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OFFICE OF RIVER PROTECTION
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

JUN 1 9 2018

18-TPD-0011

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Mr. Jeffery J. Lyon, Tank Systems Operation
and Closure Project Manager
Nuclear Waste Program
Washington State Department of Ecology
3100 Port of Benton Blvd.
Richland, Washington 99354

Mr. Lyon:

THE U.S. DEPARTMENT OF ENERGY, OFFICE OF RIVER PROTECTION TRANSMITTAL OF RPP-PLAN-62041, *SAMPLING AND ANALYSIS PLAN FOR WMA A-AX FOCUS AREA 1 (TANKS 241-A-104 AND 241-A-105)*, REV.0.

The purpose of this letter is to transmit the *Sampling and Analysis Plan for WMA A-AX Focus Area 1 (Tanks 241-A-104 and 241-A-105)*, RPP-PLAN-62041 (the SAP) for Washington State Department of Ecology (Ecology) review. The SAP was developed to specify the field characterization requirements for sampling and geophysical logging as identified in the *Data Quality Objectives for Vadose Zone Characterization at Waste Management Area A-AX*, RPP-RPT-60277 (the DQO Report) and to provide direction to sampling and laboratory personnel. The SAP will ultimately become part of the Waste Management Area (WMA) A-AX *Resource Conservation and Recovery Act of 1976* facility investigation/corrective measures study work plan, which is a primary document per the *Hanford Federal Facility Agreement and Consent Order Action Plan.* Completion of this SAP before the work plan will allow earlier initiation of field characterization activities at WMA A-AX.

Beginning in January 2017, Ecology participated in a series of workshops to develop the DQO Report. Ecology provided input on the principal study questions, decision statements, and estimation statements. The DQO Report workshop participants discussed sample collection information pertinent to WMA A-AX Focus Area 1 (Tanks 241-A-104 and 241-A-105). The SAP incorporates sample locations, the number of samples to be collected, and the constituents of interest agreed upon by the DQO Report workshop participants, with minor changes to location specifics (e.g. angle of push) that do not impact the field investigation objectives.

It is anticipated that field work for this SAP will begin in June 2018, prior to Ecology approval. When field work is initiated, status information will be provided to Ecology, and sample depth meetings required by the SAP will be scheduled to ensure a collaborative effort is maintained.

JUN 1 9 2018

If you have any questions, please contact me at (509) 376-9630.

Brian A. Hulsey for
Jan Bovier, Tank Closure Project Manager
Tank Farm Program Division

TPD:JBB

Attachment

cc w/ attachment:
J.J. Lyons, Ecology
D.R. Einan, EPA
Environmental Portal
TPA Administrative Record WMA A-AX
WRPS Correspondence

cc w/out attachment:
R.S. Skeen, CTUIR
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M. Bums, Ecology
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C.L. Whalen, Ecology
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D. Rowland, YN

ATTACHMENT

18-TPD-0011

RPP-PLAN-62041-

Sampling and Analysis Plan for WMA A-AX Focus Area 1 (Tanks 241-A-104 and 241-A-105),
Rev.0.

DOCUMENT RELEASE AND CHANGE FORM

Prepared For the U.S. Department of Energy, Assistant Secretary for Environmental Management
By Washington River Protection Solutions, LLC., PO Box 850, Richland, WA 99352
Contractor For U.S. Department of Energy, Office of River Protection, under Contract DE-AC27-08RV14800

