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Rev. 0

Sampling and Analysis Plan for the 233-S Plutonium Concentration Facility

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United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

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EXECUTIVE SUMMARY

This Sampling and Analysis Plan (SAP) provides the information and instructions to be used for sampling and analysis activities in the 233-S Plutonium Concentration Facility. The information and instructions herein are separated into three parts and address the Data Quality Objective (DQO) Summary Report, Quality Assurance Project Plan (QAPjP), and SAP.

The DQO Summary Report describes the planning approach for defining the data collection design criteria. The DQO process was performed in accordance with BHI-EE-01, *Environmental Investigations Procedures,* EIP 1.2, "Data Quality Objectives."

The QAPjP presents the objectives, functional activities, methods, and quality assurance/quality control procedures associated with the 233-S decontamination and decommissioning (D&D) sample collection and laboratory analyses. The QAPjP follows U.S. Environmental Protection Agency guidelines contained in *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations* (EPA 1994a).

The SAP provides instructions for sample collection and laboratory analysis during D&D activities at the 233-S Plutonium Concentration Facility. Data collection will be used to identify the chemical, hazardous, and radiological contamination of the facility structure and internal components. Characterization data will support the preparation of the waste profile summaries to determine the appropriate waste disposition in accordance with the *Washington Administrative Code* (WAC) Chapter 173-303, "Dangerous Waste Regulations;" *Hanford Site Solid Waste*

Acceptance Criteria (WHC 1993c); *Environmental Restoration Disposal Facility Waste Acceptance Criteria* (BHI 1996a); and supplemental Environmental Restoration Disposal Facility waste acceptance criteria, *Supplemental Waste Acceptance Criteria for Bulk Shipments to the Environmental Restoration Disposal Facility* (BHI 1997b).

CONTENTS

CONTENTS (cont.)

CONTENTS (cont.)

TABLES

CONTENTS (cont.)

FIGURES

ACRONYMS AND ABBREVIATIONS

AHA	Activity Hazards Analysis
ALARA	as low as reasonably achievable
BHI	Bechtel Hanford, Inc.
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COC	contaminant of concern
CWC	Central Waste Complex
CWS	chemical warfare service
D&D	decontamination and decommissioning
DOE-RL	U.S. Department of Energy, Richland Operations Office
DQO	Data Quality Objective
EPA	U.S. Environmental Protection Agency
ERC	Environmental Restoration Contractor
ERDF	Environmental Restoration Disposal Facility
FSP	field sampling plan
FSR	Field Sampling Request
HEPA	high-efficiency particulate air
NDA	nondestructive assay
PCB	polychlorinated biphenyl
PPE	personal protective equipment
PR	plutonium removal
QAPjP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RC	recycle
REDOX	Reduction-Oxidation
RWP	Radiation Work Permit
SAF	Sample Authorization Form
SAP	Sampling and Analysis Plan
SWP	special work permit
TRU	transuranic
TRUSAF	Transuranic Waste Storage and Assay Facility

PART I

DATA QUALITY OBJECTIVES SUMMARY

I.1. INTRODUCTION

I.1.1 DATA QUALITY OBJECTIVES

The Data Quality Objectives (DQO) process for the 233-S Plutonium Concentration Facility (233-S Facility) is a U.S. Environmental Protection Agency (EPA)-required approach to planning and coordinating data acquisition. This process is used as a decision-making tool to assess the use of historical or previously acquired data, and also establishes interfaces and promotes communication with key decision makers and other stakeholders. These decision makers and stakeholders include representatives from the U.S. Department of Energy, Richland Operations Office (DOE-RL), and the EPA.

The primary objective of the DQO process is to establish a consistent, cooperative, and streamlined approach to plan environmental data acquisition, with an emphasis on reducing cost. The DQO process employed is based on the *Guidance for the Data Quality Objectives Process* (EPA 1994b). The DQO process involves the following seven steps:

- DQO Step 1 Problem Statement
- DQO Step 2 Identify the Decisions
- DQO Step 3 Identify Inputs
- DQO Step 4 Define Boundaries
- DQO Step 5 Decision Rules
- DQO Step 6 Uncertainty
- DQO Step 7 Optimization.

I.1.2 PROJECT OBJECTIVES

The objective of the 233-S Facility DQO is to determine sampling and analysis requirements during waste stream characterization to provide information for worker safety, and support waste designation and disposal decisions during decontamination and decommissioning (D&D). The characterization data will be used to prepare the waste profile summary for evaluation against waste acceptance criteria to determine appropriate disposal options.

I.1.3 PROJECT EXCLUSIONS

The project boundary for this DQO includes the 233-S Building and subsurface structures (to a depth of 0.9 m [3 ft] below grade). Localized contamination found below the 0.9-m (3-ft) level may be removed; however, extensive soil remediation (i.e., chasing and removing extensive contamination migration) is not part of this project. Contamination remaining will be identified/documented using the applicable portions of BHI-SH-04, *Radiological Control Work Instructions*, Section 3.0, "Surveys."

I.2. FACILITY AND PROJECT BACKGROUND

I.2.1 PHYSICAL DESCRIPTION

The Hanford Site (Figure I-1) is located in south-central Washington and was selected as the nation's first large-scale nuclear materials production site in January 1943. Plutonium was produced by irradiating uranium fuel elements using reactors located in the 100 Area of the Hanford Site. After the fuel was irradiated, it was taken to separation plants located in the 200 Area where the cladding was removed from the fuel elements and plutonium was extracted. The Reduction-Oxidation (REDOX) Plant was brought on line in January 1952. The REDOX Plant was the world's first nuclear solvent extraction plant using the reduction-oxidation process and operated through July 1967. The 233-S Facility was built in 1955 to expand production and further concentrate the plutonium nitrate product solution from the REDOX facility. The 233-S Facility is located on the north side of the REDOX Plant in the 200 West Area of the Hanford Site (Figures I-1 and I-2).

The 233-S Facility is composed of the original 233-S Process Building, additions/modifications, and interconnecting piping, trenches, and ducting. The 233-S Building was modified by expansion in 1958. This expansion included the addition of maintenance platforms in the process cell viewing room with an exterior stairwell and air locks for entry, an additional plutonium removal (PR) can room, and a spare exhauster. Modifications in 1962 included the installation of an anion exchange purification process in the process hood, the conversion of one plutonium concentrator for neptunium use and other vessel modifications, and numerous piping modifications. The 233-SA Exhaust Filter Building was added in 1964 after a process upset in 1963 that resulted in a fire.

I.2.2 FACILITY DESCRIPTION

The 233-S Process Building is a reinforced concrete structure 11.3 m (37 ft) by 25.7 m (86 ft) with 20.3-cm (8-in.) thick walls and 15.2-cm (6-in.) thick floors. The building includes the main contaminated areas, primarily where process-related activities formerly took place, and nonprocess areas where contamination is expected to be significantly less. The main contaminated areas consist of the process cell, pipe trench, stairwell and air locks, viewing room, and PR can loadout room. The nonprocess areas consist of two can storage rooms, a pipe gallery, control room, the equipment room, special work permit (SWP) change room, lavoratory, an abandoned filter box, and three air locks (Figure I-3).

Figure I-1. Hanford Site Map.

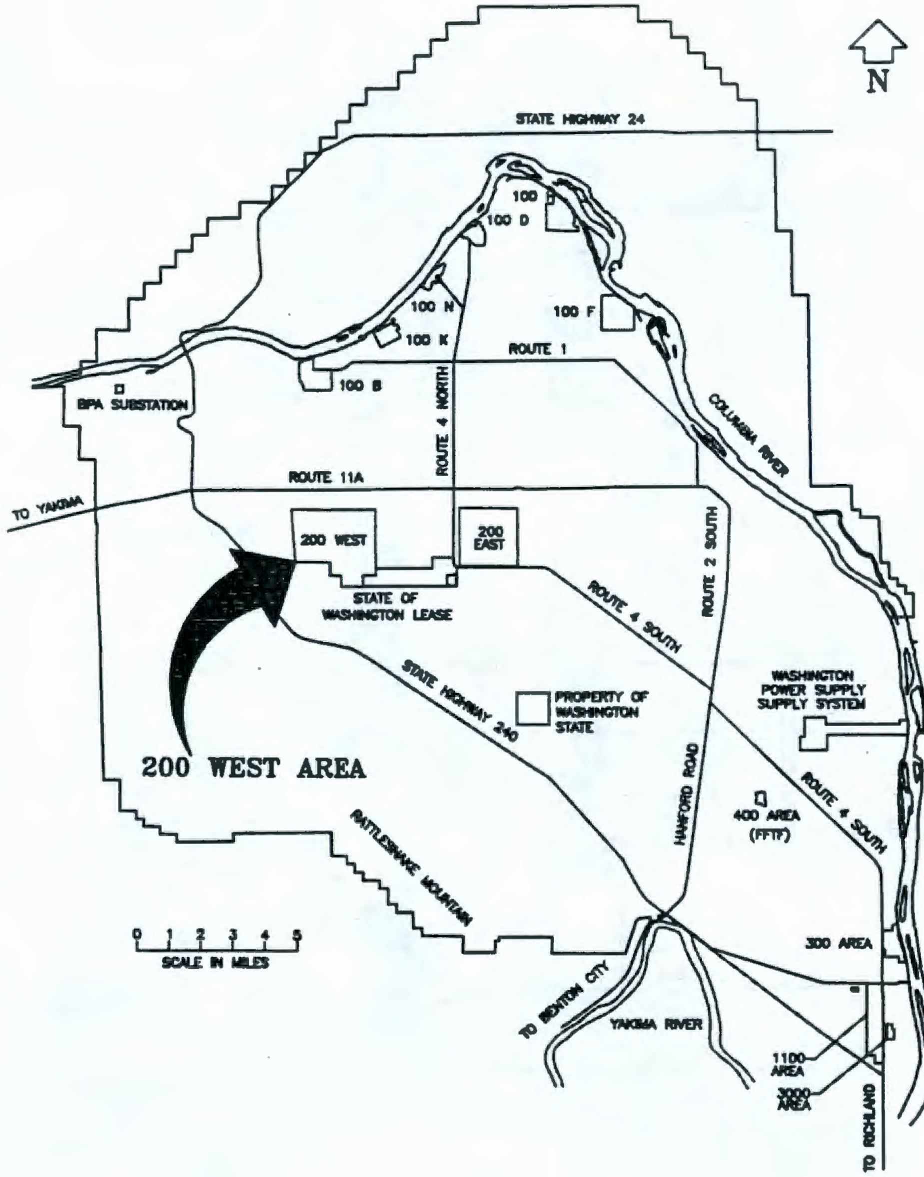


Figure I-2. Location of the 233-S Facility.

