WCH-15
Rev. 0

River Corridor
Closure Contract

DQO Summary Report for 105-N/109-N Interim Safe Storage Project Waste Characterization

September 2005

Washington Closure Hanford

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

WCH Washington Closure Hanford

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EXECUTIVE SUMMARY

This data quality objective (DQO) summary report defines the sampling and analysis requirements to characterize waste materials that will be generated during interim safe storage (ISS) of the 105-N Reactor Building and 109-N Heat Exchanger Building; and the decommissioning, deactivation, decontamination, and demolition of six associated ancillary facilities including the 105-NA Diesel Enclosure, 105-NE Fission Products Trap, 116-N Exhaust Air Stack, 117-N Exhaust Air Filter, 1605-NE Observation Post, and 1722-N Decontamination Building. Consistent with the *105-N Reactor Building and 109-N Heat-Exchanger Building Action Memorandum* (Ecology 2005), preparation for ISS will include construction of a safe storage enclosure around the shield walls of the 105-N Reactor block and 109-N steam generator cells and pipe gallery. This action reduces the potential for a release of hazardous substances that could adversely affect human health and the environment.

This DQO process uses information from historical files, deactivation files, facility inspection records, process knowledge, and other relevant sources to identify anticipated waste streams from each facility. The waste stream information is used to develop a list of the contaminants of concern and the anticipated sampling and analysis needs to support disposition of the waste materials.

This DQO process includes a characterization strategy to provide the necessary information for management of wastes associated with the Reactor ISS Project. The approach is to use existing information wherever possible from worst-case contaminant locations to establish the bounding contaminant concentrations and waste designation information. If needed, samples of specific waste media will be collected. Waste streams are assumed to be disposed at the Environmental Restoration Disposal Facility, Effluent Treatment Facility, or Central Waste Complex.

Finally, this DQO summary report provides archive information to support long-term ISS. This information will provide baseline activity prior to ISS and final disposition. The DQO process designed to achieve final closure of the site will be performed during subsequent efforts.

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ACRONYMS

AA	alternative action
ACM	asbestos-containing material
ACS	Advanced Characterization System
CERCLA	*Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
COC	contaminant of concern
COPC	contaminant of potential concern
CWC	Central Waste Complex
DQO	data quality objective
DS	decision statement
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ETF	Effluent Treatment Facility
HEPA	High Efficiency Particulate Air
HGP	Hanford Generating Plant
ISS	interim safe storage
LDR	land disposal restriction
LLW	low-level waste
MSDS	material safety data sheet
NDA	nondestructive assay
PCB	polychlorinated biphenyl
PSQ	principal study question
RCRA	*Resource Conservation and Recovery Act of 1976*
RCT	radiological control technician
RDL	required detection limit
RL	U.S. Department of Energy, Richland Operations Office
RPD	relative percent difference
SAP	sampling and analysis plan
SSE	safe storage enclosure
TCLP	toxicity characteristic leaching procedure
TRU	transuranic
WAC	*Washington Administrative Code*

Acronyms

METRIC CONVERSION CHART

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

1.0 STEP 1 – STATE THE PROBLEM

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

1.1 INTRODUCTION

This DQO summary report provides the results of the DQO process completed for waste characterization activities for the 105-N/109-N Reactor Interim Safe Storage (ISS) Project including decommission, deactivate, decontaminate, and demolish (D4) activities for six associated buildings. The action is consistent with the *105-N Reactor Building and 109-N Heat-Exchanger Building Action Memorandum* (Ecology 2005).

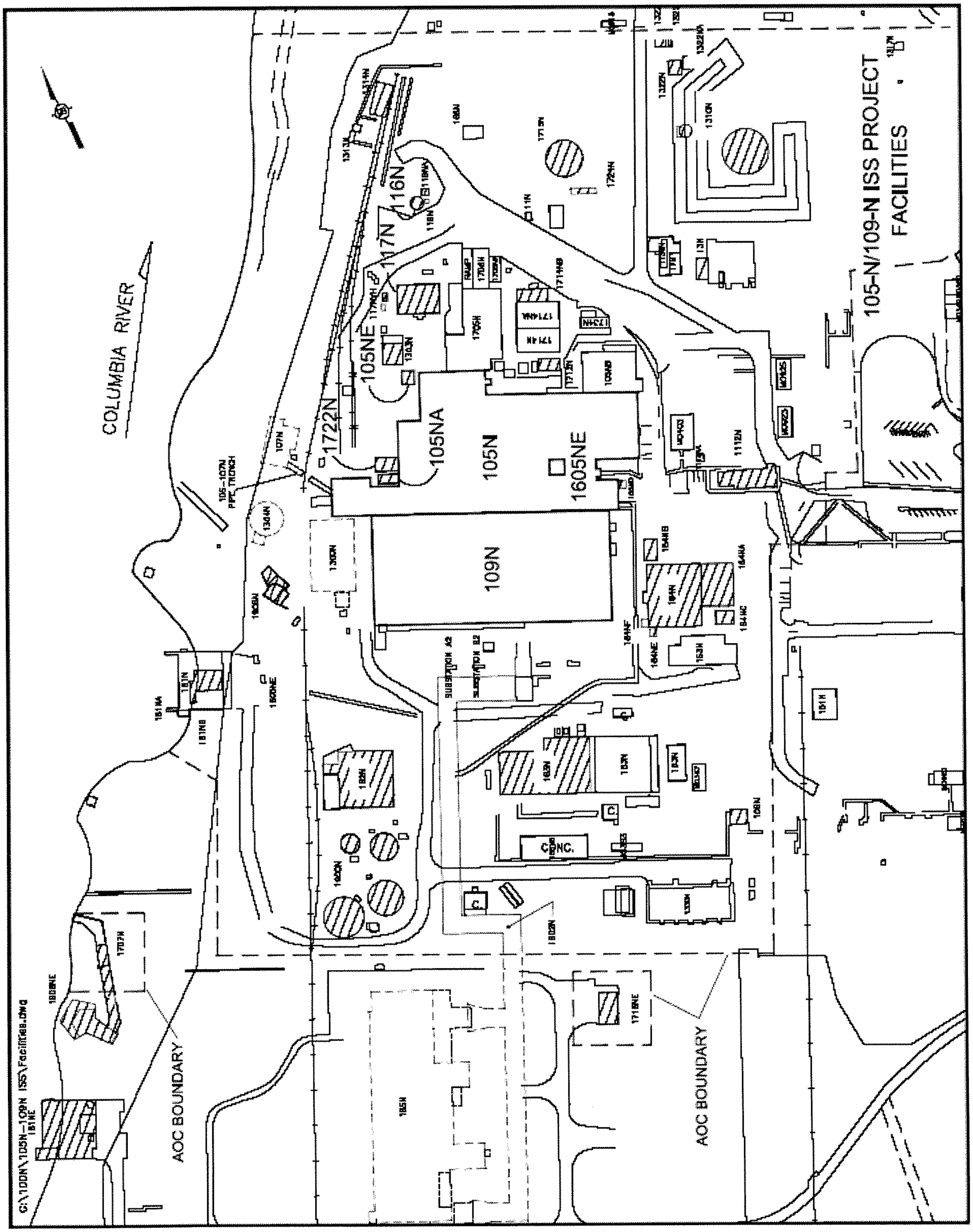
Support information for the DQO summary report has been obtained from historical files, deactivation files, facility inspection records, and other relevant sources. The information is used to evaluate the nature and extent of contamination for specific waste streams identified in the 105-N Reactor Building, 109-N Heat Exchanger Building, 105-NA Emergency Diesel Enclosure, 105-NE Fission Products Trap, 116-N Exhaust Air Stack, 117-N Exhaust Air Filter House, 1605-NE Observation Post, and the 1722-N Decontamination Building (Figure 1-1). Specific contamination information is used to develop the sampling and analysis strategy to support waste characterization of the facilities.

1.2 OBJECTIVE

This DQO process supports activities associated with ISS activities of the 105-N Reactor block and the 109-N steam generator cells and pipe gallery. Results will provide a baseline prior to ISS and final disposition. This DQO supports waste designation and disposal activities of areas outside the shield walls at 105-N Reactor, outside shield walls at the 109-N Heat Exchanger, the 105-NA Emergency Diesel Enclosure, the 105-NE Fission Products Trap, the 116-N Exhaust Air Stack, the 117-N Exhaust Air Filter House, the 1605-NE Observation Post, and the 1722-N Decontamination Buildings. The primary objective of this DQO process is to develop appropriate information for characterizing the waste streams within the scope of the 105-N/109-N ISS Project to support activities and dispose the waste in a safe, appropriate, and cost-effective manner.

The primary disposal option for the demolition waste is the Hanford Site's Environmental Restoration Disposal Facility (ERDF). However, the DQO will include a process for characterizing unexpected waste streams. If transuranic (TRU) or mixed waste is encountered, storage may be allowed at the Central Waste Complex (CWC) on a case-by-case basis and will follow CWC waste acceptance criteria. Liquid waste may be sent to the Hanford Site's Effluent Treatment Facility (ETF) and will be treated to meet the acceptance criteria of the receiving facility.

Figure 1-1. Site Plan of 105-N/109-N Reactor Interim Safe Storage Project Facilities.



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

The results presented in this DQO summary report will be developed into a sampling and analysis plan (SAP) that will contain the sampling and analysis requirements for the 105-N/109-N ISS Project demolition debris and associated wastes. Some of waste materials will be evaluated for salvage, reuse, or recycling. This may include reusable equipment, waste oils and greases suitable for energy recovery recycling, and water for dust suppression.

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

1.3 PROJECT MILESTONES AND DATA QUALITY OBJECTIVE TEAM MEMBERS

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

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

Name	Organization	Role and Responsibility
Dennis Reese	WCH	Project Director
David Encke	WCH	Characterization Specialist
Duane Jacques	WCH	Characterization Lead
Jim Golden	WCH	Project Environmental Lead
Robert Egge	WCH	Project Engineering
Eric Ison	WCH	Project Engineering
Sarah Lachmann	TRUTech	Design Engineering
Nolan Draper	WCH	Field Engineer (Historical knowledge of 105-N Reactor operations and deactivation)
Greg Borden	WCH	Waste Operations
Greg Hopkins	WCH	Waste Operations
Bob Hynes	WCH	Waste Operations

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

Name	Organization	Role and Responsibility
Jeff Ehlis	WCH	Waste Transportation Specialist
Wendy Thompson	WCH	Sampling/Data Management
Greg Gibbons	WCH	Radiological Engineering
Rich Weiss	WCH	Sampling/Data Management
Tim Lee	WCH	DQO Support
Roger Ovink	WCH	DQO Facilitator

DQO = data quality objective
WCH = Washington Closure Hanford

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

Name	Organization
Rick Bond	Washington State Department of Ecology
Dennis Faulk	U.S. Environmental Protection Agency
Chris Smith	U.S. Department of Energy

The project milestones and regulatory drivers for the 105-N/109-N ISS Project are shown in Table 1-3.

Table 1-3. Project Schedule.

Milestone	Due Date	Regulatory Driver
Data Quality Objective Summary Report	September 30, 2005	None
Sampling and Analysis Plan	December 30, 2005	None
Complete 105-N Reactor Interim Safe Storage	September 30, 2012	Tri-Party Agreement[a] Milestone M-93-20

[a]Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement), 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

1.4 PROJECT ASSUMPTIONS AND ISSUES

The project assumptions and issues described below are based on project team discussions and interviews with the regulators.

1.4.1 Project Assumptions

1. The 105-N, 109-N, and associated ancillary facilities are regulated under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA). The facilities are included in the *Removal Action Work Plan for 105-N/109-N Buildings Interim Safe Storage and Related Facilities* (DOE-RL 2005).

2. The 105-N Reactor was shut down in January 1987 and defueled in 1989. The year 1989 is used to determine the decay of the radioactive inventory in the facility because this is a few years after shutdown and when the reactor was defueled.

3. Wastes from the 105-N, 109-N, and associated ancillary facilities will be disposed at the ERDF or other regulator-approved pathways for disposal, recycle, or reuse.

4. Regulated wastes (e.g., mercury-containing switches, polychlorinated biphenyl [PCB] light ballasts, and asbestos-containing material [ACM]) may be generated during demolition of the 105-N, 109-N, and associated ancillary facilities and will be disposed or recycled as required.

5. For the purpose of this DQO summary report, the footprint of each building includes all materials and soil within a 1.5-m (5-ft) lateral perimeter of the building foundation or outline, including the excavation and layback. The footprint also includes all materials and soils to a depth of 1 m (3 ft) below grade or below the engineered structure. Associated underground utilities, process lines, soil, and concrete within the facility footprint will be characterized and disposed in accordance with the waste designation of the facility structure.

6. Contaminated soil and debris (including utilities, process lines, and other structures) beyond the facility footprint (described in assumption #5). Contaminated sites will be stabilized before being transferred to the Field Remediation Closure Project, and data will be provided (e.g., survey, samples) to aid planning for activities.

7. Extensive historical characterization data associated with the waste materials in the 105-N, 109-N, and associated ancillary facilities is available. The data will be adequate to establish the primary sources of contamination to support the generation or revision of one or more waste profiles for waste generated during the scope of this project.

8. The closure of the facility sites is not within the scope of this DQO summary report. Interim and final closure of the facility sites will be handled in subsequent documentation prepared for the Field Remediation Closure Project.

9. Decommissioning of groundwater and observation wells may occur concurrent with and in support of the ISS activities covered in this DQO summary report. Wastes generated as a part of well decommissioning efforts are already profiled for ERDF waste disposal (BHI 2003).

1.4.2 Global Issues

A global issues meeting was held with the U.S. Department of Energy, Richland Operations Office (RL) and the Washington State Department of Ecology (Ecology) on July 11, 2005. The U.S. Environmental Protection Agency (EPA) could not attend but was contacted. The global issues discussed and resolutions are as follows:

1. **Elements of the DQO.** There are three elements that should be addressed by the DQO process: (1) waste characterization for ISS disposal activities, (2) archive information needed to support ISS, and (3) final closure of the site. Do not limit the scope of this DQO to waste characterization only.

   Resolution: The first two elements (waste characterization for ISS disposal activities and archive information needed to support ISS) will be addressed in this DQO process. Sampling requirements for the third element (final closure of the site) will be addressed by the Field Remediation Closure Project during actions for below-ground structures. Planning for these actions will be based on data collected during the first two elements.

2. **Safe storage of Zone 1 areas (within the shield walls of the 105-N Reactor and 109-N Heat Exchanger Facility).** Why are areas at the 105-N/109-N Reactor Complex placed in safe storage instead of removal? Is characterization within the safe storage enclosure (SSE) needed?

   Resolution: Ecology and EPA have agreed in principle to the ISS approach (Ecology 2005). ISS will include construction of a SSE around the shield walls of the 105-N Reactor and 109-N Heat Exchanger facility. The specific objectives of the action are as follows:

   - Reducing the threat of release of hazardous substances contained within facilities
   - Protecting workers from hazards posed by these facilities
   - Minimizing or eliminating long-term surveillance and maintenance requirements and associated costs.

   Characterization of the areas within the SSE is needed to provide baseline data prior to ISS and final disposition. This DQO process will identify the needs and constraints for collecting the baseline data.

1.4.3 Project-Specific Technical Issues and Resolutions

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

1. **Underground utilities and process lines.** The areas around and under facilities within the scope of this DQO summary report may contain utilities, process lines, and contaminated soil that are tied to facilities not included in the scope of this report. To what extent should these materials be included in remediation of the 105-N/109-N ISS facilities, and how will they be characterized?

   Resolution: Utilities, process lines, and contaminated soils associated with facilities that are outside the scope of this DQO summary report but that are within the facility footprint (defined in assumption #5) will be considered part of the remediation activity, at the discretion of the Project. Utilities, process lines, and contaminated soil associated with facilities outside the scope of this DQO summary report that require removal and disposal will be characterized in accordance with the applicable requirements described in this DQO summary report.

2. **Painted surfaces containing *Resource Conservation and Recovery Act of 1976* (RCRA) metals and PCBs.** The majority of building and equipment surfaces associated with the 105-N/109-N ISS facilities are coated with paint containing regulated amounts of lead, chromium, and/or PCBs.

   Resolution: Where possible, historic sample data will be used to designate painted materials. Dried paint and primer is considered a part of the substrate and not a separate waste stream. The dried paint and primer are only a small percentage of the total debris (e.g., concrete, tanks, pumps, equipment, and sheetrock) being disposed. The average thickness of paint will be estimated and process knowledge, material safety data sheet (MSDS) information, and/or laboratory data will be used to calculate the total volume of paint as a percentage of the appropriate volume of the waste stream to which the paint is applied. If no information or applicable data exists to prepare engineering calculations for the paint and primer, then samples will be collected and analyzed. The paint will not be separated from the substrate before disposal.

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

Resolution: No COCs will be eliminated from the target list without adequate process knowledge or other appropriate data or information. If the laboratory detection limits for a constituent are higher than the target compound regulatory levels and no information is available to exclude the constituent, then the waste would be appropriately designated for that constituent.

1.5 EXISTING REFERENCES

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

Table 1-4. Existing Historical References. (5 Pages)

Reference	Summary
Activity Conversion Factors for 100-N Facilities, 0100N-CA-N0018	Calculates the radioactivity conversion factors for estimating radionuclide surface or mass specific radioactivity concentrations in selected 100-N facility areas/equipment based on in-plant dose rate measurements.
Radionuclides in 105-NE, 1305-N, and 1304-N, 0100N-CA-N0025	Calculates the radioactive material inventory in the 105-NE FPT, associated 1305-N piping, and the 1304-N Emergency Dump Tank.
Characterization of Mixed Sediment in North Cask Pit and Basin Water, 0100N-CA-N0038, Rev. 1	Calculates the physical, chemical, and radiological characteristics of the combined sediments and water to be disposed from the 105-N Basin (based on HEIS sample data).
Residual Quantities After N Basin Cleanup, 0100N-CA-N0044, Rev. 1	Calculates the quantity of materials removed from the N Basin segment and the quantity of materials that will remain after deactivation is completed.
Residual Radioactive Inventory After N Basin Cleanup, 0100N-CA-N0045	Calculates inventory of residual radioactive material remaining in N Basin at end of deactivation.
Radionuclide Inventory in 117N Building and 116N Stack, 0100N-CA-N0048	Calculates the total curies of radioactivity in the 117-N and 116-N facilities, based on radiological survey data taken in 1997 and 1998.
105-N Reactor Building Residual Radioactivity Estimate, 0100N-CA-N0049	Calculates the total residual radioactivity in the 105-N Reactor structure (decayed to 1997).
C Elevator Pit Curie Content, 0100N-CA-N0057	Engineering calculation of the amount of radioactive material in the C Elevator Pit in 105-N. Calculation uses 105-N Basin water and sediment radionuclides and activities.
105-N and 109-N Final Hazard Categorization for ISS, 0100N-CA-N0069, Rev. 0	Final hazard classification for the 105-N and 109-N ISS.
Calculation of Beryllium Content of Zircaloy in Burial Ground 618-7, 0300X-CA-V0030	Calculation that conservatively estimates the beryllium content in Zircaloy chips resulting from N fuel manufacturing process at 2.2% by weight.

Table 1-4. Existing Historical References. (5 Pages)

Reference	Summary
Action Plan for Managing Hanford Cultural Resources 100-N Reactor Area, BHI-00710, Draft	Initial draft document provides information regarding cultural resources in the 100-N Reactor Area.
Final Hazard Classification and Auditable Safety Analysis for the N Basin Segment, BHI-00968, Rev. 1	The ASA for the N Basin segment surveillance and maintenance preceding D4.
Preliminary Hazard Classification for the 105-N and 109-N Zone 1 Segment Intrusive Activities, BHI-01045	This preliminary hazard classification has been superseded by BHI-01179.
105-NE Fission Product Trap and 1305-N Piping Preliminary Hazard Classification, BHI-01110	This preliminary hazard classification has been superseded by BHI-01179.
Auditable Safety Analysis and Final Hazard Classification for the 105-N Reactor Zone and 109-N Steam Generator Zone Facility, BHI-01179, Rev. 0	This ASA provides the authorization basis for the reactor/steam generator zone segment and includes activities during both deactivation, and surveillance and maintenance preceding D&D. This document is also a source of information that can be used to evaluate future decommissioning alternatives.
Data Quality Objective Summary for the 100 Area Burial Grounds and 300-FF-2 Operable Unit Waste Sites, BHI-01501, Rev. 0	Includes a description of how waste will be characterized for waste designation.
Data Quality Objectives Summary Report for D&D Waste Characterization of the 300 Area Buildings, BHI-01750, Rev. 0	Data quality objectives for characterizing waste generated during the D&D of the 300 Area facilities.
Fission Product Trap (FPT) Water Removal, CCN 030417	A comparison of manhours and manrem to remove FPT pit water in 1996 versus 2006. Estimated 75% reduction in exposure if done in 2006.
Preliminary Hazard Classification for 105 N Building Non-Zone 1 Segment, CCN 042888	Preliminary hazard classification for 105-N Building Non-Zone 1 Segment determined that the segment was classified as "Industrial."
C Elevator Pit Contamination Control, CCN 046485	Recommends that the sediment remaining in C Elevator Pit remain wet until remediation occurs - to minimize the potential for airborne contamination.
Waste Designation - Sylvania Deluxe GL Fluorescent Lamps, CCN 0518087	Waste designation for fluorescent lights.
100N Facility Endpoint Criteria and Turnover Documentation 105-N Lift Station and Valve Pit, CCN 0521104	The electronic version contains only the checklist portion of the documentation that verifies that all deactivation criteria have been met or lists the exceptions that have not been met. The hardcopy files contain all the backup documentation for showing the endpoint criteria have been met.
100N Facility Endpoint Criteria and Turnover Documentation 105-NA Emergency Diesel Enclosure, CCN 0521105	The electronic version contains only the checklist portion of the documentation that verifies that all deactivation criteria have been met or lists the exceptions that have not been met. The hardcopy files contain all the backup documentation for showing the endpoint criteria have been met.

Table 1-4. Existing Historical References. (5 Pages)

Reference	Summary
100N Facility Endpoint Criteria and Turnover Documentation - 105-NE/1305-N Fission Products Trap (FPT)/Radioactive Liquid Waste Lines to FPT, CCN 0521108	The electronic version contains only the checklist portion of the documentation that verifies that all deactivation criteria have been met or lists the exceptions that have not been met. The hardcopy files contain all the back-up documentation for showing the endpoint criteria have been met.
100N Facility Endpoint Criteria and Turnover Documentation - 105-N Reactor/Process Building (Grade Elevations Non Zone 1), CCN 0521109	The electronic version contains only the checklist portion of the documentation that verifies that all deactivation criteria have been met or lists the exceptions that have not been met. The hardcopy files contain all the back-up documentation for showing the endpoint criteria have been met.
100N Facility Endpoint Criteria and Turnover Documentation - 105-N Reactor/Process Building (Below Grade Elevations non Zone 1), CCN 0521111	The electronic version contains only the checklist portion of the documentation that verifies that all deactivation criteria have been met or lists the exceptions that have not been met. The hardcopy files contain all the back-up documentation for showing the endpoint criteria have been met.
100N Facility Endpoint Criteria and Turnover Documentation - 105-N Reactor/Process Building (+14' and +28' Elevations non Zone 1), CCN 0521112	The electronic version contains only the checklist portion of the documentation that verifies that all deactivation criteria have been met or lists the exceptions that have not been met. The hardcopy files contain all the back-up documentation for showing the endpoint criteria have been met.
100N Facility Endpoint Criteria and Turnover Documentation 105-N Fuel Storage Basin, CCN 0521113	The electronic version contains only the checklist portion of the documentation that verifies that all deactivation criteria have been met or lists the exceptions that have not been met. The hardcopy files contain all the back-up documentation for showing the endpoint criteria have been met.
100N Facility Endpoint Criteria and Turnover Documentation - 105-N/109-N Zone 1, CCN 0521114	Contains documentation of the deactivation of this portion of 105-N/109-N.
100N Facility Endpoint Criteria and Turnover Documentation - 109-N Heat Exchanger Building (Non Zone 1), CCN 0521133	Contains documentation of the deactivation of this portion of 109-N.
100N Facility Endpoint Criteria and Turnover Documentation 1722-N Decontamination Building, CCN 0521165	Contains documentation of the deactivation of 1722-N.
Waste Designation - Elemental Mercury, CCN 0551610	Waste designation for elemental mercury.
Waste Designation - High Pressure Sodium Lamps, CCN 0555637	Waste designation for high-pressure sodium lamps.
Waste Designation - Maintenance Shop PCB Light Ballasts (PIN #100N-03-0029), CCN 0555637	Waste designation for light ballasts containing PCBs.
105-N Reactor Building and 109-N Heat-Exchanger Building Action Memorandum, CCN 119850	The regulators approval to D&D portions of the 105-N and 109-N facilities and place them into ISS.

