.47E-07	8.15E-07	2.43E-02
Am-241	6.35E-02	1.95E-06	2.13E-06	6.35E-02
Total	**1.52E+03**	**2.04E-02**	**2.22E-02**	**1.52E+03**
% of SMF Total	**100.00%**	**0.00%**	**0.00%**	**100.00%**

(a) From 0300X-CA-N0118, Rev. 1, Tables 30, 31, 33, 34 and 36.
(b) From ECF-324-BLDG-17-0086, Rev. 0, Table 27.
(c) From ECF-324-BLDG-17-0086, Rev. 0, Table 30.

Table A-5. 324 Zone I and II Containment Baseline Radionuclide Inventory (Ci), decayed to January 1, 2026

Nuclide	Zone I Containments (a)	Zone II Containments (a)	Containment Total
Sr-90	4.02E-02	2.36E-02	6.38E-02
Y-90	4.02E-02	2.36E-02	6.38E-02
Cs-137	7.66E-02	4.50E-02	1.22E-01
Ba-137m	7.23E-02	4.25E-02	1.15E-01
Eu-154	3.97E-05	2.33E-05	6.30E-05
Eu-155	6.61E-06	3.88E-06	1.05E-05
Pu-238	9.79E-05	6.29E-05	1.61E-04
Pu-239	3.59E-05	2.31E-05	5.90E-05
Pu-240	3.56E-05	2.29E-05	5.85E-05
Pu-241	1.93E-04	1.14E-04	3.07E-04
Am-241	5.13E-04	3.30E-04	8.43E-04
Cm-244	9.23E-05	5.93E-05	1.52E-04
Total	**2.30E-01**	**1.35E-01**	**3.66E-01**
% of Total	**62.97%**	**37.03%**	**100.00%**

(a) From ECF-324-BLDG-17-0086, Rev. 0, Table 40.

Table A-6. 324 HEPA Filter Baseline Radionuclide Inventory (Ci), decayed to January 1, 2026
(Excluding REC A-Frame Filters)

Nuclide	Rm 3C Hood Exhaust HEPA (a)	Rm 9 Zone 1 Exhaust Plenum HEPA (a, c)	Rm 10 Zone 1 Exhaust Plenum HEPA (a, c)	Rm 11 POG & VV Room F-102 HEPA (a)	Rm 11 POG & VV Room F-104 HEPA (a)	Rm 11 POG & VV Room F-106 HEPA (a)	Rm 134 C-Cell Exhaust Plenum Roughing Filter (a)	Rm 135 REC Airlock Exhaust Plenum Roughing Filter (b)	SMF Basement Rm 3 Exhaust HEPA (b)
Co-60	1.89E-07	1.81E-04	3.04E-04	9.55E-04	2.23E-03	2.10E-04	4.04E-05	7.92E-05	5.05E-08
Sr-90	6.32E-04	6.03E-01	1.01E+00	3.18E+00	7.42E+00	7.01E-01	1.35E-01	2.64E-01	1.69E-04
Y-90	6.32E-04	6.04E-01	1.01E+00	3.19E+00	7.42E+00	7.01E-01	1.35E-01	2.64E-01	1.69E-04
Cs-137	2.17E-05	2.07E-02	3.48E-02	1.09E-01	2.55E-01	2.40E-02	4.63E-03	9.06E-03	5.79E-06
Ba-137m	2.05E-05	1.96E-02	3.28E-02	1.03E-01	2.41E-01	2.26E-02	4.37E-03	8.55E-03	5.46E-06
Eu-154	3.14E-08	3.00E-05	5.03E-05	1.58E-04	3.69E-04	3.47E-05	6.69E-06	1.31E-05	8.36E-09
Pu-238	1.77E-08	1.68E-05	2.83E-05	8.90E-05	2.08E-04	1.96E-05	3.76E-06	7.39E-06	4.71E-09
Pu-240	1.45E-08	1.37E-05	2.31E-05	7.26E-05	1.69E-04	1.60E-05	3.07E-06	6.02E-06	3.84E-09
Pu-241	1.81E-07	1.73E-04	2.90E-04	9.13E-04	2.13E-03	2.00E-04	3.86E-05	7.56E-05	4.84E-08
Am-241	1.41E-07	1.35E-04	2.27E-04	7.11E-04	1.66E-03	1.56E-04	3.01E-05	5.90E-05	3.76E-08
Cm-244	3.78E-07	3.61E-04	6.05E-04	1.91E-03	4.44E-03	4.18E-04	8.05E-05	1.58E-04	1.01E-07
Total	**1.31E-03**	**1.25E+00**	**2.10E+00**	**6.59E+00**	**1.53E+01**	**1.45E+00**	**2.79E-01**	**5.46E-01**	**3.49E-04**
% of Total	**0.00%**	**4.53%**	**7.61%**	**23.89%**	**55.65%**	**5.26%**	**1.01%**	**1.98%**	**0.00%**

(a) From ECF-324-BLDG-17-0086, Rev. 0, Table 42.
(b) From ECF-324-BLDG-17-0086, Rev. 0, Table 43.
(c) Rm 9 and 10 Zone 1 Exhaust Plenum HEPA filters are operational. Listed inventories are subject to change due to loading over time and filter changes.

Table A-6. 324 HEPA Filter Baseline Radionuclide Inventory (Ci), decayed to January 1, 2026 (Continued)

(Excluding REC A-Frame Filters)

Nuclide	Rm 6 Zone 2 Exhaust Plenum HEPA (a, b)	Rm 7 Zone 2 Exhaust Plenum HEPA (a, b)	Rm 309A Hood Exhaust HEPA (a)	Rm 316 Filter Room 306/309 VV Exhaust (a)	Rm 317 Bldg Vacuum Air Sample Supply HEPA (a)	HEPA Filter Total
Co-60	2.89E-07	2.44E-06	1.99E-09	3.98E-08	1.59E-08	4.00E-03
Sr-90	9.66E-04	8.16E-03	6.62E-06	1.33E-04	5.30E-05	1.33E+01
Y-90	9.66E-04	8.17E-03	6.62E-06	1.33E-04	5.30E-05	1.33E+01
Cs-137	3.31E-05	2.79E-04	2.27E-07	4.55E-06	1.82E-06	4.58E-01
Ba-137m	3.13E-05	2.64E-04	2.15E-07	4.29E-06	1.72E-06	4.32E-01
Eu-154	4.79E-08	4.04E-07	3.27E-10	6.58E-09	2.63E-09	6.62E-04
Pu-238	2.70E-08	2.27E-07	1.85E-10	3.70E-09	1.48E-09	3.73E-04
Pu-240	2.20E-08	1.86E-07	1.51E-10	3.02E-09	1.21E-09	3.04E-04
Pu-241	2.76E-07	2.33E-06	1.90E-09	3.79E-08	1.52E-08	3.82E-03
Am-241	2.15E-07	1.82E-06	1.48E-09	2.96E-08	1.18E-08	2.98E-03
Cm-244	5.78E-07	4.87E-06	3.96E-09	7.94E-08	3.17E-08	7.98E-03
Total	**2.00E-03**	**1.69E-02**	**1.37E-05**	**2.74E-04**	**1.10E-04**	**2.76E+01**
% of Total	**0.01%**	**0.06%**	**0.00%**	**0.00%**	**0.00%**	**100.00%**

(a) From ECF-324-BLDG-17-0086, Rev. 0, Table 43.
(b) Rm 6 and 7 Zone 2 Exhaust Plenum HEPA filters are operational. Listed inventories are subject to change due to loading over time and filter changes.

Table A-8. 324 Piping Radionuclide Inventory (Ci), decayed to January 1, 2026

Nuclide	POG/VV Piping (a)	RLWS Piping (b)	RRLWS/CBWS Piping (b)	Piping Total
Sr-90	3.59E-01	3.35E-04	3.35E-04	3.60E-01
Y-90	3.59E-01	3.35E-04	3.35E-04	3.60E-01
Cs-137	6.85E-01	6.38E-04	6.38E-04	6.86E-01
Ba-137m	6.46E-01	6.03E-04	6.03E-04	6.48E-01
Eu-154	3.54E-04	3.30E-07	3.30E-07	3.54E-04
Eu-155	5.93E-05	5.52E-08	5.52E-08	5.94E-05
Pu-238	3.00E-04	2.81E-07	2.81E-07	3.01E-04
Pu-239	1.10E-04	1.03E-07	1.03E-07	1.10E-04
Pu-240	1.09E-04	1.02E-07	1.02E-07	1.09E-04
Pu-241	1.73E-03	1.61E-06	1.61E-06	1.73E-03
Am-241	1.65E-03	1.54E-06	1.54E-06	1.65E-03
Cm-244	2.84E-04	2.64E-07	2.64E-07	2.84E-04
Total	**2.05E+00**	**1.92E-03**	**1.92E-03**	**2.06E+00**
% of Total	**99.81%**	**0.09%**	**0.09%**	**100.00%**

(a) From ECF-324-BLDG-17-0086, Rev. 0, Table 46.
(b) From ECF-324-BLDG-17-0086, Rev. 0, Table 50.

Table A-8. 300-265 Waste Site Radionuclide Inventory (Ci), decayed to January 1, 2026

Nuclide	3/8" Dissolver Solution Pipe (a)	3/4" HLWS Pipe (a)	Encasement Pipe (a)	300-265 Total
Co-60	2.88E-03	--	--	2.88E-03
Sr-90	1.96E+00	3.03E+00	--	4.99E+00
Y-90	1.96E+00	3.04E+00	--	5.00E+00
Tc-99	1.05E-03	1.65E-03	--	2.70E-03
Cs-137	2.90E+00	4.49E+00	3.37E-02	7.42E+00
Ba-137m	2.73E+00	4.24E+00	3.18E-02	7.01E+00
Eu-154	2.06E-02	3.11E-02	1.35E-05	5.16E-02
Eu-155	7.58E-04	1.12E-03	4.92E-07	1.87E-03
Pu-238	1.35E-01	9.96E-03	--	1.45E-01
Pu-239	2.51E-02	2.00E-04	--	2.53E-02
Pu-240	4.23E-02	7.62E-04	--	4.30E-02
Pu-241	1.10E+00	8.44E-03	--	1.11E+00
Pu-242	1.41E-04	1.11E-06	--	1.42E-04
Am-241	2.94E-01	2.44E-02	3.29E-04	3.18E-01
Cm-243	--	6.12E-04	--	6.12E-04
Cm-244	2.10E-02	3.24E-02	--	5.34E-02
Total	**1.12E+01**	**1.49E+01**	**6.58E-02**	**2.62E+01**
% of Total	**42.77%**	**56.98%**	**0.25%**	**100.00%**

(a) From 0300X-CA-N0153, Rev. 0, Table 8.

