U.S. Department of Energy
Hanford Site

20-PFD-0040 August 12, 2020

Mr. Craig Cameron, Program Manager
Office of Environmental Cleanup
Site Cleanup Unit 4
U.S. Environmental Protection Agency
825 Jadwin Avenue, Suite 210
Richland, Washington 99352

Dear Mr. Cameron:

REMOVAL ACTION WORK PLAN FOR THE 224T PLUTONIUM CONCENTRATION FACILITY, DOE/RL-2019-36, DRAFT A, AND SAMPLING AND ANALYSIS PLAN FOR THE 224T PLUTONIUM CONCENTRATION FACILITY, DOE/RL-2019-37, DRAFT A

This letter transmits the Removal Action Work Plan for the 224T Plutonium Concentration Facility, DOE/RL-2019-36, Draft A (Attachment 1), and the Sampling and Analysis Plan for the 224T Plutonium Concentration Facility, DOE/RL-2019-37, Draft A (Attachment 2), for review and comment.

Comments are requested within 45 days of receipt.

If you have any questions please contact me, or your staff may contact Andy Wiborg of my staff, on (509) 376-9238.

Sincerely,

Mark S. French
Digitally signed by Mark S. French
Date: 2020.08.12 07:59:02 -07'00'

Mark S. French, Director
Project and Facilities Division
Richland Operations Office

PFD:RLL

Attachments

cc: See page 2

cc w/attachs:
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DOE/RL-2019-36
Draft A

Removal Action Work Plan for the 224T Plutonium Concentration Facility

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

U.S. Department of Energy | Richland Operations Office

P.O. Box 550
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DOE/RL-2019-36
Draft A

Removal Action Work Plan for the 224T Plutonium Concentration Facility

Date Published
June 2020

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

U.S. DEPARTMENT OF ENERGY | Richland Operations Office
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Signature Page

Having considered the extent to which the *Removal Action Work Plan for the 224T Plutonium Concentration Facility* could be inconsistent with *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* processes or could alter schedules set forth in Appendix D of the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement), the U.S. Environmental Protection Agency and the U.S. Department of Energy approve this document.

Craig E. Cameron U.S. Environmental Protection Agency	Signature	Date
Mark S. French U.S. Department of Energy Richland Operations Office	Signature	Date

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Executive Summary

This removal action work plan (RAWP) describes the activities necessary to complete the non-time-critical removal action (NTCRA) for the 224T Plutonium Concentration Facility (224T Building). The removal action alternatives were identified and evaluated in DOE/RL-2003-62, *Engineering Evaluation/Cost Analysis for the 224-T Plutonium Concentration Facility*[1] with the alternative selection documented and authorized in DOE/RL-2004-68, *Action Memorandum for the Non-Time Critical Removal Action for the 224-T Plutonium Concentration Facility*[2]. The selected removal action is Alternative 3: Decontamination and Demolition (D&D) (to grade, excluding building foundation and underlying soils/structures). Under change package J-15-01, the lead regulatory agency was switched from Washington State Department of Ecology to the U.S. Environmental Protection Agency for this NTCRA.

The 224T Building was used to purify and concentrate plutonium solution that was produced by the bismuth phosphate process in 221T (T Plant). The 224T Building is designated as Tier 1.[3] The D&D scope includes activities such as removing hazardous substances and equipment, decontaminating the structure, stabilizing contamination, demolishing the structure to slab-on-grade, disposing of waste, sampling, and stabilizing the remaining slab. The processes used to implement the removal action for the 224T Building are described herein.

This RAWP establishes the following methods and activities required to implement the selected removal action:

- Removal action elements and their implementation, including safety, health, and radiological management and controls

[1] DOE/RL-2003-62, 2003, *Engineering Evaluation/Cost Analysis for the 224-T Plutonium Concentration Facility*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/D3597230.

[2] DOE/RL-2004-68, 2005, *Action Memorandum for the Non-Time-Critical Removal Action for the 224-T Plutonium Concentration Facility,* Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/DA428391.

[3] Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at: https://www.hanford.gov/?page=81.

- Environmental management and controls, including applicable or relevant and appropriate requirements, waste management, airborne emissions, reporting for nonroutine releases, and cultural/ecological resources
- Project administration

Sampling activities to support this removal action will be performed in accordance with DOE/RL-2019-37, *Sampling and Analysis Plan for the 224T Plutonium Concentration Facility* [4] and is considered part of this RAWP.

[4] DOE/RL-2019-37, *Sampling and Analysis Plan for the 224T Plutonium Concentration Facility*, Decisional Draft pending, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Contents

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Figures

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Terms

ACM	asbestos-containing material
ALARA	as low as reasonably achievable
AM	action memorandum
ARAR	applicable or relevant and appropriate requirement
Cat I	Category I
Cat II	Category II
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CRR	cultural resource review
CSER	criticality safety evaluation report
D&D	decontamination and demolition
DOE	U.S. Department of Energy
DOE-RL	U.S. Department of Energy Richland, Operations Office
Ecology	Washington State Department of Ecology
EE/CA	engineering evaluation/cost analysis
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
HASP	health and safety plan
HEPA	high-efficiency particulate air
LLW	low-level waste
MEI	maximally exposed individual
MLLW	mixed low-level waste
NESHAP	“National Emission Standards for Hazardous Air Pollutants”
NRC	National Response Center
NTCRA	non-time-critical removal action
PCM	periodic confirmatory measurement
PPE	personal protective equipment
PTE	potential to emit
QA	quality assurance

RAO	removal action objective
RAWP	removal action work plan
RCRA	*Resource Conservation and Recovery Act of 1976*
RWP	radiological work permit
SAP	sampling and analysis plan
SWDP	State Waste Discharge Permit
TEDE	total effective dose equivalent
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TRU	transuranic
TRUM	transuranic mixed
TRUSAF	Transuranic Waste Storage and Assay Facility
TSCA	*Toxic Substances Control Act of 1976*
WIDS	Waste Information Data System

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1 Introduction

This removal action work plan (RAWP) provides guidance for implementing the selected removal action for the 224T Plutonium Concentration Facility (the 224T Building) located within the T Plant Complex in the 200 West Area of the Hanford Site. This removal action scope is authorized by DOE/RL-2004-68, *Action Memorandum for the Non-Time-Critical Removal Action for the 224-T Plutonium Concentration Facility*. The action memorandum (AM), hereinafter referred to as the 224T AM, selected Alternative 3: Decontamination and Demolition (D&D) (to grade, excluding building foundation and underlying soils/structures). This alternative was also identified, evaluated, and recommended in DOE/RL-2003-62, *Engineering Evaluation/Cost Analysis for the 224-T Plutonium Concentration Facility*, hereinafter called the engineering evaluation/cost analysis.

Implementation of this non-time-critical removal action (NTCRA) will minimize the potential for a release or threat of release of hazardous substances from the 224T Building to human health and the environment. The RAWP identifies technical requirements of the removal action and details the work elements, performance measurements, project management, oversight, and schedule for implementing the removal action.

The U.S. Department of Energy (DOE) was delegated as the authority to conduct removal actions under Section 104, “Response Authorities,” of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) by Executive Order 12580, *Superfund Implementation*. This removal action will be performed in a manner consistent with any anticipated long-term remedial action under authority of CERCLA and the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1989a), also known as the Tri-Party Agreement, which designates the U.S. Environmental Protection Agency (EPA) as the lead regulatory agency for final response actions related to the 224T Building.

Issuance of this RAWP satisfies Milestone M-085-100, which states “submit to EPA a Removal Action Work Plan to implement the approved Action Memorandum for 224T (DOE/RL-2004-68).”

1.1 Purpose

This RAWP identifies the requirements and establishes the methods to conduct the removal action for the 224T Building. This RAWP describes the following details:

- Removal action elements and how they will be implemented as well as safety and health management controls
- Environmental management and controls, including applicable or relevant and appropriate requirements (ARARs), waste management, airborne emissions, reporting for nonroutine releases, and cultural/ecological resources
- Project administration

The intent of the RAWP is to identify the basis and provide criteria for the preparation of work packages and procedures to conduct D&D activities and to meet the removal action objectives (RAOs). Using the most recent information about the conditions for the 224T Building, field-level work packages and procedures will be developed to direct work activities and instruct workers in the applicable work methods.

This removal action is consistent with the overall Hanford Site cleanup initiative and will, to the extent practicable, contribute to the efficient performance of any anticipated long-term remedial action as required by 40 CFR 300.415(d), “National Oil and Hazardous Substances Pollution Contingency Plan,” “Removal Action.” The following RAOs were identified in the 224T AM (DOE/RL-2004-68):

- Reduce or eliminate the potential for exposure to hazardous substances above levels that are protective of the public and the environment

- Reduce or eliminate the potential for a release of hazardous substances
- Safely manage (treat and/or dispose) waste streams generated by the removal action
- To the extent practicable, contribute to the efficient performance of any anticipated long-term remedial action with respect to the release concerns and ensure an orderly transition from removal to remedial response actions, including any future subsurface soil remediation

As the lead agency for removal actions, DOE will assign a Removal Action Manager from the U.S. Department of Energy, Richland Operations Office (DOE-RL) to oversee the removal activities.

1.2 Scope

The 224T Building is designated as Tier 1 based on the presence of hazardous substances that could be released to the environment. Tier 1 facilities are historically designated as "key" facilities in Section 8.1.2, "Applicability," of the Tri-Party Agreement Action Plan (Ecology et al., 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan*).

The selected removal action for the 224T Building includes the following activities:

- Removal of nonradiological and radiological hazardous substances
- Removal of equipment and associated piping
- Decontamination of the structure and/or stabilization of contamination
- Demolition of the structure to slab
- Disposal of the generated waste
- Stabilization of the area, including underground structures left in place
- Environmental sampling and analysis of slab and surrounding soil, including beneath the slab

Included in this removal action are characterization activities of remaining hazardous substances to facilitate demolition and waste disposal, determine worker controls, and document post-removal conditions for future remedial action.

1.3 Site Conditions and Background

The Hanford Site encompasses approximately 580 mi^2 in southeastern Washington State north of the confluence of the Columbia, Yakima, and Snake Rivers. The Columbia River flows east through the northern part of the Hanford Site and, turning south, forms the eastern boundary of the site. The Yakima River runs along part of the southern boundary and joins the Columbia River at the City of Richland, which bounds the Hanford Site on the southeast. The 224T Building is in the 200 West Area of the Hanford Site. Highway 240 is to the southwest of the 224T Building, and the Columbia River is to the north-northeast.

The 224T Building is part of the T Plant Complex in the 200 West Area of the Hanford Site (Figure 1). Public access to the Hanford Site is currently restricted and controlled at the Wye Barricade on Route 4 and the Yakima and Rattlesnake Barricades on State Highway 240. Unauthorized access to the 224T Building is prohibited. The building is locked, and a 6 ft tall cyclone fence encloses the entire T Plant Complex. Figure 2 depicts the location of the 224T Building within the T Plant Complex.

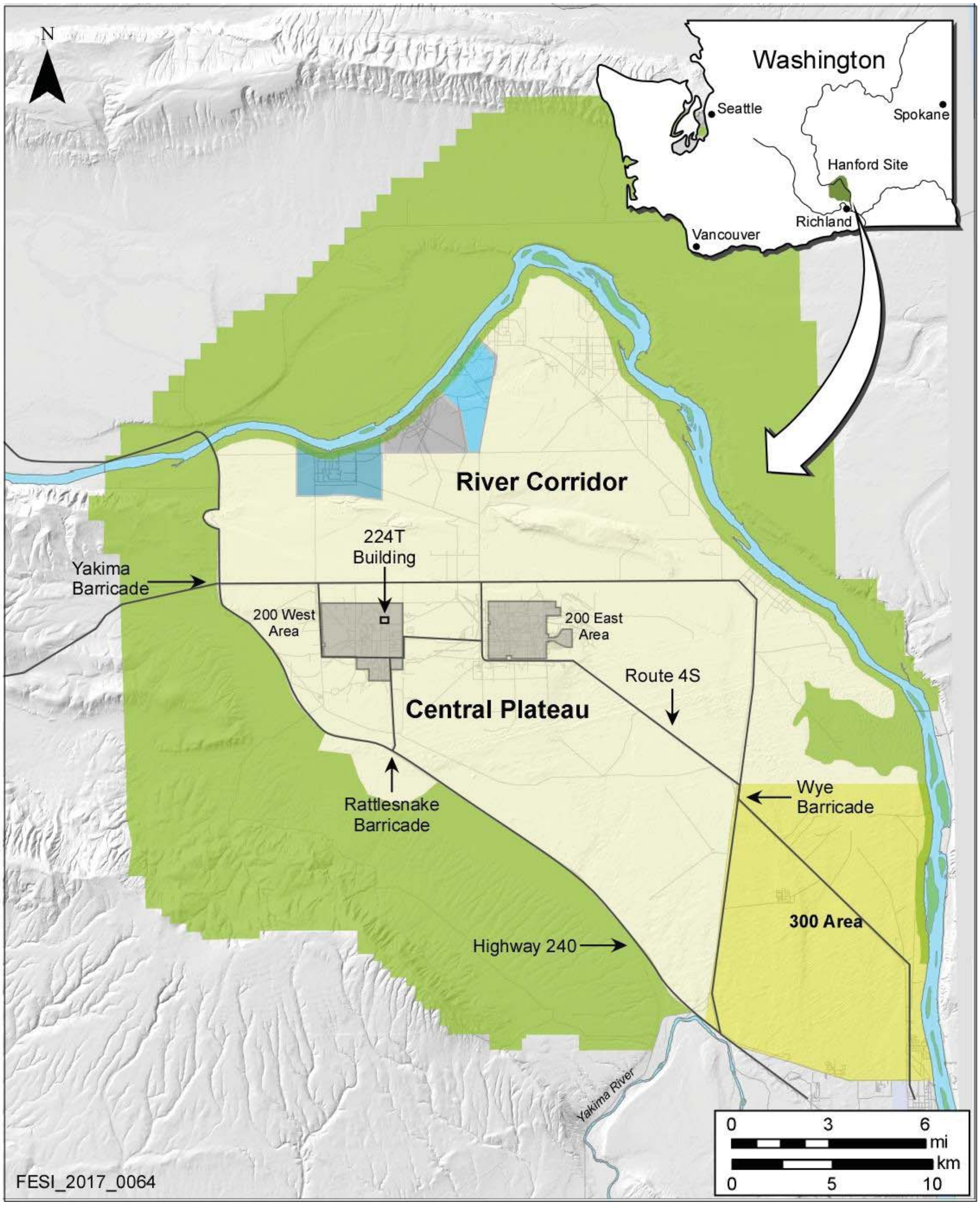

Figure 1. Hanford Site and the 224T Building Location

Figure 2. 224T Building Within the T Plant Complex

1.3.1 The 224T Plutonium Concentration Building

Constructed in 1944, the 224T Building was used to purify and concentrate plutonium solution that was produced from the bismuth phosphate process in 221T (T Plant). The concentrated plutonium solution was shipped from 224T to the 231Z Isolation Building south of 224T. Plutonium concentration operations were performed from January 1945 to early 1956, when the T Plant Complex was retired from active service as a chemical processing facility.

The 224T Building is a three-story reinforced concrete structure that originally contained 21 rooms and 5 process cells with a large operating gallery located on the third floor. A sixth process cell was constructed in 1950 to increase production. Figure 3 provides the illustration of the building layout. The building is 197 by 60 ft and is divided along its length by a concrete wall into two main sections: a cold side to the northwest and a process cell side to the southeast.

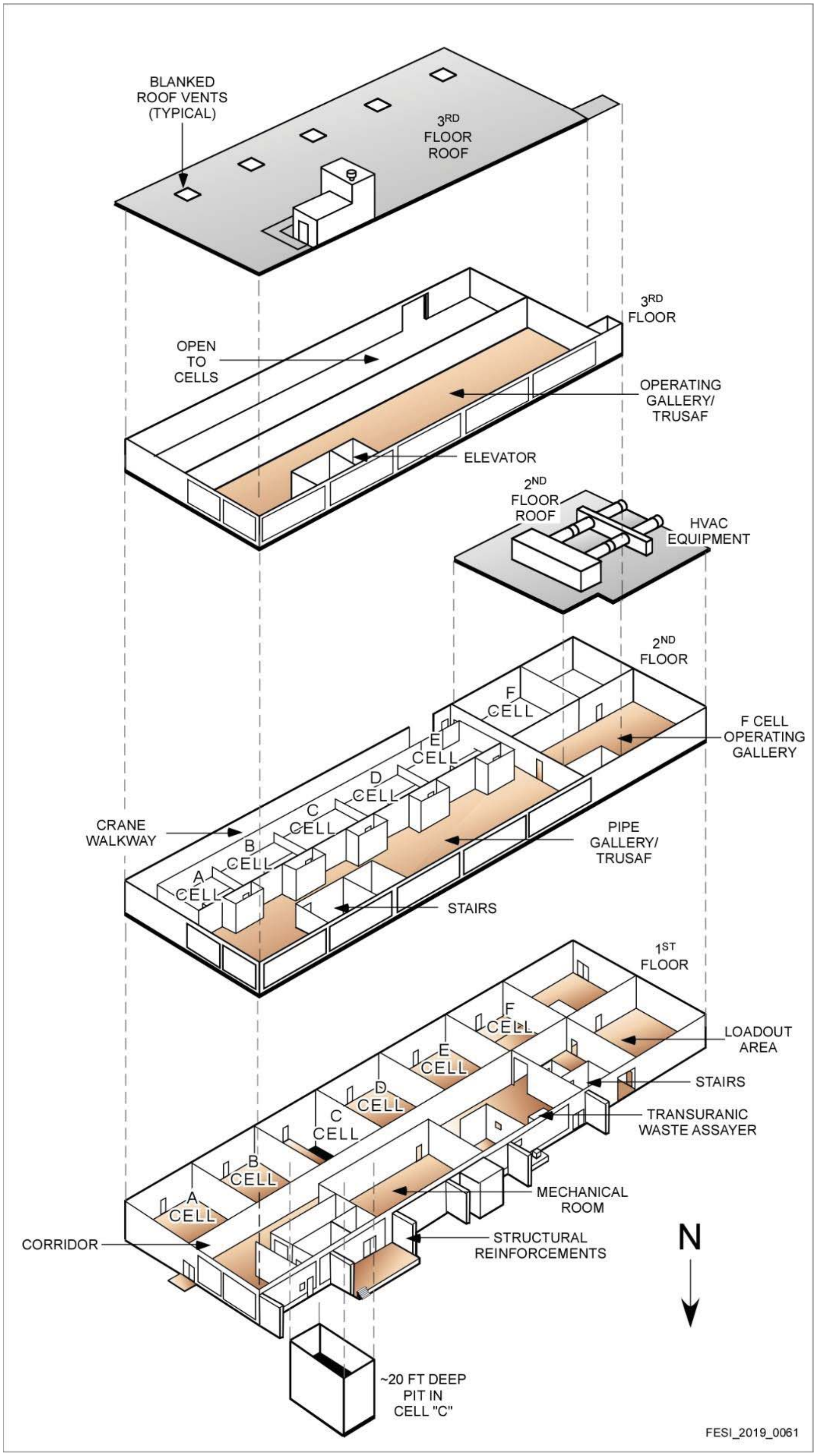

Figure 3. 224T Building Layout

Modifications were made to the building in 1975 to provide seismic and tornado resistance (CP-14641, *Documented Safety Analysis for the 224-T Facility*), including the following:

- Steel beams were attached horizontally to the original reinforced concrete walls and supported at column lines to withstand high winds.
- Shields were built over the exterior ventilation openings to protect the containers stored in the building from tornado-generated missiles.
- Block walls were replaced with reinforced concrete.
- Vertical concrete buttresses were installed: six on the northeast side and five on the southeast side.

The cold side and the process cell side of 224T are described in the following subsections. Figures 4, 5, and 6 depict floor plans 1, 2, and 3, respectively.

1.3.1.1 Cold Side

The first floor of the cold side of the 224T Building contains offices, a restroom, mechanical room, and a loadout area. The mechanical room housed air supply equipment and motor control centers for the process equipment. The loadout area is located on the west side of the building and contains a loadout (also known as the process) hood. There is a stainless-steel tank located inside of the loadout hood (F-10). A large roll-up door was installed in a wall adjacent to the loadout area. The floors were sealed with an epoxy sealant in 1989.

The east end of the second floor is a pipe gallery for Cells A through E. Chemical, steam, and water pipes; air lines; and electrical conduit pass through the concrete wall from the pipe gallery to Cells A through E. In the pipe gallery, there is a sample room for each cell that doubles as an airlock. These samples rooms lead to an operating platform in each of the cells (except for C Cell). The operating platforms are shielded by partial height concrete walls. During modifications in the 1970s, the sample rooms were sealed with concrete.

The west end of the second floor contains an operating gallery for F Cell, which includes control panels and viewing windows. Pumps and aqueous make-up tanks that were originally installed in the F Cell operating gallery have since been removed. The piping into the cell has been blanked on the gallery side of the partitioning wall that isolates the cell.

The third floor is an operating gallery for Cells A through E that contained aqueous make-up tanks, scales, pumps, and control panels for the five cells. There were observational windows with shielded covers that could be moved aside to see into Cells A through E. Equipment was removed and windows were sealed with concrete during modifications in the 1970s. An elevator on the north side of the operating gallery serves all three floors.

1.3.1.2 Process Cell Side

Also known as the canyon, the processing portion of the building consists of six cells, A through F. Five of the cells, A through E, are three stories high, each approximately 25 by 28 ft, separated by concrete walls that do not reach the ceiling. A Cell was used to carry out the bismuth phosphate byproduct precipitation process during the crossover step that allowed for further purification and concentration of the product by switching from a bismuth phosphate to a lanthanum fluoride carrier. B Cell was a spare cell used to augment operations in A or D Cell. D Cell was used for the lanthanum fluoride byproduct step, and E Cell for the subsequent lanthanum fluoride product precipitation. The lanthanum fluoride product cake was transferred to a holdup tank in F Cell where the metathesis and solution steps of the concentration process took place.

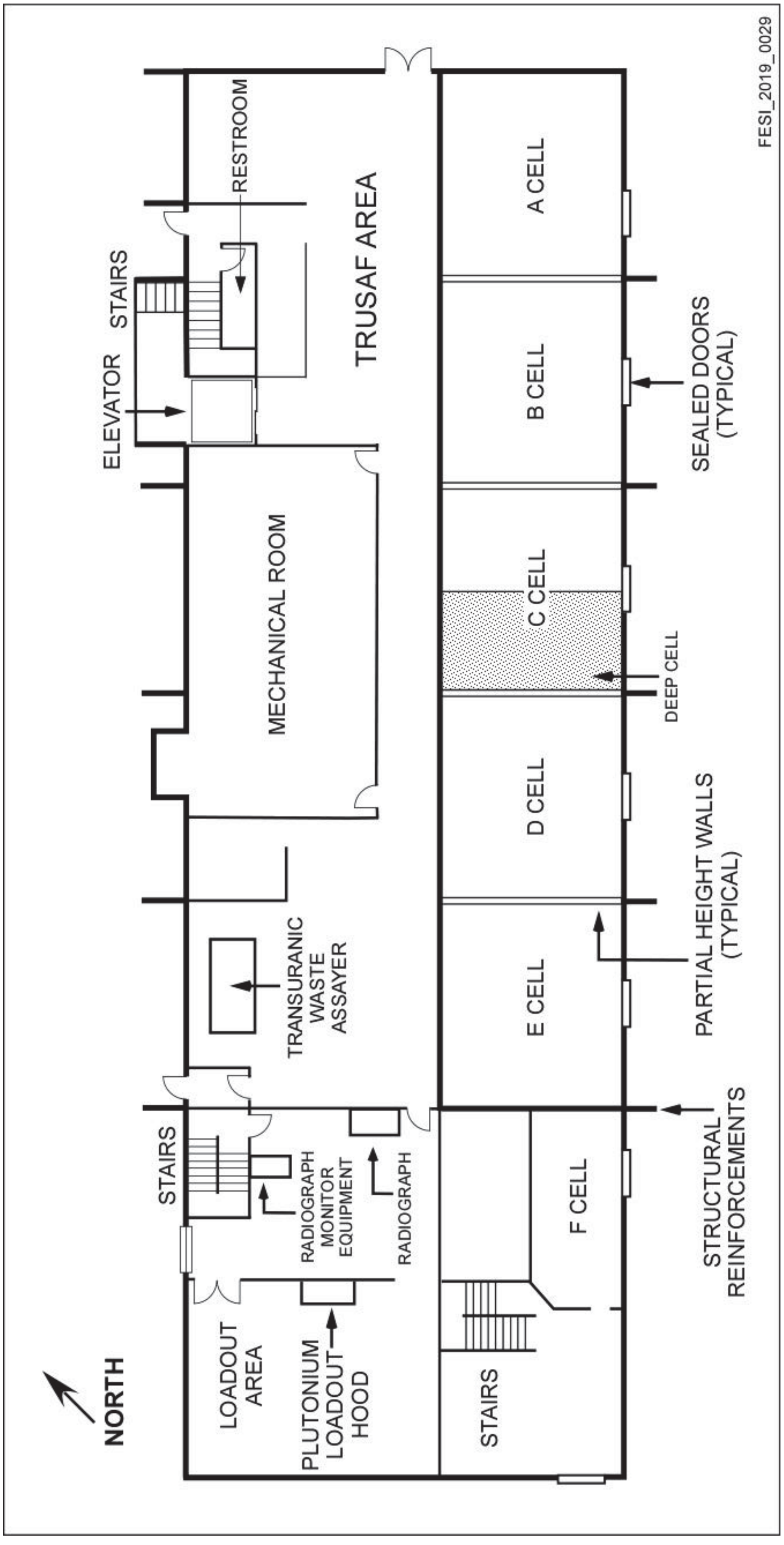

Figure 4. 224T Building–First Floor Plan View

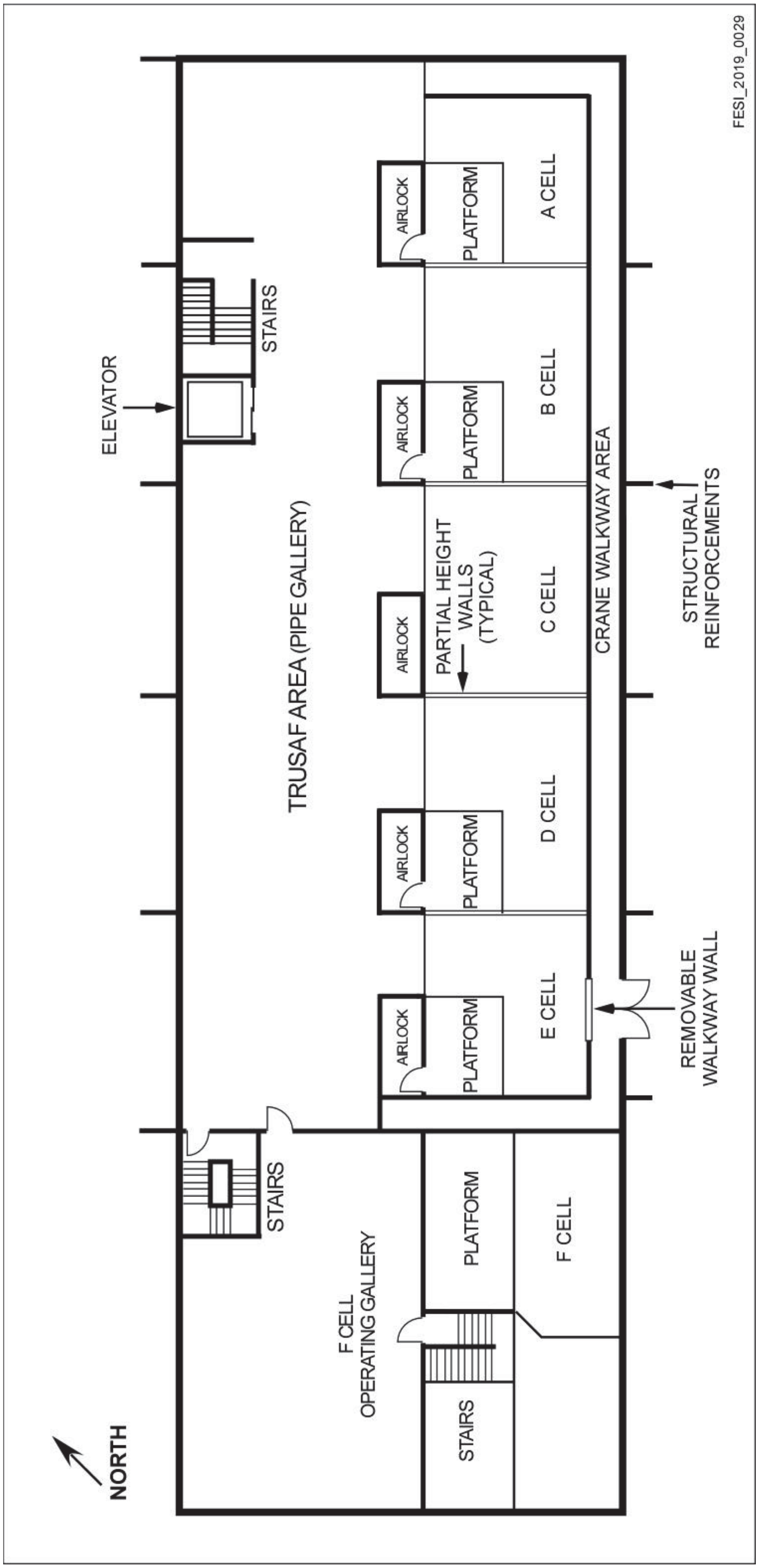

Figure 5. 224T Building–Second Floor Plan View

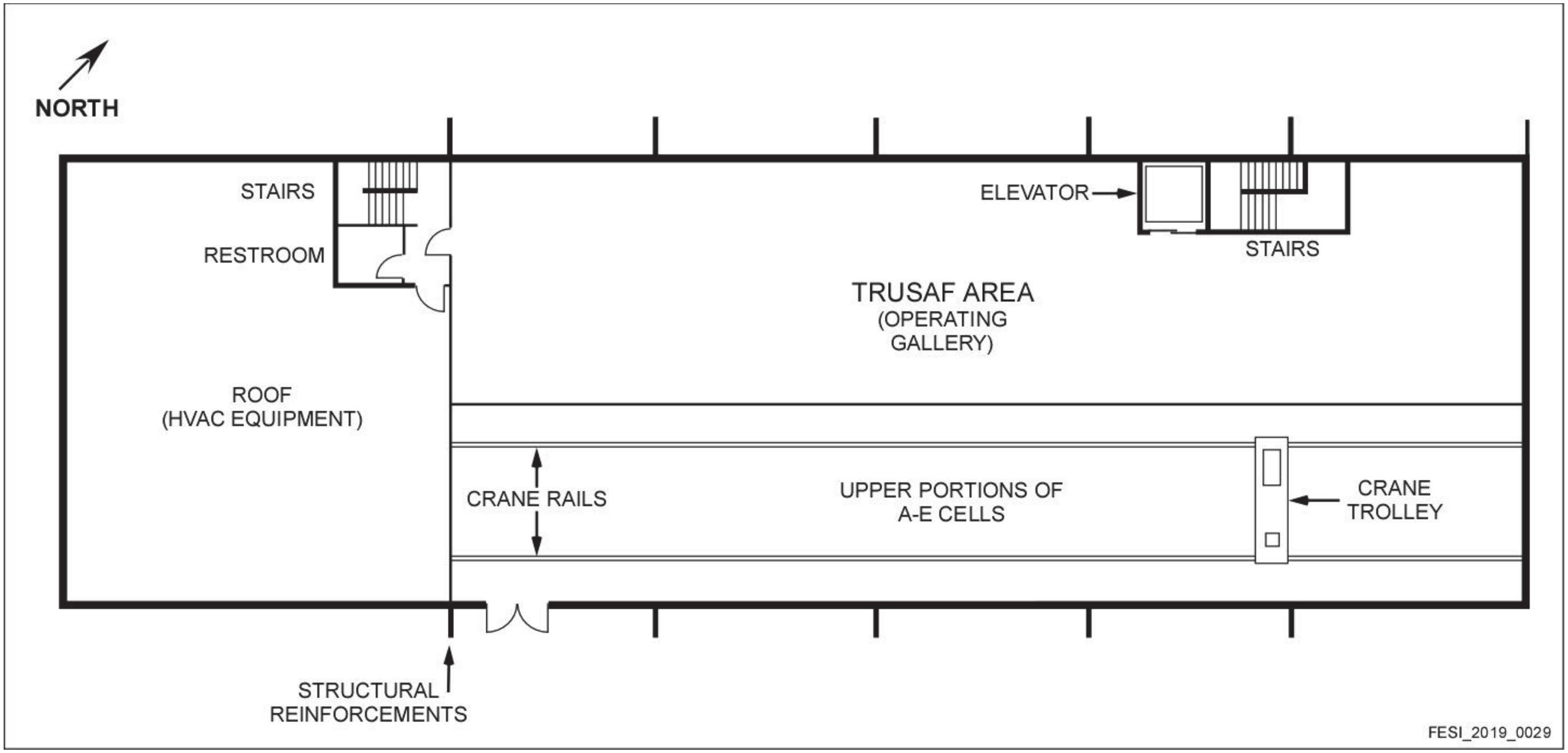

Figure 6. 224T Building–Third Floor Plan View

Cells A, B, D, and E are similar in equipment and configuration. Each cell has three tanks on the first floor; B Cell has an additional tank. Some of the tanks are equipped with agitators and motors. Cells A, B, D, and E also have an operating platform at the second floor level. Access to the platforms is through the sample rooms in the second floor pipe gallery. A centrifuge is located on each of the operating platforms of Cells A, B, D, and E.

C Cell differs from the other cells in structure and arrangement. Approximately half the cell is below the first floor level and consists of a 19 ft deep pit. There are four vessels in the cell, three of which are located in the deep pit. A pipe tunnel extends 34 ft from the deep cell beneath the first floor cold side rooms to an underground pipe trench that starts at the 224T Building boundary to 221T. The pipes within the trench were used for transferring solutions between 221T and 224T.

In addition to the access to the cells via the operating platforms, there is a first floor personnel access door into each of the six cells from outside. The original wooden doors were replaced with aluminum doors with neoprene gaskets to minimize air infiltration. There is also a crane trolley equipment access door in the top portion of the outside wall of E Cell.

A manually operated 8-ton bridge crane is installed over the cells. The rails run the length of Cells A through E. The bridge crane could be aligned with a rail that passes through the equipment access door, allowing movement of equipment into and out of the building. The crane was operated from a walkway that extends around the outsides of the cells at the second floor level. A 6 ft high wall shields the walkway from the cells. There are access doors to the walkway at both ends of the pipe gallery. The crane has been deactivated.

F Cell is 24.5 by 25 by 25 ft and is separated from the other cells by a concrete wall. Modifications completed in the 1970s reduced the size of F Cell to approximately 50% of its original size with the installation of steel barrier walls. The only connection between F Cell and the other cells is process and waste piping that runs between all the cells. One quarter of F Cell is a centrifuge platform that houses two centrifuges and a sampling station. There are five vessels on the first floor.

1.3.1.3 Utilities and Ventilation System

During operational years, utility services such as sewage, electrical power, pressurized air, water, steam, and air were provided to the 224T Building. The majority of the service piping entered the 224T Building on the southeast side. Following building occupancy, all utilities except electrical were deactivated. Drains and pipeline connections to the 224T Building are shown in Figure 7. Specific utility systems are described below.

Feed and Waste Lines. Feed lines from the 221T Cells 17 and 19 run through an underground encasement into the C Cell pit to Tank C-4. A process waste line exits C Cell from Tank C-8 to a settling tank that was isolated and blanked outside of C Cell. The service and aqueous make-up piping enters the building at the east end. The aqueous make-up chemicals (originating from 271T) and steam piping enters the building through overhead lines. Supplied make-up chemicals are no longer in service, and steam is isolated and blanked.

Cell Drains. An internal cell drainage system collected liquids from the operating platforms and floor drains in Cells A, B, D, and E. A gutter along the base of the northeast wall in A Cell to E Cell drained to a 6 in. clay pipe laid below the cell floors. Floor washings from F Cell were collected in Tank F-8, assayed for product and sent to Tank C-9. The cell drainage system collected waste water in Tank C-9 in the deep pit portion of C Cell. Because there are no active pumps to transfer liquids, accumulated liquids could overflow the 9 ft high tank and collect in the pit. Cell drainage system has not been isolated.

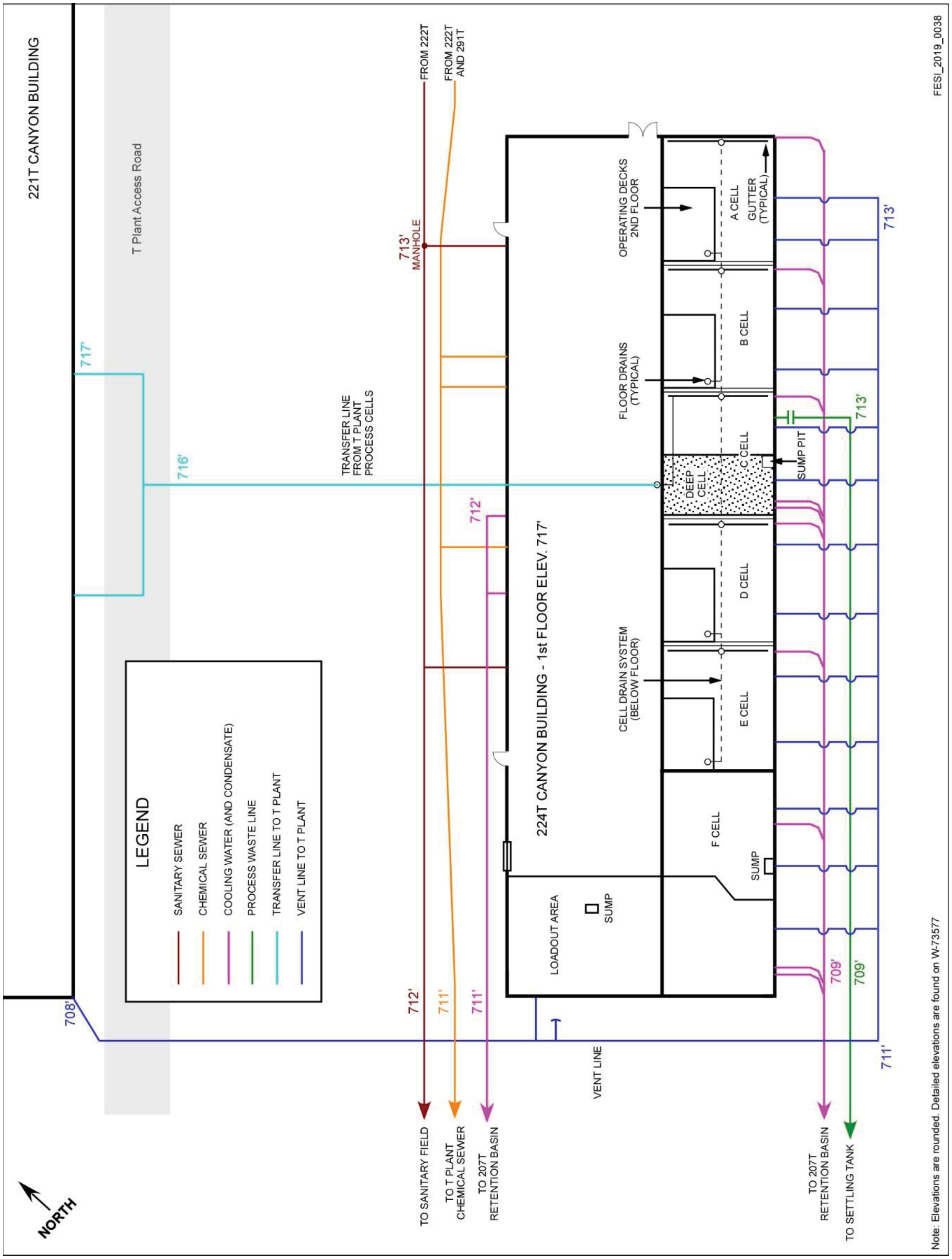

Figure 7. 224T Building-Drains and Building Connections

Cooling Water Sewer. Low-risk cooling water and condensate from the process cell vessel jackets were collected and discharged to the 221T cooling water sewer. The cooling water drain lines in each cell connect to a header laid parallel to the southeast wall of the 224T Building. Past the east end of the facility, the pipeline turns northwest and runs to 221T, where it connects to the low-risk cooling water sewer. The cooling water sewer has been deactivated.