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Release Stamp

DATE: May 29, 2018 HANFORD RELEASE

1. Doc No: RPP-PLAN-62041 **Rev.** 00

2. Title:
Sampling and Analysis Plan for WMA A-AX Focus Area 1 (Tanks 241-A-104 and 241-A-105)

3. Project Number: T2R02 ☐ N/A

4. Design Verification Required: ☐ Yes ☒ No

5. USQ Number: ☒ N/A RPP-27195

6. PrHA Number **Rev.** ☒ N/A

Clearance Review Restriction Type: public

7. Approvals

Title	Name	Signature	Date
Clearance Review	Curry, Mary P	*Curry, Mary P*	05/29/2018
Document Control Approval	Hood, Evan	*Hood, Evan*	05/29/2018
Originator	Tabor, Cindy L	*Tabor, Cindy L*	05/07/2018
Other Approver	Gassman, Paul L	*Gassman, Paul L*	05/07/2018
Other Approver	McKinney, Steve G	*McKinney, Steve G*	05/02/2018
Other Approver	Withrow, Steve M	*Withrow, Steve M*	05/02/2018
Other Approver	Snyder, Susan M	*Snyder, Susan M*	04/24/2018
Other Approver	McKinney, Jo M	*McKinney, Jo M*	05/01/2018
Responsible Manager	Rutland, Paul L	*Rutland, Paul L*	05/09/2018

8. Description of Change and Justification

Initial release.

9. TBDs or Holds ☒ N/A

10. Related Structures, Systems, and Components

a. Related Building/Facilities ☒ N/A	b. Related Systems ☒ N/A	c. Related Equipment ID Nos. (EIN) ☒ N/A

11. Impacted Documents – Engineering ☒ N/A

Document Number	Rev.	Title

12. Impacted Documents (Outside SPF):

N/A

13. Related Documents ☒ N/A

Document Number	Rev.	Title

14. Distribution

Name	Organization
Childress, Ryan D	CLOSURE & INTERIM MEASURES
Gassman, Paul L	PROCESS CHEMISTRY
McKinney, Steve G	INTEGRATION & CONTROL
Tabor, Cindy L	CLOSURE & INTERIM MEASURES
Withrow, Steve M	TANK FARM SAMPLING

INFORMATION CLEARANCE REVIEW AND RELEASE APPROVAL

Part I: Background Information

Title: Sampling and Analysis Plan for WMA A-AX Focus Area 1 (Tanks 241-A-104 and 241-A-105)	Information Category: ☐ Abstract ☐ Journal Article ☐ Summary ☐ Internet ☐ Visual Aid ☐ Software ☐ Full Paper ☐ Report ☑ Other Sampling Plan
Publish to OSTI? ☐ Yes ☑ No	

	Yes	NA
Trademark/Copyright "Right to Use" Information or Permission Documentation	☐	☑

Document Number: RPP-PLAN-62041 Revision 0 | Date: April 2018

Author: Mesford, Timothy B

Part II: External/Public Presentation Information

Conference Name:

Sponsoring Organization(s): WRPS

Date of Conference: | Conference Location:

Will Material be Handed Out? ☐ Yes ☑ No | Will Information be Published? ☐ Yes ☑ No *(If Yes, attach copy of Conference format instructions/guidance.)*

Part III: WRPS Document Originator Checklist

Description	*Yes*	*N/A*	*Print/Sign/Date*
Information Product meets requirements in TFC-BSM-AD-C-01?	☐	☑	
Document Release Criteria in TFC-ENG-DESIGN-C-25 completed? (Attach checklist)	☐	☑	
If product contains pictures, safety review completed?	☑	☐	Roberts, Sheryl K 4/24/2018 via IDMS data, file att.

Part IV: WRPS Internal Review

Function	*Organization*	*Date*	*Print Name/Signature/Date*
Subject Matter Expert	WRPS	5/29/2018	Mesford, Timothy B via IDMS data, file att.
Responsible Manager	WRPS	4/24/2018	Rutland, Paul L via IDMS data, file att.
Other:			

Part V: IRM Clearance Services Review

Description	*Yes*	*No*	*Print Name/Signature*
Document Contains Classified Information?	☐	☒	If Answer is "Yes," ADC Approval Required Print Name/Signature/Date
Document Contains Information Restricted by DOE Operational Security Guidelines?	☐	☒	Reviewer Signature: Print Name/Signature/Date
Document is Subject to Release Restrictions? *If the answer is "Yes," please mark category at right and describe limitation or responsible organization below:*	☐	☒	Document contains: ☐ Applied Technology ☐ Protected CRADA ☐ Personal/Private ☐ Export Controlled ☐ Proprietary ☐ Procurement – Sensitive ☐ Patentable Info. ☐ OUO ☐ Predecisional Info. ☐ UCNI ☐ Restricted by Operational Security Guidelines ☐ Other (Specify)
Additional Comments from Information Clearance Specialist Review?	☐	☒	Information Clearance Specialist Approval APPROVED By Mary P. Curry at 11:22 am, May 29, 2018 Print Name/Signature/Date