Table 1-4. Existing Historical References. (5 Pages)

Reference	Summary
Engineering Evaluation/Cost Analysis for the 105-N Reactor Facility and 109-N Heat Exchanger Building, DOE/RL-2004-46, Rev. 0	EE/CA for 105-N and 109-N; includes list of WIDS sites associated with 105/109-N, the primary radionuclides that are COCs, and potential hazardous substances that may be encountered.
Removal Action Work Plan for 105-N/109-N Buildings Interim Safe Storage and Related Facilities, DOE/RL-2005-43, Internal Draft	Establishes the methods and activities to place the 105-N and 109-N facilities into ISS.
RCRA Facility Investigation/Corrective Measures Study Work Plan for the 100-NR-1 Operable Unit, Hanford Site, Richland, Washington, DOE/RL-90-22, Rev. 0	Establishes the objectives, procedures, tasks, and schedule for conducting the RCRA facility investigation/corrective measures study for the 100-NR-1 source operable unit.
Limited Field Investigation Report for the 100-NR-1 Operable Unit Abatement Assessment, DOE/RL-93-80, Rev. 0	Summarizes the data collection and analysis activities conducted during the 100-NR-1 source operable unit limited field investigation and makes recommendations on the continued candidacy of high-priority sites for interim remedial measures.
Surveillance and Maintenance Plan for the 100-N Area Deactivated Facilities, DOE/RL-98-64, Rev. 0	Summarizes surveillance and maintenance requirements for the 100-N deactivated facilities.
Essential Materials Specification Manual N Reactor, DUN-M-42 PT.A	Contains the specifications, procurement, use, and control of process materials consumed in the operation of the 105-N Reactor, including water treatment chemicals, fuel oils (No. 1, 2, and 6) and several gases (Cl, He, N).
100-N Technical Manual, HW-69000	Technical manual describing all the systems and equipment for the operation of the 100-N Reactor. This or UNI-M-94 are the first documents one should look at for information on 100-N systems or equipment.
N Reactor Materials Manual, HW-79050	The manual is a catalog of the structural materials in contact with the coolants in the primary, secondary, graphite cooling, and injection water systems at the 105-N Reactor. Good reference for materials used in valves, piping, etc., at the 105-N Reactor.
List of 100-N Area Technical Specifications	This is a printout of all technical specifications related to the 100-N Area. Excellent reference to identify technical specs document numbers. Can order the documents to obtain good historical information on the materials and construction methods used at 100-N.
A History of Major Hanford Operations Involving Radioactive Material, PNL-6964	Contains historical information on radioactive material operations at the Hanford Site.
N-Reactor History, RL-GEN-1180 Sup 1	History of the 105-N Reactor from conception to electrical power generation.
N Reactor Updated Safety Analysis Report, UNI-M-90	Excellent reference document; discusses how the 105-N Reactor conforms to the NRC "General Design Criteria of Nuclear Power Plants."

Table 1-4. Existing Historical References. (5 Pages)

Reference	Summary
N Reactor Plant Manual, UNI-M-94	Describes all the systems and equipment associated with the operation of the 105-N Reactor. This manual or HW-69000 should be the first document used to obtain information on N Reactor.
Manufacturing Process Specification for N Reactor Fuel, WHC-CM-5-20	Provides the manufacturing process specifications for metallic uranium fuel elements fabricated by the co-extrusion process. This document may also be referenced as DUN-5601.
Facility Effluent Monitoring Plan for the N Reactor, WHC-EP-0477	The monitoring plan for 105-N Reactor effluents while the reactor was in standby mode.
100-N Technical Baseline Report, WCH-SD-EN-TI-251	Provides a technical baseline of waste sites located at the 100-N Area.
105-N and 109-N Roofs, Limited Asbestos Inspection Summary, CCN 065385	Report on the results of bulk asbestos sampling of the roofs of 105-N and 109-N.
105-N and 109-N Roof Asbestos Report, Revised Table, CCN 065825	Revision of the table included in CCN 065385.

ASA = auditable safety analysis
COC = contaminant of concern
D&D = Decontamination and Decommissioning
D4 = Decommission, Deactivate, Decontaminate, and Demolish
EE/CA = engineering evaluation/cost analysis
FPT = fission product trap
HEIS = Hanford Environmental Information System
ISS = interim safe storage
NRC = U.S. Nuclear Regulatory Commission
PCB = polychlorinated biphenyl
RCRA = *Resource Conservation and Recovery Act of 1976*
WIDS = Waste Information Data System

1.6 FACILITY DESCRIPTIONS AND PROCESS HISTORY

The following subsections include a description of the 105-N, 109-N, and associated ancillary facilities.

1.6.1 105-N Reactor Building

The 105-N Reactor is a 4,000-megawatt (thermal) nuclear reactor designed to operate as a dual-purpose reactor. The reactor core is a graphite-moderated, light water-cooled, horizontal pressure-tube facility designed to produce plutonium. By-product steam was routed to a nearby privately operated facility (185-N Hanford Generating Plant) to produce approximately 860 megawatts of electricity. Construction of the 105-N Reactor began in December 1959 and was completed in October 1963. The 105-N Reactor was the last of the nine Hanford Site graphite-moderated reactors. The facility contains the reactor block, front and rear elevators, pipe galleries, exhaust fans, a receiving basin for spent fuels, offices, control rooms, electrical and instrument rooms, a shop area, ventilation supply, metal preparation and storage areas, fuel storage basin, and a transfer area. On the south side of the building is the 109-N Heat Exchanger Building, which is between the pipe gallery and shares a common wall with 105-N. Asbestos-containing materials and radiological and chemical contamination exists in the 105-N Reactor Building.

The footprint of the 105-N facility is approximately 7,939 m^2 (85,450 ft^2) and includes three below-grade floor areas (minus 3 m [10 ft] level, minus 4.9 m [16 ft] level, and minus 6.4 m [21 ft] level), main floor area (0 m [0 ft] level), and four above-grade floor areas (plus 4.5 m [15 ft] level, plus 8.5 m [28 ft] level, plus 12 m [40 ft] level, and plus 18 m [60 ft] level). The roof is at the plus 21 m (70 ft) level. The roof includes a penthouse structure that extends to 24 m (80 ft) above grade that is connected to the pipe gallery of 109-N Building (pressurizer). This structure is shared with the 109-N Building. The reactor core and other primary reactor support areas are constructed of reinforced concrete and mass shield walls. Interior walls are composed of steel frame, concrete block (concrete masonry unit), and insulated panel construction. The exterior of the building is covered with insulated corrugated-metal wall panels. The roof is covered with built-up roofing with felt strips near the edges and overcovered with urethane foam and two sealer coatings.

The reactor core is composed of interlocking graphite bars containing zirconium-alloy pressure tubes, which held the zirconium alloy-clad uranium-metal fuel elements. Reactivity and reactor power levels were controlled using horizontal control rods and a vertical ball-drop system. Boron was the primary neutron-absorbing material used in the control rods and ball-drop system.

The irradiated reactor fuel was discharged to the 105-N Fuel Storage Basin and placed into metal canisters. The fuel was cooled and stored in the basin to provide for radioactive decay of short-lived radionuclides before it was shipped for processing. The basin is an unlined, reinforced-concrete structure measuring 46 m (150 ft) long, 15 m (50 ft) wide, and 7 m (24 ft) deep.

The reactor was shut down in January 1987 and defueled in 1989. Deactivation of the 105-N facility began in 1991 and was completed in 1998, which included shutdown and isolation of operational systems, cleanup of radiological and hazardous waste, inventory of remaining hazardous materials, sealing access areas, and securing the facility. Contaminated hardware and equipment, sludge, and water were removed from the fuel storage basin. Concrete cover blocks were placed over the fuel storage basin to provide shielding and isolation. Although the deactivation has been completed, portions of the building remain as high-radiation areas and airborne radiation areas. In addition, lubricating oils and/or hydraulic fluids remain in some pieces of equipment.

For management purposes, the 105-N Reactor facility has been divided into three segments:

- **Zone 1 Segment (within the shield walls).** Consistent with Ecology (2005), this segment will be within the SSE and includes the areas within the shield walls including the ball control room, fuel cladding failure detection rooms, inlet and outlet piping rooms, gas condenser room, ball recovery room, C and D Elevators, Zone 1 supply plenum, Zone I, II, and III exhaust tunnels, transducer room, corridor #3, inner and outer horizontal rod rooms, flux monitor room, front and rear face of the reactor, reactor block/process area, Zone I ventilation exhaust fan room, supply crossover pipe space, top of reactor, machinery room, Zone I and III ventilation exhaust duct, gas facility pipe tunnel, dryer rooms, Zone II ventilation exhaust fan room (Figure 1-2).

- **Non-Zone 1 Segment (outside the shield walls).** This segment is defined as all other areas of the 105-N Reactor facility that are not part of the Zone 1 Segment or the N Basin Segment. It includes the roofing material.

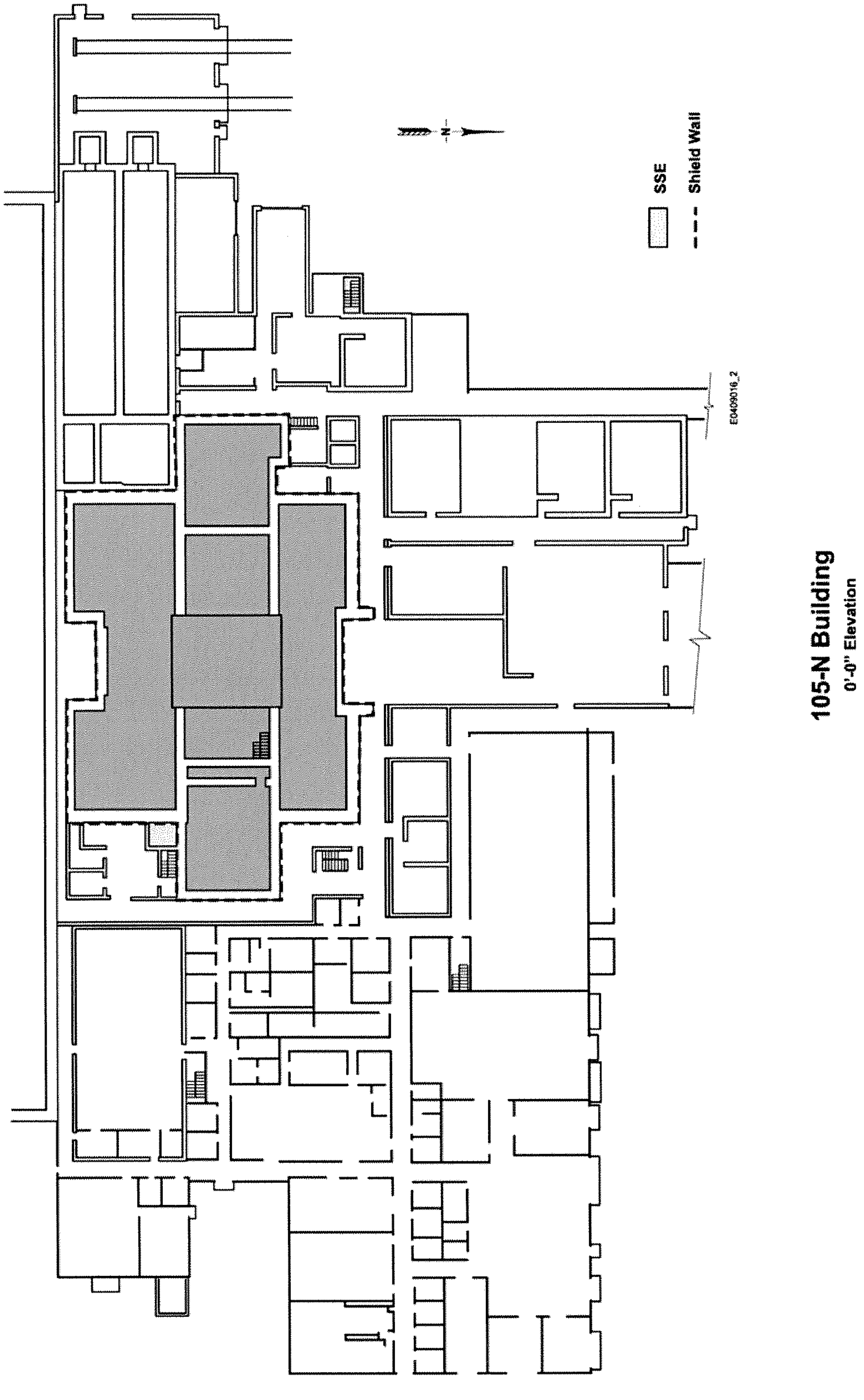
- **N Basin Segment.** This segment is defined as the 105-N Basin pool, the transfer area, discharge chute, the operating deck, the superstructure around the pool, and the lift station.

1.6.2 109-N Heat Exchanger Building

Construction of the 109-N Heat Exchanger Building began in December 1959 and was completed in October 1963. Reactor primary coolant from 105-N was circulated through the reactor to steam generators located in the 109-N Heat Exchanger Building and then routed back to the reactor via primary coolant pumps. Secondary steam from the steam generators was either dumped into water-cooled dump condensers or piped to the privately operated 185-N Hanford Generating Plant (HGP) to generate electricity. Circulation of the highly radioactive reactor primary coolant through 109-N systems contaminated the equipment, piping, and steam generators to levels comparable with the 105-N Reactor primary cooling system equipment and piping. Tube leaks in the 109-N Heat Exchanger Building's steam generators allowed radiologically contaminated primary water to be carried to the HGP's secondary systems. The HGP (185-N) along with a portion of the 1802-N pipe trestle that leads to the 185-N Building were demolished in 2003. The 109-N Building will be stabilized with the 105-N ISS due to the high levels of radionuclide contamination within the piping systems and steam generator cells in the 109-N Heat Exchanger Building and because the two facilities share important structural components.

The 109-N Heat Exchanger facility is located on the south side of the 105-N Reactor immediately next to the building. The 109-N and 105-N facilities share a common wall. The footprint of the building is approximately 8,406 m^2 (90,480 ft^2) and includes the decontamination equipment area (minus 7.3 m [24 ft] level), a below-grade floor area (minus 4.9 m [16 ft] level), main floor area (0 m [0 ft] level), and two above-grade floor areas (plus 4.5 m [15 ft] level and plus 7.3 m [24 ft] level). The roof is at the plus 11.6 m [38 ft] level and also includes a penthouse structure that extends to 24 m (80 ft) above grade (pressurizer). This structure is shared with the 105-N Building. The facility also contains a pipe gallery, auxiliary cell, and six steam generator cells in parallel, each cell containing two steam generators, a drive turbine, a circulating pump and associated piping, valves, and instrumentation. Each steam generator is 17 m (57 ft) long by 3 m (10 ft) in diameter and weighs approximately 154 metric tons (170 tons).

Figure 1-2. Schematic Floor Plan of the 105-N Reactor.



The 109-N Heat Exchanger Building includes a decontamination cell and a central penthouse area that contains a 13.5-m (44.5-ft)-high by 2-m (6.5-ft)-diameter pressure vessel weighing approximately 82 metric tons (90 tons). The building is constructed of reinforced concrete with metal siding on the exterior and polyurethane roofing material over a 10-cm (4-in.) concrete slab. Interior walls are concrete block. The reinforced-concrete walls around the steam generator cells are approximately 1.5 m (5 ft) thick. The exterior of the building has thirteen 1.8-m (6-ft)-diameter roof confinement vent valves and the steam distribution headers and piping that routed pressurized steam to the 185-N HGP via the 1802-N pipe trestle.

Deactivation of the facility was completed in 1998, which included shutdown and isolation of operational systems, cleanup of some of the radiological and hazardous waste, inventory of remaining hazardous materials, sealing access areas, and securing the facility. Although deactivation was completed, portions of the building (e.g., steam generator cells) remain as high-radiation areas and airborne radiation areas. The 109-N Heat Exchanger facility contains a large amount of asbestos and asbestos-containing materials that were primarily used for thermal insulation. In addition, lubricating oils and/or hydraulic fluids remain in some pieces of equipment.

For management purposes, the 109-N Heat Exchanger Building has been divided into two segments:

- **Zone 1 Segment (within the shield walls).** Consistent with Ecology (2005), this segment will be within the SSE and includes the six cells holding the steam generators, auxiliary systems cell, primary recirculation pump areas, pressurizer room, associated pipe galleries, spill coolers, recuperative heat exchanger room, and supply plenum (see Figure 1-3).

- **Non-Zone 1 Segment (outside the shield walls).** This segment is defined as all areas of the 109-N Heat Exchanger Building that are not within the shield walls. It includes the drive turbine bays, the decontamination cell, and the roofing material.

1.6.3 105-NA Emergency Diesel Enclosure

The 105-NA Emergency Diesel Enclosure is a 17.9-m^2 (192-ft^2) pre-engineered, steel-framed building that houses an emergency diesel-engine-powered pump designed to activate in case of a pipe break or fog-spray system activation in Radiation Zone 1 of the 105-N Reactor. Potential radioactive contamination exists within the piping system because the piping is affiliated with Radiation Zone 1 in the 105-N Reactor.

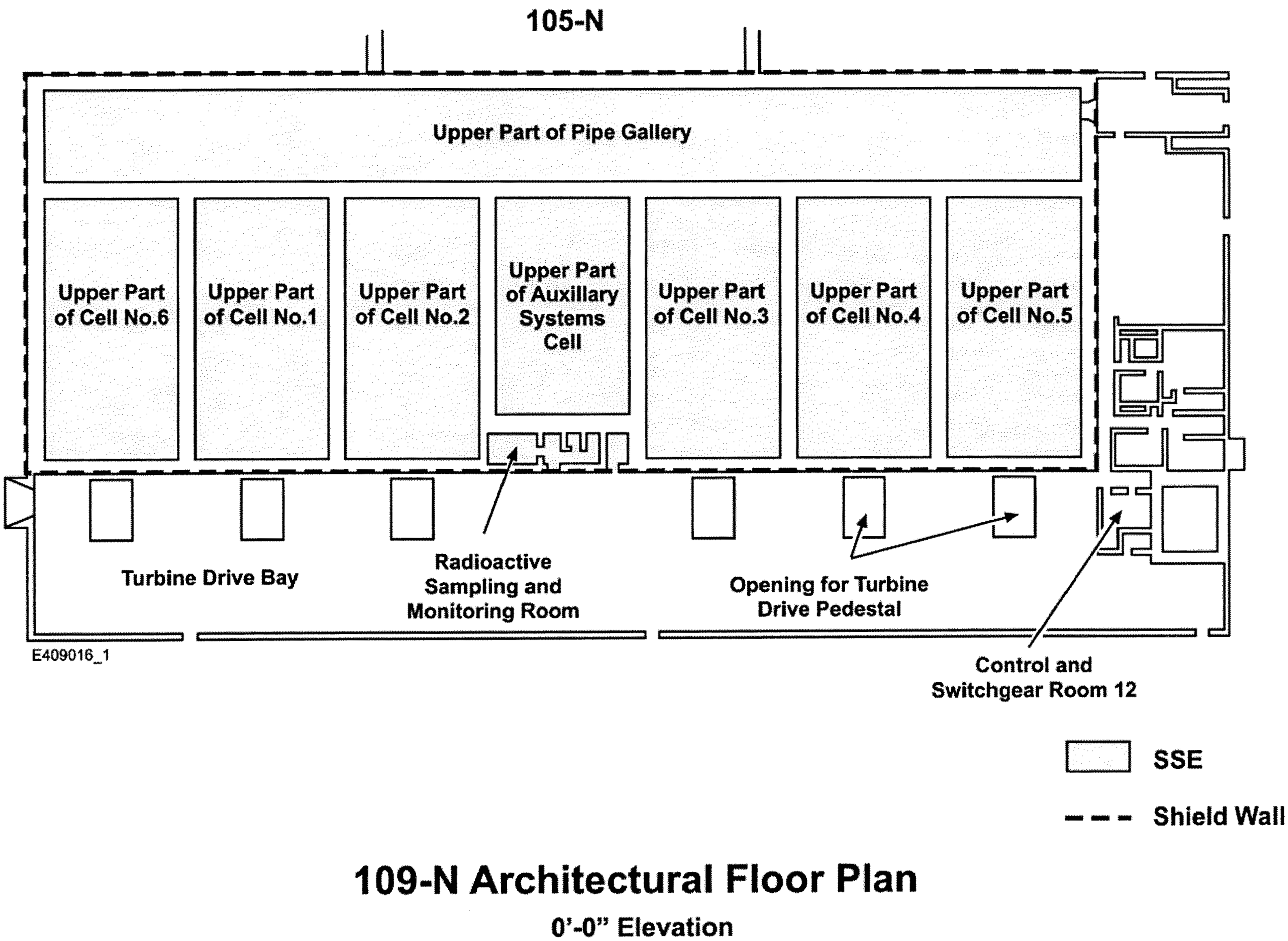


Figure 1-3. Schematic Floor Plan of the 109-N Heat Exchanger Facility.

1.6.4 105-NE Fission Products Trap

The 105-NE Fission Products Trap, also known as the 1305-N Facilities, is a below-grade structure of about 1.4 m^2 (15 ft^2). The reinforced concrete structure provides an approximately 9-m (30-ft)-deep "U-shaped" loop or trap for drain piping. Valves and drain pipes were attached to the bottom of each trap to allow for the drain off of trapped solids. The intent was to trap fission products from the 105-N Reactor in the radioactive drain systems for disposal rather than for direct disposal to the 1301-N and 1325-N Cribs. The radiological inventory of the 105-NE Fission Products Trap has been estimated and is presented in Section 1.7.4.

1.6.5 116-N Exhaust Air Stack

The 116-N Exhaust Air Stack (also called the Ventilation Stack) is a reinforced, monolithic, 69.5-m (228-ft)-tall structure that discharged ventilation exhaust to the atmosphere. It stands on an octangular-shaped below-grade base that measures 4.6 m (15 ft) at the top. It is fed by below-grade air exhaust tunnel that originates in the 117-N Exhaust Air Filter House. The 116-N stack contains low levels of radioactive contaminants associated with airborne releases from the 105-N Reactor. Some attached piping is insulated with asbestos materials.

1.6.6 117-N Exhaust Air Filter House

The 117-N Exhaust Air Filter House (also called the Ventilation Filter Facility) is a 399-m^2 (4,300-ft^2) reinforced concrete structure that housed the high-efficiency particulate air (HEPA) filter and activated charcoal filters used to remove radioactive particulates and iodine-131 from the exhaust air generated in the 105-N Reactor facility. The filters are placed in banks that allow maintenance activities without affecting reactor operations. The facility also houses a water-spray system that automatically activated if a high-temperature excursion was detected. The roof panels are removable steel panels designed for remote filter-bank replacement. The 117-N filter building contains low levels of radioactive contaminants associated with airborne releases from 105-N Reactor.

1.6.7 1605-NE East Observation Post

The 1605-NE Observation Post is an approximately 6-m^2 (64-ft^2) pre-engineered, steel-framed structure with steel siding located on the roof of the 105-N Reactor facility. There is a potential for radiological contamination in the building materials due to its location.

1.6.8 1722-N Decontamination Building

The 1722-N Decontamination Building (also called the Decon Hot Shop) is a 12.2-m by 7.6-m (40-ft by 25-ft) single-story, steel-framed building with steel siding on a concrete slab foundation. The building housed welding and mechanical tools to repair radiologically contaminated equipment. The facility is radiologically contaminated from the decontamination equipment and is believed to also be contaminated from spills and leaks resulting from the use and storage of miscellaneous solvents. Although contaminants are present, the amounts are unknown.

1.7 PROCESS KNOWLEDGE

The following sections provide descriptions of the operating systems, processes, and process materials related to the scope of the 105-N/109-N ISS Project. Figure 1-4 provides a schematic cutaway diagram of the main portion of the 105-N Reactor as a reference for the systems described in the following sections.

1.7.1 105-N Reactor Core

105-N Reactor fuel consisted of slightly enriched uranium fuel rods co-extruded with a zirconium alloy cladding. Approximately 16,000 fuel assemblies were loaded into 1,004 zirconium alloy horizontal process tubes running the width of the reactor core. The 105-N Reactor core consists of a lattice arrangement of graphite blocks transected by horizontal channels for the process tubes and control rods, and vertical channels for the ball drop system. The graphite core is encased in a thermal shield consisting of 20-cm (8-in.) cast-iron blocks on the front and rear faces and 2.5-cm (1-in.) boron-steel plate on the sides, top, and bottom of the reactor core. The biological shield consists of 102 cm (40 in.) serpentine and iron aggregate concrete on the front and rear faces, 109-cm (43-in.) high-density concrete on the sides, 165-cm (65-in.) high-density concrete on the top, and 259-cm (102-in.) regular concrete on the bottom of the core. The core was surrounded by an aluminum reflector layer. Cooling systems were provided for the process tubes, thermal shield, and horizontal control rods. The reactor core was inerted by either nitrogen (during extended outages) or a helium/carbon dioxide cover gas to control temperature and moisture levels. Table 1-5 shows the estimated radionuclide inventory for each of the main components of the 105-N Reactor core as of March 31, 2005.

The charging elevator (C Elevator) is located on the front face of the 105-N Reactor. Beneath the C Elevator is a 4.3-m (14-ft) by 11.9-m (39-ft) by 4.9-m (16-ft)-deep elevator pit. Contaminated water and sediments from the reactor coolant drained into the C Elevator Pit when the process tubes were opened during refueling. The C Elevator Pit contains contaminated debris beneath several feet of water. The water provides shielding and prevents the approximately 7.6-cm (3-in.) layer of contaminated sediments from drying out and becoming airborne. Table 1-6 shows the estimated radionuclide inventory for the C Elevator Pit as of March 31, 2005.

Figure 1-4. Schematic Cutaway Diagram of the 105-N Reactor Complex.