Chemical Sewer. The chemical sewer pipe for higher activity waste conveyed chemical waste from drains in the office and gallery areas of the 224T Building to the chemical sewer adjacent to 221T. The pipeline also received waste from the 291T stack area and 222T Building. The pipeline is routed around the southwest end of 221T and drains into the 221T chemical sewer. The 224T Building was isolated from the chemical sewer system.

T Plant Transfer Lines. Two underground plutonium feed lines are routed out the southeastern side of 221T from process Cell 36 under the northwestern side of 224T Building and terminate in Tank C-4 inside C Cell. An additional pipeline in the underground trench runs from Tank C-8 inside C Cell to 221T Cell 36.

Sanitary Sewer. The building's sanitary sewer system (i.e., toilets, sinks, and showers) drains to a sanitary sewer line that runs between the 224T and 221T Buildings. This line eventually reaches a sanitary field on the northwest side of 221T.

Sanitary Water. Sanitary water to the 224T Building is supplied via a 4 in. underground line coming off an 8 in. main line. A separate 6 in. line off the same main line supplied water for the fire suppression system. Both have been isolated through cutting and capping.

Ventilation System. Originally, the 221T main exhaust system provided ventilation to the 224T tanks and centrifuges with the vacuum created by the 291T fans. Air in-leakage provided the supply air to the process cells. Stainless-steel subheaders connected to the tanks and centrifuges inside the cells exit the southwest side of the building abovegrade. The stainless-steel headers are directed down and transition to a 6 in. clay pipe below ground level. The clay pipes connect to a 24 in. clay main header belowgrade. The 24 in. line connects to the 221T main exhaust tunnel at the west end of the 221T Building. In areas where the original soil cover was less than 4 ft or greater than 7 ft deep, the clay pipe is protected by a reinforced concrete encasement. The ventilation system was modified when 224T was converted to a storage facility. All ventilation penetrations between the cells and storage area were sealed to prevent the migration of contamination from the cells into the Transuranic Waste Storage and Assay Facility (TRUSAF) area. The isolations included the 224T TRUSAF exhaust system from 221T, sealing of the interconnecting process pipe tunnel, replacing a significant portion of the asbestos cement ducting with new metal ducting, and installing the new ventilation system with high-efficiency particulate air (HEPA) filters and turbine fans that were installed on the roof above F Cell with two capped stacks that exhaust horizontally to the southwest. The 224T Building exhaust ventilation system is not in service.

Fire Alarm and Suppression System. The fire alarm and suppression system in 224T have been deactivated. Because the facility is no longer occupied and entered only for surveillance and maintenance, the portable fire extinguishers have been removed from the building. Water to the 224T Building has been isolated. There are three fire hydrants within 300 ft from the facility that can be used for firefighting.

Electrical Utilities. Normal electrical power is supplied by a 13.8 kV three-phase line from the 251W substation that is reduced from 13.8 kV to a 480 V, three-phase system, and a 240/120 V single-phase system. The electrical power system is still active.

1.3.2 Plutonium Concentration Process Description

Underground plutonium feed lines are routed from 221T to the 224T Building. The lines are in an underground pipe trench from the south side of 221T to the northwest side of 224T. Beneath 224T, the pipes are in a trough that terminates at C Cell.

The 224T Building removed fission products and concentrated the plutonium solution by switching from a bismuth phosphate carrier to a lanthanum fluoride carrier. This "crossover" allowed for further purification and concentration of the product. The final process step, metathesis, replaced the fluoride ions with hydroxides so the plutonium could be dissolved in nitric acid. Decontamination and concentration required a four-step process: bismuth phosphate precipitation, first lanthanum fluoride precipitation, second lanthanum fluoride precipitation, and metathesis. The final plutonium nitrate solution was sent to the 231Z Isolation Building for purification and solidification before the final product was shipped to Los Alamos Laboratory.

1.3.2.1 Deactivation

The T Plant Complex became unnecessary in the mid-1950s following production rate increases at REDOX and PUREX. The 224T Building ceased its concentration process mission in early 1956. Documentation on the shutdown is not available, but monthly reports indicate that the 221T Facility was placed into layaway status with steam and water disconnected. Chemical and process lines were drained, flushed, and blanked. Similar actions were taken at the 224T Building as concluded by assessments from the late 1990s (HNF-19646, *Data Quality Objectives Summary Report for the 224-T Plutonium Concentration Facility*).

1.3.2.2 Post-Deactivation Use

The 224T Building remained in shutdown before being modified in 1975 to meet the requirements for storing plutonium-bearing scrap and liquids. The structural modifications are detailed in Section 1.3.1. The cells in the process areas were sealed and isolated from the operating gallery and service areas of the building, which were stripped of all unnecessary control equipment. Panel boards and partitions were removed to provide storage space on three floors. The first and second floor storage areas were used for containers or cans of plutonium nitrate solution. The third floor storage area consisted of storage racks for lard cans containing dry scrap.

In 1984, DOE designated the three operating gallery levels of the building for storage and assaying of retrieved and newly generated transuranic (TRU) wastes. The 224T Building was designated as a *Resource Conservation and Recovery Act of 1976* (RCRA) TSD container storage unit known as the 224T TRUSAF, which began storing TRU and TRU-mixed wastes from DOE offsite and onsite generators. Administrative waste processing in TRUSAF included inspection of containers and associated documentation, examination with a real-time radiography system to confirm the absence of prohibited items, and neutron assay of the waste containers to confirm fissile isotope content. The TRUSAF operations ended in the late 1990s, and the dangerous waste inventory was removed in August 1997. TRUSAF was certified as clean closed in 2008 (09-EMD-0013, "Resource Conservation and Recovery Act [RCRA] Closure Certification for the 224-T Transuranic Waste Storage and Assay Facility [TSD#: S-2-2]").

After deactivation, the building was limited to annual surveillance and maintenance activities.

1.4 Release or Threat of Release into the Environment of Hazardous Substances, Pollutants, or Contaminants

Since shutdown, the 224T Building has been maintained in a safe configuration. The processing area is near ambient pressure because there is no exhaust system. The process vessels within the process area are at a negative pressure relative to the process area due to the connection to the 221T ventilation line. The current plutonium inventory, deteriorating condition of the physical barriers, and low differential pressure between the cells and outside environment pose a risk to human health and the environment.

The 224T Building contains radiological materials and chemicals that were used in the plutonium concentration process as well as typical hazardous materials associated with industrial structures. Potential radiological and chemical substances have been identified from characterization data, historical operating data, and process knowledge. Contaminants of concern are provided in DOE/RL-2019-37, *Sampling and Analysis Plan for the 224T Plutonium Concentration Facility*, hereinafter referred to as the 224T Sampling and Analysis Plan (SAP).

Removal activities will be performed in accordance with appropriate procedures that ensure control of hazardous substances. The standards and procedures for managing hazardous substances ensure that personnel removing, handling, and disposing of waste perform work in a manner that achieves the following objectives:

- Protect the safety of employees and the general public
- Minimize spills and releases to the environment
- Meet applicable DOE, federal, state, and local regulatory requirements

Table 1 provides a summary of the current hazard conditions in the 224T Building.

Table 1. Current 224T Building Hazard Conditions

Area	Surveyed Area	Documented Conditions
First Floor Cold Side (offices, mechanical room area)	Yes	Evidence of animal intrusions and structural degradation were noted in the surveillance reports. Peeling paint, water intrusions, and rusting of the HVAC supply duct were also observed.
Plutonium Loadout Hood Area	Yes	The Plutonium Loadout Hood is expected to contain trace residuals. There is evidence of water and animal intrusions.
Exterior	Yes	There is spalling concrete and degraded steam line insulation on the outside of the building.
Pipe Gallery	Yes	Rainwater and drain line leakage, multiple water stains, and peeling paint were noted in the annual surveillance reports.
Operating Gallery	Yes	Evidence of water intrusion, standing water, peeling paint, and degradation of light fixture insulation were noted in the annual surveillance reports. In 2017, contamination was found under a duct.
Process Cells	No	Hazardous materials were removed from the process cells during entry in 1985 prior to isolation from TRUSAF. Based on current conditions in areas where surveillance inspections are performed, water accumulation, animal intrusion, and structural deterioration are expected in the process cell side.

HVAC = heating, ventilation, and air-conditioning
TRUSAF = Transuranic Waste Storage and Assay Facility

The cold side of the 224T Building is entered annually for surveillance and maintenance. The process cells and sample rooms that are posted as airborne radioactivity areas, high contamination areas, and high radiation areas are not entered. All utilities except electrical were deactivated.

Hazardous materials (e.g., unmarked drums) were removed from the process cells and operating platforms during the previous entry in 1985 prior to isolation from TRUSAF. All stored waste from the gallery areas were removed upon TRUSAF completion in the late 1990s. Hazards identified in the 224T Building during annual surveillance from 2008 to 2018 include the following:

- Concrete spalling
- Air duct rusted through
- Peeling paint
- Water and animal intrusions
- Steam line insulation degradation
- Miscellaneous materials on the ground (e.g., wood, boxes, tumbleweeds)

There is spalling concrete present on the upper north end of the 224T west wall. The crack was evaluated for operability in 2014, and it was determined that the defect did not affect the confinement function of the wall. A large amount of dust has accumulated in the building since processing was halted. In 2010, 224T was categorized as a beryllium clean facility.

The 224T process cells were last entered in 2002 for characterization. As documented in HNF-7640, *CSER 01-001: Remote Entry into Six Process Cells in 224-T Building for Characterization*, C Cell was discovered to have 11 ft (35,000 gal) of water in the 19 foot deep sump pit. The water source was presumed to be a result of accumulated rain and snowmelt leakage from the roof. 221T engineering documentation and cell inventory notes were examined, and it was determined to be highly unlikely that the pipe trench connecting to 221T cells was the source of the water. The water was sampled and calculated to contain 0.001 g of plutonium (HNF-7640). Approximately 1 in. of silt is estimated in the bottom of the 25 by 13.5 ft pit. Samples were taken from C Cell silt solids, combined, centrifuged, and the dried solids were measured for alpha activity. The silt in the pit was calculated to contain 2.4 g of plutonium (HNF-7640). In 2003, 13,000 gallons of water were removed.

During annual surveillance and maintenance inspections, signs of water damage and leaks through the roof, walls, and on the floors were observed. One recurring leak involves the second floor pipe penetrations adjacent to the exhauster fans that were part of the modifications made to the building in the 1970s. This leak has been repeatedly sealed with caulking material and covered with gravel. The 224T Building roof has been inspected every 5 years following re-roofing in 1990. The roof had an expected life span of 15 to 20 years.

Asbestos is present in the 224T Building. Asbestos-containing material (ACM) includes piping and vessel insulation, sheetrock, transite wallboard, floor tiles, and ceiling panels. Polychlorinated biphenyls (PCBs) are also present, as they were common in building materials at the time of construction (e.g., oils, paints, and fluorescent light ballasts).

1.4.1 Radiological Hazards

The primary hazardous substances associated with the 224T Building are radioactive materials. Plutonium-239 and americium-241 make up the majority of the inventory, but fission products such as cesium-137, strontium-90, and cobalt-60 may also be present. Secondary radiological contaminants include technetium-99, uranium-238, neptunium-237, and europium-152/154/155. Small amounts of tritium may be present in exit signs. Characterization was performed in 2002 to support decontamination and decommissioning activities, and the results of this effort are documented in CP-14641, which provides a bounding source term for plutonium and americium using the 2002 results decayed to 2009, which are included in Table 2.

Table 2. 224T Building Inventory – 2009

Isotope	A Cell	B Cell	C Cell	D Cell	E Cell	F Cell	Total
Pu-238	1.89E-03	2.97E-03	1.81E-03	1.99E-04	8.73E-04	6.59E-03	**1.43E-02**
Pu-239	9.37E+00	1.46E+01	8.96E+00	9.88E-01	4.30E+00	3.25E+01	**7.08E+01**
Pu-240	6.12E-01	9.56E-01	5.85E-01	6.45E-02	2.81E-01	2.12E+00	**4.63E+00**
Pu-241	2.42E-02	3.84E-02	2.27E-02	2.52E-03	1.13E-02	8.45E-02	**1.84E-01**
Pu-242	3.01E-03	4.69E-03	2.88E-03	3.17E-04	1.38E-03	1.04E-02	**2.27E-02**
Total Pu	**1.00E+01**	**1.56E+01**	**9.57E+00**	**1.06E+00**	**4.60E+00**	**3.47E+01**	**7.56E+01**
Am-241	7.76E-01	2.49E+00	1.36E-01	8.42E-02	7.49E-01	4.14E+00	**8.37E+00**
Total Pu and Am	**1.08E+01**	**1.81E+01**	**9.71E+00**	**1.14E+00**	**5.35E+00**	**3.89E+01**	**8.40E+01**

Reference: Table 3-2 in CP-14641, *Documented Safety Analysis for the 224-T Facility*.

Notes: Plutonium isotopes decay corrected to 2009 values; americium-241 calculated at maximum value.

There are three tanks in the C Cell sump pit that were submerged in accumulated water at the time of the Nondestructive Analysis survey. The submerged tanks were C-07, C-04, and C-09, for which no data were obtained. A conservative estimate of their plutonium content was obtained by taking the largest measured plutonium value for tanks of the same general size as the submerged tanks. The americium content of each submerged tank was conservatively estimated the same way.

1.4.2 Nonradiological Contamination

The following subsections provide brief descriptions of chemical hazards that may be present at the 224T Building.

1.4.2.1 Arsenic

Arsenic may be present in oils, grease, or other chemicals. If waste containing arsenic above regulatory limits is generated, it will be treated as appropriate prior to disposal.

1.4.2.2 Barium

Barium metal is an intermediate decay product of the uranium fission reaction. Barium may also be present in some oils or grease, white paints, and other chemicals. If waste containing barium metal above regulatory limits is generated, it will be treated as appropriate prior to disposal.

1.4.2.3 Cadmium

Cadmium is a byproduct of the metal-finishing process and may also be present in electrical equipment. If waste containing cadmium above regulatory limits is generated, it will be treated as appropriate prior to disposal.

1.4.2.4 Lead

Lead may exist in surface coatings (i.e., lead-based paint, lead-shielded cables), plumbing, and in other forms (e.g., lead shot, brick, sheet, and cast-lead). If waste containing lead above regulatory limits is generated, it will be treated as appropriate prior to disposal.

1.4.2.5 Mercury

Mercury may be present in manometers and electrical equipment (including thermostats, switches, and vapor lighting). Waste containing mercury above regulatory limits will require treatment prior to disposal.

1.4.2.6 Silver

Silver contacts may be present in the electrical system. At certain levels, silver is regulated as a hazardous waste. If waste containing silver above regulatory limits is generated, it will be treated as appropriate prior to disposal.

1.4.2.7 Asbestos

ACM is found in and around the 224T Building in the form of insulation (thermal system insulation), ductwork, gasket/packing material, and floor tiles/adhesives.

1.4.2.8 Miscellaneous Industrial Chemicals

The potential exists for the discovery of residual, used, or unused chemicals (e.g., solvents, hydraulic and fuel oils, and greases). These materials will be recycled or disposed of in accordance with requirements of the receiving facility.

1.4.2.9 Corrosives

Corrosives may be encountered in the 224T Building. Corrosive solids and liquid waste above the regulatory limits must be treated as appropriate prior to disposal.

1.4.2.10 Lubricants/Oils

Lubricants and oils may contain hazardous substances. Equipment will be drained of lubricants and oils to the extent practicable prior to disposal.

1.4.2.11 Polychlorinated Biphenyls

PCBs may be found in and around the 224T Building (e.g., painted surfaces, light ballasts, and waste oils). Materials removed or demolished that contain or may contain PCBs will be removed for disposal consistent with substantive standards of the *Toxic Substances Control Act of 1976* (TSCA).

1.4.2.12 Biological Hazards

Biological hazards such as bird, bat, snake, lizard, and rodent carcasses and feces could be encountered. If contaminated with hazardous substances, such materials will be treated and disposed, as appropriate.

1.4.2.13 Industrial Hazards

Industrial hazards may be encountered to include tripping, falling, sharp edges, and lifting (ergonomic) hazards. In addition, demolition with heavy equipment introduces other industrial hazards such as uneven walking surfaces, excessive loud noise, moving machinery parts, and falling objects.

2 Removal Action Elements

The following sections provide general descriptions of the anticipated 224T Building D&D activities.

2.1 Removal Action Work Activities

The following list includes the general activities that are within the scope of this removal action.

- Characterize the nature and extent of remaining hazardous substances to facilitate D&D and associated waste disposal.
- Decontaminate and/or fix contamination, as needed.
- Deactivate active building systems and isolate utilities.
- Remove equipment and hazardous substances.
- Characterize water in C Cell deep pit for waste disposal.
- Remove water in C Cell deep pit and send to disposal facility.
- Demolish the 224T Building to grade.
- Isolate underground piping and structures that will be left in place.
- Sample isolated systems and soils that will be left in place.
- Fill belowgrade void space.
- Conduct visual and radiological surveys and, if needed, stabilize the area to fix or isolate contamination.
- Document post-demolition conditions for future decisionmaking.

Some activities will be ongoing throughout the entire removal action, such as the following:

- Air emissions and work activity monitoring
- Waste management and disposal

Upon completion of the D&D activities, if underlying soil contamination is found above industrial cleanup standards, it will be addressed as discussed in Section 5.7.

Section 2.2 and its subsections provide additional detail on the work activities. Using the most recent information concerning field conditions, work packages will be developed in accordance with this RAWP using existing procedures and specifically developed instructions to perform and control the D&D activities.

2.2 Field Activities

The following subsections describe the field activities associated with this removal action.

2.2.1 Mobilization and Site Preparation

Mobilization and site preparation may include the following activities:

- Establish site utility services (e.g., temporary power, lighting, and water).
- Construct roads, field support facilities, waste container survey and storage areas, and decontamination stations. Hanford Site roadways will be constructed from existing site materials except the surface course, which may be imported.

- Isolate or verify isolation of utilities and systems.
- Identify underground injection control wells in the proximity of the work area and notifying the Hanford Site single point of contact.

Concurrent with these activities, waste staging areas will be set up within the 224T Building footprint area or within the onsite location outside of the footprint area to facilitate transportation of the material for recycling or disposal (Appendix A).

2.2.2 Characterization Activities

The 224T SAP (DOE/RL-2019-37) supports waste characterization and disposal activities as well as provides documentation of underlying soil, piping, and slab conditions. The data quality objectives process for data collection, sampling, and sampling rationale was used to develop the SAP. Process knowledge, historical analytical data, laboratory analysis, and radiological and chemical screenings will be used to characterize waste for disposal.

2.2.2.1 D&D Characterization

Characterization will be conducted before and during D&D activities to support worker safety and waste characterization. Data collection could include field survey and sample data. The initial characterization data will be used for the following:

- Specify worker health and safety requirements
- Identify radiological and hazardous conditions that will be encountered during removal activities
- Characterize waste for treatment and/or disposal

Initial characterization activities will be performed in accordance with the 224T SAP.

2.2.2.2 End-Point Characterization

Samples and surveys will be taken to document the conditions of the 224T Building slab and the surrounding and underlying soil. Locations where process and service piping entered and exited the facilities will be identified and marked. Underground injection wells associated with 224T will be identified and marked or removed if practicable. Pipelines entering and exiting belowgrade through the slab will be cut off and isolated or plugged. Radiological surveys will be performed as described in the SAP, and visual inspections of the pipelines will be completed. If sufficient sample volumes of anomalous solids/liquids are seen in the pipelines near the cutoff points, samples will be obtained to identify residues. The 224T SAP (DOE/RL-2019-37) describes endpoint characterization.

Sampling of the slab and soil will be conducted in conjunction with or following D&D activities to assess whether the RAOs have been achieved. Sampling of the slab and underlying soil is discussed in greater detail in Section 5.7.1.

2.2.3 Decontamination Activities

Nonradiological hazardous substances will be removed from within and around the buildings/structures as needed prior to demolition to facilitate compliance with the ARARs and to meet waste acceptance criteria for Environmental Restoration Disposal Facility (ERDF) (ERDF-00011, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*) or other EPA-approved facilities. Decontamination of equipment, waste containers, etc., to support this removal action will generally be performed using dry methods (e.g., brushing, wiping, and using HEPA filtered vacuum cleaners) to the extent possible. When the use of wet methods (e.g., water wash and pressure washers) is required to achieve decontamination objectives, the associated water or cleaning solutions will be collected, and work will be conducted by trained site workers in accordance with the following best management practices:

- Decontamination activities will be performed within the area of contamination.
- The amount of water used to clean equipment will be minimized, using raw or potable water.
- Soaps, detergents, or other cleaning agents may be added to wash water as long as there are no regulated levels of constituents present.

More aggressive equipment decontamination methods (e.g., grinding or wet grit blasting) may be used if other methods fail. These methods will also be conducted by trained site workers using best management practices to minimize the potential for airborne contamination and waste generation.

The project may also perform other equipment washing and/or decontamination methods for a completed site (e.g., wrap equipment for transfer to a decontamination pad, provide a temporary site facility to collect wash water, or fix contamination to the equipment). Decontamination fluid or wash water that is collected will be managed in accordance with Appendix A of this RAWP.

2.2.4 Removal of Hazardous Substances

Decontamination, fixing/stabilization of contamination, and isolation of systems may be performed. Interior portions of the structure may be removed as practical and necessary. These activities will be managed in accordance with procedures that address removing, handling, and disposing of these materials in a manner that protects the safety of employees and the public, minimizes spills and releases to the environment, and meets regulatory requirements. Nonradiological and radiological hazardous substances will be removed from within and around the 224T Building as needed prior to demolition.

Contaminated process equipment will be characterized, decontaminated, stabilized, and/or removed as needed to support open-air or limited-containment demolition. The equipment will be fixed or stabilized as necessary for disposal or storage. Pipes and drain lines (including floor drains) that exit structures through the foundation, slab, or grade will be isolated and sealed at the structure boundaries to prevent potential release pathways to the environment. Items requiring special handling will be identified, clearly marked, and prepared for removal before beginning structure demolition. Demolition planning will ensure that these marked items will not be subjected to demolition techniques, as they require special handling.

The following subsections address specific pre-demolition removals by hazard types within the 224T Building: asbestos, PCBs, other hazardous substances, radiological, and biological.

2.2.4.1 Asbestos

ACM could be found in and around the 224T Building. In accordance with the substantive provisions of the *Clean Air Act Amendments of 1990* (Subpart M, "National Emission Standard for Asbestos" in 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants" [NESHAP]) as identified in the 224T AM (DOE/RL-2004-68), ACM removal and disposal require special precautions to control airborne emissions of asbestos fibers during asbestos removal activities.

Asbestos abatement activities will be performed in full compliance with all substantive NESHAP (40 CFR 61) standards that are ARARs for the work. Before demolition begins, a thorough inspection of the affected facility will be performed for the presence of asbestos, including Category (Cat) I and Cat II nonfriable ACM. All Cat II nonfriable ACM will generally be presumed potentially friable and will be removed before actual demolition activities begin. If DOE identifies any Cat II ACM that should be allowed to remain in place during demolition based on knowledge that the demolition will not render it friable, information identifying the planned demolition approach and describing how the Cat II ACM will not become crumbled, pulverized, or reduced to powder by the forces expected to act on it during the demolition or otherwise friable will be provided in advance to EPA for approval. Cat I nonfriable ACM will also be removed prior to the start of actual demolition activities, except in situations where demolition practices will be used that can be or have been demonstrated to the satisfaction of EPA not to render the Cat I ACM friable, consistent with NESHAP. Demonstration can be performed using existing EPA or Washington State guidance regarding asbestos abatement under NESHAP. Such Cat I nonfriable ACM must not be in poor condition, and planned demolition activities must not subject the ACM to sanding, grinding, cutting, or abrading. In all cases, ACM that is either friable or cannot be demonstrated to remain nonfriable during demolition will be removed prior to such demolition as required by NESHAP.

2.2.4.2 PCBs

PCBs may be found in the 224T Building (e.g., fluorescent light ballasts, painted surfaces, and waste oils). Materials removed or demolished that contain or may contain PCBs will be removed for disposal consistent with the substantive provisions of the TSCA.

Known liquid PCBs will be removed from structures prior to demolition and disposed in accordance with ARARs and the waste acceptance criteria for the ERDF (ERDF-00011). Other PCBs will be removed only as needed prior to demolition to facilitate proper disposal in accordance with ARARs and the waste acceptance criteria for ERDF or another receiving facility. PCB surface coatings and PCB spills (e.g., dried paints or adhesives) on concrete and other materials (porous and nonporous materials) may be stabilized or fixed in place prior to demolition, and the resulting demolition debris disposed as PCB bulk product waste or PCB remediation waste.

Where slabs or belowgrade structures with suspected PCBs will be left in place, sampling may be performed to determine if potentially contaminated surfaces meet the substantive PCB decontamination standards of 40 CFR 761.79, “Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions,” “Decontamination Standards and Procedures,” without further action. When performed, the sample results will be used to determine the TSCA status of the slab or structure to be left in place. If the results indicate the presence of PCB contamination above applicable 40 CFR 761 levels, the contamination will be removed from the slab or structure to be left in place if practicable in accordance with substantive standards of 40 CFR 761.79(b) or (c). Materials separated from the contaminated slab or structure will be disposed as PCB waste. Subsequent sampling of the slab or structure to be left in place will be performed after decontamination. When decontamination is achieved to below the applicable levels of 40 CFR 761.79, the slab or structure will no longer be subject to the TSCA. If decontamination methods other than those addressed in 40 CFR 761.79(b) or (c) are determined necessary, concurrence of the alternate method(s) would be obtained from EPA prior to implementation. If decontamination is impracticable or unachievable, the contractor may consult with the DOE-RL Removal Action Manager to determine if placement of the slab or structure into the Waste Information Data System (WIDS) database is appropriate. If so, the site will be identified by DOE, with concurrence from the Washington State Department of Ecology and EPA, as new under the Tri-Party Agreement (Ecology et al. 1989a).

2.2.4.3 Other Hazardous Substances

Hazardous substances such as lubricants, hydraulic oils, fuel oils, aerosols, corrosive liquids, and chemical residues will be drained and recycled or disposed, as appropriate. Equipment containing mercury (e.g., switches, gauges, and thermometers) and lights containing sodium or mercury vapor will be removed, recycled, or disposed per the requirements of the receiving facility.

Other hazardous substances on surfaces or embedded in structural materials (e.g., lead paint, heavy metals such as cadmium and arsenic, or creosote) may be fixed in place prior to demolition, and the resulting structural materials are disposed as solid, hazardous, or mixed waste, as appropriate, depending on the levels of contamination and the waste characterization results.

2.2.4.4 Radiological Waste

The preferable way to control loose, accessible radiological contamination is to fix it in place. Removal of loose contamination will be performed only if necessary. Removal of fixed contamination must be performed using nonaggressive means (e.g., wet wiping or using decontamination solutions). Aggressive methods of decontamination (e.g., grinding or other abrasive or mechanical means) are used only as necessary to maintain as low as reasonably achievable (ALARA) radiological levels.

2.2.4.5 Biological Waste

Biological waste such as bird, bat, snake, lizard, and rodent carcasses and feces could be encountered. Biological waste will be field surveyed and disposed in accordance with the ERDF waste acceptance criteria (ERDF-00011).

2.2.5 Demolition

Demolition of the 224T Building will include removal of the abovegrade structure. The equipment in the C Cell pit will be removed, and connections will be blanked. Pipes may be removed from within the pit but will not be removed past the pit boundary. The transfer line between 224T and 221T will be isolated. The pit will be decontaminated as necessary and then filled with backfill or grout to the level of the slab. The majority of demolition will require the use of heavy equipment (e.g., excavator with various attachments) to demolish the structure. Other standard industry or conventional demolition practices may be used (e.g., hydraulic shears with steel shear jaws, concrete pulverizer or breaker jaws, pneumatic hammers, mechanical saws, cutting torches, and/or controlled explosives). Demolition methods will be selected based on the structural elements to be demolished, remaining contamination, location, and integrity of the structure. Controls such as portable ventilation filter units, HEPA-filtered vacuum cleaners, greenhouses, fogging agents, and/or water may be used to control dust generated through demolition activities. The amount of water used will be minimized to reduce ponding and runoff, and stormwater runon and runoff controls may be implemented. Applicable controls will be described in the work packages.

As part of the pre-demolition preparation, items requiring special handling will be identified, clearly marked, and prepared for removal before beginning structure demolition. Demolition planning will ensure that these marked items will not be subjected to demolition techniques, as they require special handling. Some items may not meet ERDF waste acceptance criteria and require disposition as TRU waste or may require treatment prior to transport to ERDF. Waste generated from the demolition activities will be managed per the waste management plan in Section 4.2.

Wells located near or within the footprint of the 224T Building will be identified. The affected organization will be informed of the demolition activities. The well will be either protected or decommissioned, as needed.

To minimize precipitation infiltration to the underlying soils, the 224T Building will be demolished only to slab-on-grade. The abovegrade structure will be demolished to within 6 in. of the slab and foundation. Efforts will be made to protect the slab and foundation. If the slab sustains damage such that precipitation infiltration could occur, repairs to the slab may be considered and may include the use of concrete or other materials. Belowgrade voids left by the demolition activities will be backfilled as needed after required sampling or surveys are completed. A walkdown will be conducted following backfilling to ensure the absence of asbestos.

The slab and/or belowgrade structures will be stabilized to control migration of contamination, and final remediation will be deferred to a future action by adding the slab and belowgrade structures to the WIDS database in accordance with TPA-MP-14, *Maintenance of the Waste Information Data System (WIDS)*. In addition, several existing waste sites (including pipelines) are either associated with the 224T Building or are in the vicinity that are not within the scope of this RAWP. Such waste sites are or will be addressed as part of other cleanup decisions.

2.2.6 Site Stabilization

The following activities will be completed and documented in the completion report (Section 5.7.2) after the demolition of abovegrade structures:

- Performing post-demolition survey
- Sealing of belowgrade accesses
- Documenting any remaining tubing, piping, ducting, and drain lines that contain contamination
- Stabilizing contaminated slabs
- Area cleanup, surveys, and postings
- Characterization, as needed
- Performing final cleanup/site stabilization
- Performing final surveys
- Final posting and access control measures

Final cleanup will be conducted as demolition activities, including sealing and eliminating confined spaces and manholes to prevent water intrusion and personnel access, are completed. Waste will be screened, segregated, removed, and disposed once it has been characterized. The site will be graded to original site contours where necessary.

Additional characterization sampling may be performed if hazardous waste is suspected. Final site surveys will be completed once the site has been graded. Surveys will include both radiation and physical hazard surveys that will be documented to support the future remedial action.

Using the data from the final survey, a site access control plan will be developed that will define areas where access must be controlled, such as belowgrade void areas. These sites will be posted and, if necessary, fences or other barriers will be built to prevent access to the area.

2.2.7 Equipment Decontamination

Decontamination that is necessary to allow removal of demolition equipment or waste trucks from contamination areas will be accomplished using standard industry and best management practices. Gross equipment decontamination methods will be employed to remove loose contamination within the contamination area. Gross cleaning and/or decontamination of heavy equipment and vehicles may consist of using wipes and nonhazardous materials to remove loose contamination. Water may be used to clean equipment in the decontamination area. However, the use of large volumes of water will be minimized. Soaps, detergents, or other nonhazardous cleaning agents may be added to the water used in the high pressure washer. If required, pressure washing will normally be performed using cold water, but hot water may be used to avoid icing. Wet grit blasting, grinding, or steam cleaning will be used only after other decontamination methods prove to be ineffective. Additional or final decontamination may take place in the contamination reduction zone using the same or similar methods. Location and characterization of all decontamination areas will be documented after use.

2.2.8 Demobilization

At the completion of field activities, trailers and equipment used to perform this removal action are demobilized or turned over to another project for reuse. In some cases, equipment (including change rooms, shower trailers, and CONEX boxes) may no longer be used due to levels of contamination or disrepair. In these instances, the equipment may be deactivated and demolished with the facility in accordance with Section 2.2.5.

2.2.9 Air Emissions Monitoring

Air emissions and work activity monitoring will be accomplished through a combination of real-time monitoring, sampling and surveys at work locations, near-facility monitors, and the Hanford Site perimeter monitors (see Section 4.3 for additional information). Temporary exhausters may be used to support the removal activities. Appendix B provides additional information about air emission monitoring.

2.2.10 Waste Management and Disposal

Several waste streams will be generated from this removal action. It is anticipated that most of the waste will be low-level waste; however, quantities of mixed low-level waste, TRU or transuranic mixed (TRUM) waste, PCB bulk product waste, dangerous waste, and ACM may be generated. The majority of the waste will be in a solid form, but some aqueous solutions might be generated. Waste will be packaged to meet the applicable waste acceptance criteria of the receiving facilities. Appendix A includes the waste management plan for this RAWP.

Waste designated as TRU or TRUM will be sent to the Central Waste Complex or another appropriate onsite area for interim storage. The waste will be treated as necessary and then certified and disposed at the Waste Isolation Pilot Plant.

Treatment of waste (onsite or offsite) may be necessary prior to disposal at ERDF or another EPA-approved disposal facility. In addition, containerized waste may be returned from offsite segregation or treatment for disposal at ERDF. Liquid waste may be treated within the area of contamination or sent to an approved treatment facility, and any treatment residues that meet the waste acceptance criteria may be disposed at ERDF.

Some materials may be eligible for salvage and recycling if the appropriate regulatory and project requirements are met and if it is economically feasible for the project to do so.

2.3 Utility Systems

Prior to demolition, electrical feed to the 224T Building will be de-energized. Alternate power supply will be considered. Water and steam have been isolated. Mobilization and site preparation activities will confirm that the utilities have been deactivated and isolated.

A source of water for dust suppression during demolition will be required. The water may be supplied from truck-mounted pumps or a fire hydrant, depending on needs and proximity to a hydrant. The site supervisor and radiological controls supervisor will dictate the daily dust suppression needs during the demolition work.

3 Safety and Health Management and Controls

This chapter describes the safety and health management and controls performed for the removal activities.

3.1 Emergency Management

The contractor Emergency Management Program (including preparedness, planning, and response) contains the administrative responsibilities for compliance with DOE/RL-94-02, *Hanford Emergency Management Plan*, and all applicable DOE orders. The Emergency Management Program establishes a coordinated emergency response organization capable of planning for, responding to, and recovering from industrial, security, and hazardous material incidents. Emergency action plans for contractor-managed hazardous facilities identify the capabilities necessary to respond to emergency conditions, provide guidance and instruction for initiating emergency response actions, and serve as a basis for training personnel in emergency actions for each facility.

The emergency response actions within the emergency action plan are provided for recognizing incidents and/or abnormal conditions, initiating protective actions, and making the proper notifications. Emergency response for this project will include required notification to the National Response Center (NRC) for reportable quantity releases and notification for other emergency situations. Notification to the NRC under 40 CFR 302, "Designation, Reportable Quantities, and Notification," applies only to hazardous substances discovered or released that were not evaluated as part of this CERCLA removal action. Hazardous substances that are subject to this CERCLA removal action are not subject to this reporting requirement because such substances are already subject to CERCLA cleanup authority.

3.2 Safeguards and Security

Access to the Hanford Site is restricted; therefore, unauthorized access to the T Plant Complex is prohibited. The complex buildings and structures are locked, and an approximately 6 ft tall cyclone fence encloses the immediate deactivated area. Access to the removal action area is controlled by the contractor using such items as fences and signs. Access requirements for employees, nonemployees, and/or visitors will be defined in a project-specific health and safety plan (HASP).

3.3 Safety and Health Program

The 224T Building is contaminated with chemical and/or radiological hazardous substances. The HASP prepared for this action will address chemical, radiological, and physical hazards as described in the following subsections. The HASP will specify the physical and administrative controls and requirements for work activities for the protection of personnel and the environment.

3.3.1 Worker Safety Program

The Integrated Safety Management System/Environmental Management System, which includes the following elements, will be incorporated into all work activities:

- Organizational structure specifying the official chain of command and overall responsibilities of supervisors and employees.
- Comprehensive work plan development before work begins at a site to identify operations and objectives and address the logistics and resources required to accomplish project goals.
- HASP developed when workers could be exposed to hazardous substances.
- Worker training commensurate with individual job duties and work assignments.

- Medical surveillance program administered to comply with 29 CFR 1910.120, "Occupational Safety and Health Standards," "Hazardous Waste Operations and Emergency Response"
- Contractor internal work requirements and processes
- Voluntary protection program

3.3.2 Health and Safety Plan and Activity Hazards Analysis

A HASP will be prepared that defines the chemical, radiological, and physical hazards and specifies the controls and requirements for implementing D&D and debris cleanup work activities for this RAWP.

Access and work activities are controlled in accordance with approved work packages, as required by established internal work requirements and processes. A HASP addresses the health and safety hazards of each phase of site operation and includes the requirements for hazardous waste operations and/or construction activities, as specified in 29 CFR 1910.120. As part of work package development, a job or activity hazards analysis will be written to identify the hazards associated with specific tasks not already covered under a HASP, which includes the following elements:

- General overview of the hazards associated with the area
- List of employee training assignments
- List of personal protective equipment (PPE) to be used at the work site
- Medical surveillance requirements
- Work site control measures
- Emergency response
- Confined space entry internal work requirements and processes
- Spill containment program

A pre-job briefing will be held with the involved workers that will include reviews of the hazards that could be encountered and their associated worker protection requirements.

3.3.3 Radiological Controls and Protection

The radiological controls and protection program is defined in DOE-approved programs and contractor approved internal work requirements and processes. The radiological controls and protection program implements the contractor policy for reducing risks to worker safety or health to ALARA levels and ensuring adequate protection of workers. The radiological protection program of the contractor meets the requirements of 10 CFR 835, "Occupational Radiation Protection." Appropriate dosimetry, PPE, ALARA planning, periodic surveys, and health physics technician support will also be provided.

In addition to a HASP, a radiological work permit (RWP) will be prepared as needed for work in areas with potential radiological hazards. The RWP extends the radiological protection program to the specific work site or operation. All personnel assigned to the project and all work site visitors must strictly adhere to the provisions identified in the HASP and RWP.

Standard contractor controls for work in radiological areas are assessed as adequate to control project activities. Besides identifying the specific conditions, these controls will govern the specific requirements for an activity, periodic radiation and contamination surveys of the work area, and periodic or continuous observation of the work by the radiological controls organization. The ALARA planning process will be used to identify shielding requirements, contamination control requirements, radiation monitoring requirements, and other radiological control requirements for the individual project tasks.

Measures will be taken to minimize impacts to the environment during work activities. Section 4.3 of this RAWP addresses the controls to be used during project activities to address the potential release of radionuclides to the environment but not to the exclusion of 10 CFR 835 requirements. Radiological worker exposure will be monitored using approved occupational radiological protection methods.

3.3.4 Criticality Safety

The 224T Building has nonexempt quantities of fissile material which requires a criticality safety evaluation report (CSER) be prepared for the 224T Building. No intrusive activities will be permitted involving piping and vessels within the 224T Building without an applicable CSER. Additional work controls may be imposed by the CSER.

4 Environmental Management and Controls

This chapter describes the environmental management and controls needed to conduct the removal action.