Table A-9. 300-296 Waste Site Radionuclide Inventory (Ci), decayed to January 1, 2026

Nuclide	300-296 Point Source (a)	300-296 Fugitive Source (b)	300-296 Total
Sr-90	3.31E+04	1.87E+04	5.18E+04
Y-90	3.31E+04	1.87E+04	5.18E+04
Cs-137	1.12E+05	--	1.12E+05
Ba-137m	1.06E+05	--	1.06E+05
Pu-238	6.49E+00	--	6.49E+00
Am-241	4.29E+00	--	4.29E+00
Cm-244	4.99E+00	--	4.99E+00
Total	**2.84E+05**	**3.73E+04**	**3.22E+05**
% of Total	**88.40%**	**11.60%**	**100.00%**

(a) From ECF-324-BLDG-17-0086, Rev. 0, Table 54.
(b) From ECF-324-BLDG-17-0086, Rev. 0, Table 55.

APPENDIX B
RADIONUCLIDE GROUP ACTIVITY

Table B-1. REC Radionuclide Group Activity

Nuclide	Group	Emission	Detect	Total (Ci)	% Group Activity	Cumulative % Group Activity
Am-241	2	α	ETD	1.24E+01	66.20%	66.20%
Cm-244	2	α	ETD	2.72E+00	14.49%	80.69%
Pu-238	2	α	ETD	2.13E+00	11.38%	92.07%
Pu-239	2	α	ETD	7.51E-01	4.00%	96.07%
Pu-240	2	α	ETD	7.37E-01	3.93%	100.00%
Cs-137	4	βγ	ETD	5.86E+03	32.79%	32.79%
Ba-137m	4	βγ	ETD	5.53E+03	30.95%	63.74%
Y-90	4	βγ	ETD	3.23E+03	18.08%	81.82%
Sr-90	4	βγ	ETD	3.23E+03	18.07%	99.88%
Eu-154	4	βγ	ETD	4.46E+00	0.02%	99.91%
Co-60	4	βγ	ETD	1.34E-01	0.00%	99.91%
Pu-241	4	βγ	HTD	1.63E+01	0.09%	100.00%
Eu-155	6	βγ	HTD	1.11E+00	100.00%	100.00%

Table B-2. HLV Radionuclide Group Activity

Nuclide	Group	Emission	Detect	Total (Ci)	% Group Activity	Cumulative % Group Activity
Am-241	2	α	ETD	1.95E+01	68.56%	68.56%
Pu-238	2	α	ETD	3.43E+00	12.08%	80.64%
Cm-244	2	α	ETD	2.93E+00	10.30%	90.94%
Pu-239	2	α	ETD	1.29E+00	4.54%	95.48%
Pu-240	2	α	ETD	1.28E+00	4.52%	100.00%
Cs-137	4	βγ	ETD	7.43E+03	33.43%	33.43%
Ba-137m	4	βγ	ETD	7.02E+03	31.56%	65.00%
Y-90	4	βγ	ETD	3.88E+03	17.46%	82.45%
Sr-90	4	βγ	ETD	3.88E+03	17.45%	99.91%
Eu-154	4	βγ	ETD	3.22E+00	0.01%	99.92%
Pu-241	4	βγ	HTD	1.72E+01	0.08%	100.00%
Eu-155	6	βγ	HTD	4.51E-01	100.00%	100.00%

Table B-3. LLV Radionuclide Group Activity

Nuclide	Group	Emission	Detect	Total (Ci)	% Group Activity	Cumulative % Group Activity
Am-241	2	α	ETD	8.80E-01	68.50%	68.50%
Pu-238	2	α	ETD	1.55E-01	12.10%	80.60%
Cm-244	2	α	ETD	1.33E-01	10.33%	90.92%
Pu-239	2	α	ETD	5.84E-02	4.54%	95.47%
Pu-240	2	α	ETD	5.82E-02	4.53%	100.00%
Cs-137	4	βγ	ETD	3.37E+02	33.45%	33.45%
Ba-137m	4	βγ	ETD	3.18E+02	31.57%	65.03%
Y-90	4	βγ	ETD	1.76E+02	17.44%	82.47%
Sr-90	4	βγ	ETD	1.76E+02	17.44%	99.91%
Eu-154	4	βγ	ETD	1.46E-01	0.01%	99.92%
Pu-241	4	βγ	HTD	7.80E-01	0.08%	100.00%
Eu-155	6	βγ	HTD	2.04E-02	100.00%	100.00%

Table B-4. SMF Radionuclide Group Activity

Nuclide	Group	Emission	Detect	Total (Ci)	% Group Activity	Cumulative % Group Activity
Am-241	2	α	ETD	6.35E-02	100.00%	100.00%
Cs-137	4	βγ	ETD	6.24E+02	41.85%	41.85%
Ba-137m	4	βγ	ETD	5.89E+02	39.51%	81.36%
Co-60	4	βγ	ETD	1.26E+01	0.84%	82.21%
Y-90	4	βγ	ETD	7.82E+00	0.52%	82.73%
Sr-90	4	βγ	ETD	7.82E+00	0.52%	83.26%
Sb-125	4	βγ	ETD	2.34E+00	0.16%	83.41%
Eu-154	4	βγ	ETD	1.71E-01	0.01%	83.42%
Mo-93	4	βγ	HTD	1.72E+02	11.50%	94.92%
Nb-93m	4	βγ	HTD	7.52E+01	5.04%	99.96%
Te-125m	4	βγ	HTD	5.54E-01	0.04%	100.00%
Pu-241	4	βγ	HTD	2.43E-02	0.00%	100.00%
Tc-99	6	βγ	ETD	1.80E+01	57.00%	57.00%
Fe-55	6	βγ	HTD	1.35E+01	42.81%	99.81%
Eu-155	6	βγ	HTD	6.03E-02	0.19%	100.00%

Table B-5. 324 Zone I and II Containment Radionuclide Group Activity

Nuclide	Group	Emission	Detect	Total (Ci)	% Group Activity	Cumulative % Group Activity
Am-241	2	α	ETD	8.43E-04	66.22%	66.22%
Pu-238	2	α	ETD	1.61E-04	12.64%	78.86%
Cm-244	2	α	ETD	1.52E-04	11.91%	90.77%
Pu-239	2	α	ETD	5.90E-05	4.63%	95.41%
Pu-240	2	α	ETD	5.85E-05	4.59%	100.00%
Cs-137	4	βγ	ETD	1.22E-01	33.37%	33.37%
Ba-137m	4	βγ	ETD	1.15E-01	31.50%	64.88%
Y-90	4	βγ	ETD	6.38E-02	17.51%	82.39%
Sr-90	4	βγ	ETD	6.38E-02	17.51%	99.90%
Eu-154	4	βγ	ETD	6.30E-05	0.02%	99.92%
Pu-241	4	βγ	HTD	3.07E-04	0.08%	100.00%
Eu-155	6	βγ	HTD	1.05E-05	100.00%	100.00%

Table B-6. 324 HEPA Filter Radionuclide Group Activity

Nuclide	Group	Emission	Detect	Total (Ci)	% Group Activity	Cumulative % Group Activity
Cm-244	2	α	ETD	7.98E-03	68.57%	68.57%
Am-241	2	α	ETD	2.98E-03	25.62%	94.18%
Pu-238	2	α	ETD	3.73E-04	3.21%	97.39%
Pu-240	2	α	ETD	3.04E-04	2.61%	100.00%
Y-90	4	βγ	ETD	1.33E+01	48.38%	48.38%
Sr-90	4	βγ	ETD	1.33E+01	48.36%	96.74%
Cs-137	4	βγ	ETD	4.58E-01	1.66%	98.40%
Ba-137m	4	βγ	ETD	4.32E-01	1.57%	99.97%
Co-60	4	βγ	ETD	4.00E-03	0.01%	99.98%
Eu-154	4	βγ	ETD	6.62E-04	0.00%	99.99%
Pu-241	4	βγ	HTD	3.82E-03	0.01%	100.00%

Table B-7. 324 Piping Radionuclide Group Activity

Nuclide	Group	Emission	Detect	Total (Ci)	% Group Activity	Cumulative % Group Activity
Am-241	2	α	ETD	1.65E-03	67.27%	67.27%
Pu-238	2	α	ETD	3.01E-04	12.25%	79.52%
Cm-244	2	α	ETD	2.84E-04	11.56%	91.08%
Pu-239	2	α	ETD	1.10E-04	4.48%	95.56%
Pu-240	2	α	ETD	1.09E-04	4.44%	100.00%
Cs-137	4	βγ	ETD	6.86E-01	33.37%	33.37%
Ba-137m	4	βγ	ETD	6.48E-01	31.50%	64.87%
Y-90	4	βγ	ETD	3.60E-01	17.52%	82.39%
Sr-90	4	βγ	ETD	3.60E-01	17.51%	99.90%
Eu-154	4	βγ	ETD	3.54E-04	0.02%	99.92%
Pu-241	4	βγ	HTD	1.73E-03	0.08%	100.00%
Eu-155	6	βγ	HTD	5.94E-05	100.00%	100.00%

Table B-8. 300-265 Radionuclide Group Activity

Nuclide	Group	Emission	Detect	Total (Ci)	% Group Activity	Cumulative % Group Activity
Am-241	2	α	ETD	3.18E-01	54.35%	54.35%
Pu-238	2	α	ETD	1.45E-01	24.72%	79.08%
Cm-244	2	α	ETD	5.34E-02	9.12%	88.20%
Pu-240	2	α	ETD	4.30E-02	7.35%	95.55%
Pu-239	2	α	ETD	2.53E-02	4.32%	99.87%
Cm-243	2	α	ETD	6.12E-04	0.10%	99.98%
Pu-242	2	α	ETD	1.42E-04	0.02%	100.00%
Cs-137	4	βγ	ETD	7.42E+00	29.02%	29.02%
Ba-137m	4	βγ	ETD	7.01E+00	27.39%	56.41%
Y-90	4	βγ	ETD	5.00E+00	19.52%	75.93%
Sr-90	4	βγ	ETD	4.99E+00	19.52%	95.45%
Eu-154	4	βγ	ETD	5.16E-02	0.20%	95.65%
Co-60	4	βγ	ETD	2.88E-03	0.01%	95.66%
Pu-241	4	βγ	HTD	1.11E+00	4.34%	100.00%
Tc-99	6	βγ	ETD	2.70E-03	59.03%	59.03%
Eu-155	6	βγ	HTD	1.87E-03	40.97%	100.00%

Table B-9. 300-296 Point Source Radionuclide Group Activity

Nuclide	Group	Emission	Detect	Total (Ci)	% Group Activity	Cumulative % Group Activity
Pu-238	2	α	ETD	6.49E+00	41.15%	41.15%
Cm-244	2	α	ETD	4.99E+00	31.63%	72.77%
Am-241	2	α	ETD	4.29E+00	27.23%	100.00%
Cs-137	4	βγ	ETD	1.12E+05	39.46%	39.46%
Ba-137m	4	βγ	ETD	1.06E+05	37.25%	76.71%
Y-90	4	βγ	ETD	3.31E+04	11.65%	88.36%
Sr-90	4	βγ	ETD	3.31E+04	11.64%	100.00%

