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

19-PFD-0019

MAY 20 2019

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

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

Addressees:

SAMPLING AND ANALYSIS PLAN FOR THE B PLANT COMPLEX TIER 2 BUILDINGS/STRUCTURES, DOE/RL-2017-45, REVISION 0

This letter transmits the approved Sampling and Analysis Plan for the B Plant Complex Tier 2 Buildings/Structures, DOE/RL-2017-45, Revision 0 to the U.S. Environmental Protection Agency and Washington State Department of Ecology.

This sampling and analysis plan establishes the data needs and defines the sampling and analysis requirements to characterize waste generated from decontamination, deactivation, decommissioning, and demolition of the B Plant Complex Tier 2 structures in the 200 East Area of the Hanford Site.

If you have any questions, please contact me, or your staff may contact, Mark French, of my staff, on (509) 373-9863.

Sincerely,

William F. Hamel, Assistant Manager
for the River and Plateau

PFD:PGE

Attachment

cc: See page 2

cc w/attach:
J. Atwood, YN
J. Bell, NPT
R. Buck, Wanapum
C. E. Cameron, EPA
L. Contreras, YN
M. Johnson, CTUIR
S. Leckband, HAB
N. M. Menard, Ecology
K. Niles, ODOE
S. N. Schleif, Ecology
Administrative Record (B Plant)
Environmental Portal

cc w/o attach:
S. G. Austin, CHPRC
S. L. Brasher, MSA
R. L. Cathel, CHPRC
S. W. Davis, MSA

DOE/RL-2017-45
Revision 0

Sampling and Analysis Plan for the B Plant Complex Tier 2 Buildings/Structures

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

U.S. DEPARTMENT OF ENERGY | Richland Operations Office

P.O. Box 550
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited

DOE/RL-2017-45
Revision 0

Sampling and Analysis Plan for the B Plant Complex Tier 2 Buildings/Structures

Date Published
April 2019

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

U.S. DEPARTMENT OF ENERGY | Richland Operations Office
P.O. Box 550
Richland, Washington 99352

APPROVED
By Julia Raymer at 2:13 pm, May 01, 2019

Release Approval | Date

Approved for Public Release;
Further Dissemination Unlimited

TRADEMARK DISCLAIMER

Reference herein to any specific commercial product, process, or service by tradename, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

This report has been reproduced from the best available copy.

Printed in the United States of America

Signature Page

Title: *Sampling and Analysis Plan for the B Plant Complex Tier 2 Buildings/Structures*

William F. Hammel, Jr. U.S. Department of Energy, Richland Operations Office	Signature	4/9/19 Date
Craig E. Cameron U.S. Environmental Protection Agency	Signature	4/9/19 Date
Stephanie N. Schleif Washington State Department of Ecology	Signature	4/9/19 Date

This page intentionally left blank.

Contents

1 Introduction 1-1

1.1 Project Scope and Objective 1-2
1.2 Background 1-2
1.3 Data Quality Objectives Summary 1-3
1.3.1 Statement of the Problem 1-3
1.3.2 Project Task and Problem Definition 1-4
1.3.3 Data Needs 1-5
1.3.4 Decision Rules 1-8
1.4 Contaminants of Concern 1-11
1.5 Project Schedule 1-12

2 Quality Assurance Project Plan 2-1

2.1 Project Management 2-1
2.1.1 Project/Task Organization 2-1
2.1.2 Quality Objectives and Criteria 2-5
2.1.3 Methods-Based Analysis 2-5
2.1.4 Analytical Priority 2-5
2.1.5 Special Training/Certification 2-5
2.1.6 Documents and Records 2-10
2.2 Data Generation and Acquisition 2-12
2.2.1 Analytical Methods Requirements 2-12
2.2.2 Field Analytical Methods 2-16
2.2.3 Quality Control 2-16
2.2.4 Measurement Equipment 2-19
2.2.5 Instrument and Equipment Testing, Inspection, and Maintenance 2-19
2.2.6 Instrument and Equipment Calibration and Frequency 2-19
2.2.7 Inspection and Acceptance of Supplies and Consumables 2-19
2.2.8 Nondirect Measurements 2-22
2.2.9 Data Management 2-22
2.3 Assessment and Oversight 2-22
2.3.1 Assessments and Response Actions 2-22
2.3.2 Reports to Management 2-23
2.4 Data Review and Usability 2-23
2.4.1 Data Review and Verification 2-23
2.4.2 Data Validation 2-23
2.4.3 Reconciliation with User Requirements 2-24

3 Field Sampling Plan 3-1
3.1 Sampling Design 3-1
3.1.1 Process Knowledge 3-1
3.1.2 Initial Characterization 3-3
3.1.3 Waste Characterization Work Packages 3-4
3.1.4 Media Sampling 3-4
3.1.5 Asbestos Inspection and Sampling 3-5
3.1.6 Post-Demolition Sampling 3-5
3.1.7 Anomalous Waste Materials 3-5
3.1.8 Statistical Sample Design 3-5
3.2 Sampling Location 3-6
3.3 Sampling Methods 3-6
3.3.1 Decontamination of Sampling Equipment 3-10
3.3.2 Radiological Field Data 3-10
3.3.3 Field Sampling 3-11
3.4 Documentation of Field Activities 3-12
3.5 Calibration of Field Equipment 3-13
3.6 Sample Handling 3-14
3.6.1 Containers 3-14
3.6.2 Container Labeling 3-14
3.6.3 Sample Custody 3-14
3.6.4 Sample Transportation 3-15
4 Management of Waste 4-1
5 Health and Safety Plan 5-1
6 References 6-1

Appendix

A 276BA Organic Storage Area ..... A-i

Figures

Figure 1-1. B Plant Complex Tier 2 Structures 1-1
Figure 2-1. Project Organization 2-2
Figure 3-1. Waste Characterization Sampling Design Flow Diagram 3-3

Tables

Table 1-1. Buildings/Structures in the Scope of this SAP 1-1
Table 1-2. DQO Team Members 1-3
Table 1-3. Principal Study Questions, Alternative Actions, and Decision Statements 1-4
Table 1-4. Global Data Needs 1-5
Table 1-5. Required Information for PSQs 1-5
Table 1-6. Possible Waste Streams 1-6
Table 1-7. Decision Rules 1-9
Table 1-8. Decision Rules with Detailed Parameters of Interest 1-10
Table 1-9. Radiological and Chemical Contaminants of Concern 1-12
Table 2-1. Data Quality Indicators 2-7
Table 2-2. Change Control for Sampling Projects 2-10
Table 2-3. Analytical Performance Requirements for Radionuclides 2-13
Table 2-4. Analytical Performance Requirements for Nonradionuclides 2-14
Table 2-5. Field and Laboratory Quality Control Requirements 2-16
Table 2-6. Sample Preservation, Container, Minimum Volume, and Holding Time Guidelines 2-20
Table 3-1. Sampling Table Summary 3-2
Table 3-2. Specific Media Sampling 3-7

This page intentionally left blank.

Terms

ALARA	as low as reasonably achievable
AM	action memorandum
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COC	contaminant of concern
CWC	Central Waste Complex
D4	decontamination, deactivation, decommissioning, and demolition
DOE	U.S. Department of Energy
DOE-RL	DOE Richland Operations Office
DOT	U.S. Department of Transportation
DQA	data quality assessment
DQI	data quality indicator
DQO	data quality objective
DR	decision rule
DS	decision statement
EB	equipment blank
ECO	environmental compliance officer
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FSP	field sampling plan
FTB	full trip blank
FWS	field work supervisor
FXR	field transfer blank
G/P	glass/plastic
HASQARD	Hanford Analytical Services Quality Assurance Requirements Document
HEIS	Hanford Environmental Information System
IATA	International Air Transport Association
LLW	low-level waste

MB	method blank
MDC	minimum detectable concentration
MLLW	mixed low-level waste
MS	matrix spike
MSD	matrix spike duplicate
NDA	nondestructive assay
PPE	personal protective equipment
PSQ	principal study question
QA	quality assurance
QAPjP	quality assurance project plan
QC	quality control
RCRA	*Resource Conservation and Recovery Act of 1976*
RCT	radiological control technician
SAP	sampling and analysis plan
SMR	Sample Management and Reporting
SPLIT	field split
SUR	surrogate
TSD	treatment, storage, and disposal
VOC	volatile organic compound
WAC	*Washington Administrative Code*
WIDS	Waste Information Data System
WIPP	Waste Isolation Pilot Plant

1 Introduction

This sampling and analysis plan (SAP) establishes the data needs and defines the sampling and analysis requirements to characterize waste generated from decontamination, deactivation, decommissioning, and demolition (D4) of the B Plant Complex Tier 2 structures in the 200 East Area of the Hanford Site. The B Plant Complex Tier 2 structures are listed in Table 1-1 and are depicted in Figure 1-1.

Table 1-1. Buildings/Structures in the Scope of this SAP

Appendix	Building/Structure Identification	Building/Structure Name
A	276BA [a,b]	Organic Storage Area
TBD	212B	Cask Load Out Station
	221BB [a]	Process Steam and Condensate Building
	221BF [a]	Condensate Effluent Discharge Facility
	271B	B Plant Support Building

a. Building/structure contains a treatment, storage, and/or disposal unit.

b. Building/structure added to scope of DOE/RL-2010-102, *Action Memorandum for Decontamination, Deactivation, Decommissioning, and Demolition (D4) Activities for 200 East Area Tier 2 Buildings/Structures*, by TPA-CN-722, *Tri-Party Agreement Change Notice Form: DOE/RL-2010-102, Rev 0., Decontamination, Deactivation, Decommissioning, and Demolition (D4) Activities for 200 East Tier 2 Buildings/Structures*.

TBD = to be determined

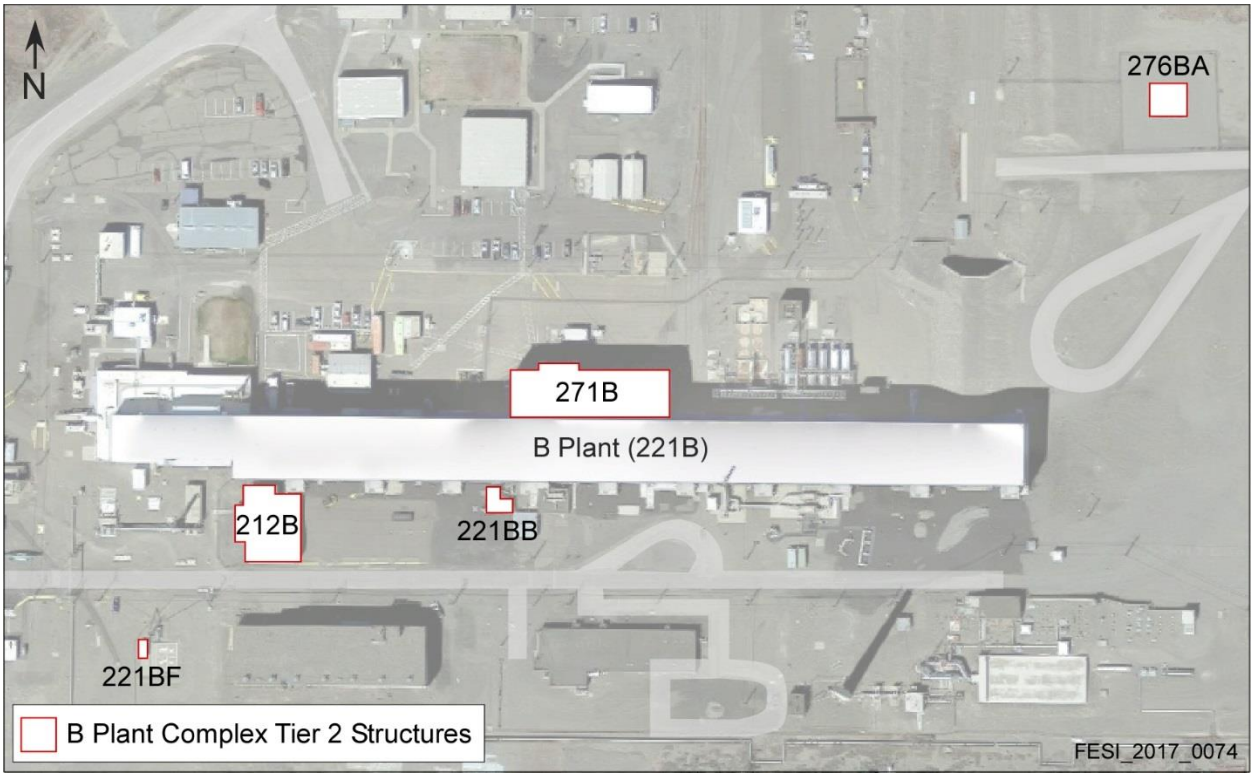

Figure 1-1. B Plant Complex Tier 2 Structures

This SAP has been prepared in accordance with DOE/RL-2010-102, *Action Memorandum for Decontamination, Deactivation, Decommissioning, and Demolition (D4) Activities for 200 East Area Tier 2 Buildings/Structures*, and supports DOE/RL-2016-46, *Removal Action Work Plan for the B Plant Complex Tier 2 Buildings/Structures*.

In addition to *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) removal activities, *Resource Conservation and Recovery Act of 1976* (RCRA) closure activities were performed for the B Plant Complex Tier 2 structure designated as a treatment, storage, and/or disposal (TSD) units, such as 276BA Organic Storage Area. Integration of the CERCLA and RCRA activities are included in the facility-specific appendices of this SAP.

1.1 Project Scope and Objective

The removal action consists of D4 of the B Plant Tier 2 structures to slab-on-grade or below, as appropriate. Implementation of this removal action will minimize the potential for a release or threat of release of hazardous substances from the B Plant Complex Tier 2 buildings/structures to human health and the environment. The waste generated during the removal action may include radiologically and/or chemically contaminated equipment, demolition debris, and soil. Equipment includes pumps, pipes, tanks, containers, compressors, ductwork, and electrical components. Demolition debris includes wood, metal, roofing, siding, gypsum, and concrete. If contaminated soil is identified, it may be excavated or sampled, as determined by the U.S. Department of Energy, Richland Operations Office (DOE-RL) Removal Action Manager.

The objectives of this SAP are to provide the characterization guidance necessary to facilitate D4 and associated waste disposal and to document post-demolition conditions for future decision making. These objectives were identified using the data quality objective (DQO) process discussed in Section 1.3.

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

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

1.2 Background

This SAP includes all the buildings/structures identified in the Tier 2 action memorandum (AM) (DOE/RL-2010-102) that are located within the B Plant Complex implementation area. Table 1-1 provides a list of the buildings/structures in the scope of this SAP.

Detailed information about each building/structure included in this SAP is provided in the facility-specific appendices of this SAP. Each appendix provides a facility description, current conditions, and sampling and analysis information. Appendix A for the 276BA Organic Storage Area is included in this revision of the SAP. The remaining facilities will be added to this SAP as they are scheduled for D4.