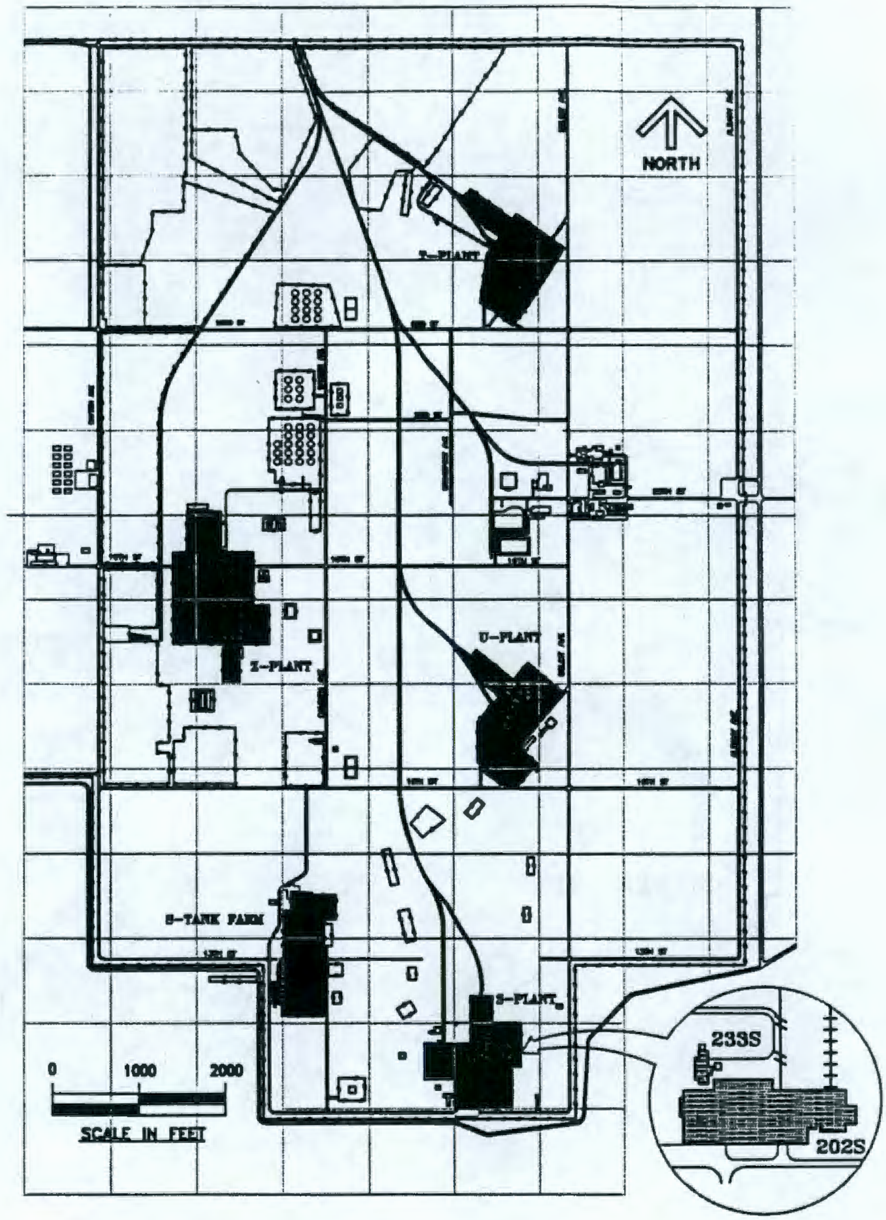
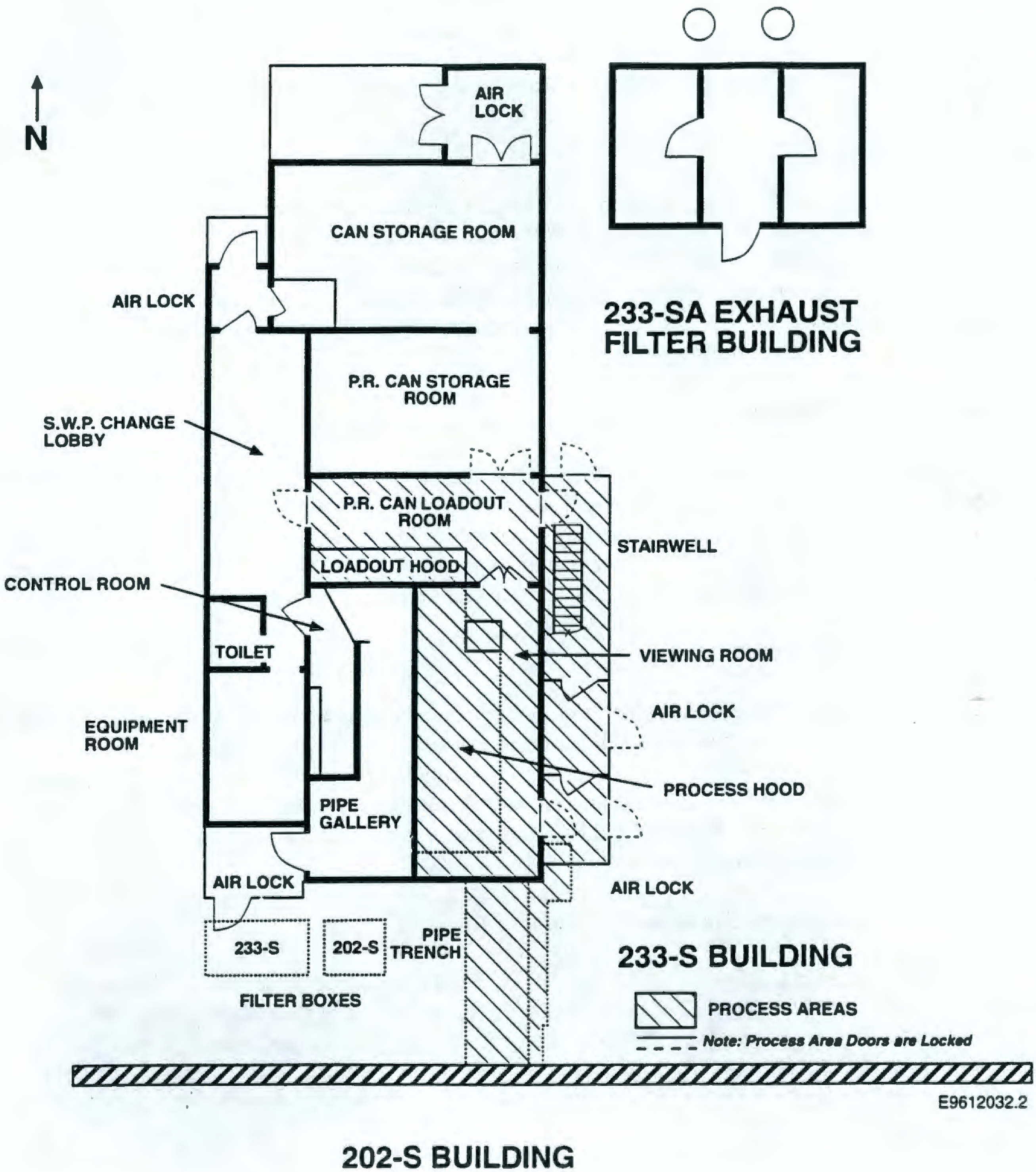


Figure I-3. Facility Diagram.



I.2.2.1 233-S Process Cells

The process cell is a four-story high bay with 30.5-cm (12-in.) thick concrete walls that is divided into two zones. The two zones, the process hood and the viewing room, are separated with a partition of transparent panels and structural steel. The transparent panels were previously covered with opaque paint for contamination control purposes.

I.2.2.2 Process Hood

The process hood is 9.7 m (32 ft) high and contains a process system array with criticality-safe process vessels up to 7 m (23 ft) tall and 17.8 cm (7 in.) inside diameter. Plutonium nitrate solution was pumped from the REDOX E-3 Feed Tank to the 233-S L-12 Feed Tank. The solution was concentrated by boiling and/or ion exchange treatment and loaded into PR cans in the loadout hood prior to shipment for final work at the 231-Z Plutonium Isolation Building of the 234-5Z Plutonium Finishing Plant.

I.2.2.3 Viewing Room

The viewing room provides access to each of the three upper levels of the process hood via three open-grating walkways along the east and south sides of the process hood enclosure. The original access ladder remains in the southwest corner. The walkways are located so they divide the height of the cell into approximately equal segments of 2.4 m (8 ft). At the north end of the hood, the wall at the upper level supports electric and process instrumentation equipment.

I.2.2.4 PR Can Loadout

The PR can loadout and decontamination room is located on the north side of the process hood. The loadout is located on the south side, or common wall with the process hood, and is a confinement-type work station that was used for loading PR cans with concentrated plutonium nitrate solution, neptunium solutions, and unloading recycle (RC) cans for rework in 233-S or 202-S. Decontamination of the PR and RC cans was performed in the loadout hood. There are no PR or RC cans remaining.

I.2.2.5 PR Can Storage Room and Equipment Room

The can storage rooms allowed 68 PR and RC cans to be stored while awaiting shipment or recycle back into the system. These rooms are on the north side of the loadout room. The equipment room contains the necessary equipment, ducting, and wiring to provide and control makeup air to the building. Much of the ducting is insulated with asbestos materials. Airborne contamination may have deposited on equipment surfaces during upset operation conditions.

I.2.2.6 Nonprocess Pipe Gallery and Control Room

The pipe gallery contains nonprocess support lines from the REDOX Building that enter the area through the viewing room. Equipment in the room includes instrument lines, steam lines, a chemical makeup tank, and a variety of control panels. The control panels are separated from the nonprocess pipe gallery by plastic panels that create an isolated control room.

I.2.2.7 Abandoned Filter Box

The abandoned filter box is a reinforced concrete structure located below grade, between the REDOX Building and the 233-S Building. The filter box is approximately 1.8 m (6 ft) wide by 1.8 m (6 ft) deep by 3.65 m (12 ft) long with 0.15-m (6-in.) thick walls, and was used as a backup system during the time of the 1963 fire. The primary system was an above-grade filter housing that provided filtration system for the facility. A temporary filtration unit was installed to allow tie-in of the 233-SA Building, the unneeded ductwork and above-ground filters were removed, and the filter box was abandoned. It is unknown if the Chemical Warfare Service (CWS) filters were abandoned in place.

I.2.2.8 Process Pipe Trench

The pipe trench is a 7.15-m (23-ft, 6-in.) long concrete subgrade structure running between the REDOX Building and the southeast corner of the 233-S Building. The pipe trench is divided into two parallel sections to separate radiological solution transfer lines and nonradiological piping. The concrete cover blocks have metal plates concealing recessed lifting bails. A neptunium pipe trench was added in the 1962 upgrade and is located adjacent to the pipe trench.

I.2.2.9 233-SA Exhaust Filter Building

The 233-SA Exhaust Filter Building was constructed following the 1963 fire to handle the exhaust ventilation for the 233-S Facility. The 233-SA Exhaust Filter Building is a one-story, 4.9-m (16-ft) by 7.3-m (24-ft) reinforced concrete structure with 15.2-cm (6-in.) thick walls. The filter building is located on a 7.3-m (24-ft) square, 0.2-m (8-in.) thick reinforced concrete pad at the northeast corner of the 233-S Process Building. The filter building contains two parallel filter banks. Each bank has a series of double high-efficiency particulate air (HEPA) filters each with its own exhaust fan, a 7.6-m (25-ft) high metal stack, and sampling equipment. The fans and stacks are located to the north of the building and are designated 296-S-7 East and 296-S-7 West.

I.2.2.10 Facility Roof Structures

The roof of the 233-S Process Building and 233-SA Filter Building consist of 0.15-m (6-in.) thick concrete covering the building sections constructed with concrete walls. The newer sections of the 233-S Process Building that are constructed with metal walls affixed to structural steel frames are roofed with metal plates. The roofs include the base structural materials (metal or concrete) and an insulation layer covered with tarred gravel. The roofs support the exhaust ventilation ducting and various arrays of electrical conduit and facility system pipes. Various roof locations that have become radioactively contaminated from past upset conditions have been coated with foam and sealants to contain contaminants. The facilities' roofs have currently been declared sufficiently sound to support minor on-roof repair operations to seal cracks and prevent in-facility water leakage.

I.3 DISCHARGES/PROCESS KNOWLEDGE

I.3.1 PROCESS DESCRIPTION

Plutonium was produced by irradiating uranium fuel elements using reactors located in the 100 Area of the Hanford Site. After the fuel was irradiated, it was taken to the 202-S REDOX Plant (located in the 200 Area) where the aluminum cladding was stripped off the fuel elements and plutonium was extracted. The plutonium solution was transferred from the 202-S REDOX Building to the 233-S Facility where the plutonium solution was concentrated and loaded into PR cans for transport to the Plutonium Finishing Plant (Z Plant) for further processing. In 1962, the operation in 233-S was expanded to include a neptunium concentration and loadout process, along with an ion exchange plutonium purification process.

The neptunium process was similar to the initial plutonium process. Neptunium solution was received from the 202-S Building and concentrated on a batch basis. The concentrated neptunium solution was then loaded into transfer cans and transported to Z Plant for further processing.

In the ion exchange process, solutions containing plutonium and undesirable impurities were passed through a resin bed where the plutonium absorbed onto the resin while the impurities remained in the solution and left the system. The purified plutonium was then chemically removed from the resin and loaded into PR cans for transport to Z Plant.