When IRM Clearance Review is Complete – Return to WRPS Originator for Final Signature Routing (Part VI)

INFORMATION CLEARANCE REVIEW AND RELEASE APPROVAL

Part VI: Final Review and Approvals

Description	*Approved for Release*		*Print Name/Signature*
	Yes	*N/A*	
WRPS External Affairs	☒	☐	McKenna, Mark via IDMS data, file att.
WRPS Office of Chief Counsel	☒	☐	Page, Christopher (Brad) via IDMS data, file att.
DOE – ORP Public Affairs/Communications	☒	☐	Marshall, Richard A via IDMS data, file att.
Other:	☐	☐	
Other:	☐	☐	

Comments Required for WRPS-Indicate Purpose of Document:

This sampling and analysis plan defines the sampling and analysis requirements for vadose zone soil characterization of the area around Tank 241-A-104 and Tank 241-A-105 in Waste Management Area A-AX.

APPROVED
By Mary P. Curry at 11:22 am, May 29, 2018

Approved for Public Release; Further Dissemination Unlimited

Information Release Station

Was/Is Information Product Approved for Release? ☒ Yes ☐ No

If Yes, what is the Level of Releaser? ☑ Public/Unrestricted ☐ Other (Specify) _____

Date Information Product Stamped/Marked for Release: 5/29/2018

Was/Is Information Product Transferred to OSTI? ☐ Yes ☒ No

Forward Copies of Completed Form to WRPS Originator

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RPP-PLAN-62041
Revision 0

Sampling and Analysis Plan for WMA A-AX Focus Area 1 (Tanks 241-A-104 and 241-A-105)

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

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC27-08RV14800

washingtonriver protectionsolutions

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Approved for Public Release;
Further Dissemination Unlimited

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ACRONYMS

bgs	below ground surface
DOE	U.S. Department of Energy
DQA	data quality assessment
DQO	data quality objective
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FWS	Field Work Supervisor
HEIS	Hanford Environmental Information System
HFFACO	*Hanford Federal Facility Agreement and Consent Order*
QA	quality assurance
QC	quality control
RFI	*Resource Conservation and Recovery Act of 1976* facility investigation
SAP	sampling and analysis plan
SMO	Sample Management Office
WMA	Waste Management Area
WRPS	Washington River Protection Solutions

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1.0 INTRODUCTION

This sampling and analysis plan (SAP) defines the sampling and analysis requirements for vadose zone soil characterization of the area around Tank 241-A-104 (A-104) and Tank 241-A-105 (A-105) in Waste Management Area (WMA) A-AX. The area to be characterized is identified as WMA A-AX Focus Area 1 (Figure 1-1). The work performed under this SAP is expected to provide information to meet this focus area's data needs identified in RPP-RPT-60227, *Data Quality Objectives for Vadose Zone Characterization at Waste Management Area A-AX* (the Data Quality Objectives [DQO] Report).