Located within the 200-CB-1 Operable Unit, the B Plant Complex served as a separations processing mission from 1945 to 1952 using irradiated fuel from the Hanford Site B and D Reactors. In the 1960s, B Plant was retrofitted for a waste partitioning mission to separate strontium-90 and cesium-137 from liquid wastes stored in the tank farms. Purified strontium and cesium solutions were then transferred to the adjacent Waste Encapsulation and Storage Facility for solidification, encapsulation, and storage in pool cells.

From 1984 through 1985, B Plant was prepared for a demonstration test in the pretreatment of neutralized acid waste. Pretreatment was to be the first step in processing the tank waste into a form compatible with long-term storage. In 1990, it was determined that B Plant could not meet modern safety, seismic, or secondary containment criteria. B Plant was eliminated from consideration as the pretreatment facility.

In May 1991, B Plant was taken out of operating mode and in September 1995, it was placed in transition status. In 1996, transition activities were initiated to stabilize, remove, and dispose of major radioactive sources, hazardous materials, and dangerous waste. In 1998, the Waste Encapsulation and Storage Facility became independent of B Plant, the facilities were decoupled, and B Plant was isolated.

1.3 Data Quality Objectives Summary

The DQO process is a strategic planning approach used to define the data collection design criteria to ensure that the type, quantity, and quality of data are appropriate for the intended application. The DQO process, as defined in EPA/240/B-06/001, *Guidance on Systematic Planning Using the Data Quality Objectives Process*, is used to support the sample design presented in this SAP. Table 1-2 identifies the individual members of the DQO team.

Table 1-2. DQO Team Members

Name	Organization	Role and Responsibility
G.J. Jackson	CHPRC	CPS&M Risk Mitigation Project Manager
F.A. Ruck		CERCLA Subject Matter Expert
D.G. Singleton		K Basin Operations and Plateau Remediation Environmental Compliance Director
C.E. Ervin	Freestone	Environmental Scientist
K.E. Murray		
M.M. Serkowski		Environmental Document Project Manager

Note: Freestone refers to Freestone Environmental Services, Inc., located in Richland, Washington.

CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*

CHPRC = CH2M HILL Plateau Remediation Company

CPS&M = Central Plateau Surveillance and Maintenance

1.3.1 Statement of the Problem

Contaminants and their concentrations are not adequately defined for the B Plant Tier 2 structures. The contaminants and their concentrations are needed to facilitate D4, support waste disposal, and document post-demolition conditions.

1.3.2 Project Task and Problem Definition

The principal study questions (PSQs) are DQO questions that require resolution in order to address the identified problem. The decision statements (DSs) will be used to guide development of the sampling and analytical program. Table 1-3 presents the PSQs and alternative actions, which are combined to form the DSs. DSs 1 through 3 are considered to be the primary DSs, while DS 4 is considered to be secondary and opportunistic in regard to near-term sampling.

Table 1-3. Principal Study Questions, Alternative Actions, and Decision Statements

PSQ		Alternative Action	
Number	**Issue**	**Number**	**Response**
1	Does waste from the B Plant Tier 2 structures contain contamination at levels that present a concern for worker health and safety?	1a	Yes; additional job-specific hazard controls will be required (e.g., PPE and containment enclosure).
		1b	No; standard health and safety controls will be used.
	DS 1: Determine whether contaminant concentrations are at levels that require additional job-specific hazard controls to protect worker health and safety, or if standard controls can be used.		
2	Does waste from the B Plant Tier 2 structures, as packaged, meet ERDF waste acceptance criteria (ERDF-00011)?	2a	Yes; ship waste to ERDF.
		2b	No; evaluate for compliance with CWC waste acceptance criteria and stage at CWC pending disposal.
	DS 2: Determine if waste, as packaged, meets ERDF waste acceptance criteria and can be disposed at ERDF or if the waste must be sent to CWC for staging.		
3	Does waste from the B Plant Tier 2 structures require treatment to meet ERDF waste acceptance criteria and LDRs?	3a	Yes; treat waste as necessary for compliance with ERDF waste acceptance criteria and LDRs.
		3b	No; package and ship waste to ERDF as LLW or MLLW.
	DS 3: Determine whether the waste meets ERDF waste acceptance criteria and LDRs or requires treatment (void space, regulated levels of polychlorinated biphenyls, dangerous waste characteristics, or listed waste, asbestos, or beryllium).		
4	Is sufficient information available to support future remedial actions?	4a	Yes; gather information on remaining contamination and formally document the as-left conditions.
		4b	No; perform additional surveys or laboratory analyses to quantify remaining contamination.
	DS 4: Determine if sufficient as-left information is available for or if additional characterization is needed to support future remedial actions.		

Reference: ERDF-00011, *Environmental Restoration Disposal Facility Waste Acceptance Criteria, formerly WCH-191 Rev 4.*

CWC	=	Central Waste Complex	LLW	=	low-level waste
DS	=	decision statement	MLLW	=	mixed low-level waste
ERDF	=	Environmental Restoration and Disposal Facility	PPE	=	personal protective equipment
LDR	=	land disposal restriction	PSQ	=	principal study question

It is anticipated that most of the waste will be disposed at ERDF. In the event that the waste will be disposed at a location other than ERDF, the waste will be characterized and packaged in accordance with the receiving facility waste acceptance criteria and staged at the Central Waste Complex (CWC) pending shipment.

1.3.3 Data Needs

Decision rules define how the data will be used to draw conclusions from the sampling effort and are typically generated from the DSs. Decision inputs such as calculations, analytical methods and parameters, and action levels provide the information needed to make decisions. Table 1-4 lists the data required to be reported to the disposal facilities and data needed for completing waste manifests.

Table 1-4. Global Data Needs

DS Number	Data Needs
1	Radiological surveys/smears and sampling and laboratory analysis of asbestos, radiological, and chemical constituents are needed to support worker safety.
2 & 3	Sampling and analysis of waste streams for asbestos, radiological, and chemical constituents are needed to supplement and/or verify process knowledge for waste management and disposal. Radiological content can be determined using field measurements or laboratory analysis, while asbestos and chemical content will be determined through laboratory analysis.
4	Radiological surveys, visual inspections, and sampling (if needed) of the as-left conditions of the B Plant Tier 2 structures will be needed to support future remedial actions.

DS = decision statement

Limits for DS 2 and 3 can be expressed in terms of meeting or not meeting CWC waste acceptance criteria (HNF-EP-0063, *Hanford Site Solid Waste Acceptance Criteria*) or ERDF waste acceptance criteria (ERDF-00011, *Environmental Restoration Disposal Facility Waste Acceptance Criteria, formerly WCH-191, Rev 4*). There is no anticipated limit for DS 4; data collection pursuant to DS 4 targets opportunistic quantification of as-left conditions after removal activities are complete. Table 1-5 provides examples of types of information that are typically required.

Table 1-5. Required Information for PSQs

PSQ Number(s)	Required Information	Do Data Exist?	Source Reference	Sufficient Quality?
1	Material at risk and planned removal action duration (Ci/d)	Yes	Limit: 10 mrem/yr effective dose equivalent for general public Data: radiological surveys and analysis	No
1	Chemical concentration (mg/kg, µg/L, or ppm)	Yes	Limit: industrial hygiene limits Data: sample results	No
2 & 3	Isotopic-specific activity (pCi/g)	Yes	Limit: ERDF and CWC waste acceptance criteria Data: sample results	No

Table 1-5. Required Information for PSQs

PSQ Number(s)	Required Information	Do Data Exist?	Source Reference	Sufficient Quality?
2 & 3	Chemical concentration (mg/kg, µg/L, or ppm)	Yes	Limit: ERDF, CWC, or other disposal/storage facility waste acceptance criteria Data: sample results	No
3	Asbestos-containing material and beryllium concentrations	Yes	Limit: none, presence invokes additional waste management requirements Data: asbestos inspection reports, industrial hygiene (beryllium) facility assessments, and sample results	No
1 & 4	Dose rates, removable, and fixed radiological contamination levels	Yes	Historical radiological surveys can be used for evaluation of health and safety requirements. Additional data will be required at the time that work is initiated and completed.	No
1–3	Radiological composition of waste	Yes	Radiological isotopes known and readily discernable by nondestructive assay and process knowledge	No

CWC = Central Waste Complex
ERDF = Environmental Restoration Disposal Facility
ppm = parts per million
PSQ = principal study question

After data have been collected to meet the various input requirements, survey and analytical results will be used to support work planning and waste disposition alternatives. The criteria for disposal of waste at ERDF and storage of waste at CWC are presented in ERDF-00011 and HNF-EP-0063, respectively, and provide the basis for the analytical criteria.

1.3.3.1 Boundaries of the Study

The scale of the decisions for each structure may encompass an entire structure, several similar structures, or an area within or adjacent to a structure. Analyses are based on the material(s) within the structure.

The geographic boundary of the study for each structure is the footprint of the building/structure and the surrounding area necessary to facilitate the removal action. Table 1-1 lists the structures within the scope of this sampling plan.

Table 1-6 identifies the waste streams anticipated to be generated during removal activities. These waste streams may fall into any combination of categories: nondangerous/nonradioactive, radioactive, mixed, dangerous, suspect radioactive, suspect dangerous, and suspect mixed waste.

Table 1-6. Possible Waste Streams

Number	Waste Stream	Media
1	Liquid residuals	Liquid residuals in miscellaneous piping system pumps, sumps, tanks, floor drains, piping, and processing equipment
2	Solids, sediments, and residuals	Sediments and residuals in piping, system pumps, sumps, tanks, floor drains, piping, and processing equipment

Table 1-6. Possible Waste Streams

Number	Waste Stream	Media
3	Bulk demolition debris	Bulk demolition debris includes but is not limited to: • Poured concrete • Concrete block • Sheetrock • Wooden doors • Non-asbestos-containing roofing materials • Pumps and miscellaneous equipment • Steel structural components • Steel siding • Ventilation system components • Stabilizing compounds
4	Asbestos-containing material	Floor tiles, insulation, cement asbestos board, asbestos siding, asbestos gaskets or packing material, soil, and roofing materials
5	Incandescent light bulbs	Lead-based bulbs
6	Florescent light ballasts	Light ballasts containing polychlorinated biphenyls
7	Lead shielding and packing	Lead packing material and bricks
8	Mercury switches and instrumentation	Switches and instrumentation containing mercury
9	Emergency light batteries	Lead-acid batteries
10	Mercury vapor light bulbs	Light bulbs containing mercury and lead bases
11	Exit signs and smoke detectors	Internal radioactive sources
12	Lubrication, grease, oil, and hydraulic oils (includes door actuators)	Nonaqueous liquids
13	High-efficiency particulate air filters and bag filters	Filter media
14	Step-off pad soft waste	PPE, garments, rags, tape, plastic, and gloves
15	Paint on interior and exterior surfaces	Dried paints
16	Contaminated equipment	Spent equipment
17	Soils	Excavated and surface soil
18	Anomalous media	Liquid, solid, or sludge

PPE = personal protective equipment

Spatial Scale of Decision Making

To create a sampling design, the homogeneity or heterogeneity of the waste must be considered. The spatial scale of the design is the individual waste streams for each structure in the corresponding appendices of this SAP based on Table 1-6.

Temporal Data Collection

The temporal boundary refers to both the timeframe (e.g., number of years) over which each DS applies and when (e.g., season, time of day, weather conditions) the data should optimally be collected. The projects typically will collect, analyze, and review characterization data before work planning.

Removal activities for the B Plant Tier 2 structures will be implemented over the course of many years (see Section 1.5), and outdoor sampling activities will generally occur during daylight hours under good weather conditions. Indoor sampling activities will generally occur during the day and are not weather-dependent.

1.3.3.2 Practical Constraints on Data Collection

Practical constraints beyond the budget approval process and trained staffing include physical barriers, difficult sample matrices, or any other condition that will need to be considered in the sampling design. The following constraints could impact data collection:

- For structures being demolished, surveys of the roof, floors, walls, and ceilings must be completed before demolition.
- Oils and greases may be consolidated into containers and then sampled before disposal.
- Aqueous waste from piping may be consolidated and then sampled, analyzed, results reviewed, and absorbent added before disposal (if ERDF is the disposal location).
- Paint on the walls may have been placed on the surfaces to fix radiological contamination, which must be considered in the sampling design. Portable gamma spectroscopy detectors can be used to find fixed contamination.
- Door actuators, light bulbs, lead packing/bricks, and mercury switches may need to be segregated for disposal at a facility other than ERDF, but this situation should present no practical restraints on data collection.
- Residues in piping and tanks are not always easily accessible. There may be limited physical ability to collect representative samples in some cases.
- Paints are not considered uniformly distributed. There are several types of paints and primers throughout the B Plant Tier 2 structures. Each color and distinct type of paint (e.g., latex or oil-based) needs to be addressed separately.
- Roofing materials may be found containing more than one layer, with old and newer roofing materials existing in the same location, which would require additional samples.
- Highly contaminated samples may have additional restrictions to address safety-related concerns associated with the as low as reasonably achievable (ALARA) principle. Instruction to obtain highly contaminated samples will be provided in the field sampling plan (FSP).

1.3.4 Decision Rules

The decision rules (DRs), often called “if…then” statements, provide the criteria for taking actions. The DRs state what action is to be taken when prescribed conditions are met based on the results of data collection and resolution of the PSQs. DRs are the mechanism for implementing DSs. Table 1-7 provides the DRs, and Table 1-8 provides the DRs with the parameters of interest for each statement. DR 3 is not included in Table 1-8 because it is a yes/no or true/false decision with no units or action levels. Sampling for DR 3 is opportunistic and subject to schedule and funding availability.

The most restrictive concentration limits or action levels for disposal are used to develop the DRs. By meeting the analytical requirements for the most restrictive options, the data will be adequate for the less-restrictive options.

For waste characterization, the most restrictive concentration limits include the following:

- ERDF-00011, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, formerly WCH-191 Rev 4
- WAC 173-303, "Dangerous Waste Regulations"
- HNF-EP-0063, *Hanford Site Solid Waste Acceptance Criteria*
- 40 CFR 268.48, "Universal Treatment Standards for Underlying Hazardous Constituents"
- HNF-3172, *Liquid Waste Processing Facilities Waste Acceptance Criteria*
- 10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Wastes"

Waste that does not meet the land disposal restrictions (WAC 173-303-140, 40 CFR 268) must be treated prior to disposal at the ERDF. The ERDF cannot accept TRU waste, TRU mixed waste, greater-than-Class C waste (as defined by 10 CFR 61), high-level waste, or dangerous waste that does not meet the land disposal restrictions or cannot be treated by the ERDF. TRU waste will be sent to and managed at CWC until sent to WIPP for disposal. Liquid waste will either be sent to ETF or treated by adding absorbent to meet acceptance criteria of the receiving facility.