4.1 Applicable or Relevant and Appropriate Requirement Compliance

The ARARs for this removal action are identified in the 224T AM (DOE/RL-2004-68). Waste streams will be evaluated, designated, and managed in compliance with the ARARs. Before disposal, waste will be managed in a protective manner to prevent releases to the environment or unnecessary exposure to personnel.

ARARs for the removal action are identified in Table 5-1 of the 224T AM (DOE/RL-2004-68). The key ARARs include standards for waste management, control of releases to the environment, reporting nonroutine releases to the environment, and protection of cultural and ecological resources. The ARARs and implementation requirements are provided in Table 3.

4.2 Waste Management Plan

Management and disposal of wastes resulting from implementation of this RAWP will be performed in accordance with CERCLA and the ARARs specified in the 224T AM. A variety of waste streams will be generated from this removal action. As specified in the AM, the waste management plan is included in Appendix A.

4.3 Standards Controlling Releases to the Environment

Airborne emissions associated with the removal action will be minimized through appropriate work controls in accordance with DOE radiation control and substantive air pollution control standards to keep Hanford Site air pollutant emissions at ALARA levels. The following sections and Appendix B describe management of these emissions to ensure that the emissions are ALARA and appropriately managed.

4.3.1 Radiological Air Emissions

Radionuclide contamination may be encountered during D&D activities under this NTCRA. Federal and state regulations and requirements for radiological air emissions are identified in Section 5.2 of the 224T AM (DOE/RL-2004-68). Substantive requirements of these standards are applicable to activities that will involve fugitive, diffuse, and/or point source emissions of radionuclides to the ambient air performed during the NTCRA, such as demolition and excavation of radioactively contaminated structures and/or soils.

Table 3. Identification of Applicable or Relevant and Appropriate Requirements and To Be Considered for 224T

ARAR Citation	ARAR or TBC	Requirement	Requirement Implementation
Waste Management Standards Regulations Pursuant to the *Resource Conservation and Recovery Act of 1976*; Implemented through RCW 70.105, "Hazardous Waste Management"; "Dangerous Waste Regulations" (WAC 173-303)			
Solid Waste Identification Specific subsections: WAC 173-303-016 WAC 173-303-017	ARAR	These regulations define how to identify when materials are and are not solid waste.	Materials that are generated for removal from the CERCLA site during the removal action are to be identification as solid waste to ensure proper management. Implementation is accomplished through Section 4.2 of the waste management plan using work processes and procedures.
WAC 173-303-045	ARAR	This regulation clarifies that reference in WAC 173-303 or 40 CFR Parts 260 through 280 and Part 124 refer to those rules in existence on July 1, 1999. This regulation also clarifies which portions of the regulations are not incorporated or adopted by reference because these are provisions that EPA cannot delegate to states.	This regulation is a statement of fact that clarifies how reference to federal RCRA regulations is implemented.
Dangerous/Mixed Waste Designation WAC 173-303-070 WAC 173-303-071 WAC 173-303-080 WAC 173-303-081 WAC 173-303-082 WAC 173-303-083 WAC 173-303-090 WAC 173-303-100 WAC 173-303-110	ARAR	This regulation establishes the procedures to be used to determine if solid waste requires management as dangerous waste. These procedures are used to identify which waste codes are appropriate for application to the waste.	Solid waste that is generated for removal from the CERCLA site during this removal action would be subject to the dangerous waste designation procedures to ensure proper management. Implementation is accomplished through Section 4.2 of the waste management plan using work processes and procedures.
Dangerous/Mixed Waste Management Specific subsections: WAC 173-303-073 WAC 173-303-077 WAC 173-303-170(3)	ARAR	These regulations establish the management standards for solid waste designated as dangerous or mixed waste. Special waste is addressed in WAC 173-303-073. Universal waste is addressed in WAC 173-303-077. Generator standards are identified through WAC 173-303-170(3).	The substantive standards for management of special waste and universal waste and the substantive standards for management of dangerous/mixed waste are applicable to the interim management of certain waste that will be generated during the removal action. For purposes of this removal action, WAC 173-303-170(3) includes the substantive provisions of WAC 173-303-200 by reference. WAC 173-303-200 further includes certain substantive standards from WAC 173-303-630 and -640 by reference. Implementation is accomplished through Section 4.2 of the waste management plan using work processes and procedures.

Table 3. Identification of Applicable or Relevant and Appropriate Requirements and To Be Considered for 224T

ARAR Citation	ARAR or TBC	Requirement	Requirement Implementation
Dangerous/Mixed Waste Disposal Specific subsection: WAC 173-303-140	ARAR	This regulation establishes state standards for land disposal of dangerous waste and incorporates by reference federal land disposal restrictions of 40 CFR 268 that are applicable to solid waste that designates as dangerous or mixed waste in accordance with WAC 173-303-070(3).	Dangerous/mixed waste that is generated and removed from the CERCLA site during the removal action for offsite (as defined by CERCLA) land disposal would be subject to the identification of applicable land disposal restrictions at the point of generation of the waste. The actual offsite treatment of such waste would not be ARAR to this removal action but would instead be subject to all applicable laws and regulations. Implementation is accomplished through Section 4.2 of the waste management plan using work processes and procedures. However, most waste will be disposed of onsite at ERDF.
Recycling Requirements Specific subsections: WAC 173-303-120(3) WAC 173-303-120(5)	ARAR	These regulations define the requirements for the recycling of materials that are solid and dangerous waste. Specifically, WAC 173-303-120(3) provides for management of certain recyclable materials, including spent refrigerants, antifreeze, and lead-acid batteries. WAC 173-303-120(5) provides for the recycling of used oil.	Recyclable materials that are exempt from regulation as dangerous waste and that are not otherwise subject to CERCLA as hazardous substances can be recycled and/or conditionally excluded from certain dangerous waste requirements. Implementation is accomplished through Section 4.2 of the waste management plan using work processes and procedures.
Regulations Pursuant to the *Toxic Substances Control Act of 1976* (TSCA); "Polychlorinated Biphenyls Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions" (40 CFR 761)			
PCB Waste Management and Disposal Specific subsections: 40 CFR 761.50(b)(1) 40 CFR 761.50(b)(2) 40 CFR 761.50(b)(3) 40 CFR 761.50(b)(4) 40 CFR 761.50(b)(7) 40 CFR 761.50(c)	ARAR	These regulations establish standards for storage and disposal of PCB wastes.	The specific identified subsections from 40 CFR 761.50(b) reference the requirements for management of each PCB waste type. Radioactive PCB waste can be disposed in accordance with 40 CFR 761.50(b)(7). Implementation is accomplished through Section 4.2 of the waste management plan using work processes and procedures.

Table 3. Identification of Applicable or Relevant and Appropriate Requirements and To Be Considered for 224T

ARAR Citation	ARAR or TBC	Requirement	Requirement Implementation
Regulations Pursuant to RCW 70.95, "Solid Waste Management—Reduction and Recycling," "Minimum Functional Standards for Solid Waste Handling" (WAC 173-304)			
Nondangerous, Nonradioactive Solid Waste Management Specific subsection: WAC 173-304-190 WAC 173-304-200	ARAR	This regulation establishes requirements for the onsite storage of solid waste that is not dangerous or radioactive waste.	Nondangerous nonradioactive solid wastes (i.e., hazardous substances that are regulated only as solid waste) that will be containerized for removal from the CERCLA site would be managed onsite according to the substantive requirements of this standard. Implementation is accomplished through Section 4.2 of the waste management plan using work processes and procedures. Note: This regulation has been replaced in its entirety by WAC 173-350.
To Be Considered Pursuant to Relevant Facility Acceptance Criteria			
ERDF Waste Acceptance Criteria	TBC	This document establishes waste acceptance criteria for ERDF.	Waste destined for management at ERDF must meet acceptance criteria to ensure proper disposal.
Standards Controlling Releases to the Environment Regulations pursuant to the *Clean Air Act Amendments of 1977*; "National Emission Standards for Hazardous Air Pollutants" (NESHAP) (40 CFR 61)			
Emissions of Hazardous Air Pollutants 40 CFR 61.01 40 CFR 61.05 40 CFR 61.12 40 CFR 61.14 40 CFR 61.92	ARAR	Emissions of radionuclides to the ambient air shall not exceed amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr.	This removal action may include activities such as open-air demolition of contaminated structures, excavation of contaminated soils, and operation of exhausters and vacuums, each of which may provide airborne emissions of radioactive particulates to unrestricted areas. As a result, requirements limiting emissions potentially apply. This activity is a risk-based standard for the purposes of protecting human health and the environment. Implementation is accomplished through Section 4.3 of this report using work processes and procedures.
40 CFR 61.145(a)(1) 40 CFR 61.145(a)(5) 40 CFR 61.145(c) 40 CFR 61.150(a)	ARAR	Regulated ACMs shall be removed in accordance with specific handling, packaging, and disposal requirements where the potential to emit asbestos exists.	This removal action includes abatement of asbestos and ACMs in the form of pipe and tank insulation, transite siding, and ductwork. As a result, there is potential to emit asbestos to unrestricted areas and the requirements for the removal, handling, and packaging of asbestos potentially apply. Implementation is accomplished through Section 4.3 of this report using work processes and procedures.

Table 3. Identification of Applicable or Relevant and Appropriate Requirements and To Be Considered for 224T

ARAR Citation	ARAR or TBC	Requirement	Requirement Implementation
Regulations pursuant to RCW 70.94, "Washington Clean Air Act"; RCW 43.21A, "Department of Ecology"; "Radioactive Protection – Air Emissions" (WAC 246-247)			
Radionuclide Emission Standards WAC 246-247-120 WAC 246-247-130	ARAR	These regulations establish limits for airborne radionuclide emissions as defined in WAC 173-480 and Subparts H and I in 40 CFR 61. The ambient air standards under WAC 173-480 require that the most stringent standard be enforced. Ambient air standards under Subparts H and I in 40 CFR 61 will not to exceed amounts that result in an effective dose equivalent of 10 mrem/yr to any member of the public. These standards specify emission monitoring requirements and the application of BARCT requirements.	Fugitive, diffuse, and point source emissions of radionuclides to the ambient air may result from activities performed during the removal action, such as open-air demolition of contaminated structures, excavation of contaminated soils, and operation of exhauster and vacuums. Implementation is accomplished through Section 4.3 of this report using work processes and procedures.
WAC 246-247-040 WAC 246-247-075	ARAR	Emissions from nonpoint and fugitive sources of airborne radioactive material shall be measured. Measurement techniques may include but are not limited to sampling, calculation, smears, or other reasonable method for identifying emissions as determined by the lead agency.	Substantive requirements of this standard are applicable because fugitive and nonpoint source emissions of radionuclides to the ambient air may result from activities performed during the removal action such as open-air demolition of contaminated structures and excavation of contaminated soils. This standard exists to assure compliance with emission standards. Implementation is accomplished through Section 4.3 of this report using work processes and procedures.
"General Regulations for Air Pollution Sources" (WAC 173-400)			
Air Contaminant Emission Standards Specific subsections: WAC 173-400-040 WAC 173-400-075	ARAR	Methods of control shall be employed to minimize the release of air contaminants associated with fugitive emissions resulting from materials handling, construction, demolition, or other operations. Emissions are to be minimized through application of best available control technology.	Substantive requirements of these standards are relevant and appropriate to this removal action because there may be visible, particulate, fugitive, and hazardous air emissions and odors resulting from decontamination, demolition, and excavation activities. As a result, standards established for the control and prevention of air pollution may be relevant and appropriate. Implementation is accomplished through Section 4.3 of this report using work processes and procedures.

Table 3. Identification of Applicable or Relevant and Appropriate Requirements and To Be Considered for 224T

ARAR Citation	ARAR or TBC	Requirement	Requirement Implementation
"Controls for New Sources of Toxic Air Pollutants" (WAC 173-460)			
WAC 173-460-040	ARAR	Emissions of toxic air contaminants shall be quantified and ambient impacts evaluated. Best available control technology for toxics shall be used as determined by the lead agency to protect human health and the environment.	Substantive requirements of these standards are relevant and appropriate to this removal action because there is the potential for toxic air pollutants to become airborne as a result of decontamination, demolition, and excavation activities. As a result, standards established for the control of toxic air contaminants may be relevant and appropriate. Implementation is accomplished through Section 4.3 of this report using work processes and procedures.
"Ambient Air Quality Standards and Emission Limits for Radionuclides" (WAC 173-480)			
Ambient Air Standards for Radionuclide WAC 173-480-040 WAC 173-480-050 WAC 173-480-060	ARAR	These requirements establish that the most stringent federal or state ambient at air quality standard for radionuclides the site be enforced. The WAC 173-480 standard defines the maximum allowable level for radionuclides in the ambient air, which will not cause a maximum accumulated dose equivalent of 10 mrem/year to any member of the public. This is the same standard within the ambient air standards under Subparts H and I in 40 CFR 61. Emission standards for new and modified emission units will use BARCT.	Requirements of this standard are applicable to removal actions performed that could emit radionuclides to the site. Implementation is accomplished through Section 4.3 of this report using work processes and procedures.

Note: Complete reference citations are provided in Chapter 6.

ACM = asbestos-containing material
ARAR = applicable or relevant and appropriate requirement
BARCT = best available radionuclide control technology
CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
EPA = U.S. Environmental Protection Agency
ERDF = Environmental Restoration Disposal Facility
NESHAP = "National Emission Standards for Hazardous Air Pollutants"
RCRA = *Resource Conservation and Recovery Act of 1976*
TBC = to be considered
TSCA = *Toxic Substances Control Act of 1976*

Radiological contaminants of concern are identified and quantified in the 224T SAP (DOE/RL-2019-37). The potential to emit (PTE) is determined through calculation or modeling and will be performed prior to work initiation. The PTE calculations are needed to determine the abatement technology required to control the potential for contamination release during the work activities. They are based on prospective calculations that delineate the total effective dose equivalent (TEDE) to the maximally exposed individual (MEI) who abides or resides in an unrestricted area. For the 224T Building, the estimated holdup in the structure is used to calculate the PTE and TEDE to the MEI. Hypothetical offsite and onsite Hanford MEIs are then evaluated. The TEDEs to the MEIs are calculated using CAP-88 modeling[1] PC software (Version 4.0). The calculation parameters and the assumptions used to derive the PTE are presented in ECF-HANFORD-19-0096, *Radiological and Toxic Air Emissions for the 224T Plutonium Concentration Facility*. The unabated PTE is estimated at 3.12E-02 mrem/yr to the offsite MEI. In accordance with the 2001 agreement reached between DOE-RL, Washington State Department of Health, and EPA, the PTE for a second MEI location (termed the onsite MEI) was calculated. The onsite MEI unabated PTE is estimated at 7.80E-02 mrem/yr located at the Laser Interferometer Gravitational-Wave Observatory. Air emission controls and monitoring requirements will be identified as needed based on the calculated/modeled value of the potential emissions and resultant public exposure. Appendix B of this document provides additional information pertaining to the release and control of potential radiological contaminants to the air.

The 224T Building is currently ventilated passively with no abatement control. Temporary point source exhausters with testable HEPA filtration may be employed to provide alternate emission paths from the building during D&D activities. For point sources with a potential emission of greater than 0.1 mrem/yr to the MEI, two stages of HEPA filtration would be considered as meeting best available radionuclide control technology requirements. Implementation of a temporary exhauster would be documented in a project manager meeting.

Within the building, standard radiological controls will be utilized such as confinement, application of fixatives, and utilization of wet methods. Portable HEPA exhausters and/or HEPA vacuums exhausting within the structure may be used to protect workers and assist in contamination control. These methods would be considered best available radionuclide control technology for minimizing diffuse and fugitive emissions from the structure during stabilization activities.

The 200 West Area Near-Facility Ambient Air Program stations upwind and downwind of the T Plant Complex provide monitoring effectiveness validation utilizing the near-facility monitoring. These five stations (N161, N304, N456, N931, and N994) do not provide real-time results, so their bi-weekly data will be used as indicators along with the worksite monitoring data for overall trending of the effectiveness of the contamination control measures. The monitoring stations are discussed in more detail in Appendix B.

Actions taken pursuant to CERCLA, after proper documentation and verification of removal and remediation activities, are exempt from clean air permitting requirements. There are two key considerations to satisfy in the transition process: (1) proper public notice and review and (2) no lapse from *Clean Air Act Amendments of 1990* permitting requirements to onset of CERCLA activities. Transitioning to CERCLA includes using the process found in Section 4.0 of the Statement of Basis

[1] The CAP-88 (Clean Air Act Assessment Package-1988) computer model is a set of computer programs, databases, and associated utility programs for estimation of dose and risk from radionuclide emissions to air. CAP-88 is a regulatory compliance tool under NESHAP (40 CFR 61). CAP-88 PC (Version 4.0) allows modeling on a personal computer and is a recent version of the code.

Hanford Site Air Operating Permit No. 00-05-006 delineating the steps to remove Air Operating Permit conditions or certifications for facilities or activities under CERCLA transition.

4.3.2 Nonradioactive Air Emissions

The primary source of emissions resulting from the removal action will be fugitive particulate matter. In accordance with the substantive requirements of WAC 173-400-040(3) and (8), “General Regulations for Air Pollution Sources,” “General Standards for Maximum Emissions,” reasonable precautions will be taken to prevent the release of air contaminants associated with fugitive emissions due to demolition, materials handling, or other operations, and prevent fugitive dust from becoming airborne from fugitive emission sources.

Operating trucks and other diesel-powered equipment during the removal activities would be expected in the short term to introduce quantities of sulfur dioxide, nitrogen dioxide, particulates, and other pollutants to the atmosphere, typical of similar sized construction projects. These releases would not be expected to exceed air quality standards. Dust generated during removal activities would be minimized by applying water or other dust control measures (e.g., fixatives). Vehicular and equipment emissions will be controlled and mitigated in compliance with the substantive standards for air quality protection that apply to the Hanford Site. These techniques are considered reasonable precautions to control fugitive emissions as required by the substantive requirements. Appendix B of this document provides additional information pertaining to nonradiological air emissions including asbestos and criteria pollutants.

Toxic air emissions may be subject to the substantive applicable requirements of WAC 173-460, “Controls for New Sources of Toxic Air Pollutants.” ECF-HANFORD-19-0096 provides details on the nonradiological air emissions for the removal action at the 224T Building. Airborne emissions control and monitoring requirements for toxic air pollutants will be identified as needed based on the calculated value of the potential emissions and resultant public exposure. This information will be provided in subsequent implementing documents and work packages, as necessary.

Some waste encountered during the removal action may require treatment to meet ERDF waste acceptance criteria (ERDF-00011). In most cases, the type of treatment anticipated will consist of solidification or stabilization techniques such as macroencapsulation or grouting, and WAC 173-460 will not be considered an ARAR because the work will not result in toxic air pollutant emissions at regulated levels. If more aggressive treatment is required that would result in regulated air pollutant emissions above the de minimis values in WAC 173-460-150, “Table of ASIL, SQER and de Minimis Emission Values,” the substantive requirements of WAC 173-400-113(2), “New Sources in Attainment or Unclassifiable Areas—Review for Compliance with Regulations,” and WAC 173-460-060, “Control Technology Requirements,” will be evaluated to determine their applicability in satisfying the substantive requirements determined to be ARAR.

4.3.3 Asbestos Emissions

Removal and disposal of asbestos and ACM are regulated under the *Clean Air Act Amendments of 1990*. The substantive provisions of these regulations provide for special precautions to prevent environmental releases or personnel exposure to airborne emissions of asbestos fibers during the removal action.

4.3.4 Emission Controls

Based on an analysis of the potential emissions and available control technologies, the following controls have been selected for use during the removal action:

- Water will be applied as needed during excavation and backfilling/recontouring activities to suppress fugitive emissions, including dust.

- Fixatives will be applied to structural materials, debris and equipment, and/or contaminated soil to minimize airborne contamination during the removal action activities for fugitive emissions and dust. Fixative application techniques may include spraying, fogging, brushing on, pouring, or other methods, as necessary.
- Fixatives or cover material (e.g., soil and gravel) will be applied to disturbed contaminated soils when field activities will be inactive more than 24 hours (except as noted in the next bullet).
- Fixatives will be applied using manufacturers' recommended specifications. The fixative will be examined to ensure that it has remained in the proper configuration and will be reapplied as necessary to ensure that it is performing its intended purpose.
- Field activities will be temporarily ceased, and the area will be placed in a safe configuration if airborne contamination control measures are not expected to be adequate based on site conditions (e.g., excessive wind). Appropriate controls such as water, fixatives, covers, containment tents, windscreens, or other controls during cessation of work activities will be applied to the extent practicable based on work environment conditions (i.e., weather and predicted wind speeds greater than 20 mph). Additionally, fixatives will be applied to demolition sites and debris piles as needed to help control dust and radiological or nonradiological contaminants.
- Portable exhausters will be utilized to control emissions from stripping operations which tend to generate respirable particulate matter (e.g. grinding, cutting, or welding) whenever it is reasonably possible to do so.
- Waste packages will remain closed once they are staged except as necessary due to inspection or repackaging activities.
- Operational limits for removable or transferable radioactive contamination levels will be established in work packages and associated radiation work procedures. Fixatives or other physical controls will be employed if removable or transferable contamination levels above 100,000 dpm/100 cm^2 beta/gamma or exceeding 2,000 dpm/100 cm^2 alpha are measured or expected.

In addition to the controls listed above, best available radionuclide control technology and ALARA control technology controls will be applied based on the PTE using a graded approach. These controls will be selected and agreed upon in the project manager meeting based on established radiological control practices. Appendix B of this document provides additional information pertaining to radiological and nonradiological air emission controls.

4.3.5 Monitoring Requirements

As the calculated unabated PTE for the removal action is less than 0.1 mrem/yr (Section 4.3.1), periodic confirmatory measurements are required by the substantive requirements of WAC 246-247-075, "Radiation Protection—Air Emissions," "Monitoring, Testing, and Quality Assurance." Worksite air monitoring for personnel protection and process monitoring will be the primary indicator of effectiveness of abatement and ALARA control methods during removal activities. Worksite monitoring includes using temporary ambient air monitors (e.g., continuous air monitors with alarms, personnel samplers, ambient air samples). In addition, existing near-facility ambient air monitoring stations surrounding the work areas will augment the workplace monitoring (Appendix B).

Periodic confirmatory measurement (PCM) will also be provided as required by the substantive requirements of WAC-246-247-075(3) and (8) for the 224T Building. Ambient air monitoring and radiological surveys will be provided to meet the PCM requirement. The primary PCM will be provided through the use of work space monitoring and radiological surveys performed in accordance with the current radiological control manual. Air monitoring will consist of portable air samplers placed in the prevailing downwind locations in the immediate work area. The samplers will be operated during work activities that have a potential for radionuclide air emissions. Results are used for verifying acceptable occupational conditions and to help confirm effectiveness of contamination controls. Handheld survey instruments will be used for alpha and beta-gamma contamination surveys.

Detailed discussion of the monitoring requirements is in Appendix B of this document.

4.3.6 Liquid Effluents

Liquid effluents may be generated during the removal activities (e.g., decontamination solutions, water sprays for dust suppression). Although CERCLA removal actions are exempt from Hanford Site State Waste Discharge Permit (SWDP), liquid effluents will be discharged if they meet the substantive provisions of existing Hanford Site SWDP. If the liquid effluents do not meet Hanford Site SWDP, effluents may need to be contained, sampled, and as necessary, transported and discharged into the Effluent Treatment Facility, or solidified for disposal at ERDF or another EPA-approved facility. Water spray for dust suppression will be used in a manner that minimizes the potential for ponding or runoff that could result in the spread of contamination.

4.4 Reporting Requirements for Nonroutine Releases

The following reporting requirements apply for hazardous substances that could be released during removal activities:

- 40 CFR 302 requires immediate notification to the NRC on discovery of a release of a hazardous substance into the environment in excess of a reportable quantity.
- 40 CFR 355, "Emergency Planning and Notification," requires immediate notification to the community emergency coordinator for the local emergency planning committee and to the State Emergency Response Commission for a release of a reportable quantity of an extremely hazardous substance, a comprehensive release of a reportable quantity of an extremely hazardous substance, or a CERCLA hazardous substance.
- Emergency response for this project will include required notification to the NRC for reportable quantity releases and Removal Action Manager notification for other emergency situations.

4.5 Cultural/Ecological Resources

Cultural and ecological resource reviews will be performed as appropriate before starting removal activities. These reviews will be conducted in accordance with DOE requirements. If potential impacts are identified, mitigation action plans will be developed and implemented. Scenarios described in the following subsections provide further detail for these reviews.

4.5.1 Cultural

Cultural resource reviews (CRRs) will follow the substantive requirements of Section 106 of the *National Historic Preservation Act of 1966*, which has been superseded by Section 306108 of the *National Preservation Programs, Division A—Historic Preservation*. The removal activities would be performed in areas that have been extensively disturbed by past construction activities, and most buildings/structures have been evaluated for their National Register of Historic Places eligibility as part of DOE/RL-97-56, *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan*. Some buildings and structures are contributing properties to the Manhattan Project or Cold War Era Historic District, and they require mitigation through documentation (e.g., completed inventory forms). DOE/RL-97-56 also requires walkthroughs to identify artifacts of educational and interpretive value. Before field activity begins, each building and structure requiring documentation will be evaluated for the following information:

- Type of documentation required for each building or structure (Historic Property Inventory Form or Expanded Historic Property Inventory Form)
- Status of the documentation

Walkthroughs of the buildings and structures will be conducted before demolition to finalize all mitigation requirements. CRR documentation requirements for any specific building or structure will be identified and completed before demolition activities begin.

CRR(s) will also be conducted to address debris cleanup. A graded CRR could be developed to address debris cleanup that has been identified to date and in the future to ensure that adverse effects on potential archaeological sites are avoided. CRR documentation requirements, including site-specific field evaluations, will be identified/completed before debris cleanup begins.

Impacts on cultural resources in the vicinity of the removal action will be mitigated in accordance with DOE/RL-98-10, *Hanford Cultural Resources Management Plan*.

4.5.2 Ecological

Ecological reviews will be completed before work begins in areas where there is potential for adverse effects to sensitive or rare biological resources consistent with existing routine procedures (DOE/RL-95-11, *Ecological Compliance Assessment Management Plan*). Because all buildings/structures could support ecological resources (e.g., nesting birds or bat roosts), surveys must be conducted prior to decommissioning. Project engineers will consult with the ecological compliance staff in advance of planned activities to allow for sufficient ecological surveys.

If any nesting birds (if not a nest, a pair of birds of the same species or a single bird that will not leave the area when disturbed) are encountered or suspected, removal activities shall be evaluated before continued work. Prior to D&D of a structure, a facility walkdown and survey will be performed during daylight hours to document any evidence indicating high numbers of bats that could suggest possible roosting site(s). In the event such evidence is discovered, DOE will be consulted for further recommendations.

No plants or animals listed as threatened, endangered, or candidate species under the federal *Endangered Species Act of 1973* are known to be affected by building/structure decommissioning. Very little native or natural habitat is present in the vicinity of buildings/structures. However, care will be taken to avoid or minimize damage to vegetation, especially shrubs or trees in the vicinity of buildings/structures.

Workers will avoid wildlife that may be found in and around the buildings/structures. Appropriate ecological surveys of debris cleanup sites also will be conducted before field activities begin. Procedures to avoid or mitigate damage to sensitive areas identified during ecological reviews will be established before work begins.

Impacts on ecological resources near the removal action will continue to be mitigated in accordance with DOE/RL-96-32, *Hanford Site Biological Resources Management Plan*.

5 Project Administration

The following sections describe the management approach for implementing the removal action, including schedule summary information, project team descriptions, training and qualifications, quality assurance (QA), and post-removal activities.

5.1 Cost Summary

The nondiscounted cost estimate for D&D of the 224T Building was $11,600,000. The accuracy range of the cost estimate is expected to be –30 to +50%. Nondiscounted costs are present day costs that are not affected by general price inflation (i.e., they represent units of stable purchasing power).

5.2 Schedule

This removal action is expected to begin upon issuance of this RAWP, which is anticipated in 2020 to use the workforce coming off of the Plutonium Finishing Plant Project. Demolition preparation activities are expected to take up to 2 years. Due to interference risks with T Plant Operations, 224T demolition is expected to be coordinated so as not to impact major T Plant operations (e.g., sludge storage and future treatment and disposition). Removal activities for the 224T Building will be executed using a phased approach based on emergent facility conditions, funding availability, craft and engineering resources availability, and overall interactive site priorities.

5.3 Project Team

The project team includes the individuals working to accomplish the removal action. Accordingly, the project team includes the lead regulatory agency (EPA), lead agency (DOE), DOE-RL Removal Action Manager, contractor removal action organization, site project organization, QA organization, radiological control organization, health and safety organization, sample and data management organization, environmental compliance officer, waste management lead, and other contractor and subcontractor staff. The HASP lists the key project team member names, their roles and responsibilities, and their respective organizations.

5.4 Change Management

If a fundamental change to the selected removal action that is not within the scope of work is identified, another engineering evaluation/cost analysis or addendum of the same and supporting documentation will be prepared to allow DOE to consider a revised removal action.

Established configuration/change control processes ensure that proposed changes are reviewed in relation to the specified commitments. If a breach of these commitments is discovered, work will cease so that stabilization or recovery actions may be identified and implemented. Change management will comply with appropriate contractor procedures.

Determining the significance of the change is the responsibility of DOE. Contractor management is responsible for tracking changes and obtaining appropriate reviews by contractor staff. Contractor management will discuss the change with DOE, and DOE will then discuss the type of change that is necessary with EPA. Appropriate documentation will follow.

5.5 Personnel Training and Qualifications

Staff experience and capabilities are important in maintaining worker and environmental safety. Knowledge of ongoing operations, understanding of conditions encountered, and lessons learned will ensure continued safe operations.

Training requirements will ensure that personnel are able to work safely in and around radiological areas and maintain ALARA radiation exposures. Safety courses, training materials, site-specific information, and available technologies will be presented to provide adequate training for workers. Records of required training will be maintained in readily accessible personnel files.

Health physics workers are required to be current in health physics technician qualification training, which includes passing examinations to demonstrate an understanding of theoretical and applied classroom materials.

Specialized training will be provided as needed to instruct workers in the use of nonstandard equipment, performance of abnormal operations, and hazards of specific activities. Specialized training could be provided through on-the-job activities, classroom instruction and testing, or pre-job briefings. The depth of training in any discipline will be commensurate with the degree of the hazards involved and the knowledge required for task performance. Some activities will require using expert services as opposed to project staff training.

The contractor training program will provide workers with the knowledge and skills necessary to execute assigned duties safely. A graded approach will be used to ensure that workers receive a level of training commensurate with their responsibility that complies with applicable requirements. Specialized employee training will include pre-job safety briefings, plan-of-the-day meetings, and facility/work site orientations. Training and qualifications will be determined as required by job assignment for specific work activities.

The SAP, HASP, RWP, and activity hazards analysis will include specific requirements for project activities, which will include PPE and required training for project personnel.

5.6 Quality Assurance Program

Overall QA for the RAWP will be planned and implemented in accordance with 10 CFR 830, "Nuclear Safety Management," Subpart A, "Quality Assurance Requirements"; EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans*; and SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium*. QA activities will use a graded approach based on potential environmental, safety, health, reliability, and continuity of operation impacts. Other specific activities will include QA implementation, responsibilities and authority, document control, QA records, and audits.

5.7 Post-Removal Action Activities

Following the removal action, the soil and remaining slabs will be visually inspected and surveyed. Although the scope of this removal action does not include soil contamination found under the buildings and structures, if evidence of contamination to surrounding soils is encountered during deactivation, decontamination, decommissioning, and demolition activities, those soils will be excavated and disposed at ERDF or other EPA-approved facilities in accordance with the waste acceptance criteria for the facility. Alternately, if the soil contamination is extensive or unusually complex or if contamination is encountered on remaining slabs or underground structures, DOE will consult with the lead regulatory agency (EPA). The parties will determine whether to address the residual contamination within the scope of this NTCRA or implement temporary measures as part of this action and defer final action to the remedial investigation and remedy selection process by adding the site to Appendix C of the Tri-Party Agreement Action Plan (Ecology et al., 1989b) in accordance with TPA-MP-14. Potential post-removal activities are summarized in the following subsections.

5.7.1 Post-Removal Action Sample Collection

Field investigations (e.g., visual inspections and radiological and/or chemical field screening) will be conducted throughout the removal action process to assess potentially contaminated areas. A walkdown is also conducted following backfilling to ensure the absence of asbestos.

If soil contamination surrounding structures is detected, post-removal contaminated soil excavation or stabilization may be performed. Alternatively, post-removal contaminated soil sites may be identified by DOE as new WIDS sites under the Tri-Party Agreement (Ecology et al., 1989a) with EPA concurrence.

5.7.2 CERCLA Cleanup Documentation

Removal activities completed as part of this removal action will be documented on a Facility Status Change Form as required by DOE O 430.1C, *Real Property Asset Management*. The form will provide a summary of the actions taken, the “as-left” condition of the area, the characterization data collected during the removal action, and an assessment of the underlying soil as applicable. DOE will approve the form to document completion of the removal action. Ultimately, this form will support the future remediation action at the T Plant Complex and the eventual disposition of the entire 200 West Area of the Hanford Site.

A Removal Action Report will be prepared as required under 40 CFR 300.415 to document the completion of the removal action. This report will summarize the scope of the removal action, removal activities that were completed, “as-left” condition of the area, characterization data collected, waste types and volumes removed, assessment of the underlying soil, and as-left conditions. This report will also support the future remediation action at the T Plant Complex and the eventual disposition of the entire 200 West Area of the Hanford Site.

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Appendix A

Waste Management Plan

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Contents

Terms

ACM	asbestos-containing material
ARAR	applicable or relevant and appropriate requirement
BFA	building footprint area
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
D&D	decontamination and demolition
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
LLW	low-level waste
MLLW	mixed low-level waste
RCRA	*Resource Conservation and Recovery Act of 1976*
SAP	sampling and analysis plan
SWDP	State Waste Discharge Permit
TRU	transuranic
TRUM	transuranic mixed
TSCA	*Toxic Substances Control Act of 1976*
WIPP	Waste Isolation Pilot Plant

A1 Introduction

This waste management plan establishes requirements for the management and disposal of waste generated from decontamination and demolition (D&D) of the 224T Building. Management and disposal of waste resulting from implementation of this removal action work plan will be performed in accordance with the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) and the applicable or relevant and appropriate requirements (ARARs) specified in DOE/RL-2004-68, *Action Memorandum for the Non-Time-Critical Removal Action for the 224-T Plutonium Concentration Facility*.

The removal action will demolish the building to slab-on-grade. As a result, several waste streams will be generated from the D&D activity. It is anticipated that most of the waste will be low-level waste (LLW). However, quantities of dangerous mixed low-level waste (MLLW), transuranic (TRU), transuranic mixed (TRUM), polychlorinated biphenyl (PCB) waste, and asbestos and asbestos-containing material (ACM) could be generated. The majority of waste will be in a solid form; however, some liquid wastes might also be generated. The following is a list of laws and regulations from which the ARARs have been developed:

- *Atomic Energy Act of 1954* for management of radioactive waste by the U.S. Department of Energy.
- As implemented by 40 CFR 260, "Hazardous Waste Management System: General," through 40 CFR 268, "Land Disposal Restrictions," and WAC 173-303, "Dangerous Waste Regulations," the *Resource Conservation and Recovery Act of 1976* (RCRA) for the management of dangerous waste. The identification and treatment, storage, and/or disposal of hazardous waste and the hazardous component of mixed waste are governed by RCRA. The State of Washington, which implements RCRA requirements under WAC 173-303, has been authorized by the U.S. Environmental Protection Agency (EPA) to implement most elements of the RCRA program. The dangerous waste standards for generation and storage will apply to the management of any dangerous or mixed waste generated by D&D activities at Hanford Site excess industrial buildings and structures as a result of debris cleanup activities. Treatment standards for dangerous or mixed waste subject to RCRA land disposal restrictions are in WAC 173-303-140, "Land Disposal Restrictions," which includes 40 CFR 268 by reference.
- The *Toxic Substances Control Act of 1976* (TSCA) includes standards for managing PCB waste. PCB waste disposal is governed by the rules of 40 CFR 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions." PCB wastes generated during D&D and debris cleanup activities will be disposed at the Environmental Restoration Disposal Facility (ERDF) or another EPA-approved disposal facility in accordance with the substantive provisions of 40 CFR 761. PCBs may be considered underlying hazardous constituents under RCRA for waste that is designated as dangerous or mixed waste and could require treatment to meet WAC 173-303 and 40 CFR 268 requirements.
- As implemented by 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," Subpart M, "National Emission Standard for Asbestos," the *Clean Air Act Amendments of 1990* regulates removal and disposal of asbestos and ACM. These regulations provide for special precautions to control environmental releases or exposure to personnel due to airborne emissions of asbestos fibers during removal activities.

Wastes generated through implementation of this removal action will be disposed at appropriate EPA-approved facilities in accordance with the waste acceptance criteria of those facilities. ERDF is the preferred waste disposal facility for waste meeting ERDF waste acceptance criteria (ERDF-00011, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*). Demolition debris will be transported to ERDF or other EPA-approved facilities and treated as necessary to meet applicable land disposal restriction requirements and waste acceptance criteria prior to disposal.

Waste that is characterized as either contact or remote-handled TRU/TRUM waste will be staged at the Central Waste Complex or another EPA-approved facility. This material will be packaged for eventual shipment to the Waste Isolation Pilot Plant (WIPP) in accordance with the schedule established for completing remedial actions at the Hanford Site. WIPP meets 40 CFR 191, “Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes,” requirements for TRU/TRUM waste disposal and is a RCRA-permitted disposal facility.

Waste management activities addressed in the work packages may include waste characterization, designation, staging, packaging, handling, marking, labeling, segregation, storage, transportation, and disposal. These activities are briefly described in the following chapters.

A2 Projected Waste Streams

One or all of the following solid waste streams are anticipated to be generated during the removal action, and may fall into any combination of categories (nondangerous/nonradioactive, radioactive, mixed, hazardous, dangerous, suspect radioactive, suspect dangerous, and suspect mixed):

- Demolition debris (e.g., structural materials, concrete, wood, rebar, metalplastic pipes, wire, equipment, pumps, tanks, boilers, compressors, ductwork, and electrical components)
- LLW and MLLW
- TRU and TRUM waste
- Liquids (e.g., decontamination liquids, water in C Cell deep pit)
- Spent/excess chemicals/reagents and used oils
- Miscellaneous solid waste (e.g., rubber, glass, paper, personal protective equipment, cloth, plastic, wipes, wood, equipment, tools, pumps, wire, metal casing, plastic piping, and sample returns)
- PCB waste
- Asbestos and ACM
- Soils (e.g., soils surrounding building slabs)

A3 Waste Management and Characterization

Waste will be managed in a protective manner to prevent releases to the environment and unnecessary exposure to personnel. Waste-specific storage and packaging requirements will comply with the substantive requirements of WAC 173-303 as specified in the ARARs. Miscellaneous solid waste will be managed as appropriate for the nonradiological and radiological contaminants present or suspected to be present. Water in C Cell pit will be treated and disposed of properly. The waste characterization process is discussed briefly in Section 2.2.6 of the main text and is discussed in DOE/RL-2019-37, *Sampling and Analysis Plan for the 224T Plutonium Concentration Facility*, hereinafter referred as the 224T Sampling and Analysis Plan (SAP).

Contamination on surrounding soils or portions of slabs may be encountered during the course of D&D activities. Any soil or portions of the slab that are contaminated with substances that are known or easily determined to be associated with normal building or structure operation or maintenance may be removed for disposal during building/structure demolition, as appropriate.

Sampling for such excavation will be performed using an observational approach focused on process knowledge with visual inspections, radiological and chemical field screening, and focused judgmental sampling, where appropriate. Sampling will be performed in accordance with the 224T SAP (DOE/RL-2019-37). Removal of contaminated soils is generally deferred to a future remedial action. The sites will be stabilized in a manner that will not hinder future remediation.