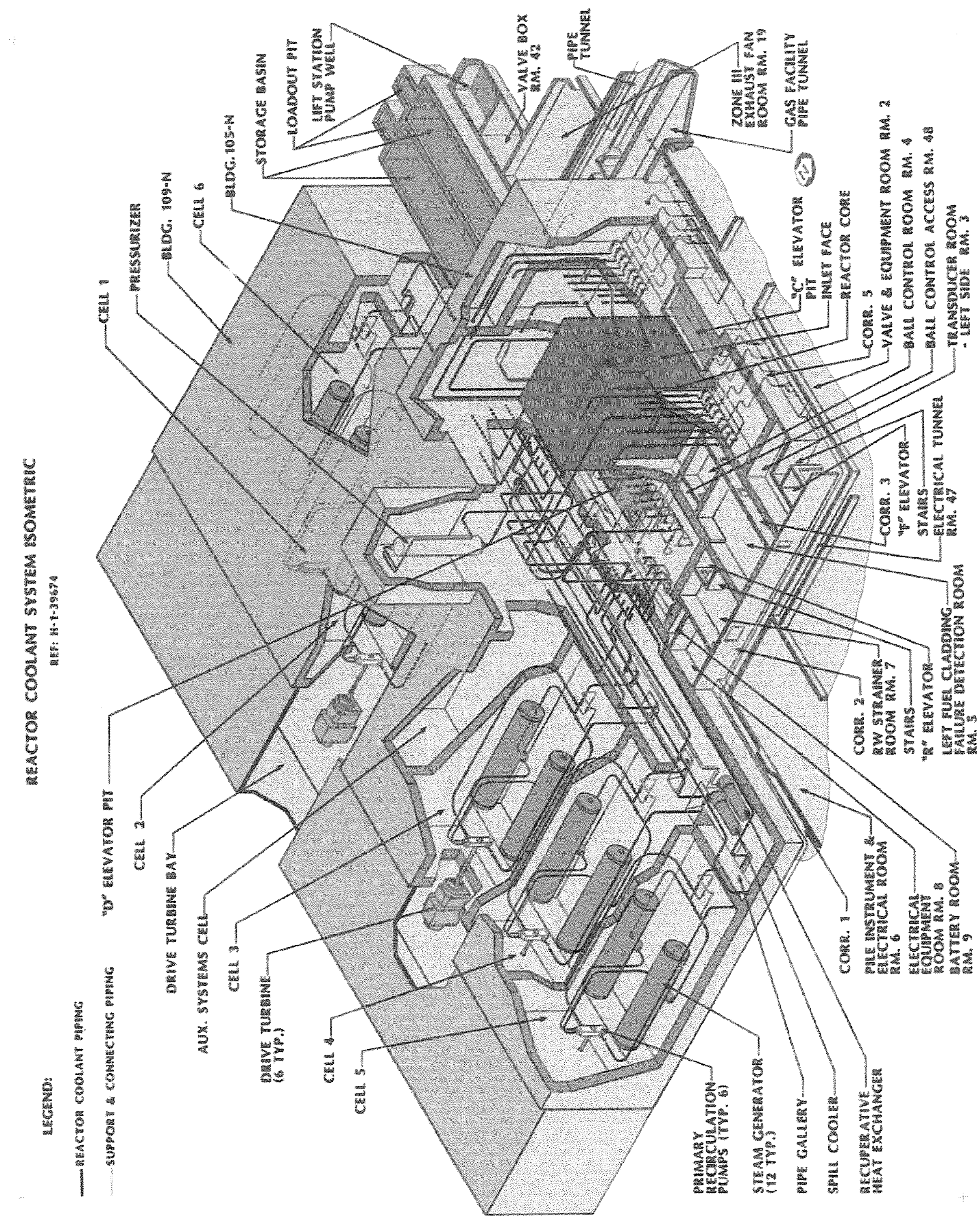


Table 1-5. Estimated Radionuclide Inventory for the 105-N Reactor Core on March 31, 2005[a].

Isotope	Graphite Stack Inventory (Ci)	Thermal and Biological Shield Inventory (Ci)	Process Tubes and Control System Inventory (Ci)	Total Inventory (Ci)
H-3	3.49E+04	-	-	3.49E+04
C-14	9.55E+03	-	-	9.55E+03
Cl-36	7.50E+01	-	-	7.50E+01
Ca-41	1.00E+00	2.00E+01	-	2.10E+01
Ni-59	-	1.20E+01	1.21E+04	1.21E+04
Co-60	4.63E+00	1.58E+04	3.63E+03	1.96E+04
Ni-63	1.43E+01	1.52E+03	1.08E+02	1.63E+03
Sr-90	1.18E+01	-	8.19E+00	1.99E+01
Y-90	1.18E+01	-	8.19E+00	2.00E+01
Mo-93	-	7.99E-02	-	7.99E-02
Zr-93	-	-	1.14E+02	1.14E+02
Nb-93m	-	2.37E-02	3.35E+01	3.35E+01
Nb-94	1.50E+00	8.00E-02	-	1.58E+00
Tc-99	-	4.00E-03	-	4.00E-03
Ag-108	-	5.04E-02	-	5.04E-02
Ag-108m	-	5.60E-01	-	5.60E-01
Cs-137	3.39E+01	-	3.59E+00	3.75E+01
Eu-152	4.58E+01	-	4.71E+01	9.29E+01
Eu-154	1.77E+01	-	3.71E+01	5.48E+01
U-235	1.00E-08	-	-	1.00E-08
Np-237	9.34E-07	-	-	9.34E-07
Pu-239	1.40E+00	-	-	1.40E+00
Am-241	3.95E-01	-	-	3.95E-01
Total	**4.47E+04**	**1.73E+04**	**1.62E+04**	**7.83E+04**

[a] Values obtained from *105-N and 109-N Final Hazard Categorization for ISS,* 2005, Calculation 0100N-CA-N0069, Bechtel Hanford, Inc., Richland, Washington.

Table 1-6. Estimated Radionuclide inventory for the C Elevator Pit on March 31, 2005[a]. (2 Pages)

Isotope	Water Inventory (Ci)	Sediment (Ci)	Total Inventory (Ci)
H-3	6.37E+00	-	6.37E+00
C-14	8.38E-03	-	8.38E-03
Fe-55	5.74E-05	-	5.74E-05
Co-58	7.73E-12	-	7.73E-12
Co-60	2.53E-04	3.13E+00	3.13E+00
Ni-63	3.85E-03	-	3.85E-03
Sr-90	1.71E+00	1.08E+01	1.25E+01
Y-90	1.71E+00	1.08E+01	1.25E+01
Tc-99	9.10E-04	6.06E-02	6.15E-02
Sb-125	4.79E-04	2.46E-02	2.51E-02
I-129	3.21E-04	-	3.21E-04
Cs-134	1.14E-04	4.65E-03	4.77E-03
Cs-137	3.77E-01	1.32E+01	1.36E+01
Eu-152	9.67E-04	-	9.67E-04
Eu-154	6.55E-05	2.20E-01	2.20E-01
Eu-155	3.17E-04	9.64E-02	9.67E-02
Ra-226	1.12E-05	3.52E-01	3.52E-01
Th-232	7.96E-27	1.62E-13	1.62E-13
U-234	6.16E-09	6.96E-03	6.96E-03
U-235	1.62E-11	1.67E-04	1.67E-04
U-236	1.03E-16	7.14E-04	7.14E-04
U-238	-	3.20E-03	3.20E-03
Np-237	1.00E-05	4.36E-06	1.44E-05
Pu-238	4.62E-04	4.19E-01	4.19E-01
Pu-239	3.54E-03	2.56E+00	2.56E+00
Pu-241	-	1.02E+02	1.02E+02
Pu-242	-	5.12E-03	5.12E-03
Am-241	1.33E-04	3.30E+00	3.30E+00
Cm-242	4.14E-10	-	4.14E-10
Am-243	-	4.73E-07	4.73E-07
Cm-243	-	3.42E-01	3.42E-01

Table 1-6. Estimated Radionuclide inventory for the C Elevator Pit on March 31, 2005[a]. (2 Pages)

Isotope	Water Inventory (Ci)	Sediment (Ci)	Total Inventory (Ci)
Cm-244	2.75E-06	-	2.75E-06
Total	1.02E+01	1.47E+02	1.57E+02

[a] Values obtained from *105-N and 109-N Final Hazard Categorization for ISS,* 2005, Calculation 0100N-CA-N0069, Bechtel Hanford, Inc., Richland, Washington.

1.7.2 105-N Reactor Cooling Systems

The 105-N Reactor generally operated at about 4,000 megawatts thermal power. To control core temperatures, the core was cooled by a closed-loop primary coolant system. The primary coolant system was composed of high-purity water pressurized and pumped through the process tubes and around the fuel assemblies to remove heat from the fission process. The primary coolant was then circulated from the process tubes in the reactor to heat exchangers (steam generators) located in the 109-N Heat Exchanger Building. Process heat was transferred from the primary coolant system to the secondary coolant system in 12 steam generators located in 6 shielded cells in the 109-N Building. As the water reached boiling temperatures, steam was produced in the closed-loop secondary cooling system. Some of this steam was used to drive the 105-N Reactor's primary turbines and coolant pumps. A portion of the steam was used to generate electric power with the 184-N turbine generator for use within the reactor plant. When the 105-N Reactor was operating in a plutonium-only mode, the balance of the steam was dissipated in the dump heat condensers located in the 109-N Building. When the 105-N Reactor was operating in a dual-purpose mode, the steam was used to drive the two large turbine generators producing approximately 860 megawatts of electricity.

The primary coolant system was supplied by the high-purity water pressurized and pumped with chemicals added for water quality control. Ammonium hydroxide was added to control the pH between 9.5 and 10.4 pH units. Hydrazine was added to maintain oxygen levels at 20 ppb with spikes of no greater than 500 ppb. This equates to ammonium hydroxide and hydrazine concentrations of approximately 1 ppm. During normal operation, oxygen levels were generally stable and hydrazine was not needed. Oxygen control was needed during shutdown when the system was opened for refueling and maintenance. The primary coolant system became contaminated with radionuclides produced by activation of materials in the system. Table 1-7 shows the estimated radiological inventory for the residue and activated materials in the primary coolant piping system as of March 31, 2005.

Table 1-7. Estimated Inventory of the 105-N Reactor Primary Coolant Piping Residue on March 31, 2005[a].

Isotope	Total (Ci)
Co-60	6.06E+02
Sr-90	1.03E+02
Y-90	1.03E+02
Cs-137	4.52E+01
Eu-152	5.93E+02
Eu-154	4.67E+02
Total	**1.92E+03**

[a] Values obtained from *105-N and 109-N Final Hazard Categorization for ISS,* 2005, Calculation 0100N-CA-N0069, Bechtel Hanford, Inc., Richland, Washington.

The secondary coolant system was supplied by demineralized water with morpholine added to control pH between 7.0 and 10.0 pH units (approximately 1 ppm) and hydrazine to maintain oxygen levels below 500 ppb (approximately 1 ppm). Periodic leaks in the steam generator heat exchanger tubing caused the secondary coolant system to be radiologically contaminated with radioactivity from the primary coolant system.

There were two additional reactor periphery cooling systems: graphite and shield cooling and reactor control rod cooling. These were closed-loop systems using demineralized water. Ammonium hydroxide was added to the graphite and shield cooling water for pH control. Hydrazine was added to the reactor control rod cooling water for oxygen control. The levels of ammonium hydroxide and hydrazine were similar to the levels maintained in the primary and secondary coolant systems.

1.7.3 105-N Reactor Fuel Storage Basin

About every 6 weeks, 20% to 30% of the 105-N Reactor fuel was discharged. When it was time to discharge irradiated fuel, the reactor was shut down. As new fuel was pushed into a process tube at the front face of the reactor, spent fuel was discharged at the rear face of the reactor. One by one, fuel assemblies would fall onto a trampoline and then into carts under water to transport the fuel to the fuel storage basin. During the fuel discharge and transfer process, a large quantity of reactor primary coolant water, containing a considerable amount of suspended and soluble metals and metal oxides, was added to the fuel storage basin water.

The fuel would remain under water in the fuel storage basin for approximately 180 days to dissipate its heat and radioactivity to allowable levels. The water served as a highly effective shield to protect workers from heat and radioactivity. After approximately 180 days, the fuel was loaded into fuel storage canisters and then into lead-shielded transport casks for processing.

In 1998, the 105-N Reactor fuel storage basin was cleaned out and interim stabilized. Contaminated hardware and equipment, sludge, fuel pieces, and contaminated water were removed from the fuel storage basin. Steel plates were put over the fuel handling cubicles, and the entire basin was covered with concrete blocks to provide shielding and isolation. A small amount of debris and sediment remains in the basin that will need to be removed. A 0.3-m (1-ft) layer of water remains in the north cask loadout pit for shielding. The basin concrete surfaces also remain contaminated.

Table 1-8 shows the estimated radionuclide inventory for the main constituents of the 105-N Reactor fuel storage basin as of March 31, 2005.

Table 1-8. Estimated Radionuclide Inventory for the 105-N Reactor Fuel Storage Basin on March 31, 2005[a]. (2 Pages)

Isotope	Debris (Ci)	Water (Ci)	Sediment (Ci)	Walls and Floor (Ci)	Total Inventory (Ci)
H-3	-	6.28E-01	-	6.36E+02	6.37E+02
C-14	7.26E-01	9.26E-04	-	9.38E-01	1.67E+00
Mn-54	1.46E-04	-	-	-	1.46E-04
Fe-55	1.77E+01	3.74E-06	-	3.79E-03	1.77E+01
Co-58	-	5.75E-16	-	5.80E-13	5.80E-13
Co-60	2.33E+01	2.14E-05	9.07E-01	4.78E+00	2.89E+01
Ni-59	1.92E+01	-	-	-	1.92E+01
Ni-63	1.78E-01	4.20E-04	-	4.25E-01	6.03E-01
Sr-90	3.76E-01	1.80E-01	3.88E+00	2.03E+02	2.07E+02
Y-90	3.76E-01	1.80E-01	3.88E+00	2.03E+02	2.07E+02
Zr-93	1.86E-02	-	-	-	1.86E-02
Nb-93m	5.68E-02	-	-	-	5.68E-02
Tc-99	-	1.01E-04	2.29E-02	2.22E-01	2.45E-01
Sb-125	4.34E-05	3.14E-05	5.52E-03	6.08E-02	6.64E-02
Te-125m	1.06E-05	7.67E-06	1.35E-03	1.49E-02	1.62E-02
I-129	-	3.55E-05	-	5.59E-02	5.59E-02
Cs-134	-	6.33E-06	8.85E-04	1.10E-02	1.19E-02
Cs-137	1.65E-01	3.98E-02	4.76E+00	6.53E+01	7.03E+01
Ba-137m	1.56E-01	3.77E-02	4.50E+00	6.18E+01	6.65E+01
Eu-152	-	9.58E-05	-	9.72E-02	9.73E-02
Eu-154	1.22E-02	6.15E-06	7.08E-02	3.77E-01	4.60E-01
Eu-155	9.05E-04	2.64E-05	2.74E-02	1.71E-01	1.99E-01

Table 1-8. Estimated Radionuclide Inventory for the 105-N Reactor Fuel Storage Basin on March 31, 2005[a]. (2 Pages)

Isotope	Debris (Ci)	Water (Ci)	Sediment (Ci)	Walls and Floor (Ci)	Total Inventory (Ci)
Ra-226	4.18E-16	1.25E-06	1.33E-01	7.00E-01	8.33E-01
Th-232	-	2.59E-27	8.86E-14	4.66E-13	5.54E-13
U-234	1.48E-08	9.75E-10	2.63E-03	1.38E-02	1.64E-02
U-235	2.77E-11	2.58E-12	6.32E-05	3.32E-04	3.95E-04
U-235m	4.21E-03	3.92E-04	9.68E-01	5.49E+00	6.46E+00
U-236	-	2.32E-17	2.70E-04	1.42E-03	1.69E-03
U-238	-	-	1.21E-03	6.37E-03	7.58E-03
Np-237	5.87E-09	1.11E-06	2.52E-06	1.13E-03	1.14E-03
Pu-238	7.64E-04	5.03E-05	1.56E-01	8.71E-01	1.03E+00
Pu-239	4.21E-03	3.92E-04	9.68E-01	5.49E+00	6.46E+00
Pu-241	5.08E-02	-	3.49E+01	1.83E+02	2.18E+02
Pu-242	-	-	1.93E-03	1.02E-02	1.21E-02
Am-241	3.00E-03	1.47E-05	1.37E+00	7.19E+00	8.56E+00
Am-243	-	-	2.52E-07	1.32E-06	1.58E-06
Cm-242	-	1.91E-12	-	1.93E-09	1.93E-09
Cm-243	-	-	1.23E-01	6.48E-01	7.71E-01
Cm-244	-	2.81E-07	-	2.84E-04	2.85E-04
Total	**6.23E+01**	**1.07E+00**	**5.66E+01**	**1.38E+03**	**1.50E+03**

[a] Values obtained from *105-N and 109-N Final Hazard Categorization for ISS,* 2005, Calculation 0100N-CA-N0069, Bechtel Hanford, Inc., Richland, Washington.

1.7.4 Fission Products Trap

The radioactive drain system that collected radioactive water and liquid discharges from the 105-N and 109-N Buildings was routed to the 1301-N and 1325-N liquid waste disposal facilities through the 105-NE Fission Products Trap. The reinforced concrete below-grade structure provided approximately 9-m (30-ft)-deep "U-shaped" loops or traps for drain piping. Valves and drain pipes were attached to the bottom of each trap to allow for the drain-off of trapped solids. The intent was to trap insoluble fission products from the 105-N Reactor in the radioactive drain systems for disposal rather than for direct disposal to the liquid waste disposal facilities.
A quantity of standing water is currently maintained in the fission products trap to cover the radioactive sediments and reduce the dose. Table 1-9 shows the estimated radionuclide inventory for the 105-NE Fission Products Trap as of March 31, 2005.

Table 1-9. Estimated Radionuclide inventory for the Fission Products Trap on March 31, 2005[a].

Isotope	Pit Water (Ci)	Piping Water (Ci)	Sediment (Ci)	Fuel Fragments (Ci)	Total Inventory (Ci)
Co-60	2.44E+00	2.17E+00	5.75E-01	-	5.19E+00
Sr-90	1.17E-01	1.05E-01	4.77E-01	1.72E+00	2.42E+00
Y-90	1.17E-01	1.05E-01	4.77E-01	1.72E+00	2.42E+00
Ru-106	-	-	-	8.25E-05	8.25E-05
Cs-134	-	-	-	4.45E-04	4.45E-04
Cs-137	5.06E-01	4.58E-01	1.10E+00	1.79E+00	3.85E+00
Eu-154	-	-	1.82E-02	-	1.82E-02
Eu-155	-	-	1.86E-02	-	1.86E-02
Ra-226	-	-	4.04E-14	4.63E-11	4.63E-11
U-234	-	-	1.15E-06	4.46E-04	4.48E-04
U-235	5.86E-10	5.21E-10	2.53E-09	8.10E-05	8.10E-05
U-238	-	-	-	3.64E-04	3.64E-04
Np-237	-	-	7.11E-07	9.50E-08	8.06E-07
Pu-238	-	-	5.31E-02	2.26E-02	7.57E-02
Pu-239	8.00E-02	7.12E-02	3.46E-01	1.51E-01	6.48E-01
Pu-241	-	-	-	1.93E+00	1.93E+00
Am-241	-	-	2.93E-01	5.22E-02	3.46E-01
Total	**3.26E+00**	**2.91E+00**	**3.35E+00**	**7.39E+00**	**1.69E+01**

[a] Values obtained from *105-N and 109-N Final Hazard Categorization for ISS,* 2005, Calculation 0100N-CA-N0069, Bechtel Hanford, Inc., Richland, Washington.

1.7.5 Non-Zone 1 Portions of the 105-N Reactor

Much of the 105-N and 109-N Buildings as well as all of the 105-NA and 1605-NE Buildings are outside of radiologically controlled contamination areas. These areas are referred to as the non-Zone 1 portions of the 105-N Reactor and contain much lower levels of radiological contamination. Table 1-10 shows the estimated radionuclide inventory for the non-Zone 1 portion of 105-N Reactor as of March 31, 2005.

Table 1-10. Estimated Radionuclide Inventory for the Non-Zone 1 Portions of the 105-N Reactor on March 31, 2005[a].

Isotope	-16 ft Elevation (Ci)	0 Through 51 ft Elevation (Ci)	60 ft Elevation (Ci)	Total Inventory (Ci)
Co-60	1.20E-03	9.66E-02	2.41E-03	1.00E-01
Sr-90	2.63E-05	2.62E-04	3.04E-04	5.92E-04
Y-90	2.63E-05	2.62E-04	3.04E-04	5.92E-04
Nb-93m	2.62E-02	-	-	2.62E-02
Ru-106	6.89E-08	1.71E-07	1.30E-07	3.71E-07
Sb-125	2.23E-05	5.70E-05	4.30E-05	1.22E-04
I-129	7.31E-06	5.80E-05	2.54E-04	3.19E-04
Cs-134	9.35E-07	2.49E-06	1.90E-06	5.33E-06
Cs-137	1.09E-04	1.17E-02	1.97E-04	1.20E-02
Eu-154	2.69E-02	-	2.59E-03	2.95E-02
Eu-155	5.09E-03	-	8.42E-04	5.93E-03
Ra-226	2.25E-18	1.31E-17	2.44E-17	3.97E-17
Th-232	2.23E-22	1.16E-21	1.58E-21	2.97E-21
U-234	5.09E-11	2.97E-10	5.52E-10	9.00E-10
U-235	6.21E-08	1.50E-06	9.97E-07	2.56E-06
U-236	1.09E-12	5.69E-12	7.72E-12	1.45E-11
U-238	3.57E-16	2.72E-15	3.28E-15	6.36E-15
Np-237	2.76E-07	2.10E-06	2.54E-06	4.92E-06
Pu-238	2.09E-06	1.22E-05	2.27E-05	3.69E-05
Pu-239	4.41E-06	2.30E-05	3.13E-05	5.87E-05
Pu-241	5.46E-05	8.09E-04	6.82E-04	1.55E-03
Pu-242	2.76E-07	2.10E-06	2.54E-06	4.92E-06
Am-241	4.35E-06	4.28E-05	3.80E-05	8.52E-05
Am-243	1.02E-11	3.40E-10	3.06E-11	3.81E-11
Cm-243	2.93E-06	1.31E-04	1.18E-05	1.45E-04
Cm-244	1.19E-06	1.09E-04	9.59E-06	1.20E-04
Total	**5.96E-02**	**1.10E-01**	**7.75E-03**	**1.78E-01**

[a] Values obtained from *105-N and 109-N Final Hazard Categorization for ISS*, 2005, Calculation 0100N-CA-N0069, Bechtel Hanford, Inc., Richland, Washington.

1.7.6 Reactor Decontamination

105-N Reactor systems and equipment were periodically decontaminated to reduce radioactive contamination levels and associated dose levels. Every 3 to 5 years, the reactor primary coolant loop was decontaminated with a 70% phosphoric acid/diethylthiourea solution diluted to an 8% solution by weight. The solution was mixed in the 109-N Building and pumped through the reactor primary cooling system to remove radioactive oxides (containing activation and fission products) that had built up as residues in the piping and valves. The decontamination solution and rinsate was pumped through the system and into the 1310-N storage tank for disposal as low-level waste (LLW).

Other 105-N Reactor systems and equipment were periodically decontaminated. The steam generator equipment was periodically decontaminated with alkaline potassium permanganate and citric oxalic acid. Ascorbic and citric acid were used to decontaminate the reactor process tube caps and inserts as well as miscellaneous hand tools. Contaminated tools were also decontaminated in an ultrasonic cleaning system using 1,1,2-trichloro-1,1,2-trifluoroethane.

1.7.7 Airborne Releases

The 105-N Reactor had five ventilation zones (confinement zones), each served by supply and exhaust fan units, and plenums connected to duct work containing dampers and supply grilles. The purpose of this system was to set up zones to prevent the spread of radioactive contamination and to provide a controlled environment for personnel comfort, optimum machinery performance, instrument reliability, and concrete stability. Air exhausted from zones 1 and 2 was routed through the 117-N Filter Building. The 117-N facility housed a HEPA filter and activated charcoal filters used to remove radioactive particulates and iodine-131 from the exhaust air. The facility also housed a water-spray system that automatically activated if a high-temperature excursion is detected. After filtration, the exhaust was routed to the 116-N Exhaust Air Stack and vented to the atmosphere. Table 1-11 shows contamination levels measured in the 117-N and 116-N facilities in 1998.

Table 1-11. Contamination Level in the 117-N and 116-N Facilities in 1998[a].

Loading	117-N Filter Building (Ci)	116-N Exhaust Stack (Ci)
Smearable Contamination	0.0030	0.00027
Fixed Contamination	0.0016	0.0050
Total Loading	**0.0046**	**0.0053**

[a] Values obtained from *105-N and 109-N Final Hazard Categorization for ISS,* 2005, Calculation 0100N-CA-N0069, Bechtel Hanford, Inc., Richland, Washington.

1.7.8 Solid Wastes

Reactor solid wastes generally consisted of reactor components, contaminated equipment, tools, and miscellaneous contaminated items (paper, rags, construction and repair debris, personal protection equipment, etc.). The main source of these wastes was reactor operations, and the most highly contaminated solid wastes were reactor components. The 105-N Reactor solid wastes were packaged and transported to other locations, either 200 Area burial grounds or other 100 Area burial grounds, for disposal. During deactivation, all solid waste materials not attached to the facility were removed and disposed.

Table 1-12 contains a supporting documentation and resources related to waste disposition and handling for the 105-N Reactor facilities in the scope of the DQO.