Table B-10. 300-296 Fugitive Source Radionuclide Group Activity

Nuclide	Group	Emission	Detect	Total (Ci)	% Group Activity	Cumulative % Group Activity
Sr-90	4	βγ	ETD	1.87E+04	50.00%	50.00%
Y-90	4	βγ	ETD	1.87E+04	50.00%	100.00%

APPENDIX C
COMPOSITE EFFICIENCY CALCULATIONS

Table C-1. REC Composite Efficiencies

Nuclide	β_{Max} (MeV)	Activity (Ci)	Activity Fraction	Instrument Efficiency @1/8 in		Weighted Efficiency	
				43-93	43-10-1	43-93	43-10-1
Cs-137/Ba-137m	1.1756	1.14E+04	63.74%	18.5%	32%	11.8%	20.4%
Sr-90/Y-90	2.2801	6.46E+03	36.14%	20%	33%	7.2%	11.9%
Eu-154	1.8453	4.46E+00	0.02%	19%	32%	0.0%	0.0%
Co-60	1.4914	1.34E-01	0.00%	10%	17%	0.0%	0.0%
Pu-241	0.0208	1.63E+01	0.09%	0%	0%	0.0%	0.0%
Eu-155	0.2522	1.11E+00	0.01%	0%	0%	0.0%	0.0%
Composite Efficiency						**19.0%**	**32.3%**

Table C-2. HLV Composite Efficiencies

Nuclide	β_{Max} (MeV)	Activity (Ci)	Activity Fraction	Instrument Efficiency @1/8 in		Weighted Efficiency	
				43-93	43-10-1	43-93	43-10-1
Cs-137/Ba-137m	1.1756	1.45E+04	65.00%	18.5%	32%	12.0%	20.8%
Sr-90/Y-90	2.2801	7.76E+03	34.91%	20%	33%	7.0%	11.5%
Eu-154	1.8453	3.22E+00	0.01%	19%	32%	0.0%	0.0%
Pu-241	0.0208	1.72E+01	0.08%	0%	0%	0.0%	0.0%
Eu-155	0.2522	4.51E-01	0.00%	0%	0%	0.0%	0.0%
Composite Efficiency						**19.0%**	**32.3%**

Table C-3. LLV Composite Efficiencies

Nuclide	β_{Max} (MeV)	Activity (Ci)	Activity Fraction	Instrument Efficiency @1/8 in		Weighted Efficiency	
				43-93	43-10-1	43-93	43-10-1
Cs-137/Ba-137m	1.1756	6.55E+02	65.03%	18.5%	32%	12.0%	20.8%
Sr-90/Y-90	2.2801	3.51E+02	34.88%	20%	33%	7.0%	11.5%
Eu-154	1.8453	1.46E-01	0.01%	19%	32%	0.0%	0.0%
Pu-241	0.0208	7.80E-01	0.08%	0%	0%	0.0%	0.0%
Eu-155	0.2522	2.04E-02	0.00%	0%	0%	0.0%	0.0%
Composite Efficiency						**19.0%**	**32.3%**

Table C-4. SMF Composite Efficiencies

Nuclide	β_{Max} (MeV)	Activity (Ci)	Activity Fraction	Instrument Efficiency @1/8 in		Weighted Efficiency	
				43-93	43-10-1	43-93	43-10-1
Cs-137/Ba-137m	1.1756	1.21E+03	79.68%	18.5%	32%	14.7%	25.5%
Co-60	1.4914	1.26E+01	0.83%	10.0%	17%	0.1%	0.1%
Sr-90/Y-90	2.2801	1.56E+01	1.03%	20%	33%	0.2%	0.3%
Sb-125[(a)]	0.6219	2.34E+00	0.15%	10.0%	17%	0.0%	0.0%
Eu-154	1.8453	1.71E-01	0.01%	18.5%	32%	0.0%	0.0%
Mo-93	---	1.72E+02	11.26%	0%	0%	0.0%	0.0%
Nb-93m	---	7.52E+01	4.93%	0%	0%	0.0%	0.0%
Te-125m	---	5.54E-01	0.04%	0%	0%	0.0%	0.0%
Pu-241	0.0208	2.43E-02	0.00%	0%	0%	0.0%	0.0%
Tc-99	0.2935	1.80E+01	1.18%	10.0%	17%	0.1%	0.2%
Fe-55	---	1.35E+01	0.89%	0%	0%	0.0%	0.0%
Eu-155	0.2522	6.03E-02	0.00%	0%	0%	0.0%	0.0%
Composite Efficiency						**15.2%**	**26.2%**

(a) Tc-99 instrument efficiencies are assumed to be reasonable surrogates for Sb-125.

Table C-5. Zone 1 and II Containment Composite Efficiencies

Nuclide	β_{Max} (MeV)	Activity (Ci)	Activity Fraction	Instrument Efficiency @1/8 in		Weighted Efficiency	
				43-93	43-10-1	43-93	43-10-1
Cs-137/Ba-137m	1.1756	2.36E-01	64.87%	18.5%	32%	12.0%	20.8%
Sr-90/Y-90	2.2801	1.28E-01	35.02%	20%	33%	7.0%	11.6%
Eu-154	1.8453	6.30E-05	0.02%	18.5%	32%	0.0%	0.0%
Pu-241	0.0208	3.07E-04	0.08%	0%	0%	0.0%	0.0%
Eu-155	0.2522	1.05E-05	0.00%	0%	0%	0.0%	0.0%
Composite Efficiency						**19.0%**	**32.3%**

Table C-6. HEPA Filter Composite Efficiencies

Nuclide	β_{Max} (MeV)	Activity (Ci)	Activity Fraction	Instrument Efficiency @1/8 in		Weighted Efficiency	
				43-93	43-10-1	43-93	43-10-1
Sr-90/Y-90	2.2801	2.67E+01	96.74%	20%	33%	19.3%	31.9%
Cs-137/Ba-137m	1.1756	8.90E-01	3.23%	18.5%	32%	0.6%	1.0%
Co-60	1.4914	4.00E-03	0.01%	10.0%	17%	0.0%	0.0%
Eu-154	1.8453	6.62E-04	0.00%	18.5%	32%	0.0%	0.0%
Pu-241	0.0208	3.82E-03	0.01%	0%	0%	0.0%	0.0%
					Composite Efficiency	**19.9%**	**33.0%**

Table C-7. Piping Composite Efficiencies

Nuclide	β_{Max} (MeV)	Activity (Ci)	Activity Fraction	Instrument Efficiency @1/8 in		Weighted Efficiency	
				43-93	43-10-1	43-93	43-10-1
Cs-137/Ba-137m	1.1756	1.33E+00	64.87%	18.5%	32%	12.0%	20.8%
Sr-90/Y-90	2.2801	7.20E-01	35.03%	20%	33%	7.0%	11.6%
Eu-154	1.8453	3.54E-04	0.02%	18.5%	32%	0.0%	0.0%
Pu-241	0.0208	1.73E-03	0.08%	0%	0%	0.0%	0.0%
Eu-155	0.2522	5.94E-05	0.00%	0%	0%	0.0%	0.0%
					Composite Efficiency	**19.0%**	**32.3%**

Table C-9. 300-265 Waste Site Composite Efficiencies

Nuclide	β_{Max} (MeV)	Activity (Ci)	Activity Fraction	Instrument Efficiency @1/8 in		Weighted Efficiency	
				43-93	43-10-1	43-93	43-10-1
Cs-137/Ba-137m	1.1756	1.44E+01	56.40%	18.5%	32%	10.4%	18.0%
Sr-90/Y-90	2.2801	9.99E+00	39.03%	20%	33%	7.8%	12.9%
Eu-154	1.8453	5.16E-02	0.20%	18.5%	32%	0.0%	0.1%
Co-60	1.4914	2.88E-03	0.01%	10%	17%	0.0%	0.0%
Pu-241	0.0208	1.11E+00	4.34%	0%	0%	0.0%	0.0%
Tc-99	0.2935	2.70E-03	0.01%	10%	17%	0.0%	0.0%
Eu-155	0.2522	1.87E-03	0.01%	0%	0%	0.0%	0.0%
					Composite Efficiency	**18.3%**	**31.0%**

Table C-10. 300-296 Waste Site Point Source Composite Efficiencies

Nuclide	β_{Max} (MeV)	Activity (Ci)	Activity Fraction	Instrument Efficiency @1/8 in		Weighted Efficiency	
				43-93	43-10-1	43-93	43-10-1
Cs-137/Ba-137m	1.1756	2.18E+05	76.71%	18.5%	32%	14.2%	24.5%
Sr-90/Y-90	2.2801	6.62E+04	23.29%	20%	33%	4.7%	7.7%
					Composite Efficiency	**18.8%**	**32.2%**

Table C-11. 300-296 Waste Site Fugitive Source Composite Efficiencies

Nuclide	β_{Max} (MeV)	Activity (Ci)	Activity Fraction	Instrument Efficiency @1/8 in		Weighted Efficiency	
				43-93	43-10-1	43-93	43-10-1
Sr-90/Y-90	2.2801	3.73E+04	100.00%	20%	33%	20.0%	33.0%
					Composite Efficiency	**20.0%**	**33.0%**

APPENDIX D
INTERNAL DOSIMETRY EVALUATION

Table D-1. A-Cell Bioassay Evaluation

Radionuclide	Max Removable (µCi/100 cm²) 1998 [(a)]	Max Removable (µCi/100 cm²) 2026	Type	ALI	(µCi/100 cm²)/(ALI)	% Internal Dose
Mn-54	ND	ND	M	1.1E+03	--	--
Co-60	6.50E-02	1.64E-03	S	7.9E+01	2.07E-05	0.00%
Se-79	1.53E-04	1.53E-04	M	4.4E+02	3.48E-07	0.00%
Sr-90	1.97E+02	1.00E+02	F	4.5E+01	2.23E+00	12.96%
Tc-99	5.08E-03	5.08E-03	M	4.2E+02	1.21E-05	0.00%
Ag-108m	---	---	F	1.9E+02	--	--
Sb-125	ND	ND	M	4.1E+02	--	--
Cs-134	1.09E-01	9.03E-06	F	1.4E+02	6.45E-08	0.00%
Cs-137	3.29E+02	1.72E+02	F	2.0E+02	8.62E-01	5.01%
Eu-154	5.25E-01	5.49E-02	M	3.9E+01	1.41E-03	0.01%
Eu-155	ND	ND	M	2.9E+02	--	--
Pu-238	4.70E-02	3.77E-02	S	1.2E-01	3.14E-01	1.82%
Pu-239	9.04E-03	9.03E-03	S	1.6E-01	5.65E-02	0.33%
Pu-240	8.86E-03	8.98E-03	S	1.6E-01	5.61E-02	0.33%
Pu-241	4.42E-01	1.14E-01	S	1.6E-01	7.13E-01	4.14%
Pu-242	1.48E-05	1.48E-05	S	1.8E-01	8.22E-05	0.00%
Am-241	6.49E-01	6.31E-01	M	5.0E-02	1.26E+01	73.32%
Cm-242	ND	ND	M	3.7E-01	--	--
Cm-243	1.18E-03	6.18E-04	M	6.8E-02	9.09E-03	0.05%
Cm-244	8.11E-02	2.76E-02	M	7.9E-02	3.49E-01	2.03%
Total	**5.28E+02**	**2.74E+02**			**1.72E+01**	**100.00%**

[(a)] From WCH-412, Table 8. B-Cell values are assumed due to A-Cell receiving equipment and debris from B-Cell after WCH-412 was published. Decay corrected to 1/1/2026.