I.3.2 HISTORY OF CONTAMINATION

In 1956, an air-activated diaphragm valve (located between a plutonium nitrate concentrator and a receiver vessel) failed, allowing the acidic solution to work back through a copper air-supply line. The acidic solution corroded the copper and about 32.5 g of solution was found in two visible spills, which showed contamination levels greater than 7×10^6 dpm alpha (an off-scale measurement on the survey meter). The ventilation system was set up to pressurize the change room and control room with respect to the process area and outside areas. Shortly after the incident occurred, it was discovered that contaminated air was also being forced outside through the gravity dampers and building doors.

In November 1963, chemical reactions occurred within the scrubload section of the L-18 ion exchange unit. The reaction resulted in a rapid pressure buildup within the column and release at a flange joint that caused a pyrolytic, plutonium-loaded ejection of resin beads. The primary barrier (the piping) was breached and a plutonium/resin pyrolytic reaction ignited a fire, causing extensive damage to the process equipment. Gross alpha contamination was spread within the process area, and radiological contamination was distributed to other portions of the facility, including the exterior roof.

I.3.3 DECONTAMINATION

Decontamination and decommissioning of 233-S was selected in 1978 as a demonstration project. A major effort began to decontaminate this facility, but stopped in 1981 due to lack of funding. This activity accomplished initial characterization and housekeeping of the facility and removed the contents and equipment from the loadout hood. The contamination within the loadout hood was stabilized, and plexiglass panels equipped with HEPA filters were installed to cover the openings. Subsequently, the interior of the loadout hood was recontaminated by particulate migration through the previously sealed wall penetrations from the adjoining process hood. The hood contains a sump (45.7 cm by 10 cm [18 in. by 4 in.] deep) that is currently covered with a dry cracked substance.

Stabilization activities, including interior and exterior areas of the facility, were completed in 1987. The stabilization work sealed the 202-S REDOX column laydown trench and the pipe trench between 233-S and 202-S. The activities also fixed contamination around these trenches and the north wall of REDOX with an asphalt emulsion, and accomplished decontamination and fixative application inside the 233-S Building.

I.3.4 PREVIOUS INVESTIGATIONS

In 1990, radiological and chemical characterization surveys were accomplished and reported in *Radiological Characterization of the 233-S Facility* (WHC 1990b) and *233-S Facility Potential Chemical Hazards* (WHC 1990a). The extent of contamination throughout the process area ranges from 25 million dpm/100 cm^2 fixed and smearable alpha (process hood) down to 30,000 dpm/100 cm^2 smearable alpha.

In 1996, characterization activities were conducted to evaluate the radiological status of the 233-S Facility and identify hazardous substance locations (BHI 1996b). The characterization activities were limited to the nonprocess areas, which include the SWP change room, toilet, equipment room, electrical cubicle, control room, and pipe gallery. Radiological surveys and sample collection activities were conducted to identify the smearable, residual, radiological concentrations throughout the nonprocess areas. The extent of contamination throughout the nonprocess area ranges from <200 to 42,000 dpm/100 cm^2 removable alpha contamination.

I.3.5 RADIOLOGICAL CONTAMINANTS OF CONCERN

Radiological surveys have documented, to the extent possible, the nature and extent of contamination. Isotopic analyses from samples taken during the surveys have identified the radioactive contaminants as neptunium-237, plutonium-238, plutonium-239, plutonium-240, plutonium-241, plutonium-242, americium-241, cesium-137, and curium.

I.3.6 CHEMICAL CONTAMINANTS OF CONCERN

Chemicals such as acetylene tetrabromide, hexone, nitric acid, sodium nitrate, and various coatings and caulking compounds are known to have been used in the 233-S Facility while the facility was operating. These substances have been identified in the building in very minor quantities. In addition, 233-S is expected to contain one or more of the hazardous substances that are present in most Hanford Site buildings: polychlorinated biphenyl (PCB) and non-PCB light ballasts, lead paint, lead for shielding, mercury switches, fluorescent light bulbs, mercury or sodium vapor lights, and used oils from motors and pumps. The hazards associated with these materials are minor because they are contained within enclosed equipment with minimal likelihood for release.

I.3.7 CRITICALITY EVALUATION

An independent evaluation was performed to assess the potential of a criticality accident due to the fissile inventories and the proposed removal actions (BHI 1996d). The criticality evaluation (BHI 1996b) demonstrated that, individually, each of the process vessels is subcritical. Calculations performed by Bechtel Hanford, Inc. (BHI) confirm this finding, assuming optimum moderation of the fissile material within the vessel and full water reflection conditions (BHI 1996d). The criticality evaluation also demonstrated that the array of process vessels is subcritical. This evaluation was again confirmed by BHI calculations using conservative assumptions that the fissile material within the vessels is optimally moderated and that the array is reflected on all sides by concrete. Finally, BHI calculations analyzed several off-normal accident conditions, including a factor of 2.6 measurement error for the fissile material in the vessel with the largest fissile material inventory and the release of the contents of all vessels to the floor during removal. For all cases analyzed, sufficient criticality safety margins were maintained, and further evaluation by BHI has concluded that criticality is not credible. Additionally, the 233-S Removal Action Report (DOE-RL 1977) contains Technical Safety Requirements and a substantial number of other requirements to ensure criticality remains not credible and to prevent unplanned redistribution of materials.

I.4 PLAN FOR PROJECT TASK ACTION

The *Engineering Evaluation/Cost Analysis for the 233-S Facility* (DOE-RL 1996a) presented four alternative approaches for future facility management and the resultant levels of safety that may be anticipated. Decontamination and/or stabilization of the facility followed by its demolition and disposal was selected as the most responsive approach to safety concerns and in concert with planned land remediation actions. This selection was verified in the March 1997 Action Memorandum that provides direction to proceed with this non-time critical removal action project (EPA 1997).

The 233-S Facility removal will be performed in a manner that will permit the early disposal of the major fissile material inventory followed by building cleanup and dismantlement efforts. The early elimination of hazardous substances and conditions will reduce the precautionary measures and the safeguards needed to protect workers and the environment and will permit the use of standard decommissioning practices. Sampling and analysis will be performed throughout the removal project to provide information for worker safety, protection of the environment, and characterization of various waste streams. This information will be used to dictate the protective controls required for workers involved in specific operations, and the preparation of the waste profile summaries for waste disposition at the Environmental Restoration Disposal Facility (ERDF). Characterization will be performed in conjunction with planned operations due to inaccessibility of piping systems within the facility. These systems will only be accessible as D&D operations occur. Throughout the duration of the project, facility conditions will change and/or additional information will become available, which may alter the initial characterization plans.

Removal of the 233-S Facility will be completed when the building and all subsurface structures (to a depth of 0.9 m [3 ft] below grade) have been removed. Contaminated soils down to this level will be excavated and appropriately disposed.

I.5 DECISION MAKERS AND TECHNICAL STAFF

The decision makers for each organization and the technical support staff are listed in Table I-1. Personnel consulted during the DQO process, are also listed.

I.6 PROJECT TASK SCOPING AND ISSUES SUMMARY

I.6.1 DATA QUALITY OBJECTIVE CHECKLIST/BINDER

The DQO checklist was prepared to identify the roles and responsibilities of the technical team. The checklist was also prepared to identify additional data needs and personnel responsible for obtaining that data. The DQO binder was prepared by gathering information from historical documents, drawings, radiological surveys, D&D project plans, and personnel interviews. Information from the binder was used to prepare the DQO scoping report. The scoping report was distributed to the technical team and decision makers prior to the DQO process.

Table I-1. Decision Makers and Technical Staff.

Participant	Responsibility	Participation		
		8/25/97	8/27/97	9/11/97
Pam Innis	EPA			
Jeff Bruggeman	DOE	x		
Allan Chaloupka	Task Lead	x		x
Scott Thoren	Deputy Task Lead	x	x	x
George Carter	D&D Engineer	x		x
Cheryl Volkman	Quality Services	x		
Charlie Blankingship	Field Support	x	x	
Jerry Fasso	Safety			
Ryan Johnson/Randy Jackson	Solid Waste Management	x	x	x
David Encke	D&D Characterization (Scientist)	x	x	x
Rikki Harris	D&D Characterization	x	x	x
Richard Weiss	Sample Management	x		
Wendy Thompson	Sampling and Analysis	x		
Joe Zoric	Environmental Compliance	x	x	
Mark Kornish	Health Physics Engineer	x		x
Roger Ovink	Environmental Science (Facilitator)	x	x	x
David St John	Sampling and Analysis			
Nelson Little	Lead Project Engineer	X		
Richard Arthur	PNNL NDA			x
Scott Peterson	Environmental Science (Statistician)			X

D&D = decontamination and decommissioning
DOE = U.S. Department of Energy
EPA = U.S. Environmental Protection Agency
PNNL = Pacific Northwest National Laboratory
NDA = nondestructive assay

I.6.2 SCOPING PROCESS ISSUES

The selected approach initially involves removing systems and building features that are known or suspected to contain significant fissile material inventory. Specific waste streams will be identified; however, it is realistic to assume that as the building layers are removed during D&D activities, waste streams that have not been specifically called out will be identified.

I.6.3 GLOBAL ISSUES/DQO MEETING SUMMARY

The global issues meeting was held on August 25, 1997, during which an overview of the project scoping document, project tasks, participant responsibilities, and scheduled deliverables were discussed. As part of the discussion, the technical team also discussed EPA issues identified during the interview process and identified issues concerning laboratory use, waste stream identification, waste stream disposition, disposal options, and use of nondestructive assay (NDA) equipment.

I.6.3.1 Laboratory Issues

The most difficult aspect of the sampling activity is on/off-site laboratory acceptance of extremely high alpha-contaminated materials. If necessary, field extraction of highly contaminated samples will be performed to reduce contamination levels prior to shipment.

The Characterization Team and Sample Management will evaluate the sample volumes, turnaround times, and analysis methods prior to sample collection. All information will be documented on the Sampling Authorization Form (SAF). This will ensure that appropriate laboratory and sample preparation will take place.

Laboratory data will be validated to at least Level C, the minimum level in which quality control samples are obtained and compared.

I.6.3.2 Nondestructive Assay

Nondestructive assay may be used to determine the contamination distribution in pipe systems, vessels, ventilation ducts, and trenches. The data will be used to support criticality evaluations and "hot spot" identification prior to sampling. Equipment limitations, project requirements, confidence levels, interference issues, and available techniques were briefly discussed; however, this will not be part of the seven-step DQO process. Further planning sessions may be needed to identify the type of NDA instruments/detectors that will be used to evaluate the alpha and other radiological contamination, specifications requirements, criteria for percent coverage of the surveys, and minimum detectable activity requirements. This information will be documented in a separate package for contract instruction.

I.6.3.3 Anomalies

It is realistic to assume that as D&D progresses, liquids and residual solids (anomalies) will be found. It was determined that these wastes will be appropriately accumulated for sampling and analysis. Prior to sample collection, sample personnel, D&D Characterization, Solid Waste Management, and Radcon engineering will evaluate the waste streams to confirm that the sampling approach is appropriate, and that the requested analysis meets the needs of Solid Waste Management to properly identify the radiological and chemical contaminants of concern (COCs).

I.6.3.4 Disposal Alternatives

The primary disposal option, as identified in the Action Memorandum for the 233-S Plutonium Concentration Facility, for each waste stream is the ERDF. In order to dispose of waste in locations other than the ERDF, EPA approval is required.

I.6.3.5 233-S Waste Streams/Historical Model

The following information includes waste stream identification, disposal options, and waste management requirements. This information will provide the basis for the subsequent steps in the DQO process.

Based on historical information, numerous facility inspections, sampling/analysis results, and detailed radiological surveys, the Environmental Restoration Contractor (ERC) has identified several waste streams within the 233-S Facility. These waste streams will be managed under the *Comprehensive Environmental Response Compensation Liability Act of 1980* (CERCLA) to allow for disposal at the ERDF.

The historical model was developed based on previous data, site and process history, and known sources of contamination types in each waste stream. Table I-2 summarizes the historical data, the source of data, and COCs for each waste stream.

I.6.3.6 ERC Solid Waste Management

Prior to disposal, BHI Solid Waste Management will need to ensure proper waste characterization, verification, and designation to satisfy the federal and state applicable or relevant and appropriate requirements and the receiving facilities waste acceptance criteria.