Table 1-12. Supporting Waste Disposition Documentation. (2 Pages)

Environmental Restoration Disposal Facility Waste Profile Data Sheet, WP100N001, Rev. 0 through Rev. 10	Waste profile for 100-N Area miscellaneous materials.
Environmental Restoration Disposal Facility Waste Profile Data Sheet, WP100N002, Rev. 0	Waste profile for 100-N Area miscellaneous wastes containing macroencapsulated lead.
Environmental Restoration Disposal Facility Waste Profile Data Sheet, WP100N003, Rev. 0	Waste profile for N Basin Sediment. Incorporates calculation 0100N-CA-N0038, *Characterization of Mixed Sediment in North Cask Pit and Basin Water*
Environmental Restoration Disposal Facility Waste Profile Data Sheet, WP100N004, Rev. 0	Waste profile for N Basin miscellaneous materials.
Environmental Restoration Disposal Facility Waste Profile Data Sheet, WP100N005, Rev. 0	Waste profile for N Basin miscellaneous materials containing lead.
Environmental Restoration Disposal Facility Waste Profile Data Sheet, WP100N007, Rev. 0	Waste profile for 11-N, 13-N, 1714-N, -NA, NB, and 1712-N. Paints and other waste from these facilities would be similar to some of the wastes generated at the 105-N/109-N facilities.
Environmental Restoration Disposal Facility Waste Profile Data Sheet, WP100N008, Rev. 0	Waste profile for 100-N Area miscellaneous materials. Waste profile for specific stream of waste containing "Quik Tred Deep Base (MSDS 027091) and floor sweep (MSDS 062229).
Environmental Restoration Disposal Facility Waste Profile Data Sheet, WP105N001, Rev. 0	Waste profile for 105-N and 109-N Roofing.
Environmental Restoration Disposal Facility Waste Profile Data Sheet, WP107N001, Rev. 0	Waste profile for 107-N miscellaneous debris. Wastes from this facility would be similar to some of the wastes generated during D&D of the 105-N/109-N facilities.
Environmental Restoration Disposal Facility Waste Profile Data Sheet, WP1300N001, Rev. 0 through Rev. 3	Waste profile for 1300-N Emergency Dump Basin waste. Wastes from this facility would be similar to some of the wastes generated during D&D of the 105-N/109-N facilities.

Table 1-12. Supporting Waste Disposition Documentation. (2 Pages)

Environmental Restoration Disposal Facility Waste Profile Data Sheet, WP1304N001, Rev. 0 and Rev. 1	Waste profile for the 1304-N Emergency Dump Tank. Wastes from this facility would be similar to some of the wastes generated during D&D of the 105-N/109-N facilities.
Activity Conversion Factors for 100-N Facilities, 0100N-CA-N0018	Calculates the radioactivity conversion factors for estimating radionuclide surface or mass specific radioactivity concentrations in selected 100-N facility areas/equipment based on in-plant dose rate measurements.
Radionuclides in 105-NE, 1305-N, and 1304-N, 0100N-CA-N0025	Calculates the radioactive material inventory in the 105-NE Fission Products Trap, associated 1305-N piping, and the 1304-N Emergency Dump Tank.
Residual Radioactive Inventory After N Basin Cleanup, 0100N-CA-N0045	Calculates inventory of residual radioactive material remaining in the N Basin at end of deactivation.
Radionuclide Inventory in 117N Building and 116N Stack, 0100N-CA-N0048	Calculates the total curies of radioactivity in the 117-N and 116-N facilities, based on radiological survey data taken in 1997 and 1998.
105-N Reactor Building Residual Radioactivity Estimate, 0100N-CA-N0049	Calculates the total residual radioactivity in the 105-N Reactor structure (decayed to 1997).
C Elevator Pit Curie Content, 0100N-CA-N0057	Engineering calculation of the amount of radioactive material in the C Elevator Pit in 105-N. Calculation uses 105-N Basin water and sediment radionuclides and activities.
Limited Field Investigation Report for the 100-NR-1 Operable Unit Abatement Assessment, DOE/RL-93-80	Summarizes the data collection and analysis activities conducted during the 100-NR-1 source operable unit limited field investigation and makes recommendations on the continued candidacy of high-priority sites for interim remedial measures.
Essential Materials Specification Manual N Reactor, DUN-M-42 PT.A	Provides the specifications, procurement, use, and control of process materials consumed in the operation of the 105-N Reactor including water treatment chemicals, fuel oils (No. 1, 2, and 6) and several gases (Cl, He, N).
N Reactor Materials Manual, HW-79050	The manual is a catalog of the structural materials in contact with the coolants in the primary, secondary, graphite cooling, and injection water systems at 105-N Reactor.

D&D = decontamination and decommissioning
FPT = Fission Product Trap
MSDS = material safety data sheet
OU = operable unit

1.8 WASTE STREAMS AND CONTAMINANTS OF POTENTIAL CONCERN

Historical and process knowledge, existing data, and other information gathered during the scoping phase of this DQO process have been evaluated by the DQO team to identify specific waste streams associated with the subject facilities. Table 1-13 summarizes specific waste streams that may be generated during future activities. General contaminants of potential concern (COPCs) for each type of waste generated are shown in the table.

Table 1-13. Waste Streams and Contaminants of Potential Concern. (4 Pages)

WS #	Waste Stream	Known or Suspected Source of Contamination
1	Bulk demolition debris (including, but not limited to, poured concrete, concrete block, sheetrock, wood, nonasbestos-containing roofing materials, pumps, piping, steel siding, miscellaneous equipment, dried paints, coatings, ventilation systems, below-grade drain lines, and sumps)	Potential radiological contamination corresponding to 105-N Reactor contamination region.
		Hazardous materials and characteristics from 105-N Reactor process chemicals and construction materials.
2	Asbestos-containing material	Potential radiological contamination corresponding to 105-N Reactor contamination region.
		Asbestos-impregnated materials (e.g., floor tiles, ceiling tiles, cement asbestos board, cove mastic, sheetrock tape, gaskets, insulation, piping, roofing materials).
		Hazardous materials and characteristics from 105-N Reactor process chemicals, commercial products, and construction materials.
3	Miscellaneous aqueous liquid (including but not limited to liquids identified in system pumps, sumps, tanks, piping, drains, and processing equipment)	Potential radiological contamination corresponding to 105-N Reactor contamination region.
		Hazardous materials and characteristics from 105-N Reactor process chemicals.
4	Miscellaneous bulk solids (including but not limited to sludge, sediment and solid materials collected from system pumps, sumps, tanks, piping, drains, and processing equipment)	Potential radiological contamination corresponding to 105-N Reactor contamination region.
		Residue from structural corrosion of processing equipment and residues from water treatment, testing, and decontamination chemicals.
5	Plant equipment lubrication grease, oil, hydraulic oils, transformer oils, oils in door actuators, and petroleum products	Potential radiological contamination corresponding to 105-N Reactor contamination region.
		Residue from metallic parts and chemicals used as additives.

Table 1-13. Waste Streams and Contaminants of Potential Concern. (4 Pages)

WS #	Waste Stream	Known or Suspected Source of Contamination
6	Refrigerated systems (drinking fountains, coolers, chillers, etc.)	Potential radiological contamination corresponding to 105-N Reactor contamination region.
		Refrigerants.
7	Mercury-containing equipment (manometers, vacuum pumps, switches, mercury vapor lights)	Potential radiological contamination corresponding to 105-N Reactor contamination region.
		Mercury-activated switches, and mercury residue.
8	Fluorescent light tubes, incandescent light bulbs	Potential radiological contamination corresponding to 105-N Reactor contamination region.
		Internals of bulbs, lead-base
9	Florescent light ballasts	Potential radiological contamination corresponding to 105-N Reactor contamination region.
		Internals of light ballasts.
10	Lead packing, washers, and shielding	Potential radiological contamination corresponding to 105-N Reactor contamination region.
		Shielding materials, packing in pipe joints, lead washers, and fasteners.
11	Emergency light batteries	Potential radiological contamination corresponding to 105-N Reactor contamination region.
		Battery constituents.
12	Exit signs and smoke detectors	Internal radioactive sources.
13	HEPA Filters	Potential radiological contamination corresponding to 105-N Reactor contamination region.
		Contaminants from operation.

Table 1-13. Waste Streams and Contaminants of Potential Concern. (4 Pages)

WS #	Waste Stream	Known or Suspected Source of Contamination
14	Underground contaminated waste piping, cable, ducts, wood, and soils	Potential radiological contamination corresponding to 105-N Reactor contamination region.
		Hazardous materials and characteristics from 105-N Reactor process chemicals and construction materials.
		Asbestos felt wrap.
		Lead packing.
15	Miscellaneous material for salvage (including steel walkways, steps, landings, and miscellaneous equipment)	Potential radiological contamination corresponding to 105-N Reactor contamination region.
		Hazardous materials and characteristics from 105-N Reactor process chemicals and construction materials.
16	Unexpected media and waste forms (including solids and liquids)	Potential radiological contamination corresponding to 105-N Reactor contamination region.
		To be determined using historical information and process knowledge.
17	Process equipment/systems and building structure within SSE (for archive information purposes)(including, but not limited to, poured concrete, concrete block, pumps, piping, steel siding, miscellaneous equipment, ventilation systems, below-grade drain lines, and sumps) NOTE: Materials that will be removed from Zone 1 areas will be a part of Waste Stream #1.	Radiological contamination corresponding to 105-N Reactor and heat exchanger contamination region.
18	Waste from biological sources (feces, nests, carcasses, etc.)	Potential radiological contamination corresponding to 105-N Reactor contamination region.
19	Charcoal filters	Potential radiological contamination corresponding to 105-N Reactor contamination region.
		Chemical contaminants from operation.

Table 1-13. Waste Streams and Contaminants of Potential Concern. (4 Pages)

WS #	Waste Stream	Known or Suspected Source of Contamination
20	Fission Products Trap (including solids and liquids)	Radiological contamination corresponding to 105-N Reactor contamination region.
		Hazardous materials and characteristics from 105-N Reactor process chemicals and construction materials.

COPC = contaminant of potential concern
HEPA = high-efficiency particulate air
PCB = polychlorinated biphenyl
RCRA = *Resource Conservation and Recovery Act of 1976*
SSE = safe storage enclosure
TRU = transuranic
WS = waste stream

1.9 CONTAMINANTS OF POTENTIAL CONCERN

Table 1-14 identifies the COPCs that could potentially be associated with the 105-N/109-N ISS Project facilities. Table 1-14 represents the complete unconstrained set of COPCs for the 105-N/109-N ISS Project facilities. The radioactive COPC list was developed from ORIGEN2 (Croff 1983) modeling of 105-N Reactor MKIV fuel at burnup = 2.2851 X 10^3 MWD with a decay of 10 years. The chemical COPC list was developed from materials known to be used in the processes occurring in the facilities within the scope of this DQO summary report. Waste characteristics needed for waste designation were also added to the COPC list.

Table 1-14. Sources of Contamination, COPCs, and Affected Media. (2 Pages)

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

Radioactive COPCs

Americium-241	Europium-152	Plutonium-239/240	Strontium-90
Americium-242	Europium-154	Plutonium-241	Technetium-99
Americium-242m	Europium-155	Plutonium-242	Tellurium-125m
Americium-243	Iodine-129	Praseodymium-144	Thorium-231
Antimony-125	Iron-55	Praseodymium-144m	Thorium-232
Antimony-126	Krypton-85	Promethium-146	Thorium-234
Antimony-126m	Lead-210	Promethium-147	Tin-119m
Barium-137m	Manganese-54	Protactinium-233	Tin-121m
Cadmium-113m	Neptunium-237	Protactinium-234m	Tin-126
Carbon-14	Neptunium-239	Radium-226	Tritium
Cerium-144	Nickel-59	Radium-228	Uranium-234
Cesium-134	Nickel-63	Rhodium-102	Uranium-235
Cesium-135	Niobium-93m	Rhodium-106	Uranium-236
Cesium-137	Niobium-94	Ruthenium-106	Uranium-237
Cobalt-60	Palladium-107	Samarium-151	Uranium-238
Curium-242	Plutonium-236	Selenium-79	Yttrium-90
Curium-243	Plutonium-238	Silver-110m	Zirconium-93
Curium-244			

Inorganic Chemical COPCs

Aluminum	Chloride	Nitrate	Sodium chloride
Aluminum sulfate	Chromium	Nitric acid	Sodium hydroxide
Ammonia	Copper	Phosphoric acid	Sodium metabisulfite
Ammonium hydroxide	Cyanide	Potassium chloride	Sodium phosphate
Ammonium	Hydrazine	Potassium dichromate	Sodium thiosulfate
Arsenic	Hydrochloric acid	Potassium iodide	Sulfate
Asbestos	Iron	Potassium permanganate	Sulfide
Barium	Lead	Potassium phosphate	Sulfuric acid
Beryllium	Mercury	Selenium	Uranium
Boric acid	Morpholine	Silver	Zinc
Cadmium	Nickel		

Table 1-14. Sources of Contamination, COPCs, and Affected Media. (2 Pages)

Organic Chemical COPCs			
Ascorbic acid 1,1,2-trichloro-1,1,2-trifluoroethane Benzenesulfonic acid, dimethylammonium salt Benzenesulfonic acid, dodecyl with 2,2',2"-nitrilotris-(ethanol) Bromocresol green Carboxylate Citric acid Creosote	Diethylthiourea Disodium succinate Ethylenediaminetetra acetic acid Freon Formaldehyde Formazin polymer Glycine-n,n'-1,2-ethanediylbis-n-(carboxymethyl), tetrasodium salt Herbicides Hexamethylenetetramine	Methyl red n,n-diethyl-p-phenylenediamine Oxalic acid Paint thinner Phenolphthalein Polynuclear aromatic hydrocarbons (PAH) Poly(oxy-1,2-ethanediyl), alpha(undecyl)-omega-hydroxyl Polyvinyl butryal Potassium acid phthalate	Pesticides PCBs Perchloroethylene Succinic acid Tar Trichloroethene Oil and grease BTEX
Waste Characteristic COPCs			
Conductivity Corrosivity Gross alpha activity Gross beta activity	Flashpoint (ignitability) Semivolatile organic compounds (target analyte list)	pH Total dissolved solids Total organic carbon Total organic halogens	Total suspended solids Volatile organic compounds (target analyte list)

BTEX = benzene, toluene, ethylbenzene, and xylene
COPC = contaminant of potential concern
PCB = polychlorinated biphenyl

1.10 CONTAMINANT OF POTENTIAL CONCERN EXCLUSIONS

Table 1-15 presents a list of the COPCs to be excluded from the investigation. These exclusions are based on physical laws, process knowledge, and/or other mitigating factors. Table 1-15 also provides rationale for the exclusion of the identified COPCs.

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

The COPCs identified in Table 1-15 were excluded from further consideration for this DQO summary report because they meet at least one of the following criteria for exclusion:

- If the major radionuclide content of a radioactive waste meets all of the conditions in the *Environmental Restoration Disposal Facility Waste Acceptance Criteria* (BHI 2002), then it can be excluded. The four conditions are (1) short-lived radionuclides with half-lives greater than 2 years, (2) present in a concentration in excess of 1 pCi/g, (3) naturally occurring isotopes at or below background levels, and (4) is not in secular equilibrium with parent nuclide.

- Chemicals that exist in a gaseous state under ambient conditions and cannot accumulate.
- Chemicals that are not federally regulated (40 *Code of Federal Regulations* [CFR] 261, 40 CFR 268, or 40 CFR 761) or Washington State regulated (*Washington Administrative Code* [WAC] 173-303).
- Chemical water-test reagents and standards used in small quantities and diluted during use to levels below designation limits and regulatory concern.
- Chemicals that are not persistent in the environment due to biological degradation or other natural mitigating features.

Table 1-15. COPC Exclusions. (4 Pages)

COPC	Rationale for Exclusion
Radionuclides	
Americium-242	Less than 2-year half-life.
Antimony-126	Less than 2-year half-life.
Antimony-126m	Less than 2-year half-life.
Barium-137m	Less than 2-year half-life and is in secular equilibrium with parent radionuclide.
Cerium-144	Less than 2-year half-life.
Curium-242	Less than 2-year half-life.
Krypton-85	Gas.
Manganese-54	Less than 2-year half-life.
Neptunium-239	Less than 2-year half-life.
Praseodymium-144	Less than 2-year half-life.
Praseodymium-144m	Less than 2-year half-life.
Promethium-146	Less than 2-year half-life.
Protactinium-233	Less than 2-year half-life.
Protactinium-234m	Less than 2-year half-life.
Rhodium-106	Less than 2-year half-life.
Ruthenium-106	Less than 2-year half-life.
Silver-110m	Less than 2-year half-life.
Tellurium-125m	Less than 2-year half-life.
Thorium-231	Less than 2-year half-life.
Thorium-234	Less than 2-year half-life.
Tin-119m	Less than 2-year half-life.

Table 1-15. COPC Exclusions. (4 Pages)

COPC	Rationale for Exclusion
Uranium-237	Less than 2-year half-life.
Yttrium-90	Less than 2-year half-life and is in secular equilibrium with parent radionuclide.
Metals	
Aluminum	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Berylium	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Boron (from boric acid)	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Copper	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Iron	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Phosphorus	Excluded as a solid material, as only the elemental form would be regulated. Not expected in elemental form.
Potassium	Excluded as a solid material, as only the elemental form would be regulated. Not expected in elemental form.
Sodium	Excluded as a solid material, as only the elemental form would be regulated. Not expected in elemental form.
Zinc	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Inorganics	
Chloride	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Hydrazine	Not persistent in aqueous solutions or aerobic conditions.
Morpholine	Not persistent in aqueous solutions or aerobic conditions.
Nitrate	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Phosphate	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Sulfate	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Sulfite	Excluded as a solid material; not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Organics	
Ascorbic acid	Chemical water-test reagent used in small quantities and diluted during use to levels below designation limits.
Benzenesulfonic acid, dimethylammonium salt	Chemical water-test reagent used in small quantities and diluted during use to levels below designation limits.

Table 1-15. COPC Exclusions. (4 Pages)

COPC	Rationale for Exclusion
Benzenesulfonic acid, dodecyl with 2,2',2"-nitrilotris-(ethanol)	Chemical water-test reagent used in small quantities and diluted during use to levels below designation limits.
Bromocresol green	Chemical water-test reagent used in small quantities and diluted during use to levels below designation limits.
Carboxylate	Chemical water-test reagent used in small quantities and diluted during use to levels below designation limits.
Citric Acid	Chemical water-test reagent used in small quantities and diluted during use to levels below designation limits.
Diethylthiourea	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Disodium succinate	Chemical water-test reagent used in small quantities and diluted during use to levels below designation limits.
Ethylenediaminetetra acetic acid	Chemical water-test reagent used in small quantities and diluted during use to levels below designation limits.
Formaldehyde	Chemical water-test reagent used in small quantities and diluted during use to levels below designation limits.
Formazin polymer	Chemical water-test reagent used in small quantities and diluted during use to levels below designation limits.
Glycine-n,n'-1,2-ethanediylbis-n-(carboxymethyl), tetrasodium salt	Chemical water-test reagent used in small quantities and diluted during use to levels below designation limits.
Herbicides	Used per manufacturer's recommendations.
Hexamethylenetetramine	Chemical water-test reagent used in small quantities and diluted during use to levels below designation limits.
Methyl red	Chemical water-test reagent used in small quantities and diluted during use to levels below designation limits.
n,n-diethyl-p-phenylenediamine	Chemical water-test reagent used in small quantities and diluted during use to levels below designation limits.
Oxalic acid	Chemical water-test reagent used in small quantities and diluted during use to levels below designation limits.
Phenolphthalein	Chemical water-test reagent used in small quantities and diluted during use to levels below designation limits.
Poly(oxy-1,2-ethanediyl), alpha(undecyl)-omega-hydroxyl	Chemical water-test reagent used in small quantities and diluted during use to levels below designation limits.
Polyvinyl butyral	Not a Washington State toxic or persistent waste and not a UHC as defined in 40 CFR 268.2.
Potassium acid phthalate	Chemical water-test reagent used in small quantities and diluted during use to levels below designation limits.

Table 1-15. COPC Exclusions. (4 Pages)

COPC	Rationale for Exclusion
Succinic acid	Chemical water-test reagent used in small quantities and diluted during use to levels below designation limits.

40 CFR 268, "Land Disposal Restrictions," *Code of Federal Regulations*, as amended.
COPC = contaminant of potential concern
UHC = underlying hazardous constituent

1.11 CONTAMINANT OF CONCERN CONCENTRATIONS ESTIMATED BY CALCULATION

Table 1-16 identifies the COCs that will not require laboratory analysis for quantification but will be estimated based on calculations from other COC concentrations by one of the following methods:

- The concentration of the progeny can be determined from the parent nuclide when in secular equilibrium with a parent nuclide (i.e., the progeny is decaying as least as fast as it is formed from the parent).
- Any radionuclide with concentrations less than 1 pCi/g based on laboratory analytical measurements or can be calculated using reactor physics principles/relationships from known concentrations of isotopes being analyzed during the characterization activities.

Table 1-16. COCs to Be Determined by Calculation. (2 Pages)

COC	Rationale for Determination by Calculation
Radionuclides	
Americium-242m	The concentration of this isotope will be calculated using reactor physics principles/relationships (ORIGEN2[a] code) from known concentrations of isotopes being analyzed.
Americium-243	The concentration of this isotope will be calculated using reactor physics principles/relationships (ORIGEN2 code) from known concentrations of isotopes being analyzed.
Cadmium-113m	Isotopic concentration can be calculated based on ORIGEN2 modeling.
Cesium-134	Isotopic concentration can be calculated based on ORIGEN2 modeling.
Cesium-135	Isotopic concentration can be calculated based on ORIGEN2 modeling.
Curium-243	The concentration of this isotope will be calculated using reactor physics principles/relationships (ORIGEN2 code) from known concentrations of isotopes being analyzed.
Curium-244	The concentration of this isotope will be calculated using reactor physics principles/relationships (ORIGEN2 code) from known concentrations of isotopes being analyzed.

Table 1-16. COCs to Be Determined by Calculation. (2 Pages)

COC	Rationale for Determination by Calculation
Iodine-129	Isotopic concentration can be calculated based on ORIGEN2 modeling.
Iron-55	The concentration can be calculated based on ORIGEN2 modeling of weapons-grade fuel activation and scaled from cobalt-60 and nickel-63 activity.
Lead-210	Isotopic concentration can be calculated based on ORIGEN2 modeling and scaled from radium-222 activity.
Nickel-59	Isotopic concentration can be calculated based on ORIGEN2 modeling and scaled from nickel-63 activity..
Niobium-93m	Isotopic concentration can be calculated based on ORIGEN2 modeling.
Niobium-94	Isotopic concentration can be calculated based on ORIGEN2 modeling and scaled from nickel-63 activity.
Palladium-107	The concentration can be calculated based on ORIGEN2 modeling of weapons-grade fuel activation.
Plutonium-236	The concentration of this isotope will be calculated using reactor physics principles/relationships (ORIGEN2 code) from known concentrations of isotopes being analyzed.
Plutonium-241	Isotopic concentration can be calculated based on ORIGEN2 modeling.
Plutonium-242	The concentration of this isotope will be calculated using reactor physics principles/relationships (ORIGEN2 code) from known concentrations of isotopes being analyzed.
Promethium-147	Isotopic concentration can be calculated based on ORIGEN2 modeling.
Rhodium-102	Isotopic concentration can be calculated based on ORIGEN2 modeling.
Samarium-151	Isotopic concentration can be calculated based on ORIGEN2 modeling.
Selenium-79	Isotopic concentration can be calculated based on ORIGEN2 modeling.
Tin-121m	Isotopic concentration can be calculated based on ORIGEN2 modeling.
Tin-126	Isotopic concentration can be calculated based on ORIGEN2 modeling.
Uranium-236	Measurement cannot resolve uranium-235 + uranium-236 isotopes, reported as uranium-235.
Zirconium-93	Isotopic concentration can be calculated based on ORIGEN2 modeling.
Metals	
Metals associated with paint	The concentration of metals in paint will be calculated using information and applicable data.

[a] Croff, A. G., 1983, "ORIGEN2: A Versatile Computer Code for Calculating the Nuclide Compositions and Characteristics of Nuclear Materials," *Nuclear Technology*, 62, p 335, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

COC = contaminant of concern

1.12 FINAL LIST OF CONTAMINANTS OF CONCERN

This section identifies the final list of COCs and the rationale of inclusion. Table 1-17 identifies the COCs for which laboratory analysis may be conducted.

Table 1-17. Final COC List. (3 Pages)

Final COC	Rationale for Inclusion
Radiological Constituents	
Americium-241	Known product of reactor operations.
Antimony-125	Known fission product.
Carbon-14	Known product of reactor operations.
Cesium-137	Known fission product.
Cobalt-60	Known activation product.
Europium-152	Known activation product.
Europium-154	Known activation and fission product.
Europium-155	Known activation and fission product.
Neptunium-237	Known production from fission reaction.
Nickel-63	Known activation product.
Plutonium-238	Known production from fission reaction.
Plutonium-239/240	Known production from fission reaction.
Radium-226	Needed for waste designation.
Radium-228	Needed for waste designation.
Strontium-90	Known fission product. Analyzed as total radioactive strontium.
Technetium-99	Known fission product.
Thorium-232	Reactor fuel/target component.
Tritium	Known product of reactor operations.
Uranium-234	Reactor fuel component.
Uranium-235	Reactor fuel component.
Uranium-238	Reactor fuel component.
Nonradiological Constituents – Metals	
Aluminum	Needed only for liquids going to ETF.
Antimony	Needed only for liquids going to ETF.
Arsenic	Suspected to be present in building materials (paint).
Barium	Suspected to be present in building materials (paint).
Beryllium	Needed only for liquids going to ETF.