	Am-241	73.32%	Am-241 > 25% of internal dose. Am-241 bioassay required.	
	Total Pu	0.17		
	Sr:Cs Ratio	0.58	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.
	Cs:Pu	1,015.33		
	Cs:Am	N/A		
	Sr:Pu	N/A		
	Sr:Am	N/A		

Table D-2. B-Cell Bioassay Evaluation

Radionuclide	Max Removable (µCi/100 cm²) 1998 [a]	2026	Type	ALI	(µCi/100 cm²)/(ALI)	% Internal Dose
Mn-54	ND	ND	M	1.1E+03	--	--
Co-60	6.50E-02	1.64E-03	S	7.9E+01	2.07E-05	0.00%
Se-79	1.53E-04	1.53E-04	M	4.4E+02	3.48E-07	0.00%
Sr-90	1.97E+02	1.00E+02	F	4.5E+01	2.23E+00	12.96%
Tc-99	5.08E-03	5.08E-03	M	4.2E+02	1.21E-05	0.00%
Ag-108m	---	---	F	1.9E+02	--	--
Sb-125	ND	ND	M	4.1E+02	--	--
Cs-134	1.09E-01	9.03E-06	F	1.4E+02	6.45E-08	0.00%
Cs-137	3.29E+02	1.72E+02	F	2.0E+02	8.62E-01	5.01%
Eu-154	5.25E-01	5.49E-02	M	3.9E+01	1.41E-03	0.01%
Eu-155	ND	ND	M	2.9E+02	--	--
Pu-238	4.70E-02	3.77E-02	S	1.2E-01	3.14E-01	1.82%
Pu-239	9.04E-03	9.03E-03	S	1.6E-01	5.65E-02	0.33%
Pu-240	8.86E-03	8.98E-03	S	1.6E-01	5.61E-02	0.33%
Pu-241	4.42E-01	1.14E-01	S	1.6E-01	7.13E-01	4.14%
Pu-242	1.48E-05	1.48E-05	S	1.8E-01	8.22E-05	0.00%
Am-241	6.49E-01	6.31E-01	M	5.0E-02	1.26E+01	73.32%
Cm-242	ND	ND	M	3.7E-01	--	--
Cm-243	1.18E-03	6.18E-04	M	6.8E-02	9.09E-03	0.05%
Cm-244	8.11E-02	2.76E-02	M	7.9E-02	3.49E-01	2.03%
Total	**5.28E+02**	**2.74E+02**			**1.72E+01**	**100.00%**
[a] From WCH-412, Table 8. Decay corrected to 1/1/2026.						
	Am-241	73.32%	Am-241 > 25% of internal dose. Am-241 bioassay required.			
	Total Pu	0.17				
	Sr:Cs Ratio	0.58	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
	Cs:Pu	1,015.33				
	Cs:Am	N/A				
	Sr:Pu	N/A				
	Sr:Am	N/A				

Table D-3. C-Cell Bioassay Evaluation

Radionuclide	Max Removable (µCi/100 cm^2)		Type	ALI	(µCi/100 cm^2)/(ALI)	% Internal Dose
	1998 [(a)]	2026				
Mn-54	ND	ND	M	1.1E+03	--	--
Co-60	8.49E-04	2.14E-05	S	7.9E+01	2.71E-07	0.00%
Se-79	8.66E-07	8.66E-07	M	4.4E+02	1.97E-09	0.00%
Sr-90	6.60E-01	3.36E-01	F	4.5E+01	7.47E-03	2.88%
Tc-99	2.87E-05	2.87E-05	M	4.2E+02	6.83E-08	0.00%
Ag-108m	---	---	F	1.9E+02	--	--
Sb-125	ND	ND	M	4.1E+02	--	--
Cs-134	5.55E-03	4.60E-07	F	1.4E+02	3.29E-09	0.00%
Cs-137	1.10E+00	5.77E-01	F	2.0E+02	2.88E-03	1.11%
Eu-154	6.98E-03	7.29E-04	M	3.9E+01	1.87E-05	0.01%
Eu-155	2.10E-03	3.54E-05	M	2.9E+02	1.22E-07	0.00%
Pu-238	1.70E-03	1.36E-03	S	1.2E-01	1.14E-02	4.37%
Pu-239	3.61E-04	3.61E-04	S	1.6E-01	2.26E-03	0.87%
Pu-240	3.53E-04	4.04E-04	S	1.6E-01	2.52E-03	0.97%
Pu-241	1.76E-02	4.54E-03	S	1.6E-01	2.84E-02	10.93%
Pu-242	5.91E-07	5.91E-07	S	1.8E-01	3.28E-06	0.00%
Am-241	3.67E-03	3.93E-03	M	5.0E-02	7.86E-02	30.25%
Cm-242	ND	ND	M	3.7E-01	--	--
Cm-243	4.15E-04	2.17E-04	M	6.8E-02	3.20E-03	1.23%
Cm-244	2.86E-02	9.73E-03	M	7.9E-02	1.23E-01	47.39%
Total	**1.83E+00**	**9.34E-01**			**2.60E-01**	**100.00%**

(a) From WCH-412, Table 8. Decay corrected to 1/1/2026.

	Am-241	30.25%	Am-241 > 25% of internal dose. Am-241 bioassay required.			
	Cm-244	47.39%	Cm-244 > 25% of internal dose. Cm-244 bioassay required.			
	Total Pu	0.01				
	Sr:Cs Ratio	0.58	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
	Cs:Pu	86.42				
	Cs:Am	N/A				
	Sr:Pu	N/A				
	Sr:Am	N/A				

Table D-4. D-Cell Bioassay Evaluation

Radionuclide	Max Removable (µCi/100 cm^2)		Type	ALI	(µCi/100 cm^2)/(ALI)	% Internal Dose
	1998 [a]	2026				
Mn-54	ND	ND	M	1.1E+03	--	--
Co-60	1.31E+00	3.30E-02	S	7.9E+01	4.17E-04	0.00%
Se-79	1.79E-04	1.79E-04	M	4.4E+02	4.07E-07	0.00%
Sr-90	2.50E+02	1.27E+02	F	4.5E+01	2.83E+00	7.75%
Tc-99	5.93E-03	5.93E-03	M	4.2E+02	1.41E-05	0.00%
Ag-108m	1.59E-02	1.52E-02	F	1.9E+02	7.99E-05	0.00%
Sb-125	ND	ND	M	4.1E+02	--	--
Cs-134	2.17E-01	1.80E-05	F	1.4E+02	1.28E-07	0.00%
Cs-137	1.25E+03	6.55E+02	F	2.0E+02	3.28E+00	8.97%
Eu-154	6.99E+00	7.30E-01	M	3.9E+01	1.87E-02	0.05%
Eu-155	ND	ND	M	2.9E+02	--	--
Pu-238	1.72E-01	1.38E-01	S	1.2E-01	1.15E+00	3.15%
Pu-239	7.02E-02	7.02E-02	S	1.6E-01	4.39E-01	1.20%
Pu-240	6.88E-02	7.13E-02	S	1.6E-01	4.46E-01	1.22%
Pu-241	3.43E+00	8.85E-01	S	1.6E-01	5.53E+00	15.15%
Pu-242	1.15E-04	1.15E-04	S	1.8E-01	6.39E-04	0.00%
Am-241	7.57E-01	8.06E-01	M	5.0E-02	1.61E+01	44.12%
Cm-242	5.75E-03	7.32E-22	M	3.7E-01	1.98E-21	0.00%
Cm-243	2.20E-02	1.15E-02	M	6.8E-02	1.69E-01	0.46%
Cm-244	1.52E+00	5.17E-01	M	7.9E-02	6.55E+00	17.92%
Total	**1.51E+03**	**7.86E+02**			**3.65E+01**	**100.00%**
[a] From WCH-412, Table 8. Decay corrected to 1/1/2026.						
	Am-241	44.12%	Am-241 > 25% of internal dose. Am-241 bioassay required.			
	Total Pu	1.16				
	Sr:Cs Ratio	0.19	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
	Cs:Pu	562.41				
	Cs:Am	N/A				
	Sr:Pu	N/A				
	Sr:Am	N/A				

Table D-5. REC Airlock Bioassay Evaluation

Radionuclide	Max Removable (µCi/100 cm²) 1998 [(a)]	Max Removable (µCi/100 cm²) 2026	Type	ALI	(µCi/100 cm²)/(ALI)	% Internal Dose
Mn-54	ND	ND	M	1.1E+03	--	--
Co-60	5.19E-03	1.31E-04	S	7.9E+01	1.65E-06	0.00%
Se-79	6.37E-06	6.37E-06	M	4.4E+02	1.45E-08	0.00%
Sr-90	1.55E+01	7.90E+00	F	4.5E+01	1.76E-01	15.61%
Tc-99	2.11E-04	2.11E-04	M	4.2E+02	5.02E-07	0.00%
Ag-108m	---	---	F	1.9E+02	--	--
Sb-125	ND	ND	M	4.1E+02	--	--
Cs-134	1.46E-03	1.21E-07	F	1.4E+02	8.64E-10	0.00%
Cs-137	3.76E+01	1.97E+01	F	2.0E+02	9.86E-02	8.76%
Eu-154	1.72E-02	1.80E-03	M	3.9E+01	4.61E-05	0.00%
Eu-155	ND	ND	M	2.9E+02	--	--
Pu-238	6.12E-03	4.91E-03	S	1.2E-01	4.09E-02	3.63%
Pu-239	2.19E-03	2.19E-03	S	1.6E-01	1.37E-02	1.22%
Pu-240	2.15E-03	2.16E-03	S	1.6E-01	1.35E-02	1.20%
Pu-241	1.07E-01	2.76E-02	S	1.6E-01	1.73E-01	15.35%
Pu-242	3.59E-06	3.59E-06	S	1.8E-01	1.99E-05	0.00%
Am-241	2.70E-02	2.84E-02	M	5.0E-02	5.67E-01	50.44%
Cm-242	9.01E-05	1.15E-23	M	3.7E-01	3.10E-23	0.00%
Cm-243	1.40E-04	7.33E-05	M	6.8E-02	1.08E-03	0.10%
Cm-244	9.64E-03	3.28E-03	M	7.9E-02	4.15E-02	3.69%
Total	**5.33E+01**	**2.77E+01**			**1.12E+00**	**100.00%**
[(a)] From WCH-412, Table 8. Decay corrected to 1/1/2026.						
	Am-241	50.44%	Am-241 > 25% of internal dose. Am-241 bioassay required.			
	Total Pu	0.04				
	Sr:Cs Ratio	0.40	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
	Cs:Pu	534.47				
	Cs:Am	N/A				
	Sr:Pu	N/A				
	Sr:Am	N/A				