Table 1-7. Decision Rules

DR Number	Decision Rule
1	**If** contaminant concentrations present a worker health and safety concern, **then** develop and implement appropriate job-specific hazard controls. **If** contaminant concentrations do not present a worker health and safety concern, **then** use standard health and safety controls.
2	**If** the waste meets ERDF waste acceptance criteria and LDR requirements, **then** dispose of waste at ERDF. **If** the waste does not meet ERDF waste acceptance criteria and LDR requirements, **then** treat waste prior to disposal at ERDF or stage at CWC.
3	**If** available information for as-left conditions is not sufficient, **then** perform additional characterization. **If** available information for as-left conditions is sufficient, **then** formally document conditions.

Reference: ERDF-00011, *Environmental Restoration Disposal Facility Waste Acceptance Criteria, formerly WCH-191 Rev 4.*

CWC = Central Waste Complex
ERDF = Environmental Restoration Disposal Facility
LDR = land disposal restriction

Table 1-8. Decision Rules with Detailed Parameters of Interest

DR Number	Population Parameter	Sample Statistics	Environmental Variable		Unit or Scale of Decision Making	Relationship	Action Level	Alternative Action Number 1	Relationship	Alternative Action Number 2
			Attribute	Unit						
1	If the contaminant concentration	As determined by process knowledge, NDA, and/or analytical results	Of radionuclides or nonradiological contaminants	nCi/g, mg/kg, mg/L, or ppm	Within the structure or area	Is greater than	Criteria in Radiological Controls and Health and Safety Programs	Then develop and implement job-specific hazard controls.	If not	Then implement standard health and safety controls.
2	If the contaminant concentration	As determined by process knowledge, NDA, and/or analytical results	Of the radionuclides and nonradiological contaminants	nCi/g, mg/kg, mg/L, or ppm	In a waste item or container	meets	ERDF waste acceptance criteria and LDR requirements (ERDF-00011)	Then dispose of waste at ERDF.	If not	Then treat waste prior to disposal at ERDF or stage waste at CWC for future disposition.

Reference: ERDF-00011, *Environmental Restoration Disposal Facility Waste Acceptance Criteria, formerly WCH-191 Rev 4*.

CWC = Central Waste Complex
DR = decision rule
ERDF = Environmental Restoration Disposal Facility
LDR = land disposal restriction
NDA = nondestructive assay

1.3.4.1 Performance or Acceptance Criteria

The terms statistical and nonstatistical can be independently applied to two factors of the sampling design. First, the number of samples can be determined statistically or not; second, the locations can be determined randomly or not. If the location is not determined randomly, the determination is said to be biased (judgmental). If the locations are random, statistical calculations can be performed on the results. If the locations are biased to areas of high or low concentrations, then applying statistical calculations may not be appropriate to evaluate the results. If during facility inspections a focused sampling design that reliably characterizes the facility cannot be developed, then a statistical sampling approach will be used to estimate contaminant concentrations.

As an example, the goal of obtaining isotopic ratios requires samples and/or in-situ measurements to be collected from areas of higher deposition to obtain enough radioactivity to count the isotopes of interest. Thus, the locations for these samples are purposely biased toward areas of high contamination.

1.3.4.2 Obtaining Data

Optimization of the sampling design will focus on gathering the radiological and chemical information necessary to protect worker health and safety, dispose waste, and support future remedial actions. A focused sampling design is suited to provide characterization information that will meet the DSs for the waste streams identified in this project. The sampling design will incorporate historical information, process knowledge, facility inspections, radiation surveys, and samples of selected waste materials to determine the upper bounding level of each contaminant of concern (COC) in a particular waste stream. Section 3.1 provides information on the various parts of the proposed sample design.

For waste streams that need additional sampling/analytical data for final disposition, discrete samples of specific media will be collected from biased locations. Laboratory data will quantify contamination concentrations in each of the materials and support the development of the waste profile. The primary disposal facility for the waste streams is ERDF. Those waste streams that are not acceptable to ERDF will be staged at CWC pending final disposition. Waste must meet applicable acceptance criteria for ERDF or CWC for disposal or storage.

1.4 Contaminants of Concern

Table 1-9 contains the bounding radiological and chemical COCs for the B Plant Tier 2 buildings/structures. The COCs were identified through review of process knowledge and historical documents. Specific radionuclides and chemicals for each structure are identified in the corresponding appendices of this SAP. For some structures, historical information is not comprehensive, therefore significant characterization will be undertaken. The final COCs and characterization approach will be evaluated and identified during implementation of the activities described in Chapter 3.

Table 1-9. Radiological and Chemical Contaminants of Concern

Radiological Contaminants	Chemical Contaminants
Americium-241	Metals (ICP)
Antimony-125	Metals (ICP/MS)
Cesium-134/137	Ammonia/Ammonium
Cobalt-60	Anions
Europium-152/154/155	Asbestos (chrysotile), $Mg_3Si_2O_5(OH)_4$
Gross alpha and gross beta	Beryllium
	Corrosives (acids and caustics)
Iodine-129	Mercury
Neptunium-237	Lubricants/oils[b]
Plutonium-238/239/240/241/242[a]	pH (corrosivity)
Radium-226	Polychlorinated biphenyls (PCBs)
Strontium-90	Total organic carbon
Technicium-99	Total organic halides
Thorium-230/232	Semivolatile organic compounds (including tributyl phosphate)
Tritium	Total petroleum hydrocarbons (TPH diesel and TPH kerosene)
Uranium-233/234/235/236/238	Volatile organic compounds

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

b. Only applies to lubricants and oils drained from pumps.

ICP = inductively coupled plasma

ICP/MS = inductively coupled plasma/mass spectroscopy

TPH = total petroleum hydrocarbon

1.5 Project Schedule

Removal activities for the B Plant Complex Tier 2 structures are expected to commence following the issuance of the removal action work plan (DOE/RL-2016-46). The first structure identified for D4 is the 276BA Organic Storage Area. The remaining structures will be scheduled for D4 based on environmental risk, funding priority, availability of trained resources, and competing operational missions.

2 Quality Assurance Project Plan

A Quality Assurance Project Plan (QAPjP) establishes the quality requirements for environmental data collection. It includes planning, implementation, and assessment of sampling tasks, field measurements, laboratory analysis, and data review. This chapter describes the applicable environmental data collection requirements and controls based on the quality assurance (QA) elements found EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5), and DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Document* (HASQARD). DoD/DOE QSM, 2017, *Department of Defense (DoD) Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories* is also discussed. Section 7.8 of the *Hanford Federal Facility Agreement and Consent Order Action Plan* (Ecology et al., 1989b; hereinafter call the Tri-Party Agreement Action Plan), requires the QA/quality control (QC) and sampling and analysis activities specify the QA requirements for treatment, storage, and disposal units as well as for past-practice processes. This QAPjP also describes the applicable requirements and controls based on guidance in Washington State Department of Ecology (Ecology) Publication No. 04-03-030, *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies*, and EPA/240/R-02/009, *Guidance for Quality Assurance Project Plans* (EPA QA/G-5). This QAPjP supplements the contractor's environmental QA program plan.

The QAPjP references are included in Chapter 6. This QAPjP includes the following sections, which describe the quality requirements and controls applicable to this investigation:

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

2.1 Project Management

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

2.1.1 Project/Task Organization

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

2.1.1.1 Regulatory Lead

The lead regulatory agency (LRA) is responsible for regulatory oversight of cleanup projects and activities. DOE-RL will submit this SAP to the LRA for review and comment. DOE-RL will collaborate with EPA to resolve any comments. Per 40 CFR 300.415(b)(4) EPA will approve this SAP. Per the Action Memorandum (DOE/RL-2010-102) for this removal action, the LRA, Ecology, will also approve this SAP.

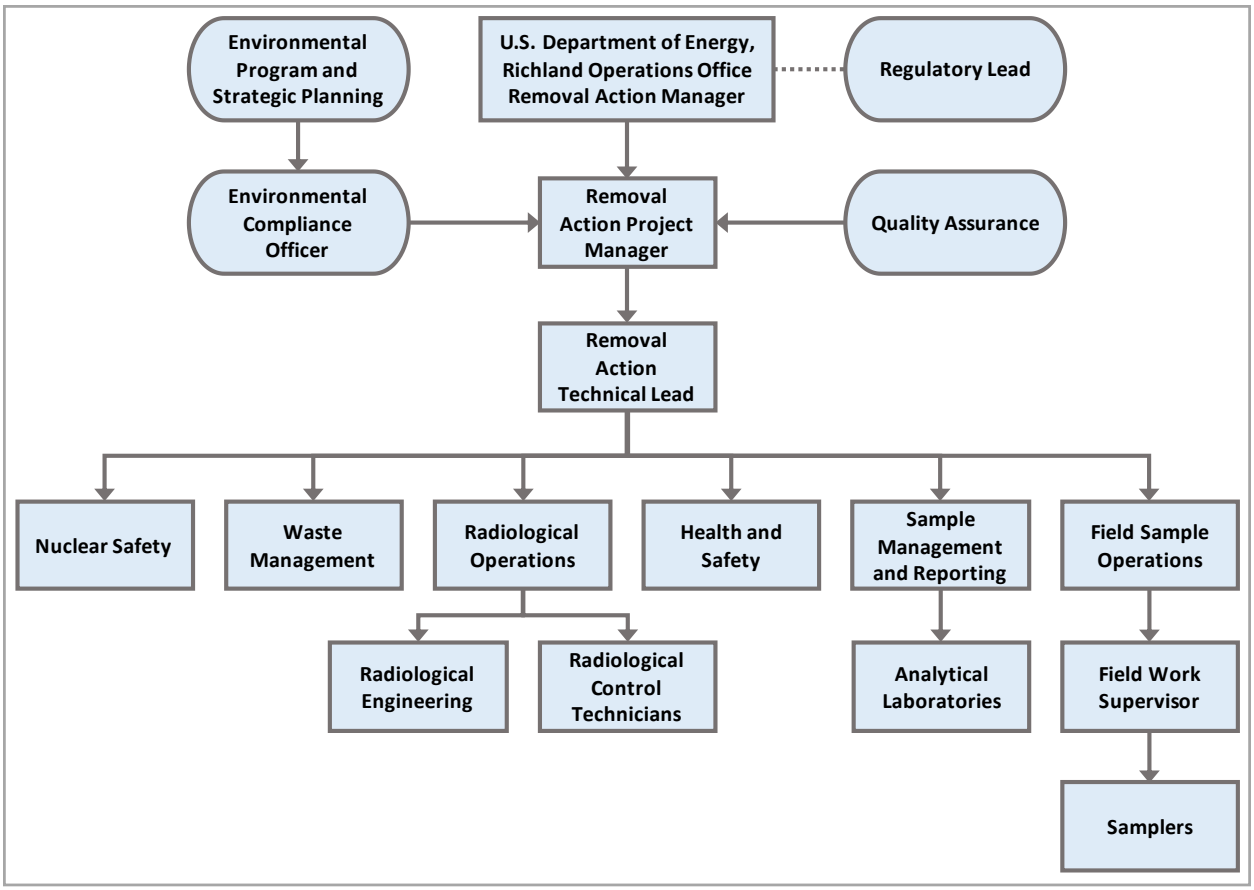

Figure 2-1. Project Organization

2.1.1.2 DOE-RL Removal Action Manager

Hanford Site cleanup is the responsibility of DOE-RL. The DOE-RL Manager is responsible for authorizing the contractor to perform activities at the Hanford Site under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA); *Resource Conservation and Recovery Act of 1976* (RCRA); *Atomic Energy Act of 1954* (AEA); and the Tri-Party Agreement (Ecology et al., 1989a). The DOE-RL Removal Action Manager is also responsible for obtaining Ecology and EPA approval of the SAP authorizing field sampling activities.

2.1.1.3 Removal Action Project Manager

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

- Managing sampling documents and requirements, field activities, and subcontracted tasks and ensuring that the project file is properly maintained.
- Ensuring that the project personnel are working to the current version of the SAP.
- Ensuring that the field sampling instructions comply with the sampling design requirement as specified in this SAP.

- Ensuring that appropriate support organizations (Environmental, QA, Sample Management and Reporting [SMR], Nuclear Safety, Waste Management, Radiological Operation, Health and Safety, and Operations) are involved in planning, approving, and implementing the work scope.
- Maintaining a list of key project team member names, their roles and responsibilities, and their respective organizations.

2.1.1.4 Removal Action Technical Lead

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

2.1.1.5 Sample Management and Reporting Organization

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

2.1.1.6 Field Sample Operations

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

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

- Objective of the activities
- Individual tasks to be performed
- Hazards associated with the planned tasks
- Controls applied to mitigate the hazards
- Environment in which the job will be performed

- Facility where the job will be performed
- Equipment and material required

2.1.1.7 Quality Assurance

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

2.1.1.8 Environmental Compliance Officer

The ECO provides technical oversight, direction, and acceptance of project and subcontracted environmental work and also develops appropriate mitigation measures with the goal of minimizing adverse environmental impacts. The ECO reviews plans, protocols, and technical documents to ensure that environmental requirements have been addressed; identifies environmental issues that affect operations; and responds to environmental/regulatory issues or concerns raised by DOE-RL and/or the regulatory agencies. The ECO also oversees project implementation for compliance with applicable internal and external environmental requirements.

2.1.1.9 Health and Safety

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

2.1.1.10 Radiological Engineering

The contractor Radiological Operations organization is responsible for Radiological Engineering and radiological control technician (RCT) support within the project. Responsibilities include conducting ALARA reviews, exposure and release modeling, and radiological controls optimization.
The Radiological Engineering lead identifies radiological hazards and ensures the implementation of appropriate controls to maintain worker exposures at ALARA levels. The Radiological Engineering lead also interfaces with the project Health and Safety contact and assists in planning and directing RCT support for all activities.

2.1.1.11 Waste Management

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

2.1.1.12 Analytical Laboratories

The analytical laboratories analyze samples in accordance with established procedures and the requirements of this plan and provide necessary data packages containing analytical and QC results. Laboratories provide explanations of results to support data review and in response to resolution of analytical issues. Statements of work flow down quality requirements consistent with the HASQARD (DOE/RL-96-68). The laboratories are evaluated under the DOE Consolidated Audit Program to DoD/DOE QSM (2017) requirements and must be accredited by EPA and Ecology for the analyses performed.

2.1.2 Quality Objectives and Criteria

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

Data quality is defined by the degree of rigor in the acceptance criteria assigned to the DQIs. Typically, the acceptance criteria are set by the analytical method itself; however, project-specific requirements, as indicated by DQOs, may result in more stringent acceptance criteria. The applicable QC guidelines, DQI acceptance criteria, and levels of effort for assessing data quality are dictated by the intended use of the data and the requirements of the analytical method. DQIs are evaluated during the data quality assessment (DQA) process (Section 2.4.3).

2.1.3 Methods-Based Analysis

Laboratory testing for analytes described in Tables 2-3 and 2-4 may include nontarget analytes that are part of the analytical method (i.e., methods-based reporting). The additional constituents that are part of the method and reported by the laboratory are for informational purposes. Analytical performance requirements will be applicable only to the analytes specific to this SAP. Poor QC related to nontarget analyte results would not result in any required corrective action by the laboratory, except for the application of proper result qualification flags.