All waste streams will be certified, radiologically and chemically, through process knowledge and/or approved sampling and analytical methods. This information will be used by Solid Waste Management to prepare waste profile summaries. The required data to prepare waste profile summaries are listed in Table I-3.

Table I-2. Historical Model. (3 Pages)

Waste Stream	Source of Historical Data	Contamination Source	Waste Matrices	Contaminants of Concern
1. Process Drains	Radiological Characterization (WHC-SD-CP-TI-163) Chemical Hazard (WHC-SD-DD-TI-056) 1997, Final Characterization Report for the Non-Process Areas (BHI-01032)	Chemical flow process, spills	Pipe system/possible liquids	RCRA metals, PCBs, resin, plutonium, neptunium, americium, curium, cesium, nitrates. If liquids are found, then VOAs/semi-VOA and nitric acid become a COC.
2. Exhaust Ducts	Radiological Characterization (WHC-SD-CP-TI-163) Chemical Hazard (WHC-SD-DD-TI-056)	Process solution blowback incident, chemical fire	Duct work	RCRA metals, nitrates, plutonium, neptunium, americium, curium, cesium.
3. Elemental Lead	None	Shielding material. Shielding use, chemical fire	Lead sheeting	RCRA metals, nitrates, plutonium, neptunium, americium, curium, cesium.
4. Anion Ion Exchanger	None	Purification process.	Solid/possible liquids	RCRA metals, nitrates, plutonium, neptunium, americium, curium, cesium. Resin. If liquid is found, then VOA/semi-VOA and nitric acid become a COC.
5. Np Concentrator (L-2 Vessel)	Process flow sheet described in the process description. No document number	Process use	Scale/liquid	RCRA metals, nitrates, plutonium, neptunium, americium, curium, cesium. Resin. If liquids are found, then VOAs/semi-VOA and nitric acid become a COC.
6. Product Concentrator (L-3 Vessel)	Process flow sheet described in the process description. No document number	Process use	Scale/residue, possible liquid	RCRA metals, nitrates, plutonium, neptunium, americium, curium, cesium. Resin. If liquids are found, then VOAs/semi-VOA and nitric acid become a COC.
7. Np Concentrator Condenser (L-8)	Process flow sheet described in the process description. No document number	Process use	Scale/residue, possible liquid	RCRA metals, nitrates, plutonium, neptunium, americium, curium, cesium. Resin. If liquids are found, then VOAs and nitric acid become a COC.
8. Process Hood (Sump)	Process flow sheet described in the process description. No document number	Process use	Scale/residue, possible liquid	RCRA metals, PCBs, nitrates, plutonium, neptunium, americium, curium, cesium. Resin. If liquids are found, then VOA/semi-VOA and nitric acid become a COC.
9. Process Pipe Trench (Concrete Structure)	None	Chemical process flow	Scabble/concrete pieces	RCRA metals, nitrates, plutonium, neptunium, americium, curium, cesium.

Table I-2. Historical Model. (3 Pages)

Waste Stream	Source of Historical Data	Contamination Source	Waste Matrices	Contaminants of Concern
10. Process Pipe Trench (Process Pipe)	None	Chemical process flow	Pipe system	RCRA metals, nitrates, plutonium, neptunium, americium, curium, cesium.
11. Non-Process Piping	1997, Final Characterization Report for the Non-Process Areas (BHI-01032)	Process solution blowback incident, chemical fire	Pipe system	Plutonium, neptunium, americium, curium, cesium, nitrates.
12. Loadout Hood (sump)	None	Process use, chemical fire	Scale/liquid	RCRA metals, nitrates, plutonium, americium, neptunium, curium, cesium. If liquids are found, then VOA/semi-VOA and nitric acid become a COC.
13. BF3 Tubes	None	Chemical fire	Contained gas	Fluoride, plutonium, neptunium, americium, curium, cesium.
14. HEPA Filters	None	Ventilation filtration	Filter media, vacuum cleaner filters, 9,000 cfm exhauster and decon trailer exhauster filter media	RCRA metals, DOP, nitrates, plutonium, neptunium, americium, cesium curium.
15. Asphalt	None	Process solution blowback, chemical fire	Asphalt	RCRA metals, nitrates, resin, plutonium, neptunium, americium, curium, cesium.
16. Concrete (floor/walls)	Radiological Characterization (WHC-SD-CP-TI-163) Chemical Hazard (WHC-SD-DD-TI-056) 1997, Final Characterization Report for the Non-Process Areas (BHI-01032)	Chemical fire, process solution blowback	Cement matrix	RCRA metals, nitrates, plutonium, neptunium, americium, curium, cesium.
17. Asbestos Containing Material (ACM)	None	Asbestos fibers and chemical fire, process solution blowback incident	Pipe insulation, cement wall board, floor tiles, valve gaskets, roofing material, duct work	Asbestos fibers, plutonium, neptunium, americium, curium, cesium.
18. Wood/Sheetrock	None	Chemical fire, process solution blowback incident. RCRA metals in paint pigment	Wood matrix/sheetrock matrix	RCRA metals. Chromium, plutonium, neptunium, americium, curium, cesium.
19. Roofing Material	Radiological Characterization (WHC-SD-CP-TI-163) 1997, Final Characterization Report for the Non-Process Areas (BHI-01032)	Chemical fire	Tar, rolled sheeting, roof matrix	RCRA metals, plutonium, neptunium, americium, curium, cesium, asbestos.

Table I-2. Historical Model. (3 Pages)

Waste Stream	Source of Historical Data	Contamination Source	Waste Matrices	Contaminants of Concern
20. Misc. Routine Waste	None	Contamination associated with mercury components, PCB, tritium components, chemical fire, and process solution blowback incident	Oils, conductor fluids, lead buttons, source units	Mercury-containing components in manometers, lead associated with incandescent bulbs, PCB associated with light ballasts, tritium sources for exit signs, sodium bulbs. Also radiological contaminants of concern
21. Paint	1997, Final Characterization Report for the Non-Process Areas (BHI-01032)	Lead and cadmium in paint. Radiological contamination from chemical fire, process solution blowback, and use as fixative	Paint chips	RCRA metals, plutonium, neptunium, americium, curium, cesium.
22. Process Hood Floor Dirt/Debris	None	Chemical fire	Dirt, debris	RCRA metals, nitrates, plutonium, neptunium, americium, curium, cesium
23. Lubricant/Oil	None	Oil/lubricant components. Equipment use	Used equipment oil and grease	PCB, RCRA metals, plutonium, neptunium, americium, curium, cesium.
24. Soil	None	Chemical fire	Soil from contaminated locations	RCRA metals, nitrates, resin, plutonium, neptunium, americium, curium, cesium.
25. Pu Recycle Tank (L16 Vessel)	None	Chemical process flow, chemical fire	Scale, powder, possible liquid	RCRA metals, nitric acid, nitrates, resin, hexone, plutonium, neptunium, americium, curium, cesium. If liquids are found, then VOA/semi-VOA and nitric acid become a COC.
26. French Drain	Data from process descriptions, COC identification	Exhaust/air condensate collection	Soil/gravel, possible liquids	RCRA metals, nitrates, resin, plutonium, neptunium, americium, curium, cesium. If liquids are found, then VOA/semi-VOA and nitric acid become a COC
27. Anomalies	None	Chemical process, chemical fire	Solid/liquid	Plutonium, neptunium, americium, curium, cesium. Chemical constituents unknown until an evaluation of purpose and use is made.

COC = contaminants of concern
RCRA = *Resource Conservation and Recovery Act of 1976*
VOA = volatile organic analysis
DOP = dioctyl phthalate

Table I-3. Required Actions for Waste Designation.

Characterization (ERDF, CWC)	Criteria
1. Determine if the waste is regulated as a listed dangerous waste[a].	WAC 173-303-080,-081, and -082
2. Determine the applicability of characteristic waste codes: corrosivity, ignitability, reactivity, and toxicity.	WAC 173-303-090 (2)-(8).
3. Determine if a waste meets the definition of a toxic dangerous waste (i.e., those wastes with equivalent concentrations of toxic components of 0.001% or more).	WAC 173-303-100/ WAC 173-303-100 [5])
4. Determine if a waste meets the definition of a persistent waste: those wastes that contain a total concentration of halogenated hydrocarbons of 0.01% or more, or a total concentration of polycyclic aromatic hydrocarbons of 1.0% or more.	WAC 173-303 (6)
5. Determine if the waste is regulated due to its polychlorinated biphenyl (PCB) concentrations.	40 CFR 761
6. Determine constituents that may be regulated for land disposal if the waste is designated as dangerous.	WAC 173-303-140 and 40 CFR 268
7. Determine the reportable quantities of radiological constituents.	49 CFR 171-173
8. Determine the isotopic and specific activities of radiological constituents.	Used to support the preparation of waste profiles to compare against the acceptance criteria at ERDF (BHI-00139) or CWC (WHC-EP-0063)

[a]No listed waste is expected to be generated during the 233-S D&D project.

I.7 DQO PROCESS SUMMARY

I.7.1 STEP 1: PROBLEM STATEMENT

The 233-S Facility has been inactive for over 25 years and has no identified future use that would justify a partial cleanup/maintenance approach. The building is radioactively contaminated and has undergone structural deterioration due to exposure to the extreme weather conditions.

Removal of the 233-S Facility will be performed in a sequential progression of operations designed to initially eliminate the most hazardous conditions, followed by a logical course of operations for removal. Sampling and analysis will be performed throughout the removal project to provide information for worker safety, protection of the environment, and identification of various waste streams. This information will be used to dictate the protective controls required for workers involved in D&D operations and to develop the waste profile summaries to support waste disposition decisions.

I.7.2 STEP 2: IDENTIFY THE DECISIONS

The list of decisions with potential actions follows. These decisions are focused on waste stream segregation, storage or disposal options, and criteria to meet the storage or disposal options.

1. Determine the waste stream boundaries to optimize sampling and analysis efforts.

2. Determine the nature and extent of contamination of each waste stream, including a determination of whether the waste stream contains dangerous waste, low level radioactive waste, mixed waste, hazardous waste, TRU waste, or TRU-mixed waste.

3. Determine the storage or disposal options for each waste stream, including whether the waste will be disposed of at the ERDF, stored at the Central Waste Complex (CWC) or the Transuranic Waste Storage and Assay Facility (TRUSAF), or other EPA-approved storage or disposal site.

I.7.3 STEP 3: IDENTIFY INPUTS TO THE DECISION

The information required to resolve each decision is listed in Table I-4, which also lists sources of information needed, and the use of the information in the decision.

I.7.3.1 Information Needed

The information needed is listed below.

1. NDA information for criticality evaluations, "hot spot" identification prior to sample collection, and waste package disposition, prior to shipping and disposal.

2. Radiological surveys, using hand-held instruments, to identify fixed and smearable contamination. The radiological surveys will be performed prior to sample collection to identify worst-case radiological concentrations of the waste stream matrices. Surveys will follow guidelines as referenced in BHI-SH-04, *Radiological Control Work Instructions*, Instructions 3.1 and 3.8, and BHI-SH-02, Volume 2, *Safety and Health Procedures*, Procedure 2.3.3.

3. Sample collection and laboratory analysis, to identify contaminant concentrations. The laboratory data will be used to prepare waste profile summaries that determine waste disposal options.

Table I-4. Decisions, Inputs, Source, and Use.

Decision	Input	Source	Use
1. Determine the boundaries of each waste stream to optimize the sample, laboratory, and cost efficiency.	Process knowledge, Table I-1	Historical documents. Facility drawings, radiological surveys, sampling/analytical data	Assess waste stream matrices and COCs
2. Determine if the waste stream contains dangerous waste, low-level radioactive waste, mixed waste, hazardous waste, TRU waste, or TRU-mixed waste.	Process knowledge	Historical data. 1996 final characterization report of the nonprocess area	Identify the COCs for requested analysis
	Disposal levels	ERDF WAC, CWC WAC	Compare levels versus sampling results
	Input from sample data	Characterization data	Prepare waste profile for final waste designation
3. Determine the disposal options for each waste stream. Will the waste be disposed of at the ERDF or CWC?	Inputs from decision 2 above	See decision 2 above	Use data to assess options, cost packaging requirements
	Waste profile	Waste profile summary	Used to determine cumulative total of radionuclides, and concentrations of metals versus disposal criteria
	NDA	NDA	Final disposition of packages waste prior to shipment and disposal

COC = contaminants of concern
CWC = Central Waste Complex
ERDF = Environmental Restoration Disposal Facility
NDA = nondestructive assay
TRU = transuranic
WAC = waste acceptance criteria

I.7.4 STEP 4: DEFINE THE STUDY BOUNDARIES

The project boundary for this DQO includes the 233-S internal equipment, components, and building and subsurface structures (to a depth of 0.9 m [3 ft] below grade). Localized contamination found below the 0.9-m (3-ft) level may be removed; however, extensive soil remediation (i.e., chasing and removing extensive contamination migration) is not part of this project.