Table D-6. REC Pipe Trench Bioassay Evaluation

Radionuclide	Total Ci (2026) [(a)]	Type	ALI	(Ci)/(ALI)	% Internal Dose
Mn-54	--	M	1.1E+03	--	--
Co-60	--	S	7.9E+01	--	--
Se-79	--	M	4.4E+02	--	--
Sr-90	4.04E+01	F	4.5E+01	8.97E-01	12.29%
Tc-99	--	M	4.2E+02	--	--
Ag-108m	--	F	1.9E+02	--	--
Sb-125	--	M	4.1E+02	--	--
Cs-134	--	F	1.4E+02	--	--
Cs-137	7.74E+01	F	2.0E+02	3.87E-01	5.30%
Eu-154	3.35E-02	M	3.9E+01	8.60E-04	0.01%
Eu-155	4.69E-03	M	2.9E+02	1.62E-05	0.00%
Pu-238	3.58E-02	S	1.2E-01	2.98E-01	4.09%
Pu-239	1.35E-02	S	1.6E-01	8.41E-02	1.15%
Pu-240	1.33E-02	S	1.6E-01	8.33E-02	1.14%
Pu-241	1.79E-01	S	1.6E-01	1.12E+00	15.36%
Pu-242	--	S	1.8E-01	--	--
Am-241	2.02E-01	M	5.0E-02	4.04E+00	55.36%
Cm-242	--	M	3.7E-01	--	--
Cm-243	--	M	6.8E-02	--	--
Cm-244	3.05E-02	M	7.9E-02	3.86E-01	5.29%
Total	**1.18E+02**			**7.30E+00**	**100.00%**
[(a)] From ECF-324-BLDG-17-0086, Revision 0, Table 20. Decay corrected to 1/1/2026.					
Am-241	55.36%	Am-241 > 25% of internal dose. Am-241 bioassay required.			
Total Pu	0.24				
Sr:Cs Ratio	0.52	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
Cs:Pu	319.73				
Cs:Am	N/A				
Sr:Pu	N/A				
Sr:Am	N/A				

Table D-7. REC A-Frame Filters Bioassay Evaluation

Radionuclide	Total Ci (2026) [a]	Type	ALI	(Ci)/(ALI)	% Internal Dose
Mn-54	--	M	1.1E+03	--	--
Co-60	--	S	7.9E+01	--	--
Se-79	--	M	4.4E+02	--	--
Sr-90	9.35E+00	F	4.5E+01	2.08E-01	12.94%
Tc-99	--	M	4.2E+02	--	--
Ag-108m	--	F	1.9E+02	--	--
Sb-125	--	M	4.1E+02	--	--
Cs-134	--	F	1.4E+02	--	--
Cs-137	1.78E+01	F	2.0E+02	8.90E-02	5.54%
Eu-154	1.07E-02	M	3.9E+01	2.74E-04	0.02%
Eu-155	--	M	2.9E+02	--	--
Pu-238	7.55E-03	S	1.2E-01	6.30E-02	3.92%
Pu-239	2.72E-03	S	1.6E-01	1.70E-02	1.06%
Pu-240	2.70E-03	S	1.6E-01	1.69E-02	1.05%
Pu-241	4.76E-02	S	1.6E-01	2.97E-01	18.53%
Pu-242	--	S	1.8E-01	--	--
Am-241	4.09E-02	M	5.0E-02	8.17E-01	50.91%
Cm-242	--	M	3.7E-01	--	--
Cm-243	--	M	6.8E-02	--	--
Cm-244	7.65E-03	M	7.9E-02	9.68E-02	6.03%
Total	**2.73E+01**			**1.60E+00**	**100.00%**
[a] From ECF-324-BLDG-17-0086, Revision 0, Table 36. Decay corrected to 1/1/2026.					
Am-241	50.91%	Am-241 > 25% of internal dose. Am-241 bioassay required.			
Total Pu	0.06				
Sr:Cs Ratio	0.53	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
Cs:Pu	293.81				
Cs:Am	N/A				
Sr:Pu	N/A				
Sr:Am	N/A				

Table D-8. REC Exhaust Duct Bioassay Evaluation

Radionuclide	Total Ci (2026) [(a)]	Type	ALI	(Ci)/(ALI)	% Internal Dose
Mn-54	--	M	1.1E+03	--	--
Co-60	--	S	7.9E+01	--	--
Se-79	--	M	4.4E+02	--	--
Sr-90	7.48E+00	F	4.5E+01	1.66E-01	12.94%
Tc-99	--	M	4.2E+02	--	--
Ag-108m	--	F	1.9E+02	--	--
Sb-125	--	M	4.1E+02	--	--
Cs-134	--	F	1.4E+02	--	--
Cs-137	1.43E+01	F	2.0E+02	7.13E-02	5.55%
Eu-154	8.53E-03	M	3.9E+01	2.19E-04	0.02%
Eu-155	--	M	2.9E+02	--	--
Pu-238	6.04E-03	S	1.2E-01	5.04E-02	3.92%
Pu-239	2.17E-03	S	1.6E-01	1.36E-02	1.06%
Pu-240	2.17E-03	S	1.6E-01	1.35E-02	1.05%
Pu-241	3.81E-02	S	1.6E-01	2.38E-01	18.53%
Pu-242	--	S	1.8E-01	--	--
Am-241	3.27E-02	M	5.0E-02	6.54E-01	50.90%
Cm-242	--	M	3.7E-01	--	--
Cm-243	--	M	6.8E-02	--	--
Cm-244	6.12E-03	M	7.9E-02	7.75E-02	6.04%
Total	**2.18E+01**			**1.28E+00**	**100.00%**
[(a)] From ECF-324-BLDG-17-0086, Revision 0, Table 36. Decay corrected to 1/1/2026.					
Am-241	50.90%	Am-241 > 25% of internal dose. Am-241 bioassay required.			
Total Pu	0.05				
Sr:Cs Ratio	0.52	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
Cs:Pu	294.07				
Cs:Am	N/A				
Sr:Pu	N/A				
Sr:Am	N/A				

Table D-9. HLV Bioassay Evaluation

Radionuclide	Total Ci (2026) [(a)]	Type	ALI	(Ci)/(ALI)	% Internal Dose
Mn-54	--	M	1.1E+03	--	--
Co-60	--	S	7.9E+01	--	--
Se-79	--	M	4.4E+02	--	--
Sr-90	3.88E+03	F	4.5E+01	8.62E+01	12.28%
Tc-99	--	M	4.2E+02	--	--
Ag-108m	--	F	1.9E+02	--	--
Sb-125	--	M	4.1E+02	--	--
Cs-134	--	F	1.4E+02	--	--
Cs-137	7.43E+03	F	2.0E+02	3.72E+01	5.29%
Eu-154	3.22E+00	M	3.9E+01	8.27E-02	0.01%
Eu-155	--	M	2.9E+02	--	--
Pu-238	3.43E+00	S	1.2E-01	2.86E+01	4.07%
Pu-239	1.29E+00	S	1.6E-01	8.06E+00	1.15%
Pu-240	1.28E+00	S	1.6E-01	8.03E+00	1.14%
Pu-241	1.72E+01	S	1.6E-01	1.08E+02	15.33%
Pu-242	--	S	1.8E-01	--	--
Am-241	1.95E+01	M	5.0E-02	3.90E+02	55.46%
Cm-242	--	M	3.7E-01	--	--
Cm-243	--	M	6.8E-02	--	--
Cm-244	2.93E+00	M	7.9E-02	3.70E+01	5.27%
Total	**1.14E+04**			**7.03E+02**	**100.00%**
[(a)] From ECF-324-BLDG-17-0086, Revision 0, Tables 33 and 48, and 0300X-CA-N0118, Revision 1, Table 28. Decay corrected to 1/1/2026.					
Am-241	55.46%	Am-241 > 25% of internal dose. Am-241 bioassay required.			
Total Pu	23.24				
Sr:Cs Ratio	0.52	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
Cs:Pu	319.90				
Cs:Am	N/a				
Sr:Pu	N/A				
Sr:Am	N/A				

Table D-10. LLV Bioassay Evaluation

Radionuclide	Total Ci (2026) [(a)]	Type	ALI	(Ci)/(ALI)	% Internal Dose
Mn-54	--	M	1.1E+03	--	--
Co-60	--	S	7.9E+01	--	--
Se-79	--	M	4.4E+02	--	--
Sr-90	1.76E+02	F	4.5E+01	3.90E+00	12.28%
Tc-99	--	M	4.2E+02	--	--
Ag-108m	--	F	1.9E+02	--	--
Sb-125	--	M	4.1E+02	--	--
Cs-134	--	F	1.4E+02	--	--
Cs-137	3.37E+02	F	2.0E+02	1.68E+00	5.30%
Eu-154	1.46E-01	M	3.9E+01	3.75E-03	0.01%
Eu-155	2.04E-02	M	2.9E+02	7.04E-05	0.00%
Pu-238	1.55E-01	S	1.2E-01	1.30E+00	4.08%
Pu-239	5.84E-02	S	1.6E-01	3.65E-01	1.15%
Pu-240	5.82E-02	S	1.6E-01	3.64E-01	1.15%
Pu-241	7.80E-01	S	1.6E-01	4.87E+00	15.34%
Pu-242	--	S	1.8E-01	--	--
Am-241	8.80E-01	M	5.0E-02	1.76E+01	55.41%
Cm-242	--	M	3.7E-01	--	--
Cm-243	--	M	6.8E-02	--	--
Cm-244	1.33E-01	M	7.9E-02	1.68E+00	5.29%
Total	**5.14E+02**			**3.18E+01**	**100.00%**
[(a)] From ECF-324-BLDG-17-0086, Revision 0, Tables 33 and 48, and 0300X-CA-N0118, Revision 1, Table 26. Decay corrected to 1/1/2026.					
Am-241	55.41%	Am-241 > 25% of internal dose. Am-241 bioassay required.			
Total Pu	1.05				
Sr:Cs Ratio	0.52	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
Cs:Pu	320.08				
Cs:Am	N/A				
Sr:Pu	N/A				
Sr:Am	N/A				