Table 1-17. Final COC List. (3 Pages)

Final COC	Rationale for Inclusion
Cadmium	Suspected to be present in building materials (reactor components).
Calcium	Needed only for liquids going to ETF.
Chromium	Suspected to be present in building materials (paint, stainless steel corrosion product).
Copper	Needed only for liquids going to ETF.
Iron	Needed only for liquids going to ETF.
Lead	Suspected to be present in building materials (paint, shielding, plumbing packing).
Magnesium	Needed only for liquids going to ETF.
Manganese	Needed only for liquids going to ETF.
Mercury	Suspected to be present in building materials (paint, electrical switches instruments).
Nickel	Suspected to be present in building materials (stainless steel corrosion product).
Potassium	Needed only for liquids going to ETF.
Selenium	Suspected to be present in electrical components.
Silicon	Aqueous liquids only; needed for liquids to ETF.
Silver	Suspected to be present in electrical components.
Sodium	Needed only for liquids going to ETF.
Vanadium	Needed only for liquids going to ETF.
Zinc	Needed only for liquids going to ETF.
Nonradiological Constituents – General Inorganics	
Ammonia/ammonium	Needed only for liquids going to ETF, used in 109-N water treatment processes.
Asbestos	Suspected to be present in building materials.
Bromide	Needed only for liquids going to ETF.
Chloride (from hydrochloric acid)	Needed only for liquids going to ETF.
Cyanide	No known source, needed for liquids going to ETF.
Fluoride	Needed only for liquids going to ETF.
Nitrate (from nitric acid)	Needed only for liquids going to ETF.
Nitrite	Needed only for liquids going to ETF.
Phosphate (from phosphoric acid)	Needed only for liquids going to ETF.
Sulfide	Needed only for liquids going to ETF.
Sulfate (from sulfuric acid)	Needed only for liquids going to ETF.

Table 1-17. Final COC List. (3 Pages)

Final COC	Rationale for Inclusion
Volatile Organic Compounds	
1,1,2-trichloro-1,1,2-trifluoroethane	Needed only for liquids going to ETF, used in decontamination processes in 105-N Room 191, assessed via VOA target analyte list
Freon	Needed only for liquids going to ETF, used as refrigerant, assessed via VOA target analyte list
Paint thinner	Containerized liquids only, assessed via VOA target analyte list.
Perchloroethylene	Liquids and sludge only, used as a degreaser, assessed via VOA target analyte list.
Trichloroethene	Liquids and sludge only, used as a degreaser, assessed via VOA target analyte list.
BTEX	Containerized liquids only, assessed via VOA target analyte list.
Organic Compounds	
Creosote	Suspected to be present as wood preservation (telephone poles and rail road ties), assessed via SVOA target analyte list.
Polynuclear aromatic hydrocarbon	No basis for exclusion (oil, wood preservative, etc).
PCBs	Suspected to be used in electrical equipment and plasticizers.
Tar	Suspected to be used in roofing and water proofing, assessed via SVOA target analytes.
Oil and grease	No basis for exclusion, assessed via SVOA target analytes.
Pesticides	Sludge only, no basis for exclusion.
Waste Characteristics	
Conductivity	Needed only for liquids going to ETF.
Corrosivity	Needed for waste designation, assessed via pH.
Gross alpha activity	Needed only for liquids going to ETF.
Gross beta activity	Needed only for liquids going to ETF.
Ignitability	Needed for waste designation.
SVOA target analytes	Needed for waste designation.
Total dissolved solids	Needed only for liquids going to ETF.
Total organic carbon	Needed only for liquids going to ETF.
Total organic halogens	Needed only for liquids going to ETF.
Total suspended solids	Needed only for liquids going to ETF.
VOA target analytes	Needed for waste designation.

BTEX = benzene, toluene, ethylbenzene, and xylene
COC = contaminant of concern
ETF = Effluent Treatment Facility
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analyte
VOA = volatile organic analyte

1.13 FINAL WASTE STREAM AND CONTAMINANT OF CONCERN LIST

Table 1-18 shows the waste streams and specific COCs identified for each waste stream of the 105-N/109-N ISS Project.

1.14 UNEXPECTED WASTE MATERIALS

This waste category includes any unplanned or unexpected material discovered during ISS activities. The unexpected waste category is provided to allow field decision making based on "as-found" conditions discovered during demolition (described in further detail in Sections 3.0, and 7.0). Waste Operations will support the final determination that is required on a case-by-case basis.

1.15 WASTE DISPOSITION OPTIONS

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

Liquid waste will either be sent to the ETF (with regulatory approval) or will be treated to meet the acceptance criteria. Waste acceptance criteria for the ETF are established after submittal of waste stream characterization data.

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

1.15.1 TRU Waste

The ERDF cannot accept TRU waste, TRU-mixed waste, or high-level waste. High-level waste is not expected. If TRU or TRU-mixed waste is encountered, storage is allowed at the CWC on a case-by-case basis and requires regulatory approval. The CWC will not accept nonradioactive waste. Mixed waste shipped to the CWC must meet the acceptance and packaging criteria outlined in *Hanford Site Solid Waste Acceptance Criteria* (HNF-EP-0063).

Table 1-18. Waste Streams and Final Contaminants of Concern. (5 Pages)

WS #	Waste Stream	Specific Media	COCs
1	Bulk demolition debris (including but not limited to poured concrete, concrete block, sheetrock, wood, nonasbestos-containing roofing materials, telephone poles, railroad ties, pumps, piping, steel siding, miscellaneous equipment, dried paints, coatings, ventilation systems, below-grade drain lines, and sumps)	Exposed surfaces	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-17
			Metals from Table 1-17 (COCs for solids only): As, Ba, Cd, Cr, Pb, Hg, Ni, Se, and Ag
			VOA target analytes, SVOA target analytes, PCB, PAH
2	Asbestos-containing material	Exposed surfaces	See COCs specified for Waste Stream #1
		Building materials and structures	Asbestos fibers
			SVOA target analytes
3	Miscellaneous aqueous liquid (including but not limited to liquids identified in system pumps, sumps, tanks, piping, drains, and processing equipment)	Bulk liquids collected from facility systems, pipes, sumps, drainage, or other sources of accumulation	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-17
			Metals from Table 1-17 (liquids only): Al, Sb, As, Ba, Be, Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Hg, Ni, P, Se, Si, Ag, Na, V, and Zn
			Ammonium, anions from Table 1-17: bromide, chloride, cyanide, fluoride, nitrate, nitrite, phosphate, sulfide, sulfate
			VOA target analytes
			Conductivity, pH, TDS, TOC, TOX, TSS

Table 1-18. Waste Streams and Final Contaminants of Concern. (5 Pages)

WS #	Waste Stream	Specific Media	COCs
4	Miscellaneous bulk solids (including but not limited to sludge, sediment and solid materials collected from system pumps, sumps, tanks, piping, drains, and processing equipment)	Bulk solids collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-17
			Metals from Table 1-17 (COCs for solids only): As, Ba, Cd, Cr, Pb, Hg, Ni, Se, and Ag
			Cyanide, sulfide, ignitability, pH
			SVOA target analytes, PCB, pesticides
5	Plant equipment lubrication grease, oil, hydraulic oils, transformer oils, oils in door actuators, and oil/grease	Bulk oils, greases, and other organic liquids collected from facility systems, pipes, sumps, tanks, or other sources of accumulation	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-17
			TCLP RCRA metals: As, Ba, Cd, Cr, Pb, Hg, Ag, and Se
			Cyanide, sulfide, ignitability
			VOA target analytes, SVOA target analytes
			PCB, TOX
6	Refrigerated systems (drinking fountains, coolers, chillers, etc.)	Refrigerants and residues from soldered systems	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-17
			TCLP RCRA metals: As, Ba, Cd, Cr, Pb, Hg, Ag, and Se
			VOA target analytes (Freon), SVOA target analytes
7	Mercury-containing equipment (manometers, vacuum pumps, switches, mercury vapor lights)	Mercury-activated switches and mercury residue	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-17
			Hg

Table 1-18. Waste Streams and Final Contaminants of Concern. (5 Pages)

WS #	Waste Stream	Specific Media	COCs
8	Fluorescent light tubes, incandescent light bulbs	Internals of bulbs, lead-base	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-17
			TCLP RCRA metals: As, Ba, Cd, Cr, Pb, Hg, Ag, and Se
9	Florescent light ballasts	Internals of light ballasts	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-17
			SVOA target analytes, PCB
10	Lead packing, washers, and shielding	Shielding materials, packing in pipe joints, lead washers and fasteners	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-17
			Pb
11	Emergency light batteries	Battery constituents	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-17
			TCLP RCRA metals: As, Ba, Cd, Cr, Pb, Hg, Ag, Se, and Ni
			Sulfides and pH
12	Exit signs and smoke detectors	Internal radioactive sources	Tritium and americium-241
13	HEPA filters	Potentially contaminated filter media from vacuums, exhausters, filter beds, and other similar sources	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-17
			TCLP RCRA metals: As, Ba, Cd, Cr, Pb, Hg, Ag, and Se
			Asbestos

Table 1-18. Waste Streams and Final Contaminants of Concern. (5 Pages)

WS #	Waste Stream	Specific Media	COCs
14	Underground contaminated waste piping, cable, ducts, wood, and soils	Exposed surfaces, buildings materials and structures, and potentially contaminated soil	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-17
			Metals from Table 1-17 (COCs for solids only): As, Ba, Cd, Cr, Pb, Hg, Ni, Se, and Ag
			Cyanide, sulfide, asbestos
			VOA target analytes, SVOA target analytes
			PCB, PAH
			Pesticides
15	Miscellaneous material for salvage	Exposed surfaces of steel items only. (See waste streams #5 and #8 for other recyclable items)	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-17
16	Unexpected media and waste forms (including solids and liquids)	Unexpected demolition debris and waste forms	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-17
			To be determined
17	Process equipment/systems and building structurewithin SSE (for archive information purposes)(including, but not limited to, poured concrete, concrete block, pumps, piping, steel siding, miscellaneous equipment, ventilation systems, below-grade drain lines, and sumps) NOTE: Materials that will be removed from Zone 1 areas will be a part of Waste Stream #1	Exposed surfaces	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-17
18	Waste from biological sources (feces, nests, carcasses, etc.)	Solids collected from piles or other sources of accumulation	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-17

Table 1-18. Waste Streams and Final Contaminants of Concern. (5 Pages)

WS #	Waste Stream	Specific Media	COCs
19	Charcoal filters	Potentially contaminated filter media from exhausters, filter beds, and other similar sources	Gross alpha activity, gross beta activity, and radionuclide COCs listed in Table 1-17
			VOA target analytes, SVOA target analytes

COC = contaminant of concern
PAH = polynuclear aromatic hydrocarbons
PCB = polychlorinated biphenyl
RCRA = *Resource Conservation and Recovery Act of 1976*
SSE = safe storage enclosure
SVOA = semivolatile organic analyte
TCLP = toxicity characteristic leaching procedure
TDS = total dissolved solids
TOC = total organic carbon
TOX = total organic halides
TSS = total suspended solids
VOA = volatile organic analyte

2.0 STEP 2 – IDENTIFY THE DECISION

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

2.1 PRINCIPAL STUDY QUESTIONS, ALTERNATIVE ACTIONS, AND DECISION STATEMENTS

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

Table 2-1. Principal Study Questions, Alternative Actions, and Decision Statements for 105-N/109-N ISS Project Waste Characterization DQO. (4 Pages)

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

Table 2-1. Principal Study Questions, Alternative Actions, and Decision Statements for 105-N/109-N ISS Project Waste Characterization DQO. (4 Pages)

AA#	Alternative Action	Description of Consequences of Implementing the Wrong Alternative Action	Severity of Consequences (Low/Severe)
DS #2 – Determine if the chemical and/or physical properties of the waste material exceed the disposal facility's waste acceptance criteria limits.			
PSQ #3 – Is the waste material a listed dangerous waste?			
3-1	The waste material is a listed dangerous waste and receives a listed waste code.	Waste is managed as a nonlisted dangerous waste and improperly disposed.	Severe
3-2	The waste material is not a listed dangerous waste and is not regulated as such.	Waste is unnecessarily managed as a listed dangerous waste. Additional project costs incurred.	Low
DS #3 – Determine if the waste material is regulated as listed dangerous waste.			
PSQ #4 – Is the waste material a characteristic dangerous waste (e.g., ignitable, corrosive, reactive, or toxic)?			
4-1	The waste material is a characteristic dangerous waste (e.g., corrosive, ignitable, reactive, and/or toxic) and receives a characteristic waste code.	Waste is managed as a noncharacteristic dangerous waste and improperly disposed.	Severe
4-2	The waste material is not a characteristic dangerous waste (e.g., corrosive, ignitable, reactive, and/or toxic) and is not regulated as such.	Waste is unnecessarily managed as a characteristic dangerous waste. Additional project costs incurred.	Low
DS #4 – Determine if the characteristic dangerous waste codes (e.g., corrosivity, ignitability, reactivity, and toxicity) apply to the waste material.			
PSQ #5 – Is the waste material a toxic dangerous waste per Washington State criteria?			
5-1	The waste material is a toxic dangerous waste per Washington State criteria and receives a toxic dangerous waste code.	Waste is managed as a nontoxic dangerous waste and improperly disposed.	Severe
5-2	The waste material is not a toxic dangerous waste per Washington State criteria and is not regulated as such.	Waste is unnecessarily managed as a toxic dangerous waste. Additional project costs incurred.	Low

Table 2-1. Principal Study Questions, Alternative Actions, and Decision Statements for 105-N/109-N ISS Project Waste Characterization DQO. (4 Pages)

AA#	Alternative Action	Description of Consequences of Implementing the Wrong Alternative Action	Severity of Consequences (Low/Severe)
DS #5 – Determine if the waste material meets the definition of a toxic dangerous waste in accordance with Washington State criteria.			
PSQ #6 – Is the waste material a persistent dangerous waste in accordance with Washington State criteria?			
6-1	The waste material meets the definition of a persistent dangerous waste in accordance with Washington State criteria.	Waste is managed as a nonpersistent dangerous waste and improperly disposed.	Severe
6-2	The waste material does not meet the definition of a persistent dangerous waste in accordance with Washington State criteria.	Waste is unnecessarily managed as a persistent dangerous waste. Additional project cost incurred.	Low
DS #6 – Determine if the waste material meets the definition of a persistent dangerous waste in accordance with Washington State criteria.			
PSQ #7 – Is the waste material a PCB waste?			
7-1	The waste material is regulated due to PCB concentrations.	Waste is managed as a non-PCB regulated waste and improperly disposed.	Severe
7-2	The waste material is not regulated due to PCB concentrations	Waste is unnecessarily managed as a PCB regulated waste.	Low
DS #7 – Determine if the waste material is regulated due to PCB concentrations.			
PSQ #8– Is the waste material ACM?			
8-1	The waste material is regulated due to asbestos content.	Waste is managed as non-ACM and improperly disposed.	Severe
8-2	The waste material is not regulated due to asbestos content.	Waste is unnecessarily managed as an ACM. Additional project cost incurred.	Low
DS #8 – Determine if the waste material is regulated due to asbestos content.			
PSQ #9 – Is the waste material land disposal restricted (LDR)?			
9-1	The waste material is LDR. Treatment is imposed on the debris prior to disposal.	Waste is managed and disposed as non-LDR waste when it should have been treated.	Severe
9-2	The waste material is not LDR. Treatment is not required for the debris prior to disposal. The debris will be disposed in an onsite facility without treatment.	Waste is unnecessarily managed as LDR waste. Additional project costs incurred.	Low

Table 2-1. Principal Study Questions, Alternative Actions, and Decision Statements for 105-N/109-N ISS Project Waste Characterization DQO. (4 Pages)

AA#	Alternative Action	Description of Consequences of Implementing the Wrong Alternative Action	Severity of Consequences (Low/Severe)
DS #9 – Determine if LDR requirements impose treatment for waste material.			
PSQ #10 – Does the material meet the requirements for recycling?			
10-1	The affected media meets the requirements for recycling.	Waste is disposed when it could have been recycled. Additional project costs incurred.	Low
10-2	The affected media does not meet the requirements for recycling and must be managed as a waste material.	Waste is improperly recycled when it should have been disposed.	Severe
DS #10 – Determine if the affected media meets the recycling requirements.			

[a] The definition of dangerous waste also includes hazardous waste.

AA = alternative action
ACM = asbestos containing material
DQO = data quality objective
DS = decision statement
ISS = interim safe storage
LDR = land disposal restriction
PCB = polychlorinated biphenyl
PSQ = principal study questions

3.0 STEP 3 – IDENTIFY INPUTS TO THE DECISION

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

3.1 INFORMATION REQUIRED TO RESOLVE DECISION STATEMENTS

Table 3-1 identifies each DS and the information needed to resolve the DS for each waste stream identified in Step 1 of the DQO. For each DS, the table also identifies if there is existing data that may be used to resolve the DS and, where existing data are available, if it is of sufficient quality to resolve the DS. For those cases where data do not exist or are insufficient to resolve the DS, the table identifies the computational, surveying, or sampling information needed to resolve the DS.

As noted in Table 3-1, sufficient information may be based on process knowledge (provided such knowledge can be demonstrated to be sufficient for proper designation) and environmental measurements. If a waste is designated as dangerous, compliance with land disposal restrictions (LDR) must be demonstrated based on testing. Process knowledge is not sufficient to demonstrate compliance with LDR standards prior to disposal (40 CFR 268). However, sampling the wastes after treatment is beyond the scope of the sampling design presented in this DQO summary report, as the final waste forms (and volume) of treated wastes (if any) are unknown at this time. This is also noted in DQO Step 5.

Table 3-1. Required Information and Reference Sources. (7 Pages)

DS #	Informational Need	WS #	Required Data	Do Data Exist? (Y/N)	Available Information	Sufficient Data? (Y/N)	Additional Computational Methods Needed	Additional Survey/Sampling Information Needed
1	Radionuclides	1	Radiological activity in the waste material	Y	Existing historical laboratory data (Table 1-4), Appendix A, existing inventory estimates (Tables 1-5 through 1-11), and waste disposition documentation (Table 1-12)	N	Engineering calculations	NDA, radiological instrument surveys
		2 through 5, 14, 20		Y	Existing historical laboratory data (Table 1-4), Appendix A, existing inventory estimates (Tables 1-5 through 1-11), and waste disposition documentation (Table 1-12)	N	Engineering calculations	NDA, radiological instrument surveys, and/or media sampling/analysis
		6 through 12		Y	Process knowledge	Y	Engineering calculations	None
		13		Y	Process knowledge, waste disposition documentation (Table 1-12)	N	Engineering calculations	NDA, radiological instrument surveys, and/or media sampling/analysis
		15, 16, 18		N	None	N	N/A	NDA, radiological surveys, and/or media sampling and analysis
		17		Y	Process knowledge, existing historical laboratory data (Table 1-4)	N	Engineering calculations	NDA, radiological instrument surveys
		19		Y	Process knowledge	N	Engineering calculations	NDA, radiological surveys, and/or media sampling/analysis
2	Chemical contaminants	1 through 5, 14, 20	Chemical concentration and/or physical properties	Y	Existing historical laboratory data (Table 1-4), Appendix A, and waste disposition documentation (Table 1-12)	N	Engineering calculations	Media sampling/analysis

Table 3-1. Required Information and Reference Sources. (7 Pages)

DS #	Informational Need	WS #	Required Data	Do Data Exist? (Y/N)	Available Information	Sufficient Data? (Y/N)	Additional Computational Methods Needed	Additional Survey/Sampling Information Needed
		6 through 12		Y	Process knowledge, MSDS	Y	Engineering calculations	None
		13		Y	Process knowledge, waste disposition documentation (Table 1-12)	N	Engineering calculations	Media sampling/analysis
		15, 16, 18		N	None	N	N/A	Media sampling and analysis
		17		Y	Process knowledge	N	Engineering calculations	Media sampling and analysis
		19		Y	Process knowledge	N	Engineering calculations	Media sampling/analysis
3	Listed dangerous waste status	All	Process knowledge about materials	Y	Existing designation of routine waste streams that are common in all reactor facilities	Y	Engineering calculations	None
4	Characteristic dangerous waste code status	1 through 5, 14, 20	Chemical and/or physical properties	Y	Process knowledge, existing historical laboratory data (Table 1-4), Appendix A, waste disposition documentation (Table 1-12), existing designation of routine waste streams that are common in all reactor facilities	Y	Engineering calculations	None
		6 through 12		Y	Process knowledge, MSDS, existing historical laboratory data (Table 1-4), Appendix A, waste disposition documentation (Table 1-12), existing designation of routine waste streams that are common in all reactor facilities	Y	Engineering calculations	None
		13		Y	Process knowledge, waste disposition documentation (Table 1-12)	N	Engineering calculations	Chemical information collected for DS #2

Table 3-1. Required Information and Reference Sources. (7 Pages)

DS #	Informational Need	WS #	Required Data	Do Data Exist? (Y/N)	Available Information	Sufficient Data? (Y/N)	Additional Computational Methods Needed	Additional Survey/Sampling Information Needed
		15, 16, 18		N	None	N	None	Chemical information collected for DS #2
		17		Y	Process knowledge	N	Engineering calculations	Chemical information collected for DS #2
		19		N	None	N	None	Chemical information collected for DS #2
5	Toxic dangerous waste code status	1 through 5, 14, 20	Chemical and/or physical properties	Y	Process knowledge, existing historical laboratory data (Table 1-4), Appendix A, waste disposition documentation (Table 1-12), existing designation of routine waste streams that are common in all reactor facilities	N	Engineering calculations	Chemical information collected for DS #2
		6 through 12		Y	Process knowledge, MSDS, existing historical laboratory data (Table 1-4), Appendix A, waste disposition documentation (Table 1-12), existing designation of routine waste streams that are common in all reactor facilities	Y	Engineering calculations	None
		13		Y	Process knowledge, waste disposition documentation (Table 1-12)	N	Engineering calculations	Chemical information collected for DS #2
		15, 16, 18		N	None	N	None	Chemical information collected for DS #2
		17		Y	Process knowledge	N	Engineering calculations	Chemical information collected for DS #2
		19		Y	Process knowledge	N	Engineering calculations	Chemical information collected for DS #2

Table 3-1. Required Information and Reference Sources. (7 Pages)

DS #	Informational Need	WS #	Required Data	Do Data Exist? (Y/N)	Available Information	Sufficient Data? (Y/N)	Additional Computational Methods Needed	Additional Survey/Sampling Information Needed
6	Persistent dangerous waste code status	1 through 5, 14, 20	Chemical and/or physical properties	Y	Process knowledge, existing historical laboratory data (Table 1-4), Appendix A, waste disposition documentation (Table 1-12), existing designation of routine waste streams that are common in all reactor facilities	N	Engineering calculations	Chemical information collected for DS #2
		6 through 12		Y	Process knowledge, MSDS, existing historical laboratory data (Table 1-4), Appendix A, waste disposition documentation (Table 1-12), existing designation of routine waste streams that are common in all reactor facilities	Y	Engineering calculations	None
		13		Y	Process knowledge, waste disposition documentation (Table 1-12)	N	None	Chemical information collected for DS #2
		15, 16, 18		N	None	N	None	Chemical information collected for DS #2
		17		Y	Process knowledge	N	Engineering calculations	Chemical information collected for DS #2
		19		Y	Process knowledge	N	None	Chemical information collected for DS #2
7	PCB concentrations	1 through 5, 14, 20	Chemical concentration and/or physical properties	Y	Process knowledge, existing historical laboratory data (Table 1-4), Appendix A, waste disposition documentation (Table 1-12)	N	Engineering calculations	Chemical information collected for DS #2
		6 through 12		Y	Process knowledge, MSDS, existing historical laboratory data (Table 1-4), Appendix A, waste disposition documentation (Table 1-12)	Y	Engineering calculations	None
		13		Y	Process knowledge, waste disposition documentation (Table 1-12)	N	Engineering calculations	Chemical information collected for DS #2

Table 3-1. Required Information and Reference Sources. (7 Pages)

DS #	Informational Need	WS #	Required Data	Do Data Exist? (Y/N)	Available Information	Sufficient Data? (Y/N)	Additional Computational Methods Needed	Additional Survey/Sampling Information Needed
		15, 16, 18		N	None	N	Engineering calculations	Chemical information collected for DS #2
		17		Y	Process knowledge	Y	Engineering calculations	None
		19		Y	Process knowledge	N	None	Chemical information collected for DS #2
8	Asbestos Containing Material	2	Percent of asbestos in the waste material	Y	Process knowledge, existing historical laboratory data (Table 1-4), Appendix A, waste disposition documentation (Table 1-12)	N	Engineering calculations	Media sampling/analysis
		1, 3 through 5		Y	Process knowledge, existing historical laboratory data (Table 1-4), Appendix A, waste disposition documentation (Table 1-12)	Y	None	None
		6 through 12		Y	Process knowledge	Y	None	None
		13, 14, 20		Y	Process knowledge	N	Engineering calculations	Media sampling/analysis
		16		N	None	N	Engineering calculations	Media sampling/analysis
		15, 17, 18, 19		Y	Process knowledge	Y	None	None

Table 3-1. Required Information and Reference Sources. (7 Pages)

DS #	Informational Need	WS #	Required Data	Do Data Exist? (Y/N)	Available Information	Sufficient Data? (Y/N)	Additional Computational Methods Needed	Additional Survey/Sampling Information Needed
9	LDRs	1, 2, 14, 20	Chemical concentration and/or physical properties	Y	Process knowledge, existing historical laboratory data (Table 1-4), Appendix A, waste disposition documentation (Table 1-12), existing designation of routine waste streams that are common in all reactor facilities	Y	Engineering calculations	None
		3 through 5		Y	Process knowledge, existing historical laboratory data (Table 1-4), Appendix A, waste disposition documentation (Table 1-12), existing designation of routine waste streams that are common in all reactor facilities	N	Engineering calculations	Information collected for DS #1 and 2
		6 through 12		Y	Process knowledge, MSDS, existing historical laboratory data (Table 1-4), Appendix A, waste disposition documentation (Table 1-12), existing designation of routine waste streams that are common in all reactor facilities	Y	None	None
		13		Y	Process knowledge, waste disposition documentation (Table 1-12)	N	Engineering calculations	Information collected for DS #1 and 2
		16, 18		N	None	N	Engineering calculations	Information collected for DS #1 and 2
		15		Y	Process knowledge	Y	None	None
		17, 19		Y	Process knowledge	N	None	Information collected for DS #1 and 2
10	Radionuclides and Chemical contaminants	All	Radiological activity of waste materials	Y	Data collection for general waste designation to answer DS #1	N	N/A	Radiological information collected for DS #1 and/ or NDA/radiological instrument surveys

Table 3-1. Required Information and Reference Sources. (7 Pages)

DS #	Informational Need	WS #	Required Data	Do Data Exist? (Y/N)	Available Information	Sufficient Data? (Y/N)	Additional Computational Methods Needed	Additional Survey/Sampling Information Needed
			Chemical and/or physical properties of the waste materials	Y	Data collection for general waste designation to answer DS #2	N	N/A	Chemical information collected for DS #2

DS = decision statement
LDR = land disposal restriction
MSDS = material safety data sheet
N/A = not applicable
NDA = nondestructive assay
PCB = polychlorinated biphenyl
WS = waste stream

3.2 ENGINEERING CALCULATIONS

Estimates have been prepared (Tables 1-5 through 1-11) to support radiological waste inventories. Engineering calculations are needed for waste profiles (Table 1-16). Engineering calculations are needed to develop waste inventories prior to removal and final disposition of many waste streams, as determined in Table 3-1. The engineering calculations will use existing data or additional data that is required to be collected prior to final waste disposition. These waste calculations will assist in the determination of final designation and packaging and will be used by Waste Operations.