2.1.4 Analytical Priority

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

2.1.5 Special Training/Certification

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

Training has been instituted by the contractor management team to meet training and qualification programs that satisfy multiple training drivers imposed by applicable DOE, *Code of Federal Regulations* and *Washington Administrative Code* requirements. For example, the environmental, safety, and health training program provides workers with the knowledge and skills necessary to safely execute assigned duties. Field personnel typically will have completed the following training before starting work:

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

- Hanford General Employee Training
- Radiological Worker Training

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

- Training requirements or qualifications needed by sampling personnel and nondestructive assay (NDA) technicians will be in accordance with QA requirements.
- Samplers are required to have received training and required certifications for the type of sampling that is being performed in the field.
- Qualification requirements for RCTs are established by the Radiation Protection Program. RCTs assigned to these activities will be qualified through the prescribed training program and will undergo ongoing training and qualification activities.

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

Table 2-1. Data Quality Indicators

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

Table 2-1. Data Quality Indicators

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

Table 2-1. Data Quality Indicators

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

a. From SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update V*.

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

2.1.6 Documents and Records

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

Table 2-2. Change Control for Sampling Projects

Type of Change [a]	Type of Change (Tri-Party Agreement Action Plan [b])	Action	Documentation
Minor change: Change has no impact on the sample or field analytical result, and little or no impact on performance or cost. Further, the change does not affect the DQOs specified in the SAP.	**Minor field change:** Changes that have no adverse effect on the technical adequacy of the job or the work schedule.	The field personnel recognizing the need for a field change will consult with the Removal Action Project Manager (or designee) prior to implementing the field change.	Minor field changes will be documented in the field logbook. The logbook entry will include the field change, the reason for the field change, and the names and titles of those approving the field change.
Significant change: Change has a considerable effect on performance or cost but still allows for meeting the DQOs specified in the SAP.	**Minor change:** Changes to approved plans that do not affect the overall intent of the plan or schedule.	The Removal Action Project Manager will inform the DOE-RL Removal Action Manager, Ecology, and EPA of the change and seek concurrence at a Unit Managers' Meeting or comparable Tri-Party Agreement forum. The lead regulatory agency (Ecology) and EPA determine there is no need to revise the document.	Documentation of this change approval would be in the Unit Managers' Meeting minutes or comparable Tri-Party Agreement record, such as a change notice. [c]
Fundamental change: Change has significant effect on the sample or the field analytical result, performance, or cost, and the change does not meet the requirements specified in the DQOs in the sampling document.	**Revision necessary:** Lead regulatory agency (Ecology) and EPA determine that changes to approved plans require revision to document.	If it is anticipated that a fundamental change will require the approval of the Regulatory Lead (Ecology) and EPA, the Removal Action Project Manager will inform the DOE-RL Removal Action Manager and will be involved in the decision prior to implementation of a fundamental change. Ecology and EPA determine the change requires a revision to the document.	Formal revision of the sampling document.

a. Consistent with DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Document* (HASQARD).

b. Consistent with Sections 9.3 and 12.4 of Ecology et al., 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan*.

c. Section 9.3 of the *Hanford Federal Facility Agreement and Consent Order Action Plan* (Ecology et al., 1989b) defines the minimum elements of a change notice.

DOE-RL	=	U.S. Department of Energy, Richland Operations Office	EPA	=	U.S. Environmental Protection Agency
DQO	=	data quality objective	SAP	=	sampling and analysis plan
Ecology	=	Washington State Department of Ecology			

Logbooks and data forms are required for field activities. The logbook must be identified with a unique project name and number. Individuals responsible for the logbooks shall be identified in the front of the logbook, and only authorized individuals may make entries into the logbooks. Logbooks will be controlled in accordance with internal work requirements and processes.

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

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

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

The following records are managed and maintained by SMR personnel:

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

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

- Analytical logbooks
- Raw data and QC sample records
- Standard reference material and/or proficiency test sample data
- Sample chain-of-custody and sample storage temperature logs
- Instrument calibration and detection limit study information
- Training records for employees, as they relate to analytical methods
- Laboratory state accreditation records
- Laboratory audit records

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

2.2 Data Generation and Acquisition

This section addresses data generation and acquisition to ensure that the project's methods for sampling measurement and analysis, data collection or generation, data handling, and QC activities are appropriate and documented. Requirements for instrument calibration and maintenance, supply inspections, and data management are also addressed. The sampling design is presented in the FSP in Chapter 3.

2.2.1 Analytical Methods Requirements

Analytical method requirements for samples collected are presented in Table 2-3 for radionuclides and Table 2-4 for nonradionuclides. These analytical methods were identified based upon the radionuclides and chemicals listed in Table 1-9.

Updated EPA and nationally recognized standard methods may be substituted for the analytical methods identified in Tables 2-3 and 2-4. The new method will achieve project DQOs as well or better than the replaced method and is required due to the nature of the sample (e.g., high radioactivity). Deviations from the analytical methods must be approved in accordance with HASQARD (DOE/RL-96-68).

Table 2-3. Analytical Performance Requirements for Radionuclides

Chemical Abstracts Service No.	Analyte	Analytical Method[a]	Liquids			Solids		
			Highest Allowable MDC or PQL (pCi/L)[b]	Accuracy (Percent Recovery)	Precision (Relative Percent Difference)	Highest Allowable MDC or PQL (pCi/g)[b]	Accuracy (Percent Recovery)	Precision (Relative Percent Difference)
14596-10-2	Americium-241	AEA	1	80-120	≤20	1	80-120	≤30
14234-35-6	Antimony-125	GEA	50			0.3		
13967-70-9	Cesium-134		80			0.5		
10045-97-3	Cesium-137		15			0.1		
10198-40-0	Cobalt-60		25					
14683-23-9	Europium-152		50					
15585-10-1	Europium-154							
14391-16-3	Europium-155							
12587-46-1	Gross alpha	Gross alpha	3			5		
12587-47-2	Gross beta	Gross beta	4			10		
15046-84-1	Iodine-129	GEA	5			2		
13994-20-2	Neptunium-237	AEA	1			1		
13981-16-3	Plutonium-238	Plutonium AEA						
Pu-239/240	Plutonium-239/240							
13982-63-3	Radium-226	AEA						
10098-97-2	Strontium-90	GFPC, LSC	2			2		
14133-76-7	Technicium-99	LSC	50			5		
14269-63-7	Thorium-230	AEA	1			1		
TH-232	Thorium-232							
10028-17-8	Tritium	LSC	700			30		
U-233/234	Uranium-233/234	Uranium AEA	1			1		
15117-96-1	Uranium-235/236							
7440-61-1	Uranium-238							

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

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

AEA = alpha energy analysis
GEA = gamma energy analysis
GFPC = gas flow proportional counting
LSC = liquid scintillation counting
MDC = minimum detectable concentration
PQL = practical quantitation limit

Table 2-4. Analytical Performance Requirements for Nonradionuclides

Analyte	Analytical Method[a]	Liquids			Solids		
		Highest Allowable MDC or PQL (µg/L) [b]	Accuracy (Percent Recovery)	Precision (Relative Percent Difference)	Highest Allowable MDC or PQL (mg/kg) [b]	Accuracy (Percent Recovery)	Precision (Relative Percent Difference)
Inorganics							
Metals (ICP)	EPA Method 6010	5-5,000	75-125	≤20	0.5-500	75-125	≤35
Metals (ICP/MS)	EPA Method 6020	0.5-1,000			0.15-100		
Ammonia/ammonium	EPA Method 350.1	50			0.5		
Anions (IC)	EPA Method 300.0 or 9056	100-550			2-55		
Asbestos fibers	Polarized light microscopy (NIOSH 9002 or EPA-600/R-93/116)	N/A	N/A	N/A	<1 %	N/A	N/A
	NIOSH 7400				7 fibers/mm^2		
Beryllium	NIOSH 7300, 7303, OSHA ID-125G (reporting limit)				0.025 µg/filter 0.025 µg/wipe 0.2 µg/g (bulk)	75-125	≤35
Hexavalent chromium	EPA Method 7196	10	75-125	≤20	0.5		
Mercury	EPA Method 7470 or 7471	0.5			0.2		
Oil and grease	EPA Method 1664A	5,000			200		
Organics							
Polychlorinated biphenyls (aroclors)	EPA Method 8082	1	Statistically derived	≤20	0.333 (aroclor-1016) 0.033 (remaining aroclors)	Statistically derived	≤30
Total petroleum hydrocarbons – diesel to oil (kerosene) range	NWTPH [c]	500	70-130		25	70-130	
Semivolatile organic analytes	EPA Method 8270	10-5,000	Statistically derived		0.333-16.5	Statistically derived	
Volatile organic analytes	EPA Method 8260	1-5,000	70-130		0.005-5	70-130	≤20

Table 2-4. Analytical Performance Requirements for Nonradionuclides

Analyte	Analytical Method[a]	Liquids			Solids		
		Highest Allowable MDC or PQL (µg/L) [b]	Accuracy (Percent Recovery)	Precision (Relative Percent Difference)	Highest Allowable MDC or PQL (mg/kg) [b]	Accuracy (Percent Recovery)	Precision (Relative Percent Difference)
General Chemical Parameters							
pH (Corrosivity)	Probe	0.5 pH unit	N/A	N/A	0.5 pH unit	N/A	N/A
Total organic carbon	EPA Method 415.1 or 9060	1,000	75-125	≤20	100	75-125	≤35
Total organic halides	EPA Method 9020 or 9023	10			0.5		

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

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

c. From Ecology Publication ECY 97-602, *Analytical Methods for Petroleum Hydrocarbons*. Ecology uses a modification to EPA Method 8015.

Ecology = Washington State Department of Ecology
EPA = U.S. Environmental Protection Agency
IC = ion chromatography
ICP = inductively coupled plasma
ICP/MS = inductively coupled plasma/mass spectroscopy
MDC = minimum detectable concentration
OSHA = Occupational Safety and Health Administration
N/A = not applicable
NIOSH = National Institute for Occupational Safety and Health
NWTPH = Northwest Total Petroleum Hydrocarbon
PQL = practical quantitation limit

2.2.2 Field Analytical Methods

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

2.2.3 Quality Control

The QC requirements specified in the SAP must be followed in the field and analytical laboratory to ensure that reliable data are obtained. Field QC samples will be collected to evaluate the potential for cross-contamination and to provide information pertinent to field sampling variability. Laboratory QC samples estimate the precision, bias, and matrix effects of the analytical data. Field and laboratory QC samples are summarized in Table 2-5. Acceptance criteria for field and laboratory QC are identified in the contractor's environmental QA program plan. Data will be qualified and flagged in HEIS, as appropriate.

Table 2-5. Field and Laboratory Quality Control Requirements

Sample Type	Frequency	Characteristics Evaluated
Field Quality Control		
Field duplicate	1 for every 20 samples	Precision, including sampling and analytical variability
Field split	As needed. When needed, the minimum is one for every analytical method, for analyses performed.	Precision, including sampling, analytical, and inter-laboratory.
Full trip blank	1 for every 20 samples for each media collected	Cross-contamination from containers or transportation.
Field transfer blank	One each day that volatile organic compounds are sampled	Contamination from sampling site.
Equipment blank	As needed. If only disposable equipment is used, then an equipment blank is not required. Otherwise, 1 for every 20 samples.[a]	Adequacy of sampling equipment decontamination and contamination from nondedicated equipment
Laboratory Quality Control [b]		
Laboratory sample duplicates	One per analytical batch	Laboratory reproducibility and precision
Matrix spike	One per analytical batch	Matrix effect/laboratory accuracy
Matrix spike duplicate	One per analytical batch	Laboratory accuracy and precision
Laboratory control sample	One per analytical batch	Laboratory accuracy
Method blank	One per analytical batch	Laboratory contamination
Surrogates	Added to each sample and QC sample	Recovery and yield
Carrier	Added to each sample and QC sample	Recovery and yield

Table 2-5. Field and Laboratory Quality Control Requirements

Sample Type	Frequency	Characteristics Evaluated
Tracer	Added to each sample and QC sample	Recovery and yield

a. An equipment blank will be collected for all nondedicated equipment, until it can be shown that less frequent collection of equipment blanks is adequate to monitor the decontamination procedure for the nondedicated equipment.

b. Batching across projects is allowed for similar matrices (e.g., soil, liquids). The maximum batch size is 20 samples.

2.2.3.1 Field Quality Control Samples

Field QC samples are collected to evaluate the potential for cross-contamination and provide information pertinent to field sampling variability and laboratory performance to help ensure reliable data are obtained. Field QC samples include field duplicates, field split (SPLIT) samples, and three types of field blanks (equipment blanks [EBs], field transfer blanks [FXRs], and full trip blanks [FTBs]). Field blanks are typically prepared using high-purity reagent water.[1] Field QC samples are defined below:

- **Field duplicates**: Independent samples collected as close as possible to the same time and same location as the scheduled sample and intended to be identical. Field duplicates are placed in separate sample containers and analyzed independently. Field duplicates are used to determine precision for both sampling and laboratory measurements.
- **Field splits (SPLITs)**: Two samples collected as close as possible to the same time and same location and intended to be identical. SPLITs will be stored in separate containers and analyzed by different laboratories for the same analytes. SPLITs are inter-laboratory comparison samples used to evaluate comparability between laboratories.
- **Equipment blanks (EBs)**: High-purity water passed through or poured over decontaminated sampling equipment identical to the sample set collected and placed in sample containers, as identified on the SAF. EB sample bottles are placed in the storage containers with samples from the associated sampling event and are analyzed for the same constituents as samples from the sampling event. EBs are used to evaluate decontamination process effectiveness; these samples are not required for disposable (e.g., single use) sampling equipment.
- **Field transfer blanks (FXRs)**: Preserved volatile organic analysis sample vials filled with high-purity water at the sample collection site where VOC samples are collected. FXR samples are prepared during sampling to evaluate potential contamination attributable to field conditions. After collection, FXR sample vials are sealed and placed in the same storage containers with samples collected the same day for the associated sampling event. FXR samples are analyzed for VOCs only.
- **Full trip blanks (FTBs)**: Bottles prepared by the sampling team before travel to the sampling site. The preserved bottle set is either for VOC analysis only or is identical to the set that will be collected in the field. It is filled with high-purity water and the bottles are sealed and transported (unopened) to the field in the same storage containers used for samples collected that day. Collected FTBs are typically analyzed for the same constituents as the samples from the associated sampling event.

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

FTBs are used to evaluate potential contamination from the sample bottles, preservative, handling, storage, and transportation.