Waste generated through the removal action will be characterized in accordance with the 224T SAP (DOE/RL-2019-37) and the waste acceptance criteria of the receiving facility (e.g., ERDF). Characterization is performed using a variety of information that includes but is not limited to process knowledge, historical analytical data, new sampling and analysis data, and radiological and chemical field screening.

A3.1 Hazardous/Dangerous Waste, Low-Level Waste, and Mixed Waste

These wastes will be managed in a protective manner to prevent releases to the environment or exposure to personnel. Waste-specific storage and packaging requirements will comply with the substantive requirements of WAC 173-303 as specified in the ARARs.

A3.2 Transuranic Waste

TRU waste may be generated from this removal action. Process equipment, piping, and drains are potential sources of TRU waste. Liquids and sludges in the process system and drains may also be encountered. See Section 3.3.4 of the main text for additional requirements.

A3.3 Transuranic Mixed Waste

TRUM waste may be generated from this removal action. This waste will likely be solid; however, there could be residual liquid from decontamination activities or process-related systems. See Section 3.3.4 of the main text for additional requirements.

A3.4 Solid Waste

Solid waste (e.g., personal protective equipment) will be managed as appropriate for the nonradiological and radiological contaminants present or suspected to be present. Miscellaneous solid waste that has contacted suspect dangerous or suspect mixed waste will be managed as such. Field screening will be used to segregate radioactive waste from nonradioactive waste. Containers will be properly marked and labeled. The containers will be segregated as appropriate and then stored within a designated waste container storage area within the area of contamination or at ERDF. The area of contamination will be established as part of the work planning process. Miscellaneous solid waste will be dispositioned based on waste characterization information.

A3.5 Asbestos and ACM Waste

Removing, handling, packaging, and disposing of asbestos and ACM will be performed in accordance with the substantive provisions of 40 CFR 61.145(c), “Standard for Demolition and Renovation”; 40 CFR 61.150, “Standard for Waste Disposal for Manufacturing, Fabricating, Demolition, Renovation, and Spraying Operations”; and 29 CFR 1926.1101, “Safety and Health Regulations for Construction,” "Asbestos," for ACM removal. Additional information about asbestos and ACM waste generated from the D&D activities will be specified in the field work packages and procedures, as necessary.

A3.6 PCB Waste

The management and disposal of PCB wastes is governed by the TSCA, which is implemented by 40 CFR 761. The TSCA regulations contain specific provisions for PCB waste, including PCB waste that contains a radioactive component. PCBs are also considered underlying hazardous constituents under RCRA and may be subject to WAC 173-303-140 and 40 CFR 268 requirements. Additional information about PCB waste generated from the D&D activities will be specified in the fieldwork packages and procedures, as necessary.

A3.7 Returned Sample Waste

Screening and analysis of both solids and liquids may be conducted at the demolition site, at laboratories on or off the Hanford Site, or at a radiological counting facility. Samples analyzed at a radiological counting facility or at Hanford Site laboratories may be returned to the original waste location or to ERDF for disposition with other CERCLA waste. Unused samples and associated waste generated at offsite laboratories will be dispositioned in accordance with contract specifications.

A3.8 Decontamination Fluids

Although CERCLA removal actions are exempt from the Hanford Site State Waste Discharge Permit (SWDP), decontamination fluids (water and/or nondangerous cleaning solutions) will be discharged if they meet the substantive provisions of the existing SWDP. If the decontamination fluids do not meet the Hanford Site SWDP, fluids generated from cleaning equipment and tools in the area of contamination may need to be contained, sampled, and (as necessary) transported or solidified for disposal at ERDF or another EPA-approved facility.

A3.9 Equipment Waste

Equipment used to support the removal action that is chemically or radiologically contaminated will be decontaminated as described in Section 2.2.2 of the main text. If the equipment cannot be decontaminated, the equipment will be disposed at ERDF or other EPA-approved facilities.

A3.10 Management of Bulk Waste

Bulk waste will be placed in ERDF cans for eventual disposal at ERDF or other EPA-approved facilities and treated as necessary to meet applicable land disposal restriction requirements and waste acceptance criteria prior to disposal. Waste will be stored in the area of contamination or at a site-specific storage area at ERDF, as appropriate. Bulk containers will be covered when waste is not being added or removed. Lightweight material (e.g., plastic and paper) will be bagged if appropriate prior to placement in the bulk container to eliminate the potential for materials blowing out of the bulk container or truck. Applicable packaging and pre-transportation requirements for dangerous or mixed waste generated by the removal action will be identified and implemented before the waste container is moved. Additionally, a fixative will be applied as needed to the demolition site and any loose soil to control dust, which may contain radiological and nonradiological contaminants.

A3.11 Management of Waste Containers

Prior to disposal, dangerous waste containers will be managed in accordance with the substantive provisions of WAC 173-303-200, "Conditions for Exemption for a Large Quantity Generator that

Accumulates Dangerous Waste," as specified in the ARARs. Waste containers, including ERDF roll-on/roll-off containers, are inspected before use to ensure container integrity. The containers will be stored inside the applicable site-specific waste container storage area or area of contamination. Containers awaiting analytical results will be marked and labeled, as appropriate. Weekly inspections of the containers will be performed to document the integrity; container marking/labeling; physical container placement; storage area boundaries/identification/warning signs; and indication of any potential leakage. Containers showing signs of deterioration will be identified and will be overpacked or repackaged, as necessary.

Spills or releases will be reported as stated in Section 4.4 of the main text. In the event of a spill or release, actions will be taken to protect human health and the environment.

A4 Waste Handling, Storage and Packaging

Marking, labeling, segregating, and staging waste containers will be performed or directed by the waste specialist. Waste containers will be shipped directly to the disposal site. In the event that waste containers need to be temporarily stored pending final disposition, they will be stored at an EPA-approved facility. Dangerous or mixed waste may also be accumulated in accordance with the substantive generator requirements of WAC 173-303-200.

Applicable packaging and transportation requirements for dangerous or mixed waste generated by the removal action will be identified and implemented before movement of waste. Before being removed from the area of contamination or site-specific waste storage area, containers and haul trucks released from radiologically controlled areas will meet exterior contamination limits. Other waste type specific handling and packaging requirements may be applicable and will be described in the contractor's work documents, as appropriate.

The building footprint area (BFA) will include the individual building/structure footprint and the surrounding area suitable to support D&D of buildings and structures and excavations. The BFA will be established as part of the work planning process. Waste management locations outside of the BFA will meet the substantive requirements of the ARARs. For waste management inside the BFA, safe and effective management practices will be established to ensure protection of human health and the environment during performance of demolition and related work.

As an alternative to management within the BFA, waste that is not immediately transported to ERDF or other EPA-approved disposal facility may be stored in staging piles. Staging piles used for management of dangerous waste will be operated in accordance with substantive provisions of standards and design criteria prescribed in 40 CFR 264.554, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," "Staging Piles," paragraphs (d) through (k) as follows:

- Staging piles will be used only as part of this removal action for temporary storage at a facility and must be located within the contiguous property where the waste to be managed in the staging piles is oriented.
- The staging pile will be designed to prevent or minimize releases of hazardous wastes and hazardous constituents into the environment and minimize or adequately control cross-media transfer. To protect human health and the environment, release prevention or minimization may include installation of berms, dust control practices, or using plastic liners or covers, as appropriate.
- The staging pile must not operate more than 2 years (measured from the first-time remediation waste is placed in the pile), except when EPA grants an operating term extension. A record of the date when

remediation waste was first placed in the staging pile must be maintained until final closeout of the site is achieved.

- Ignitable or reactive waste will not be placed in a staging pile unless it has been treated or mixed before being placed in the pile so that the waste no longer meets the definition of ignitable or reactive waste, or the waste is managed to protect it from exposure to any material or condition that may cause it to ignite.
- Incompatible wastes will not be placed in the same staging pile, unless the requirements in 40 CFR 264.17(b), "General Requirements for Ignitable, Reactive, or Incompatible Wastes," have been met. The incompatible materials will be separated, or the waste will not be piled on the same base where incompatible wastes or materials were previously piled unless the base has been decontaminated sufficiently to comply with 40 CFR 264.17(b).

Once the waste has been removed, characterization of the residual soil will be performed as appropriate to close out the staging pile. In cases where staging piles for industrial waste sites are located in an uncontaminated area, the observational approach may be used. In situations where sampling is appropriate and results indicate presence of residual contamination, efforts will be made to remove such contamination.

A4.1 Waste Profile

Waste profiling to establish values for the waste tracking form may take place concurrently with removal action activities. Field screening measurements may be used to adjust the waste tracking form. The waste profile may be adjusted as necessary through a combination of in-process field screening data and analytical laboratory analyses.

A4.2 Final Waste Disposal

Dangerous, mixed, and radioactive wastes generated through the removal action will be disposed at ERDF, which is the preferred disposal location for waste meeting the facility waste acceptance criteria (ERDF-00011) because it is engineered to meet appropriate RCRA technological requirements for landfills as described in EPA et al., 1995, *Record of Decision: U.S. DOE Hanford Environmental Restoration Disposal Facility Hanford Site Benton County, Washington*. If any waste does not meet the ERDF waste acceptance criteria, it will be transferred to an offsite disposal facility deemed suitable by the EPA regional office.

TRU/TRUM waste generated as part of this removal action will be sent to the Central Waste Complex or other EPA-approved facility. TRU/TRUM waste will be treated as necessary, certified, and disposed at WIPP.

A4.3 Waste Disposal Records

Original sample reports and a copy of the shipping papers for each waste container will be retained and forwarded to the assigned waste specialist for inclusion in the project file following final waste disposal.

A5 Waste Treatment

Treatment of waste generated from demolition activities (e.g., grouting, macroencapsulation, solidification, separation, and size reduction) will be performed, if needed. If treatment is deemed necessary to provide safe transport, such treatment may be conducted at the generating site. If treatment is deemed necessary to meet the disposal facility waste acceptance criteria and/or address land disposal restriction requirements, such treatment may be conducted at the generating site or the receiving site. Treatment will be performed at an EPA-approved facility in accordance with 40 CFR 300.400, "National Oil and Hazardous Substances Pollution Contingency Plan," "General." Residuals from waste treatment originating from the removal action can be disposed at ERDF if they meet ERDF waste acceptance criteria (ERDF-00011).

A6 Waste Minimization and Recycling

Waste minimization practices will be followed to the extent technically and economically feasible during waste management. Introducing clean materials into a contamination area as well as contaminating clean materials will be minimized to the extent practicable. Emphasis will be placed on source reduction to eliminate or minimize the volume of waste generated.

A7 Equipment

Equipment used to support the removal action that contacts dangerous and/or mixed waste will be decontaminated as described in Section 2.2.2 of the main text. If the equipment cannot be decontaminated, the equipment will be designated for disposal at ERDF or other appropriate facility.

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Appendix B

Air Monitoring Plan

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Terms

ACM	asbestos-containing material
ALARA	as low as reasonably achievable
D&D	decontamination and demolition
HEPA	high-efficiency particulate air (filter)
MEI	maximally exposed individual
NESHAP	"National Emission Standards for Hazardous Air Pollutants"
PTE	potential to emit

B1 Introduction

This air monitoring plan describes the management of air emissions from the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* non-time-critical removal action at the 224T Plutonium Concentration Facility (224T Building). The removal action includes decontamination and demolition (D&D) of the 224T Building to slab-on-grade. Federal and state applicable or relevant and appropriate requirements for air emissions are identified in Section 5.3 of DOE/RL-2004-68, *Action Memorandum for the Non-Time-Critical Removal Action for the 224-T Plutonium Concentration Facility*. Substantive requirements of these standards are applicable to the removal action, as it has the potential to emit (PTE) both radionuclides and nonradiological pollutants to the ambient air.

In accordance with U.S. Department of Energy radiation control and substantive air pollution control standards, airborne emissions associated with the removal action will be minimized through appropriate work controls to maintain Hanford Site air pollutant emissions at as low as reasonably achievable (ALARA) levels. Chapter B2 describes the radiological air emissions associated with the D&D activities, and Chapter B3 describes the nonradiological emissions. When multiple hazards are present, the most conservative requirements will be applied.

B2 Radiological Air Emissions

The state implementing regulation WAC 173-480, "Ambient Air Quality Standards and Emission Limits for Radionuclides," sets standards that are as or more stringent than the federal implementing regulation, 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants" (NESHAP), Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities," and the *Clean Air Act Amendments of 1990*. The U.S. Environmental Protection Agency partial delegation of the 40 CFR 61 authority to the State of Washington includes all substantive emissions monitoring, abatement, and reporting aspects of the federal regulation. The federal and state standards require that emissions of radionuclides to the ambient air from the Hanford Site shall not exceed amounts that would cause any member of the public to receive an effective dose equivalent of 10 mrem/yr.

The state implementing regulations address control of radioactive airborne emissions where economically and technologically feasible. To address the substantive aspect of these requirements, applicable emission control technologies (those successfully operated in similar applications) will be used when economically and technologically feasible (i.e., based on cost-benefit). Section B2.2 discusses controls that will be used as part of this removal action. WAC 246-247, "Radioactive Protection—Air Emissions," further addresses radioactive airborne emission sources by requiring monitoring of the sources. Monitoring requires physical measurement of the effluent or ambient air. The substantive provisions of WAC 246-247 that require monitoring radioactive airborne emissions would be applicable to the removal action. Radioactive airborne emissions monitoring is discussed in Section B2.3.

The removal action for the 224T Building includes D&D to slab-on-grade. The D&D activities include removing hazardous substances; removing equipment and piping; and decontamination, demolition, and backfilling belowgrade areas. Activities that could generate air emissions include removal of accessible contamination from the building and stabilization of contaminants in place so that they are less likely to be disturbed during subsequent demolition activities. The use of temporary exhausters, portable exhausters, and vacuums to support pre-demolition work in the 224T Building may be necessary. These exhausters and vacuums are described in greater detail in Sections B2.2 and B2.3.1.

Demolition activities also have the ability to generate air emissions. Demolition generally means large-scale facility destruction using heavy equipment. Demolition methods will be selected based on the structural elements to be demolished, remaining contamination, and integrity of the structure. Standard equipment will be used to support this removal action. It is assumed that demolition work may make use of high-efficiency particulate air (HEPA)-type-filtered vacuum cleaner(s), which are described in Section B2.2.

Soil excavation is not anticipated as part of this removal action. However, if significant soil contamination is present, an addendum will be added to this removal action work plan that identifies follow on actions. An air monitoring plan for the additional actions may be developed, if needed.

B2.1 Airborne Source Information

The potential exists for point source and diffuse and fugitive radionuclide emissions resulting from D&D activities at the 224T Building. The estimate assumes that the activities will be accomplished in a single year. The primary hazardous substances associated with the 224T Building are radioactive materials. Plutonium-239 and americium-241 make up the majority of the inventory, but fission products such as cesium-137, strontium-90, and cobalt-60 may also be present. The total curie content for the 224T Building is estimated at 132 Ci of alpha emitting radionuclides and 59 Ci of beta/gamma-emitting radionuclides. Additional information about the radiological inventory of the 224T Building is included in Section 1.3.2.2 of the main text.

The annual unabated PTE and total effective dose equivalent calculations for the maximally exposed individual (MEI) are based on estimated holdup in the 224T Building. Hypothetical offsite and onsite Hanford MEIs are then evaluated. The total effective dose equivalents to the MEIs are calculated using the CAP-88 PC[1] software (Version 4). The unabated PTE is estimated at 3.12E-02 mrem/yr to the offsite MEI who abides or resides in an unrestricted area off the Hanford Site. In accordance with the 2001 agreement reached between the U.S. Department of Energy, Richland Operations Office; Washington State Department of Health; and U.S. Environmental Protection Agency, the PTE for a second MEI location (termed the onsite MEI) was calculated. The onsite MEI unabated PTE is estimated at 7.80E-02 mrem/yr located at the Laser Interferometer Gravitational-Wave Observatory. The calculation parameters and the assumptions used to derive the PTE are presented and discussed in ECF-HANFORD-19-0096, *Radiological and Toxic Air Emissions for the 224T Plutonium Concentration Facility*.

B2.2 Control Methods

Both point source and diffuse and fugitive emissions may be generated from this removal action. The following subsections describe the controls for point source and diffuse and fugitive emissions.

Throughout the D&D activities, portable HEPA-filtered vacuums, portable HEPA-filtered exhausters, and various types of containments will be used, as needed. Portable exhausters are minor emission units that are easily set up for use and readily portable, being either hand carried or wheel mounted. These portable units typically exhaust within the building rather than directly to the environment. Due to the nature of the activities involving use of the HEPA-filtered air movers, measurable abated releases associated with these devices are not anticipated, and the near-facility monitoring stations described in Section B2.3.2.2 will be used to assess the effectiveness of contamination control for the activities associated with these sources. The temporary HEPA-filtered exhausters that are exhausting directly to the environment are fitted with testable HEPA abatement to meet the substantive requirement of the standards.

[1] The CAP-88 (Clean Air Act Assessment Package-1988) computer model is a set of computer programs, databases, and associated utility programs for estimation of dose and risk from radionuclide emissions to air. CAP-88 is a regulatory compliance tool under NESHAP (40 CFR 61). CAP-88 PC (Version 4.0) allows modeling on a personal computer and is a recent version of the code.

B2.2.1 Point Source Controls

There is no active ventilation system for the 224T Building; thus, the majority of radiological air emissions will be diffuse and fugitive. In addition to diffuse and fugitive emissions, point source emissions from temporary exhausters with HEPA filters may occur at various locations during decommissioning and preparation for final demolition. For individual point sources exhausting to the environment with a potential emission of greater than 0.1 mrem/yr to the MEI, tested and certified HEPA filtration would be considered as meeting best available radionuclide control technology requirements.

The need for additional in-place leak tests will be evaluated if there is reason to believe that an exhauster may have been damaged during a move or other event.

B2.2.2 Diffuse and Fugitive Controls

During decommissioning and preparation for final demolition, loose material will be confined, fixatives will be applied, and wet methods will be employed to control diffuse and fugitive emissions. Use of portable HEPA exhausters and/or HEPA vacuums exhausting within the structure to protect workers and assist in contamination control would be considered best available radionuclide control technology for minimizing diffuse and fugitive emissions from the structure during stabilization activities.

Before starting intrusive activities (such as isolating utilities and piping), removable contamination in the affected area(s) will be fixed or reduced to ALARA. Measures such as decontamination solutions, expandable foam, encasement in grout, fixatives, or glove bags will also be used to the extent practicable to help minimize the spread of contamination.

Based on analysis of the potential emissions and evaluation of available control technologies, the following active controls of diffuse and fugitive emissions have been selected for use when practicable during the demolition portion of the removal action. The radiological control and environmental organizations are responsible for selecting and ensuring appropriate controls are implemented to maintain both worker exposure and environmental releases ALARA.

- Items to be handled outside of ventilated space may be internally and externally stabilized and handled in a manner to minimize any potential release prior to being removed from ventilated space or securing ventilation.
- Water in mists or fine sprays will be applied as practicable for suppression of fugitive emissions and dust during demolition and backfilling activities when contamination is present.
- Radiological surveys (e.g., swipes/smears) will be taken of demolition equipment leaving areas where there is the potential for removable surface contamination above 2,000 dpm/100 cm^2 alpha following any demolition action. During decontamination activities, equipment, tools, and material with removable contamination above 100,000 dpm/100 cm^2 beta/gamma or 2,000 dpm/100 cm^2 alpha will be decontaminated, wrapped, or the contamination otherwise fixed by an appropriate means before being removed from a structure.
- Appropriate controls such as water, fixatives, covers, containment tents, windscreens, or other controls during cessation of work activities will be applied to the extent practicable based on conditions in the work environment (i.e., weather conditions and predicted wind speeds greater than 20 mph).
- Fixatives or cover material (e.g., soil, gravel, and plastic) will be applied to disturbed contaminated soils and debris associated with the 224T Building demolition activities at the end of the shift or any time that field activities will be inactive for more than 24 hours. Additionally, if the sustained wind

speed is predicted to be greater than 20 mph overnight based on the Hanford Meteorological Station forecast, fixative or cover material will be applied, as practicable.

- During open-air demolition, stabilized items identified as requiring special handling would be managed in a manner that minimizes disturbance of the contamination. Methods of stabilization will be implemented prior to demolition to address void space issues and eliminate the need for excessive crushing, size reduction, or other actions that could lead to potential airborne releases.
- Waste containers will remain closed except during packaging and waste inspection activities.
- Any vacuum cleaners and portable exhausters used for demolition activities will be equipped with appropriately tested HEPA filters.

The following additional controls have been selected and could be implemented as practicable to minimize diffuse and fugitive emissions further.

- Planning could occur for the special handling of stabilized items in order to minimize risk of damage during handling.
- Vacuum cleaners and/or portable exhausters used for demolition activities to provide point source or down draft contamination control will be equipped with HEPA filters. HEPA-filtered vacuums intended for use will vary in size and primarily will be small, portable units of the type like those in use on the Hanford Site, with flow capacities between 50 and 300 ft^3/min. Larger capacity units with flow rates of 2,000 ft^3/min or higher could be used. These units will be used to manage localized airborne contamination.

B2.3 Monitoring

The quantification of radioactive air emissions and air monitoring have been identified as requirements for the removal action at the 224T Building. There are two components associated with airborne emission monitoring at the 224T Building: point source monitoring and diffuse and fugitive monitoring. Point source monitoring will be used primarily during pre-demolition activities, with diffuse and fugitive monitoring occurring throughout the duration of the project.

B2.3.1 Point Source Air Monitoring

Use of temporary exhausters may be necessary to provide alternate exhaust during preparation for final demolition. The temporary exhausters will be monitored using an alternate method on a routine basis for potential radionuclide releases using a fixed head sampler with the sample head positioned to monitor the effluent stream. An evaluation will be conducted to determine the appropriate sample head location and sample flow rate prior to use of the temporary exhausters.

When one of the temporary exhaust units is in use, the associated sampler will be in operation. These exhausters may be used intermittently or continuously.

B2.3.2 Diffuse and Fugitive Air Monitoring

Diffuse and fugitive radionuclide emissions from the activities described in the removal action work plan may be monitored using near-facility air monitors or radiological control monitoring. These monitoring methods are described further in the following subsections.

B2.3.2.1 Near-Facility Air Monitors

The Near-Facility Ambient Air Program stations upwind and downwind of the 224T Building provide a second layer of monitoring. There are five existing near-facility ambient air monitoring stations upwind and downwind of the 224T Building: N161, N304, N456, N931, and N994 (Figure B-1). These stations do not provide real-time results; therefore, the data will be used as indicators of contamination control effectiveness and trended throughout the removal action. During periods of demolition and debris removal, no more than one of these five monitors will be allowed to be inoperable for more than 24 hours.

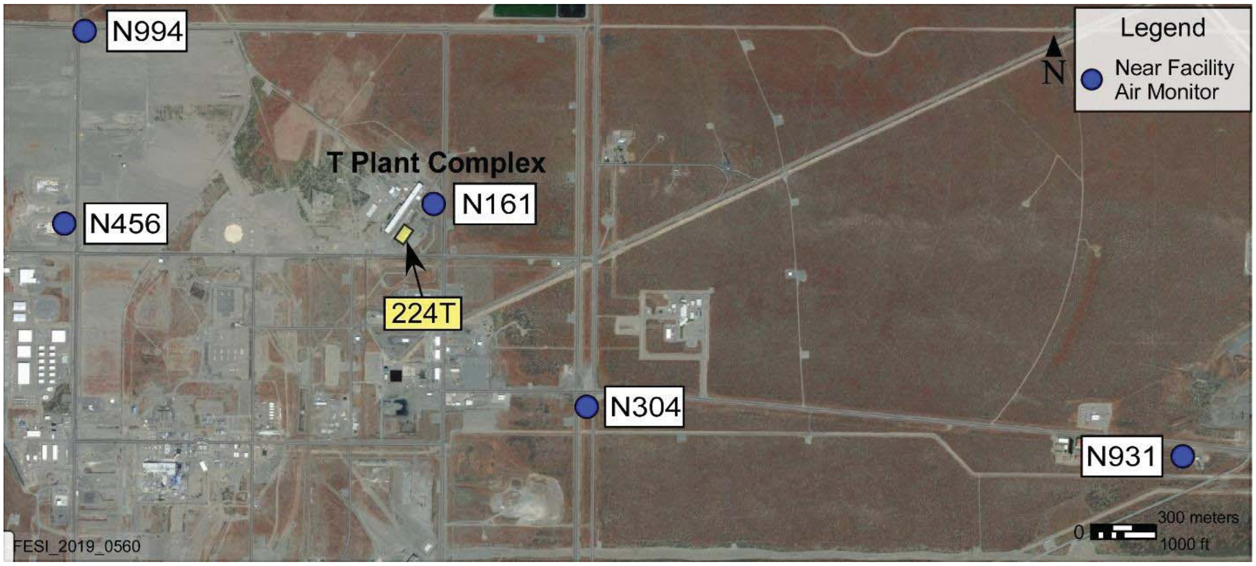

Figure B-1. 224T Near-Facility Monitoring Locations

The Hanford Site protocol established for the Near-Facility Monitoring Program ambient air stations will be followed for station repairs, retirement, data collection, sampling frequencies, sample analysis, and data reporting (DOE/RL-91-50, *Hanford Site Environmental Monitoring Plan*). The air samples will be changed every 2 weeks and analyzed for total alpha and total beta. The samples are composited semi-annually and analyzed for gamma-emitting radionuclides, strontium-90, plutonium isotopes, and uranium isotopes. The data results for these air monitors are entered into the Hanford Environmental Information System and/or the Automated Bar Coding of Air Samples at Hanford database. The data collected from air monitoring will be summarized in the annual report prepared for the Hanford Site in compliance with Subpart H of 40 CFR 61 and WAC 246-247, and that is used to demonstrate compliance with 40 CFR 61.92, “Standard.”

B2.3.2.2 Radiological Control Monitoring

Radiological control monitoring includes worksite air monitoring and radiological control monitoring, which are discussed below.

Worksite Air Monitoring. Worksite air monitoring for personnel protection and process monitoring will be the primary indicator of effectiveness of abatement and ALARA control methods during D&D activities. Worksite monitoring includes using temporary ambient air monitors (e.g., continuous air monitors with alarms, personnel samplers, ambient air samples). Worksite monitoring will be used inside the building during demolition preparation. To support demolition of the 224T Building, a worksite monitoring network will be established as directed by the radiological control organization with concurrence from the environmental organization. The monitoring network provides the primary emissions data used to ensure that the limits set in the radiological work permit are not exceeded.

Radiological Smear Surveys. Additional monitoring will be conducted during D&D activities and will consist of radiological surveys in accordance with the current radiological control manual. The surveys will serve as an indicator for effectiveness of controls based on gross residual contamination levels. Both alpha and beta/gamma surveys will be performed.

HEPA-filtered exhausters and vacuums will be used to manage localized airborne contamination. To verify control, a contamination survey of the outlet of the device will be performed at the completion of use (or daily, in the case of multiple day use). Using one of these devices has no specific contamination limit but will be controlled based on the specifics of the situation to ensure that the PTE from each unit does not exceed the minor source criterion. If a vacuum is to be used in areas of contamination levels over 2,000 dpm alpha/100 cm^2 (i.e., high surface contamination area), a separate evaluation regarding emissions measurement will be conducted.

B3 Nonradiological Air Emissions

The primary source of emissions resulting from the removal action will be fugitive particulate matter. In accordance with the substantive requirements of WAC 173-400-040(3) and (8), "General Regulations for Air Pollution Sources," "General Standards for Maximum Emissions," reasonable precautions will be taken to prevent the release of air contaminants associated with fugitive emissions due to demolition, materials handling, or other operations and prevent fugitive dust from becoming airborne from fugitive emission sources.

Toxic air requirements associated with asbestos-containing materials (ACM) at the 224T Building will be addressed in a separate NESHAP asbestos inspection by an *Asbestos Hazard Emergency Response Act of 1986*-certified building inspector. Controls for asbestos are described in Section B3.2.

B3.1 Airborne Source Information

The chemical contaminants present in the 224T Building are identified in Table B-1. The process tanks, chemical scale tanks, and pipes were rinsed, flushed, and drained during past decontamination and deactivation activities. During the last entry in 2002, 11 ft of water was discovered in the 19 ft deep sump pit in C Cell; otherwise, only minimal dried residuals remain in the process equipment.

Table B-1. Chemical Contaminants of Concern

<table>
<tr><th>Contaminants</th><th>Corrosives</th></tr>
<tr><td>Anions (bromide, fluoride, nitrate, nitrite, phosphate, and sulfate) [a]</td><td rowspan="9">Acids and caustics including:
• Ammonium sulfate, $(NH_4)_2SO_4$
• Ammonium nitrate, NH_4NO_3
• Bismuth phosphate, $BiPO_4$
• Chromium nitrate, $Cr(NO_3)_3$
• Hydrofluoric acid, HF
• Lanthanum fluoride, LaF_3
• Lanthanum hydroxide, $La(OH)_3$
• Magnesium oxide, MgO
• Magnesium nitrate, $Mg(NO_3)_2$
• Manganese nitrate, $Mn(NO_3)_2$
• Nitric acid, HNO_3
• Oxalic acid, $C_2H_2O_4$
• Phosphoric acid, H_3PO_4
• Plutonium nitrate, $Pu(NO_3)_4$ [a]
• Potassium fluoride, KF
• Potassium hydroxide, KOH
• Potassium nitrate, KNO_3
• Potassium permanganate, $KMnO_4$
• Sodium bismuthate, $NaBiO_3$
• Sodium dichromate, $Na_2Cr_2O_7$
• Sodium hydroxide, NaOH
• Sodium nitrate, $NaNO_3$
• Sulfuric acid, H_2SO_4</td></tr>
<tr><td>Asbestos fibers</td></tr>
<tr><td>Beryllium [a]</td></tr>
<tr><td>Lubricants/oils [a]</td></tr>
<tr><td>Metals (arsenic, barium, cadmium, chromium, lead, mercury, niobium [b], nickel, and silver)</td></tr>
<tr><td>Polychlorinated biphenyls</td></tr>
<tr><td>Total inorganic carbon [c]</td></tr>
<tr><td>Total organic carbon [a,c]</td></tr>
<tr><td>Total organic halides [a]</td></tr>
</table>

Reference: Tables 1-15 and 1-16 in HNF-19646, *Data Quality Objectives Summary Report for the 224-T Plutonium Concentration Facility*.

a. Contaminant added to list in HNF-19646 based on additional document reviews.

b. Niobium will not be analyzed for as the concentration can be calculated from cobalt-60 results.

c. Replaces carbon as a contaminant.

The contaminants in Table B-1 were compared to WAC 173-460-150, "Controls for New Sources of Toxic Air Pollutants," "Table of ASIL, SQER and de Minimis Emission Values," to determine if they were regulated. Because only minimal dried residuals remain in the process equipment and the process equipment will not be handled in a manner to create emissions, no emission in excess of the de minimis emissions values is anticipated. ECF-HANFORD-19-0096, provides additional details on the nonradiological air emissions for D&D activities at the 224T Building.

Operating trucks and other diesel-powered equipment during the removal activities would be expected in the short term to introduce quantities of sulfur dioxide, nitrogen dioxide, particulates, and other pollutants to the atmosphere, typical of similar sized construction projects. These releases would not be expected to exceed air quality standards. Dust generated during removal activities would be minimized by applying water or other dust control measures (e.g., fixatives). Vehicular and equipment emissions will be mitigated in compliance with the substantive standards for air quality protection that apply to the Hanford Site. These techniques are considered reasonable precautions to control fugitive emissions as required by the substantive requirements of air emissions ARARs.

B3.2 Control Methods

Based on the analysis of the potential emissions and analysis of available control technologies, the following controls have been selected for use during the removal action.

- Water will be applied as needed during any excavation, backfilling, or recontouring activities to spray for suppression of fugitive emissions, including dust.
- Fixatives will be applied to structural materials, debris and equipment, and contaminated soil as needed to minimize airborne contamination during the removal action activities for fugitive emissions

and dust. Fixative application techniques may include spraying fogging, brushing on, pouring, or some other method, as necessary. Fixatives will be applied according to the manufacturer's instructions.

- Fixatives or cover material (e.g., soil and gravel) will be applied to disturbed contaminated soils when field activities will be inactive more than 24 hours.
- Fixatives will not be applied in the following scenarios:
  - If the contaminated items are frozen or it is raining, snowing, or other frozen precipitation is falling
  - If a fixative has already been applied and the fixed contamination item will remain undisturbed
- Field activities will be temporarily ceased and the area placed in a safe configuration if airborne contamination control methods are not expected to be adequate based on site conditions (e.g., excessive wind). Additionally, fixative will be applied to the demolition site and debris piles as needed to help control dust and radiological and nonradiological contaminants.

During the demolition of areas where Category I and Category II ACM are encountered, the project will control emissions in the following ways:

- Wet methods will be used on ACM items during removal.
- The demolition activity will only use methods that minimize breaking, crushing, pulverizing, or reducing to powder suspect ACM during removal with heavy equipment.
- Cutting and grinding of suspect ACM will not be allowed.
- Operators will be directed to remove suspect ACM in as large of pieces as possible.
- Suspect ACM will be lowered to the ground, not dropped.
- Suspect ACM will be segregated from other waste to the extent possible. Comingled ACM and non-ACM waste materials will be treated as ACM.
- ACM will be managed in accordance with the substantive requirements of NESHAP and the U.S. Department of Transportation.
- ACM will be kept adequately wet at all times after demolition and during handling and loading for transport to the disposal site. This ACM will be transported and disposed in bulk following applicable site procedures.

If unanticipated new sources of airborne pollutants are encountered, the potential for emissions will be reviewed, and appropriate controls and monitoring if needed will be implemented, as required.

B4 References

40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," *Code of Federal Regulations*. Available at: https://www.govinfo.gov/content/pkg/CFR-2019-title40-vol10/pdf/CFR-2019-title40-vol10-part61.pdf.

Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities" (61.90–61.97).

61.92, "Standard."

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WAC 173-460-150, "Controls for New Sources of Toxic Air Pollutants," "Table of ASIL, SQER and de Minimis Emission Values," *Washington Administrative Code*, Olympia, Washington. Available at: https://apps.leg.wa.gov/WAC/default.aspx?cite=173-460-150.

WAC 173-480, "Ambient Air Quality Standards and Emission Limits for Radionuclides," *Washington Administrative Code*, Olympia, Washington. Available at: https://apps.leg.wa.gov/WAC/default.aspx?cite=173-480.

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DOE/RL-2019-37
Draft A

Sampling and Analysis Plan for the 224T Plutonium Concentration Facility

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

U.S. DEPARTMENT OF ENERGY | Richland Operations Office

P.O. Box 550
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Draft A

Sampling and Analysis Plan for the 224T Plutonium Concentration Facility

Date Published
June 2020

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

U.S. DEPARTMENT OF ENERGY | Richland Operations Office

P.O. Box 550
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APPROVED
By Lynn M. Ayers at 1:48 pm, Jul 01, 2020

Release Approval   Date

Signature Page

Title: *Sampling and Analysis Plan for the 224T Plutonium Concentration Facility*

U.S. Department of Energy, Richland Operations Office	Signature	Date
U.S. Environmental Protection Agency	Signature	Date

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Executive Summary

This sampling and analysis plan (SAP) provides information and instructions for conducting the sampling and analysis activities at the 224T Plutonium Concentration Building (224T Building) as authorized by DOE/RL-2004-68.[1] The SAP consists of three main parts: data quality objectives, quality assurance project plan (QAPjP), and field sampling plan.

Data quality objectives (discussed in Chapter 1) describe the planning approach for defining the design criteria for data obtained through sampling and analysis, visual inspection, and direct-reading radiological surveys.

The QAPjP (Chapter 2) presents the objectives, functional activities, methods, and quality assurance/quality control procedures associated with sample collection, laboratory analyses, visual inspection, and radiological surveys. The QAPjP follows the guidelines contained in EPA/240/B-01/003.[2]

The field sampling plan (Chapter 3) provides the strategy for sample collection, laboratory analyses, visual inspections, and radiological surveys during characterization activities at the 224T Building. Data collection from sampling, process knowledge, and/or existing characterization will be used to identify contamination, internal components, and the wastes resulting from removal activities. Data collection will also support preparation of the waste profile summaries to determine appropriate waste disposition in accordance with ERDF-00011,[3] and/or waste acceptance criteria for other receiving facilities.

Waste management and health and safety controls during sampling are addressed in Chapters 4 and 5, respectively.

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[1] DOE/RL-2004-68, 2004, *Action Memorandum for the Non-Time-Critical Removal Action for the 224-T Plutonium Concentration Facility,* Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/DA428391.

[2] EPA/240/B-01/003, 2001, *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5, Office of Environmental Information, U.S. Environmental Protection Agency, Washington, D.C. Available at: https://www.epa.gov/sites/production/files/2016-06/documents/r5-final_0.pdf.

[3] ERDF-00011, 2018, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, Rev. 1, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-01205.

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Contents

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Terms

ACM	asbestos-containing material
ALARA	as low as reasonably achievable
AM	action memorandum
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COC	contaminant of concern
CWC	Central Waste Complex
D&D	decontamination and demolition
DOE	U.S. Department of Energy
DOECAP-AP	U.S. Department of Energy Consolidated Audit Accreditation Program
DOE-RL	U.S. Department of Energy, Richland Operations Office
DOT	U.S. Department of Transportation
DQA	data quality assessment
DQI	data quality indicator
DQO	data quality objective
DS	decision statement
DUP	laboratory sample duplicate
EB	equipment blank
ECO	environmental compliance officer
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FSO	Field Sample Operations
FSP	field sampling plan
FTB	full trip blank
FWS	field work supervisor
FXR	field transfer blank
HASQARD	*Hanford Analytical Services Quality Assurance Requirements Document*
HEIS	Hanford Environmental Information System

HEPA	high-efficiency particulate air (filter)
HVAC	heating, ventilation, and air conditioning
IATA	International Air Transport Association
IDLH	immediately dangerous to life or health
LCS	laboratory control sample
LRA	lead regulatory agency
MB	method blank
MS	matrix spike
MSD	matrix spike duplicate
NDA	nondestructive assay
NTCRA	non-time-critical removal action
QA	quality assurance
QAPjP	quality assurance project plan
QC	quality control
RAWP	removal action work plan
RCRA	*Resource Conservation and Recovery Act of 1976*
RCT	radiological control technician
S&M	surveillance and maintenance
SAP	sampling and analysis plan
SMR	Sample Management and Reporting
SPLIT	field split
SUR	surrogate
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TRU	transuranic
TRUM	transuranic mixed
TRUSAF	Transuranic Waste Storage and Assay Facility
VOC	volatile organic compound

1 Introduction

This sampling and analysis plan (SAP) supports the non-time-critical removal action (NTCRA) at the 224T Plutonium Concentration Facility (hereinafter called the 224T Building) located within the T Plant Complex in the 200 West Area of the Hanford Site (Figure 1-1).

Figure 1-1. 224T Building Within the T Plant Complex

1.1 Project Scope and Objective

The sampling activities in this SAP provide support for the removal activities documented in DOE/RL-2019-36, *Removal Action Work Plan for the 224T Plutonium Concentration Facility*, and are considered part of the removal action work plan (RAWP). This removal action consists of decontamination and demolition (D&D) of the 224T Building to slab-on-grade (excluding the building foundation and underlying soils/structures). This removal action will reduce the threat to human health and the environment. It involves removing the nonradiological and radiological hazardous substances from the building, removing equipment and associated piping, decontaminating the structure and/or stabilizing contamination, demolishing the structure to slab, disposing of the waste, and stabilizing the area. Implementation of this removal action will minimize the potential for a release or threat of release of hazardous substances from the 224T Building to human health and the environment and support the final remedial action for the T Plant Complex. The waste generated during the removal action may include radiologically and/or chemically contaminated equipment, demolition debris, and soil. Equipment includes pumps, pipes, tanks, containers, compressors, ductwork, and electrical components. Demolition debris includes wood, metal, roofing, siding, gypsum, and concrete. If identified, contaminated soil will be sampled or may be excavated, as determined by the U.S. Department of Energy, Richland Operations Office (DOE-RL) Removal Action Manager.