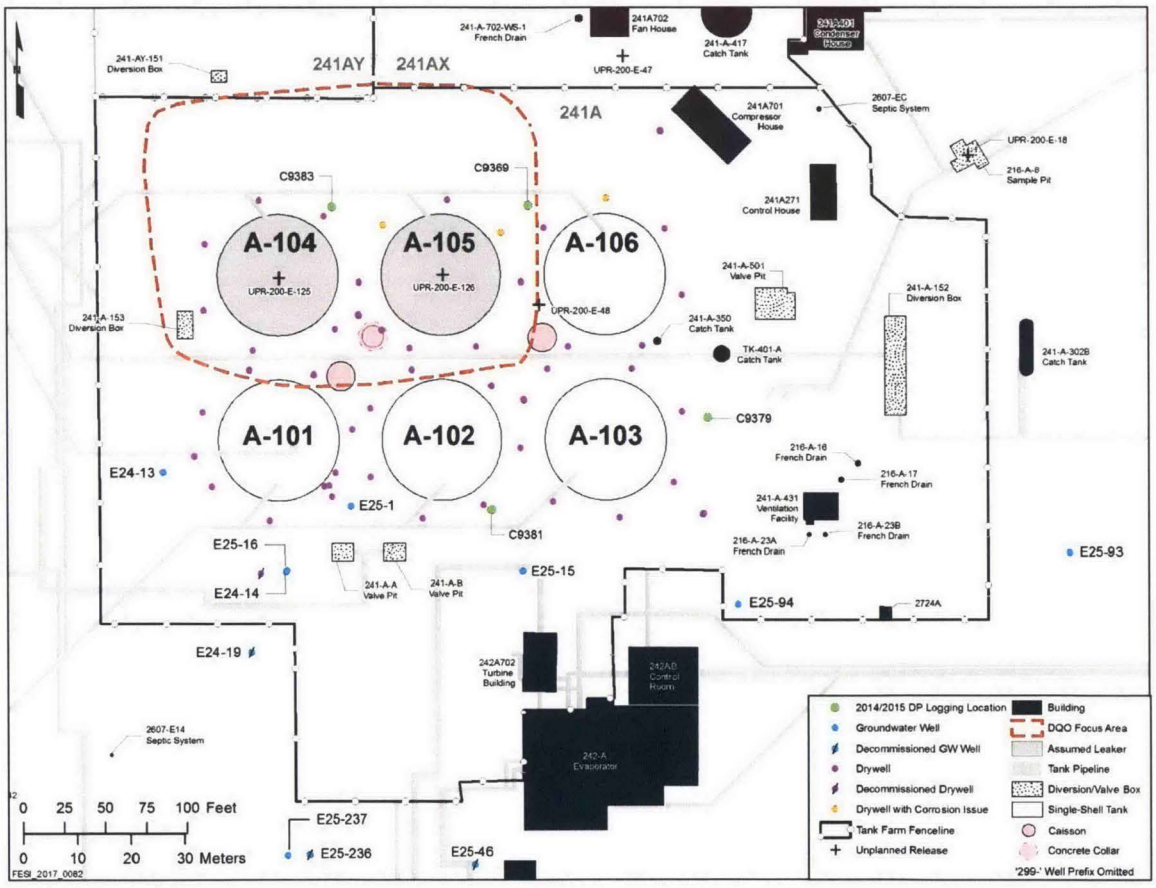
As described in the DQO Report, characterization activities will be undertaken in an iterative manner, with SAPs being prepared to address different focus areas, as needed. After the boundary of WMA A-AX is defined, all focus areas are identified, and all sampling locations pertaining to WMA A-AX characterization are agreed upon, a *Resource Conservation and Recovery Act of 1976* facility investigation (RFI)/corrective measures study work plan will be developed. The work plan will present the preliminary conceptual site model; summarize focus area-specific data needs for WMA A-AX; and provide the context for this SAP within the overall decision-making process for the WMA A-AX performance assessment and closure. Completion of this SAP before the work plan will allow earlier initiation of field characterization activities at WMA A-AX.

This SAP supports vadose zone data collection around Focus Area 1. If the decision makers determine other focus areas should be investigated, then additional SAPs will be developed, as needed. Each SAP will be a stand-alone document to support field and laboratory efforts. This SAP is comprised of the following components:

- Introduction (Section 1.0)
- Project Organization (Section 2.0)
- Quality Assurance and Quality Control Requirements (Section 3.0)
- Drywell Logging (Section 4.0)
- Field Sampling Plan (Section 5.0)
- Sample Analysis Requirements (Section 6.0)
- Data Management (Section 7.0)
- Change Control (Section 8.0)
- Documents and Records (Section 9.0)
- Management of Waste (Section 10.0)
- Health and Safety Plan (Section 11.0)
- References (Section 12.0).

Much of the rationale and background material for characterization work and focus area selection are contained in the DQO Report. The DQO principal study questions, decision statements, and estimation statements developed for WMA A-AX are also contained in the DQO Report.