Table D-11. SMF South Cell Bioassay Evaluation

Radionuclide	Max Removable (µCi/100 cm²) 1998 [a]	Max Removable (µCi/100 cm²) 2026	Type	ALI	(µCi/100 cm²)/(ALI)	% Internal Dose
Mn-54	1.93E-01	2.64E-11	M	1.1E+03	2.40E-14	0.00%
Co-60	1.34E+01	3.37E-01	S	7.9E+01	4.27E-03	0.52%
Se-79	---	---	M	4.4E+02	--	--
Sr-90	8.34E+00	4.25E+00	F	4.5E+01	9.44E-02	11.49%
Tc-99	---	---	M	4.2E+02	--	--
Ag-108m	---	---	F	1.9E+02	--	--
Sb-125	ND	ND	M	4.1E+02	--	--
Cs-134	2.21E+00	1.83E-04	F	1.4E+02	1.31E-06	0.00%
Cs-137	2.76E+02	1.45E+02	F	2.0E+02	7.24E-01	87.99%
Eu-154	ND	ND	M	3.9E+01	--	--
Eu-155	ND	ND	M	2.9E+02	--	--
Pu-238	---	---	S	1.2E-01	--	--
Pu-239	---	---	S	1.6E-01	--	--
Pu-240	---	---	S	1.6E-01	--	--
Pu-241	---	---	S	1.6E-01	--	--
Pu-242	---	---	S	1.8E-01	--	--
Am-241	---	---	M	5.0E-02	--	--
Cm-242	---	---	M	3.7E-01	--	--
Cm-243	---	---	M	6.8E-02	--	--
Cm-244	---	---	M	7.9E-02	--	--
Total	**3.00E+02**	**1.49E+02**			**8.22E-01**	**100.00%**
[a] From WCH-412, Table 6. Decay corrected to 1/1/2026.						
	Cs-137	87.99%	Cs-137 > 25% of internal dose. WBC for Cs-137 required.			
	Total Pu	0.00				
	Sr:Cs Ratio	0.03	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
	Cs:Pu	N/A				
	Cs:Am	N/A				
	Sr:Pu	N/A				
	Sr:Am	N/A				

Table D-12. SMF East Cell Bioassay Evaluation

Radionuclide	Max Removable (µCi/100 cm^2)		Type	ALI	(µCi/100 cm^2)/(ALI)	% Internal Dose
	1998 [a]	2026				
Mn-54	ND	ND	M	1.1E+03	--	--
Co-60	1.81E-05	4.56E-07	S	7.9E+01	5.77E-09	0.00%
Se-79	---	---	M	4.4E+02	--	--
Sr-90	4.59E-02	2.34E-02	F	4.5E+01	5.20E-04	99.23%
Tc-99	---	---	M	4.2E+02	--	--
Ag-108m	---	---	F	1.9E+02	--	--
Sb-125	ND	ND	M	4.1E+02	--	--
Cs-134	1.53E-05	1.27E-09	F	1.4E+02	9.06E-12	0.00%
Cs-137	1.53E-03	8.02E-04	F	2.0E+02	4.01E-06	0.77%
Eu-154	ND	ND	M	3.9E+01	--	--
Eu-155	ND	ND	M	2.9E+02	--	--
Pu-238	---	---	S	1.2E-01	--	--
Pu-239	---	---	S	1.6E-01	--	--
Pu-240	---	---	S	1.6E-01	--	--
Pu-241	---	---	S	1.6E-01	--	--
Pu-242	---	---	S	1.8E-01	--	--
Am-241	---	---	M	5.0E-02	--	--
Cm-242	---	---	M	3.7E-01	--	--
Cm-243	---	---	M	6.8E-02	--	--
Cm-244	---	---	M	7.9E-02	--	--
Total	**4.75E-02**	**2.42E-02**			**5.24E-04**	**100.00%**

[a] From WCH-412, Table 6. Decay corrected to 1/1/2026.

	Sr-90	99.23%	Sr-90 > 25% of internal dose. Sr-90 bioassay required.			
	Total Pu	0.00				
	Sr:Cs Ratio	29.17	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
	Cs:Pu	N/A				
	Cs:Am	N/A				
	Sr:Pu	N/A				
	Sr:Am	N/A				

Table D-13. SMF Airlock Bioassay Evaluation

Radionuclide	Max Removable (µCi/100 cm²) 1998 [(a)]	Max Removable (µCi/100 cm²) 2026	Type	ALI	(µCi/100 cm²)/(ALI)	% Internal Dose
Mn-54	1.93E-01	2.64E-11	M	1.1E+03	2.40E-14	0.00%
Co-60	1.34E+01	3.37E-01	S	7.9E+01	4.27E-03	0.52%
Se-79	---	---	M	4.4E+02	--	--
Sr-90	8.34E+00	4.25E+00	F	4.5E+01	9.44E-02	11.49%
Tc-99	---	---	M	4.2E+02	--	--
Ag-108m	---	---	F	1.9E+02	--	--
Sb-125	ND	ND	M	4.1E+02	--	--
Cs-134	2.21E+00	1.83E-04	F	1.4E+02	1.31E-06	0.00%
Cs-137	2.76E+02	1.45E+02	F	2.0E+02	7.24E-01	87.99%
Eu-154	ND	ND	M	3.9E+01	--	--
Eu-155	ND	ND	M	2.9E+02	--	--
Pu-238	---	---	S	1.2E-01	--	--
Pu-239	---	---	S	1.6E-01	--	--
Pu-240	---	---	S	1.6E-01	--	--
Pu-241	---	---	S	1.6E-01	--	--
Pu-242	---	---	S	1.8E-01	--	--
Am-241	---	---	M	5.0E-02	--	--
Cm-242	---	---	M	3.7E-01	--	--
Cm-243	---	---	M	6.8E-02	--	--
Cm-244	---	---	M	7.9E-02	--	--
Total	**3.00E+02**	**1.49E+02**			**8.22E-01**	**100.00%**

[(a)] From WCH-412, Table 6. South Cell values are assumed due to cross contamination into the Airlock during South Cell grouting. Decay corrected to 1/1/2026.

	Cs-137	87.99%	Cs-137 > 25% of internal dose. WBC for Cs-137 required.			
	Total Pu	0.00				
	Sr:Cs Ratio	0.03	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
	Cs:Pu	N/A				
	Cs:Am	N/A				
	Sr:Pu	N/A				
	Sr:Am	N/A				

Table D-14. Room 147 Hood Bioassay Evaluation

Radionuclide	Max Removable (µCi/100 cm²) 1998 [(a)]	Max Removable (µCi/100 cm²) 2026	Type	ALI	(µCi/100 cm²)/(ALI)	% Internal Dose
Mn-54	ND	ND	M	1.1E+03	--	--
Co-60	9.11E-04	2.29E-05	S	7.9E+01	2.90E-07	0.09%
Se-79	1.79E-09	1.79E-09	M	4.4E+02	4.07E-12	0.00%
Sr-90	1.16E-02	5.91E-03	F	4.5E+01	1.31E-04	38.76%
Tc-99	5.94E-08	5.94E-08	M	4.2E+02	1.41E-10	0.00%
Ag-108m	---	---	F	1.9E+02	--	--
Sb-125	ND	ND	M	4.1E+02	--	--
Cs-134	ND	ND	F	1.4E+02	--	--
Cs-137	1.93E-02	1.01E-02	F	2.0E+02	5.06E-05	14.93%
Eu-154	ND	ND	M	3.9E+01	--	--
Eu-155	ND	ND	M	2.9E+02	--	--
Pu-238	1.72E-06	1.38E-06	S	1.2E-01	1.15E-05	3.39%
Pu-239	---	---	S	1.6E-01	--	--
Pu-240	---	---	S	1.6E-01	--	--
Pu-241	---	---	S	1.6E-01	--	--
Pu-242	---	---	S	1.8E-01	--	--
Am-241	7.59E-06	7.26E-06	M	5.0E-02	1.45E-04	42.83%
Cm-242	ND	ND	M	3.7E-01	--	--
Cm-243	---	---	M	6.8E-02	--	--
Cm-244	---	---	M	7.9E-02	--	--
Total	**3.18E-02**	**1.61E-02**			**3.39E-04**	**100.00%**

(a) From WCH-412, Table 5. Hood #2 values are assumed due to having higher contamination levels and more detectable radionuclides than other hoods. Decay corrected to 1/1/2026.

	Sr-90	38.76%	Sr-90 > 25% of internal dose. Sr-90 bioassay required.	
	Am-241	42.83%	Am-241 > 25% of internal dose. Am-241 bioassay required.	
	Total Pu	0.00		
	Sr:Cs Ratio	0.58	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.
	Cs:Pu	7,338.65		
	Cs:Am	N/A		
	Sr:Pu	N/A		
	Sr:Am	N/A		

Table D-15. Zone 1 and 2 Containment Bioassay Evaluation

Radionuclide	Total Ci (2026) [a]	Type	ALI	(Ci)/(ALI)	% Internal Dose
Mn-54	--	M	1.1E+03	--	--
Co-60	--	S	7.9E+01	--	--
Se-79	--	M	4.4E+02	--	--
Sr-90	6.38E-02	F	4.5E+01	1.42E-03	5.72%
Tc-99	--	M	4.2E+02	--	--
Ag-108m	--	F	1.9E+02	--	--
Sb-125	--	M	4.1E+02	--	--
Cs-134	--	F	1.4E+02	--	--
Cs-137	1.22E-01	F	2.0E+02	6.08E-04	2.45%
Eu-154	6.30E-05	M	3.9E+01	1.61E-06	0.01%
Eu-155	1.05E-05	M	2.9E+02	3.62E-08	0.00%
Pu-238	1.61E-04	S	1.2E-01	1.34E-03	5.41%
Pu-239	5.90E-05	S	1.6E-01	3.69E-04	1.49%
Pu-240	5.85E-05	S	1.6E-01	3.65E-04	1.47%
Pu-241	3.07E-04	S	1.6E-01	1.92E-03	7.74%
Pu-242	--	S	1.8E-01	--	--
Am-241	8.43E-04	M	5.0E-02	1.69E-02	67.97%
Cm-242	--	M	3.7E-01	--	--
Cm-243	--	M	6.8E-02	--	--
Cm-244	1.52E-04	M	7.9E-02	1.92E-03	7.74%
Total	**1.87E-01**			**2.48E-02**	**100.00%**
[a] From ECF-324-BLDG-17-0086, Revision 0, Table 40. Decay corrected to 1/1/2026.					
Am-241	69.97%	Am-241 > 25% of internal dose. Am-241 bioassay required.			
Total Pu	0.00				
Sr:Cs Ratio	0.52	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
Cs:Pu	207.78				
Cs:Am	N/A				
Sr:Pu	N/A				
Sr:Am	N/A				