The objectives of this SAP are to provide characterization necessary for the safe removal of radiologically and/or chemically contaminated equipment and demolition debris, compliant disposal of the removed materials, and preparation for the future remedial action. These objectives were identified using the data quality objective (DQO) process discussed in Section 1.3.

The strategy presented in this SAP will help to obtain additional characterization information that will be used for the following purposes:

- Identify the controls necessary to protect workers performing removal activities.
- Support removal activity planning (i.e., work sequencing).
- Assist with waste management decisions.
- Develop waste profiles for waste disposed to the Hanford Site Environmental Restoration Disposal Facility (ERDF) or other approved and appropriate treatment/disposal facilities, if needed.
- Provide information about post-demolition conditions and support future remedial actions.
- Provide additional data on subsurface soil under and surrounding the 224T Building.

1.2 Background

Constructed in 1944, the 224T Building was used to purify and concentrate plutonium solution that was produced in the first major step of the plutonium recovery process conducted at the 221T Separations Facility (T Plant). The concentrated plutonium nitrate solution was shipped from 224T to the 231Z Isolation Building in the 200 West Area for final purification and solidification. The resulting plutonium product was then sent offsite. Plutonium concentration operations at 224T were performed from January 1945 to early 1956, when 221T was retired from active service as a chemical processing facility. The 224T Building was modified in 1975 to meet the requirements for storing plutonium-bearing wastes. In 1985, the building became the 224T Transuranic Waste Storage and Assay Facility (TRUSAF) and operated in that capacity until the late 1990s.

DOE-RL determined that a *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) removal action was warranted to mitigate the potential risk to human health and the environment presented by the inactive and degrading 224T Building. DOE-RL was delegated with the authority to conduct removal actions under CERCLA Section 104, "Response Authorities," by Executive Order 12580, *Superfund Implementation*. Under change package J-15-01, the lead regulatory agency (LRA) was switched from the Washington State Department of Ecology (Ecology) to the U.S. Environmental Protection Agency (EPA) for this NTCRA.

The removal action alternatives were identified, evaluated, and recommended in DOE/RL-2003-62, *Engineering Evaluation/Cost Analysis for the 224-T Plutonium Concentration Facility*. DOE/RL-2004-68, *Action Memorandum for the Non-Time-Critical Removal Action for the 224-T Plutonium Concentration Facility* (hereinafter called the 224T action memorandum [AM]), documents the selected alternative and provides authorization for the NTCRA. The alternative selected is Alternative 3: Decontamination and Demolition (to grade, excluding building foundation and underlying soils/structures). DOE/RL-2019-36, *Removal Action Work Plan for the 224T Plutonium Concentration Facility* (hereinafter called the 224T RAWP), was prepared to provide guidance for the various removal activities. Sampling will be performed as needed to support work planning, perform proper waste disposal, and provide as-left conditions to support a future remedial action.

During generation of the 224T AM (DOE/RL-2004-68), DOE-RL and Ecology agreed that collection of soil samples beneath and surrounding the 224T slab was warranted to provide information to support a future site remediation. This data collection is identified in the 224T AM and included in this SAP.

1.2.1 Facility Description

The 224T Building is a three-story reinforced concrete structure that originally contained 21 rooms and 5 process cells plus a large operating gallery located on the third floor. A sixth process cell was constructed in 1950 to increase production. The building is 197 by 60 ft and is divided along its length by a concrete wall into two main sections: a cold side to the northwest and a process side to the southeast sealed off from the cold side.

CP-14641, *Documented Safety Analysis for the 224-T Facility* (hereinafter referred to as the documented safety analysis), states that the 224T Building was upgraded in 1975 to provide tornado resistance and seismic resistance. The modifications were as follows:

- Steel beams were attached horizontally to the original reinforced concrete walls and supported at column lines to withstand high wind negative pressure transient.
- Shields were built over the exterior ventilation openings to protect the containers stored in the building from tornado-generated missiles.
- Vertical, concrete buttresses were installed, six on the northeast side and five on the southeast side.
- Block walls were replaced with reinforced concrete.

In addition to the alterations listed above, WHC-SD-WM-ES-288, *224-T TRUSAF Building Upgrade*, notes additional upgrades. The cell access doors and viewing windows between the operating gallery and the hot cells were removed and filled with concrete. Minor upgrades were also performed on the electrical and service utilities and the heating, ventilation, and air conditioning (HVAC) system, which included the following:

- Isolating the 224T TRUSAF original exhaust system from the 221T Building
- Sealing of the interconnecting pipe tunnel
- Replacing a significant portion of the asbestos cement ducting with new metal ducting
- Installing a new ventilation system with high-efficiency particulate air (HEPA) filters and turbine fans.

In addition to drains and building connections, the cold and the process cell sides of 224T are described in the following sections.

1.2.1.1 Cold Side

The first floor of the cold side of the 224T Building contains offices, a restroom, mechanical room, and a loadout area (Figure 1-2). The mechanical room housed air supply equipment and motor control centers for the process equipment. The loadout area is located on the west side of the building and contains a loadout (also known as process) hood. There is a stainless-steel tank located inside of the loadout hood (F-10). A large roll-up door was installed in a wall adjacent to the loadout area. The floors were sealed with an epoxy sealant in 1989.

The east end of the second floor was a pipe gallery for Cells A through E (Figure 1-3). Chemical, steam and water pipes, air lines, and electrical conduit pass through the concrete wall from the pipe gallery to Cells A through E. In the pipe gallery, there is a sample room for Cells A through E that doubles as an airlock. These sample rooms lead to an operating platform in each of the cells (except for C Cell). The operating platforms are shielded by partial height concrete walls. During modifications in the 1970s, the sample rooms were sealed with concrete.

The west end of the second floor contains an operating gallery for F Cell, which includes control panels and viewing windows. Pumps and aqueous makeup tanks that were originally installed in the F Cell operating gallery have since been removed. The piping into the cell has been blanked on the gallery side of the metal partitioning wall that isolates the cell.

The third floor was an operating gallery for Cells A through E (Figure 1-4) that contained aqueous makeup tanks, scales, pumps, and control panels for the five cells. There were observational windows with shielded covers that could be moved aside to see into Cells A through E. Equipment was removed and windows were sealed with concrete during modifications in the 1970s. An elevator on the north side of the operating gallery serves all three floors.

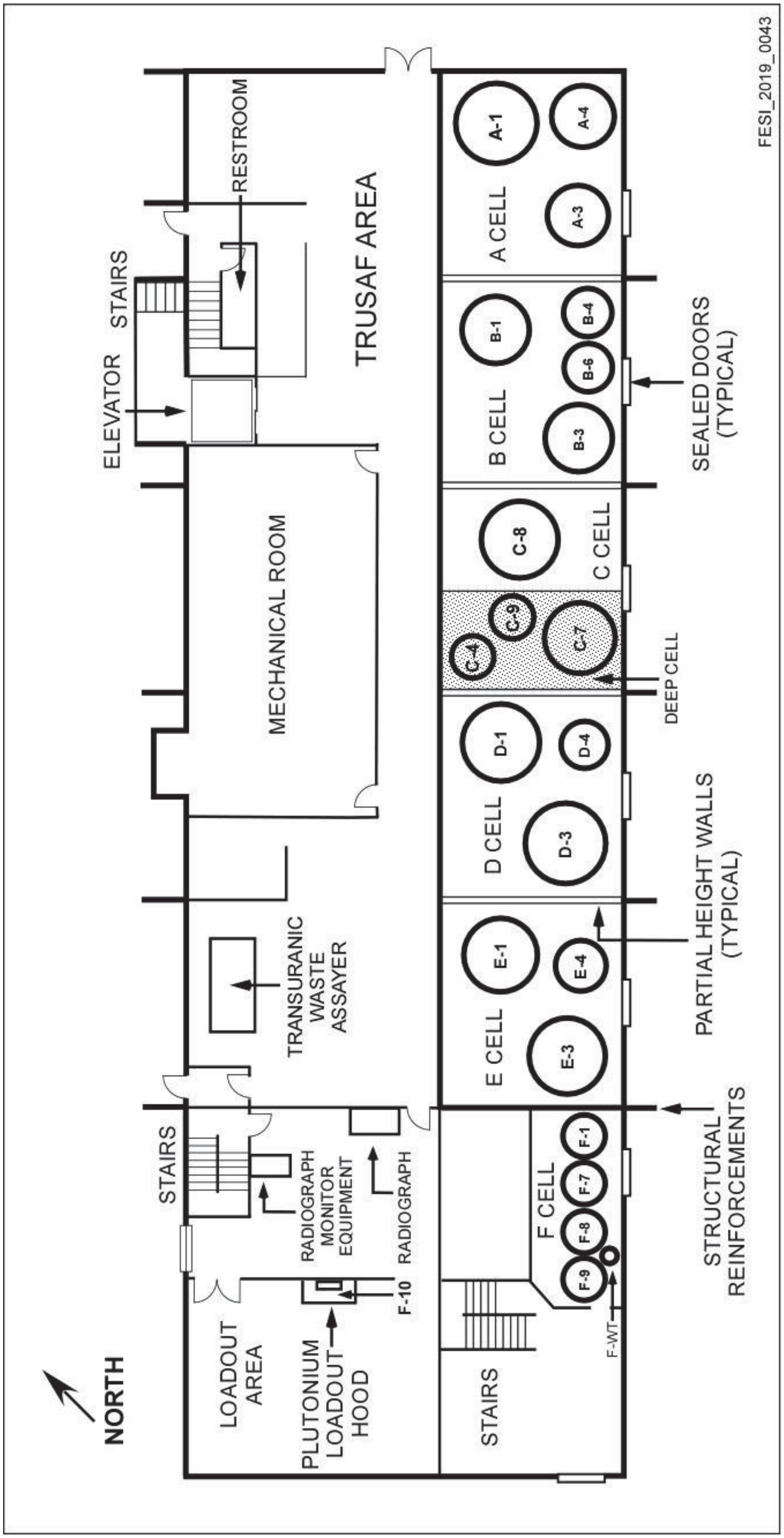

Figure 1-2. 224T Building–First Floor Plan View

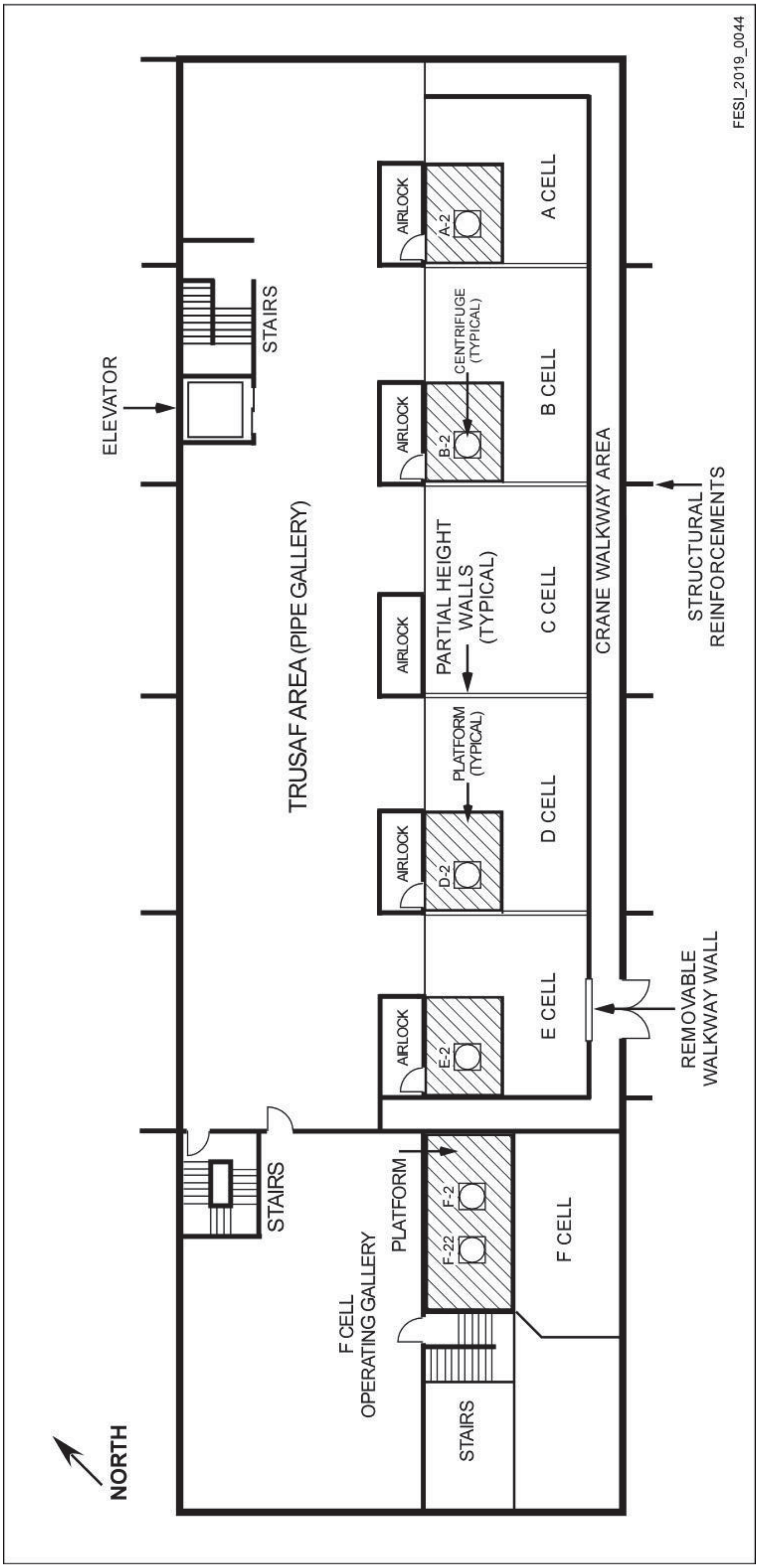

Figure 1-3. 224T Building–Second Floor Plan View

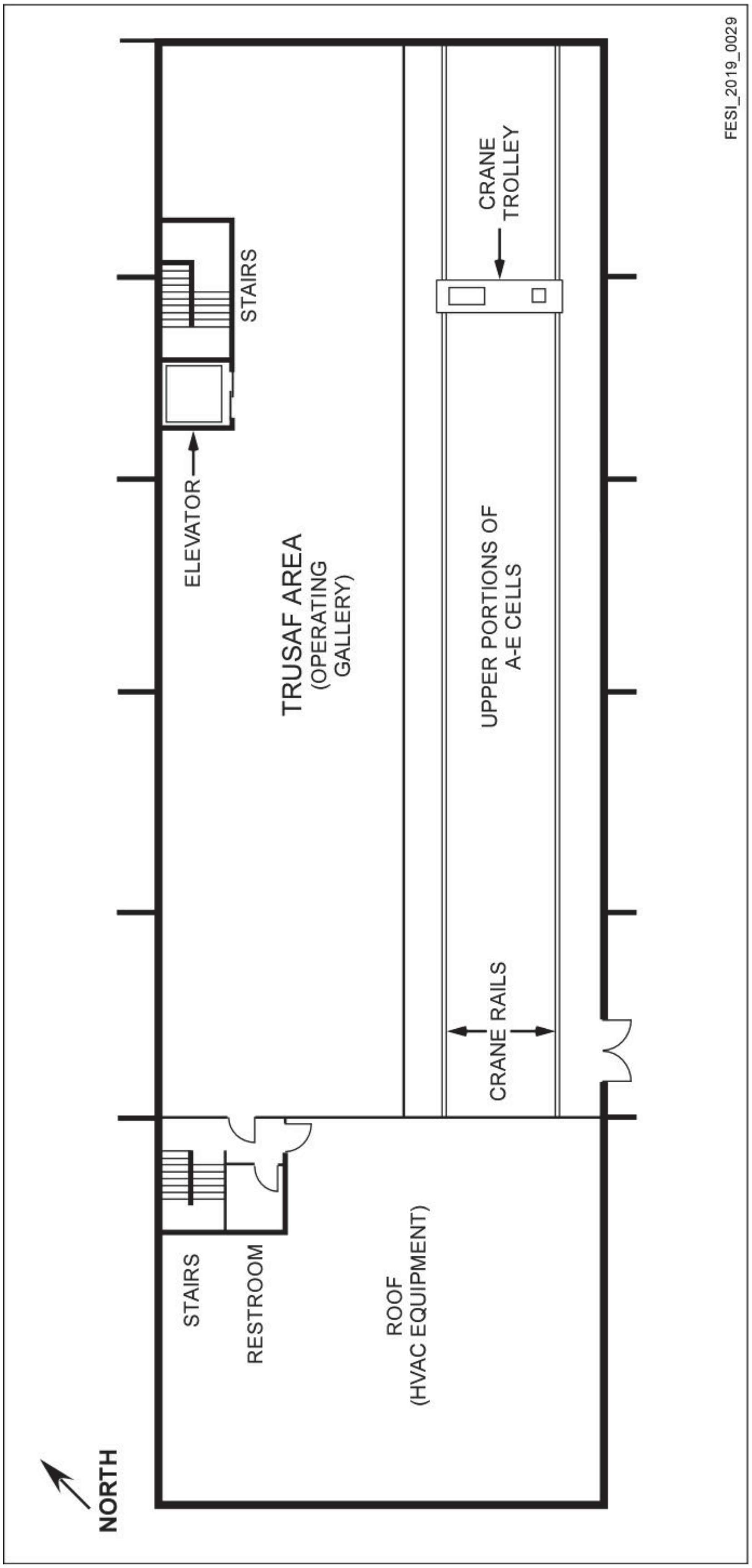

Figure 1-4. 224T Building–Third Floor Plan View

1.2.1.2 Process Cell Side

The processing portion of the building, also known as the canyon, consists of six cells, A through F (Figures 1-2 and 1-3). Five of the cells, A through E, are three stories high and are separated by concrete walls that do not run all the way to the ceiling. Each of these five cells is approximately 25 by 28 ft. A Cell was used to perform the bismuth phosphate byproduct precipitation process during the crossover step that allowed for further purification and concentration of the product by switching from a bismuth phosphate to a lanthanum fluoride carrier. B Cell is a spare cell used to augment operations in A or D Cell. D Cell was used for the lanthanum fluoride byproduct step, and E Cell for the subsequent lanthanum fluoride product cake precipitation that was transferred to a holdup tank in F Cell where the metathesis and solution steps of the concentration process took place.

Cells A, B, D, and E are similar in equipment and configuration. Each cell has three tanks on the first floor; B Cell has an additional tank, and some of the tanks are equipped with agitators and motors. Cells A, B, D, and E also have an operating platform on the second floor. Access to the platforms is through the sample rooms in the second floor pipe gallery. A centrifuge is located on each of the operating platforms of Cells A, B, D, and E.

C Cell differs from the other cells in structure and arrangement. Approximately half of the cell is below the first floor and consists of a 19 ft deep pit. There are four vessels in the cell, three of which are located in the deep pit. A pipe tunnel extends 34 ft from the deep cell beneath the first-floor cold side rooms to an underground pipe trench that starts at the 224T Building boundary to 221T. The pipes within the trench were used for transferring solutions between 221T and 224T.

In addition to access to the cells via the operating platforms, there is a first-floor personnel access door into each of the six cells from outside. The original wooden doors were replaced with aluminum doors with neoprene gaskets to minimize air infiltration. There is also a crane trolley equipment access door in the top portion of the outside wall of E Cell.

A manually operated 8-ton bridge crane is installed over the cells. The rails run the length of Cells A through E. The bridge crane could be aligned with a rail that passes through the equipment access door, allowing movement of equipment into and out of the building. The crane was operated from a walkway that extends around the outsides of the second floor cells. A 6 ft high wall shields the walkway from the cells. There are access doors to the walkway at both ends of the pipe gallery. The crane has been deactivated.

F Cell is 24.5 by 25 by 25 ft and is separated from the other cells by a concrete wall. Modifications completed in the 1970s reduced F Cell to approximately 50% of its original size with the installation of steel barrier walls. The only connection between F Cell and the other cells is process and waste piping that run between all of the cells. One quarter of F Cell is a centrifuge platform that houses two centrifuges and a sampling station. There are five vessels on the first floor.

1.2.1.3 Drains and Building Connections

Figure 1-5 shows the drains and pipeline connections to the 224T Building and are described below.

Feed and Process Waste Lines. Feed lines from 221T Cells 17 and 19 run through an underground encasement into the C Cell pit to Tank C-4. A process waste line exits C Cell from Tank C-8 to a settling tank. This line was isolated and blanked outside of C Cell. The service and aqueous makeup piping enters the building at the east end. The aqueous makeup chemicals (originating from 271T) and steam piping enters the building through overhead lines. Supplied makeup chemicals and steam are no longer in service, and steam is isolated and blanked.

Cell Drains. An internal cell drainage system collected liquids from the operating platforms and floor drains in Cells A, B, D, and E. A gutter along the base of the northeast wall in A Cell to E Cell drained to a 6 in. clay pipe laid below the cell floors. Floor washings from F Cell were collected in Tank F-8, assayed for product, and sent to Tank C-9. The cell drainage system collected waste water in Tank C-9 in the deep pit portion of C Cell. Because there are no active pumps to transfer liquids, accumulated liquids could overflow the 9 ft high tank and collect in the pit. Cell drainage system has not been isolated.

Cooling Water Sewer. Low-risk cooling water and condensate from the process cell vessel jackets were collected and discharged to the 221T cooling water sewer. The cooling water drain lines in each cell connect to a header laid parallel to the southeast wall of the 224T Building. Past the east end of the facility, the pipeline turns northwest and runs to 221T, where it connects to the low risk cooling water sewer that has been deactivated.

Chemical Sewer. The chemical sewer pipe for higher activity waste conveyed chemical waste from drains in the office and gallery areas of the 224T Building to the chemical sewer adjacent to 221T. The pipeline also received waste from the 291T stack area and 222T Building. The pipeline is routed around the southwest end of 221T and drains into the 221T chemical sewer. The 224T Building was isolated from the chemical sewer system.

T Plant Transfer Lines. Two underground plutonium feed lines are routed out the southeastern side of 221T from process Cell 36 under the northwestern side of 224T Building and terminate in Tank C-4 inside C Cell. An additional pipeline in the underground trench runs from Tank C-8 inside C Cell to 221T Cell 36.

Sanitary Sewer. The building’s sanitary sewer system (i.e., toilets, sinks, and showers) drains to a sanitary sewer line that runs between the 224T and 221T Buildings. This line eventually reaches a sanitary field on the northwest side of 221T.

Sanitary Water. Sanitary water to the 224T Building is supplied via a 4 in. underground line coming off an 8 in. main line. A separate 6 in. line off the same main line supplies water for the fire suppression system. Both have been isolated through cutting and capping.

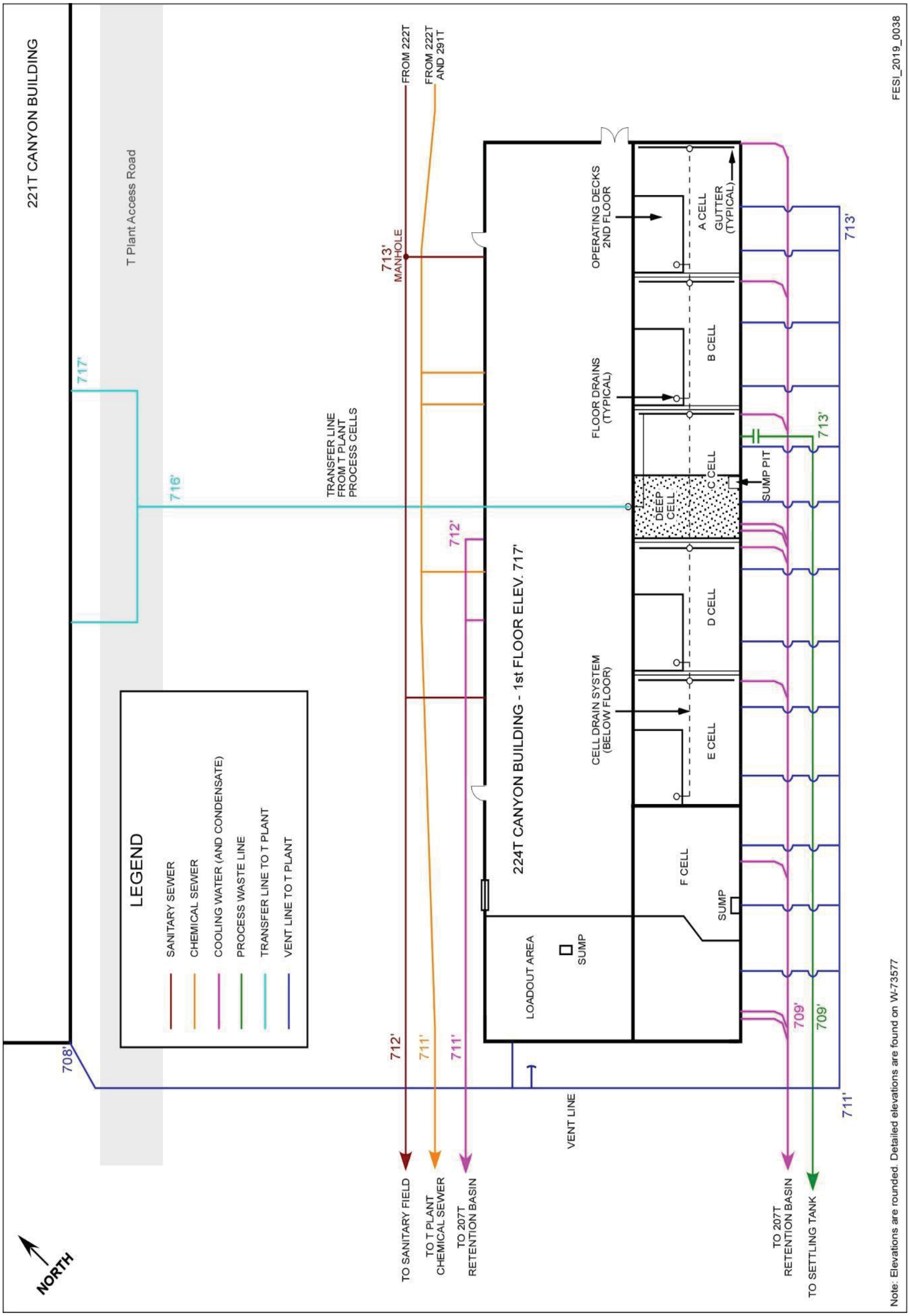

Figure 1-5. 224T Building–Drains and Building Connections

Ventilation System. Originally, the 221T main exhaust system provided ventilation to the 224T tanks and centrifuges with the vacuum created by the 291T fans. Air in-leakage provided the supply air to the process cells. Stainless steel subheaders connected to the tanks and centrifuges inside the cells exit the southwest side of the building abovegrade. The stainless steel headers are directed down and transition to a 6 in. clay pipe below ground level. The clay pipes connect to a 24 in. clay main header belowgrade. The 24 in. line connects to the 221T main exhaust tunnel at the west end of the 221T Building. In areas where the original soil cover was less than 4 ft or greater than 7 ft deep, the clay pipe was protected by a reinforced concrete encasement. The ventilation system was modified when 224T was converted to a storage facility. All ventilation penetrations between the cells and storage area were sealed to prevent the migration of contamination from the cells into the TRUSAF area, including isolation of the 224T TRUSAF exhaust system from 221T, sealing of the interconnecting process pipe tunnel, replacement of a significant portion of the asbestos cement ducting with new metal ducting, and installation of the new ventilation system with HEPA filters and turbine fans on the roof above F Cell with two stacks that exhaust horizontally to the southwest that have been capped. The 224T Building exhaust ventilation system is not in service.

Fire Alarm and Suppression System. The fire alarm and suppression systems in 224T have been deactivated. Because the facility is no longer occupied and entered only for surveillance and maintenance (S&M), the portable fire extinguishers have been removed from the building. Water to the 224T Building has been isolated. There are three fire hydrants within 300 ft of the facility that can be used for firefighting.

Electrical Utilities. Normal electrical power is supplied by a 13.8 kV three-phase line from the 251W substation that is reduced from 13.8 kV to a 480 V three-phase system and a 240/120 V single-phase system. The electrical power system is still active.

1.2.1.4 Deactivation

The 221T Complex became unnecessary in the mid-1950s following production rate increases at REDOX and PUREX. The 224T Building ceased its concentration process mission in early 1956. Documentation on the shutdown of the building is not available, but monthly reports indicate that the 221T Facility was placed into a layaway status with steam and water disconnected. Chemical and process lines were drained, flushed, and blanked. Similar actions were taken at the 224T Building as concluded by assessments in the late 1990s (HNF-19646, *Data Quality Objective Report for the 224-T Plutonium Concentration Facility*).

1.2.1.5 Post-Deactivation Use

The 224T Building remained in shutdown mode before being modified in 1975 to meet the requirements for storing plutonium-bearing wastes. The structural modifications are detailed in Section 1.2.1. The cells in the process areas were sealed and isolated from the operating gallery and services areas of the building, and the gallery and service areas were stripped of all unnecessary control equipment. Panel boards and partitions were removed to provide storage space on three floors. The first and second floor storage areas were used for containers or cans of plutonium nitrate solution, and the third floor storage area consisted of storage racks for lard cans containing dry scrap.

In 1984, the U.S. Department of Energy (DOE) designated the three operating gallery levels of the building for storage and assaying of retrieved and newly generated transuranic (TRU) wastes. The 224T Building was designated as a *Resource Conservation and Recovery Act of 1976* (RCRA) treatment, storage, and/or disposal container storage unit known as the 224T TRUSAF, which began storing TRU and TRU mixed wastes from DOE offsite and onsite generators. Administrative waste processing in TRUSAF included inspection of containers and associated documentation, examination with real-time radiography system to confirm the absence of prohibited items, and neutron assay of the waste containers to confirm fissile isotope content. The TRUSAF operations ended in the late 1990s, and the dangerous waste inventory was removed in August 1997. TRUSAF was certified as clean closed in 2008 (09-EMD-0013, "Resource Conservation and Recovery Act [RCRA] Closure Certification for the 224-T Transuranic Waste Storage and Assay Facility [TSD#: S-2-2]").

After deactivation, the building was limited to annual S&M activities.

1.2.2 Current Facility Conditions

This section identifies the current condition of the 224T Building, including radiological, chemical, and structural hazards. General conditions are discussed first, followed by specific equipment.

1.2.2.1 General Conditions

The primary hazardous substances associated with the 224T Building are radionuclides. Plutonium-239 and americium-241 make up the majority of the inventory, but fission products such as cesium-137, strontium-90, and cobalt-60 may also be present. Minor radiological contaminants include technetium-99, uranium-238, neptunium-237, and europium-152/154/155. Small amounts of tritium may be present in exit signs. A radiological characterization was performed in 2002 to support decontamination and decommissioning activities. The results of this effort are provided in the documented safety analysis (CP-14641) and provide a bounding inventory for plutonium and americium using the 2002 results decayed to 2009 included in Table 1-1.

Table 1-1. Bounding 224T Building Inventory (g) – 2009

Isotopes	A Cell	B Cell	C Cell[a]	D Cell	E Cell	F Cell[b]	F10	Total
Pu-238	1.89E-03	2.97E-03	1.81E-03	1.99E-04	8.73E-04	4.51E-03	2.08E-03	**1.43E-02**
Pu-239	9.37E+00	1.46E+01	8.96E+00	9.88E-01	4.30E+00	2.22E+01	1.03E+01	**7.08E+01**
Pu-240	6.12E-01	9.56E-01	5.85E-01	6.45E-02	2.81E-01	1.45E+00	6.73E-01	**4.63E+00**
Pu-241	2.42E-02	3.84E-02	2.27E-02	2.52E-03	1.13E-02	5.84E-02	2.61E-02	**1.84E-01**
Pu-242	3.01E-03	4.69E-03	2.88E-03	3.17E-04	1.38E-03	7.14E-03	3.30E-03	**2.27E-02**
Total Pu	**1.00E+01**	**1.56E+01**	**9.57E+00**	**1.06E+00**	**4.59E+00**	**2.37E+01**	**1.10E+01**	**7.56E+01**
Am-241	7.76E-01	2.49E+00	1.36E-01	8.42E-02	7.49E-01	3.80E+00	3.39E-01	**8.37E+00**
Total Pu and Am	**1.08E+01**	**1.81E+01**	**9.71E+00**	**1.14E+00**	**5.35E+00**	**2.75E+01**	**1.13E+01**	**8.40E+01**

Reference: Table C-6 in CP-14641, *Documented Safety Analysis for the 224-T Facility*.
a. Includes estimated inventory for submerged tanks.
b. Not including F10.

The cold side of the 224T Building is entered annually for S&M. The process cells and sample rooms are posted as airborne radioactivity, high contamination, high radiation areas and are not entered.

Hazardous materials (e.g., unmarked drums) were removed from the process cells and operating platforms during the previous entry in 1985 prior to isolation from TRUSAF. All stored waste from the gallery areas were removed upon TRUSAF completion in the late 1990s. Hazards identified in the 224T Building during annual surveillances from 2008 to 2018 include concrete spalling, air duct rusted through, peeling paint, water and animal intrusions, and miscellaneous materials (e.g., wood, boxes, tumbleweeds). In addition, there is spalling concrete present on the upper north end of the 224T west wall. The crack was evaluated for operability in 2014, and it was determined that it did not affect the confinement function of the wall. A large amount of dust has accumulated in the building since processing was halted.

The 224T process cells were last entered in 2002 for characterization. As documented in HNF-7640, *CSER 01-001: Remote Entry into Six Process Cells in 224-T Building for Characterization*, C Cell was discovered to have 11 ft (35,000 gal) of water in the 19-ft deep sump pit presumed to be a result of accumulated rain and snowmelt leakage from the roof. After the 221T engineering documentation and cell inventory notes were examined, it was determined highly unlikely that the pipe trench connecting to 221T cells was the water source. The water was sampled and calculated to contain 0.001 g of plutonium (HNF-7640). Approximately 1 in. of silt is estimated in the bottom of the 25 by 13.5 ft pit. Samples were taken from C Cell silt solids, combined, centrifuged, and dried solids were measured for alpha activity. The silt in the pit was calculated to contain 2.4 g of plutonium (HNF-7640). In 2003, 13,000 gal of water were removed.

There are three submerged tanks (Tank C-07, Tank C-04, and Tank C-09) in the Cell C sump pit in accumulated water at the time of the nondestructive assay (NDA) survey.. No data was obtained for these tanks. A conservative estimate of their plutonium content was obtained by taking the largest measured plutonium value for tanks of the same general size as the submerged tanks. Similarly, the americium content of each submerged tank was conservatively estimated.

During annual S&M inspections, signs of water damage and leaks through the roof, walls, and on the floors were observed. One recurring leak involved the second floor pipe penetrations adjacent to the exhauster fans that were part of the modifications made to the building in the 1970s. This leak had been repeatedly sealed with caulking material and covered with gravel. The 224T Building roof, which had an expected life span of 15 to 20 years, was inspected every 5 years following re-roofing in 1990.

Asbestos is present in the 224T Building. Asbestos-containing material (ACM) includes piping and vessel insulation, sheetrock, transite wallboard, floor tiles, and ceiling panels. Polychlorinated biphenyls (PCBs) are also present as they were common in building materials at the time of construction (e.g., oils, paints, and fluorescent light ballasts).

1.2.2.2 Equipment Conditions

Operations ceased at 224T in 1956, and no further processing was performed at the facility. Operational reports from late 1956 and early 1957 indicate that the process was shut down normally, and that process equipment and lines were flushed and drained. As part of preparation for RCRA closure and D&D planned in the late 1990s, an assessment of the status of the tanks and lines in the building was performed, which concluded that although documentation of tank and line draining and flushing did not exist, personnel accounts stated that these activities took place, and all external visual indications were that there were no liquids present in the equipment.

Besides radionuclide contamination, residual amounts of process chemicals, acids, and caustics may remain in the facility. Although the equipment and lines may have been flushed, the remaining inventory of radionuclides and process chemicals has not been well established. The preferred alternative for the disposition of the facility is to remove equipment and materials from the building and demolish the structure to a slab-on-grade condition.

The following details for each process tank are in Table 1-2:

- Tank capacity and dimensions
- Expected chemicals based on operational function and deactivation procedures

- Process function (process tanks only)
- Expected condition of tank

Information for the table was obtained from HNF-19646 and HW-23043, *Flow Sheets and Flow Diagrams of Precipitation Separations Process.*

Table 1-2. 224T Building Process Equipment Details

Vessel Number	Capacity and Dimensions*	Chemicals	Process Function	Expected Condition
A-1	4,280 gal 9×9 ft	Nitric acid, phosphoric acid, bismuth phosphate, sodium dichromate	Initial bismuth phosphate precipitation	Empty, drained with trace residuals
A-2	N/A		Centrifuge used to separate liquid from solids from initial bismuth phosphate precipitation	Empty, drained with trace residuals
A-3	4,280 gal 9×9 ft	Nitric acid, phosphoric acid, sodium dichromate	Received product solution from centrifuge	Empty, drained with trace residuals
A-4	833 gal 4.5×7 ft	Bismuth phosphate, nitric acid	Received effluent solution from centrifuge	Empty, drained with trace residuals
B-1	4,280 gal 9×9 ft	Nitric acid, phosphoric acid, sodium nitrate, potassium nitrate, chromium nitrate, hydrofluoric acid, lanthanum fluoride, oxalic acid, manganese nitrate, ammonium nitrate, sulfuric acid, ammonium sulfate	Second and third lanthanum precipitation steps	Empty, drained with trace residuals
B-2	N/A		Centrifuge used to separate liquid from solids for second and third lanthanum precipitation steps	Empty, drained with trace residuals
B-3	4,280 gal 9×9 ft	Nitric acid, phosphoric acid, sodium nitrate, potassium nitrate, chromium nitrate, hydrofluoric acid, oxalic acid, manganese nitrate, ammonium nitrate, sulfuric acid, ammonium sulfate	Received effluent solution from centrifuge	Empty, drained with trace residuals
B-4	833 gal 4.5×7 ft	Lanthanum hydroxide, potassium hydroxide, potassium fluoride	Received product solution from centrifuge	Empty, drained with trace residuals
B-6				
C-4	833 gal 4.5×7 ft	Bismuth phosphate, nitric acid, sodium bismuthate, sodium dichromate	Received feed from 221T and performed oxidation step	Empty, drained with trace residuals
C-7	4,280 gal 9×9 ft	Ammonium nitrate, ammonium sulfate, bismuth phosphate, chromium nitrate, hydrofluoric acid, lanthanum hydroxide, lanthanum fluoride, manganese nitrate, manganese oxide, nitric acid, oxalic acid, phosphoric acid, potassium fluoride, potassium hydroxide, potassium nitrate, sodium nitrate, sulfuric acid	Overflow tank for C-8	Empty, drained with trace residuals
C-8			Tank that received waste from other cells, neutralized and shipped waste to disposal	Empty, drained with trace residuals
C-9	833 gal 4.5×7 ft		Waste receiver tank (wastes rerouted from Tank C-8)	Empty, drained with trace residuals
D-1	4,280 gal 9×9 ft	Nitric acid, phosphoric acid, sodium dichromate, potassium permanganate, hydrofluoric acid, lanthanum fluoride, ammonium nitrate, potassium nitrate, sulfuric acid, ammonium sulfate	First lanthanum precipitation and crossover step, recycle from E-4 added here	Empty, drained with trace residuals
D-2	N/A		Centrifuge used to separate liquid from solids from first lanthanum precipitation step	Empty, drained with trace residuals

Table 1-2. 224T Building Process Equipment Details

Vessel Number	Capacity and Dimensions*	Chemicals	Process Function	Expected Condition
D-3	4,280 gal 9×9 ft	Nitric acid, phosphoric acid, sodium dichromate, potassium permanganate, hydrofluoric acid, ammonium nitrate, potassium nitrate, sulfuric acid, ammonium sulfate	Received product solution from centrifuge	Empty, drained with trace residuals
D-4	833 gal 4.5×7 ft	Lanthanum fluoride, nitric acid, hydrofluoric acid, manganese oxide,	Received effluent solution from centrifuge	Empty, drained with trace residuals
E-1	4,280 gal 9×9 ft	Nitric acid, phosphoric acid, sodium nitrate, potassium nitrate, chromium nitrate, hydrofluoric acid, lanthanum fluoride, oxalic acid, manganese nitrate, ammonium nitrate, sulfuric acid, ammonium sulfate	Second and third lanthanum precipitation steps	Empty, drained with trace residuals
E-2	N/A		Centrifuge used to separate liquid from solids for second and third lanthanum precipitation step	Empty, drained with trace residuals
E-3	4,280 gal 9×9 ft	Nitric acid, phosphoric acid, sodium nitrate, potassium nitrate, chromium nitrate, hydrofluoric acid, oxalic acid, manganese nitrate, ammonium nitrate, sulfuric acid, ammonium sulfate	Received effluent solution from centrifuge	Empty, drained with trace residuals
E-4	833 gal 4.5×7 ft	Potassium nitrate, sulfuric acid, ammonium sulfate	Received recycle solution from 231Z	Empty, drained with trace residuals
F-1	470 gal 4×5 ft	Lanthanum hydroxide, potassium hydroxide, potassium fluoride	Metathesis step to concentrate product	Empty, drained with trace residuals
F-2	N/A		Centrifuges used to separate liquid from solids for metathesis step	Empty, drained with trace residuals
F-22				
F-7	470 gal 4×5 ft	Lanthanum hydroxide, potassium hydroxide, potassium fluoride, ammonium nitrate	Received effluent from metathesis step, also used for rework solutions	Empty, drained with trace residuals
F-8		Potassium hydroxide, potassium fluoride, ammonium nitrate	Received effluent from metathesis step	Empty, drained with trace residuals
F-9				
F-10	20 gal 4 in.×3 ft×2.67 ft	Lanthanum nitrate, nitric acid, potassium nitrate, plutonium nitrate	Received product from metathesis step, loadout tank for final product concentrated plutonium solution	Empty, drained with trace residuals
F-WT (special tank)	75 gal Dimensions N/A	Lanthanum nitrate, nitric acid, potassium nitrate, plutonium nitrate	Believed to have received product from metathesis step	Empty, drained with trace residuals
Misc tank	N/A	Unknown	Appears to be a process tank removed from the process and left on the mezzanine	Empty, drained with trace residuals

Reference: Section 1.6.2 in HNF-19646, *Data Quality Objectives Summary Report for the 224-T Plutonium Concentration Facility*.