Figure 1-1. Study Boundary for WMA A-AX Focus Area 1



1.1 PURPOSE AND SCOPE

The purpose of this SAP is to specify the requirements for field characterization (i.e., sampling and geophysical logging), laboratory analysis, and data reporting for soil samples that will be collected around Tanks A-104 and A-105. The requirements are based on objectives developed using a DQO process as documented in the DQO Report. The State of Washington Department of Ecology (Ecology), the U.S. Department of Energy (DOE), and its contractors participated in the DQO process. This SAP and the future work plan provide and will provide information that is consistent with guidelines described in WAC 173-340-820, "Model Toxics Control Act – Cleanup," "Sampling and Analysis Plans." More specifically, this SAP provides overall requirements for soil characterization that will be performed to support development of an RFI report and subsequent corrective measures study, as appropriate, for WMA A-AX.

The scope of this SAP consists of collecting vadose zone soil samples from identified direct push locations and performing geophysical logging at these locations and in drywells in the area around Tanks A-104 and A-105 to support the:

- Preparation of the WMA A-AX RFI report and corrective measures study, as appropriate, including assessment of risk to human health and the environment
- Development and refinement of the WMA A-AX conceptual site model
- Process of risk-informed tank waste retrieval at WMA A-AX.

Information regarding treatment, management, and disposal of the radioactive source, byproduct material, and/or special nuclear components of mixed waste (as defined by the *Atomic Energy Act of 1954*, as amended) is not provided in this SAP for the purpose of regulating the radiation hazards of such components under the authority of this SAP or the Hazardous Waste Management Act (RCW 70.105, "Hazardous Waste Management"), but is provided for informational purposes only.

1.2 FOCUS AREA BACKGROUND INFORMATION

Tanks A-104 and A-105 are located in the northern portion of the 241-A Tank Farm, south of the 241-AX Tank Farm. Tanks A-104 and A-105 are both 22.9 m (75 ft) diameter, constructed with a carbon steel liner within a cylindrical reinforced concrete shell. Each tank is approximately 13.4 m (44 ft) deep with an operating capacity of approximately 3,785,411 L (1,000,000 gal). The tanks were designed for the storage of boiling waste generated from irradiated fuel reprocessing at the Plutonium-Uranium Extraction Plant. Lateral lines extending under the tanks were used as leak detection systems.

As per RPP-ENV-37956, *Hanford 241-A/AX Farm Leak Inventory Assessment Report*, Tanks A-104 and A-105 are assumed to be the only leaking tanks in WMA A-AX, with Tank A-105 having the largest waste loss at an estimated 7,570 to 151,416 L (2,000 to

40,000 gal) and Tank A-104 having a waste loss of 7,570 L (2,000 gal). For this reason, the area around these two tanks was selected to be the first focus area investigated at WMA A-AX. RPP-ENV-37956 provides depictions of leak locations for both Tanks A-104 and A-105 (Figures 1-2 and 1-3, respectively) along with information obtained from the tank laterals. Numerous documents provide information about Tanks A-104 and A-105. Much of this information is summarized in RPP-ENV-37956, which is the primary source for the information presented below. Appendix C of the DQO Report also provides the relevant information pertaining to sample location selection.

1.2.1 Tank A-104

Tank A-104 was designated as a "confirmed leaker" in April 1975 based on increased radioactivity detected in laterals 14-04-01 and 14-04-02 (refer to Figure 1-2). Lateral data obtained from 1975 to 1986 show elevated gamma activity below the tank that indicates the presence of a tank liner leak.

Based on the activity in the laterals under the tank and the absence of gamma activity from drywells surrounding the tank, it appears the tank liner leaked at or near the tank footing, likely due to tank liner failure. The actual size of the leak is uncertain, and additional characterization has been recommended to better assess the volume and extent of the tank liner leak.