I.7.5 STEP 5: DEVELOP DECISION RULES

The decisions were presented in Section I.7.2. Decision 1 was made by the technical team, based on process knowledge, waste stream matrix, and waste stream location. Decisions 2 and 3 and associated decision rules are listed below.

2. Determine if the waste streams contain dangerous waste, PCB waste, low-level radioactive waste, mixed waste, hazardous waste, TRU waste, or TRU-mixed waste.

- If the sample obtained from waste streams exceeds the dangerous waste criteria (WAC 173-303-080, -081), then the waste must be treated as dangerous waste.
- If the sample obtained from waste streams exceeds the PCB waste criteria (40 CFR 761), then the waste must be treated as PCB waste.
- If contamination concentrations exceed the dangerous waste criteria (WAC 173-303-090 (2)-(8)), then the waste must be treated as hazardous waste.
- If contamination concentrations exceed the radiological waste criteria (DOE Order 5820.2A, *Radioactive Waste Management* [DOE 1988]), then the material is radioactive and must be treated as low-level waste.
- If contamination concentrations exceed the radiological waste criteria (DOE Order 5820.2A [DOE 1988]) and the material contains PCB wastes, then the material is radioactive and must be treated as PCB low-level waste.
- If contamination concentrations exceed the mixed waste criteria as defined by DOE Order 5820.2A (DOE 1988), and WAC 173-303, then the material must be treated as mixed waste.
- If contamination concentrations exceed the TRU waste criteria (DOE Order 5820.2A [DOE 1988]), then the material will need to be treated as TRU waste.
- If contamination concentrations exceed the TRU waste criteria (DOE Order 5820.2A [DOE 1988]) and the material contains PCB wastes, then the material will need to be treated as PCB-TRU waste.
- If contamination concentrations exceed the dangerous waste criteria (WAC 173-303) and the TRU waste criteria (DOE Order 5820.2A [DOE 1988]), then the material will need to be treated as TRU-mixed waste.

3. Determine the storage/disposal options for each waste stream. Will the waste be disposed of at the ERDF, the CWC, or TRUSAF?

   If the waste stream profile does not comply with the ERDF criteria, then the waste will be stored at the CWC or TRUSAF.

I.7.5.1 Parameters of Interest

I.7.5.1.1 Facility Structure and Internal Components. Process knowledge, NDA information, and radiological surveys show that the waste matrices are radiologically contaminated. There are worst-case, or "hot spot," locations in the pipe systems, ducts, and areas of the facility structure that have a higher potential for radioactive material buildup. Process knowledge also shows that these "hot spots" have a correlation with a buildup of hazardous chemical concentrations as well. A sampling design, based on professional judgement, and worst-case (authoritative) sampling will be used to determine the maximum levels of radiological contamination. The parameter of interest will be a single maximum analytical value for every constituent in each waste stream that will be compared against the WAC decision levels. This design is described in better detail in Step 7, Optimization.

I.7.5.1.2 Soil Excavation. Removal of the 233-S Facility and its systems will be completed to a depth of 0.9 m (3 ft) below grade. Soil characterization of the excavated area will be performed by detailed radiation surveys and the analysis of representative soil samples as specified in *Soils and Solid Media* (EPA 1989) and *Guidance on Sampling and Data Analysis Methods* (Ecology 1995). These efforts will involve establishing a grid system on the area and performing radiological surveys. These surveys will verify the remaining conditions at the conclusion of the removal activities. If the remaining soil is contaminated, with DOE/EPA concurrence, further remediation will become the responsibility of a future remedial action. A cap of clean borrow soil will be placed over the involved area, and routine surveillance activities will be initiated.

I.7.5.2 Decision Levels

The COCs and waste decision criteria for waste designation are summarized in Table I-5. The COCs in this table are based on process knowledge of known contaminants in the identified waste streams. The COCs also represent analyses needed to identify unknown waste streams that may discovered during D&D activities. The waste decision criteria in Table I-5 are based on the required actions for waste designation listed in Table I-3.

Decision levels for the radiological surveys are based on the levels presented in Regulatory Guide 1.86 (AEC 1974) and DOE Order 5400.5 (DOE 1990). These surface activity limits are 20 dpm/100 cm^2 for removable transuranics, 500 dpm/100 cm^2 for fixed + removable transuranics, and 1,000 dpm/100 cm^2 beta/gamma removable, 5,000 dpm/100 cm^2 beta/gamma fixed + removable.

I.7.6 STEP 6: SPECIFY LIMITS ON DECISION ERROR

Because a statistical sampling approach is not feasible or deemed necessary for the 233-S waste streams, professional judgement, and a worst-case (maximum COC concentration), authoritative sample design will be applied.

I.7.7 STEP 7: OPTIMIZE THE DESIGN FOR OBTAINING DATA

I.7.7.1 Analysis Criteria

The laboratory analyses, methods, waste decision criteria, and laboratory detection limits are listed in Table I-5. This table covers the laboratory analysis for identified waste streams, as well as anomalies that may be found. Process knowledge will be evaluated by ERC Solid Waste Management prior to sampling activities to eliminate or add analyses, if appropriate.

Radiological surveys, using hand-held instruments, will be used to identify fixed and smearable contamination. The radiological surveys will be performed prior to sample collection to identify worst-case radiological concentrations of the waste stream matrices. Surveys will follow guidelines as referenced in BHI-SH-04, *Radiological Control Work Instructions*, Instructions 3.1 and 3.8, and BHI-SH-02, Volume 2, *Safety and Health Procedures,* Procedure 2.3.3.

I.7.7.2 Sample Optimization

The sampling design for the 233-S Facility structure and internal equipment is based on a "worst case" (maximum COC concentration) sampling approach that identifies accessible locations where sufficient information for safety considerations and waste designation can be applied. Table I-6 provides the sample strategy and rationale for each waste stream, and suspect matrices for each waste stream.

Table I-5 describes sample volumes needed for each analysis requested. The sample volumes are separated into maximum volumes for full protocol analysis and minimum volumes for quick-turnaround data. Previous sampling activities at the 233-S Facility, process knowledge, and as low as reasonably achievable (ALARA) information indicate that under most circumstances maximum volume collection may not be achieved. Each sample location will be evaluated on a case-by-case basis to determine if full protocol will be used or if minimum volume collection will be used for quick-turnaround data.

Table I-5. Detection Limits. (3 Pages)

Contaminant of Concern (COC)	Analytical Callout	EPA Method	Laboratory Accuracy and Precision[a]	Analytical Technique	Waste Decision Criteria	Commercial Laboratory			
						Detection Limits[b]		Volume Requirements[b]	
						Solid[c]	Liquid[c]	Solid[d]	Liquid[d]
Pu-238, Pu-239/240, Pu-241, Pu-242	Pu Isotopic	Lab specific	a	Alpha Energy Analysis	100 nCi/g total TRU	1 20	1 20	25 4	600 50
Am-241, Cm-244	Am/Cm Isotopic	Lab specific	a	Alpha Energy Analysis	100 nCi/g total TRU	1 20	1 20	25 4	600 50
Np-237	Np-237	Lab specific	a	Alpha Energy Analysis	100 nCi/g total TRU	1 20	1 20	25 4	600 50
Co-60[e]	GEA	Lab specific	a	Gamma Energy Analysis	50 nCi/g 0.5 nCi/L	0.1 1	25 100	1500 50	1500 50
Cs-137	GEA	Lab specific	a	Gamma Energy Analysis	50 nCi/g 0.5 nCi/L	0.1 1	15 100	1500 50	1500 50
Eu-152[e]	GEA	Lab specific	a	Gamma Energy Analysis	50 nCi/g 0.5 nCi/L	0.1 1	50 400	1500 50	1500 50
Eu-154[e]	GEA	Lab specific	a	Gamma Energy Analysis	50 nCi/g 0.5 nCi/L	0.1 1	50 400	1500 50	1500 50
Sr-90[e]	Total Radioactive Sr	Lab specific	a	Beta Counting	50 nCi/g 0.5 nCi/L	1 5	2 10	18 3	3000 250
Gross Alpha	Gross Alpha	Lab specific	a	Proportional Counting	100 nCi/g	10 25	3 7	2 0.5	600 150
Gross Beta	Gross Beta	Lab specific	a	Proportional Counting	100 nCi/g, 1 nCi/L	15 30	4 8	2 0.5	600 150
$Al(NO_3)_3$, NH_4NO_3, $NaNO_3$, HNO_3	Anions - Nitrate	EPA 300.0	a	Ion Chromatography	5 mg/kg, 5 mg/L	0.1 5	10 50	40 5	300 50
$NaNO_2$	Anions - Nitrite	EPA 300.0	a	Ion Chromatography	5 mg/kg, 5 mg/L	0.1 5	10 50	40 5	300 50
H_2SO_4, Na_2SO_4, $Fe(NH_4)_2(SO_4)_2$	Anions - Sulfate	EPA 300.0	a	Ion Chromatography	5 mg/kg, 5 mg/L	2 10	150 700	40 5	300 50
NH_4F	Anions - Fluoride	EPA 300.0	a	Ion Chromatography	5 mg/kg, 5 mg/L	0.2 1	15 70	40 5	300 50
H_3PO_4	Anions - Phosphate	EPA 300.0	a	Ion Chromatography	5 mg/kg, 5 mg/L	2 10	150 700	40 5	300 50
Oxalic Acid	Anions - Oxalate	EPA 300.0	a	Ion Chromatography	5 mg/kg, 5 mg/L				

Table I-5. Detection Limits. (3 Pages)

Contaminant of Concern (COC)	Analytical Callout	EPA Method	Laboratory Accuracy and Precision[a]	Analytical Technique	Waste Decision Criteria	Commercial Laboratory			
						Detection Limits[b]		Volume Requirements[b]	
						Solid[c]	Liquid[c]	Solid[d]	Liquid[d]
Acids	pH	SW-846 9040/9041A	a	Electrode/paper	<pH 2	0.1 0.1	0.1 0.1	10 3	100 25
Hexone	Volatile Organic	SW-846 8260A	a	GC/MS	1 mg/kg, 10 µg/L	.002 .002	1 1	20 5	120 40
PCBs	PCBs	SW-846 8082	a	GC	1 mg/kg, 1µg/L	0.05 10	0.5 100	120 1	2000 20
Chromate, SS Steel Corrosion-Chromium	Total Cr	SW-846 6010A	a	ICP	100 mg/kg, 5 mg/L	0.5 5	3 20	15 2	500 150
Lead Based Paint, Bulk Lead	Total Pb	SW-846 6010A	a	ICP	100 mg/kg, 5 mg/L	20 40	250 500	15 2	500 150
Cadmium Based Paint	Total Cd	SW-846 6010A	a	ICP	20 mg/kg, 1 mg/L	1 5	5 10	15 2	500 150
SS Steel Corrosion - Nickel	Total Ni	SW-846 6010A	a	ICP	100 mg/kg, 5 mg/L	4 10	20 100	15 2	500 150
Mercury	Total Hg	SW-846 7471	a	CVAA	4 mg/kg, 0.2 mg/L	0.1 15	0.5 2	15 2	500 150
Toxicity Characteristic Leach Procedure	TCLP – Pb	SW-846 1311/6010A	a	Extraction - ICP	5 mg/L	Extract[f]>>>	250 500	300 25	500 150
Toxicity Characteristic Leach Procedure	TCLP – Cr	SW-846 1311/6010A	a	Extraction - ICP	5 mg/L	Extract[f]>>>	3 20	300 25	500 150
Toxicity Characteristic Leach Procedure	TCLP – Cd	SW-846 1311/6010A	a	Extraction - ICP	1 mg/L	Extract[f]>>>	5 10	300 25	500 150
Toxicity Characteristic Leach Procedure	TCLP – Ag	SW-846 1311/6010A	a	Extraction - ICP	5 mg/L	Extract[f]>>>	5 10	300 25	500 150
Toxicity Characteristic Leach Procedure	TCLP – As	SW-846 1311/6010A	a	Extraction - ICP	5 mg/L	Extract[f]>>>	5 10	300 25	500 150
Toxicity Characteristic Leach Procedure	TCLP – Se	SW-846 1311/6010A	a	Extraction - ICP	5 mg/L	Extract[f]>>>	5 10	300 25	500 150