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

2.2.3.2 Laboratory Quality Control Samples

Internal QA/QC programs are maintained by laboratories used by the project. Laboratory QA includes a comprehensive QC program that includes the use of laboratory control samples (LCSs), laboratory sample duplicates (DUPs), matrix spikes (MSs), matrix spike duplicates (MSDs), method blanks (MBs), and surrogates (SURs), carriers, and tracers. These QC analyses are required by EPA methods (e.g., those in SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update V*), and will be run at the frequency specified in the respective references unless superseded by agreement. QC checks outside of control limits are documented in analytical laboratory reports during DQAs, if performed. Laboratory QC checks and their typical frequencies are listed in Table 2-5. Following are descriptions of the various types of laboratory QC samples.

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

Suggested sample container, preservation, and holding time requirements (Table 2-6) are in accordance with the analytical method specified. The final container types and volumes will be identified on the sampling authorization form and the chain-of-custody form. This SAP defines a sample as a filled sample bottle for starting the clock for holding time restrictions.

Laboratories are required to analyze samples within the holding times specified in Table 2-6.Holding time is the elapsed time period between sample collection and analysis. Exceeding required holding times could result in changes in constituent concentrations due to volatilization, decomposition, radiological decay, or other alterations. Required holding times depend on the analytical method, as specified in the three-digit EPA methods (EPA-600/4-79-020) or four-digit EPA methods (SW-846). Data from samples analyzed outside of the holding times are flagged in the HEIS database with an "H."

2.2.4 Measurement Equipment

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

2.2.5 Instrument and Equipment Testing, Inspection, and Maintenance

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

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

2.2.6 Instrument and Equipment Calibration and Frequency

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

2.2.7 Inspection and Acceptance of Supplies and Consumables

Supplies and consumables used in support of sampling and analysis activities are procured in accordance with internal work requirements and processes. Responsibilities and interfaces necessary to ensure that items procured/acquired for the contractor meet the specific technical and quality requirements must be in place. The procurement system ensures that purchased items comply with applicable procurement specifications. Supplies and consumables are checked and accepted by users prior to use.

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

Table 2-6. Sample Preservation, Container, Minimum Volume, and Holding Time Guidelines

Method [a]	Analyte or Group	Liquids				Solids			
		Minimum Volume (mL) [b]	Preservation Requirement	Holding Time	Bottle Type	Minimum Volume (g) [b]	Preservation Requirement	Holding Time	Bottle Type
EPA Method 300.0 or 9056	Anions	25	Cool ≤6°C	48 hours or 28 days[c]	G/P	10	Cool ≤6°C	28 days/ 48 hours or 28 days [c,d]	G/P
EPA Method 350.1	Ammonia	25	H_2SO_4 to pH <2, Cool ≤6°C	28 days	G/P	10	H_2SO_4 to pH <2, cool ≤6°C	28 days	G/P
EPA Method 415.1 or 9060	Total organic carbon	60	HCl or H_2SO_4 to pH <2, Cool ≤6°C	28 days	AG	5	HCl or H_2SO_4 to pH <2, cool ≤6°C	28 days	AG
EPA Method 1664A	Oil and grease	1,000	HCl or H_2SO_4 to pH <2, Cool ≤6°C	28 days	Glass	N/A	N/A	N/A	N/A
EPA Method 6010 or 6020	Metals	100	HNO_3 to pH <2	6 mo	G/P	2	None	6 mo	G/P
EPA Method 7196	Chromium, hexavalent	25	Cool ≤6°C	24 hr	G/P	10	Cool ≤6°C	30 days/ 24 hours [d]	G/P
EPA Method 7470 or 7471	Mercury	100	HNO_3 to pH <2	28 days	G/P	2	Cool ≤6°C	28 days	G/P
EPA Method 8082	Polychlorinated biphenyls (aroclors)	1,000	Cool ≤6°C	1 yr/ 40 days [d]	AG [e]	50	Cool ≤6°C	1 yr/ 40 days [d]	AG [e]
EPA Method 8260	Volatile organic analytes	3 × 40	HCl or H_2SO_4 to pH <2, Cool ≤6°C	14 days maximum (preserved)	Glass [e]	3 × 5	Cool ≤6°C	14 days maximum (preserved)	Glass [e]
EPA Method 8270	Semivolatile organic analytes	1,000	Cool ≤6°C	7 days/ 40 days [d]	AG	50	Cool ≤6°C	14 days/ 40 days [d]	AG
EPA Method 9020 or 9023	Total organic halides	200	H_2SO_4 to pH <2, Cool ≤6°C	28 days	Glass [e]	1	H_2SO_4 to pH <2, cool ≤6°C	28 days	G/P
NIOSH 7300	Beryllium	N/A	N/A	N/A	N/A	1,250 L (2 mg dust filter load, max)	N/A	N/A	Filter [f]

Table 2-6. Sample Preservation, Container, Minimum Volume, and Holding Time Guidelines

Method [a]	Analyte or Group	Liquids				Solids			
		Minimum Volume (mL) [b]	Preservation Requirement	Holding Time	Bottle Type	Minimum Volume (g) [b]	Preservation Requirement	Holding Time	Bottle Type
NIOSH 7303	Beryllium	N/A	N/A	N/A	N/A	35 L (2 mg dust filter load, max)	N/A	N/A	Filter [g]
NIOSH 7400	Asbestos	N/A	N/A	N/A	N/A	100–1,300 fibers/mm^2	N/A	N/A	Filter [h]
NIOSH 9002 or EPA-600/R-93/116	Asbestos	N/A	N/A	N/A	N/A	1–10 [i]	N/A	N/A	G/P
NWTPH [j]	Total petroleum hydrocarbons – diesel to oil (kerosene) range	1000	HCl to pH ≤2, Cool ≤6°C	14 days (preserved)	Glass [e]	50	Cool ≤6°C	14 days/ 40 days [c]	Glass [e]
Varies	Radiological parameters	Varies	HNO_3 to pH <2 or none	6 months	G/P	Varies	None	6 months	G/P

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

b. Minimum volumes do not include quality control samples.

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

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

e. Use a Teflon® lined cap with the sample bottle.

f. Use a 0.8 µm cellulose ester membrane or 5.0 µm polyvinyl chloride membrane filter to collect air sample.

g. Use a 0.8 µm cellulose ester membrane filter to collect air sample.

h. Use a 0.45 to 1.2-µm cellulose ester membrane (25 mm); conductive cowl on cassette.

i. Sample should be large enough to determine the construction material (e.g., floor tile, dry wall, insulation, caulking) and to identify discrete layers (which are analyzed separately).

j. From Ecology Publication ECY 97-602, *Analytical Methods for Petroleum Hydrocarbons*. Ecology uses a modification to EPA Method 8015.

® Teflon is a registered trademark of E.I. DuPont Nemours and Company, Wilmington, Delaware.

AG	=	amber glass	N/A	=	not applicable
EPA	=	U.S. Environmental Protection Agency	NIOSH	=	National Institute for Occupational Safety and Health
G/P	=	glass/plastic	NWTPH	=	Northwest total petroleum hydrocarbon

2.2.8 Nondirect Measurements

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

2.2.9 Data Management

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

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

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

2.3 Assessment and Oversight

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

2.3.1 Assessments and Response Actions

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

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

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

2.3.2 Reports to Management

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

2.4 Data Review and Usability

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

2.4.1 Data Review and Verification

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

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

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

2.4.2 Data Validation

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

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

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

The criteria for data validation are based on a graded approach, using five levels of validation: Levels A through E. Level A is the lowest level and is the same as verification. Level E is a 100% review of all data

(e.g., calibration data and calculations of representative samples from the data set). Data validation will be performed to Level C, which is a review of the QC data. Level C validation consists of a review of the QC data and specifically requires verification of deliverables; requested versus reported analyses; and qualification of the results based on evaluation of analytical holding times, MB results, MS/MSD results, surrogate recoveries, and duplicate sample results. Level C data validation is generally equivalent to Level 2A in EPA 540-R-08-005, *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*. Level C data validation will be performed on at least 5% of the data by matrix and analyte group under the direction of SMR. Analyte group refers to categories such as radionuclides, volatile chemicals, semivolatiles, metals, and anions. The goal is to include each of the various analyte groups and matrices during the data validation process. The DOE-RL Removal Action Manager or contractor Removal Action Project Manager may specify a higher percentage of data to be validated or that data validation be performed at higher levels.

2.4.3 Reconciliation with User Requirements

The purpose of reconciliation with user requirements is to determine if quantitative data are of the correct type and are of adequate quality and quantity to meet the project data needs. The DQA process is the scientific and statistical evaluation of previously verified and validated data to determine if information obtained from environmental data operations are of the right type, quality, and quantity to support their intended use (usability). The DQA process uses the entirety of the collected data to determine usability for decision making. If a statistical sampling design was utilized during field sampling activities, then the DQA will be performed following guidance in EPA/240/B-06/003, *Data Quality Assessment: Statistical Methods for Practitioners* (EPA QA/G-9S). When judgmental (focused) sampling designs are implemented in the field, (DQIs) such as precision, accuracy, representativeness, comparability, completeness, and sensitivity for the specific data sets (individual data packages) will be evaluated in accordance with EPA/240/R-02/004, *Guidance on Environmental Data Verification and Data Validation* (EPA QA/G8). Data verification and data validation are integral to both the statistical DQA data evaluation process and the DQI evaluation process. Results of the DQA or DQI processes will be used by the contractor Removal Action Project Manager to interpret the data and determine if the DQOs for this activity have been met.

3 Field Sampling Plan

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

Sampling designs specify a variety of sampling requirements, including sampling locations, sample numbers, sample collection and handling methods, analytical methods, QC requirements, data verification needs, data validation requirements, reporting documents, and recordkeeping requirements.

3.1 Sampling Design

Table 3-1 provides a summary of the sampling that will be conducted. Data from the sampling and characterization activities prior to and during removal activities will be used to support work planning, waste designation, and future remedial actions. The waste is expected to be low-level waste (LLW)/mixed low-level waste (MLLW) and will be shipped to ERDF for disposal.

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

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

3.1.1 Process Knowledge

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

- Solid waste storage/disposal records, waste certification summaries, and other applicable waste acceptance documentation
- Published documentation
- Unpublished information or notes
- Interviews
- Internal generator procedures, including operating and administrative
- Laboratory and/or field analysis data from testing a representation sample of the waste or a material generated by a similar process
- Safety data sheets of commercial products
- Inventory sheets
- Vendor and procurement information
- Past construction practices (mercury, tritium, asbestos, etc.)
- Radiation work packages
- Test data from similar waste

Table 3-1. Sampling Table Summary

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

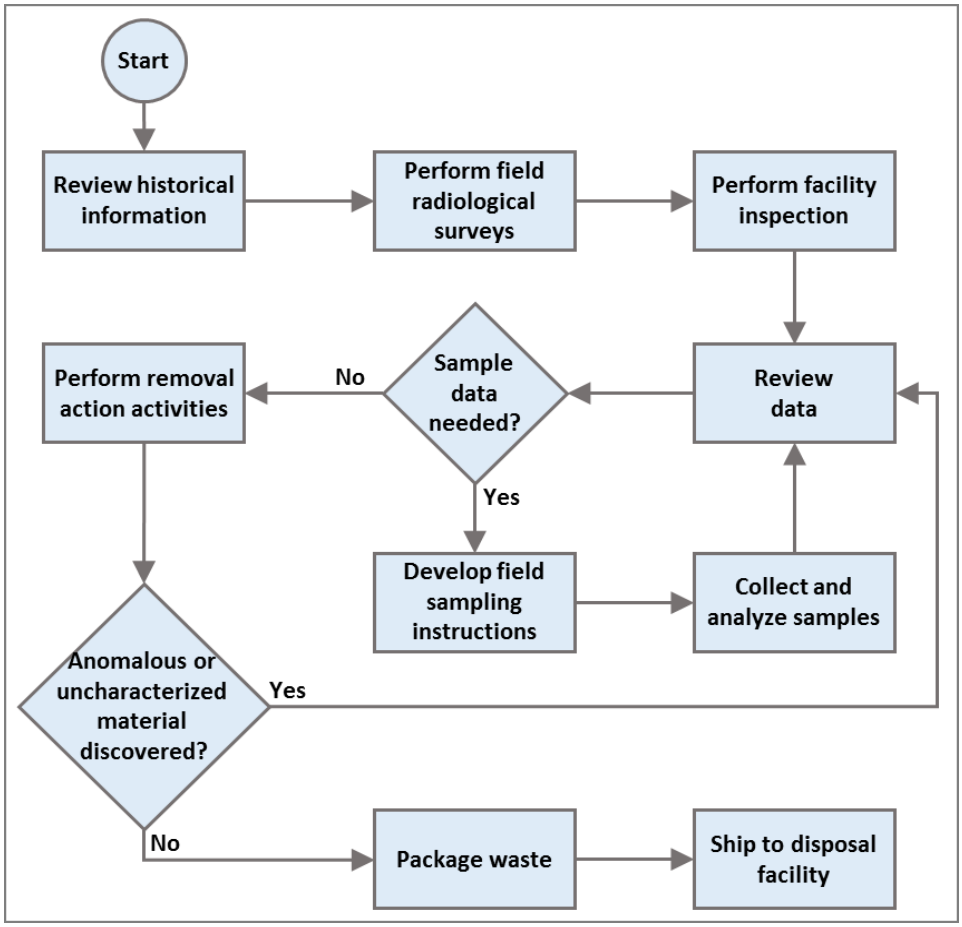

Figure 3-1. Waste Characterization Sampling Design Flow Diagram

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

3.1.2 Initial Characterization

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

3.1.2.1 Historical Site Assessment

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

3.1.2.2 Field Radiological Surveys

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

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

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

3.1.2.3 Facility Inspection

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

3.1.3 Waste Characterization Work Packages

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

3.1.4 Media Sampling

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

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

If a potential pathway for volumetric contamination exists and historical information or facility inspections indicate that volumetric sampling is warranted, volumetric samples may be collected for analysis as part of the judgment-based sampling measurements. Such samples (e.g., concrete or cinderblock boring samples) will be collected in areas where contamination may have migrated into base materials. For example, volumetric samples may be collected in areas with evidence of staining or that have a history of repeated spills of contaminated liquids. Samples will be collected from sampling locations based on the judgment of the Removal Action Project Manager and the appropriate support organizations. If judgment-based sampling locations cannot be reliably determined, a statistical sampling design may be developed, as described in Section 3.1.8.

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

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

Samples will be analyzed for the radiological and chemical COCs identified in the work packages based on process knowledge. Analytical performance requirements are established in Tables 2-3 and 2-4. The laboratory data will be used to confirm contamination levels in each of the materials and determine the appropriate disposition of the waste materials.

3.1.5 Asbestos Inspection and Sampling

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

3.1.6 Post-Demolition Sampling

After demolition of a structure to grade, radiological characterization will be performed on all newly exposed surfaces prior to backfilling. A field survey will encompass the entire footprint of the structure and adjacent area. If contamination is found, opportunistic sampling may be performed as determined by the DOE-RL Removal Action Manager. Sampling of the concrete slab is addressed in Section 3.3.3.5; soil sampling is in Sections 3.3.3.6 (surface) and 3.3.3.7 (subsurface). The selection of sampling units (i.e., number, location, and/or timing of sample collection) will be determined in the work package.