Table D-16. HEPA Filter Bioassay Evaluation

Radionuclide	Total Ci (2026) [(a)]	Type	ALI	(Ci)/(ALI)	% Internal Dose
Mn-54	--	M	1.1E+03	--	--
Co-60	4.00E-03	S	7.9E+01	5.07E-05	0.01%
Se-79	--	M	4.4E+02	--	--
Sr-90	1.33E+01	F	4.5E+01	2.96E-01	60.69%
Tc-99	--	M	4.2E+02	--	--
Ag-108m	--	F	1.9E+02	--	--
Sb-125	--	M	4.1E+02	--	--
Cs-134	--	F	1.4E+02	--	--
Cs-137	4.58E-01	F	2.0E+02	2.29E-03	0.47%
Eu-154	6.62E-04	M	3.9E+01	1.70E-05	0.00%
Eu-155	--	M	2.9E+02	--	--
Pu-238	3.73E-04	S	1.2E-01	3.11E-03	0.64%
Pu-239	--	S	1.6E-01	--	--
Pu-240	3.04E-04	S	1.6E-01	1.90E-03	0.39%
Pu-241	3.82E-03	S	1.6E-01	2.39E-02	4.89%
Pu-242	--	S	1.8E-01	--	--
Am-241	2.98E-03	M	5.0E-02	5.96E-02	12.22%
Cm-242	--	M	3.7E-01	--	--
Cm-243	--	M	6.8E-02	--	--
Cm-244	7.98E-03	M	7.9E-02	1.01E-01	20.70%
Total	**1.38E+01**			**4.88E-01**	**100.00%**
[(a)] From ECF-324-BLDG-17-0086, Revision 0, Tables 42 and 43. Decay corrected to 1/1/2026.					
Sr-90	60.69%	Sr-90 > 25% of internal dose. Sr-90 bioassay required.			
Total Pu	0.00				
Sr:Cs Ratio	29.11	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
Cs:Pu	101.82				
Cs:Am	153.62				
Sr:Pu	N/A				
Sr:Am	N/A				

Table D-17. POG/VV Piping Systems Bioassay Evaluation

Radionuclide	Total Ci (2026) [a]	Type	ALI	(Ci)/(ALI)	% Internal Dose
Mn-54	--	M	1.1E+03	--	--
Co-60	--	S	7.9E+01	--	--
Se-79	--	M	4.4E+02	--	--
Sr-90	3.59E-01	F	4.5E+01	7.98E-03	12.74%
Tc-99	--	M	4.2E+02	--	--
Ag-108m	--	F	1.9E+02	--	--
Sb-125	--	M	4.1E+02	--	--
Cs-134	--	F	1.4E+02	--	--
Cs-137	6.85E-01	F	2.0E+02	3.42E-03	5.46%
Eu-154	3.54E-04	M	3.9E+01	9.06E-06	0.01%
Eu-155	5.93E-05	M	2.9E+02	2.05E-07	0.00%
Pu-238	3.00E-04	S	1.2E-01	2.50E-03	3.99%
Pu-239	1.10E-04	S	1.6E-01	6.87E-04	1.10%
Pu-240	1.09E-04	S	1.6E-01	6.81E-04	1.09%
Pu-241	1.73E-03	S	1.6E-01	1.08E-02	17.24%
Pu-242	--	S	1.8E-01	--	--
Am-241	1.65E-03	M	5.0E-02	3.30E-02	52.65%
Cm-242	--	M	3.7E-01	--	--
Cm-243	--	M	6.8E-02	--	--
Cm-244	2.84E-04	M	7.9E-02	3.59E-03	5.73%
Total	**1.05E+00**			**6.27E-02**	**100.00%**
[a] From ECF-324-BLDG-17-0086, Revision 0, Table 46. Decay corrected to 1/1/2026.					
Am-241	52.65%	Am-241 > 25% of internal dose. Am-241 bioassay required.			
Total Pu	0.00				
Sr:Cs Ratio	0.52	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
Cs:Pu	304.55				
Cs:Am	N/A				
Sr:Pu	N/A				
Sr:Am	N/A				

Table D-18. RLWS Piping Systems Bioassay Evaluation

Radionuclide	HEIS Sample ID J1C2W1 [(a)]				Type	ALI (µCi) [(b)]	(Avg pCi/g)/(ALI)	% Internal Dose
	Lab ID S009249-01	Lab ID S009249-01 Dup	Avg (Oct 2010)	Avg (2026)				
	pCi/g	pCi/g	pCi/g	pCi/g				
Gross Beta	1.78E+06	1.94E+06	1.86E+06	--	--	--	--	--
Mn-54	--	--	--	--	M	1.1E+03	--	--
Co-60	--	--	--	--	S	7.9E+01	--	--
Se-79	--	--	--	--	M	4.4E+02	--	--
Sr-90 [(c)]	1.12E+06	1.28E+06	1.20E+06	8.33E+05	F	4.5E+01	1.85E+04	87.38%
Tc-99	--	--	--	--	M	4.2E+02	--	--
Ag-108m	--	--	--	--	F	1.9E+02	--	--
Sb-125	--	--	--	--	M	4.1E+02	--	--
Cs-134	--	--	--	--	F	1.4E+02	--	--
Cs-137	6.60E+05	6.62E+05	6.61E+05	4.66E+05	F	2.0E+02	2.33E+03	10.99%
Eu-152	<MDC	<MDC	<MDC	<MDC	M	5.0E+01	--	--
Eu-154	9.41E+02	1.02E+03	9.81E+02	2.89E+02	M	3.9E+01	7.40E+00	0.03%
Eu-155	<MDC	<MDC	<MDC	<MDC	M	2.9E+02	--	--
U-233+234	<MDC	<MDC	<MDC	<MDC	S	2.0E-01	--	--
U-235+236	<MDC	<MDC	<MDC	8.05E-07	S	2.1E-01	3.83E-06	0.00%
U-238	<MDC	<MDC	<MDC	<MDC	S	2.4E-01	--	--
Pu-238	<MDC	<MDC	<MDC	<MDC	S	1.2E-01	--	--
Pu-239+240	7.12E+01	3.65E+01	5.39E+01	5.39E+01	S	1.6E-01	3.37E+02	1.59%
Pu-241	--	--	--	--	S	1.6E-01	--	--
Pu-242	--	--	--	--	S	1.6E-01	--	--
Am-241	<MDC	<MDC	<MDC	<MDC	M	5.0E-02	--	--
Cm-242	--	--	--	--	M	3.7E-01	--	--

Table D-18. RLWS Piping Systems Bioassay Evaluation

	HEIS Sample ID J1C2W1 [a]							
	Lab ID S009249-01	Lab ID S009249-01 Dup	Avg (Oct 2010)	Avg (2026)		ALI (µCi) [b]		
Radionuclide	pCi/g	pCi/g	pCi/g	pCi/g	Type		(Avg pCi/g)/(ALI)	% Internal Dose
Cm-243+244	--	--	--	--	M	6.8E-02	--	--
Total	**1.78E+06**	**1.94E+06**	**1.86E+06**	**1.30E+06**			**2.12E+04**	**100.00%**

[a] From Eberline Analytical Services Report for RLWS Sump Solids Sample HEIS ID J1C2W1. Decay corrected to 1/1/2026.
[b] Where paired radionuclides are listed (e.g., U-233+234), the most restrictive ALI is assumed.
[c] Sr-90 analysis was not reported. Sr-90 is assumed to equal Gross Beta activity minus the sum of Cs-137 and Eu-154 activity.

			Sr-90	87.38%	Sr-90 > 25% of internal dose. Sr-90 bioassay required.			
			Total Pu	53.88				
			Sr:Cs Ratio	1.79	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
			Cs:Pu	8643.28				
			Cs:Am	N/A				
			Sr:Pu	N/A				
			Sr:Am	N/A				

Table D-19. RRLWS & CBWS Piping Systems Bioassay Evaluation

Radionuclide	HEIS Sample ID J1C2W1 [a]				Type	ALI (µCi) [b]	(Avg pCi/g)/(ALI)	% Internal Dose
	Lab ID S009249-01	Lab ID S009249-01 Dup	Avg (Oct 2010)	Avg (2026)				
	pCi/g	pCi/g	pCi/g	pCi/g				
Gross Beta	1.78E+06	1.94E+06	1.86E+06	--	--	--	--	--
Mn-54	--	--	--	--	M	1.1E+03	--	--
Co-60	--	--	--	--	S	7.9E+01	--	--
Se-79	--	--	--	--	M	4.4E+02	--	--
Sr-90 [c]	1.12E+06	1.28E+06	1.20E+06	8.33E+05	F	4.5E+01	1.85E+04	87.38%
Tc-99	--	--	--	--	M	4.2E+02	--	--
Ag-108m	--	--	--	--	F	1.9E+02	--	--
Sb-125	--	--	--	--	M	4.1E+02	--	--
Cs-134	--	--	--	--	F	1.4E+02	--	--
Cs-137	6.60E+05	6.62E+05	6.61E+05	4.66E+05	F	2.0E+02	2.33E+03	10.99%
Eu-152	<MDC	<MDC	<MDC	<MDC	M	5.0E+01	--	--
Eu-154	9.41E+02	1.02E+03	9.81E+02	2.89E+02	M	3.9E+01	7.40E+00	0.03%
Eu-155	<MDC	<MDC	<MDC	<MDC	M	2.9E+02	--	--
U-233+234	<MDC	<MDC	<MDC	<MDC	S	2.0E-01	--	--
U-235+236	<MDC	<MDC	<MDC	8.05E-07	S	2.1E-01	3.83E-06	0.00%
U-238	<MDC	<MDC	<MDC	<MDC	S	2.4E-01	--	--
Pu-238	<MDC	<MDC	<MDC	<MDC	S	1.2E-01	--	--
Pu-239+240	7.12E+01	3.65E+01	5.39E+01	5.39E+01	S	1.6E-01	3.37E+02	1.59%
Pu-241	--	--	--	--	S	1.6E-01	--	--
Pu-242	--	--	--	--	S	1.6E-01	--	--
Am-241	<MDC	<MDC	<MDC	<MDC	M	5.0E-02	--	--
Cm-242	--	--	--	--	M	3.7E-01	--	--

Table D-19. RRLWS & CBWS Piping Systems Bioassay Evaluation

	HEIS Sample ID J1C2W1 [(a)]							
	Lab ID S009249-01	Lab ID S009249-01 Dup	Avg (Oct 2010)	Avg (2026)		ALI (µCi) [(b)]		
Radionuclide	pCi/g	pCi/g	pCi/g	pCi/g	Type		(Avg pCi/g)/(ALI)	% Internal Dose
Cm-243+244	--	--	--	--	M	6.8E-02	--	--
Total	**1.78E+06**	**1.94E+06**	**1.86E+06**	**1.30E+06**			**2.12E+04**	**100.00%**

(a) From Eberline Analytical Services Report for RLWS Sump Solids Sample HEIS ID J1C2W1. Decay corrected to 1/1/2026.
(b) Where paired radionuclides are listed (e.g., U-233+234), the most restrictive ALI is assumed.
(c) Sr-90 analysis was not reported. Sr-90 is assumed to equal Gross Beta activity minus the sum of Cs-137 and Eu-154 activity.