Table I-5. Detection Limits. (3 Pages)

Contaminant of Concern (COC)	Analytical Callout	EPA Method	Laboratory Accuracy and Precision[a]	Analytical Technique	Waste Decision Criteria	Commercial Laboratory			
						Detection Limits[b]		Volume Requirements[b]	
						Solid[c]	Liquid[c]	Solid[d]	Liquid[d]
Toxicity Characteristic Leach Procedure	TCLP – Ba	SW-846 1311/6010A	a	Extraction - ICP	100 mg/L	Extract[f]>>>	5 10	300 25	500 150
Toxicity Characteristic Leach Procedure	TCLP – Hg	SW-846 1311/7470	a	Extraction - CVAA	0.2 mg/L	Extract[f]>>>	0.5 2	300 25	500 150
Reactivity-Cyanide	Cyanide	SW-846 7.33	a	Spectrophotometric	10 mg/kg, 10 µg/L	0.5 5	5 15	40 5	2000 250
Reactivity-Sulfide	Sulfide	SW-846 7.34	a	Spectrophotometric	10 mg/kg, 300 µg/L	5 15	100 500	40 5	1200 100
Asbestos	Asbestos	NA	a	Microscopy	1%	NA	NA	NA	NA

[a]Precision and accuracy requirements for both commercial and onsite laboratories are established prior to testing. The basis for measurement accuracy and precision is specified in Volume 4, Section 7 of DOE-RL (1996b).

[b]First value is for "Full Protocol;" second value is for rapid turnaround or reduced volume analysis. Full protocol detection limits require the larger volume shown. Detection limits are based on optimal conditions. Sample-specific matrix effects or interferences may raise the values shown. Detection limits are minimum detection activities for radionuclides and minimum detectable concentrations for chemicals.

[c]Values in pCi/g or mg/kg for solids and pCi/L or µg/L for liquids.

[d]Values in g for solids or mL for liquids. Radionuclide analyses and metals analyses volumes may be combined to reduce total volume needed.

[e]These radionuclides are not considered as "contaminants of concern" for the 233-S Facility. They are used as flags for potential cross-contamination from REDOX, West Tank Farms, or the 222-S Laboratories.

[f]Toxicity characteristic leach procedure (TCLP) values are reported as liquid extract concentrations for solid samples and bulk liquid concentrations for liquid samples.

CVAA = cold vapor atomic absorption
GC = gas chromatograph
GEA = gamma energy analysis

Table I-6. 233-S Waste Stream Sampling Strategy. (4 Pages)

Number	Waste Stream	Waste Stream Description	Sample Strategy	Sample Method
1	Process Drains	Two process drains connecting to the 202-S return line	1. Visual inspection of drains to confirm if sample matrix is liquid or residual sediment. 2. Because of small sample volume, the sample matrix will be collected from both drains and combined into one composite sample.	Liquids (if present) will be collected from each drain using pipettes with thumb vacuum control, peristaltic pump. Residual solids (if present) will be collected by scraping the solids from the drain.
2	Exhaust Duct	Located throughout facility. Duct is radiologically contaminated	1. NDA information and/or radiological surveys will be used to determine worst locations for contamination concentrations. 2. Because of the large sample volume needed, samples will be collected from the worst-case locations and combined into one composite sample.	Samples will be collected using 4-in. carbide hole saw. Different bits will be used for each boundary.
3	Elemental lead	Located in the process hood area	1. Perform visual inspection. 2. If necessary, collect swipes for radiological information.	Technical smears will be obtained for radiological screening.
4	Anion Ion Exchanger	Two (4 in. x 24 ft) schedule 10 pipe with resin and screen assemblies, 24 in. center to center	1. Perform visual inspection to confirm if sample matrix is liquid, resin, or residual solid. 2. NDA information and/or radiological surveys will be used to determine worst locations for contamination concentrations. 3. Because of small sample volume (if any), the sample matrix will be collected from the worst-case locations and combined into one composite sample.	Liquids (if present) will be collected using pipettes with thumb vacuum control, peristaltic pump. Resin or residual solids (if present) will be collected by scraping or scooping, as appropriate.
5	Np Concentrator (L-2 Vessel)	7 in. x 23 ft H, 44 in. W overall, 10 ft of Raschig ring packing, 32 turns of ¾-in. sch. 40 coil	1. Perform visual inspection to confirm if sample matrix is liquid or residual solid. 2. One sample will be collected from each concentrator, condenser. These will not be composite samples.	Liquids (if present) will be collected from each concentrator using pipettes with thumb vacuum control, peristaltic pump. Residual solids (if present) will be collected by scraping the solids from the concentrators.
6	Product Concentrator (L-3 Vessel)	Top 7 in. x 6½ ft, middle 6 in. x 9½ ft sch. 10, bottom 3 in. x 4 ft sch. 10; boiler 6 in. x 6 ft sch. 10 filled with 12 1-in.-outer diameter process tubes; 4 ft 6 in. center-to-center		
7	Np Concentrator/ Condenser (L-8 Vessel)	7 in. x 4.5 ft, 20 in. W overall, 27 turns of ¾-in. sch. 40 coil		
8	Process Hood (sump)	Approximately 2 in. wide by 31 ft long Y-shaped trough	1. Perform visual inspection to confirm if sample matrix is liquid or residual solid. 2. Radiological surveys will be conducted to identify worst-case locations for contamination concentrations. 3. Samples will be collected from the worst-case locations, or every 5 ft and combined into one composite sample.	Liquids (if present) will be collected from the sump using pipettes with thumb vacuum control, peristaltic pump. Residual solids (if present) will be collected by scraping or scooping the solids from the sump.

Table I-6. 233-S Waste Stream Sampling Strategy. (4 Pages)

Number	Waste Stream	Waste Stream Description	Sample Strategy	Sample Method
9	Process Pipe Trench (Concrete Structure)	23 ft 6 in. long, 4 ft 8 in. wide, 3 ft 4 in. deep	1. NDA information and/or radiological surveys will be used to determine worst locations for contamination concentrations. 2. Sampling of the concrete will occur in succession with scabbling activities.	Sample will be collected from the scabble debris using scoop or appropriate sample tool.
10	Process Pipe Trench(Process Pipe)	Six process lines, 23 ft 6 in. long	1. Perform visual inspection to confirm if sample matrix is liquid or residual solid. 2. NDA information and/or radiological surveys will be used to determine worst locations for contamination concentrations. 3. Liquid/solid samples will only be collected if sample volume is adequate (composite sampling will be used). Pipe samples will be collected from worst-case locations.	Liquid samples will be collected using pipettes with thumb vacuum control. Residual solids will be scraped from the pipe system into collection jar. Pipe samples will be collected using hole saw or other appropriate method for cutting pipe.
11	Non process piping	Approximately 800 lineal feet	1. Perform visual inspection to confirm if sample matrix is liquid or residual solid. 2. NDA information and/or radiological surveys will be used to determine worst locations for contamination. 3. Liquid/solid samples may only be collected if sample volume is adequate (composite sampling will be used). Pipe samples will be collected from worst-case locations.	Liquid samples will be collected using pipettes with thumb vacuum control. Residual solids will be scraped from the pipe system into collection jar. Pipe samples will be collected using hole saw or other appropriate method for cutting pipe.
12	Loadout hood (Sump)	1.5-in.-diameter schedule 40 pipe 4 in. long	1. Perform visual inspection to confirm if sample matrix is liquid, or residual solid. 2. Radiological surveys will be conducted to identify worst-case locations for contamination concentrations. 3. One sample will be collected.	Liquid samples will be collected using pipettes with thumb vacuum control. Residual solids will be scraped from the pipe.
13	BF3 Tubes	N/A	No samples will be obtained. If these can be decontaminated, they will be shipped to Pacific Northwest National Laboratory for reuse.	None.
14	HEPA Filters	8 (24 in. x 24 in. x 11.5 in.) in CWS, 18 (24 in. x 24 in.) in 233-SA	1. Radiological surveys will be conducted to identify worst-case contamination. 2. One core sample will be collected from each filter in the CWS and combined into one composite. One sample will be collected from each filter in the 233-SA and combined into one composite. This will allow for sufficient sample volume as well as a representative sample of the filter system.	Core samples will be collected using a coring tool.
15	Asphalt	N/A	1. NDA information and/or radiological surveys will be used to determine worst locations for contamination. 2. Asphalt samples will be collected from worst-case locations.	Asphalt samples will be collected using saws or drills. Different drills or bits will be used for each boundary. Tools will be field deconed between samples.

Table I-6. 233-S Waste Stream Sampling Strategy. (4 Pages)

Number	Waste Stream	Waste Stream Description	Sample Strategy	Sample Method
16	Concrete Floors/Walls	N/A	1. NDA information and/or radiological surveys will be used to determine worst locations for contamination. 2. Asphalt samples will be collected from worst-case locations.	Samples will be collected using saws or drills. Different blades or bits will be used for each boundary. Tools will be wiped clean and surveyed between samples.
17	Asbestos Containing Material	N/A	1. AHERA asbestos inspector will perform good faith inspection to determine which material is suspect. 2. Radiological surveys will also be conducted prior to sampling. 3. Samples will be obtained in accordance with Simplified Sampling Scheme for Friable Surfacing Materials (EPA 1985).	Samples will be collected using chisel, hammer, and pliers.
18	Wood/Sheetrock	N/A	1. NDA information and/or radiological surveys will be used to determine worst locations for contamination. 2. Samples will be collected from worst-case locations.	Samples will be collected using saws or drills, depending on the material.
19	Roofing Material	N/A	1. Radiological surveys will be used to determine worst-case locations for contamination. 2. Sample will be collected from the worst-case location.	Samples will be collected using chisels, drills, or appropriate method.
20	Misc. Routine Waste	Includes light ballasts, exit signs, smoke detectors, fluorescent bulbs	1. These are all well-established waste streams-no sampling required.	None.
21	Paint	Paint used as fixative on equipment, walls, floors, pipe systems	1. NDA information and/or radiological surveys will be used to determine worst-case locations for contamination. 2. Paint will be separated into different sample boundaries based on texture, color, and type.	Each sample boundary will be sampled separately. Paint samples will be collected by scraping from the surface into a large polyethylene bag and collected into sampling containers.
22	Process Hood Floor (dirt/debris)	Small pile of debris	1. Perform visual inspection to confirm if sample volume is adequate. 2. NDA information and/or radiological surveys will be used to determine worst locations for contamination. 3. If the sample matrix is not of criticality concern, the dirt and debris will be mixed and one sample will be obtained.	Sample will be collected using spoons, scoopulas, or other appropriate method.
23	Lubricant/Oil	Found in equipment	Lubricant reservoirs in all equipment will be visually inspected. If found, oils will be collected into a single composite sample container.	Samples will be obtained using pipettes or bulb droppers.
24	Excavation Soil	N/A	1. Field determination will be used to decide if NDA information and/or radiological surveys will be needed for criticality evaluation prior to sampling. Information will also be used to determine worst-case contamination. 2. Samples from each excavated soil boundary will be collected and combined into one composite. Samples will be collected from worst-case locations.	Samples will be obtained using core or auger equipment. Sample matrix will be combined into one collection container and transferred into sample jars using spoon, scoopulas, or other appropriate method.