3.1.7 Anomalous Waste Materials

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

3.1.8 Statistical Sample Design

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

3.2 Sampling Location

Field sampling will be conducted as discussed in Section 3.3. Exact sample locations will be confirmed with the Removal Action Project Manager and the appropriate support organizations. When sample locations have been identified, they will be incorporated into work packages identifying sample points, analytes, sampling methods, special sampling equipment, and sample analyte priorities (if there is not enough sample volume to run all analyses). Detection limits and precision and accuracy requirements would also be identified if they differ from those identified in Tables 2-3 and 2-4.

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

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

3.3 Sampling Methods

Potential field sampling methods are as described in Section 3.1.4, Table 3-2, and the following subsections. Sampling instructions will be prepared during the development of work packages. Sampling locations and methods will be provided for each area. To ensure sample and data usability, sampling will be performed in accordance with HASQARD (DOE/RL-96-68) pertaining to sample collection, collection equipment, and sample handling. For some samples, preservatives are required (Table 2-6). Preservatives may be added to the collection bottles before their use in the field, or it is allowable to add the preservatives immediately after sample collection.

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

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

Table 3-2. Specific Media Sampling

Number	Waste Stream	Media	Sampling Strategy	Contaminants of Concern
1	Liquid residuals	Aqueous liquid residuals in miscellaneous piping system pumps, sumps, tanks, floor drains, piping, and processing equipment	In systems, tanks, equipment, etc. for which there is no existing or limited data, non-intrusive liquid presence sampling using ultrasonic instruments, or hot taps into low spots or likely collection locations (see Section 3.3.3.4). If found, collect liquids in containers and take one representative sample. Radiological contamination data to be collected as stated under waste stream 3.	See Tables 2-3 and 2-4. COCs will vary by building/structure. [a]
2	Solids, sediments, and residuals	Sediments and residuals in piping, system pumps, sumps, tanks, floor drains, piping, and processing equipment	In systems for which there is no existing or limited data, visual surveys and solids sampling will be performed. If found, collect solids in a container and take one representative sample, or perform in-field analysis using field analytical instruments	See Tables 2-3 and 2-4. COCs will vary by buildings/structure. [a]
3	Bulk demolition debris	Bulk demolition debris includes, but is not limited to: • Poured concrete • Concrete block • Sheetrock • Wooden doors • Non-asbestos-containing roofing materials • Pumps and miscellaneous equipment • Steel structural components • Steel siding • Ventilation system components • Stabilizing compounds	A limited number of samples will be required to establish upper levels of contamination. Samples will be taken from radiological hot spots found during facility surveys, as described in Section 3.1.2.2. IH samples may be taken at the discretion of the IH organization.	See Tables 2-3 and 2-4. COCs will vary by buildings/structure. [a]

Table 3-2. Specific Media Sampling

Number	Waste Stream	Media	Sampling Strategy	Contaminants of Concern
4	Asbestos-containing material	Floor tiles, insulation, cement asbestos board, asbestos siding, asbestos gaskets or packing material, roofing materials, and post- demolition soil surface	AHERA-certified asbestos inspector will perform the inspection. Samples will be obtained in accordance with simplified sampling scheme for friable surface materials (EPA 560/5-85-030a)	Asbestos fibers
5	Incandescent light bulbs	Lead-based bulbs	No sampling required, use process knowledge for waste designation	Process knowledge [b]
6	Florescent light ballasts	Light ballasts containing polychlorinated biphenyls	No sampling required, use process knowledge for waste designation	Process knowledge [b]
7	Lead shielding and packing	Lead packing material and bricks	No sampling required, use process knowledge for waste designation	Process knowledge [b]
8	Mercury switches and instrumentation	Switches and instruments containing mercury	No sampling required, use process knowledge for waste designation	Process knowledge [b]
9	Emergency light batteries	Lead-acid batteries	No sampling required, use process knowledge for waste designation	Process knowledge [b]
10	Mercury vapor light bulbs	Light bulbs containing mercury and lead bases	No sampling required, use process knowledge for waste designation	Process knowledge [b]
11	Exit signs and smoke detectors	Internal radioactive sources	No sampling required, use process knowledge for waste designation	Process knowledge [b]
12	Lubrication, grease, oil, and hydraulic oils (includes door actuators)	Nonaqueous liquids	One representative sample per container or batch of the same material from the same source	See Table 2-4 for PCBs, arsenic, barium, cadmium, chromium, lead, mercury, and total organic halides.
13	High-efficiency particulate air filters and bag filters	Filter media	One representative sample per filter/bag or one sample from the entire system, if process knowledge shows that the same material is expected throughout the system.	See Tables 2-3 and 2-4. COCs will vary by buildings/structure. [a]

Table 3-2. Specific Media Sampling

Number	Waste Stream	Media	Sampling Strategy	Contaminants of Concern
14	Step-off pad soft waste	PPE, garments, rags, tape, plastic, and gloves	No sampling required, radiological analysis performed on other waste streams bound this waste.	Process knowledge [b]
15	Paint on interior and exterior surfaces	Dried paints	Scraping paint (minimum of one representative sample from each type and color of paint/coating) or perform in-field analysis using field analysis instruments.	See Table 2-3 for isotopic requirements; arsenic, cadmium, chromium, barium, lead, mercury, selenium, silver, PCBs.
16	Contaminated equipment	Spent equipment	One representative smear sample for each piece of equipment.	See Tables 2-3 and 2-4. COCs will vary by buildings/structure. [a]
17	Soils	Excavated soil and surface soil	Soil will be sampled at the discretion of the DOE-RL Removal Action Manager.	See Tables 2-3 and 2-4. COCs will vary by buildings/structure. [a]
18	Anomalous media	Liquid, solid, or sludge	Collect one representative sample per media type for radiological and chemical analyses on a case-by-case basis.	See Tables 2-3 and 2-4. COCs will vary by buildings/structure. [a]

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

a. For COCs, see the appendix specific to the building/structure.

b. Process knowledge includes information from safety data sheets, personnel interviews, historical documents, and existing data.

AHERA = Asbestos Hazard Emergency Response Act of 1986
COC = contaminant of concern
DOE-RL = U.S. Department of Energy, Richland Operations Office
IH = industrial hygiene
PCB = polychlorinated biphenyl
PPE = personal protective equipment

3.3.1 Decontamination of Sampling Equipment

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

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

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

Decontamination of sampling equipment is performed using high-purity water in each step. In general, three rinse cycles are performed to decontaminate sampling equipment: a detergent rinse, an acid rinse, and a water rinse. During the detergent rinse, the equipment is washed in a phosphate-free detergent solution, followed by rinsing with high-purity water in three sequential containers. After the third high-purity water rinse, equipment that is stainless steel or glass is rinsed in a 1 M nitric acid solution (pH <2). Equipment is then rinsed with high-purity water in three sequential containers (the high-purity water rinses following the acid rinse are conducted in separate water containers that are not used for detergent rinse). Following the final high-purity water rinse, equipment is rinsed in hexane and then placed on a rack to dry. Dry equipment is loaded into a drying oven. The oven is set at 50°C (122°F) for items that are not metal or glass or at 100°C (212°F) for metal or glass. Once reaching temperature, equipment is baked for 20 minutes and then cooled. The equipment is then removed from the oven, and the equipment is wrapped in clean, unused aluminum foil using surgeon's gloves. The wrapped equipment is stored in a custody locked, controlled access area.

3.3.2 Radiological Field Data

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

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

- Instructions to RCTs on the methods required to measure sample activity and media for gamma, alpha, and/or beta emissions, as appropriate.
- Information regarding portable radiological field instrumentation, including a physical description of the instruments, radiation and energy response characteristics, calibration/maintenance and performance testing descriptions, and the application/operation of the instrument. These instruments are commonly used on the Hanford Site to obtain measurements of removable surface contamination measurements and direct measurements of total surface contamination.
- Instructions regarding the minimum requirements for documenting radiological controls information in accordance with 10 CFR 835, "Occupational Radiation Protection."

- Instructions for managing the identification, creation, review, approval, storage, transfer, and retrieval of radiological information.
- The minimum standards and practices necessary for preparing, performing, and retaining radiological related information.
- The requirements associated with preparing and transporting regulated material.
- Daily reports of radiological surveys and measurements collected during conduct of field investigation activities. Data will be cross-referenced between laboratory analytical data and radiation measurements to facilitate interpreting the investigation results.

3.3.3 Field Sampling

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

3.3.3.1 Routine Radiological Surveys

Routine radiological surveys will be conducted prior to removal of equipment and demolition activities. The surveys will be performed on accessible surfaces of the waste media and will be conducted by project RCTs. Existing survey information will be reviewed by the removal action project team. Additional surveys may be required at specific locations to fill voids in the existing data identified by the review or to address areas of concern identified during visual inspections. Information obtained from the routine radiological surveys will be used to determine the extent of contamination in the facility and to support worker health and safety during D4 activities.

3.3.3.2 Nondestructive Assay

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

3.3.3.3 Material Release Surveys for Reuse

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

3.3.3.4 Inspection of Piping Entering/Exiting Facility

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

3.3.3.5 Concrete Sampling

Concrete sampling of the structures or remaining slabs may be performed to support waste characterization or a future remedial action. These samples will be collected by various methods (e.g., coring or chipping).

3.3.3.6 Surface Soil Sampling of Localized Soil Contamination

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

3.3.3.7 Subsurface Soil Sampling

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

3.4 Documentation of Field Activities

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

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

A summary of information is to be recorded in logbooks or on the data forms is as follows:

- Day and date; time task started; weather conditions; and names, titles, and organizations of personnel performing the task.
- Purpose of visit to the task area.
- Site activities in specific detail (e.g., maps and drawings) or the forms used to record such information. Also, details of any field tests that were conducted; reference any forms that were used, other data records, and methods followed in conducting the activity.
- Details of any field calibrations and surveys that were conducted. Reference any forms that were used, other data records, and the methods followed in conducting the calibrations and surveys.
- Details of any samples collected and the preparation (if any) of splits, duplicates, MSs, or blanks. Reference the methods followed in sample collection or preparation; list location of sample collected, sample type, each label or tag numbers, sample identification, sample containers and volume, preservation method, packaging, chain-of-custody form number, and analytical request form number

pertinent to each sample or sample set; and note the time and the name of the individual to whom custody of samples was transferred.

- Time, equipment type, serial or identification number, and methods followed for decontaminations and equipment maintenance performed. Reference the page number(s) of any logbook where detailed information is recorded.
- Any equipment failures or breakdowns that occurred, with a brief description of repairs or replacements

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

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

Changes in sample activities that require notification, approval, and documentation will be performed as specified in Table 2-2.

3.5 Calibration of Field Equipment

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

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

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

3.6 Sample Handling

Sample handling and transfer will be in accordance with established methods to preclude loss of identity, damage, deterioration, and loss of sample. Custody seals or custody tape will be used to verify that sample integrity has been maintained during sample transport. The custody seal will be inscribed with the sampler's initials and date. If during the chain-of-custody process, it is discovered that the custody tape has been tampered with or broken on both the sample bottle and the cooler, the sample will be analyzed, but the results will include a flag to indicate that custody was broken. If the sample data did not trend with the other data or were not as expected, the data from the sample would be flagged accordingly.

A sampling and analytical database is used to track samples from the point of collection through the laboratory analysis process.

3.6.1 Containers

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

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

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

3.6.2 Container Labeling

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

3.6.3 Sample Custody

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

Shipping requirements will determine how sample shipping containers are prepared for shipment. The analyses requested for each sample will be indicated on the accompanying chain-of-custody form.

Each time the responsibility for the custody of the sample changes, new and previous custodians will sign the record and note the date and time. The field sampling team will make a copy of the signed record before sample shipment and will transmit the copy to the SMR group.

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

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

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

3.6.4 Sample Transportation

Packaging and transportation instructions shall comply with applicable transportation regulations and DOE requirements. Regulations for classifying, describing, packaging, marking, labeling, and transporting hazardous materials, hazardous substances, and hazardous wastes are enforced by the U.S. Department of Transportation (DOT) as described in 49 CFR 171, "Transportation," "General Information, Regulations, and Definitions," through 177, "Carriage by Public Highway."[2] Carrier-specific requirements, defined in the current edition of International Air Transport Association (IATA) *Dangerous Goods Regulations*, shall also be used when preparing sample shipments conveyed by air freight providers.

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

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

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

are radioactive, they shall be properly classified, described, packaged, marked, labeled, and transported according to DOT/IATA requirements.

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

4 Management of Waste

Waste materials are generated during sample collection, processing, and sampling activities. The method of identification, storage, and disposition of hazardous, radioactive, or mixed waste and unused samples (including unexpected waste) generated by sampling activities will be managed in accordance with the waste management plan in the B Plant Complex Tier 2 RAWP (DOE/RL-2016-46).

Offsite analytical laboratories are responsible for the disposal of unused sample quantities. On a monthly basis, the laboratory will coordinate sample disposal and status with SMR by providing a list of samples more than 90 days post-data delivery for which disposal is requested in the following month.
The laboratory will also provide on a monthly basis a list of samples disposed in the preceding month that includes disposal date and method or other relevant information. Signed chain-of-custody forms indicating sample disposal will be retained in laboratory case files pending return of case files to the contractor.

Pursuant to 40 CFR 300.440, “National Oil and Hazardous Substances Pollution Contingency Plan,” “Procedures for Planning and Implementing Off Site Response Actions,” approval from the EPA Remedial Project Manager is required before returning unused samples or waste from offsite laboratories.

This page intentionally left blank.

5 Health and Safety Plan

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

Site-specific health and safety plans will be prepared to supplement the general health and safety program. Site access and sampling work activities will be controlled in accordance with the site-specific and general health and safety plans.

This page intentionally left blank.

6 References

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," *Code of Federal Regulations*. Available at: https://www.ecfr.gov/cgi-bin/text-idx?SID=279682d26bdc8a01d970114dac64ea0d&mc=true&node=pt10.2.61&rgn=div5.

10 CFR 830, "Nuclear Safety Management," Subpart A, "Quality Assurance Requirements," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&rgn=div5&view=text&node=10:4.0.2.5.27&idno=10.

10 CFR 835, "Occupational Radiation Protection," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=e8511ae2d049cea9a5c7bf5f3dad3ced&mc=true&node=pt10.4.835&rgn=div5.

10 CFR 851, "Worker Safety and Health Program," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title10-vol4/xml/CFR-2010-title10-vol4-part851.xml.

29 CFR 1910.120, "Occupational Safety and Health Standards," "Hazardous Waste Operations and Emergency Response," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&rgn=div8&view=text&node=29:5.1.1.1.8.8.33.14&idno=29.

40 CFR 268.48, "Land Disposal Restrictions," "Universal Treatment Standards," *Code of Federal Regulations*. Available at: https://www.ecfr.gov/cgi-bin/text-idx?SID=279682d26bdc8a01d970114dac64ea0d&mc=true&node=pt40.29.268&rgn=div5.