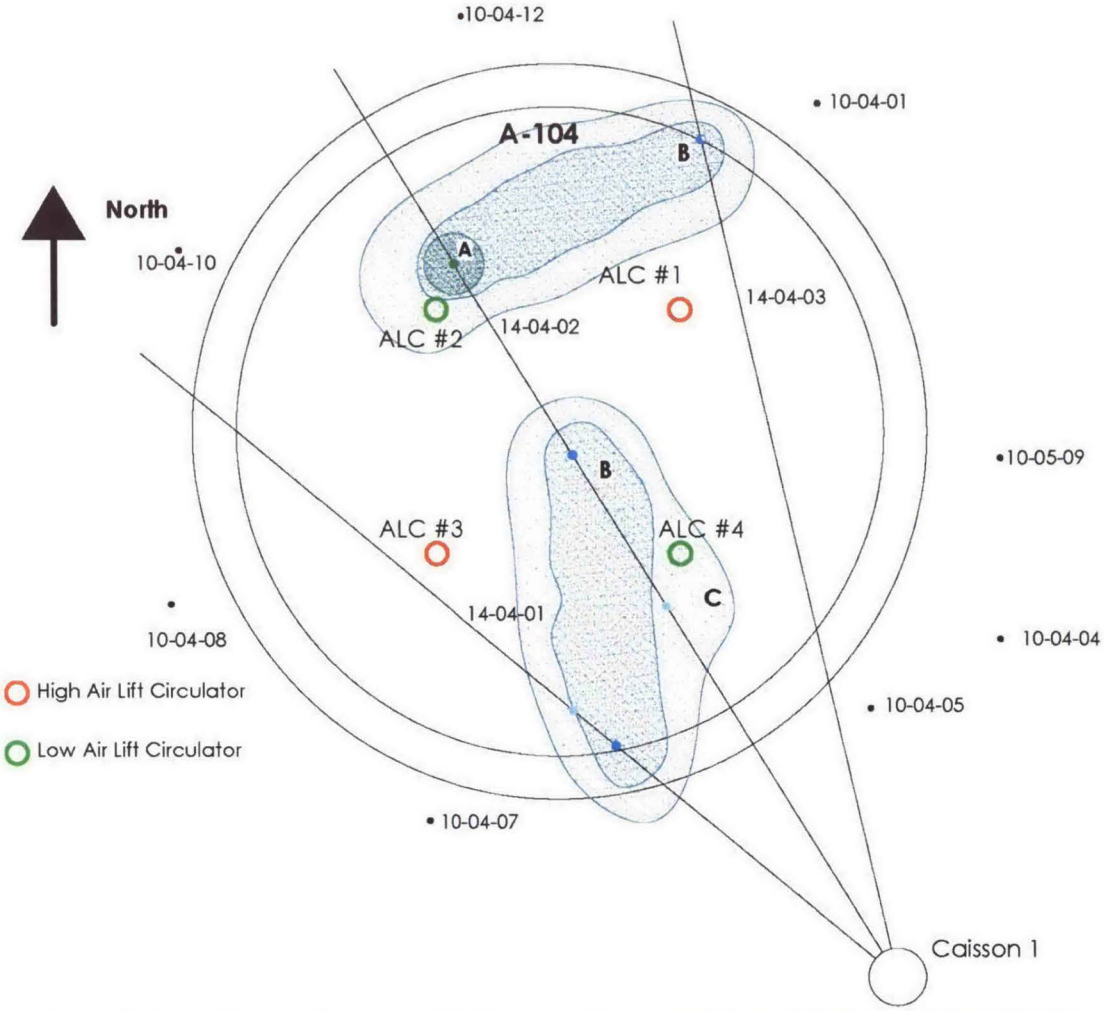
Leak locations depicted in Figure 1-2 are based on peak readings and are a representation of possible initial and subsequent boundaries of radioactivity. It was determined that the leak site or sites are located at or near the tank footing, because the liquid level in Tank A-104 was reported at 78.7 cm (31 in.) at the end of February 1975. Several possible causes for liner leaks were examined, but the most likely cause was the Tank A-104 thermal conditions.

The level of radioactivity measured at the laterals indicates the leak was small. Leak volume estimates range from 1,892 to 9,463 L (500 to 2,500 gal). The best estimate for the leak volume was determined to be ~7,570 L (2,000 gal) (ARH-LD-206 B, *Atlantic Richfield Hanford Monthly Report August 1975*, pp. 10).

1.2.2 Tank A-105

Tank A-105 was designated as a "confirmed leaker" in April 1975, based on increased radioactivity detected in laterals 14-05-01 and 14-05-02 and increased temperatures in tank laterals. In-tank surface level changes and video observation of a bulge and ripped liner confirm the tank leaked.