*Dimensions are given as diameter by height, unless noted.

N/A = not applicable

1.3 Data Quality Objectives Summary

The DQO process is a strategic planning approach used to define the data collection design criteria to ensure that the type, quantity, and quality of data are appropriate for the intended application. The DQO process to support this removal action was conducted in 2004 and documented in HNF-19646 to establish the data needs and define the sampling and analysis requirements to characterize facility and waste materials generated during the D&D of the 224T Building. This DQO report was reviewed during the preparation of this SAP. The DQO process results support the removal action and are summarized in this SAP with any changes from HNF-19646 identified.

1.3.1 Statement of the Problem

The problem statement from the DQO report (HNF-19646) is as follows:

> The volume and concentrations of chemicals and radionuclides are not well defined but are needed to allow execution of the preferred alternative for facility disposition.

Waste streams anticipated to be generated during the removal activities were identified during Step 1 of the DQO process (Table 1-3). These waste streams may fall into any combination of the following categories: nondangerous/nonradioactive, TRU, transuranic mixed (TRUM), radioactive, mixed, hazardous, dangerous, suspect TRU, suspect radioactive, suspect dangerous, and suspect mixed waste.

Table 1-3. Waste Streams

Number	Waste Stream	Media
1	Process equipment	Process vessels, equipment, and piping in A through F Cells
2	Liquid residuals	Miscellaneous aqueous liquid residuals identified in system pumps, sumps, tanks, piping, drains, and processing equipment
3	Solids, sediments, and residuals	Miscellaneous solids, sediments, and residuals identified in system pumps, sumps, tanks, piping, and processing equipment
4	Bulk demolition debris	Bulk demolition debris includes but is not limited to the following: • Poured concrete • Concrete block • Sheetrock • Wooden doors • Non-asbestos-containing roofing materials • Pumps and miscellaneous equipment • Steel siding • Ventilation system components • Dried paints
5	Asbestos-containing material	Asbestos in pipe insulation, cement wall board, floor tiles, valve gaskets, and roofing materials
6	Incandescent light fixtures	Lead-based bulbs
7	Florescent light fixtures	Light ballasts containing polychlorinated biphenyls and light bulbs containing mercury
8	Lead packing material	Lead packing in bell and spigot piping in galleries
9	Lead shielding	Lead bricks and blankets used for shielding
10	Mercury switches and instrumentation	Switches and instrumentation containing mercury
11	Emergency light batteries	Lead-acid batteries
12	Exit signs and smoke detectors	Internal radioactive sources

Table 1-3. Waste Streams

Number	Waste Stream	Media
13	Lubrication, grease, oil, and hydraulic oils (includes door actuators and transformer oil)	Nonaqueous liquids, residues from metallic parts and chemicals used as additives
14	HEPA filters	Filter media
15	Step off pad soft waste	Personal protective equipment, garments, rags, tape, plastic, and gloves
16	Subsurface soil below building slab and adjacent to building	Contaminated soils
17	Water in C Cell pit	Contaminated water

Reference: Table 1-11 in HNF-19646, *Data Quality Objectives Summary Report for the 224-T Plutonium Concentration Facility*.

Note: Waste stream for "RCRA closure samples from concrete" was not included in this table as it was completed as part of the TSD unit closure after the 224T DQO was written.

DQO = data quality objective
HEPA = high-efficiency particulate air
RCRA = *Resource Conservation and Recovery Act of 1976*
TSD = treatment, storage, and disposal

1.3.2 Decision Statements

Table 1-4 presents the decision statements (DSs) that must be addressed for final disposition and disposal of waste associated with the removal activities. These DSs are the result of Step 2 of the DQO process. While the DSs focus on waste stream characterization for proper and compliant disposal, data collected will also be used to support worker safety, to aid selection of D&D methods, and to provide a better understanding of the subsurface conditions.

Table 1-4. Decision Statements

Number	Decision Statement
1	Determine if the radionuclides present in the waste material exceed the disposal facility's waste acceptance criteria.
2	Determine if the chemical and/or physical properties of the waste material exceed the disposal facility's waste acceptance criteria limits.
3	Determine if the waste material is regulated as listed dangerous waste.
4	Determine if the characteristic dangerous waste codes (e.g., corrosivity, ignitability, reactivity, and toxicity) apply to the waste material.
5	Determine if the waste material meets the definition of a toxic dangerous waste in accordance with Washington State criteria.
6	Determine if the waste material meets the definition of a persistent dangerous waste in accordance with Washington State criteria.
7	Determine if the waste material is regulated due to polychlorinated biphenyl concentrations.
8	Determine if the waste material is regulated due to asbestos content.
9	Determine if land disposal restrictions impose treatment for waste material.
10	Determine if the affected media meets the recycling requirements.

Reference: Table 2-1 in HNF-19646, *Data Quality Objectives Summary Report for the 224-T Plutonium Concentration Facility*.

It is anticipated that some of the waste will be TRU/TRUM and will be shipped to the Hanford Site Central Waste Complex (CWC) for staging, pending final disposal at the Waste Isolation Pilot Plant near Carlsbad, New Mexico. Nonradiologically contaminated chemical waste (i.e., dangerous waste) may be sent off the Hanford Site to an approved RCRA treatment, storage, and disposal unit for treatment and possible disposal. The remainder of the waste will be disposed at ERDF or an EPA-approved disposal facility. If disposed at a location other than ERDF, the waste will be characterized and packaged in accordance with the receiving facility waste acceptance criteria and staged at CWC pending shipment.

1.3.3 Decision Rules

The decision rules are based on inputs from Steps 2 through 5 of the DQO process. Decision inputs such as engineering calculations, isotopic evaluations, analytical methods and parameters, and action levels provide the information needed to make decisions. Decision rules are the mechanism for implementing the DSs. The decision rules are discussed in Chapter 5 of the DQO report (HNF-19646).

A sampling design (based on professional judgment) and worst-case sampling will be used to determine the maximum levels of radiological and chemical contamination. The parameter of interest will be a single maximum analytical value for every constituent in each waste stream that will be compared with the waste acceptance criteria decision levels.

The concentration or action levels for disposal/recycling/reuse options are described in Tables 5-1 through 5-5 of the DQO report (HNF-19646). Action levels have changed in some instances since the DQO report was issued in 2004. The current action levels will be used to determine the disposal/recycling/reuse option. The change in action levels do not affect the results reached by the DQO process.

1.3.4 Select Type of Sample Design

Based on information developed in Step 6 of the DQO process, characterization of the waste streams (Table 1-3) does not require statistically based sampling as it deals with individual waste components. The potential consequences for waste disposed at ERDF are generally acknowledged to have a low degree of severity because the matrix will reside in an engineered facility remote from human population centers; in addition, the waste is retrievable if necessary (HNF-19646). Thus, a focused sampling design is suited for obtaining waste characterization information for all of the waste streams identified as needing additional data for final disposition. Discrete samples will be collected from selected areas to determine the upper-bounding level of each contaminant of interest.

1.3.5 Design Summary

The sampling and analysis design developed in Step 7 of the DQO process is based on information from previous DQO steps. The field sampling plan (FSP) in Chapter 3 further identifies the sampling design.

1.3.5.1 Focused Sampling Design

A focused sampling design is suited to provide waste characterization information that will meet the DSs for all of the waste streams identified in this project. The sample design will incorporate historical information, process knowledge, and facility inspections, together with radiation surveys and discrete samples of selected waste materials, to determine the upper-bounding level of each contaminant of concern (COC) in each waste stream (HNF-19646).

1.3.5.2 Specific Media Sampling

As needed, discrete samples of specific media will be collected from biased locations from those waste streams that have been identified as needing additional sampling/analytical data for final disposition. The laboratory data will be used to confirm contamination levels in each of the materials and establish the waste profile. This sampling and analysis process will occur prior to and during facility demolition (HNF-19646).

1.4 Contaminants of Concern

Table 1-5 includes the final radionuclide and chemical COCs for the 224T Building for which laboratory analysis may be conducted in accordance with Table 3-1, as appropriate. The list of COCs was based on process knowledge, historical analytical data, and agreement by the original DQO team (HNF-19646).

Table 1-5. Radionuclide and Chemical Contaminants of Concern

Radionuclides		
Americium-241	Gross alpha and gross beta[a]	Technetium-99
Cesium-137	Neptunium-237	Tritium
Cobalt-60	Plutonium-238/239/240/241/242[b]	Uranium-238
Europium-150/152/154/155[c]	Strontium-90	Yttrium-90[d]
Chemicals		
Anions (bromide, fluoride, nitrate, nitrite, phosphate, and sulfate)[a]	Corrosives (acids and caustics):[e], including:	
	Ammonium sulfate, $(NH_4)_2SO_4$	Phosphoric acid, H_3PO_4
Asbestos fibers	Ammonium nitrate, NH_4NO_3	Plutonium nitrate, $Pu(NO_3)_4$[a]
Beryllium[a,f]	Bismuth phosphate, $BiPO_4$	Potassium fluoride, KF
Lubricants/oils[a]	Chromium nitrate, $Cr(NO_3)_3$	Potassium hydroxide, KOH
Metals (arsenic, barium, cadmium, chromium, lead, mercury, niobium[d], nickel, and silver)	Hydrofluoric acid, HF	Potassium nitrate, KNO_3
	Lanthanum fluoride, LaF_3	Potassium permanganate, $KMnO_4$
	Lanthanum hydroxide, $La(OH)_3$	Sodium bismuthate, $NaBiO_3$
Polychlorinated biphenyls	Magnesium oxide, MgO	Sodium dichromate, $Na_2Cr_2O_7$
Total inorganic carbon[g]	Magnesium nitrate, $Mg(NO_3)_2$	Sodium hydroxide, NaOH
Total organic carbon[a,g]	Manganese nitrate, $Mn(NO_3)_2$	Sodium nitrate, $NaNO_3$
Total organic halides[a]	Nitric acid, HNO_3	Sulfuric acid, H_2SO_4
	Oxalic acid, $C_2H_2O_4$	

Reference: Tables 1-8, 1-16, and 1-17 in HNF-19646, *Data Quality Objectives Summary Report for the 224-T Facility*.

a. Contaminant added to list in HNF-19646 based on additional document reviews.

b. Plutonium-241/242 will not be analyzed for as their concentrations can be calculated from nondestructive assay data and plutonium isotopic ratios from smears and samples on material and equipment.

c. Europium-150 will not be analyzed for as it is not listed in current analytical laboratory contracts.

d. Yttrium-90 and niobium will not be analyzed as the concentration can be calculated from strontium-90 and cobalt-60 results, respectively.

e. The chemicals listed in this table were identified in HNF-19646, with the specific constituents to be analyzed in Tables 2-3, 2-4, and 2-5.

f. In 2010, 224T was categorized as a beryllium cleared facility. Beryllium is listed as a contaminant of concern from the potential for beryllium-containing components due to building similarities with 224B.

g. Replaces carbon as a contaminant.

1.5 Project Schedule

No milestones currently exist for completion of this removal action. Removal activities for the 224T Building are planned to begin in the near term (2020-2021) and are expected to commence following issuance of the 224T RAWP (DOE/RL-2019-36) and this SAP.

2 Quality Assurance Project Plan

A Quality Assurance Project Plan (QAPjP) establishes the quality requirements for environmental data collection. It includes planning, implementation, and assessment of sampling tasks, field measurements, laboratory analysis, and data review. This chapter describes the applicable environmental data collection requirements and controls based on the quality assurance (QA) elements found in EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5), and DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Document* (hereinafter called HASQARD). DoD/DOE, 2019, *Department of Defense (DoD) Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories*, is also discussed. Section 7.8 of the *Hanford Federal Facility Agreement and Consent Order Action Plan* (Ecology et al., 1989b; hereinafter called the Tri-Party Agreement Action Plan) requires the QA/quality control (QC) and sampling and analysis activities to specify the QA requirements for Past-Practice Processes. This QAPjP also describes applicable requirements and controls based on guidance in Ecology Publication No. 04-03-030, *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies*, and EPA/240/R-02/009, *Guidance for Quality Assurance Project Plans* (EPA QA/G-5). This QAPjP supplements the contractor's environmental QA program plan.

The QAPjP references are included in Chapter 6. This QAPjP includes the following sections that describe the quality requirements and controls applicable to Hanford Site removal action sampling activities:

- Section 2.1, "Project Management"
- Section 2.2, "Data Generation and Acquisition"
- Section 2.3, "Assessment and Oversight"
- Section 2.4, "Data Review and Usability"

2.1 Project Management

This section includes project goals, planned management approaches, and planned output documentation.

2.1.1 Project/Task Organization

DOE-RL is the lead agency for the removal action presented in this SAP. Implementation of the SAP is performed via direction from DOE-RL to a contractor, or its approved subcontractor, who is responsible for planning, coordinating, collecting, preparing, packaging, and shipping samples to the laboratory. For sampling and characterization, the project organization is described in the following sections and is shown graphically in Figure 2-1.

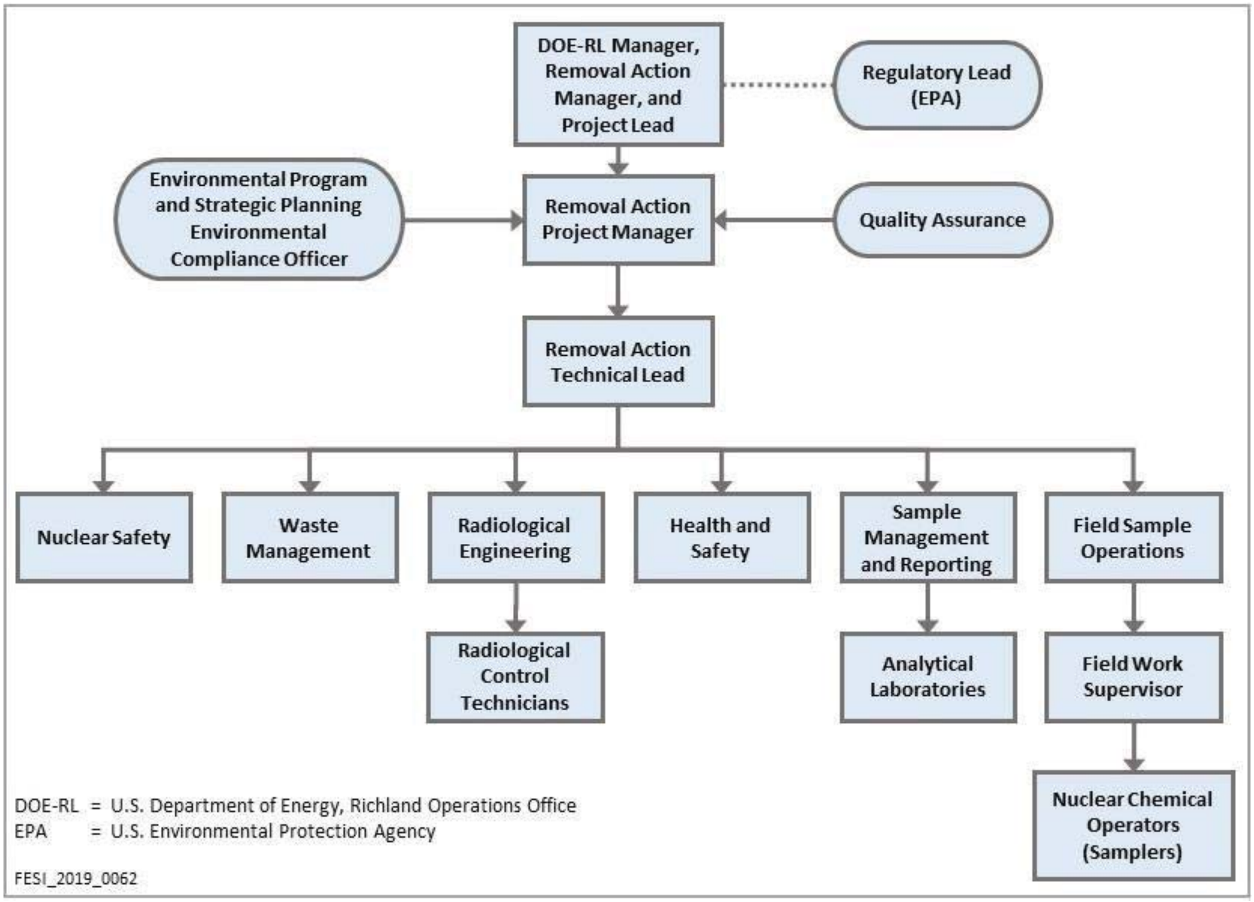

Figure 2-1. Project Organization

2.1.1.1 Regulatory Lead

The LRA for the removal action is EPA. The LRA is responsible for regulatory oversight of cleanup projects and activities. EPA retains approval authority for all SAPs. EPA works with DOE-RL to resolve concerns over the work described in this SAP in accordance with the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement; Ecology et al., 1989a). The LRA is responsible, along with the DOE-RL Removal Action Manager, for approval of the SAP authorizing field sampling activities.

2.1.1.2 DOE-RL Manager

Hanford Site cleanup in the removal action for the 224T Building is the responsibility of DOE-RL. The DOE-RL Manager is responsible for authorizing the contractor to perform activities described within this SAP at the Hanford Site under CERCLA, RCRA, *Atomic Energy Act of 1954*, and the Tri-Party Agreement (Ecology et al., 1989a).

2.1.1.3 DOE-RL Removal Action Manager

The DOE-RL Removal Action Manager is responsible and accountable for the overall management of the removal action and coordinates with the regulators. The DOE-RL Removal Action Manager is also responsible, along with EPA, for approval of the SAP authorizing field sampling activities.

2.1.1.4 DOE-RL Project Lead

The DOE-RL Project Lead is responsible for providing oversight of the contractor's performance of the work scope, working with the contractor to identify and work through issues, and providing technical input to the DOE-RL Removal Action Manager. The DOE-RL Project Lead is also responsible for obtaining EPA approval of the SAP authorizing field sampling activities.

2.1.1.5 Removal Action Project Manager

The contractor Removal Action Project Manager is responsible and accountable for project-related activities and coordinates with DOE-RL and contractor management in support of sampling activities to ensure that work is performed in a safe, compliant, and cost effective manner. The Removal Action Project Manager is also responsible for the following tasks:

- Managing sampling documents and requirements, field activities, and subcontracted tasks, and ensuring that the project file is properly maintained.
- Ensuring that the project personnel are working to the current version of the SAP.
- Ensuring that the field sampling instructions comply with the sampling design requirement as specified in this SAP.
- Ensuring that appropriate support organizations (Environmental, QA, Sample Management and Reporting [SMR], Nuclear Safety, Waste Management, Radiological Operation, Health and Safety, and Operations) are involved in planning, approving, and implementing the work scope.
- Maintaining a list of key project team member names, their roles and responsibilities, and their respective organizations.

2.1.1.6 Removal Action Technical Lead

The contractor Removal Action Technical Lead is responsible for developing specific sampling designs, analytical requirements, and QC requirements either independently or as defined through a systematic planning process. The Removal Action Technical Lead ensures that sampling and analysis activities as delegated by the Removal Action Project Manager are carried out in accordance with the SAP and works closely with the Environmental Compliance Officer (ECO), QA, Health and Safety, the Field Work Supervisor (FWS), and the SMR group to integrate these and other technical disciplines in planning and implementing the work scope.

2.1.1.7 Sample Management and Reporting

The SMR group oversees offsite analytical laboratories, coordinates laboratory analytical work to ensure that laboratories conform to the requirements of this plan and verifies that laboratories are qualified for performing Hanford Site analytical work. The SMR group generates field sampling documents, labels, and instructions for field sampling personnel and develops the sample authorization form, which provides information and instruction to the analytical laboratories. The SMR group ensures that field sampling documents are revised to reflect approved changes. The SMR group receives analytical data from the laboratories, ensures the data are appropriately reviewed, performs data entry into the Hanford Environmental Information System (HEIS) database, and arranges for data validation and recordkeeping. The SMR group is responsible for resolving sample documentation deficiencies or issues associated with Field Sample Operations (FSO), laboratories, or other entities. The SMR group is responsible for informing the Removal Action Project Manager of any issues reported by the analytical laboratories.

2.1.1.8 Field Sampling Operations

FSO is responsible for planning and coordinating field sampling resources. The FWS directs the nuclear chemical operators (samplers), who collect samples in accordance with this sampling plan and corresponding standard methods and work packages. The FWS ensures that deviations from field sampling documents or issues encountered in the field are documented appropriately (e.g., in the field logbook). The FWS ensures that samplers are appropriately trained and available. Samplers collect samples in accordance with sampling requirements. Samplers also complete field logbooks, data forms, and chain-of-custody forms (including any shipping paperwork) and enable delivery of the samples to the analytical laboratory.

Pre-job briefings are conducted by FSO in accordance with work management and work release requirements to evaluate activities and associated hazards by considering the following factors:

- Objective of the activities
- Individual tasks to be performed
- Hazards associated with the planned tasks
- Controls applied to mitigate the hazards
- Environment in which the job will be performed
- Facility where the job will be performed
- Equipment and material required

2.1.1.9 Quality Assurance

The QA point of contact provides independent oversight and is responsible for addressing QA issues on the project, overseeing implementation of the project QA requirements. Responsibilities include reviewing project documents (including the QAPjP) and participating in QA assessments on sample collection and analysis activities, as appropriate.

2.1.1.10 Environmental Compliance Officer

The ECO provides technical oversight, direction, and acceptance of project and subcontracted environmental work and develops appropriate mitigation measures with the goal of minimizing adverse environmental impacts.

2.1.1.11 Health and Safety

The Health and Safety organization is responsible for coordinating industrial safety and health support within the project as carried out through health and safety plans, job hazard analyses, and other pertinent safety documents required by federal regulation or internal primary contractor work requirements.

2.1.1.12 Radiological Engineering

Radiological Engineering is responsible for the following:

- Radiological engineering and project health physics support
- Conducting as low as reasonably achievable (ALARA) reviews, exposure and release modeling, and radiological controls optimization
- Identifying radiological hazards and ensuring appropriate controls are implemented to maintain worker exposures at ALARA levels
- Interfacing with the project Health and Safety representative and other appropriate personnel as needed to plan and direct project Radiological Control Technician (RCT) support

2.1.1.13 Waste Management

Waste Management is responsible for identifying waste management sampling/characterization requirements to ensure regulatory compliance and interpreting data to determine waste designations and profiles. Waste Management communicates policies and practices and ensures project compliance for storage, transportation, disposal, and waste tracking in a safe, cost-effective manner.

2.1.1.14 Analytical Laboratories

The analytical laboratories accept, manage, prepare, and analyze samples in accordance with established methods and the requirements of their subcontract, and provide necessary data packages containing analytical and QC results. Laboratories provide explanations of results to support data review and in response to resolution of analytical issues. Laboratory quality requirements are consistent with the HASQARD (DOE/RL-96-68). The laboratories are evaluated under the U.S. Department of Energy Consolidated Audit Accreditation Program (DOECAP-AP) or its successor programs to DoD/DOE, 2019, requirements. HASQARD requirements beyond those within the DoD/DOE Quality Systems Manual are also evaluated under the DOECAP-AP. Further, laboratories are accredited by Ecology for the analyses performed under this SAP.

2.1.2 Quality Objectives and Criteria

The QA objective of this plan is to ensure the generation of analytical data of known and appropriate quality is acceptable and useful in order to meet the evaluation requirements stated in the sampling plan. Data descriptors known as data quality indicators (DQIs) help determine the acceptability and usefulness of data to the user. The principal DQIs (precision, accuracy, representativeness, comparability, completeness, bias, and sensitivity) are defined for the purposes of this document in Table 2-1.

Data quality is defined by the degree of rigor in the acceptance criteria assigned to the DQIs. Acceptance criteria for field and laboratory QC are identified in the contractor's environmental QA program plan. The applicable QC guidelines, DQI acceptance criteria, and levels of effort for assessing data quality are dictated by the intended use of the data and the requirements of the analytical method. DQIs are evaluated during a process to assess data usability (Section 2.4.3).

Table 2-1. Data Quality Indicators

Data Quality Indicator (QC Element)	Definition[a]	Determination Methodologies	Corrective Actions
Precision (field duplicates, laboratory sample duplicates, and matrix spike duplicates)	Precision measures the agreement among a set of replicate measurements. Field precision is assessed through the collection and analysis of field duplicates. Analytical precision is estimated by duplicate/replicate analyses, usually on laboratory control samples, spiked samples, and/or field samples. The most commonly used estimates of precision are the relative standard deviation and, when only two samples are available, the relative percent difference.	Use the same analytical instrument to make repeated analyses on the same sample. Use the same method to make repeated measurements of the same sample within a single laboratory. Acquire replicate field samples for information on sample acquisition, handling, shipping, storage, preparation, and analytical processes and measurements.	If duplicate data do not meet objective: • Evaluate apparent cause (e.g., sample heterogeneity). • Request reanalysis or re-measurement. • Qualify the data before use.
Accuracy (laboratory control samples, matrix spikes, surrogates, carriers, and tracers)	Accuracy is the closeness of a measured result to an accepted reference value. Accuracy is usually measured as a percent recovery. QC analyses used to measure accuracy include standard recoveries, laboratory control samples, spiked samples, and surrogates.	Analyze a reference material or reanalyze a sample to which a material of known concentration or amount of pollutant has been added (a spiked sample).	If recovery does not meet objective: • Qualify the data before use. • Request reanalysis or re-measurement.
Representativeness (field duplicates)	Sample representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. It is dependent on the proper design of the sampling program and will be satisfied by ensuring the approved plans were followed during sampling and analysis.	Evaluate whether measurements are made and physical samples are collected in such a manner that the resulting data appropriately reflect the environment or condition being measured or studied.	If results are not representative of the system sampled: • Identify the reason for results not being representative. • Flag for further review. • Review data for usability. • If data are usable, qualify the data for limited use and define the portion of the system that the data represent. • If data are not usable, flag as appropriate. • Redefine sampling and measurement requirements and protocols. • Resample and reanalyze, as appropriate.

Table 2-1. Data Quality Indicators

Data Quality Indicator (QC Element)	Definition[a]	Determination Methodologies	Corrective Actions
Comparability (field duplicate, field splits, laboratory control samples, matrix spikes, and matrix spike duplicates)	Comparability expresses the degree of confidence with which one data set can be compared to another. It is dependent on the proper design of the sampling program and will be satisfied by ensuring that the approved plans are followed and that proper sampling and analysis techniques are applied.	Use identical or similar sample collection and handling methods, sample preparation and analytical methods, holding times, and QA protocols.	If data are not comparable to other data sets: • Identify appropriate changes to data collection and/or analysis methods. • Identify quantifiable bias, if applicable. • Qualify the data, as appropriate. • Resample and/or reanalyze, if needed. • Revise sampling/analysis protocols to ensure future comparability.
Completeness (no QC element; addressed in data verification and validation)	Completeness is a measure of the amount of valid data collected compared to the amount planned. Measurements are considered to be valid if they are unqualified or qualified as estimated data during validation. Field completeness is a measure of the number of samples collected versus the number of samples planned. Laboratory completeness is a measure of the number of valid measurements compared to the total number of measurements planned.	Compare the number of valid measurements completed (samples collected or samples analyzed) with those established by the project's quality criteria (data quality objectives or performance/acceptance criteria).	If data set does not meet completeness objective: • Identify appropriate changes to data collection and/or analysis methods. • Identify quantifiable bias, if applicable. • Resample and/or reanalyze, if needed. • Revise sampling/analysis protocols to ensure future completeness.

Table 2-1. Data Quality Indicators

Data Quality Indicator (QC Element)	Definition[a]	Determination Methodologies	Corrective Actions
Bias (equipment blanks, field transfer blanks, full trip blanks, laboratory control samples, matrix spikes, and method blanks)	Bias is the systematic or persistent distortion of a measurement process that causes error in one direction (e.g., the sample measurement is consistently lower than the sample's true value). Bias can be introduced during sampling, analysis, and data evaluation. Analytical bias refers to deviation in one direction (i.e., high, low, or unknown) of the measured value from a known spiked amount.	Sampling bias may be revealed by analysis of replicate samples. Analytical bias may be assessed by comparing a measured value in a sample of known concentration to an accepted reference value or by determining the recovery of a known amount of contaminant spiked into a sample (matrix spike).	For sampling bias: • Properly select and use sampling tools. • Institute correct sampling and subsampling practices to limit preferential selection or loss of sample media. • Use sample handling practices, including proper sample preservation, that limit the loss or gain of constituents to the sample media. • Analytical data that are known to be affected by either sampling or analytical bias are flagged to indicate possible bias. • Laboratories that are known to generate biased data for a specific analyte are asked to correct their methods to remove the bias as best as practicable. Otherwise, samples are sent to other laboratories for analysis.
Sensitivity (method detection limit, practical quantitation limit, and relative percent difference)	Sensitivity is an instrument's or method's minimum concentration that can be reliably measured (i.e., instrument detection limit or limit of quantitation).	Determine the minimum concentration or attribute to be measured by an instrument (instrument detection limit) or by a laboratory (limit of quantitation). The lower limit of quantitation[b] is the lowest level that can be routinely quantified and reported by a laboratory.	If detection limits do not meet objective: • Request reanalysis or re-measurement using methods or analytical conditions that will meet required detection or limit of quantitation. • Qualify/reject the data before use.

a. Source: SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium.*

b. For purposes of this sampling plan, the lower limit of quantitation is interchangeable with the practical quantitation limit.

QA = quality assurance

QC = quality control

2.1.3 Methods-Based Analysis

Laboratory testing for analytes described in Sections 2.1.6 and 2.2.1 may include nontarget analytes that are part of the analytical method (i.e., methods-based reporting). The additional constituents that are part of the method and reported by the laboratory are for informational purposes. Analytical performance requirements will be applicable only to the analytes specific to this SAP. Poor QC-related to nontarget analyte results would not result in any required corrective action by the laboratory, except for the application of proper result qualification flags.

2.1.4 Analytical Priority

If sample volume is insufficient to analyze for all analytes listed for a given sampling area, the highest priority analytes critical for supporting removal action decisions are required to be analyzed. While insufficient sample volume is not expected to be a concern, priority is normally given first to volatile organic compounds (VOCs), second to chemicals that may be immediately dangerous to life or health (IDLH), and third to substances that are readily mobile in the immediate environment. Because the target analytes do not contain volatile organics or IDLH, priority will be given to the most mobile chemicals and TRU radionuclides. Attempts will be made to collect at least every other sample of the lesser priority analytes that are important for supporting removal action decisions. Lowest priority analytes not critical for supporting removal action decisions will be analyzed only if sufficient sample volumes are collected.

2.1.5 Special Training/Certification

Workers receive a level of training commensurate with their responsibility for collecting and transporting samples and compliant with applicable DOE orders and government regulations. In coordination with line management, the FWS will ensure that special training requirements for field personnel are met.

Training has been instituted by the contractor management team to meet training and qualification programs that satisfy multiple training drivers imposed by applicable DOE, *Code of Federal Regulations*, and *Washington Administrative Code* requirements. For example, the environmental, safety, and health training program provides workers with the knowledge and skills necessary to execute assigned duties safely. Personnel will not conduct work for which they are not trained. Field personnel typically will have completed the following training before starting work:

- Occupational Safety and Health Administration 40-Hour Hazardous Waste Worker Training and supervised 24-hr hazardous waste site experience
- 8-Hour Hazardous Waste Worker Refresher Training (as required)
- Hanford General Employee Radiation Training
- Hanford General Employee Training
- Radiological Worker Training

Project-specific safety training geared specifically toward the project and the day's activity will be provided. Project-specific training includes but is not limited to the following requirements:

- Training requirements or qualifications needed by sampling personnel and NDA technicians will be in accordance with QA requirements.
- Samplers are required to have received training and required certifications for the type of sampling that is being performed in the field.

- Qualification requirements for RCTs are established by the Radiation Protection Program. RCTs assigned to these activities will be qualified through the prescribed training program and will undergo ongoing training and qualification activities.

Training records are maintained for each employee in an electronic training record database. The contractor's training organization maintains the training records system. Line management confirms that an employee's training is appropriate and up to date prior to performing work under this SAP.

2.1.6 Documents and Records

The Removal Action Project Manager (or designee) is responsible for ensuring that the current version of the SAP is being used and providing any updates to field personnel. Version control is maintained by the administrative document control process. Table 2-2 defines the types of changes that impact the sampling design and the associated approvals, notifications, and documentation requirements.

Table 2-2. Change Control for Sampling Projects

Type of Change[a]	Action	Documentation
Minor field change. Changes that have no adverse effect on the technical adequacy of the sampling activity or the work schedule.	The field personnel recognizing the need for a field change will consult with the Removal Action Project Manager (or designee) prior to implementing the field change.	Minor field changes will be documented in the field logbook. The logbook entry will include the field change, the reason for the field change, and the names and titles of those approving the field change.
Minor change. Changes to approved plans that do not affect the overall intent of the plan or schedule.	The Removal Action Project Manager will inform DOE-RL and the Regulatory Lead of the change. EPA determines there is no need to revise the document.	Documentation of this change approval would be in the Project Managers' Meeting minutes or comparable Tri-Party Agreement Change Notice.[b]
Revision necessary. Lead regulatory agency determines changes to approved plans require revision to document.	If it is anticipated that a revision is necessary, the Removal Action Project Manager will inform DOE-RL and the Regulatory Lead. EPA determines the change requires a revision to the document.	Formal revision of the sampling document.

References: DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Documents*.

Ecology et al., 1989a, *Hanford Federal Facility Agreement and Consent Order*.

Ecology et al, 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan*.

a. Consistent with DOE/RL-96-68 and Sections 9.3 and 12.4 of Ecology et al., 1989b.

b. Section 9.3 of the Tri-Party Agreement Action Plan defines the minimum elements of a change notice.

DOE-RL	=	U.S. Department of Energy, Richland Operations Office
EPA	=	U.S. Environmental Protection Agency
Tri-Party Agreement	=	*Hanford Federal Facility Agreement and Consent Order*

Logbooks and data forms are required for field activities. The logbook must be identified with a unique project name and number. Only authorized individuals may make entries into the logbooks. Logbooks will be controlled in accordance with internal work requirements and processes. Information recorded on data forms must follow the same requirements as those for logbooks.

The FWS, SMR, or any field crew supervisor are responsible for ensuring that the field instructions are maintained and aligned with revisions or approved changes to the SAP. The SMR will ensure that deviations from the SAP are reflected in revised field sampling documents for the samplers and the analytical laboratory. The FWS or appropriate field crew supervisor will ensure that deviations from the SAP or problems encountered in the field are documented correctly (e.g., in the field logbook).

The Removal Action Project Manager, FWS, or designee is responsible for communicating field corrective action requirements and ensuring immediate corrective actions are applied to field activities. The Removal Action Project Manager is also responsible for ensuring that project files are appropriately set up and maintained. The project files will contain project records or references to the storage locations. Project files may include the following information:

- Operational records and logbooks
- Data forms
- Global positioning system data (a copy will be provided to SMR)
- Inspection or assessment reports and corrective action reports
- Field summary reports
- Interim progress reports
- Final reports
- Photographs

The following records are managed and maintained by SMR personnel:

- Completed field sampling logbooks
- Field equipment calibration data
- Sample and field sample reports
- Completed chain-of-custody forms
- Sample receipt records
- Laboratory data packages
- Analytical data verification and validation reports
- Analytical data "case file purges" (i.e., raw data purged from laboratory files) provided by the offsite analytical laboratories

Convenience copies of laboratory analytical results are maintained in the HEIS database. Records may be stored in either electronic (e.g., in the managed records area of the Integrated Document Management System) or hard copy format (e.g., DOE Records Holding Area). Documentation and records, regardless of medium or format, are controlled in accordance with internal work requirements and processes that ensure the accuracy and retrievability of stored records. Records required by the Tri-Party Agreement (Ecology et al., 1989a) will be managed per Tri-Party Agreement requirements.

2.2 Data Generation and Acquisition

This section addresses data generation and acquisition to ensure that the project's methods for sampling measurement and analysis, data collection or generation, data handling, and QC activities are appropriate and documented. Requirements for instrument calibration and maintenance, supply inspections, and data management are also addressed.

2.2.1 Analytical Methods Requirements

Analytical method requirements for samples collected are presented in Tables 2-3 and 2-4 for solids and Table 2-5 for liquids. These analytical methods were identified based on the radionuclides and chemicals listed in Table 1-5. The performance requirements for the methods were updated from the values in HNF-19646 to match current standards. Methods for plutonium-241/242 are not included, as their concentrations can be calculated from NDA data and plutonium isotopic ratios from smears and samples on material and equipment. A method for yttrium-90 is not included, as the concentration can be calculated from strontium-90 results.