40 CFR 300.415, "National Oil and Hazardous Substances Pollution Contingency Plan," "Removal Action," *Code of Federal Regulations*. Available at: https://www.ecfr.gov/cgi-bin/text-idx?SID=279682d26bdc8a01d970114dac64ea0d&mc=true&node=pt40.30.300&rgn=div5.

40 CFR 300.440, "National Oil and Hazardous Substances Pollution Contingency Plan," "Procedures for Planning and Implementing Off-Site Response Actions," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=e8511ae2d049cea9a5c7bf5f3dad3ced&mc=true&node=pt40.28.300&rgn=div5#se40.28.300_1440.

49 CFR, "Transportation," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=e8511ae2d049cea9a5c7bf5f3dad3ced&mc=true&tpl=/ecfrbrowse/Title49/49tab_02.tpl.

49 CFR 171, "General Information, Regulations, and Definitions."

49 CFR 172, "Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans."

49 CFR 173, "Shippers—General Requirements for Shipments and Packagings."

49 CFR 174, "Carriage by Rail."

49 CFR 175, "Carriage by Aircraft."

49 CFR 176, "Carriage by Vessel."

49 CFR 177, "Carriage by Public Highway."

Asbestos Hazard Emergency Response Act of 1986, 15 USC 2614 et seq. Available at: https://www.gpo.gov/fdsys/pkg/USCODE-2009-title15/html/USCODE-2009-title15-chap53-subchapII.htm.

Atomic Energy Act of 1954, as amended, 42 USC 2011, Pub. L. 83-703, 68 Stat. 919. Available at: https://science.energy.gov/~/media/bes/pdf/nureg_0980_v1_no7_june2005.pdf.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq., Pub. L. 107-377, December 31, 2002. Available at: https://www.csu.edu/cerc/researchreports/documents/CERCLASummary1980.pdf.

DoD/DOE, 2017, *Department of Defense (DoD) Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories*, Version 5.1, U.S. Department of Defense Environmental Data Quality Workgroup and the U.S. Department of Energy Consolidated Audit Program, [Washington, D.C.]. Available at: http://www.p2s.com/wp-content/uploads/FINAL-QSM-5.1-SIGNED-010517.pdf.

DOE/RL-96-68, 2014, *Hanford Analytical Services Quality Assurance Requirements Document* (HASQARD), Rev. 4, Volume 1, *Administrative Requirements*; Volume 2, *Sampling Technical Requirements*; Volume 3, *Field Analytical Technical Requirements*; and Volume 4, *Laboratory Technical Requirements*, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:
http://www.hanford.gov/files.cfm/DOE-RL-96-68-VOL1-04.pdf.
http://www.hanford.gov/files.cfm/DOE-RL-96-68-VOL2-04.pdf.
http://www.hanford.gov/files.cfm/DOE-RL-96-68-VOL3-04.pdf.
http://www.hanford.gov/files.cfm/DOE-RL-96-68-VOL4-04.pdf.

DOE/RL-2010-102, 2011, *Action Memorandum for Decontamination, Deactivation, Decommissioning, and Demolition (D4) Activities for 200 East Tier 2 Buildings/Structures*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0072140H.

Modified by:

TPA-CN-722, 2016, *Tri-Party Agreement Change Notice Form: DOE/RL-2010-102, Rev 0., Decontamination, Deactivation, Decommissioning, and Demolition (D4) Activities for 200 East Tier 2 Buildings/Structures*, dated April 25, U.S. Department of Energy, Richland Operations Office, and Washington State Department of Ecology, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0077111H.

DOE/RL-2016-46, 2016, *Removal Action Work Plan for the B Plant Complex Tier 2 Buildings/Structures*, Decisional Draft, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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

Ecology, EPA, and DOE, 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan*, as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.hanford.gov/?page=82.

Ecology Publication Number 04-03-030, 2004, *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies*, Washington State Department of Ecology, Olympia, Washington. Available at: https://fortress.wa.gov/ecy/publications/summarypages/0403030.html.

Ecology Publication ECY 97-602, 1997, *Analytical Methods for Petroleum Hydrocarbons*, Washington State Department of Ecology, Olympia, Washington. Available at: https://fortress.wa.gov/ecy/publications/documents/97602.pdf.

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

EPA/240/B-06/001, 2006, *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4, Office of Environmental Information, U.S. Environmental Protection Agency, Washington, D.C. Available at: https://www.epa.gov/sites/production/files/2015-06/documents/g4-final.pdf.

EPA/240/B-06/003, 2006, *Data Quality Assessment: Statistical Methods for Practitioners*, EPA QA/G-9S, Office of Environmental Information, U.S. Environmental Protection Agency, Washington, D.C. Available at: https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=900B0D00.TXT.

EPA/240/R-02/004, 2002, *Guidance on Environmental Data Verification and Data Validation*, EPA QA/G-8, Office of Environmental Information, U.S. Environmental Protection Agency, Washington, D.C. Available at: https://www.epa.gov/sites/production/files/2015-06/documents/g8-final.pdf.

EPA/240/R-02/009, 2002, *Guidance for Quality Assurance Project Plans*, EPA QA/G-5, Office of Environmental Information, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=20011HPE.PDF.

EPA 540-R-08-005, 2009, *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*, OSWER No. 9200.1-85, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C. Available at: https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P1002WWF.TXT.

EPA-540-R-2017-001, 2017, *National Functional Guidelines for Inorganic Superfund Methods Data Review*, Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency, Washington, D.C. Available at: https://www.epa.gov/sites/production/files/2017-01/documents/national_functional_guidelines_for_inorganic_superfund_methods_data_review_01302017.pdf.

EPA-540-R-2017-002, 2017, *National Functional Guidelines for Organic Superfund Methods Data Review*, Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency, Washington, D.C. Available at: https://www.epa.gov/sites/production/files/2017-01/documents/national_functional_guidelines_for_organic_superfund_methods_data_review_013072017.pdf.

EPA 560/5-85-030a, 1985, *Asbestos in Buildings: Simplified Sampling Scheme for Friable Surfacing Materials*, Office of Pesticides and Toxic Substances, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://nepis.epa.gov/Exe/ZyPDF.cgi/91013B6F.PDF?Dockey=91013B6F.PDF.

EPA-600/4-79-020, 1983, *Methods for Chemical Analysis of Water and Wastes*, Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D196019611.

EPA/600/R-93/100, 1993, *Methods for the Determination of Inorganic Substances in Environmental Samples*, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio. Available at: http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=30002U3P.txt.

ERDF-00011, 2016, *Environmental Restoration Disposal Facility Waste Acceptance Criteria, formerly WCH-191 Rev 4*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0068234H.

HNF-EP-0063, 2017, *Hanford Site Solid Waste Acceptance Criteria*, Rev. 17, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://www.hanford.gov/files.cfm/HNF-EP-0063_Rev_17_Hanford_Site_Solid_Waste_Accpetance_Criteria.pdf.

IATA, 2017, *Dangerous Goods Regulations*, 57th Edition, as amended, International Air Transport Association, Montreal, Quebec, Canada. Available at: http://www.iata.org/publications/store/Pages/dgr-print-manuals.aspx.

Price-Anderson Amendments Act of 1988, Pub. L. 100 408, Aug. 20, 1988, 102 Stat. 1066, 42 USC 2010, et seq. Available at: http://www.gpo.gov/fdsys/pkg/STATUTE-102/pdf/STATUTE-102-Pg1066.pdf.

Resource Conservation and Recovery Act of 1976, 42 USC 6901 et seq. Available at: https://elr.info/sites/default/files/docs/statutes/full/rcra.pdf.

SW-846, 2015, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update V*, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C. Compendium methods available at: https://www.epa.gov/hw-sw846/sw-846-compendium.

Appendix A

276BA Organic Storage Area

This page intentionally left blank.

Contents

A1 Introduction A-1

A2 Facility Description A-1

A3 Current Conditions A-3

A4 Sampling and Analysis A-3

A4.1 Anticipated Waste Streams A-3

A4.2 Contaminants of Concern A-5

A4.3 CERCLA and RCRA Sampling Integration A-7

A4.4 Sampling Design A-7

A5 References A-10

Figures

Figure A-1. B Plant Complex with 276BA Organic Storage Area A-2

Figure A-2. 276BA Organic Storage Area A-2

Figure A-3. Sampling Locations Beneath Secondary Containment Structure A-9

Tables

Table A-1. Anticipated Waste Streams from the 276BA Organic Storage Area A-3

Table A-2. CERCLA Contaminants of Concern A-5

Table A-3. RCRA Contaminants of Concern A-5

Table A-4. RCRA Closure Performance Standards for Target Analytes A-6

This page intentionally left blank.

Terms

ASTM	American Society for Testing and Materials
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COC	contaminant of concern
D4	decontamination, deactivation, decommissioning, and demolition
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
RCRA	*Resource Conservation and Recovery Act of 1976*
SAP	sampling and analysis plan

This page intentionally left blank

A1 Introduction

This appendix provides sampling guidance to support the non-time-critical removal action at the 276BA Organic Storage Area. The removal action includes decontamination, deactivation, decommissioning, and demolition (D4) of the 276BA Organic Storage Area. Detailed descriptions of the removal activities are specified in DOE/RL-2016-46, *Removal Action Work Plan for the B Plant Complex Tier 2 Buildings/Structures*. Descriptions of the facility, the conditions, and the sampling strategy are provided in this appendix.

In addition to *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) removal activities, *Resource Conservation and Recovery Act of 1976* (RCRA) closure activities will be performed at the 276BA Organic Storage Area. The closure process for the 276BA Area dangerous waste management unit (storage container ISO East) is described in DOE/RL-2015-70, *Closure Plan for the B Plant Organic Tank TK-ISO East* (hereinafter referred to as the closure plan). This closure plan documents the sampling strategy, removal activities, and regulatory requirements for removal of the RCRA-permitted ISO East storage container and the secondary containment structure to demonstrate clean closure of the ISO East container.

The 276BA container was previously classified as a tank in the Draft B Plant Complex Part A Form concerning the B Plant Organic Mixed Waste Storage System. Upon further review, the U.S. Department of Energy determined that 276BA ISO East should be classified as a container, since it meets the RCRA definition of a container as specified per WAC 173-303-040, “Dangerous Waste Regulations,” “Definitions.” The Washington State Department of Ecology (Ecology) has concurred with this reclassification. The 276BA Organic Storage Area will be closed under the container standards in WAC 173-303-630(10), “Use and Management of Containers.”

A2 Facility Description

When it was constructed in 1996, the 276BA Organic Storage Area (Figure A-1) consisted of a secondary containment structure and two identical aboveground stainless-steel storage vessels: ISO West and ISO East. The secondary containment structure provided individual containment for both vessels and was lined with compatible coating for organic mixed waste as a precaution for unplanned releases. The structure was built per drawing H-2-926596 and polymer coating was applied to all interior surfaces including retaining walls, sumps, trenches, and the top of curbs. Figure A-2 is a photo of the ISO East container and secondary structure associated with the 276BA Organic Storage Area.

Each storage vessel was a cylindrically shaped 3.1 m (9.8 ft) diameter, 6 m (20 ft) long transport vessel with a capacity of 17,500 L (4,623 gal). There was no specific ancillary equipment associated with either vessel. The ISO East container received organic waste from the B Plant Organic Mixed Waste Storage System in March 1997. The organic waste contained normal paraffin hydrocarbons, di-(2-ethylhexyl)phosphoric acid, tributyl phosphate, and small amounts of strontium-89/90 and cesium-137. In November 1997, the contents of the ISO East container were pumped to a minimum heel and were transferred to a tanker truck for offsite disposal. The unused ISO West vessel was removed from the site in 1998.

Figure A-1. B Plant Complex with 276BA Organic Storage Area

Figure A-2. 276BA Organic Storage Area

D4 of the 276BA Organic Storage Area includes removal of the ISO East container, the secondary containment structure, and up to 0.9 m (3 ft) of the underlying soil. Removal activities to attain clean closure, as specified in Chapter 5 of the closure plan (DOE/RL-2015-70) and DOE/RL-2016-46, include the following:

- Mobilization and site preparation
- Container removal and disposal
- Secondary containment structure demolition
- Soil excavation and removal (up to 0.9 m [3 ft] below grade)
- Decontamination
- Site stabilization and completion

A3 Current Conditions

At present, the 276BA Organic Storage Area consists of one aboveground container (ISO East) and the coated concrete secondary containment structure. The container was pumped to a minimum heel in 1997, and the residual content is expected to be less than 7.6 L (2 gal). No known spills have occurred within the secondary containment. Except for degradation of the coating on the secondary containment, no other structural deterioration has been identified.

A4 Sampling and Analysis

Sampling and analysis of the 276BA Organic Storage Area will be performed to facilitate D4 activities, support waste disposal, document post-demolition conditions, and verify clean closure of the RCRA closure unit. Historical information, process knowledge, radiological surveys, and facility inspections will be used to support waste characterization. The sampling instructions, as specified in this section, comply with the data quality objectives in Section 1.3 of the main text of the document and the components of the Environmental Protection Agency (EPA) Data Quality Objective 7 step process that are contained in the closure plan (DOE/RL-2015-70). Both CERCLA and RCRA sampling activities are discussed in this section. The closure plan contains more information about the RCRA closure activity.

A4.1 Anticipated Waste Streams

Waste streams identified in Table A-1 are anticipated to be generated during the removal activities for the 276BA Organic Storage Area. The first three columns in this table are identical to Table 1-6 in the main text of this document.

Table A-1. Anticipated Waste Streams from the 276BA Organic Storage Area

Number	Waste Stream	Media	Anticipated Waste Stream
1	Liquid residuals	Liquid residuals in miscellaneous piping system pumps, sumps, tanks, floor drains, piping, and processing equipment	No
2	Solids, sediments, and residuals	Sediments and residuals in piping, system pumps, sumps, tanks, floor drains, piping, and processing equipment	Yes, in the form of absorbed liquid

Table A-1. Anticipated Waste Streams from the 276BA Organic Storage Area

Number	Waste Stream	Media	Anticipated Waste Stream
3	Bulk demolition debris	Bulk demolition debris includes but is not limited to: • Poured concrete • Concrete block • Sheetrock • Wooden doors • Non-asbestos-containing roofing materials • Pumps and miscellaneous equipment • Steel structural components • Steel siding • Ventilation system components • Stabilizing compounds	Yes
4	Asbestos-containing material	Floor tiles, insulation, cement asbestos board, asbestos siding, asbestos gaskets or packing material, soil, and roofing materials	No
5	Incandescent light bulbs	Lead-based bulbs	No
6	Florescent light ballasts	Light ballasts containing polychlorinated biphenyls	No
7	Lead shielding and packing	Lead packing material and bricks	No
8	Mercury switches and instrumentation	Switches and instrumentation containing mercury	No
9	Emergency light batteries	Lead-acid batteries	No
10	Mercury vapor light bulbs	Light bulbs containing mercury and lead bases	No
11	Exit signs and smoke detectors	Internal radioactive sources	No
12	Lubrication, grease, oil, and hydraulic oils (includes door actuators)	Nonaqueous liquids	No
13	High-efficiency particulate air filters and bag filters	Filter media	No
14	Step-off pad soft waste	Personal protective equipment, garments, rags, tape, plastic, and gloves	Yes
15	Paint on interior and exterior surfaces	Dried paints	Yes
16	Contaminated equipment	Spent equipment	Yes
17	Soils	Excavated soil	Yes
18	Anomalous media	Liquid, solid, or sludge	Yes

A4.2 Contaminants of Concern

Tables A-2 and A-3 list the contaminants of concern (COCs) that may be analyzed for at the 276BA Organic Storage Area during the removal and closure activities. Sampling for these radionuclides and chemicals will be performed using the methods listed in Section 2.2.1 of the main text of this document. Additional analyses may be performed as needed. Suggested sample container, preservation, and holding time requirements are identified in Table 2-6 of the main text of this document. Tables 2-3 and 2-4 of the main text define the analytical performance requirements (e.g., practical quantitation limit, precision, and accuracy) for the target analytes.