			Sr-90	87.38%	Sr-90 > 25% of internal dose. Sr-90 bioassay required.			
			Total Pu	53.88				
			Sr:Cs Ratio	1.79	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
			Cs:Pu	8643.28				
			Cs:Am	N/A				
			Sr:Pu	N/A				
			Sr:Am	N/A				

Table D-20. 300-265 Piping Systems Bioassay Evaluation

Radionuclide	Total Ci (2026) [(a)]	Type	ALI	(Ci)/(ALI)	% Internal Dose
Mn-54	--	M	1.1E+03	--	--
Co-60	2.88E-03	S	7.9E+01	3.64E-05	0.00%
Se-79	--	M	4.4E+02	--	--
Sr-90	4.99E+00	F	4.5E+01	1.11E-01	0.70%
Tc-99	2.70E-03	M	4.2E+02	6.43E-06	0.00%
Ag-108m	--	F	1.9E+02	--	--
Sb-125	--	M	4.1E+02	--	--
Cs-134	--	F	1.4E+02	--	--
Cs-137	7.42E+00	F	2.0E+02	3.71E-02	0.24%
Eu-154	5.16E-02	M	3.9E+01	1.32E-03	0.01%
Eu-155	1.87E-03	M	2.9E+02	6.46E-06	0.00%
Pu-238	1.45E-01	S	1.2E-01	1.21E+00	7.65%
Pu-239	2.53E-02	S	1.6E-01	1.58E-01	1.00%
Pu-240	4.30E-02	S	1.6E-01	2.69E-01	1.71%
Pu-241	1.11E+00	S	1.6E-01	6.94E+00	44.00%
Pu-242	1.42E-04	S	1.8E-01	7.90E-04	0.01%
Am-241	3.18E-01	M	5.0E-02	6.36E+00	40.35%
Cm-242	--	M	3.7E-01	--	--
Cm-243	6.12E-04	M	6.8E-02	9.00E-03	0.06%
Cm-244	5.34E-02	M	7.9E-02	6.76E-01	4.29%
Total	1.42E+01			1.58E+01	100.00%
[(a)] From 0300X-CA-N0153, Revision 0, Table 8. Decay corrected to 1/1/2026.					
Pu-241	44.00%	Pu-241 > 25% of internal dose. Pu bioassay required.			
Am-241	40.35%	Am-241 > 25% of internal dose. Am bioassay required			
Total Pu	0.00				
Sr:Cs Ratio	0.52	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
Cs:Pu	304.55				
Cs:Am	N/A				
Sr:Pu	N/A				
Sr:Am	N/A				

Table D-21. 300-296 Point Source (Remote Excavation) Bioassay Evaluation

Radionuclide	HEIS Sample ID J1JD50 [a]				Type	ALI (µCi) [b]	(Avg µCi/g)/(ALI)	% Internal Dose
	Lab ID 11-1397 µCi/g	Lab ID 11-1397 Dup µCi/g	Avg (Sep 2011) µCi/g	Avg (2026) µCi/g				
Mn-54	--	--	--	--	M	1.1E+03	--	--
Co-60	<MDC	<MDC	<MDC	<MDC	S	7.9E+01	--	--
Se-79	--	--	--	--	M	4.4E+02	--	--
Sr-90	3.87E+02	3.68E+02	3.78E+02	2.68E+02	F	4.5E+01	5.96E+00	15.06%
Tc-99	--	--	--	--	M	4.2E+02	--	--
Ag-108m	--	--	--	--	F	1.9E+02	--	--
Sb-125	--	--	--	--	M	4.1E+02	--	--
Cs-134	--	--	--	--	F	1.4E+02	--	--
Cs-137	8.19E+03	7.78E+03	7.99E+03	5.75E+03	F	2.0E+02	2.88E+01	72.63%
Eu-152	--	--	--	--	M	5.0E+01	--	--
Eu-154	<MDC	<MDC	<MDC	<MDC	M	3.9E+01	--	--
Eu-155	--	--	--	--	M	2.9E+02	--	--
U-233+234	--	--	--	5.63E-06	S	2.0E-01	2.81E-05	0.00%
U-235+236	--	--	--	3.42E-10	S	2.1E-01	1.63E-09	0.00%
U-238	--	--	--	--	S	2.4E-01	--	--
Pu-238	1.59E-01	1.36E-01	1.48E-01	1.32E-01	S	1.2E-01	1.10E+00	2.78%
Pu-239+240	2.72E-02	2.13E-02	2.43E-02	2.44E-02	S	1.6E-01	1.52E-01	0.38%
Pu-241	--	--	--	--	S	1.6E-01	--	--
Pu-242	--	--	--	--	S	1.6E-01	--	--
Am-241	9.62E-02	8.18E-02	8.90E-02	8.70E-02	M	5.0E-02	1.74E+00	4.39%
Cm-242	4.65E-04	5.07E-04	4.86E-04	1.17E-13	M	3.7E-01	3.15E-13	0.00%
Cm-243+244	1.87E-01	1.69E-01	1.78E-01	1.28E-01	M	6.8E-02	1.88E+00	4.76%
Total	8.58E+03	8.15E+03	8.36E+03	6.02E+03			3.96E+01	100.00%

Table D-21. 300-296 Point Source (Remote Excavation) Bioassay Evaluation

	HEIS Sample ID J1JD50 [(a)]							
	Lab ID 11-1397	Lab ID 11-1397 Dup	Avg (Sep 2011)	Avg (2026)				
Radionuclide	µCi/g	µCi/g	µCi/g	µCi/g	Type	ALI (µCi) [(b)]	(Avg µCi/g)/(ALI)	% Internal Dose
[(a)] From WCH Doc. No. 161417. Decay corrected to 1/1/2026. [(b)] Where paired radionuclides are listed (e.g., U-233+234), the most restrictive ALI is assumed.								
			Cs-137	72.63%	Cs-137 > 25% of internal dose. Annual WBC required.			
			Total Pu	0.16				
			Sr:Cs Ratio	0.05	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
			Cs:Pu	36,729.48				
			Cs:Am	66,099.55				
			Sr:Pu	N/A				
			Sr:Am	N/A				

Table D-21. 300-296 Fugitive Source (Facility Stabilization/Open-Air Excavation) Bioassay Evaluation

Radionuclide	HEIS Sample ID J1JD549[a]				Type	ALI (µCi) [b]	(Avg µCi/g)/(ALI)	% Internal Dose
	Lab ID 11-1397	Lab ID 11-1397 Dup	Avg (Sep 2011)	Avg (2026)				
	µCi/g	µCi/g	µCi/g	µCi/g				
Mn-54	--	--	--	--	M	1.1E+03	--	--
Co-60	8.21E-03	5.12E-03	6.67E-03	1.02E-03	S	7.9E+01	1.29E-05	0.00%
Se-79	--	--	--	--	M	4.4E+02	--	--
Sr-90	2.88E+02	2.95E+02	2.92E+02	2.07E+02	F	4.5E+01	4.60E+00	98.16%
Tc-99	--	--	--	--	M	4.2E+02	--	--
Ag-108m	--	--	--	--	F	1.9E+02	--	--
Sb-125	--	--	--	--	M	4.1E+02	--	--
Cs-134	<MDC	<MDC	<MDC	<MDC	F	1.4E+02	--	--
Cs-137	4.93E+00	3.93E+00	4.43E+00	3.19E+00	F	2.0E+02	1.59E-02	0.34%
Eu-152	<MDC	<MDC	<MDC	<MDC	M	5.0E+01	--	--
Eu-154	<MDC	<MDC	<MDC	<MDC	M	3.9E+01	--	--
Eu-155	--	--	--	--	M	2.9E+02	--	--
U-233+234	3.32E-06	2.56E-06	2.94E-06	3.01E-06	S	2.0E-01	1.50E-05	0.00%
U-235+236	<MDC	<MDC	<MDC	1.07E-11	S	2.1E-01	5.08E-11	0.00%
U-238	2.10E-06	2.57E-06	2.34E-06	2.34E-06	S	2.4E-01	9.75E-06	0.00%
Pu-238	2.31E-03	1.26E-03	1.79E-03	1.60E-03	S	1.2E-01	1.33E-02	0.28%
Pu-239+240	9.03E-04	6.17E-04	7.60E-04	7.61E-04	S	1.6E-01	4.75E-03	0.10%
Pu-241	--	--	--	--	S	1.6E-01	--	--
Pu-242	--	--	--	--	S	1.6E-01	--	--
Am-241	1.72E-03	1.05E-03	1.39E-03	1.36E-03	M	5.0E-02	2.72E-02	0.58%
Cm-242	9.54E-06	3.53E-06	6.54E-06	1.57E-15	M	3.7E-01	4.24E-15	0.00%

Table D-21. 300-296 Fugitive Source (Facility Stabilization/Open-Air Excavation) Bioassay Evaluation

Radionuclide	HEIS Sample ID J1JD549[(a)] Lab ID 11-1397 µCi/g	Lab ID 11-1397 Dup µCi/g	Avg (Sep 2011) µCi/g	Avg (2026) µCi/g	Type	ALI (µCi) [(b)]	(Avg µCi/g)/(ALI)	% Internal Dose
Cm-243+244	2.99E-03	1.73E-03	2.36E-03	1.70E-03	M	6.8E-02	2.50E-02	0.53%
Total	**2.93E+02**	**2.99E+02**	**2.96E+02**	**2.10E+02**			**4.69E+00**	**100.00%**

[(a)] From WCH Doc. No. 161417. Decay corrected to 1/1/2026.
[(b)] Where paired radionuclides are listed (e.g., U-233+234), the most restrictive ALI is assumed.

			Sr-90	98.16%	Sr-90 > 25% of internal dose. Sr bioassay required.			
			Total Pu	0.00				
			Sr:Cs Ratio	64.99	Annual WBC	Per HNF-55719-1, Table 5.1, an annual WBC will be used as an indicator for other radionuclides.		
			Cs:Pu	1,351.13				
			Cs:Am	2,345.84				
			Sr:Pu	N/A				
			Sr:Am	N/A				