Table I-6. 233-S Waste Stream Sampling Strategy. (4 Pages)

Number	Waste Stream	Waste Stream Description	Sample Strategy	Sample Method
25	Pu Recycle Tank	Three (6 in. x 56 in. high) schedule 40 pipes	1. Perform visual inspection to confirm if sample matrix is liquid or residual solid. 2. NDA information and/or radiological surveys will be used to determine worst locations for contamination. 3. Liquid/solid samples will only be collected if sample volume is adequate (composite sampling will be used). Pipe samples will be collected from worst-case locations.	Liquid samples will be collected using pipettes with thumb vacuum control. Residual solids will be scraped from the pipe system into collection jar. Pipe samples will be collected using hole saw or other appropriate method for cutting pipe.
26	French Drain	Approximately 24 in. in diameter, 5 ft deep	1. Perform visual inspection. 2. NDA information and/or radiological surveys will be used to determine contamination concentrations for criticality evaluation prior to sampling. 3. Three samples will be collected and combined into one composite. Based on the diameter of the french drain, three samples should represent data results.	Samples will be obtained using core sampler or auger. Samples will be combined in one collection jar and transferred into sample containers using spoons, scoopulas, or other appropriate methods.
27	Anomalies (Liquid/Solid)	N/A	1. Unknown liquids and solids will be accumulated in appropriate containers and evaluated to determine sampling and analysis requirements for waste designation.	Liquids (if present) will be collected using pipettes with thumb vacuum pressure. Peristaltic pumps will be used if volume is large enough. Solids (if present) will be scraped, shoveled, and scooped into collection jars for analysis.

AHERA = Asbestos Hazard Emergency Response Act
CWS = Chemical Warfare Service
HEPA = high-efficiency particulate air
NDA = nondestructive assay

PART II

QUALITY ASSURANCE PROJECT PLAN

II.1 PROJECT MANAGEMENT

The following section identifies the project management and discusses the roles and responsibilities of individuals or organizations participating in the sample activities. This section also discusses the special training requirements for the staff performing the work and the quality objectives for measurement data.

II.1.1 PROJECT ORGANIZATION

The ERC Characterization Team shall be responsible for coordinating the sampling and analysis events with the 233-S Project Team Lead, Project Engineer, field sampling staff, Sample Data Management, and BHI Field Support.

The field samplers will be responsible for sample collection, packaging, and shipping. The ERC Field Support Group shall provide project assistance in performing environmental surveys and collecting environmental samples. The ERC Sample and Data Management Group shall arrange for analytical services. The ERC Safety and Health Group shall provide radiological control and safety support as required, while the Quality Services Group shall be responsible for performing independent quality assurance activities.

II.1.2 ROLES AND RESPONSIBILITIES

This section identifies the responsibilities of various organizations supporting the characterization effort. The 233-S D&D Project organizational chart can be found on the ERC Website under Human Resources. This chart will contain the most current organizational information.

II.1.2.1 D&D Characterization

- Prepare the characterization plan
- Arrange sampling and analysis activities
- Oversee sampling activities
- Interpret analytical data
- Prepare the final characterization report.

II.1.2.2 Sample Management

- Arrange for laboratory analysis of samples
- Develop and issue Sample Authorization Form/Field Sampling Request (SAF/FSR)
- Receive data packages from the laboratory
- Provide unique sample numbers for sample identification

- Provide laboratory data package
- Validate data to level identified in this plan.

II.1.2.3 Field Sampling Personnel

- Perform sampling and field screening
- Provide certified clean sampling bottles/containers
- Document sampling activities in a controlled logbook
- Initiate chain-of-custody documentation for samples
- Package and transport samples to the laboratory or shipping center.

II.1.2.4 233-S D&D Field Support Personnel

- Prepare work packages to support the sample team
- Conduct and document pre-job meetings when supporting the sample team
- Provide field support to the sample team
- Provide coordination with other site organizations (Radiation Control, Safety, etc.) to support the sample team.

II.1.2.5 Industrial Safety, QS&H

- Provide industrial safety support and monitoring for the sample team
- Provide the approved Activity Hazard Analysis (AHA).

NOTE: The personal protective equipment (PPE) to be worn during sampling shall be listed on the job-specific AHA and Radiation Work Permit (RWP), as required.

II.1.2.6 Radiological Controls, QS&H

- Provide radiation control coverage for the sample team
- Provide dose rate data for sample collection, packaging, and shipping
- Recommend as low as reasonably achievable actions where necessary
- Provide the radiological work permit(s)
- Conduct radiological surveys.

II.1.2.7 BHI Waste Management

- Waste designation
- Waste packaging instructions
- Waste shipping.

II.1.2.8 Quality Assurance/Quality Control (QA/QC), QS&H

- Conduct random surveillances to verify compliance with requirements of this plan.

II.1.2.9 Data Users

- Project Engineering
- Field Support Services
- Radiological Controls, QS&H
- Industrial Safety, QS&H
- Waste Management.

II.1.3 TRAINING REQUIREMENTS

Training or certification requirements needed by personnel are described in BHI-HR-02 and BHI-QA-03, Plans 5.1, 5.2, and 5.3 The Environmental Safety and Health Training Program also provides workers with the knowledge and skills necessary to safely execute assigned duties. A graded approach is used to ensure that workers receive a level of training commensurate with their responsibility that complies with applicable DOE orders and government regulations. Specialized employee training includes pre-job briefings, on-the-job training, emergency preparedness, plan of the day, and facility/work site orientations, including all members of the Building Emergency Response Organization. The following training and qualifications are applicable for 233-S Facility work and activities.

II.1.3.1 Training in Accordance with 29 CFR 1910.120(e)

- 40-Hour Hazardous Waste Worker/8-Hour Refresher
- 24-Hour Experience Component
- 8-Hour Supervisor Training (for selected individuals)
- Pre-job briefing.

II.1.3.2 Other

- Respirator Training
- First Aid (two qualified persons per shift/crew)
- Certified Asbestos Worker/or Asbestos Awareness
- Lead Worker
- Samplers shall meet training requirements of BHI-EE-01, Procedure 1.12, "Indoctrination, Training and Qualification."

II.1.3.3 Training in Accordance with HSRCM-1

- Radiation Worker II
- Criticality Safety Training (Site-Specific).

II.1.3.4 Medical Surveillance Requirements

- Hazardous Waste Worker Physical
- Respirator User Medical
- Mask Fit
- Lead Worker Baseline
- Asbestos Worker.

II.1.3.5 Dosimetry and Bioassay Requirements

- Thermoluminescent dosimeter
- Whole body count
- Chest count
- Plutonium urinalysis.

II.1.4 DOCUMENTATION AND RECORDS

Sample collection and analysis activities shall be planned in accordance with BHI-EE-01, *Environmental Investigation Procedures*, Procedures 1.5, "Field Logbooks," 1.15, "Sampling Documents," Section 2, "Sample Management," and Section 3, "General Sampling." The SAF/FSR information generated through the sample event coordination process shall specify the sampling container, size, and preservatives; onsite measurements test methods; and laboratory analytical methods, turnaround times, and data deliverable types. Careful coordination with Radiological Protection and the laboratory is required to minimize sample volumes and potential radiological exposures associated with sample collection, packaging, and shipping.

Field documents shall be maintained in accordance with BHI-EE-01, including the following procedures:

- Procedure 1.5, "Field Logbooks"
- Procedure 1.13, "Environmental Site Identification and Information Reporting"
- Procedure 3.0, "Chain of Custody"
- Procedure 3.1, "Sample Packaging and Shipping."

II.2 MEASUREMENT DATA ACQUISITION

The following section presents the quality objectives for measurement data and requirements for sampling methods, sample handling and custody, analytical methods, and field and laboratory quality control. This section also addresses the requirements for instrument calibration and maintenance, supply inspections, and data management.

II.2.1 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The decision levels are summarized in the DQO summary, Table I-5. Precision and accuracy requirements for analyses are set by the SW-846 methods used.

Decision levels for the radiological surveys are based on the levels presented in Regulatory Guide 1.86 (AEC 1974) and DOE Order 5400.5 (DOE 1990). These surface activity limits are 20 dpm/100 cm^2 for removable transuranics, 500 dpm/100 cm^2 for fixed + removable transuranics, and 1,000 dpm/100 cm^2 beta/gamma removable, 5,000 dpm/100 cm^2 beta/gamma fixed + removable.

As stated in Section I.6.3, NDA will also be used to support contamination distribution, and "hot spot" identification in pipe systems, vessels, ventilation ducts, and trenches. Equipment limitations, project requirements, confidence levels, and interference issues were not part of this DQO due to procurement reasons, and will be identified and documented in the scope of work for NDA support.

II.2.2 SAMPLING METHOD REQUIREMENTS

The procedures to be implemented in the field will be consistent with those outlined in BHI-EE-01, *Environmental Investigations Procedures*; SW-846, *Test Methods for Evaluating Solid Waste* (EPA 1994c); DOE/EM-0089T, *DOE Methods for Evaluating Environmental and Waste Management Samples* (DOE 1994); and BHI-SH-04, *Radiological Control Work Instruction,* including the following:

- Procedure 6.2, "Establishing Radioactive Control Areas"
- Procedure 6.3, "Radiological Material Shipment Surveys"
- Procedure 6.4, "Radiological Material Labeling and Packaging."

II.2.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

All sample handling, shipping, and custody requirements shall be performed in accordance with BHI-EE-01, Procedure 3.1, "Sample Packaging and Shipping;" Procedure 3.0, "Chain of Custody;" and Procedure 4.2, "Sample Storage and Shipping Facility." In addition, sample handling, shipping, and custody requirements shall be performed in accordance with BHI-SH-04, Procedure 6.3, "Radiological Material Shipment Survey," and Procedure 6.4, "Radiological Material Labeling and Packaging."

II.2.4 SAMPLE PRESERVATION, CONTAINERS, AND HOLDING TIMES

Sample preservation and container details will be addressed in the SAF/FSR in accordance with BHI-EE-01, Procedure 2.0, "Sample Event Coordination." The sample preservation, container, and holding times may be impacted by expected high TRU contaminant concentrations and resulting handling restrictions, potential requirements for laboratory or field extractions, etc. These items may adversely affect holding times for certain constituents and the ability to analyze for other constituents. If sample preservation, container type, or holding times cannot be met due to radiological contamination levels, it shall be documented in the field logbook.

II.2.5 ANALYTICAL METHOD REQUIREMENTS

Samples will be sent to an ERC-approved laboratory that performs analyses in accordance with SW-846 guidelines. Methods requirements are identified in Table I-5. The requirements for the project analytical needs are also defined in Table I-5 by the callouts for Analytical Technique, Detection Limits, and Laboratory.

Table I-5 describes sample volumes needed for each analysis requested. The sample volumes are separated into maximum volumes for full protocol analysis and minimum volumes for quick-turnaround data. Previous sampling activities at the 233-S Facility, process knowledge, and ALARA information indicate that under most circumstances maximum volume collection may not be achieved. Each sample location will be evaluated on a case-by-case basis to determine if full protocol will be used or if minimum volume collection will be used for quick-turnaround data.

II.2.6 QUALITY CONTROL REQUIREMENTS

The QC procedures must be followed in the field and laboratory to ensure that reliable data are obtained. When performing this field sampling effort, care shall be taken to prevent the cross-contamination of sampling equipment, sample bottles, and other equipment that could compromise sample integrity. Deviations shall be controlled in accordance with BHI-EE-01, Procedure 2.7, "Sample Disposition Record."

QC requirements for the field sample collection process are as follows:

> One duplicate sample, or a minimum of one field duplicate per every 20 samples of the same matrix, will be collected. Field duplicates are two samples produced from the same material and collected in the same location or from the same equipment. Field duplicates provide information concerning the homogeneity of the matrix, and an evaluation of the precision of the sampling and analysis process.

Specific sampling instructions will be included in the work packages.

II.2.7 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

All field screening and analytical instruments shall be tested, inspected, and maintained in accordance BHI-QA-03, Procedure 5.2, "Onsite Measurements Quality Assurance Program Plan," and BHI-QA-03, Procedure 5.3, "Onsite Radiological Measurements Quality Assurance Program Plan." The results from all testing, inspection, and maintenance activities shall be recorded in a bound logbook in accordance with procedures outlined in BHI-EE-01, Procedure 1.5, "Field Logbooks."