3.3 DANGEROUS WASTE EVALUATION

The waste streams that are being evaluated for regulation under the LDRs include those waste streams with dried paint, used oils and grease, HEPA filters, and sludges. Dried paint is only a small percentage of the total debris (e.g., concrete, tanks, pumps, equipment, and sheetrock) being disposed. The average thickness of paint will be estimated and information (i.e., MSDS), process knowledge, and/or existing laboratory data will be used to calculate the total volume of paint as a percentage of the appropriate volume of the waste stream to which the paint is applied. If no information and/or applicable data exist to prepare engineering calculations for the paint and primer, then samples will be collected and analyzed.

The oils, greases, and other liquid will be characterized. No engineering calculations will be required in support of final disposition. The information (e.g., MSDS, process knowledge) and/or applicable data will be used to confirm contamination levels in the waste stream materials and to determine appropriate disposition of the waste materials. Containerized petroleum products may be evaluated for reuse or recycling.

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

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

3.4 ISOTOPIC EVALUATION

Process history, existing data (Table 1-4), and existing inventory calculations (Tables 1-5 through 1-11) show that the 105-N Reactor Core (Table 1-5), C Elevator Pit (Table 1-6), 105-N Reactor Fuel Storage Basin (Table 1-8), and Fission Products Trap (Table 1-9) (waste streams #1, #2, #4, #13, and #14) may encounter materials that exceed the radiological ERDF criteria. The existing laboratory data are sufficient to determine the isotopic mixture of these waste streams; however, additional evaluation to assist with the final removal design for appropriate waste disposition and packaging may be required.

Nondestructive assay (NDA) may be used as needed to detect gamma-emitting radionuclides in waste streams. Not all of the radionuclides of interest that are present in these waste streams can be directly measured; therefore, isotopic ratios or scaling factors must be provided for the nondetectable nuclides. The isotopic ratios and scaling factors can be obtained with engineering calculations. The information used in the engineering calculations will be based on existing data (Table 1-4) and inventory calculations (Tables 1-5 through 1-11). The NDA information will be used in correlation with existing laboratory data and engineering calculations to support optimum removal and the final disposal approach.

3.5 ANOMOLOUS WASTE

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

3.6 FIELD MEASUREMENT METHODS AND ANALYTICAL PERFORMANCE REQUIREMENTS

Table 3-2 defines the analytical performance requirements for the data that need to be collected to resolve each of the DSs for the solids and oils that require additional analytical data. Table 3-3 defines the analytical performance requirements for the data that need to be collected to resolve each of the DSs for aqueous liquids. These tables also reflect additional analyses that are associated with anomalous media (i.e., liquids and solids) that may be found during ISS activities and must meet ETF and/or ERDF analytical criteria, as well as the analysis requirements to determine if waste can be recycled. The specific methods (e.g., EPA Method 6010B [EPA 1997]), based on contracts with the standard fixed laboratory, will be identified in the SAP. The action level and performance requirements include the required detection limit (RDL) and precision and accuracy requirements.

Table 3-2. Analytical Performance Requirements for Solid/Other Materials. (3 Pages)

Analyte	Analytical Method	Action Level	RDL Requirement	Accuracy (% Recovery)	Precision (% RPD)
Radiological Constituents					
Americium-241	AmAEA	2 ρCi/g	1 ρCi/g	70-130[a]	±30[a]
Antimony-125	GEA	10 ρCi/g	0.2 ρCi/g	70-130[a]	±30[a]
Carbon-14	Liquid scintillation	50 ρCi/g	50 ρCi/g	70-130[a]	±30[a]
Cesium-137	GEA	10 ρCi/g	0.1 ρCi/g	70-130[a]	±30[a]
Cobalt-60	GEA	10 ρCi/g	0.05 ρCi/g	70-130[a]	±30[a]
Europium-152	GEA	10 ρCi/g	0.1 ρCi/g	70-130[a]	±30[a]
Europium-154	GEA	10 ρCi/g	0.1 ρCi/g	70-130[a]	±30[a]
Europium-155	GEA	2 ρCi/g	0.1 ρCi/g	70-130[a]	±30[a]
Neptunium-237	NpAEA	2 ρCi/g	1 ρCi/g	70-130[a]	±30[a]
Nickel-63	Liquid scintillation	30 ρCi/g	30 ρCi/g	70-130[a]	±30[a]
Plutonium-238	PuAEA	2 ρCi/g	1 ρCi/g	70-130[a]	±30[a]
Plutonium-239/240	PuAEA	2 ρCi/g	1 ρCi/g	70-130[a]	±30[a]
Radium-226	GEA	2 ρCi/g	0.1 ρCi/g	70-130[a]	±30[a]
Radium-228	GEA	2 ρCi/g	0.2 ρCi/g	70-130[a]	±30[a]
Total strontium	Rad-Sr	10 ρCi/g	1 ρCi/g	70-130[a]	±30[a]
Technetium-99	Proportional counting	30 ρCi/g	15 ρCi/g	70-130[a]	±30[a]
Thorium-232	ThAEA	2 ρCi/g	1 ρCi/g	70-130[a]	±30[a]
Tritium	Liquid scintillation	30 ρCi/g	400 ρCi/g	70-130[a]	±30[a]
Uranium-234	UAEA	2 ρCi/g	1 ρCi/g	70-130[a]	±30[a]
Uranium-235	UAEA	2 ρCi/g	1 ρCi/g	70-130[a]	±30[a]
Uranium-238	UAEA	2 ρCi/g	1 ρCi/g	70-130[a]	±30[a]
Nonradiological Constituents – Metals					
Arsenic	EPA Method 6010	100 mg/kg	10 mg/kg	70-130[b]	±30[b]
	EPA Method 1311/6010	5.0 mg/L[c]	0.5 mg/L	70-130[b]	±30[b]
Barium	EPA Method 6010	2,000 mg/kg	2 mg/kg	70-130[b]	±30[b]
	EPA Method 1311/6010	100 mg/L[c]	10 mg/L	70-130[b]	±30[b]
Cadmium	EPA Method 6010	20 mg/kg	0.5 mg/kg	70-130[b]	±30[b]
	EPA Method 1311/6010	1.0 mg/L[c]	0.1 mg/L	70-130[b]	±30[b]

Table 3-2. Analytical Performance Requirements for Solid/Other Materials. (3 Pages)

Analyte	Analytical Method	Action Level	RDL Requirement	Accuracy (% Recovery)	Precision (% RPD)
Chromium	EPA Method 6010	100 mg/kg	10 mg/kg	70-130[b]	±30[b]
	EPA Method 1311/6010	5.0 mg/L[c]	0.5 mg/L	70-130[b]	±30[b]
Lead	EPA Method 6010	100 mg/kg	5 mg/kg	70-130[b]	±30[b]
	EPA Method 1311/6010	5.0 mg/L[c]	0.5 mg/L	70-130[b]	±30[b]
Mercury	EPA Method 7471	4.0 mg/kg	0.2 mg/kg	70-130[b]	±30[b]
	EPA Method 1311/7471	0.2 mg/L[c]	0.02 mg/L	70-130[b]	±30[b]
Selenium	EPA Method 6010	20 mg/kg	10 mg/kg	70-130[b]	±30[b]
	EPA Method 1311/6010	1.0 mg/L[c]	0.1 mg/L	70-130[b]	±30[b]
Silver	EPA Method 6010	100 mg/kg	1 mg/kg	70-130[b]	±30[b]
	EPA Method 1311/6010	5.0 mg/L[c]	0.5 mg/L	70-130[b]	±30[b]
Nonradiological Constituents – General Inorganics					
Asbestos	PLM	1 wt%	<1 wt%	N/A	N/A
Cyanide	EPA 9010	30 mg/kg	0.5 mg/kg	70-130[b]	±30[b]
Sulfide	EPA 9030	None	5 mg/kg	70-130[b]	±30[b]
Organic Compounds					
PCBs	EPA Method 8082	2 mg/kg	0.017 mg/kg	50-150[c]	±30[c]
Pesticides	EPA Method 8081	Compound-specific[d]	0.005 to 0.020 mg/kg[e]	50-150[c]	±30[c]
Herbicides	EPA Method 8151	Compound-specific[d]	0.020 to 0.50 mg/kg[e]	50-150[c]	±30[c]
Waste Characteristics					
Corrosivity	EPA Method 9045 (pH)	2.0 <pH <12.5	0.1 pH unit	70-130[b]	±30[b]
Gross alpha	Proportional counting	5 ρCi/g	10 ρCi/g	70-130[a]	±30[a]
Gross beta	Proportional counting	10 ρCi/g	15 ρCi/g	70-130[a]	±30[a]
Ignitability (flash point)	EPA Method 1010	<140°F	N/A	N/A	N/A
SVOAs	EPA Method 8270	Compound-specific[d]	0.33 to 0.85 mg/kg[e]	50-150[f]	±30[f]
TOX	EPA Method 9020	1,000 mg/kg	0.5 mg/kg	70-130[f]	±30[f]

Table 3-2. Analytical Performance Requirements for Solid/Other Materials. (3 Pages)

Analyte	Analytical Method	Action Level	RDL Requirement	Accuracy (% Recovery)	Precision (% RPD)
VOAs	EPA Method 8260	Compound-specific[d]	0.005 to 0.05 mg/kg[e]	Compound-specific[d]	Compound-specific[d]

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

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

[c] Lower action level may be needed to determine land disposal treatment requirements.

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

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

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

NOTE: EPA's *Test Methods for Evaluating Solid Waste: Physical and Chemical Methods,* SW-846, 3rd ed., as amended, U.S. Environmental Protection Agency, Washington, D.C. (1997), except for Methods 300.0 and 418.1, which are from EPA's *Methods for Chemical Analysis of Water and Wastes*, EPA 600/4-79-020, U.S. Environmental Protection Agency, Washington, D.C. (1983).

AEA = alpha energy analysis
EPA = U.S. Environmental Protection Agency
GEA = gamma energy analysis
N/A = not applicable
PCB = polychlorinated biphenyl
PLM = polarized light microscopy
RDL = required detection limit
RPD = relative percent difference
SVOA = semivolatile organic analyte
TOX = total organic halides
VOA = volatile organic analyte

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

Analyte	Analytical Method	Action Level	RDL Requirement	Accuracy (% Recovery)	Precision (% RPD)
Radiological Constituents					
Americium-241	AmAEA	None	1 ρCi/L	80-120[a]	±20[a]
Antimony-125	GEA	None	50 ρCi/L	80-120[a]	±20[a]
Carbon-14	Liquid scintillation	None	200 ρCi/L	80-120[a]	±20[a]
Cesium-137	GEA	None	15 ρCi/L	80-120[a]	±20[a]
Cobalt-60	GEA	None	25 ρCi/L	80-120[a]	±20[a]
Europium-152	GEA	None	50 ρCi/L	80-120[a]	±20[a]
Europium-154	GEA	None	50 ρCi/L	80-120[a]	±20[a]
Europium-155	GEA	None	50 ρCi/L	80-120[a]	±20[a]
Neptunium-237	NpAEA	None	1 ρCi/L	80-120[a]	±20[a]
Nickel-63	Liquid scintillation	None	15 ρCi/L	80-120[a]	±20[a]
Plutonium-238	PuAEA	None	1 ρCi/L	80-120[a]	±20[a]
Plutonium-239/240	PuAEA	None	1 ρCi/L	80-120[a]	±20[a]
Radium-226	EPA Method 903.1	None	1 ρCi/L	80-120[a]	±20[a]
Radium-228	EPA Method 904.0	None	1 ρCi/L	80-120[a]	±20[a]
Total strontium	Rad-Sr	None	2 ρCi/L	80-120[a]	±20[a]
Technetium-99	Proportional counting	None	15 ρCi/L	80-120[a]	±20[a]
Thorium-232	ThAEA	None	1 ρCi/L	80-120[a]	±20[a]
Tritium	Liquid scintillation	None	400 ρCi/L	80-120[a]	±20[a]
Nonradiological Constituents – Metals					
Aluminum	EPA Method 6010	None	50 μg/L	80-120[b]	±20[b]
Antimony	EPA Method 6010	None	60 μg/L	80-120[b]	±20[b]
Arsenic	EPA Method 6010	None	100 μg/L	80-120[b]	±20[b]
Barium	EPA Method 6010	None	20 μg/L	80-120[b]	±20[b]
Beryllium	EPA Method 6010	None	5 μg/L	80-120[b]	±20[b]
Cadmium	EPA Method 6010	None	5 μg/L	80-120[b]	±20[b]
Calcium	EPA Method 6010	None	1,000 μg/L	80-120[b]	±20[b]
Chromium	EPA Method 6010	None	10 μg/L	80-120[b]	±20[b]
Iron	EPA Method 6010	None	50 μg/L	80-120[b]	±20[b]
Lead	EPA Method 6010	None	50 μg/L	80-120[b]	±20[b]
Magnesium	EPA Method 7470	None	750 μg/L	80-120[b]	±20[b]
Manganese	EPA Method 7470	None	5 μg/L	80-120[b]	±20[b]
Mercury	EPA Method 7470	None	0.5 μg/L	80-120[b]	±20[b]
Nickel	EPA Method 6010	None	40 μg/L	80-120[b]	±20[b]

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

Analyte	Analytical Method	Action Level	RDL Requirement	Accuracy (% Recovery)	Precision (% RPD)
Potassium	EPA Method 6010	None	4,000 µg/L	80-120[b]	±20[b]
Selenium	EPA Method 6010	None	100 µg/L	80-120[b]	±20[b]
Silicon	EPA Method 6010	None	20 µg/L	80-120[b]	±20[b]
Silver	EPA Method 6010	None	10 µg/L	80-120[b]	±20[b]
Sodium	EPA Method 6010	None	500 µg/L	80-120[b]	±20[b]
Vanadium	EPA Method 7470	None	25 µg/L	80-120[b]	±20[b]
Zinc	EPA Method 6010	None	10 µg/L	80-120[b]	±20[b]
Nonradiological Constituents – General Inorganics					
Ammonium	EPA Methods 350.1, 2, or 3	100,000 mg/L	50 µg/kg	80-120[b]	±20[b]
Bromide	EPA Method 300.0	None	250 µg/kg	80-120[b]	±20[b]
Chloride	EPA Method 300.0	None	200 µg/kg	80-120[b]	±20[b]
Cyanide	EPA Method 9010	None	5 µg/kg	80-120[b]	±20[b]
Fluoride	EPA Method 300.0	None	500 µg/kg	80-120[b]	±20[b]
Nitrate	EPA Method 300.0	None	250 µg/kg	80-120[b]	±20[b]
Nitrite	EPA Method 300.0	None	250 µg/kg	80-120[b]	±20[b]
Phosphate	EPA Method 300.0	None	500 µg/kg	80-120[b]	±20[b]
Sulfide	EPA Method 9030	None	500 µg/kg	80-120[b]	±20[b]
Sulfate	EPA Method 300.0	None	500 µg/kg	80-120[b]	±20[b]
Waste Characteristics					
Conductivity	EPA Method 120.1	None	1 µmho/cm³	80-120[b]	±20[b]
Corrosivity	EPA Method 150.1 (pH)	0.5 <pH <13.0	0.1 pH unit	80-120[b]	±20[b]
Gross alpha	Proportional counting	None	3 ρCi/L	80-120[a]	±20[a]
Gross beta	Proportional counting	None	4 ρCi/L	80-120[a]	±20[a]
Ignitability	EPA 1010	60°C/140°F	1°C	NA	NA
SVOAs	EPA Method 8270	Compound-specific	10 to 50 µg/L[c]	50-150[d]	±30[d]
TDS	EPA Method 160.1	None	10 mg/L	80-120[b]	±20[b]
TOC	EPA Method 415 or 9060	None	1 mg/L	80-120[b]	±20[b]
TSS	EPA Method 160.2	None	5 mg/L	80-120[b]	±20[b]
TOX	EPA Method 9020	None	20 mg/L	80-120[b]	±20[b]
Pesticides	EPA Method 8081	Compound specific	0.1-5 mg/L	80-120[b]	±20[b]

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

Analyte	Analytical Method	Action Level	RDL Requirement	Accuracy (% Recovery)	Precision (% RPD)
VOAs	EPA Method 8260	Compound specific	5 to 50 µg/L[e]	50-150[c]	±30[c]

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

NOTE: EPA's *Test Methods for Evaluating Solid Waste: Physical and Chemical Methods* , SW-846, 3rd ed., as amended, U.S. Environmental Protection Agency, Washington, D.C. (1997), except for Methods 300.0 and 418.1, which are from EPA's *Methods for Chemical Analysis of Water and Wastes,* EPA 600/4-79-020, U.S. Environmental Protection Agency, Washington, D.C. (1983).

AEA = alpha energy analysis
EPA = U.S. Environmental Protection Agency
GEA = gamma energy analysis
N/A = not applicable
PCB = polychlorinated biphenyl
PLM = polarized light microscopy
RDL = required detection limit
RPD = relative percent difference
SVOA = semivolatile organic analyte
TOX = total organic halides
VOA = volatile organic analyte

3.7 RADIOLOGICAL SURVEY PERFORMANCE REQUIREMENTS

Table 3-4 defines the radiological survey instrument performance requirements for the data that need to be collected to resolve each of the DSs. Table 3-5 provides the methods for obtaining the concentration of each radionuclide using NDA equipment and the action levels that would be unacceptable for disposal at ERDF.

Table 3-4. Radiological Survey Instrument Performance Requirements.

Analyte	Analytical Method	Action Level/ Detection Limit	Accuracy Requirement	Precision Requirement
Standard Survey Instruments				
Dose rate	Portable sodium iodide detector or Bicron[a] µrem meter or ion chamber	0.1 mR/h	[b]	[b]
Removable alpha	Bench-top scaler for removable alpha Portable radiation detector	20 dpm/100 cm^2	[b]	[b]
Total (fixed + removable) alpha		100 dpm/100 cm^2		
Removable beta-gamma		1,000 dpm/ 100 cm^2		
Total (fixed + removable) beta-gamma		5,000 dpm/ 100 cm^2		
Advanced Characterization System				
Removable alpha	Electra Plus survey instrument with DP-8B 600-cm^2 probe[c]	20 dpm/100 cm^2	[b]	[b]
Total (fixed + removable) alpha		100 dpm/100 cm^2		
Removable beta-gamma		1,000 dpm/ 100 cm^2		
Total (fixed + removable) beta-gamma		5,000 dpm/ 100 cm^2		
Am-241	ISOCS, or equivalent	2 ρCi/g	[b]	[b]
Co-60		10 ρCi/g		
Cs-137		10 ρCi/g		
Eu-152		10 ρCi/g		
Eu-154		10 ρCi/g		
Eu-155		2 ρCi/g		

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

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

Table 3-5. Analytical Performance Requirements for NDA.

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

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

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

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

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

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Wastes," *Code of Federal Regulations,* as amended.

CFR = *Code of Federal Regulations*
GTCC = greater than Class C
MDA = minimum detectable activity
NDA = nondestructive assay
TRU = transuranic

4.0 STEP 4 – DEFINE THE BOUNDARIES OF THE STUDY

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

4.1 POPULATION OF INTEREST

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

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

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

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

4.2 ZONES WITH HOMOGENOUS CHARACTERISTICS

The elements of the population are segregated into zones or subsets that exhibit relatively homogenous characteristics in DQO Step 4. This distinction has already been made by the identification of waste streams in Table 1-18. See Table 1-18 for the identification of homogeneous characteristics.

4.3 SPATIAL SCALE OF DECISION MAKING

The spatial scale of decision making for this DQO process is the individual waste streams identified in each facility.

4.4 TEMPORAL BOUNDARIES

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

Table 4-2. Temporal Boundaries of the Investigation.

DS #	WS #	Time Frame	When to Collect Data
All	All	1,000 years	No temporal boundaries have been identified for collection of data for D4 activities.

D4 = Decommission, Deactivate, Decontaminate, and Demolish
DS = decision statement
WS = waste stream

4.5 PRACTICAL CONSTRAINTS

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

Table 4-3. Practical Constraints on Data Collection.

• Soils and underground-contaminated pipelines are not accessible until after the building is demolished.
• Some materials are not accessible (liquids, pipes, oil in hydraulic lines, sludge in sumps, etc.) until D4 actions have occurred. These materials will be segregated and representative samples collected for analysis.
• The paints are not considered a separate waste stream. They are a part of the substrate. Process knowledge, MSDSs, and/or existing laboratory data will primarily be used to characterize the paints and primers, which will be addressed as a part of the material on which it is applied. Stains will be treated in a similar manner.
• There is limited ability to collect representative samples inside shield walls due to high radiation levels. Collecting samples in Zone 1 areas may not be feasible. Inventory estimates will be limited to process knowledge, existing data, and measuring radiation dose rates on exposed surfaces.
• Roofing materials may be found containing more than one layer, with old and new roofing materials existing in the same area.

D4 = Decommission, Deactivate, Decontaminate, and Demolish
MSDS = material safety data sheet

5.0 STEP 5 – DEVELOP DECISION RULES

The preceding sections present the basis for making decisions for characterization and final disposition of the waste streams identified in Table 1-15. Step 5 of the DQO process develops the decision rules, which establish specific criteria for these determinations.

5.1 PARAMETER OF INTEREST

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

5.2 FINAL ACTION LEVELS

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

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

COCs	Concentration Limits
***SVOCs*[a]**	
Benzo(a)pyrene	25,000 mg/kg
Benzo(k)fluoranthene	25,000 mg/kg
***Pesticides/PCBs*[a]**	
4,4'DDD	760,000 mg/kg
4,4'DDE	540,000 mg/kg
PCBs	500 mg/kg
***Metals*[a]**	
Antimony	19,000 mg/kg
Arsenic	3,000 mg/kg
Barium	940,000 mg/kg

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

COCs	Concentration Limits
Cadmium	39,000 mg/kg
Chromium (total)	59,000 mg/kg
Manganese	440,000 mg/kg
Selenium	400,000 mg/kg
Silver	350,000 mg/kg
Thallium	5,600 mg/kg
Vanadium	330,000 mg/kg
Radionuclides[b]	
Americium-241	0.050 Ci/m^3 [(c,d)]
Americium-243	0.057 Ci/m^3 [(d,e)]
Carbon-14	5.1 Ci/m^3 [(e)]
Cesium-134	Unlimited
Cesium-135	8.8 Ci/m^3 [(e)]
Cesium-137	32 Ci/m^3 [(c)]
Cobalt-60	Unlimited
Curium-243	85 Ci/m^3 [(d,e)]
Curium-244	40 Ci/m^3 [(d,e)]
Europium-152	21,000,000 Ci/m^3 [(c)]
Europium-154	Unlimited
Iodine-129	0.080 Ci/m^3 [(f)]
Neptunium-237	0.0015 Ci/m^3 [(c,d)]
Nickel-59	210 Ci/m^3 [(e)]
Nickel-63	700 Ci/m^3 [(f)]
Niobium-94	0.012 Ci/m^3 [(e)]
Palladium-107	830 Ci/m^3 [(e)]
Plutonium-238	1.5 Ci/m^3 [(c,d)]
Plutonium-239	0.029 Ci/m^3 [(c,d)]
Plutonium-240	0.029 Ci/m^3 [(c,d)]
Plutonium-241	6.2 Ci/m^3 [(c,d)]
Plutonium-242	0.11 Ci/m^3 [(d,e)]
Radium-226	0.00014 Ci/m^3 [(c)]

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

COCs	Concentration Limits
Radium-228	0.00022 Ci/m^3 (c)
Samarium-151	53,000 Ci/m^3 (e)
Selenium-79	28 Ci/m^3 (e)
Strontium-90	7,000 Ci/m^3 (f)
Technetium-99	1.3 Ci/m^3 (e)
Thorium-232	0.0060 Ci/m^3 (e)
Tritium	Unlimited
Uranium-233/234	0.074 Ci/m^3 (c)
Uranium-235	0.0027 Ci/m^3 (c)
Uranium-238 + daughters	0.012 Ci/m^3 (c)
Zirconium-93	140 Ci/m^3 (e)
Waste Characteristics	
Ignitability (flash point)	60°C/140°F[g]
pH	2 < pH <12.5
Moisture content	Fail

[a] Public exposure is limiting (DOE-RL 1994).
[b] Radioactive waste Class C limits also apply (10 CFR 61).
[c] *Remedial Investigation and Feasibility Study Report for the Environmental Restoration Disposal Facility* (DOE-RL 1994).
[d] Environmental Restoration Disposal Facility limit is lower of indicated value and transuranic limit of 100 nCi/g.
[e] *Environmental Restoration Disposal Facility Performance Assessment* (BHI 1995).
[f] Class C limit in accordance with 10 CFR 61.
[g] Ignitable nonliquids in accordance with WAC 173-303-090(5)(a)(ii). Capable under standard temperature and pressure of causing fire through friction, absorption of moisture, or spontaneous chemical changes, and when ignited, burns so vigorously and persistently that it creates a hazard.