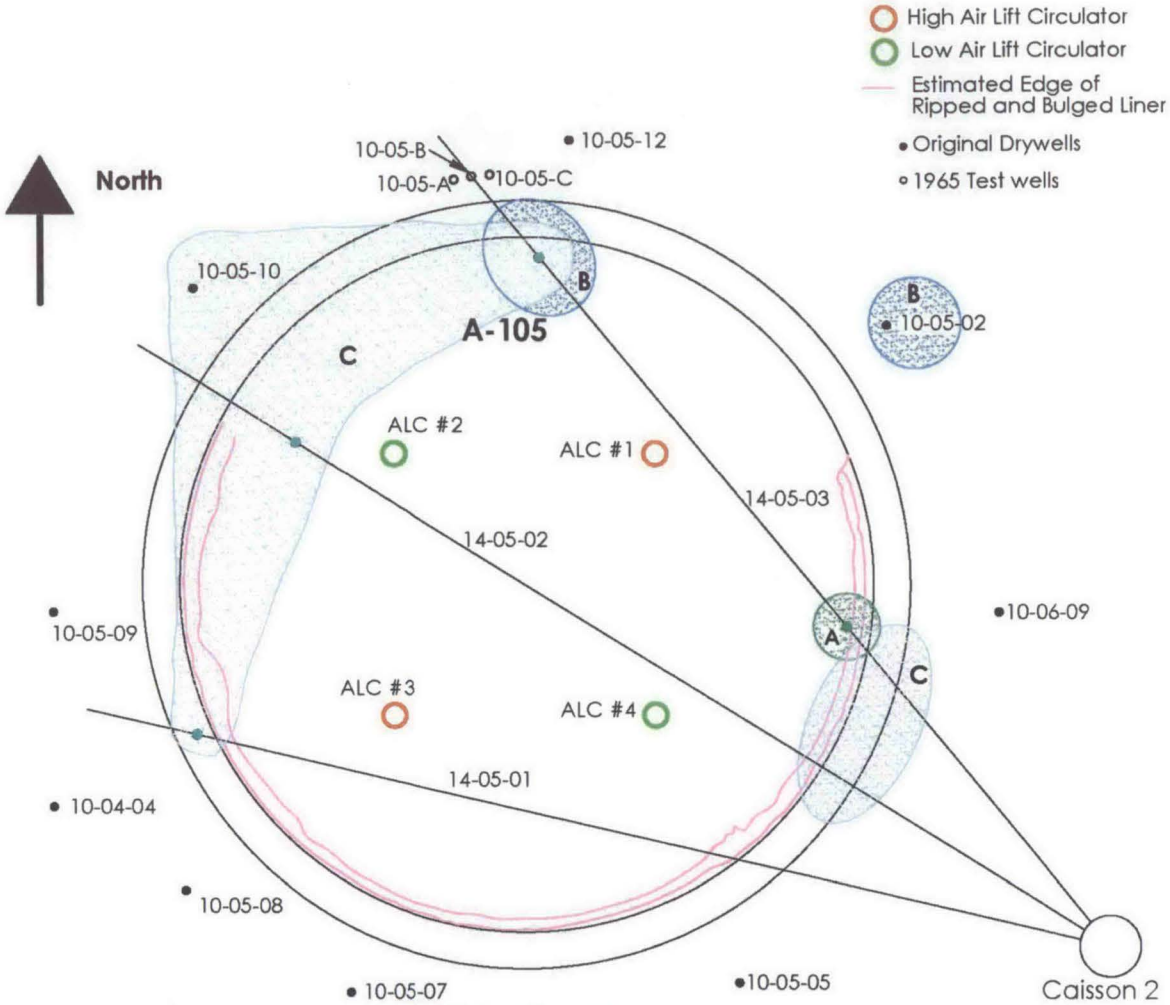
Figure 1-2. Tank A-104 Possible Leak Locations and Indicators