II.2.7.1 Instrument Calibration and Frequency

All field screening and analytical instruments shall be calibrated in accordance with BHI-QA-03, Procedure 5.2, "Onsite Measurements Quality Assurance Program." The results from all instrument calibration activities shall be recorded in a bound logbook in accordance with BHI-EE-01, Procedure 1.5, "Field Logbooks." Tags will be attached to all field screening and onsite analytical instruments, noting the date when the instrument was last calibrated along with the calibration expiration date. If during calibration deficiencies are found, they shall be documented per BHI-SH-06, Procedure QSP 3.3, "Nonconformance Control."

II.2.8 ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

Sample containers and equipment shall comply with the cleanliness guidelines in SW-846 (EPA 1994c).

II.2.9 DATA MANAGEMENT

Data resulting from the implementation of the SAP will be managed and stored by the ERC's Sample Management organization in accordance with BHI-EE-01, Section 2.0, "Sample Management."

All validated reports and supporting analytical data packages shall be subject to final technical review by qualified reviewers before submittal to regulatory agencies or inclusion in reports or technical memoranda, at the direction of the BHI Project Task Lead. Electronic data access, when appropriate, shall be through computerized databases (i.e., the Hanford Environmental Information System). Where electronic data are not available, hard copies will be provided in accordance with Section 9.6 of the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1995).

II.2.10 FIELD DOCUMENTATION

Field documentation shall be kept in accordance with BHI-EE-01, *Environmental Investigation Procedures*, including the following:

- Procedure 1.5, "Field Logbooks"
- Procedure 1.13, "Environmental Site Identification and Information Reporting"
- Procedure 3.0, "Chain of Custody."

II.3 ASSESSMENT/OVERSIGHT

II.3.1 ASSESSMENTS AND RESPONSE ACTIONS

The QS&H, Quality Service Engineer may conduct random surveillance and assessments in accordance with BHI-SH-06, Procedure 3.1, "Surveillance," to verify compliance with the requirements outlined in the SAP, project work packages, the ERC Quality Program, and BHI procedures and regulatory requirements.

Deficiencies identified by self-assessments shall be reported in accordance with BHI-MA-02, Procedure 5.3, "Self Assessment." When appropriate, corrective actions will be taken by the Project Engineer in accordance with the *Hanford Analytical Services Quality Assurance Requirements Document*, Volume 1, Section 4.0 (DOE-RL 1996b) to minimize recurrence.

II.3.2 REPORTS TO MANAGEMENT

Management shall be made aware of all deficiencies identified by the surveillances and self-assessments, and the deficiencies shall be reported in accordance with BHI-MA-02, Procedure 5.3, "Self Assessment," and BHI-SH-06, Procedure 3.1, "Surveillance."

II.4 DATA VALIDATION AND USABILITY

II.4.1 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

Data verification and validation is performed on analytical data sets, primarily to confirm that sampling and chain-of-custody documentation is complete, sample numbers can be tied to the specific sampling location, samples were analyzed within the required holding times, and analyses met the data quality requirements specified in the SAP.

II.4.2 VALIDATION AND VERIFICATION METHODS

All data verification and validation shall be performed in accordance with BHI-EE-01, Procedure 2.5, "Data Package Validation Process;" *Data Validation Procedures for Radiochemistry Analyses* (WHC 1993a); and *Data Validation Procedures for Chemical Analyses* (WHC 1993b). A validation performed in a comparable manner to Level C, as described in the preceding procedures, will be performed on onsite laboratory analyses. This allows the review of all QC data, transcription error verification, and holding time review. This level is the middle validation level and does not require review of raw data and recalculation of data. Should problems arise from the Level C review, the project reserves the option to review or recalculate.

II.4.3 RECONCILIATION WITH USER REQUIREMENTS

A data quality assessment will be performed on the resulting analytical data in accordance with *Guidance for Data Quality Assessment* (EPA 1996). The data quality assessment will determine if the data are the right type, quality, and quantity to support their intended use. The data evaluation for this project entails the following:

- Reviewing analytical data, including data packages and QA reports
- Drawing conclusions from the data
- Interpreting and communicating the test results.

PART III

SAMPLING AND ANALYSIS PLAN

III.1 FIELD SAMPLING PLAN

III.1.1 SAMPLING OBJECTIVES

The objective of the field sampling plan (FSP) is to clearly identify the sampling and analysis activities needed to resolve the decision rules identified in Step 5 of the DQO Summary Report. The FSP takes the sampling design proposed in Step 7 of the DQO Summary Report and presents the parameters to identify sampling locations, total number of samples to be collected, sampling procedures to be implemented, analyses to be performed, and sample bottle requirements.

III.1.2 SAMPLING LOCATIONS

The field sampling will be conducted using a phased approach. The first step will be visual inspection to identify accessibility, sample matrix, and sample volume. Exact sample locations will be confirmed with the D&D Characterization team members, sample personnel, and Radiological Control Technician supervisors. The second step will be radiological surveys or NDA of specified locations. These locations will identify "hot spot," or worst-case locations, for sampling. The third, and last, step will be sample collection for laboratory analysis. Table I-6 describes the sample location, sample strategy, and sampling method. If ALARA reasons or field conditions prevent collection of samples as identified in Table I-6, then any deviations shall be documented in the field logbook.

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

III.1.2.1 DOE and EPA Approval of Specific Sample Events and Locations

D&D activities in the 233-S Plutonium Concentration Facility are planned in a sequence that proceeds from areas of relatively low risk to areas of higher risk. Individual work packages will be used for these sequential scopes of work. Sampling and characterization hold points in these work packages will allow for appropriate decision making.

When proposed sample locations have been identified, an electronic mail message will be sent to the DOE-AME 233-S Program Manager identifying sample points, special sampling equipment and sample analyte priorities if there is not enough sample volume to run all analyses. Detection limits and precision and accuracy requirements would also be identified if they are different from those identified in the *Hanford Analytical Services Quality Assurance Requirements Documents* (DOE-RL 1996b). Upon DOE's concurrence, the message will be electronically forwarded to the EPA for approval. Upon receipt of EPA's approval, the document will be entered into BHI

Document Information System's database, which will assign a document number to the approved message for future tracking.

III.1.3 LABORATORY ANALYSIS

The COCs, analytical method, technique, required detection limit, and laboratory detection limits needed to support data for waste designation are summarized in Table I-5. These analyses will support the identified waste streams as well as anomalies found during decommissioning activities. The sample volumes are separated into maximum volumes for full protocol analysis and minimum volumes for quick-turnaround data. Previous sampling activities at the 233-S Facility, process knowledge, and ALARA information indicate that under most circumstances maximum volume collection may not be achieved. Each sample location will be evaluated on a case-by-case basis to determine if full protocol will be used or if minimum volume collection will be used for quick-turnaround data.

III.1.4 RADIOLOGICAL SURVEYS

Radiological surveys, using hand-held instruments, will be used to identify fixed and smearable contamination. The radiological surveys will be performed prior to sample collection to identify "worst case" radiological concentrations of the waste stream matrices. The decision levels for the radiological surveys are based on the levels presented in Regulatory Guide 1.86 (AEC 1974) and DOE Order 5400.5 (DOE 1990). These surface activity limits are 20 dpm/100 cm^2 for removable transuranics, 500 dpm/100 cm^2 for fixed + removable transuranics, and 1,000 dpm/100 cm^2 beta/gamma removable, 5,000 dpm/100 cm^2 beta/gamma fixed + removable.

III.1.5 NDA

As stated in Section I.6.3, NDA may also be used to support contamination distribution, and "hot spot" identification in pipe systems, vessels, ventilation ducts, and trenches. Equipment limitations, project requirements, confidence levels, and interference issues were not part of this DQO due to procurement reasons, and will be identified and documented in the scope of work for NDA support.

III.1.6 SAMPLING PROCEDURES

The sampling procedures to be implemented in the field shall be consistent with those outlined in BHI-EE-01, *Environmental Investigation Procedures*, and BHI-SH-04, *Radiological Control Work Instructions*.

III.1.7 SAMPLE MANAGEMENT

Sample management activities shall be performed in accordance with the following BHI-EE-01 procedures:

- Procedure 3.1, "Sample Packaging and Shipping "
- Procedure 4.2, "Sample Storage and Shipping Facility"
- Procedure 3.0, "Chain of Custody."

III.1.8 MANAGEMENT OF INVESTIGATION-DERIVED WASTE

Investigation-derived waste generated by characterization activities will be managed in accordance with BHI-EE-10, *Waste Management Plan*. As investigation-derived waste, it shall be handled, stored, and disposed of in accordance with the "Action Memorandum – Removal Action at the 233-S Plutonium Concentration Facility" (EPA 1997) and applicable portions of 40 CFR 260, WAC 173-303-330, and the *233-S Facility Waste Storage Inspection Plan* (BHI 1997a).

III.2 HEALTH AND SAFETY

All field operations will be performed in accordance with BHI health and safety requirements outlined in BHI-SH-01, *Hanford ERC Environmental, Safety, and Health Program*, and the requirements of HSRCM-1, *Hanford Site Radiological Control Manual*. In addition, a work control package will be prepared in accordance with BHI-MA-02, *ERC Project Procedures*, which will further control site operations. This package will include an activity hazard analysis and site-specific health and safety plan, and will reference applicable RWPs.

The sampling procedures and associated activities will take into consideration exposure reduction and contamination control techniques that will minimize the radiation exposure to the sampling team as required by BHI-QA-01, *ERC Quality Program*, and BHI-SH-01, *Hanford ERC Environmental, Safety, and Health Program.*

III.3 REFERENCES

40 CFR 260, "Hazardous Waste Management Program," *Code of Federal Regulations*, as amended.

40 CFR 268, "Land Disposal Restrictions," *Code of Federal Regulations*, as amended.

40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*, as amended.

40 CFR 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," *Code of Federal Regulations*, as amended.

49 CFR 171-173, "Hazardous Materials Regulations for Research and Special Programs Administration; Department of Transportation," *Code of Federal Regulations*, as amended.

AEC, 1974, *Termination of Operating Licenses for Nuclear Reactors*, Regulatory Guide 1.86, U.S. Atomic Energy Commission, Washington, D.C.

BHI, 1996a, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, BHI-00139, Rev. 2, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1996b, *Criticality Evaluation for the 233-S Decontamination and Decommissioning Project*, BHI-00891, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1996c, *Final Characterization Report for the Non-Process Areas of the 233-S Plutonium, Concentration Facility*, BHI-01032, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1996d, *Plutonium Concentration System Removal Criticality Review*, Calculation No. 0200W-CA-N0001, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1997a, *233-S Facility Waste Storage Inspection Plan*, BHI-01114, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1997b, *Supplemental Waste Acceptance Criteria for Bulk Shipments to the Environmental Restoration Disposal Facility*, 0000X-DC-W00001, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.

BHI-EE-01, *Environmental Investigations Procedures*, Rev. 2, Bechtel Hanford, Inc., Richland, Washington.

BHI-EE-10, *Waste Management Plan*, Bechtel Hanford, Inc., Richland, Washington.

BHI-FS-01, *Field Support*, Bechtel Hanford, Inc., Richland, Washington.

BHI-HR-02, *ERC Training* Procedures, Bechtel Hanford, Inc., Richland, Washington.

BHI-MA-02, *ERC Project Procedures*, Bechtel Hanford, Inc., Richland, Washington.

BHI-QA-01, *ERC Quality Program*, Bechtel Hanford, Inc., Richland, Washington.

BHI-QA-03, *ERC Quality Assurance*, Bechtel Hanford, Inc., Richland, Washington.

BHI-SH-01, *Hanford ERC Environmental, Safety, and Health Program*, Bechtel Hanford, Inc., Richland, Washington.

BHI-SH-02, *Safety and Health Procedures*, Vol. 2, Bechtel Hanford, Inc., Richland, Washington.

BHI-SH-04, *Radiological Work Instructions*, Bechtel Hanford, Inc., Richland, Washington.

BHI-SH-05, *Industrial Hygiene Work Instructions*, Bechtel Hanford, Inc., Richland, Washington.

BHI-SH-06, *Quality Services Procedures*, Bechtel Hanford, Inc., Richland, Washington.

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