The purpose of sampling for the RCRA analytes is to verify clean closure. The CERCLA analytes will be tested to support waste characterization. Clean closure of the ISO East container and secondary containment structure will be achieved by removal. The closure performance standards for closure of the 276BA Organic Storage Area are included in Table A-4.

Table A-2. CERCLA Contaminants of Concern

Contaminants	Chemical Abstracts Service Number
Radionuclides	
Americium-241	14596-10-2
Cesium-137	10045-97-3
Plutonium-238/239/240/241/242	15117-48-3 14119-33-6
Strontium-90	10098-97-2

Table A-3. RCRA Contaminants of Concern

Contaminants	Chemical Abstracts Service Number
Chemicals	
Metals Inductively Coupled Plasma	
Arsenic	7440-38-2
Barium	7440-39-3
Cadmium	7440-43-9
Chromium	7440-47-3
Lead	7439-92-1
Mercury	7439-97-6
Selenium	7782-49-2
Silver	7440-22-4

Table A-3. RCRA Contaminants of Concern

Contaminants	Chemical Abstracts Service Number
Semivolatile Organic Analytes	
o-cresol	95-48-7
p-cresol	106-44-5
Volatile Organic Analytes	
1,1,1-Trichloroethane	71-55-6
Acetone	67-64-1
Methylene chloride	75-09-2
Methyl ethyl ketone (MEK)	78-93-3
Methyl isobutyl ketone (MIBK)	108-10-1

Table A-4. RCRA Closure Performance Standards for Target Analytes

CAS Number	Analyte	Analytical Method[a]	Closure Performance Standard[b] (mg/kg)
7440-38-2	Arsenic	SW-846 Method 6010	20.0
7440-39-3	Barium		132
7440-43-9	Cadmium		0.69
7440-47-3	Chromium		42.0
7439-92-1	Lead		50.0
7782-49-2	Selenium		10.0
7440-22-4	Silver		2.0
7439-97-6	Mercury	SW-846 Method 7471	0.2
71-55-6	1,1,1-Trichloroethane	SW-846 Method 8260	1.58
67-64-1	Acetone		28.9
75-09-2	Methylene chloride		0.0218
78-93-3	Methyl ethyl ketone		19.6
108-10-1	Methyl isobutyl ketone		2.73
95-48-7	o-cresol	SW-846 Method 8270	2.33
106-44-5	p-cresol		8.00

Table A-4. RCRA Closure Performance Standards for Target Analytes

CAS Number	Analyte	Analytical Method[a]	Closure Performance Standard[b] (mg/kg)

Source: SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update V*.

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

b. Closure performance standards are the numeric cleanup levels calculated according to WAC 173-340, "Model Toxics Control Act–Cleanup," Method B (unrestricted use standards).

CAS = Chemical Abstracts Service

A4.3 CERCLA and RCRA Sampling Integration

The CERCLA removal action for the 276BA Organic Storage Area will be integrated with clean closure of the RCRA treatment, storage, and disposal unit. The CERCLA removal action for the 276BA Organic Storage Area will be compete when the ISO East container and secondary containment have been removed and disposed. The unit will be considered RCRA clean closed when sampling shows that all analytes are below the closure performance standards. The closure plan provides detailed sampling information for clean closure. Requirements for both RCRA and CERCLA sampling are provided in the main body of this sampling and analysis plan (SAP).

All sampling and analysis to support clean closure will be performed in accordance with the sampling and quality standards established in the main body of this SAP. The SAP utilizes SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update V*; the American Society for Testing and Materials (ASTM) *Annual Book of ASTM Standards*; and applicable EPA guidance. Sampling and analysis activities will meet applicable requirements of the most current versions of SW-846, ASTM standards, EPA-approved methods, and DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Document*. The SAP was also developed using Section 7.0 in Ecology Publication 94-111, *Guidance for Clean Closure of Dangerous Waste Units and Facilities*, and EPA/240/R-02/005, *Guidance on Choosing a Sampling Design for Environmental Data Collection for Use in Developing a Quality Assurance Project Plan* (EPA QA/G-5S).

The objective of sampling the soil underneath the secondary containment structure for RCRA clean closure is to obtain analytical data to confirm that the soil does not contain contaminants exceeding the WAC 173-340, "Model Toxics Control Act—Cleanup," Method B clean closure performance standards for the target analytes listed in Table A-4. Closure performance standards are discussed in Chapter 3 of the closure plan (DOE/RL-2015-70).

A4.4 Sampling Design

The sampling design for the 276BA Organic Storage Area includes the activities described below. Both RCRA and CERCLA sampling activities will be performed:

- **Initial Field Surveys and Smears**: Identified in Section 3.1.2 of the main text of this document, with focused sampling on radiological hot spots and source locations (e.g., leaking equipment, stained soils).
- **Soil**: Identified in Section 3.1.6 and Table 3-2 of the main text of this document. Soil will be sampled for both CERCLA and RCRA COCs, as described below.

The SAP uses Section 7.0, “Sampling and Analysis for Clean Closure,” of Ecology Publication 94-111 to determine the type of sampling design to be used to demonstrate clean closure. When designing a sampling plan, both focused and area wide (grid) sampling methods were considered. Section 7.2.1 of Ecology Publication 94-111 identifies that area-wide sampling is appropriate when the spatial distribution of contamination at or from the closure unit is uncertain. Focused sampling (as identified in Section 7.2.2 of Ecology Publication 94-111) involves selective sampling of areas where contamination is expected or releases have been documented. The 276BA Organic Storage Area briefly stored organic mixed waste and shows no history of spills, leaks, or other monitoring concerns. There is no history of releases, but due to the configuration of the secondary containment, which has a sloped floor, trench, and sump (Figure A-3), a focused sampling approach is proposed for collecting soil samples underlying the 276BA Organic Storage Area.

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

The secondary containment is a single structure consisting of two basins that held the individual ISO East and ISO West vessels. The basin formerly housing the empty ISO West vessel never received waste. The ISO East container, which received waste directly from the B Plant Complex, was placed in the 276BA Organic Storage Area secondary containment structure sealed and intact. Stored wastes were then removed from the ISO East container to a tanker truck for offsite disposal. Any potential releases from the ISO East container would likely be encountered in the location of the sump or trench within the ISO East portion of the secondary containment structure. These areas have been identified for soil sampling to demonstrate clean closure. Both RCRA and CERCLA COCs will be analyzed from each of the locations shown in Figure A-3.

For focused sampling beneath the concrete secondary containment structure, the number and location of samples was determined based on the configuration of the secondary containment. The basin cell that housed the ISO West vessel was administratively clean closed and will not be sampled. Five sampling locations beneath the ISO East secondary containment structure were determined to be sufficient to support the overall sampling approach. No structural degradation of the secondary containment has been noted, so all sampling locations were designated to soil beneath low spots and concrete seams in the secondary containment. If, upon inspection, it is observed that the structural integrity of the secondary containment has been compromised, additional samples will be taken at those locations. In addition, any discoloration or concrete staining will be examined to determine if additional focused sampling locations are warranted upon removal of the concrete structure. Figure A-3 provides the proposed sampling locations beneath the secondary containment. Global positioning system coordinates will be obtained to determine the locations for the sample sites within the sump and along concrete seams. After the secondary containment structure is removed, these locations will then be sampled. Figure A-3 shows the sample locations.

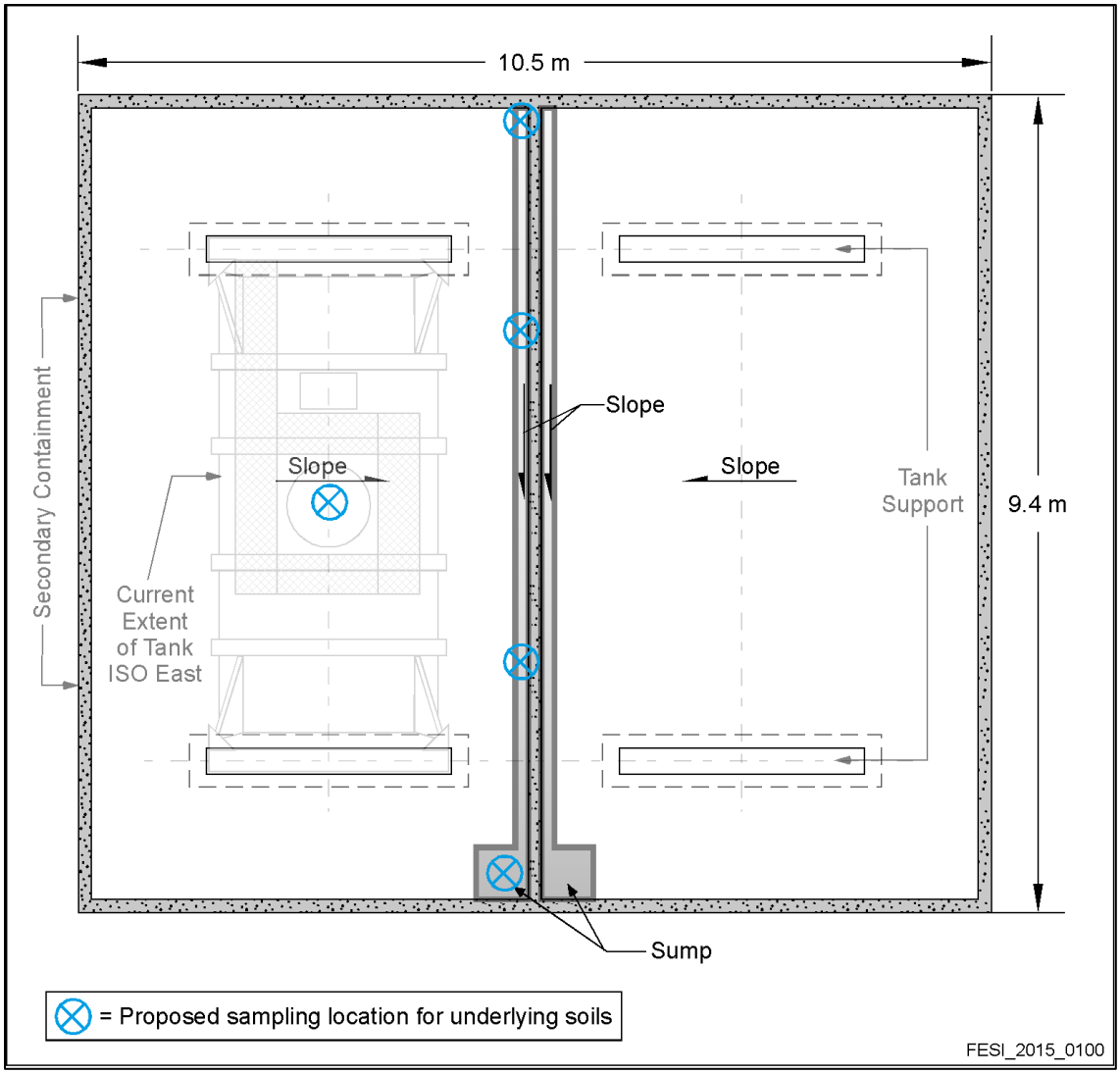

Figure A-3. Sampling Locations Beneath Secondary Containment Structure

A grab sample matrix normally consists of soil collected in pre-cleaned sample containers, taken at a depth of 0 to 15.24 cm (0 to 6 in.) below ground surface. No historical dangerous waste releases were identified; therefore, subsurface sampling is deemed unnecessary. For the purpose of this SAP, the "soil surface" is defined as the exposed surface layer once the secondary containment structure and up to 1 m of soil has been removed.

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

Sample container, preservation, and holding time requirements are specified in Table 2-6 of the SAP. These requirements are in accordance with the specified analytical methods. The final container type and volumes will be identified on the sample authorization form and the chain-of-custody form.

A5 References

ASTM International, 2017, *Annual Book of ASTM Standards*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq., Pub. L. 107-377, December 31, 2002. Available at: https://www.csu.edu/cerc/researchreports/documents/CERCLASummary1980.pdf.

DOE/RL-96-68, 2014, *Hanford Analytical Services Quality Assurance Requirements Document*, Rev. 4, Volume 1, *Administrative Requirements*; Volume 2, *Sampling Technical Requirements*; Volume 3, *Field Analytical Technical Requirements*; and Volume 4, *Laboratory Technical Requirements*, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www.hanford.gov/files.cfm/DOE-RL-96-68-VOL1-04.pdf. http://www.hanford.gov/files.cfm/DOE-RL-96-68-VOL2-04.pdf. http://www.hanford.gov/files.cfm/DOE-RL-96-68-VOL3-04.pdf. http://www.hanford.gov/files.cfm/DOE-RL-96-68-VOL4-04.pdf.

DOE/RL-2015-70, 2016, *Closure Plan for the B Plant Organic Tank TK- ISO East*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0077214H.

DOE/RL-2016-46, 2016, *Removal Action Work Plan for the B Plant Complex Tier 2 Buildings/Structures*, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology Publication 94-111, 2005, *Guidance for Clean Closure of Dangerous Waste Units and Facilities*, as amended, Washington State Department of Ecology, Olympia, Washington. Available at: https://fortress.wa.gov/ecy/publications/documents/94111.pdf.

EPA/240/R-02/005, 2002, *Guidance on Choosing a Sampling Design for Environmental Data Collection for Use in Developing a Quality Assurance Project Plan*, EPA QA/G-5S, Office of Environmental Information, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=20011HKB.txt.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq. Available at: https://elr.info/sites/default/files/docs/statutes/full/rcra.pdf.

SW-846, 2015, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update V*, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C. Compendium methods available at: https://www.epa.gov/hw-sw846/sw-846-compendium.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-303.

173-040, "Definitions."

173-630, "Use and Management of Containers."

WAC 173-340-740, "Model Toxics Control Act—Cleanup," "Unrestricted Land Use Soil Cleanup Standards," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-340-740.

This page intentionally left blank.