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Wastes," *Code of Federal Regulations,* as amended.

BHI, 1995, *Environmental Restoration Disposal Facility Performance Assessment,* BHI-00169, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

DOE-RL, 1994, *Remedial Investigation and Feasibility Study Report for the Environmental Restoration Disposal Facility,* DOE/RL-93-99, Rev. 0, U. S. Department of Energy, Richland Operations Office, Richland, Washington.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code,* as amended.

CFR = *Code of Federal Regulations*
COC = contaminant of concern
PCB = polychlorinated biphenyl
SVOC = semivolatile organic compound

Table 5-2. Action Levels – Dangerous Waste Limits – WAC 173-303[a].

COCs	Action Levels[b]	
	Totals	TCLP
Silver	100 mg/kg	5 mg/L
Arsenic	100 mg/kg	5 mg/L
Barium	2,000 mg/kg	100 mg/L
Cadmium	20 mg/kg	1 mg/L
Chromium	100 mg/kg	5 mg/L
Mercury	4.0 mg/kg	0.2 mg/L
Lead	100 mg/kg	5 mg/L
Selenium	20 mg/kg	1 mg/L
PCBs	2 mg/kg	
VOAs	Chemical-specific	
SVOAs	Chemical-specific	
Ignitability	<140°F	
pH	2.0 < pH <12.5	

[a] WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.
[b] UHCs may require lower limits in accordance with 40 CFR 268.48.

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

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

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

COCs	Concentration Limits
VOCs	
EPA VOA target analyte list	Compound- or chemical family-specific.
SVOCs	
EPA SVOA target analyte list	Compound- or chemical family-specific.
Metals	
Aluminum	No specific limits. Information needed for development of ETF waste profile.
Antimony	
Arsenic	
Barium	
Beryllium	
Cadmium	
Calcium	
Chromium	
Copper	
Iron	
Lead	
Magnesium	
Manganese	
Mercury	
Nickel	
Potassium	
Selenium	
Silicon	
Silver	
Sodium	
Uranium	
Vanadium	
Zinc	
Nonmetals	
Ammonia	100,000 mg/L

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

COCs	Concentration Limits
Bromide	No specific limits. Information needed for development of ETF waste profile.
Chloride	
Cyanide	
Fluoride	
Nitrate	
Nitrite	
Phosphate	
Sulphate	
Radionuclides	
Americium-241	No specific limits. Information needed for development of ETF waste profile.
Antimony-125	
Carbon-14	
Cerium-144	
Cesium-134	
Cesium-137	
Cobalt-60	
Curium-244	
Europium-154	
Europium-155	
Iodine-129	
Neptunium-237	
Niobium-94	
Plutonium-238	
Plutonium-239/240	
Radium-226	
Ruthenium-106	
Selenium-79	
Strontium-90	
Technetium-99	
Tritium	
Zinc-65	

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

COCs	Concentration Limits
Waste Characteristics	
pH	0.5 < pH < 13.0
Gross alpha	No specific limits. Information needed for development of ETF waste profile.
Gross beta	
TSS	
TDS	
TOC	
Conductivity	

COC = contaminant of concern
EPA = U.S. Environmental Protection Agency
ETF = Effluent Treatment Facility
SVOA = semivolatile organic analyte
SVOC = semivolatile organic compound
TDS = total dissolved solids
TOC = total organic carbon
TSS = total suspended solids
VOA = volatile organic analyte
VOC = volatile organic compound

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

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

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

Table 5-5. Action Levels – BHI-EE-10 Radiological Release Limits.[a] (2 Pages)

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

[a] BHI-EE-10, *Waste Management Plan*, Bechtel Hanford, Inc., Richland, Washington.
COC = contaminant of concern
N/A = not applicable
WS = waste stream

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

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

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

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

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

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

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

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Wastes," *Code of Federal Regulations,* as amended.

BHI, 2001, *Safety Analysis for the Environmental Restoration Disposal Facility,* BHI-00370, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2002, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, BHI-00139, Rev. 4, Bechtel Hanford, Inc., Richland, Washington.

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

6.0 STEP 6 – SPECIFY TOLERABLE LIMITS ON DECISION ERRORS

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

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

6.1 DECISION ERRORS

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

6.2 NULL HYPOTHESIS

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

Table 6-1. Defining the Null Hypothesis.

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

7.0 STEP 7 – OPTIMIZE THE DESIGN

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

7.1 FOCUSED SAMPLE DESIGN

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

7.2 SPECIFIC MEDIA SAMPLING

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

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

Table 7-1. Specific Media Sampling. (5 Pages)

WS #	Waste Stream	Media	Existing Data	Sampling Methods, If Existing Sample Data are Determined Insufficient to Characterize Waste	COC
1	Bulk demolition debris	Exposed surfaces	Existing historical laboratory data (Table 1-4), Appendix A, existing inventory estimates (Tables 1-5 through 1-11), and waste disposition documentation (Table 1-12)	Field radiation surveys or NDA, as needed; media sampling and analysis, as needed; see Table 3-1	See Table 1-18
2	ACM	Exposed surfaces and asbestos-impregnated materials (e.g., floor tiles, ceiling tiles, cement asbestos board, cove mastic, sheetrock tape, gaskets, insulation, piping, and roofing materials)	Existing historical laboratory data (Table 1-4), Appendix A, and waste disposition documentation (Table 1-12)	Field radiation surveys or NDA, as needed, and scraping, coring, or other appropriate method; AHERA guidelines for the appropriate type of ACM or pipe insulation	Asbestos; see Table 1-18
3	Miscellaneous aqueous liquids	Aqueous liquid residuals identified in piping system pumps, sumps, tanks, piping, drains, and processing equipment	Existing historical laboratory data (Table 1-4), Appendix A, existing inventory estimates (Tables 1-5 through 1-11), and waste disposition documentation (Table 1-12)	One representative sample per container or batch of compatible material from the same source	See Table 1-18
4	Miscellaneous solids	Sediments and residuals identified in piping system pumps, sumps, tanks, piping, rains, and processing equipment	Existing historical laboratory data (Table 1-4), Appendix A, existing inventory estimates (Tables 1-5 through 1-11), and waste disposition documentation (Table 1-12)	Field radiation surveys or NDA, as needed; media sampling and analysis, as needed; see Table 3-1	See Table 1-18

Table 7-1. Specific Media Sampling. (5 Pages)

WS #	Waste Stream	Media	Existing Data	Sampling Methods, If Existing Sample Data are Determined Insufficient to Characterize Waste	COC
5	Lubrication grease, oil, hydraulic oils (includes door actuators and transformer oil)	Nonaqueous liquids	Existing historical laboratory data (Table 1-4), Appendix A, existing inventory estimates (Tables 1-5 through 1-11), and waste disposition documentation (Table 1-12)	One representative sample per container or batch of compatible material from the same source	See Table 1-18
6	Refrigerated systems	Residuals identified in piping system	Existing historical laboratory data (Table 1-4), Appendix A, existing inventory estimates (Tables 1-5 through 1-11), and waste disposition documentation (Table 1-12)	Field radiation surveys; see Table 3-1	See Table 1-18
7	Mercury switches	Switchgears	Existing historical laboratory data (Table 1-4), Appendix A, existing inventory estimates (Tables 1-5 through 1-11), and waste disposition documentation (Table 1-12)	Field radiation surveys; see Table 3-1	See Table 1-18
8	Incandescent light fixtures	Lead-base bulbs	Existing historical laboratory data (Table 1-4), Appendix A, existing inventory estimates (Tables 1-5 through 1-11), and waste disposition documentation (Table 1-12)	Field radiation surveys; see Table 3-1	Lead
9	Florescent light ballasts	Internal light ballasts	Existing historical laboratory data (Table 1-4), Appendix A, existing inventory estimates (Tables 1-5 through 1-11), and waste disposition documentation (Table 1-12)	Field radiation surveys; see Table 3-1	PCBs

Table 7-1. Specific Media Sampling. (5 Pages)

WS #	Waste Stream	Media	Existing Data	Sampling Methods, If Existing Sample Data are Determined Insufficient to Characterize Waste	COC
10	Lead packing in process piping, lead shielding	Lead packing material, lead bricks, blankets	Existing historical laboratory data (Table 1-4), Appendix A, existing inventory estimates (Tables 1-5 through 1-11), and waste disposition documentation (Table 1-12)	Field radiation surveys; see Table 3-1	See Table 1-18
11	Emergency light batteries	Battery constituents	Existing historical laboratory data (Table 1-4), Appendix A, existing inventory estimates (Tables 1-5 through 1-11), and waste disposition documentation (Table 1-12)	Field radiation surveys; see Table 3-1	Cadmium, nickel, lead, mercury, sulfides, acid
12	Exit signs and smoke detectors	Internal radioactive sources	Existing historical laboratory data (Table 1-4), Appendix A, existing inventory estimates (Tables 1-5 through 1-11), and waste disposition documentation (Table 1-12)	Field radiation surveys; see Table 3-1	Tritium, americium-241
13	HEPA filters	Filter media	Existing historical laboratory data (Table 1-4), Appendix A, existing inventory estimates (Tables 1-5 through 1-11), and waste disposition documentation (Table 1-12)	Field radiation surveys or NDA, as needed; media sampling and analysis; see Table 3-1	See Table 1-18
14	Underground contaminated waste piping, cable, ducts, wood, and soils	Exposed surfaces and asbestos felt wrap	Existing historical laboratory data (Table 1-4), Appendix A, existing inventory estimates (Tables 1-5 through 1-11), and waste disposition documentation (Table 1-12)	Field radiation surveys or NDA, as needed, and scraping, coring, or other appropriate method; AHERA guidelines for the appropriate type of ACM or pipe insulation	See Table 1-18, asbestos

Table 7-1. Specific Media Sampling. (5 Pages)

WS #	Waste Stream	Media	Existing Data	Sampling Methods, If Existing Sample Data are Determined Insufficient to Characterize Waste	COC
15	Miscellaneous materials for salvage	Exposed surfaces/paint	Existing historical laboratory data (Table 1-4), Appendix A, existing inventory estimates (Tables 1-5 through 1-11), and waste disposition documentation (Table 1-12)	Field radiation surveys or NDA, as needed; media sampling and analysis; see Table 3-1	See Table 1-18
16	Unexpected media and anomalous waste forms	Exposed surfaces	None	Field radiation surveys or NDA, as needed; media sampling and analysis; see Table 3-1	See Table 1-18
17	Process equipment/systems and building structure within SSE (for archive information)	Exposed surfaces	Existing historical laboratory data (Table 1-4), Appendix A, and existing inventory estimates (Tables 1-5 through 1-11)	Field radiation surveys; see Table 3-1	See Table 1-18
18	Waste from biological sources (e.g., feces, nests, carcasses)	Solids and residuals	None	Field radiation surveys or NDA, as needed; one representative sample per batch of compatible material from the same source	See Table 1-18
19	Charcoal filters	Filter media	Existing historical laboratory data (Table 1-4), Appendix A, existing inventory estimates (Tables 1-5 through 1-11), and waste disposition documentation (Table 1-12)	Field radiation surveys or NDA, as needed; one representative sample per batch of compatible material from the same source	See Table 1-18

Table 7-1. Specific Media Sampling. (5 Pages)

WS #	Waste Stream	Media	Existing Data	Sampling Methods, If Existing Sample Data are Determined Insufficient to Characterize Waste	COC
20	Fission Products Trap	Exposed surfaces	Existing historical laboratory data (Table 1-4), Appendix A, existing inventory estimates (Tables 1-5 through 1-11), and waste disposition documentation (Table 1-12)	Field radiation surveys or NDA, as needed; media sampling and analysis, as needed; see Table 3-1	See Table 1-18

ACM = asbestos-containing material
AHERA = *Asbestos Hazard Emergency Response Act of 1986*, 20 U.S.C. 52, Sec. 4011, et seq.
COC = contaminant of concern
HEPA = high-efficiency particulate air
NDA = nondestructive assay
PCB = polychlorinated biphenyl
SSE = safe storage enclosure
WS = waste stream

7.3 NONDESTRUCTIVE ASSAY

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

The subcontractor's quality control procedures shall be compatible with specifications in the *Hanford Analytical Services Quality Assurance Requirements Document* (DOE-RL 1998). Applicable quality assurance procedures shall be followed in the field to ensure that reliable data are obtained.

7.4 RADIOLOGICAL SURVEYS

7.4.1 Radiological Surveys

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

In addition, the Advanced Characterization System (ACS) may be used to obtain information on gamma-emitting radionuclide concentrations. The project radiological engineer will determine the use and application of the ACS and the scaling of this data for determining nongamma-emitting radionuclides as appropriate. Trained technicians will operate the ACS in accordance with appropriate procedures and/or task instructions.

7.4.2 Percent Profile Verification Surveys

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

7.4.3 Material Release Surveys for Reuse

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

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

7.5 ANOMALOUS WASTE MATERIALS

Anomalous waste materials include any unplanned or unexpected material discovered during operations that may require additional sampling and analysis to support waste designation. The anomalous waste category is provided to allow field decision making based on "as-found" conditions discovered during demolition. Waste Operations will support the final determination of the sample analysis that is required on a case-by-case basis. The project will evaluate appropriate historical information, process knowledge, and existing analytical data to determine if additional analytical information is needed to facilitate the appropriate disposal pathway.

8.0 REFERENCES

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Wastes," *Code of Federal Regulations*, as amended.

40 CFR 261, "Identification and Listing of Hazardous Waste," *Code of Federal Regulations*, as amended.

40 CFR 268, "Land Disposal Restrictions," *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.

Asbestos Hazard Emergency Response Act of 1986, 20 U.S.C. 52, Sec. 4011, et seq.

BHI-EE-01, *Waste Management Plan,* Bechtel Hanford, Inc., Richland, Washington.

BHI, 1995, *Environmental Restoration Disposal Facility Performance Assessment,* BHI-00169, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2001, *Safety Analysis for the Environmental Restoration Disposal Facility*, BHI-00370, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2002, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, BHI-00139, Rev. 4, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2003, *Environmental Restoration Disposal Facility Waste Profile Datasheet,* WP-100NR2001, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2005, *105-N and 109-N Final Hazard Categorization for ISS,* Calculation Brief No. 0100N-CA-N0069, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. 9601, et seq.

Croff, A. G., 1983, "ORIGEN2: A Versatile Computer Code for Calculating the Nuclide Compositions and Characteristics of Nuclear Materials," *Nucl. Technol.*, 62, p 335, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

DOE-RL, 1994, *Remedial Investigation and Feasibility Study Report for the Environmental Restoration Disposal Facility,* DOE/RL-93-99, Rev. 0, U. S. Department of Energy, Richland Operations Office, Richland, Washington.

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DOE-RL, 1998, *Hanford Analytical Services Quality Assurance Requirements Document*, DOE/RL-96-68, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2005, *Removal Action Work Plan for 105-N/109-N Buildings Interim Safe Storage and Related Facilities,* DOE/RL-2005-43, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, 2005, *105-N Reactor Building and 109-N Heat-Exchanger Building Action Memorandum,* CCN119850, Washington State Department of Ecology, Richland, Washington.

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

EPA, 1983, *Methods for Chemical Analysis of Water and Wastes*, EPA 600/4-79-020, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1997, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, SW-846, 3rd ed., as amended, U.S. Environmental Protection Agency, Washington, D.C.

HNF-EP-0063, 2002, *Hanford Site Waste Acceptance Criteria*, Fluor Hanford, Inc., Richland, Washington.

Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901, et seq.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

APPENDIX A

ANALYTICAL DATA

APPENDIX A
ANALYTICAL DATA

This data quality objective summary report calls for using existing information, process knowledge, and applicable data instead of collecting additional samples wherever possible. Table A-1 summarizes a portion of the existing information that is available to be used for characterizing the waste streams that will be generated during the Reactor Interim Safe Storage Project. These data, coupled with any other information or applicable data, will be compared with existing waste profiles to determine if additional sampling is required.

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
Waste Stream #1 - Bulk Demolition Debris					
105-N Lift Station Paint Chips	105-N Lift Station	06-Mar-97	B0JX80	EL-1301 pg 50	RCF screen for offsite shipment
105-N Lift Station Paint Chips	105-N Lift Station	06-Mar-97	B0JX81	EL-1301 pg 50	Sample consisted of white paint and red primer under red paint
105-N Building Wall Residue Sampling	Corridor 15 at 105-N	26-May-98	B0P066	NA	
100N Ancillary Facilities & 190-DR Other Solid Sampling for ERDF Waste Designation	1714NA	20-May-04	J01J86	EL-1516-2, pg 85	Red paint on fire lines
100N Ancillary Facilities & 190-DR Other Solid Sampling for ERDF Waste Designation	1714NA	25-May-04	J01J87	EL-1516-2, pg 91	Gray paint on transformers.
100N Ancillary Facilities & 190-DR Other Solid Sampling for ERDF Waste Designation	1714NA	20-May-04	J01J88	EL-1516-2, pg 85	Silver paint on steel support beams
100N Ancillary Facilities & 190-DR Other Solid Sampling for ERDF Waste Designation	1714NA	20-May-04	J01J89	EL-1516-2, pg 85	Beige paint on office walls
Waste Stream #2 – Asbestos-Containing Material					
105-N Roof Sampling	105-N Roof	06-Jun-97	B0L7X2	EFL-1133-4, pg 5	105-N +14 ft front side
105-N Roof Sampling	105-N Roof	06-Jun-97	B0L7X3	EFL-1133-4, pg 5	105-N +14 ft front side
105-N Roof Sampling	105-N Roof	06-Jun-97	B0L7X4	EFL-1133-4, pg 5	105-N +28 ft

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
105-N Roof Sampling	105-N Roof	06-Jun-97	B0L7X5	EFL-1133-4, pg 5	105-N +40 ft north side
105-N Roof Sampling	105-N Roof	06-Jun-97	B0L7X6	EFL-1133-4, pg 5	105-N +14 ft north side
105-N Roof Sampling	105-N Roof	06-Jun-97	B0L7X7	EFL-1133-4, pg 5	105-N +14 ft over basin change room
105-N Roof Sampling	105-N Roof	06-Jun-97	B0L7X8	EFL-1133-4, pg 5	105-N +70 ft middle of roof
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R670	EFL-1133-6, pg 1-3	109-N roof/cell # Aux-4
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R671	EFL-1133-6, pg 1-3	109-N roof/cell #3-2
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R672	EFL-1133-6, pg 1-3	109-N roof/cell #6-6
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6C0	EFL-1133-6, pg 1-3	109-N roof/cell #1-1
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6C1	EFL-1133-6, pg 1-3	109-N roof/cell #1-2
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6C2	EFL-1133-6, pg 1-3	109-N roof/cell #1-3
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6C3	EFL-1133-6, pg 1-3	109-N roof/cell #1-5
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6C4	EFL-1133-6, pg 1-3	109-N roof/cell #Aux-1
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6C5	EFL-1133-6, pg 1-3	109-N roof/cell #Aux-2
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6C6	EFL-1133-6, pg 1-3	109-N roof/cell #Aux-4

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6C7	EFL-1133-6, pg 1-3	109-N roof/cell #2-1
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6C8	EFL-1133-6, pg 1-3	109-N roof/cell #2-2
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6C9	EFL-1133-6, pg 1-3	109-N roof/cell #2-4
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6D0	EFL-1133-6, pg 1-3	109-N roof/cell #3-1
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6D1	EFL-1133-6, pg 1-3	109-N roof/cell #3-2
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6D2	EFL-1133-6, pg 1-3	109-N roof/cell #3-3
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6D3	EFL-1133-6, pg 1-3	109-N roof/cell #3-4
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6D4	EFL-1133-6, pg 1-3	109-N roof/cell #4-1
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6D5	EFL-1133-6, pg 1-3	109-N roof/cell #4-2
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6D6	EFL-1133-6, pg 1-3	109-N roof/cell #4-3
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6D7	EFL-1133-6, pg 1-3	109-N roof/cell #4-4
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6D8	EFL-1133-6, pg 1-3	109-N roof/cell #5-1
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6D9	EFL-1133-6, pg 1-3	109-N roof/cell #5-2
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6F0	EFL-1133-6, pg 1-3	109-N roof/cell #5-3

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6F1	EFL-1133-6, pg 1-3	109-N roof/cell #5-4
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6F2	EFL-1133-6, pg 1-3	109-N roof/cell #6-1
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6F3	EFL-1133-6, pg 1-3	109-N roof/cell #6-2
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6F4	EFL-1133-6, pg 1-3	109-N roof/cell #6-3
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6F5	EFL-1133-6, pg 1-3	109-N roof/cell #6-4
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6F6	EFL-1133-6, pg 1-3	109-N roof/cell #6-5
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6F7	EFL-1133-6, pg 1-3	109-N roof/cell #6-6
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6F8	EFL-1133-6, pg 1-3	109-N roof/cell #C-1
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6F9	EFL-1133-6, pg 1-3	109-N roof/cell #C-2
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6H0	EFL-1133-6, pg 1-3	109-N roof/cell #C-3
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6H1	EFL-1133-6, pg 1-3	109-N roof/cell #C-4
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6J0	EFL-1133-6, pg 1-3	109-N roof/cell #1-1
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6J1	EFL-1133-6, pg 1-3	109-N roof/cell #1-2
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6J2	EFL-1133-6, pg 1-3	109-N roof/cell #1-3

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6J3	EFL-1133-6, pg 1-3	109-N roof/cell #1-5
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6J4	EFL-1133-6, pg 1-3	109-N roof/cell #Aux-1
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6J5	EFL-1133-6, pg 1-3	109-N roof/cell #Aux-2
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6J6	EFL-1133-6, pg 1-3	109-N roof/cell #Aux-4
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6J7	EFL-1133-6, pg 1-3	109-N roof/cell #2-1
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6J8	EFL-1133-6, pg 1-3	109-N roof/cell #2-2
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6J9	EFL-1133-6, pg 1-3	109-N roof/cell #2-4
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6K0	EFL-1133-6, pg 1-3	109-N roof/cell #3-1
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6K1	EFL-1133-6, pg 1-3	109-N roof/cell #3-2
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6K2	EFL-1133-6, pg 1-3	109-N roof/cell #3-3
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6K3	EFL-1133-6, pg 1-3	109-N roof/cell #3-4
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6K4	EFL-1133-6, pg 1-3	109-N roof/cell #4-1
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6K5	EFL-1133-6, pg 1-3	109-N roof/cell #4-2
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6K6	EFL-1133-6, pg 1-3	109-N roof/cell #4-3

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6K7	EFL-1133-6, pg 1-3	109-N roof/cell #4-4
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6K8	EFL-1133-6, pg 1-3	109-N roof/cell #5-1
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6K9	EFL-1133-6, pg 1-3	109-N roof/cell #5-2
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6L0	EFL-1133-6, pg 1-3	109-N roof/cell #5-3
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6L1	EFL-1133-6, pg 1-3	109-N roof/cell #5-4
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6L2	EFL-1133-6, pg 1-3	109-N roof/cell #6-1
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6L3	EFL-1133-6, pg 1-3	109-N roof/cell #6-2
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6L4	EFL-1133-6, pg 1-3	109-N roof/cell #6-3
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6L5	EFL-1133-6, pg 1-3	109-N roof/cell #6-4
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6L6	EFL-1133-6, pg 1-3	109-N roof/cell #6-5
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6L7	EFL-1133-6, pg 1-3	109-N roof/cell #6-6
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6L8	EFL-1133-6, pg 1-3	109-N roof/cell #C-1
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6L9	EFL-1133-6, pg 1-3	109-N roof/cell #C-2
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6M0	EFL-1133-6, pg 1-3	109-N roof/cell #C-3