Table 2-3. Analytical Performance Requirements for Radionuclides in Solids

Analyte	CAS Number	Analytical Method[a]	MDC for Soil (pCi/g)[b]
Americium-241	14596-10-2	AEA	1
Cesium-137	10045-97-3	GEA	0.1
Cobalt-60	10198-40-0	GEA	0.1
Europium-152	14683-23-9	GEA	0.1
Europium-154	15585-10-1	GEA	0.1
Europium-155	14391-16-3	GEA	0.1
Gross alpha	12587-46-1	GFPC	5
Gross beta	12587-47-2	GFPC	10
Neptunium-237	13994-20-2	AEA	1
Plutonium-238	13981-16-3	AEA	1
Plutonium-239 Plutonium-240	15117-48-3 14119-33-6	AEA	1
Strontium-90	10098-97-2	GFPC	2
Technetium-99	14133-76-7	LSC or GPC	5
Tritium	10028-17-8	LSC	30
Uranium-238	7440-61-1	AEA	1

a. For each analytical method, the latest promulgated version will be used.

b. Highest allowable MDCs are specified in contracts with analytical laboratories. Actual practical quantitation limits vary by laboratory and may be lower. Method detection limits for analyses are three to five times lower than quantitation limits.

AEA = alpha energy analysis
CAS = Chemical Abstracts Service
GEA = gamma energy analysis
GFPC = gas flow proportional counting
HAPQL = highest allowable practical quantification limit
LSC = liquid scintillation counting
MDC = minimum detectible concentration

Table 2-4. Analytical Performance Requirements for Nonradionuclides in Solids

Analyte	CAS Number	Analytical Method[a]	PQL for Soil (mg/kg)[b,c]
Wet Chemistry			
Ammonia	7664-41-7	EPA Method 350.1	0.5
Bromide	24959-67-9	EPA Method 300.0 or 9056	12.5
Fluoride	16984-48-8		25
Nitrate	14797-55-8		12.5
Nitrite	14797-65-0		12.5
Phosphate	14265-44-2		5
Sulfate	14808-79-8		27.5
Total Inorganic Carbon	TIC	EPA Method 415.1 or 9060	100
Total Organic Carbon	TOC		100
Total Organic Halides	59473-04-0	EPA Method 9020 or 9023	0.5
Metals			
Arsenic	7440-38-2	EPA Method 6010	10
		EPA Method 6020	1
Barium	7440-39-3	EPA Method 6010	5
		EPA Method 6020	2
Beryllium	7440-41-7	EPA Method 6010	0.5
		EPA Method 6020	0.2
		NIOSH 7300 or 7303, OSHA ID-125G (reporting limit)	0.025 µg/filter 0.025 µg/wipe 0.2 µg/g (bulk)
Bismuth	7440-69-9	EPA Method 6010	20
		EPA Method 6020	2
Cadmium	7440-43-9	EPA Method 6010	0.5
		EPA Method 6020	0.2
Chromium	7440-47-3	EPA Method 6010 or 6020	1
Lead	7439-92-1	EPA Method 6010	5
		EPA Method 6020	0.3
Magnesium	7439-95-4	EPA Method 6010	100
		EPA Method 6020	50
Manganese	7439-96-5	EPA Method 6010	5
		EPA Method 6020	1
Mercury	7439-97-6	EPA Method 7471	0.2
Nickel	7440-02-0	EPA Method 6010	4
		EPA Method 6020	0.5

Table 2-4. Analytical Performance Requirements for Nonradionuclides in Solids

Analyte	CAS Number	Analytical Method[a]	PQL for Soil (mg/kg)[b,c]
Potassium	7440-09-7	EPA Method 6010	500
		EPA Method 6020	100
Silver	7440-22-4	EPA Method 6010	1
		EPA Method 6020	0.2
Sodium	7440-23-5	EPA Method 6010	100
		EPA Method 6020	20
Organics			
Total petroleum hydrocarbons–diesel to oil range (kerosene)	TPHKEROSENE TPHDIESEL TPH/OILH	NWTPH[e]	25
Polychlorinated biphenyls (Aroclors)	1336-36-3	EPA Method 8082	0.333 (Aroclor-1016) 0.033 (remaining Aroclors)
Physical Parameters			
pH (corrosivity)	pH	EPA Method 9045D	0.5 pH unit
Asbestos	12001-29-5	Polarized light microscopy – NIOSH 9002 or EPA/600/R-93/116[d]	<1%
		NIOSH 7400	7 fibers/mm^2

a. DOE/RL-92-24, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, and ECF-HANFORD-11-0038, *Soil Background for Interim Use at the Hanford Site*.

b. For EPA Method 300.0, see EPA/600/R-93/100, *Methods for the Determination of Inorganic Substances in Environmental Samples*. For EPA Method 350.1, see EPA-600/4-79-020, *Methods for Chemical Analysis of Water and Wastes*. For four-digit EPA methods, see SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium*. Equivalent methods may be substituted. For each analytical method, the latest promulgated version will be used.

c. Method detection limits for chemical analyses are three to five times lower than quantitation limits.

d. EPA/600/R-93/116, *Test Method: Method for the Determination of Asbestos in Bulk Building Materials*.

e. From Ecology Publication No. ECY 97-602, *Analytical Methods for Petroleum Hydrocarbons*. The Ecology methods use a modification to EPA Method 8015.

CAS = Chemical Abstracts Service
Ecology = Washington State Department of Ecology
EPA = U.S. Environmental Protection Agency
NIOSH = National Institute for Occupational Safety and Health
NWTPH = Northwest Total Petroleum Hydrocarbon
PQL = practical quantitation limit
TIC = total inorganic carbon
TOC = total organic carbon

Table 2-5. Analytical Performance Requirements for Liquids

Analyte	CAS Number	Method[a]	MDC or PQL[b]
Radionuclides			
Americium-241	14596-10-2	AEA	1 pCi/L
Cesium-137	10045-97-3	GEA	15 pCi/L
Cobalt-60	10198-40-0	GEA	25 pCi/L

Table 2-5. Analytical Performance Requirements for Liquids

Analyte	CAS Number	Method[a]	MDC or PQL[b]
Europium-152	14683-23-9	GEA	50 pCi/L
Europium-154	15585-10-1	GEA	50 pCi/L
Europium-155	14391-16-3	GEA	50 pCi/L
Gross alpha	12587-46-1	GFPC	3 pCi/L
Gross beta	12587-47-2	GFPC	4 pCi/L
Neptunium-237	13994-20-2	AEA	1 pCi/L
Plutonium-238	13981-16-3	AEA	1 pCi/L
Plutonium-239 Plutonium-240	15117-48-3 14119-33-6	AEA	1 pCi/L
Strontium-90	10098-97-2	GFPC, LSC	2 pCi/L
Technetium-99	14133-76-7	LSC	50 pCi/L
Tritium	10028-17-8	LSC	700 pCi/L
Uranium-238	U-238	AEA	1 pCi/L
Nonradionuclides–Metals			
Arsenic	7440-38-2	EPA Method 6020	10.5 µg/L
Barium	7440-39-3	EPA Method 6020	5.25 µg/L
Beryllium	7440-41-7	EPA Method 6020	1.05 µg/L
Bismuth	7440-69-9	EPA Method 6010	210 µg/L
Cadmium	7440-43-9	EPA Method 6020	2.1 µg/L
Chromium	7440-47-3	EPA Method 6020	10.5 µg/L
Lead	7439-92-1	EPA Method 6020	3.15 µg/L
Magnesium	7439-95-4	EPA Method 6010	1,050 µg/L
Manganese	7439-96-5	EPA Method 6020	5.25 µg/L
Mercury	7439-97-6	EPA Method 7470	0.5 µg/L
Nickel	7440-02-0	EPA Method 6020	21 µg/L
Potassium	7440-09-7	EPA Method 6010	5,250 µg/L
Silver	7440-22-4	EPA Method 6020	5.25 µg/L
Sodium	7440-23-5	EPA Method 6010	1,050 µg/L
Nonradionuclides–Inorganics			
Ammonia	7664-41-7	EPA Method 350.1	105 µg/L
Oil and grease	Oil/grease	EPA Method 1664A or 9070	5,250 µg/L
Total dissolved solids	TDS	EPA Method 160.1 or 2540	21,000 µg/L
Total inorganic carbon	TIC	EPA Method 415.1 or 9060	1050 µg/L
Total organic carbon	TOC	EPA Method 415.1 or 9060	1050 µg/L
TOX	59473-04-0	EPA Method 9020 or 9023	31.5 µg/L

Table 2-5. Analytical Performance Requirements for Liquids

Analyte	CAS Number	Method[a]	MDC or PQL[b]
Total suspended solids	TSS	EPA Method 160.2 or 2540	21,000 µg/L
Nonradionuclides–Anions			
Bromide	24959-67-9	EPA Method 300.0 or 9056	262.5 µg/L
Fluoride	16984-48-8	EPA Method 300.0 or 9056	525 µg/L
Nitrate	14797-55-8	EPA Method 300.0 or 9056	250 µg/L
Nitrite	14797-65-0	EPA Method 300.0 or 9056	250 µg/L
Phosphate	14265-44-2	EPA Method 300.0 or 9056	525 µg/L
Sulfate	14808-79-8	EPA Method 300.0 or 9056	1,050 µg/L
Nonradionuclides–Organics			
Polychlorinated biphenyls (roclors)	N/A	EPA Method 8082	2.1 µg/L for Aroclor-1221, 1.05 µg/L for all other Aroclors

a. For EPA Method 300.0, see EPA/600/R-93/100, *Methods for the Determination of Inorganic Substances in Environmental Samples*. For EPA Method 350.1, see EPA-600/4-79-020, *Methods for Chemical Analysis of Water and Wastes*. For four-digit EPA methods, see SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium*. For each analytical method, the latest promulgated version will be used.

b. Minimum detectable concentrations and practical quantitation limits are specified in contracts with analytical laboratories. Actual quantitation limits vary by laboratory and may be lower. Method detection limits for chemical analyses are three to five times lower than quantitation limits.

AEA = alpha energy analysis
CAS = Chemical Abstracts Service
EPA = U.S. Environmental Protection Agency
GEA = gamma energy analysis
GFPC = gas flow proportional counting
LSC = liquid scintillation counting
MDC = minimal detectable concentration
N/A = not applicable
PQL = practical quantitation limit
TDS = total dissolved solids
TIC = total inorganic carbon
TOC = total organic carbon
TOX = total organic halides
TSS = total suspended solids

Updated EPA methods and nationally recognized standard methods may be substituted for the analytical methods identified in Tables 2-3 through 2-5. The new method will achieve project DQOs as well or better than the replaced method and is required due to the nature of the sample (e.g., high radioactivity). Deviations from the analytical methods must be approved in accordance with HASQARD (DOE/RL-96-68).

2.2.2 Field Analytical Methods

Field screening and survey data will be measured consistent with HASQARD (DOE/RL-96-68). Field analytical methods (e.g., test kits) are performed in accordance with the manufacturers' manuals. Field measurements may include but are not limited to radiological surveys and pH. Section 3.3 further discusses field measurements.

2.2.3 Quality Control

The QC protocol specified in the SAP must be followed in the field and analytical laboratory to ensure that reliable data are obtained. Field QC samples will be collected to evaluate the potential for cross contamination and to provide information pertinent to field sampling variability. Laboratory QC samples estimate the precision, bias, and matrix effects of the analytical data. Field and laboratory QC samples are summarized in Table 2-6. Acceptance criteria for field and laboratory QC are identified in the contractor's environmental QA program plan. Data will be qualified and flagged in HEIS, as appropriate.

Table 2-6. Field and Laboratory Quality Control Protocol

Sample Type	Primary Characteristics Evaluated	Frequency
Field Quality Control		
Equipment blank	Contamination from nondedicated sampling equipment	As needed[a,b]
Full trip blank	Contamination from containers, preservative reagents, storage, or transportation	1 per 20 sampling events
Field transfer blank	Contamination from sampling site	1 per day; VOCs are sampled; additional field transfer blanks are collected if VOC samples are acquired on the same day for multiple laboratories
Field duplicate samples	Reproducibility/sampling precision	1 in 20 sampling events
Field split samples	Inter-laboratory comparability	When needed, the minimum is one for every analytical method, for analyses performed.
Laboratory Batch Quality Control[c]		
Carrier	Recovery/yield	Added to each sample and quality control sample[d]
Method blanks	Laboratory contamination	1 per analytical batch[d]
Laboratory sample duplicate	Laboratory reproducibility and precision	1 per analytical batch[d]
Matrix spikes	Matrix effect/laboratory accuracy	1 per analytical batch[d]
Matrix spike duplicate	Laboratory reproducibility, and method accuracy and precision	1 per analytical batch[d]
Surrogates	Recovery/yield for organic compounds	Added to each sample and quality control
Tracers	Recovery/yield	Added to each sample and quality control
Laboratory control	Method accuracy	1 per analytical batch[d]

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

b. Vendor provided borehole equipment is considered dedicated equipment and equipment blanks are not typically acquired in this instance.

c. Batching across projects is allowed for similar matrices (e.g., soil, liquids).

d. Unless not required by, or different frequency is called out, in laboratory analysis method.

VOC = volatile organic compound

2.2.3.1 Field Quality Control Samples

Field QC samples are collected to evaluate the potential for cross-contamination and provide information pertinent to field sampling variability and laboratory performance to help ensure that reliable data are obtained. Field QC samples include field duplicates, field split (SPLIT) samples, and three types of field blanks (equipment blanks [EBs], field transfer blanks [FXRs], and full trip blanks [FTBs]). Field blanks are typically prepared using high purity reagent water.[4] QC sample definitions and their required frequency for collection are described below.

- **Field duplicates**: Independent samples collected as close as possible to the same time and same location as the scheduled sample and intended to be identical. Field duplicates are placed in separate sample containers and analyzed independently. Field duplicates are used to determine precision for both sampling and laboratory measurements.

- **Field splits (SPLITs)**: Two samples collected as close as possible to the same time and same location and intended to be identical. SPLITs will be stored in separate containers and analyzed by different laboratories for the same analytes. SPLITs are interlaboratory comparison samples used to evaluate comparability between laboratories.

- **Equipment blanks (EBs)**: High purity water passed through or poured over decontaminated sampling equipment identical to the sample set collected and placed in sample containers as identified on the sample authorization form. EB sample bottles are placed in the storage containers with samples from the associated sampling event and are analyzed for the same constituents as samples from the sampling event. EBs are used to evaluate decontamination process effectiveness; these samples are not required for disposable (e.g., single use) sampling equipment.

- **Field transfer blanks (FXRs)**: Preserved volatile organic analysis sample vials filled with high purity water at the sample collection site where VOC samples are collected. FXR samples are prepared during sampling to evaluate potential contamination attributable to field conditions. After collection, FXR sample vials are sealed and placed in the same storage containers with samples collected the same day for the associated sampling event. FXR samples are analyzed for VOCs only.

- **Full trip blanks (FTBs)**: Bottles prepared by the sampling team before travel to the sampling site. The preserved bottle set is either for VOC analysis only or is identical to the set that will be collected in the field. It is filled with high purity water and the bottles are sealed and transported (unopened) to the field in the same storage containers used for samples collected that day. Collected FTBs are typically analyzed for the same constituents as the samples from the associated sampling event. FTBs are used to evaluate potential contamination from the sample bottles, preservative, handling, storage, and transportation.

For the field blanks (i.e., FTBs, FXRs, and EBs), results greater than 5% sample concentration are identified as suspected contamination. However, for common laboratory contaminants such as acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the limit is greater than five times the method detection limit. For radiological data, blank results are flagged if they are greater than 5% sample activity.

2.2.3.2 Laboratory Quality Control Samples

Internal QA/QC programs are maintained by laboratories used by the project. Laboratory QA includes a comprehensive QC program that includes the use of laboratory control samples (LCSs), laboratory sample duplicates (DUPs), matrix spikes (MSs), matrix spike duplicates (MSDs), method blanks (MBs), and surrogates (SURs), carriers, and tracers. These QC analyses are required by EPA methods (e.g., those in SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium*), and will

[4] High purity water is generally defined as water that has been distilled, deionized, or any combination of distillation, deionization, reverse osmosis, activated carbon filtration, ion exchange, particulate filtration, or other polishing techniques (DOE/RL-96-68).

be run at the frequency specified in the respective references unless superseded by agreement. QC checks outside of control limits are documented in analytical laboratory reports during data usability assessments, if performed. Laboratory QC checks and their typical frequencies are listed in Table 2-6. Following are descriptions of the various types of laboratory QC samples.

- **Carrier**: A known quantity of nonradioactive isotope that is expected to behave similarly and is added to an aliquot of sample. Sample results are generally corrected based on carrier recovery.
- **Laboratory control sample (LCS)**: A control matrix (e.g., reagent water) spiked with analytes representing the target analytes or certified reference material used to evaluate laboratory accuracy.
- **Laboratory sample duplicate (DUP)**: An intra-laboratory replicate sample that is used to evaluate the precision of a method in a given sample matrix.
- **Matrix spike (MS)**: An aliquot of a sample spiked with a known concentration of target analyte(s). The MS is used to assess the bias of a method in a given sample matrix. Spiking occurs prior to sample preparation and analysis.
- **Matrix spike duplicate (MSD)**: A replicate spiked aliquot of a sample that is subjected to the entire sample preparation and analytical process. MSD results are used to determine the bias and precision of a method in a given sample matrix.
- **Method blank (MB)**: An analyte-free matrix to which the same reagents are added in the same volumes or proportions as used in the sample processing. The MB is carried through the sample preparations and analytical procedure and is used to quantify contamination resulting from the analytical process.
- **Surrogate (SUR)**: A compound added to every sample in the analysis batch (field samples and QC samples) prior to preparation. SURs are typically similar in chemical composition to the analyte being determined, but they are not normally encountered. SURs are expected to respond to the preparation and measurement systems in a manner similar to the analytes of interest. Because they are added to every standard, sample, and QC sample, SURs are used to evaluate overall method performance in a given matrix. SURs are used only in organic analyses.
- **Tracer**: A known quantity of radioactive isotope that is different from that of the isotope of interest but expected to behave similarly and is generally added to an aliquot of sample prior to the sample preparation step. A tracer does not chemically interfere with the target radioisotope during radiochemical preparation, separation, and counting. Sample results are generally corrected based on tracer recovery.

Laboratories are required to analyze samples within the holding times specified in Table 2-7. In some instances, constituents in the samples not analyzed within the holding times may be compromised by volatilization, decomposition, or by other chemical changes. Data from samples analyzed outside of the holding times are flagged in the HEIS database with an "H."

Table 2-7. Sample Preservation and Holding Time Guidelines

Method[a]	Analyte or Group	Liquids		Solids	
		Preservation Requirement	Holding Time	Preservation Requirement	Holding Time
EPA Method 160.1 or 2540C	Total Dissolved Solids	Cool ≤6°C	7 days	N/A	N/A
EPA Method 160.2 or 2540D	Total Suspended Solids	Cool ≤6°C	7 days	N/A	N/A
EPA Method 300.0 or 9056	Anions	Cool ≤6°C	48 hr or 28 days[b]	Cool ≤6°C	28 days/48 hr or 28 days[b,c]
EPA Method 350.1	Ammonia	H_2SO_4 to pH <2, Cool ≤6°C	28 days	None	28 days
EPA Method 376.1, 4500D, 9030, or 9034	Sulfide	ZnAc+NaOH to pH > 9 Cool ≤6°C	7 days	Cool ≤6°C	7 days
EPA Method 415.1 or 9060	TIC and TOC	HCl or H_2SO_4 to pH <2, Cool ≤6°C	28 days	Cool ≤6°C	28 days
EPA Method 1664A	Oil and grease	HCl to pH <2, Cool ≤6°C	28 days	N/A	N/A
EPA Method 6010	Metals	HNO_3 to pH <2	6 months	None	6 months
EPA Method 6020	Metals	HNO_3 to pH <2	6 months	None	6 months
EPA Method 7470	Mercury	HNO_3 to pH <2	28 days	None	28 days
EPA Method 8082	Polychlorinated biphenyls	Cool ≤6°C	1 yr/40 days[c]	Cool ≤6°C	1 yr/40 days[c]
EPA Method 9020 or 9023	Total Organic Halides	H_2SO_4 to pH <2, Cool ≤6°C	28 days	Cool ≤6°C	28 days
NIOSH 7300	Beryllium	N/A	N/A	N/A	N/A
NIOSH 7303	Beryllium	N/A	N/A	N/A	N/A
NIOSH 7400	Asbestos	N/A	N/A	N/A	N/A
NIOSH 9002 or EPA/600/R-93/116	Asbestos	N/A	N/A	N/A	N/A
NWTPH[d]	Total petroleum hydrocarbons – diesel to oil (kerosene) range	HCl to pH ≤2, Cool ≤6°C	14 days (preserved)/40 days for extraction	Cool ≤6°C	14 days/40 days[c]

Table 2-7. Sample Preservation and Holding Time Guidelines

Method[a]	Analyte or Group	Liquids		Solids	
		Preservation Requirement	Holding Time	Preservation Requirement	Holding Time
AEA	Americium-241	HNO_3 to pH <2	6 months	None	6 months
GEA	Cesium-137	HNO_3 to pH <2	6 months	None	6 months
GEA	Cobalt-60	HNO_3 to pH <2	6 months	None	6 months
GEA	Europium-152	HNO_3 to pH <2	6 months	None	6 months
GEA	Europium-154	HNO_3 to pH <2	6 months	None	6 months
GEA	Europium-155	HNO_3 to pH <2	6 months	None	6 months
GFPC	Gross alpha	HNO_3 to pH <2	6 months	None	6 months
GFPC	Gross beta	HNO_3 to pH <2	6 months	None	6 months
AEA	Neptunium-237	HNO_3 to pH <2	6 months	None	6 months
AEA	Plutonium-238	HNO_3 to pH <2	6 months	None	6 months
AEA	Plutonium-239/240	HNO_3 to pH <2	6 months	None	6 months
GFPC, LSC	Strontium-90	HNO_3 to pH <2	6 months	None	6 months
LSC	Technicium-99	HNO_3 to pH <2	6 months	None	6 months
LSC	Tritium	HNO_3 to pH <2	6 months	None	6 months
Uranium AEA	Uranium-238	HNO_3 to pH <2	6 months	None	6 months

Reference: EPA/600/R-93/116, *Test Method: Method for the Determination of Asbestos in Bulk Building Materials*.

a. For EPA Method 300.0, see EPA/600/R-93/100, *Methods for the Determination of Inorganic Substances in Environmental Samples*. For EPA Method 350.1, see EPA-600/4-79-020, *Methods for Chemical Analysis of Water and Wastes*. For four-digit EPA methods, see SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium*. Equivalent methods may be substituted. For each analytical method, the latest promulgated version will be used.

b. EPA Method 300.0 or 9056 nitrate, nitrite, and phosphate holding time is 48 hr (after extraction, if a solid sample); holding time of 28 days applies to all other anions by EPA Method 300.0 or 9056.

c. The first number shown is the holding time for extraction; the second number is the holding time for analysis of the extract.

d. From Ecology Publication No. ECY 97-602, *Analytical Methods for Petroleum Hydrocarbons*. Ecology uses a modification to EPA Method 8015.

AEA = alpha energy analysis
Ecology = Washington State Department of Ecology
EPA = U.S. Environmental Protection Agency
GEA = gamma energy analysis
GFPC = gas flow proportional counting
LSC = liquid scintillation counting
N/A = not applicable
TIC = total inorganic carbon
TOC = total organic carbon

2.2.4 Measurement Equipment

Each measuring equipment user is responsible to ensure the equipment is functioning as expected, properly handled, and properly calibrated at required frequencies per methods governing control of the equipment. Onsite environmental instrument testing, inspection, calibration, and maintenance will be recorded in accordance with approved methods. Field screening instruments will be used, maintained, and calibrated in accordance with the manufacturers' specifications and other approved methods.

2.2.5 Instrument and Equipment Testing, Inspection, and Maintenance

Collection, measurement, and testing equipment will meet applicable standards (e.g., ASTM International, formerly the American Society for Testing and Materials) or have been evaluated as acceptable and valid in accordance with instrument-specific methods, requirements, and specifications. Software application will be acceptance tested before use in the field.

Measurement and testing equipment used in the field or in the laboratory will be subject to preventive maintenance measures to ensure minimization of downtime. Laboratories and onsite measurement organizations must maintain and calibrate their equipment. Maintenance requirements (e.g., documentation of routine maintenance) will be included in the individual laboratory and onsite organization's QA plan or operating protocols, as appropriate. Maintenance of laboratory instruments will be performed in a manner consistent with HASQARD requirements (DOE/RL-96-68).

2.2.6 Instrument and Equipment Calibration and Frequency

Field equipment calibration is discussed in Section 3.5. Analytical laboratory instruments and measuring equipment are calibrated in accordance with the laboratory's QA plan and applicable Hanford Site requirements.

2.2.7 Inspection and Acceptance of Supplies and Consumables

Consumables, supplies, and reagents will be reviewed in accordance with SW-846 requirements and will be appropriate for their use. Supplies and consumables used in support of sampling and analysis activities are procured in accordance with internal work requirements and processes. Responsibilities and interfaces necessary to ensure that items procured or acquired for the contractor meet specific technical and quality requirements must be in place. The procurement system ensures purchased items comply with applicable procurement specifications. Supplies and consumables are checked and accepted by users prior to use.

Supplies and consumables procured by the analytical laboratories are procured, checked, and used in accordance with the laboratory's QA plan.

2.2.8 Nondirect Measurements

Data obtained from sources such as computer databases, programs, literature files, and historical databases will be technically reviewed to the same extent as data generated as part of any sampling and analysis QA/QC effort. Data used in evaluations will be identified by source.

2.2.9 Data Management

The SMR group, in coordination with the Removal Action Project Manager, is responsible for ensuring that analytical data are appropriately reviewed, managed, and stored in accordance with applicable programmatic requirements governing data management methods.

Electronic data access, when appropriate, will be through a Hanford Site database (e.g., HEIS). Where electronic data are not available, hard copies will be provided in accordance with Section 9.6 of the Tri-Party Agreement Action Plan (Ecology et al., 1989b).

Laboratory errors are reported to the SMR group through an established process. For reported laboratory errors, a sample issue resolution form will be initiated in accordance with applicable methods. This process is used to document analytical errors and to establish their resolution with the Removal Action Project Manager. The sample issue resolution forms become a permanent part of the analytical data package for future reference and records management.

2.3 Assessment and Oversight

Assessment and oversight activities address the effectiveness of project implementation and associated QA/QC activities. The purpose of assessment is to ensure that the QAPjP is implemented as prescribed.

2.3.1 Assessments and Response Actions

Assessments may be performed to verify compliance with the requirements outlined in this SAP, project field instructions, the QAPjP, methods, and regulatory requirements. Assessments include but are not limited to management assessments, surveillances, management systems reviews, readiness reviews, technical systems audits, performance evaluations, audits of data quality, and assessments of data usability. Assessment processes, roles, and responsibilities will be in accordance with existing QA program methods and as directed jointly by the Removal Action Project Manager and the QA point of contact. If circumstances arise in the field dictating the need for additional assessment activities, then additional assessments will be performed.

Deficiencies identified by these assessments will be reported in accordance with existing programmatic requirements. The project's line management chain coordinates the corrective actions or deficiency resolutions in accordance with the contractor QA program, the corrective action management program, and associated methods implementing these programs. When appropriate, corrective actions will be taken by the Removal Action Project Manager (or designee).

Oversight activities in the analytical laboratories, including corrective action management, are conducted in accordance with the laboratory's QA plans. The SMR group oversees offsite analytical laboratories and verifies that the laboratories are qualified to perform Hanford Site analytical work.

2.3.2 Reports to Management

Program and project management (as appropriate) will be made aware of deficiencies identified by assessments. Issues reported by the laboratories are communicated to the SMR group, which then initiates a sample issue resolution form. This process is used to document analytical or sample issues and to establish resolution with the Removal Action Project Manager. If an assessment finding results in sampling issues that impact a regulatory requirement, DOE would be informed and the matter discussed with the regulatory agencies.

2.4 Data Review and Usability

This section addresses QA activities that occur after the data collection. Implementation of these elements determines whether the data conform to the specified criteria, thus satisfying the project objectives.

2.4.1 Data Review and Verification

Data review and verification are performed to confirm that sampling and chain-of-custody documentation are complete. This review includes linking sample numbers to specific sampling locations and reviewing sample collection dates and sample preparation and analysis dates to assess whether holding times, if any, have been met. Furthermore, a review of QC data is used to determine whether analyses have met the data quality requirements specified in this SAP.

The criteria for verification include but are not limited to review for contractual compliance (samples were analyzed as requested), use of the correct analytical method, transcription errors, correct application of dilution factors, appropriate reporting of dry weight versus wet weight, and correct application of conversion factors. Field QA/QC results will be reviewed to ensure they are usable.

The Removal Action Technical Lead performs data reviews to help determine if observed changes reflect potential data errors that may result in submitting a request for data review on questionable data. The laboratory may be asked to check calculations or reanalyze the sample. In extreme cases, another sample may be collected. Results of the request for the data review process are used to flag the data appropriately in the HEIS database and/or to add comments.

2.4.2 Data Validation

Data validation is an independent assessment to ensure the reliability of the data. Analytical data validation provides a level of assurance that an analyte is present or absent. Validation may also include:

- Verification of instrument calibrations
- Evaluation of analytical results based on method blanks
- Recovery of various internal standards
- Correctness of uncertainty calculations
- Correctness of identification and quantification of analytes
- The effect of quality deficiencies on data reliability

The contractor follows the data validation process described in EPA-540-R-2017-001, *National Functional Guidelines for Inorganic Superfund Methods Data Review*, and EPA-540-R-2017-002, *National Functional Guidelines for Organic Superfund Methods Data Review*, adjusted for use with SW-846, HASQARD (DOE/RL-96-68), and radiochemistry methods.

The criteria for data validation are based on a graded approach using five levels of validation: Levels A through E. Level A is the lowest level and is the same as verification. Level E is a 100% review of all data (e.g., calibration data and calculations of representative samples from the data set). Data validation will be performed to Level C, which is a review of the QC data. Level C validation consists of a review of the QC data and specifically requires verification of deliverables; requested versus reported analyses; and qualification of the results based on evaluation of analytical holding times, MB results, MS/MSD results, surrogate recoveries, and duplicate sample results. Level C data validation is generally equivalent to Level 2A in OSWER No. 9200.1-85, *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*. Level C data validation will be performed on at least 5% of the data by matrix and analyte group under the direction of SMR. Analyte group refers to categories such as radionuclides, volatile chemicals, semivolatiles, metals, and anions. The goal is to include each of the various analyte groups and matrices during the data validation process. The DOE-RL Project Lead or Removal Action Project Manager may specify a higher percentage of data to be validated or that data validation be performed at higher levels.

2.4.3 Reconciliation with User Requirements

The purpose of reconciliation with user requirements is to determine whether quantitative data are of the correct type and adequate quality and quantity to meet project data needs. The data quality assessment (DQA) process is the scientific and statistical evaluation of previously verified and validated data to determine if information obtained from environmental data operations are of the right type, quality, and quantity to support their intended use (usability). The DQA process uses the entirety of the collected data to determine usability for decision making. If a statistical sampling design was utilized during field sampling activities, then the DQA will be performed following guidance in EPA/240/B-06/003, *Data Quality Assessment: Statistical Methods for Practitioners*. When judgmental (focused) sampling designs are implemented in the field, DQIs such as precision, accuracy, representativeness, comparability, completeness, and sensitivity for the specific data sets (individual data packages) will be evaluated in accordance with EPA/240/R-02/004, *Guidance on Environmental Data Verification and Data Validation*. Data verification and data validation are integral to both the statistical DQA data evaluation process and the DQI evaluation process. Results of the DQA or DQI processes will be used by the contractor Removal Action Project Manager to interpret the data and determine if the DQOs for this activity have been met.

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3 Field Sampling Plan

The objective of the FSP is to define project sampling and analytical requirements, including sampling methods and analyses that will be performed. The following sections provide field characterization activities, scoping survey strategies, media sampling strategies, and sampling/analysis activities to be implemented in the field.

Sampling designs specify a variety of sampling requirements, including but not limited to sampling locations, sample numbers, sample collection and handling methods, analytical methods, QC requirements, data verification needs, data validation requirements, reporting documents, and recordkeeping requirements.

3.1 Sampling Design

Table 3-1 provides a summary of the sampling that will be conducted. Data from the sampling and characterization activities prior to and during removal activities will be used to support work planning, waste designation, and future remedial actions. It is anticipated that some of the waste will be TRU/TRUM, and will be shipped to CWC for storage and then eventually disposed at Waste Isolation Pilot Plant. The remaining waste is expected to be low-level waste/mixed low-level waste, and will be shipped to ERDF for disposal.

When necessary, sampling designs will be developed by the project lead or delegate using historical information, process knowledge, field surveys, and facility inspections. The final sampling design decisions will be developed with concurrence from the removal action project team and will include the project characterization lead and technical specialists (e.g., waste services, waste operations, and engineering services).

In many cases, waste is not expected to be characterized adequately with only process knowledge. Data collection will be used to supplement and verify process knowledge or characterize waste. Previous results will be used to guide sampling efforts. Figure 3-1 shows a flow diagram of the sample design that will be used to characterize waste materials to support the removal activities.

Table 3-1. Sampling Table Summary

Location	Data Needs	Sampling Approach	Location and Number of Samples	Sample Analytes
224T	Radiological, chemical, and asbestos data for worker safety, equipment removal, waste disposal, and future remedial action	Perform initial site evaluation, including site historical document review, visual inspections, and initial radiation surveys to guide comprehensive radiological field screening. Perform field radiological surveys and/or chemical field surveys and document conditions (photographs, field screening reports, etc.) to identify contamination locations requiring removal or sampling to confirm contamination levels. Where zones of contamination (radiological hot spots) are indicated by inspections and field screening that require sampling: • Perform focused, judgmental sampling appropriate to the specific media as specified under the "Location and Number of Samples" column, and document sampling and field activities (photographs, field screening reports, etc.). As required, perform sampling of the balance of the site (non-hotspot locations).	Collect one quality control duplicate and one field blank for each specific media type sampled. At each noncontiguous sample location, collect at least one focused, judgmental media sample. For small areas, collect at least one sample from random site grids possibly using the coordinates established for the radiological survey. For larger areas, collect up to four samples using a similar grid system.	Where both chemical and radiological contamination is indicated, analyze samples for all constituents applicable to the structure or area. Where only chemicals are present and radiological field screening identifies no radionuclide contamination, analyze only for those chemicals applicable to the structure or area. Where only radiological contamination is present, radiological surveys will be used to verify contaminant levels.

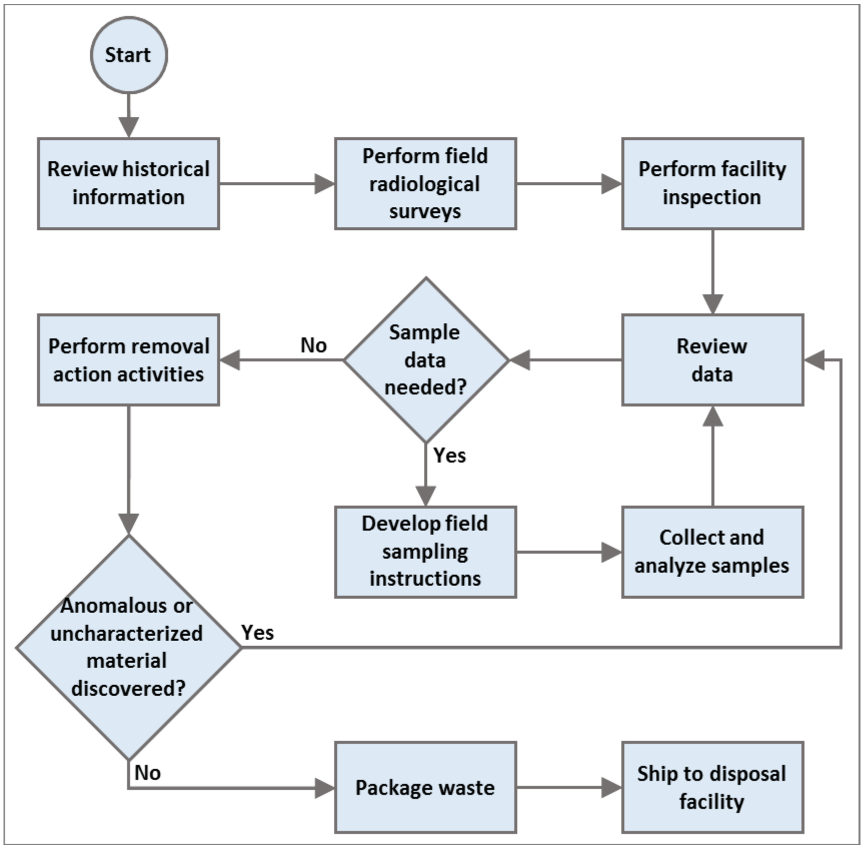

Figure 3-1. Waste Characterization Sampling Design Flow Diagram

3.1.1 Process Knowledge

As the initial method for determining waste characteristics, process knowledge consists of historical information about the waste and test/measurement performed on the waste or waste samples. Process knowledge may consist of the following types and forms of information:

- Solid waste storage/disposal records, waste certification summaries, and other applicable waste acceptance documentation
- Published documentation
- Unpublished information or notes
- Interviews
- Internal generator procedures, including operating and administrative
- Laboratory and/or field analysis data from testing a representation sample of the waste or a material generated by a similar process
- Safety data sheets of commercial products
- Mass balance for waste generating processes to the extent that such data provide a sufficient understanding of the characteristics and constituents of the waste stream
- Inventory sheets
- Vendor and procurement information

- Past construction practices (mercury, tritium, asbestos, etc.)
- Radiation work packages
- Test data from similar waste

Process knowledge will be confirmed as necessary using a graded approach with visual examination, radiation surveys, field analysis, and sampling.

3.1.2 Initial Characterization

Initial characterization will be conducted to identify potential hazards, determine health and safety requirements, establish radiological and chemical contamination levels, determine appropriate waste management requirements, and support work planning processes. Initial characterization will include activities described in the following sections. Field surveys may also include an industrial hygiene baseline survey of the building at the discretion of the project industrial hygiene professional.

3.1.2.1 Historical Site Assessment

Historical information will be identified, reviewed, summarized, and documented prior to removal activities. Information reviewed may include the Waste Information Data System and HEIS databases, facility drawings, historical reports, deactivation files (if available), radiation survey reports, and other sources.

3.1.2.2 Field Radiological Surveys

Field surveys may consist of routine radiation surveys of accessible media surfaces conducted by RCTs. Additional uniformly distributed and/or judgment-based measurements may be collected at the discretion of the project radiological engineer.

All areas within the facilities may not have the same potential for contamination and therefore will not require the same level of survey coverage. Facilities may be divided into survey areas to facilitate the characterization surveys. Survey area is a general term referring to any portion of a facility. For example, a survey area could be a group of facilities, a single facility, or one or more rooms within a facility. Survey areas will be delineated based on contamination potential, considering historical information and current radiological postings. The Removal Action Project Manager and the appropriate support organizations will be responsible for dividing the facilities into suitable survey areas.

Information from surveys will be used to determine the extent of contamination in the facility and support worker health and safety decisions during removal activities.

3.1.2.3 Facility Inspection

The structure will be inspected prior to removal activities. The inspection will include an assessment of hazardous materials (radiological and chemical) and potentially hazardous materials located in or materials used for construction of the facility. The inspection will include checking areas of material buildup such as sumps, drains, ventilation ductwork, and other effluent handling systems. Potential media specific sampling locations may be identified during the inspection. Identification of anomalous materials and conditions is an important part of this activity. Photographs and sketches of the site may be used to support the inspection.

3.1.3 Waste Characterization Work Packages

When characterization sampling is needed, a sampling design will be developed that identifies the number of samples needed, where the samples will be collected, the required analyses, and any specific sampling requirements. The sampling design information will be incorporated into the characterization work packages. Field sampling will be planned and conducted in accordance with the work packages. Sample design information for additional materials discovered during removal activities will be added to the characterization work packages. The Removal Action Project Manager will ensure that the characterization work packages will be developed, reviewed, and approved by the appropriate support organizations.