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
109-N Roof Sampling	109-N Roof	21-Oct-98	B0R6M1	EFL-1133-6, pg 1-3	109-N roof/cell #C-4
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T697	CCN #065825	Black textured floor mat
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T698	CCN #065825	White chaulky material over pipes
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T699	CCN #065825	Gray caulk patch
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6B0	CCN #065825	Black tar-like patch
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6B1	CCN #065825	TSI elbow/joint insulation.
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6B2	CCN #065825	TSI patch material
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6B3	CCN #065825	Black textured floor mat
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6B4	CCN #065825	Corrugated metal roof
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6B5	CCN #065825	Black tar-like patch
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6B6	CCN #065825	White material in pipe runs
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6B7	CCN #065825	Corrugated metal roof
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6B8	CCN #065825	White material in pipe runs
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6B9	CCN #065825	Black textured floor mat
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6C0	CCN #065825	White caulk-like patch
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6C1	CCN #065825	Black tar-like patch
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6C2	CCN #065825	Corrugated metal roof
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6C3	CCN #065825	White material in pipe runs
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6C4	CCN #065825	White material in pipe runs
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6C5	CCN #065825	TSI insulation
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6C6	CCN #065825	White material in pipe runs
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6C7	CCN #065825	White insulation material

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6C8	CCN #065825	Black tar-like patch
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6C9	CCN #065825	Gray caulk patch
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6D0	CCN #065825	White caulk-like patch
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6D1	CCN #065825	White caulk-like patch
109-N Roof Sampling	109-N Roof	10-Nov-98	B0T6D2	CCN #065825	TSI elbow/joint insulation.
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6D3	CCN #065825	TSI elbow/joint insulation.
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6D4	CCN #065825	Gray caulk patch
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6D5	CCN #065825	TSI elbow/joint insulation
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6D6	CCN #065825	TSI elbow/joint insulation
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6D7	CCN #065825	White material in pipe runs
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6D8	CCN #065825	TSI elbow/joint insulation
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6D9	CCN #065825	Gray caulk patch
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6F0	CCN #065825	White caulk-like patch
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6F1	CCN #065825	Hard black patch material on HVAC duct
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6F2	CCN #065825	HVAC damping boot
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6F3	CCN #065825	TSI patch material
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6F4	CCN #065825	White caulk-like patch
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6F5	CCN #065825	Black tar-like patch
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6F6	CCN #065825	Dark brown fibrous mat
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6F7	CCN #065825	Light tan thin coat patch
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6F8	CCN #065825	TSI elbow/joint insulation
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6F9	CCN #065825	Thin gray elastic covering
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6H0	CCN #065825	Black tar-like backing on HVAC

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6H1	CCN #065825	Light brown elastic patch
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6H2	CCN #065825	Gray caulk-like under HVAC flashing
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6H3	CCN #065825	Light tan thin coat patch
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6H4	CCN #065825	Light tan thin coat patch
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6H5	CCN #065825	Light tan thin coat patch
109-N Roof Sampling	109-N Roof	11-Nov-98	B0T6H6	CCN #065825	TSI elbow/joint insulation
109-N Roof Sampling	109-N Roof	05-Mar-99	B0V0K3	EL-1381-1	109-N roof 40 ft level
109-N Roof Sampling	109-N Roof	05-Mar-99	B0V0K4	EL-1381-1	109-N roof 40 ft level
109-N Roof Sampling	109-N Roof	05-Mar-99	B0V0K5	EL-1381-1	109-N roof 40 ft level
109-N Roof Sampling	109-N Roof	05-Mar-99	B0V0K6	EL-1381-1	105-N roof 70 ft level
109-N Roof Sampling	109-N Roof	05-Mar-99	B0V0K7	EL-1381-1	105-N roof 70 ft level
109-N Roof Sampling	109-N Roof	05-Mar-99	B0V0K8	EL-1381-1	105-N roof 70 ft level
109-N Roof Sampling	109-N Roof	05-Mar-99	B0V0K9	EL-1381-1	105-N roof 70 ft level
Waste Stream #3 - Miscellaneous Aqueous Liquids					
109-N Oil Sampling -- 1000 Steam Cleaner Liquid		18-Jun-96	B0HGK3	EFL-1133-1, pg 115	Liquid from a drum
105-N Basin - Bulk Water Sampling	105-N Basin	03-Jun-97	B0L5L8	EFL-1133-4, pg 2	Liquid from 105-N Basin
105-N Basin - Bulk Water Sampling	105-N Basin	03-Jun-97	B0L5L9	EFL-1133-4, pg 2	Liquid from 105-N Basin
105-N Basin - Bulk Water Sampling	105-N Basin	03-Jun-97	B0L5M0	EFL-1133-4, pg 3	Liquid from 105-N Basin
105-N Basin - Bulk Water Sampling	105-N Basin	03-Jun-97	B0L5M1	EFL-1133-4, pg 3	Liquid from 105-N Basin

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
105-N Basin - Bulk Water Sampling	105-N Basin	03-Jun-97	B0L5M2	EFL-1133-4, pg 3	Liquid from 105-N Basin
105-N Basin - Bulk Water Sampling	105-N Basin	03-Jun-97	B0L5M3	EFL-1133-4, pg 3	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	20-Jun-97	B0L7J4	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	20-Jun-97	B0L7J5	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	20-Jun-97	B0L7J6	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	20-Jun-97	B0L7J7	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	20-Jun-97	B0L7J8	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	20-Jun-97	B0L7J9	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7K0	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7K1	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7K2	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7K3	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7K4	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7K5	NA	Liquid from 105-N Basin

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7K6	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7K7	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7K8	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7K9	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7L0	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7L1	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7L2	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7L3	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7L4	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7L5	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7L6	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7L7	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7L8	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7L9	NA	Liquid from 105-N Basin

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7M0	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7M1	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7M2	NA	Liquid from 105-N Basin
105-N Basin Water - Pre/Post Filtration	105-N Basin	21-Jun-97	B0L7M3	NA	Liquid from 105-N Basin
105-N/109-N Zone 1 Materials Drum Sampling - Other Liquid	105-N	12-Sep-97	B0LYR6	EL-1309-1, pg 21	Liquid from drum collected within Zone 1
105-N/109-N Zone 1 Materials Drum Sampling - Other Liquid	105-N	11-Sep-97	B0LYR8	EL-1309-1, pg 20	Liquid from drum collected within Zone 1
105-N/109-N Zone 1 Materials Drum Sampling - Other Liquid	105-N	11-Sep-97	B0LYT0	EL-1309-1, pg 20	Liquid from drum collected within Zone 1
105-N/109-N Zone 1 Materials Drum Sampling - Other Liquid	105-N	12-Sep-97	B0LYT2	EL-1309-1, pg 21	Liquid from drum collected within Zone 1
105-N/109-N Zone 1 Materials Drum Sampling - Other Liquid	105-N	11-Sep-97	B0LYV0	EL-1309-1, pg 20	Liquid from drum collected within Zone 1
105-N/109-N Zone 1 Materials Drum Sampling - Other Liquid	105-N	12-Sep-97	B0LYV3	EL-1309-1, pg 21	Liquid from drum collected within Zone 1
105-N/109-N Zone 1 Materials Drum Sampling - Other Liquid	105-N	11-Sep-97	B0LYV4	EL-1309-1, pg 22	Liquid from drum collected within Zone 1
105-N/109-N Zone 1 Materials Drum Sampling - Other Liquid	105-N	12-Sep-97	B0LYV7	EL-1309-1, pg 21	Liquid from drum collected within Zone 1
105-N/109-N Zone 1 Materials Drum Sampling - Other Liquid	105-N	11-Sep-97	B0LYV8	EL-1309-1, pg 20	Liquid from drum collected within Zone 1
105-N/109-N Zone 1 Materials Drum Sampling - Other Liquid	105-N	12-Sep-97	B0LYW1	NA	

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
105-N/109-N Zone 1 Materials Drum Sampling - Other Liquid	105-N	12-Sep-97	B0LYW4	NA	
105-N/109-N Zone 1 Materials Drum Sampling - Other Liquid	105-N	12-Sep-97	B0LYY0	NA	
105-N Basin Water Testing	105-N Basin	25-Nov-97	B0MJ73	NA	
105-N Basin Water Testing	105-N Basin	25-Nov-97	B0MJ75	NA	
105-N Basin Water Testing	105-N Basin	25-Nov-97	B0MJ76	NA	
105-N Basin Water Testing	105-N Basin	25-Nov-97	B0MJ77	NA	
105-N Basin Water Testing	105-N Basin	26-Nov-97	B0MJ78	NA	
105-N Basin Phase 2 Rinsate Samples	105-N Basin	22-Dec-97	B0MPC7	NA	
105-N Basin - Bulk Water Sampling - Quick Turn	105-N Basin	09-Apr-98	B0NKT2	NA	
105-N Basin - Bulk Water Sampling - Quick Turn	105-N Basin	23-Jun-98	B0NRF5	NA	
105-N Basin - Bulk Water Sampling - Quick Turn	105-N Basin	26-Jun-98	B0NRF6	NA	
105-N Basin - Bulk Water Sampling - Quick Turn	105-N Basin	30-Jun-98	B0NRF7	NA	
105-N Basin - Bulk Water Sampling - Quick Turn	105-N Basin	09-Jul-98	B0NRF8	NA	
105-N Basin - Bulk Water Sampling - Quick Turn	105-N Basin	11-Jul-98	B0NRF9	NA	
Waste Stream #4 - Miscellaneous Bulk Solids					
100N Emergency Dump Basin -- Sediment Sampling	100N Pad	22-May-96	B0HG98	EL-1133-1, pg 104	Sediment out of carboy that is described on pg 102 of the logbook

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
1300N Emergency Dump Basin Sediment Sampling	100N EDB burial box	25-Apr-97	B0K876	EL-1133-3, pg 18	Sticky clay-like material
1300N Emergency Dump Basin Sediment Sampling	100N EDB burial box	25-Apr-97	B0K878	EL-1133-3, pg 18	Sticky clay-like material
105-N Basin Lift Station Sediment Samples	105-N lift station	21-Apr-97	B0KBH6	EL-1133-3, pg 13	105-N lift station
105-N Basin Lift Station Sediment Samples	105-N lift station	21-Apr-97	B0KBH6-QES	EL-1133-3, pg 13	105-N lift station
1300N Emergency Dump Basin Sediment Sampling	1300N Emergency Dump	22-Sep-97	B0M119	EL-1309-1, pg 30	Sampled from drum of 1300N EDB sediment
1300N Emergency Dump Basin Sediment Sampling	1300N Emergency Dump	22-Sep-97	B0M120	EL-1309-1, pg 30	Sampled from drum of 1300N EDB sediment
105-N Basin Phase 2 Sediment Samples	105-N Basin	22-Dec-97	B0MPC8	NA	
105-N Basin Phase 2 Sediment Samples	105-N Basin	22-Dec-97	B0MPC9	NA	
105-N Basin Phase 2 Sediment Samples	105-N Basin	22-Dec-97	B0MPD0	NA	
105-N Basin Phase 2 Sediment Samples	105-N Basin	22-Dec-97	B0MPD1	NA	
105-N Basin Phase 2 Sediment Samples	105-N Basin	22-Dec-97	B0MPD3	NA	
105-N Basin Phase 2 Sediment Samples	105-N Basin	22-Dec-97	B0MPD4	NA	
105-N Basin Phase 2 Sediment Samples	105-N Basin	22-Dec-97	B0MPD5	NA	

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
105-N Basin Phase 2 Sediment Samples	105-N Basin	22-Dec-97	B0MPD6	NA	
N Reactor Fuel Storage Basin Water Filter	105-N Basin	22-Apr-97	B0K888	EL-1133-3, pg 20-21	N Reactor Fuel Storage Basin water filter
N Reactor Fuel Storage Basin Water Filter	105-N Basin	22-Apr-97	B0K889	EL-1133-3, pg 20-21	N Reactor Fuel Storage Basin water filter
N Reactor Fuel Storage Basin Water Filter	105-N Basin	22-Apr-97	B0K890	EL-1133-3, pg 20-21	N Reactor Fuel Storage Basin water filter
N Reactor Fuel Storage Basin Water Filter	105-N Basin	22-Apr-97	B0K891	EL-1133-3, pg 20-21	N Reactor Fuel Storage Basin water filter
N Reactor Fuel Storage Basin Water Filter	105-N Basin	22-Apr-97	B0K892	EL-1133-3, pg 20-21	N Reactor Fuel Storage Basin water filter
N Reactor Fuel Storage Basin Water Filter	105-N Basin	24-Apr-97	B0K893	EL-1133-3, pg 20-21	N Reactor Fuel Storage Basin water filter
N Reactor Fuel Storage Basin Water Filter	105-N Basin	25-Apr-97	B0K894	EL-1133-3, pg 20-21	N Reactor Fuel Storage Basin water filter
N Reactor Fuel Storage Basin Water Filter	105-N Basin	25-Apr-97	B0K895	EL-1133-3, pg 20-21	N Reactor Fuel Storage Basin water filter
105-N Basin Sediment Samples - Phase 1	105-N Basin	11-Feb-97	B0JY49	EL-1287, pg 30	North cask pit sludge
100N Ancillary Facilities & 190-DR Other Solid Sampling for ERDF Waste Designation	1304N	19-Feb-04	J01847	EL-1516-2, pg 46	Oiled sand collected from below the 1304N emergency dump tank
100N Ancillary Facilities & 190-DR Other Solid Sampling for ERDF Waste Designation	1304N	19-Feb-04	J01848	EL-1516-2, pg 46	Oiled sand collected from below the 1304N emergency dump tank

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
100N Ancillary Facilities & 190-DR Other Solid Sampling for ERDF Waste Designation	1304N	19-Apr-04	J01FV0	EL-1516-2, pg 75	Soil collected from where the railroad ties and rails are being removed northwest of the 1304N emergency dump basin. Activity levels range from 600K-900K direct on the soil and on the end of the railroad ties.
100N Ancillary Facilities & 190-DR Other Solid Sampling for ERDF Waste Designation	1304N	16-Apr-04	J01HK1	EL-1516-2, pg 78	Soil collected from where the railroad ties and rails are being removed northwest of the 1304N emergency dump basin. Activity levels range from 600K-900K direct on the soil and on the end of the railroad ties.
100N Ancillary Facilities & 190-DR Other Solid Sampling for ERDF Waste Designation	1714NA	24-May-04	J01J85	EL-1516-2, pg 88	White paint over red primer on metal around doorway. White paint over beige on corrugated metal. White paint on wood surfaces.
105-N Shops Parts Cleaner - Sludge	105-N Parts Shop	18-Jul-00	B0YN62	EFL-1133-8, pg 135	Sediment/sludge from sump at the 105-N parts shop
Waste Stream #5 - Plant Equipment Lubrication Grease, Oil, Hydraulic Oils, Transformer Oils, Oils in Door					
109-N Oil Sampling -- Oil	109-N Building	20-Jun-96	B0HGX4	EFL-1133-1, pg 117	109-N oil from drum
109-N Oil Sampling -- Oil	109-N Building	20-Jun-96	B0HGX5	EFL-1133-1, pg 117	109-N oil from drum
109-N Oil Sampling -- Oil	109-N Building	20-Jun-96	B0HGX6	EFL-1133-1, pg 117	109-N oil from drum
109-N Oil Sampling -- Oil	109-N Building	20-Jun-96	B0HGX7	EFL-1133-1, pg 117	109-N oil from drum
109-N Oil Sampling -- Oil	109-N Building	20-Jun-96	B0HGX8	EFL-1133-1, pg 117	109-N oil from drum
109-N Oil Sampling -- Oil	109-N Building	20-Jun-96	B0HGX9	EFL-1133-1, pg 117	109-N oil from drum
109-N Oil Sampling -- Oil	109-N Building	20-Jun-96	B0HGY0	EFL-1133-1, pg 117	109-N oil from drum

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
109-N Oil Sampling -- Oil	109-N Building	20-Jun-96	B0HGY1	EFL-1133-1, pg 118	109-N oil from drum
109-N Oil Sampling -- Oil	109-N Building	20-Jun-96	B0HGY2	EFL-1133-1, pg 118	109-N oil from drum
109-N Oil Sampling -- Oil	109-N Building	20-Jun-96	B0HGY3	EFL-1133-1, pg 118	109-N oil from drum
Waste Stream #6 - Refrigerated Systems					
Waste Stream #7 - Mercury Containing Equipment					
Waste Stream #8 - Fluorescent Light Tubes, Incandescent Light Bulbs					
Waste Stream #9 - Fluorescent Light Ballasts					
Waste Stream #10 - Lead Packing, Washers, and Shielding					
Waste Stream #11 - Emergency Light Batteries					
Waste Stream #12- Exit Signs and Light Batteries					
Waste Stream #13 - HEPA Filters					
RadCon Air Filter Analysis - 100N Fission Products Trap	100 N EPT Area	17-Dec-99	RCF 6924 AIR		
N-Facility Backlog/Compliance--Air Filters	116N Stack	29-Feb-96	B0H7D9	NA	
N-Facility Backlog/Compliance--Air Filters	116N Stack	29-Feb-96	B0H7F0	NA	
N-Facility Backlog/Compliance--Air Filters	116N Stack	29-Feb-96	B0H7F1	NA	
N-Facility Backlog/Compliance--Air Filters	116N Stack	29-Feb-96	B0H7F2	NA	
N-Facility Backlog/Compliance--Air Filters	116N Stack	29-Feb-96	B0H7F3	NA	

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
N-Facility Backlog/Compliance-- Air Filters	116N Stack	29-Feb-96	B0H7F4	NA	
N-Facility Backlog/Compliance-- Air Filters	116N Stack	29-Feb-96	B0H7F5	NA	
N-Facility Backlog/Compliance-- Air Filters	116N Stack	29-Feb-96	B0H7F6	NA	
N-Facility Backlog/Compliance-- Air Filters	116N Stack	29-Feb-96	B0H7F7	NA	
N-Facility Backlog/Compliance-- Air Filters	116N Stack	29-Feb-96	B0H7F8	NA	
N-Facility Backlog/Compliance-- Air Filters	116N Stack	29-Feb-96	B0H7F9	NA	
N-Facility Backlog/Compliance-- Air Filters	116N Stack	29-Feb-96	B0H7G0	NA	
N-Facility Backlog/Compliance-- Air Filters	116N Stack	29-Feb-96	B0H7G1	NA	
116N Main Stack and 107N Stack Air Filter Sampling -- Monthly	116N Stack & 107N Filter	04-Sep-96	B0J1D3	EFL-1133-2, pg 11	116N stack
116N Main Stack and 107N Stack Air Filter Sampling -- Monthly	116N Stack & 107N Filter	18-Sep-96	B0J1D4	EFL-1133-2, pg 11	116N stack
116N Main Stack and 107N Stack Air Filter Sampling	116N Stack & 107N Filter	24-Jan-96	B0J1H3	EFL-1133-2, pg 2	Air filter samples
116N Main Stack and 107N Stack Air Filter Sampling	116N Stack & 107N Filter	07-Feb-96	B0J1H4	EFL-1133-2, pg 2	Air filter samples
116N Main Stack and 107N Stack Air Filter Sampling	116N Stack & 107N Filter	21-Feb-96	B0J1H5	EFL-1133-2, pg 2	Air filter samples
116N Main Stack and 107N Stack Air Filter Sampling	116N Stack & 107N Filter	06-Mar-96	B0J1H6	EFL-1133-2, pg 2	Air filter samples

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
116N Main Stack and 107N Stack Air Filter Sampling	116N Stack & 107N Filter	20-Mar-96	B0J1H7	EFL-1133-2, pg 2	Air filter samples
116N Main Stack and 107N Stack Air Filter Sampling	116N Stack & 107N Filter	03-Apr-96	B0J1H8	EFL-1133-2, pg 2	Air filter samples
116N Main Stack and 107N Stack Air Filter Sampling	116N Stack & 107N Filter	17-Apr-96	B0J1H9	EFL-1133-2, pg 2	Air filter samples
116N Main Stack and 107N Stack Air Filter Sampling	116N Stack & 107N Filter	01-May-96	B0J1J0	EFL-1133-2, pg 2	Air filter samples
116N Main Stack and 107N Stack Air Filter Sampling	116N Stack & 107N Filter	15-May-96	B0J1J1	EFL-1133-2, pg 2	Air filter samples
116N Main Stack and 107N Stack Air Filter Sampling	116N Stack & 107N Filter	29-May-96	B0J1J2	EFL-1133-2, pg 2	Air filter samples
116N Main Stack and 107N Stack Air Filter Sampling	116N Stack & 107N Filter	12-Jun-96	B0J1J3	EFL-1133-2, pg 2	Air filter samples
116N Main Stack and 107N Stack Air Filter Sampling	116N Stack & 107N Filter	26-Jun-96	B0J1J4	EFL-1133-2, pg 2	Air filter samples
116N Main Stack and 107N Stack Air Filter Sampling	116N Stack & 107N Filter	10-Jul-96	B0J1J5	EFL-1133-2, pg 2	Air filter samples
116N Main Stack and 107N Stack Air Filter Sampling	116N Stack & 107N Filter	24-Jul-96	B0J1J6	EFL-1133-2, pg 2	Air filter samples
116N Main Stack and 107N Stack Air Filter Sampling	116N Stack & 107N Filter	07-Aug-96	B0J1J7	EFL-1133-2, pg 2	Air filter samples
116N Main Stack and 107N Stack Air Filter Sampling	116N Stack & 107N Filter	14-Aug-96	B0J1J8	EFL-1133-2, pg 2	Air filter samples
116N Main Stack and 107N Stack Air Filter Sampling -- Monthly 1997	116N Main Stack	12-Mar-97	B0JLN3	NA	

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
116N Main Stack and 107N Stack Air Filter Sampling -- Monthly 1997	116N Main Stack	26-Mar-97	B0JM28	NA	
116N Main Stack and 107N Stack Air Filter Sampling -- Monthly 1997	116N Main Stack	09-Apr-97	B0JM29	NA	
Waste Stream #14 - Underground Contaminated Waste Piping, Cable, Ducts, Wood, and Soils					
100-N Crib Sample Analysis - Soil	100-N Crib	17-Dec-98	B0TBY8-A	EFL-1133-6, pg 62	Soil from 1301N/1325N Crib
100-N Crib Sample Analysis - Soil	100-N Crib	17-Dec-98	B0TBY8-B	EFL-1133-6, pg 62	Soil from 1301N/1325N Crib
100-N Crib Sample Analysis - Soil	100-N Crib	17-Dec-98	B0TC00-A	EFL-1133-6, pg 62	Soil from 1301N/1325N Crib
100-N Crib Sample Analysis - Soil	100-N Crib	17-Dec-98	B0TC00-B	EFL-1133-6, pg 62	Soil from 1301N/1325N Crib
100-N Crib Sample Analysis - Soil	100-N Crib	21-Dec-98	B0TDJ2-A	EFL-1133-6, pg 66	Soil from 1301N/1325N Crib
100-N Crib Sample Analysis - Soil	100-N Crib	21-Dec-98	B0TDJ2-B	EFL-1133-6, pg 66	Soil from 1301N/1325N Crib
100-N Crib Sample Analysis - Soil	100-N Crib	21-Dec-98	B0TDJ3-A	EFL-1133-6, pg 67	Soil from 1301N/1325N Crib
100-N Crib Sample Analysis - Soil	100-N Crib	21-Dec-98	B0TDJ3-B	EFL-1133-6, pg 67	Soil from 1301N/1325N Crib

Table A-1. Analytical Data. (21 Pages)

SAF Title	Sample Location	Sample Date/Time	Sample Number	Logbook and Page	Comments
Waste Stream #15 - Miscellaneous Material for Salvage					
Waste Stream #16 - Unexpected Media and Waste Forms					
Waste Stream #17 - 105-N and 109-N Construction Materials Left In Situ Within SSE					
N Reactor Fuel Storage Basin Monitoring	105-N Room 191	12-Jul-96	B0HY92	EFL-1133-1, pg 124	Clear liquid from room 191
Waste Stream #18 - Waste from Biological Sources					
Waste Stream #19 - Charcoal Filters					
Waste Stream #20 - Fission Products Trap					
100-N Crib Sample Analysis - Soil	100-N Crib	17-Dec-98	B0TBY8-A	EFL-1133-6, pg 62	Soil from 1301N/1325N Crib – downstream of the FPT
100-N Crib Sample Analysis - Soil	100-N Crib	17-Dec-98	B0TBY8-B	EFL-1133-6, pg 62	Soil from 1301N/1325N Crib – downstream of the FPT
100-N Crib Sample Analysis - Soil	100-N Crib	17-Dec-98	B0TC00-A	EFL-1133-6, pg 62	Soil from 1301N/1325N Crib – downstream of the FPT
100-N Crib Sample Analysis - Soil	100-N Crib	17-Dec-98	B0TC00-B	EFL-1133-6, pg 62	Soil from 1301N/1325N Crib – downstream of the FPT
100-N Crib Sample Analysis - Soil	100-N Crib	21-Dec-98	B0TDJ2-A	EFL-1133-6, pg 66	Soil from 1301N/1325N Crib – downstream of the FPT
100-N Crib Sample Analysis - Soil	100-N Crib	21-Dec-98	B0TDJ2-B	EFL-1133-6, pg 66	Soil from 1301N/1325N Crib – downstream of the FPT
100-N Crib Sample Analysis - Soil	100-N Crib	21-Dec-98	B0TDJ3-A	EFL-1133-6, pg 67	Soil from 1301N/1325N Crib – downstream of the FPT
100-N Crib Sample Analysis - Soil	100-N Crib	21-Dec-98	B0TDJ3-B	EFL-1133-6, pg 67	Soil from 1301N/1325N Crib – downstream of the FPT

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