3.1.4 Media Sampling

Existing data and process knowledge will be used to support safety and health and waste management decisions. If existing data and process knowledge are not adequately available, media sampling will be needed. The goal of media sampling is to identify and quantify radiological and/or chemical contaminants. Media sampling will also provide data to support the future remedial action.

Surface media samples (e.g., flooring material, roofing material, pipe scale, filters, and sediment) will be collected as needed to provide focused characterization data if the initial characterization effort indicates that such samples are warranted. Surface media samples will be collected from sampling locations based on the judgment of the Removal Action Project Manager and the appropriate support organizations.

If a potential pathway for volumetric contamination exists and historical information or facility inspections indicate that volumetric sampling is warranted, volumetric samples may be collected for analysis as part of the judgment-based sampling measurements. Such samples (e.g., concrete or cinderblock boring samples) will be collected in areas where contamination may have migrated into base materials. For example, volumetric samples may be collected in areas with evidence of staining or that have a history of spills of contaminated liquids. Samples will be collected from sampling locations based on the judgment of the Removal Action Project Manager and the appropriate support organizations. If judgment-based sampling locations cannot be reliably determined, a statistical sampling design may be developed, as described in Section 3.1.9.

Specific media may be sampled to characterize materials for waste disposal, which may include drummed or bulk liquids, solids, or sludge materials. A single sample may be used to characterize containerized liquid media provided that a representative profile of the material can be obtained during sampling. If strata are identified in the material, subsampling of identified strata may be required for adequate characterization of the material.

Containerized or bulk solids, sediment, or sludge media are generally considered more likely to be heterogeneous than liquid materials. Discrete samples may be obtained from the same source to characterize solids, sediment, or sludge material at locations of high potential contamination. Field radiological measurements and visual observations will be used to determine judgment-based sampling locations.

Samples will be analyzed for the radiological and chemical COCs identified in the work packages based on process knowledge. Analytical performance requirements are established in Tables 2-3 through 2-5. The laboratory data will be used to confirm contamination levels in each of the materials and determine the appropriate disposition of the waste materials.

3.1.5 Asbestos Inspection and Sampling

Inspection and possibly sampling of potential ACM (e.g., thermal system insulation, ceiling tiles) may be needed to confirm the presence of asbestos. Category I and Category II nonfriable ACM in poor condition will be sampled, as needed. Inspection and representative sampling of insulated electrical wiring (by voltage type) will be performed only after the existing electrical system has been deactivated. Initial limited asbestos sampling will be used to support worker safety decisions. A walkdown will be conducted following backfilling to ensure the absence of asbestos.

3.1.6 Post-Demolition Sampling

After demolition of a structure to grade, radiological characterization will be performed on all newly exposed surfaces prior to backfilling. A field survey will encompass the entire footprint of the structure and adjacent area. If contamination is found, opportunistic sampling may be performed as determined by the Removal Action Project Manager. Sampling of the concrete slab is addressed in Section 3.3.3.6; soil sampling under and surrounding the slab is in Section 3.3.3.7. The selection of sampling units (i.e., number, location, and/or timing of sample collection) will be determined in the work package.

3.1.7 Anomalous Waste Materials

Anomalous waste materials are any unanticipated material discovered during facility inspections or removal action operations that will require sampling and analysis to support disposition. Sampling and analytical decisions will be made for the materials based on consultation between the Removal Action Project Manager and the appropriate support organizations. The team will evaluate appropriate historical information, process knowledge, and existing analytical data to determine whether additional analytical information is needed to support waste management and worker safety decisions.

3.1.8 Nondestructive Assay Performance

For NDA of equipment, the following activities will be performed. An area of low background radiation suitable for equipment setup and inventory movement will be identified. NDA equipment will be set up within the identified low background radiation area. NDA may be performed on individual pieces of equipment that have been transported to the low background area or on standard waste boxes filled with size-reduced material.

3.1.9 Statistical Sample Design

This SAP is based on the use of a focused sample design to provide data to support waste management and worker safety decisions. If a particular waste media or contaminated matrix is encountered that warrants use of a statistical sample design, the design will be developed during characterization activities. The statistical sample design will be reviewed and approved by the project and functional representatives as part of the characterization activities discussed in this SAP.

3.2 Sampling Location

Field sampling will be conducted as discussed in Section 3.3.3. Exact sample locations will be confirmed with the Removal Action Project Manager and appropriate support organizations. When sample locations have been identified, they will be incorporated into work packages identifying sample points, analytes, sampling methods, special sampling equipment, and sample analyte priorities (if there is not enough sample volume to run all analyses). Detection/quantitation limits would also be identified if they differ from those provided in Tables 2-3 through 2-5.

Table 3-2 describes the general sampling media and strategy by waste stream. If field conditions prevent the collection of samples (identified in Table 3-2), any deviations will be documented in the field logbook (see minor field changes in Table 2-2 and Section 3.4). If the sampling requirements cannot be followed as specified in this SAP, DOE, Ecology, and EPA will be notified to approve an alternative method of characterization or the use of alternative detection limits, accuracy, or another standard.

Table 3-2. Specific Media Sampling

Number	Waste Stream	Media	Sampling Strategy	Contaminants of Concern*
1	Process equipment	Process vessels, equipment, and piping in Cells A through F Residual solids and surface contamination, potential for residual liquids	1. Visual observation of material consistency and geometry in tanks 2. Check piping for liquid via nonintrusive methods or hot taps 3. If found, sample residual liquids 4. NDA and flange smear or sample residual material in tanks and centrifuges listed in Section 3.3.3.2	Radionuclides from Table 1-5 Carbon (TIC/TOC), nickel, chromium, niobium, bismuth phosphate, nitric acid, lanthanum fluoride, potassium hydroxide, phosphoric acid, sodium nitrate, potassium nitrate, chromium nitrate, oxalic acid, manganese nitrate, magnesium oxide, magnesium nitrate, potassium permanganate, ammonium sulfate, ammonium nitrate, potassium fluoride, hydrofluoric acid, lanthanum hydroxide, sodium dichromate, sodium hydroxide, sodium bismuthate, sulfuric acid
2	Liquid residuals	Miscellaneous aqueous liquid residuals identified in system pumps, sumps, tanks, piping, drains, and processing equipment	Nonintrusive liquid presence sampling using ultrasonic instruments, or hot taps into low spots or likely collection locations (Section 3.3.3.5)	
3	Solids, sediments, and residuals	Miscellaneous solids, sediments, and residuals identified in system pumps, sumps, tanks, piping, and processing equipment	Sample as indicated in Sections 3.3.3.2 and 3.3.3.5	
4	Bulk demolition debris	Paint/coatings on exterior of materials, if observed	Scraping paint; minimum of one representative sample from each type of paint/coating	Cadmium, chromium, barium, lead, silver, mercury, and PCBs
		Bulk demolition debris includes but is not limited to the following: • Poured concrete • Concrete block • Sheetrock • Wooden doors • Non-asbestos-containing roofing materials • Pumps and miscellaneous equipment • Steel siding • Ventilation system components	Field screening for waste disposition as described in Section 3.3.3.3	Radionuclides from Table 1-5 Carbon (TIC/TOC), nickel, chromium, niobium, bismuth phosphate, nitric acid, lanthanum fluoride, potassium hydroxide, phosphoric acid, sodium nitrate, potassium nitrate, chromium nitrate, oxalic acid, manganese nitrate, magnesium oxide, magnesium nitrate, potassium permanganate, ammonium sulfate, ammonium nitrate, potassium fluoride, hydrofluoric acid, lanthanum hydroxide, sodium dichromate, sodium hydroxide, sodium bismuthate, sulfuric acid, silver

Table 3-2. Specific Media Sampling

Number	Waste Stream	Media	Sampling Strategy	Contaminants of Concern*
5	Asbestos-containing material	Asbestos in pipe insulation, cement wall board, floor tiles, valve gaskets, and roofing materials	AHERA-certified asbestos inspector will perform the inspection Samples will be obtained in accordance with simplified sampling scheme for friable surface materials (EPA 560/5-85-030a)	Asbestos fibers
6	Incandescent light fixtures	Lead-based bulbs	No sampling required, use process knowledge for waste designation	N/A
7	Florescent light fixtures	Light ballasts containing PCBs and light bulbs containing mercury	No sampling required, use process knowledge for waste designation	N/A
8	Lead packing material	Lead packing in bell and spigot piping in galleries	No sampling required, use process knowledge for waste designation	N/A
9	Lead shielding	Lead bricks and blankets used for shielding	No sampling required, use process knowledge for waste designation	N/A
10	Mercury switches and instrumentation	Switches and instrumentation containing mercury	No sampling required, use process knowledge for waste designation	N/A
11	Emergency light batteries	Lead-acid batteries	No sampling required, use process knowledge for waste designation	N/A
12	Exit signs and smoke detectors	Internal radioactive sources	No sampling required, use process knowledge for waste designation	N/A
13	Lubrication, grease, oil, and hydraulic oils (includes door actuators and transformer oil)	Nonaqueous liquids, residues from metallic parts and chemicals used as additives	One representative sample per container or batch of the same material from the same source	Radionuclides from Table 1-5 PCBs, TOX, arsenic, barium, cadmium, chromium, lead, and mercury
14	HEPA filters	Filter media	1. The isotopic breakdown developed for waste stream 1 will be assumed for the filters 2. NDA may be done on a case-by-case basis to verify non-TRU prior to disposal	Radionuclides from Table 1-5

Table 3-2. Specific Media Sampling

Number	Waste Stream	Media	Sampling Strategy	Contaminants of Concern*
15	Step off pad soft waste	Personal protective equipment, garments, rags, tape, plastic, and gloves	No sampling required, analysis performed for other waste streams bounds this waste	N/A
16	Subsurface soil below building slab and adjacent to building	Contaminated soils	Standard sampling/compositing methods (Section 3.3.3.7)	Radionuclides from Table 1-5 PCBs, carbon (TIC/TOC), nickel, chromium, niobium, bismuth phosphate, nitric acid, lanthanum fluoride, potassium hydroxide, phosphoric acid, sodium nitrate, potassium nitrate, chromium nitrate, oxalic acid, manganese nitrate, magnesium oxide, magnesium nitrate, potassium permanganate, ammonium sulfate, ammonium nitrate, potassium fluoride, hydrofluoric acid, lanthanum hydroxide, sodium dichromate, sodium hydroxide, sodium bismuthate, sulfuric acid
17	RCRA closure samples	Concrete	Sample concrete in two specific locations requested by the Washington State Department of Ecology (Section 3.3.3.6)	Radionuclides from Table 1-5 Carbon (TIC/TOC), nickel, chromium, niobium, bismuth phosphate, nitric acid, lanthanum fluoride, potassium hydroxide, phosphoric acid, sodium nitrate, potassium nitrate, chromium nitrate, oxalic acid, manganese nitrate, magnesium oxide, magnesium nitrate, potassium permanganate, ammonium sulfate, ammonium nitrate, potassium fluoride, hydrofluoric acid, lanthanum hydroxide, sodium dichromate, sodium hydroxide, sodium bismuthate, sulfuric acid
18	Water in C Cell Pit	Contaminated water	One water sample to confirm process knowledge and past analytical results	Radionuclides from Table 1-5 Total RCRA Metals

References: EPA 560/5-85-030a, *Asbestos in Buildings: Simplified Sampling Scheme for Friable Surfacing Materials*.

Tables 1-16, 1-17, 3-1, and 7-1 in HNF-19646, *Data Quality Objectives Summary Report for the 224-T Plutonium Concentration Facility*.

*The chemicals listed in this table were identified in HNF-19646. The specific constituents that will be analyzed are provided in Tables 2-3, 2-4, and 2-5.

AHERA = *Asbestos Hazard Emergency Response Act of 1986*
HEPA = high-efficiency particulate air
N/A = not applicable
NDA = nondestructive examination
PCB = polychlorinated biphenyl
TIC = total inorganic carbon
TOC = total organic carbon
TOX = total organic halides
TRU = transuranic

Throughout the duration of the project, facility conditions will change and/or additional information will become available that may alter the characterization plans. Uncertainties such as the use of sampling equipment and accessibility are possible. Therefore, the key to the success of this characterization effort lies with the ability to adjust efforts in the field due to uncertainties and changing conditions.

3.3 Sampling Methods

Potential field sampling strategies are as described in Section 3.1.4, Table 3-2, and the following sections. Sampling instructions will be prepared during the development of work packages. Sampling locations and methods will be provided for each area. To ensure sample and data usability, sampling will be performed in accordance with HASQARD (DOE/RL-96-68) pertaining to sample collection, collection equipment, and sample handling. For some samples, preservatives are required (Table 2-7). Preservatives may be added to the collection bottles before their use in the field, or it is allowable to add the preservatives immediately after sample collection.

Sampling designs will minimize interactions between high and low concentration areas and will minimize common utilization of equipment, instrumentation, and facilities. A contamination control plan that minimizes the potential spread of contamination will meet the fundamental elements of the ALARA program. Specially controlled facilities or areas will be established for the receipt of highly contaminated materials and storage of samples.

Highly contaminated samples may have additional restrictions to address safety-related concerns associated with the ALARA principle. Work package documentation will address how highly contaminated samples will be collected, preserved, handled, packaged, and shipped.

3.3.1 Decontamination of Sampling Equipment

Sampling equipment will be decontaminated in accordance with sampling equipment decontamination methods. To prevent potential contamination of samples, care must be taken to use decontaminated equipment for each sampling activity. Decontamination of sampling equipment used for highly contaminated samples may not be possible (i.e., single use) and should be considered during the sample collection planning process.

Special care must be taken to avoid the following common ways in which cross-contamination or background contamination may compromise the samples:

- Improperly storing or transporting sampling equipment and sample containers
- Contaminating the equipment or sample bottles by setting the equipment/sample bottle on or near potential contamination sources (e.g., uncovered ground)
- Handling bottles or equipment with dirty hands or gloves
- Improperly decontaminating equipment before sampling or between sampling events

Decontamination of sampling equipment is performed using high purity water in each step. In general, three rinse cycles are performed to decontaminate sampling equipment: a detergent rinse, an acid rinse, and a water rinse. During the detergent rinse, the equipment is washed in a phosphate-free detergent solution, followed by rinsing with high purity water in three sequential containers. After the third high purity water rinse, equipment that is stainless steel or glass is rinsed in a 1M nitric acid solution (pH <2). Equipment is then rinsed with high purity water in three sequential containers (the high purity water rinses following the acid rinse are conducted in separate water containers that are not used for detergent rinse). Following the final high purity water rinse, equipment is rinsed in hexane and then placed on a rack to dry. Dry equipment is loaded into a drying oven. The oven is set at 122°F for items that are not metal or glass or 212°F for metal or glass. Once reaching temperature, equipment is baked for 20 minutes and cooled. The equipment is then removed from the oven and wrapped in clean, unused aluminum foil using surgeon's gloves. The wrapped equipment is stored in a custody-locked controlled access area.

3.3.2 Radiological Field Data

Alpha and beta/gamma data collection in the field will be used as needed to support sampling and analysis efforts. Radiological screening will be performed by RCTs or other qualified personnel. RCTs will record field measurements, noting the location of the sample and the instrument reading.

The following information will be provided to field personnel performing work in support of this SAP:

- Instructions to RCTs on the methods required to measure sample activity and media for gamma, alpha, and/or beta emissions, as appropriate.
- Information regarding portable radiological field instrumentation, including a physical description of the instruments, radiation and energy response characteristics, calibration/maintenance and performance testing descriptions, and the application/operation of the instrument. These instruments are commonly used on the Hanford Site to obtain measurements of removable surface contamination measurements and direct measurements of total surface contamination.
- Instructions regarding the minimum requirements for documenting radiological controls information in accordance with 10 CFR 835, "Occupational Radiation Protection."
- Instructions for managing the identification, creation, review, approval, storage, transfer, and retrieval of radiological information.
- Minimum standards and practices necessary for preparing, performing, and retaining radiological related information.
- Requirements associated with preparing and transporting regulated material.
- Daily reports of radiological surveys and measurements collected during conduct of field investigation activities (data will be cross referenced between laboratory analytical data and radiation measurements to facilitate interpreting the investigation results).

3.3.3 Field Sampling

Characterization activities for the removal action will include field sampling. The selection of sampling method and sampling units (i.e., number, location, and/or timing of sample collection) will be determined by the removal action project team and documented in the characterization work package.

3.3.3.1 Routine Radiological Surveys

Routine radiological surveys will be conducted prior to removal of equipment and demolition activities. The surveys will be performed on accessible surfaces of the waste media and will be conducted by project RCTs. Existing survey information will be reviewed by the removal action project team. Additional surveys may be required at specific locations to fill voids in the existing data identified by the review or to address areas of concern identified during visual inspections. Information obtained from the routine radiological surveys will be used to determine the extent of contamination in the facility and to support worker health and safety during D&D activities.

3.3.3.2 Nondestructive Assay – Verification

Because existing NDA data is available from the 2002 cell entries, additional NDA will be limited only to those groups of tanks that could not be measured and are currently inaccessible. The list of tanks that were not assayed in 2002 and will be verified are Tanks C-4, C-7, and C-9 (all located in the C Cell deep pit).

The tanks will be visually inspected if possible to supplement the NDA and provide information on the distribution and homogeneity of any residual materials. Smears and/or samples will be taken where possible to determine isotopic distribution and form of material. As described in Chapter 3, the use of the NDA, isotopic information, and sample data will be correlated with dose readings through engineering calculations in a conservative manner to perform waste designation and determine equipment/piping inventory values (HNF-19646).

3.3.3.3 Percent Profile Verification Surveys

Prior to waste disposition, radiological surveys will be completed for all of the waste materials in the scope of this project. These surveys will involve environmental radiological surveys of the shipping containers and will be conducted by project RCTs under the direction of the waste transportation specialist. The profile verification surveys will be used to determine and document the activity per volume (pCi/g) of waste profile for the waste materials (HNF-19646).

3.3.3.4 Material Release Surveys for Reuse

Salvageable materials that have no potential for volumetric contamination may be surveyed for release. The material release surveys will involve routine radiation surveys of accessible surfaces of the waste materials. Additional surveys for offsite release will be conducted as needed in accordance with appropriate property release requirements.

3.3.3.5 Inspection of Piping Entering/Exiting Facility

As the facility is demolished, points where process and service piping entered and exited the facility will be identified. Because the desired end point for this remedial action is a slab-on-grade condition, pipelines entering and exiting from belowgrade through the slab will be cut off and isolated or plugged. As this activity is performed, normal radiological surveys will be performed, and visual inspection of the pipelines will be done. If significant quantities of anomalous solids/liquids are seen in the pipelines near the cutoff points and samples can be readily obtained, sampling will be performed to provide an indication of the properties of the residues in the pipes (HNF-19646).

3.3.3.6 Concrete Sampling

If needed for waste characterization, concrete samples will be collected to support existing NDA information. Concrete samples of the remaining slab will also be collected by various methods (e.g., coring, scabbling, or chipping) at radiological hot spots and areas with evidence of staining to support a future remedial action.

3.3.3.7 Soil Sampling

The intent of sampling soil beneath and around the 224T Building footprint is to provide information for future remedial activities. HNF-19646 includes requirements for the collection of specific limited data on subsurface soil samples under and near the 224T Building (Table 3-3 and Figure 3-2). Supplemental soil samples added during SAP development after a review of the process history and the 224T Building connections (Figure 1-5) are identified in Table 3-4 with recommended sampling locations in Figure 3-2. The supplemental samples on pipelines will focus on connections and elbows, which are the most vulnerable areas. No samples are recommended for the sanitary sewer line as sanitary waste is not regulated under RCRA or CERCLA.

Table 3-3. Original Soil Sampling Locations

Location	Justification	Sample Method/Depth
C Cell sump	Most likely location for any standing liquid to have been incurred, and therefore the most likely for any long-term leakage path leading to external soil contamination.	Bore an access core hole through the concrete floor in or adjacent to the sump and obtain a soil sample external to the building structure. Approximate depth of the soil column sample will be 3 ft below the concrete.
UPR-200-W-102 waste site	Will provide a preliminary indication of the depth and levels of chemical and radionuclide contamination associated with the site.	Sample depth will represent a 3 ft deep column of soil.

Reference: Section 7.7 in HNF-19646, *Data Quality Objectives Summary Report for the 224-T Plutonium Concentration Facility*.

Table 3-4. Supplemental Soil Sampling Locations

Location	Justification	Sample Method	Depth
F Cell sump	Location for possible standing liquids and long-term leakage path leading to external soil contamination.	Bore an access core hole through the concrete floor in or adjacent to the sump and obtain a soil column sample external to the building structure.	Approximate depth of the soil column sample will be 3 ft below the concrete.
Loadout area sump	Location for possible standing liquids and long-term leakage path leading to external soil contamination.	Bore an access core hole through the concrete floor in or adjacent to the sump and obtain a soil column sample external to the building structure.	Approximate depth of the soil column sample will be 3 ft below the concrete.
Chemical sewer line	Location for possible off-normal piping leak leading to external soil contamination.	Minimum of six samples on the northwest side of 224T at the exits from the building and at connections with the main line.	Approximate depth of each soil column sample is 1 to 2 ft below bottom of pipe or encasement.
Cooling water (and condensate) sewer line	Location for possible off-normal piping leak leading to external soil contamination.	Minimum of 12 samples along the line route (eight southeast, four northwest of 224T). Eight on the southeast side of 224T at the connections to the main line. Four on the northwest side of 224T at exits from the building and at connections with the line.	Approximate depth of each soil column sample is 1 to 2 ft below bottom of pipe or encasement.
Process waste line (to settling tank)	Location for possible process piping leak leading to external soil contamination.	Minimum of two samples along the line route (one southeast at the elbow and one south of 224T).	Approximate depth of each soil column sample is 1 to 2 ft below bottom of pipe or encasement.
Transfer line to T Plant	Location for possible process piping leak in transfer line to/from B Plant leading to external soil contamination.	Bore an access core hole through the concrete floor in C Cell pipe trough and obtain a soil column sample external to the building structure.	Approximate depth of the soil column sample will be 3 ft below the concrete.
		Minimum of three samples along the line route between 221T and 224T: one on the southeast side of the access road, one adjacent to the line branch into 221T, and one to the northeast of 224T.	Approximate depth of each soil column sample is 1 to 2 ft below bottom of pipe or encasement.
Ventilation line to T Plant	Location for possible off-normal piping leak leading to external soil contamination.	Minimum of 17 samples along the line route (four southwest and 13 southeast of 224T). Samples to the southeast of 224T alternate between the belowgrade elbow (~1 ft from the building) and the connection with the 24 in. clay main ventilation line.	Approximate depth of each soil column sample 1 to 2 ft below bottom of pipe or encasement.

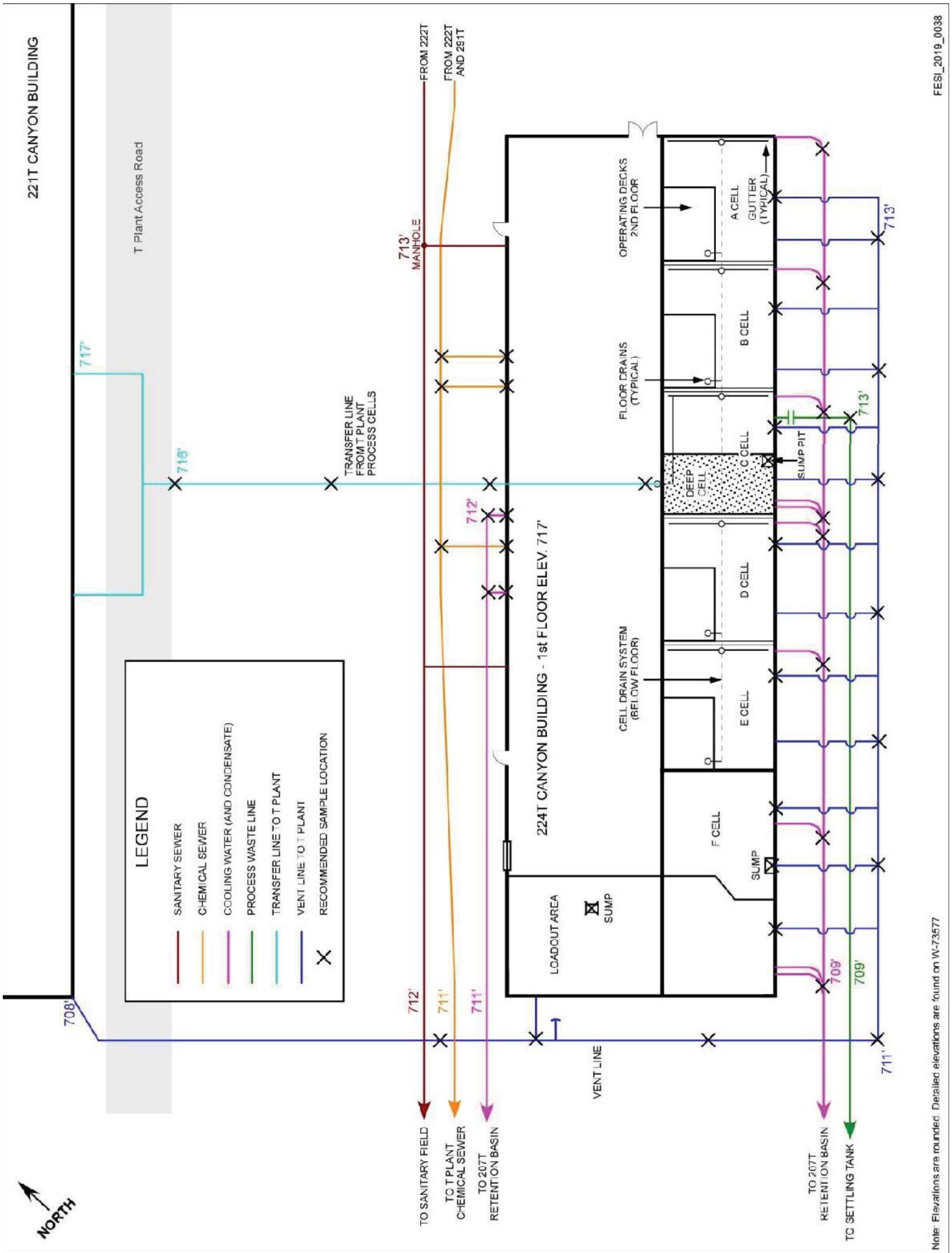

Figure 3-2. 224T Building Soil Sampling Locations

Surface Soil Sampling. Collection of localized surface soil samples (hot spots) will be accomplished with tools such as spades, shovels, trowels, and scoops. Surface material is first brushed aside, then a stainless steel or plastic scoop is used to collect the soil sample.

Subsurface Soil Sampling. Collection of subsurface soil samples will be accomplished using split-spoon samplers advanced with conventional drilling technology to specified depths. All drilling will be done using a method approved by the removal action project team and will conform to site-specific technical specifications for environmental drilling services. Drilling methods may use direct- or angle-push technology. When sampling below concrete, an access hole is first bored through the concrete, and then a sample of the underlying soil is collected.

3.4 Documentation of Field Activities

Logbooks or data forms are required for field activities and will be used in accordance with HASQARD (DOE/RL-96-68) requirements. A logbook must be identified with a unique project name and number. Only authorized persons may make entries in logbooks. Logbook entries will be reviewed by the FWS, Removal Action Technical Lead, or other responsible manager; the review will be documented with a signature and date. Logbooks will be permanently bound, waterproof, and ruled with sequentially numbered pages. Pages will not be removed from logbooks for any reason. Entries will be made in indelible ink. Corrections will be made by marking through the erroneous data with a single line, entering the correct data, and initialing and dating the changes.

Data forms may be used to collect field information; however, information recorded on data forms must follow the same requirements as those for logbooks. The data forms must be referenced in the logbooks. A summary of information to be recorded in logbooks or on the data forms is as follows:

- Day and date; time task started; weather conditions; and names, titles, and organizations of personnel performing the task.
- Purpose of visit to the task area.
- Site activities in specific detail (e.g., maps and drawings) or the forms used to record such information. Also, details of any field tests that were conducted; reference any forms that were used, other data records, and methods followed in conducting the activity.
- Details of any field calibrations and surveys that were conducted. Reference any forms that were used, other data records, and the methods followed in conducting the calibrations and surveys.
- Details of any samples collected and the preparation (if any) of splits, duplicates, MSs, or blanks. Reference the methods followed in sample collection or preparation; list location of sample collected, sample type, each label or tag numbers, sample identification, sample containers and volume, preservation method, packaging, chain-of-custody form number, and analytical request form number pertinent to each sample or sample set; and note the time and the name of the individual to whom custody of samples was transferred.
- Time, equipment type, serial or identification number, and methods followed for decontaminations and equipment maintenance performed. Reference the page number(s) of any logbook where detailed information is recorded.
- Any equipment failures or breakdowns that occurred, with a brief description of repairs or replacements.

The Removal Action Project Manager, FWS, and SMR personnel must document deviations from protocols, issues pertaining to sample collection, chain-of-custody forms, target analytes, COCs, sample transport, or noncompliant monitoring. Examples of deviations include samples not collected due to field conditions, changes in sample locations due to physical obstructions, or additions of sample depth(s).

As appropriate, such deviations or issues will be documented in the field logbook or on nonconformance report forms in accordance with internal corrective action methods. The Removal Action Project Manager, FWS, or SMR personnel will be responsible for communicating field corrective action requirements and ensuring that corrective actions are applied to field activities as soon as practical.

Changes in sample activities require notification, approval, and documentation as noted in Table 2-2.

3.5 Calibration of Field Equipment

The FWS is responsible for ensuring that field equipment is calibrated appropriately. Onsite environmental instruments are calibrated in accordance with the manufacturers' operating instructions, internal work requirements and processes, and/or field instructions that provide direction for equipment calibration or verification of accuracy by analytical methods. Calibration records will include the raw calibration data, identification of the standards used, associated reports, date of analysis, and analyst's name or initials. The results from all instrument calibration activities are recorded in accordance with HASQARD requirements (DOE/RL-96-68).

Field instrumentation, calibration, and QA checks will be performed as follows:

- Prior to initial use of a field analytical measurement system.
- At the frequency recommended by the manufacturer or methods, or as required by regulations.
- Upon failure to meet specified QC criteria.
- Calibration of radiological field instruments on the Hanford Site that is performed by the Hanford Site prime contractors, as specified by their calibration program.
- Daily calibration checks will be performed and documented for each instrument used. These checks will be made on standard materials sufficiently like the matrix under consideration for direct comparison of data. Analysis times will be sufficient to establish detection efficiency and resolution.
- Using standards for calibration that are traceable to a nationally recognized standard agency source or measurement system. Manufacturer's recommendations for storage and handling of standards (if any) will be followed. Expired standards will not be used for calibration.

3.6 Sample Handling

Sample handling and transfer will be in accordance with established methods to preclude loss of identity, damage, deterioration, and loss of sample. Custody seals or custody tape will be used to verify that sample integrity has been maintained during sample transport. The custody seal will be inscribed with the sampler's initials and date. If during the chain-of-custody process it is discovered that the custody tape has been tampered with or broken on the sample bottle, SMR personnel will be notified, the sample will be analyzed, but the results will include a flag to indicate that custody was broken. If the custody tape has been tampered with or broken on the cooler, this condition will be documented in the data package. If the sample data did not trend with the other data or were not as expected, the data for the sample would be flagged accordingly. A sampling and analytical database is used to track samples from the point of collection through the laboratory analysis process.

3.6.1 Containers

Samples shall be collected, where and when appropriate, in break-resistant containers. The field sample collection record shall indicate the laboratory lot number of the bottles used in sample collection. When commercially pre-cleaned containers are used in the field, the name of the manufacturer, lot identification, and certification shall be retained for documentation.

Containers shall be capped and stored in an environment that minimizes the possibility of sample container contamination. If contamination of the stored sample containers occurs, corrective actions shall be implemented to prevent reoccurrences. Contaminated sample containers cannot be used for a sampling event. Container sizes may vary depending on laboratory-specific volumes/requirements for meeting analytical detection limits. Container types and sample amounts/volumes are identified on the chain-of-custody form.

The Radiological Control organization will measure both the contamination levels and dose rates associated with the filled sample containers. This information, along with other data, will be used to select proper packaging, marking, labeling, and shipping paperwork and verify that the sample can be received by the analytical laboratory in accordance with the laboratory's radioactivity acceptance criteria. If the dose rate on the outside of a sample container or the curie content exceeds levels acceptable by an offsite laboratory, the FWS (in consultation with the SMR organization) can send smaller sample volumes to the laboratory.

3.6.2 Container Labeling

Each sample is identified by affixing a standardized label or tag to the container. This label or tag shall contain the sample identification number. The label shall identify or provide reference to associate the sample with the date and time of collection, preservative used (if applicable), analysis required, and collector's name or initials. Sample labels may be either pre-printed or handwritten in indelible or waterproof ink.

3.6.3 Sample Custody

Sample custody will be maintained in accordance with existing protocols to ensure that sample integrity is maintained throughout the analytical process. Chain-of-custody protocols will be followed throughout sample collection, transfer, analysis, and disposal to ensure that sample integrity is maintained. A chain-of-custody record will be initiated in the field at the time of sampling and will accompany each sample or set of samples shipped to any laboratory.

Shipping requirements will determine how sample shipping containers are prepared for shipment. The analyses requested for each sample will be indicated on the accompanying chain-of-custody form. Each time the responsibility for the custody of the sample changes, new and previous custodians will sign the record and note the date and time. The field sampling team will make a copy of the signed record before sample shipment and transmit the copy to the SMR group.

The following minimum information is required on a completed chain-of-custody form:

- Project name
- Collectors' names
- Unique sample number
- Date, time, and location (or traceable reference thereto) of sample collection

- Matrix
- Preservatives
- Chain-of-possession information (i.e., signatures and printed names of each individual involved in the transfer of sample custody and storage locations, and dates/times of receipt and relinquishment)
- Requested analyses (or reference thereto)
- Number of sample containers per unique sample identification number
- Shipped-to information (i.e., analytical laboratory performing the analysis)

Samplers will note any anomalies with the samples. If anomalies are found, samplers will inform the SMR group so special direction for analysis can be provided to the laboratory, if deemed necessary.

3.6.4 Sample Transportation

Packaging and transportation instructions shall comply with applicable transportation regulations and DOE requirements. Regulations for classifying, describing, packaging, marking, labeling, and transporting hazardous materials, hazardous substances, and hazardous wastes are enforced by the U.S. Department of Transportation (DOT) as described in 49 CFR 171, “Transportation,” “General Information, Regulations, and Definitions,” through 49 CFR 177, “Carriage by Public Highway.”[5] Carrier-specific requirements defined in the current edition of the International Air Transport Association (IATA, 2020, *Dangerous Goods Regulations*) shall also be used when preparing sample shipments conveyed by air freight providers.

Samples containing hazardous constituents above regulated amounts shall be considered hazardous material in transportation and transported according to DOT/IATA requirements. If the sample material is known or can be identified, then it will be packaged, marked, labeled, and shipped according to the specific instructions for that material. Appropriate laboratory notifications will be made if necessary through the SMR project coordinator.

Materials are classified by DOT/IATA as radioactive when the isotope specific activity concentration and the exempt consignment limits described in 49 CFR 173, “Shippers—General Requirements for Shipments and Packagings,” are exceeded. Samples shall be screened or relevant historical data will be used to determine if these values are exceeded. When screening or historical data indicate samples are radioactive, they shall be properly classified, described, packaged, marked, labeled, and transported according to DOT/IATA requirements.

Prior to shipping radioactive samples to the laboratory, the organization responsible for shipping shall notify the laboratory of the approximate number of and radiological levels of the samples. This notification is conducted through the SMR project coordinator. The laboratory is responsible for ensuring that the applicable license limits are not exceeded. Prior to sample receipt, the laboratory shall provide SMR with written acceptance for samples with elevated radioactive contamination or dose.

[5] Transportation regulations 49 CFR 174, “Carriage by Rail,” and 49 CFR 176, “Carriage by Vessel,” are not applicable, as these two transportation methods are not used.

3.7 Achievement of Removal Action Objectives

For samples of the remaining 224T Building slab and surrounding and underlying soils, the 224T AM (DOE/RL-2004-68) included additional requirements to assess whether the removal action objectives have been achieved. Table 3-5 identifies each requirement and how it will be implemented.

Table 3-5. Implementation of Requirements for 224T Building Slab and Soil Samples

Requirements*	Implementation
Implementing the approved SAP for samples of the slab and soil surrounding and below the slab. The DQO process will identify the COCs to be identified in the SAP.	The COCs were identified in the DQO report (HNF-19646) and modified as shown in Table 1-5.
Obtaining analytical results from samples. Verifying that the QA/QC specified in the SAP were met by the laboratory.	Samples will be analyzed in accordance with this SAP. Data validation, in accordance with Section 2.4, will verify the QA/QC specified in this SAP are met.
Placing analytical data in the administrative record.	Analytical results will be documented in the administrative record through appropriate closure documentation, in accordance with DOE/RL-2019-36.
Comparing analytical results with industrial clean-up standards. These standards will be the same as the standards used for the 200 Area remedial actions.	The industrial clean-up standards are the preliminary actions levels identified in Tables 2-3 and 2-4.
If the results are below the industrial clean-up standards, then no further action is necessary under this removal action. Results will be documented in the administrative record through appropriate closure documentation.	Analytical results will be documented in the administrative record through appropriate closure documentation, in accordance with DOE/RL-2019-36.
If the results are above industrial clean-up standards, then a work plan addendum to identify follow-on actions will be developed by DOE and approved by EPA. These actions may include no further action, performing additional removal, or deferring to a later remedial action.	Follow-on actions will be documented via an addendum or revision to DOE/RL-2019-36 with the appropriate DOE and regulatory approvals.

References: DOE/RL-2019-36, *Removal Action Work Plan for the 224T Plutonium Concentration Facility.*
HNF-19646, *Data Quality Objectives Summary Report for the 224-T Plutonium Concentration Facility.*
*From Chapter 8 of DOE/RL-2004-68, *Action Memorandum for the Non-Time-Critical Removal Action for the 224-T Plutonium Concentration Facility.*

COC	=	contaminant of potential concern	SAP	=	sampling and analysis plan
EPA	=	U.S. Environmental Protection Agency	QA	=	quality assurance
DOE	=	U.S. Department of Energy	QC	=	quality control
DQO	=	data quality objective			

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4 Management of Waste

Waste materials are generated during sample collection, processing, and subsampling activities. Waste will be managed in accordance with the Waste Management Plan in the 224T RAWP (DOE/RL-2019-36).

Miscellaneous solid waste that has contacted suspect dangerous waste will be managed as dangerous waste. Decontamination fluids will be collected and managed in accordance with the Waste Management Plan in the 224T RAWP (DOE/RL-2019-36). Packaging and labeling during waste storage and transportation will meet the applicable substantive federal and/or state requirements. Waste materials requiring collection will be placed in containers appropriate for the material and the receiving facility in accordance with the applicable waste management or waste control plan and applicable substantive federal and/or state requirements.

Offsite analytical laboratories are responsible for the disposal of unused sample quantities and wastes from analytical processes.

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5 Health and Safety Plan

DOE established the hazardous waste operations safety and health program pursuant to the *Price-Anderson Amendments Act of 1988* to ensure the safety and health of workers involved in mixed-waste site activities. The program was developed to comply with the requirements of 10 CFR 851, "Worker Safety and Health Program," which incorporates the standards of 29 CFR 1910.120, "Occupational Safety and Health Standards," "Hazardous Waste Operations and Emergency Response"; 10 CFR 830, "Nuclear Safety Management"; and 10 CFR 835. The health and safety program defines the chemical, radiological, and physical hazards and specifies the controls and requirements for daily work activities on the overall Hanford Site. Personnel training, control of industrial safety and radiological hazards, personal protective equipment, site control, and general emergency response to spills, fire, accidents, injury, site visitors, and incident reporting are governed by the health and safety program. Site-specific health and safety plans will be prepared to supplement the general health and safety program.

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