A	B	C
March 1975	**April 1975**	**May 1975**
Radioactivity first detected in lateral 14-04-02 in March 1975 in the northern portion of tank A-104 shortly after the start of sluicing the tank in September 1974. The peak radioactivity was reported at 100 cpm in lateral 14-04-02 at approximately 94-ft from the caisson. No radioactivity was detected in the other laterals or drywells during this time.	A week after initial radioactivity was detected in lateral 14-04-02, counts continued to increase in the northern portion of the tank. Thus, sluicing was halted on April 7, 1975. On April 8, 1975, radioactivity was first detected in lateral 14-04-01 and an additional peak was recorded in lateral 14-04-02, both in the southern portion of the tank. On April 21, 1975, radioactivity was first reported in lateral 14-04-03 in the northern portion of the tank. Tank A-104 was declared a confirmed leaker and supernatant was pumped out of the tank from April 9 through April 19, 1975.	In May 1975, additional peaks were detected in lateral 14-04-02 along the southern edge of the tank. Radioactivity in site B continued to slowly increase through 1975. Radioactivity in lateral 14-04-03 slowly increased in May 1975 and then slowly declined. The tank A-104 liquid level was reported at 6.5-in at the end of April 1975 and radioactivity in the laterals appeared to stabilize by the end of 1975. No radioactivity was detected in the surrounding drywells.

Reference: RPP-RPT-54912, *Hanford Single-Shell Tank Leak Causes and Locations - 241-A Farm.*

Figure 1-3. Tank A-105 Possible Leak Locations and Indicators



A	B	C
Nov-63	**Feb-65**	**Aug-68**
Radioactivity first detected in lateral 14-05-03 in November 1963 in the southeast portion of tank A-105. Readings remained relatively stable through March 1965. A sidewall leak was postulated during this time; however, it was not confirmed. No radioactivity was detected in the other laterals or drywells, and tank A-105 remained in service.	A steam eruption occurred in tank A-105 on January 28, 1965 causing the bottom liner to tear. One month later, radioactivity was reported in lateral 14-05-03 in the north portion of the tank. Three test wells were drilled near this lateral; however, no radioactivity or moisture was detected in these test wells. Radioactivity was detected January 1965 in drywell 10-05-02 at 74-ft BGS. The source of radioactivity may have been migration of mobile Ru-106 from a tank A-105 leak, possibly related to the November 1963 event.	In March 1968, tank A-105 was declared a confirmed leaker. Tank A-105 sluicing campaigns were conducted in 1968 and 1970. Laterals 14-05-01 and 14-05-02 began to increase in radioactivity during the first sluicing campaign August 1968 to November 1968. Sluicing became ineffective and was shut down. A second, more aggressive, sluicing campaign began August 1970 and was halted November 1970 after significant increases were detected in all the laterals underneath tank A-105. Radioactivity in drywell 10-05-10 increased between 1965 and 1972 which appears to be associated with radioactivity detected in lateral 14-05-02.

Reference: RPP-RPT-54912, *Hanford Single-Shell Tank Leak Causes and Locations - 241-A Farm.*

On November 19, 1963, radioactivity detected in lateral 14-05-03 (ARH-78, *PUREX TK-105-A Waste Storage Tank Liner Instability and Its Implications on Waste Containment and Control*) indicated Tank A-105 had leaked. On January 28, 1965, Tank A-105 experienced a rapid pressurization event that resulted in the tank liner bulging upward ~2.4 m (8 ft) and the liner being ripped around the edges of the tank. Radioactivity (250,000 to 350,000 counts per minute [c/m]) was detected beneath the tank in March 1965 in lateral 14-05-03. Radioactivity was also detected beneath the tank in October 1967 in laterals 14-05-02. Cooling water was added through January 1968.

From February 1968 through August 1968, the supernate in Tank A-105 was removed and the supernate heel diluted through a series of flushes using 221-B Plant cesium ion exchange supernate. In July 1968, radioactivity was detected below the west edge of the tank in laterals 14-05-01 and 14-05-02. Following the dilution and flushing of Tank A-105 supernate, two sluicing campaigns were conducted to remove the sludge from Tank A-105. The first sluicing campaign, conducted from August through November 1968, used cesium-denuded supernate derived from operation of the cesium ion exchange process in B Plant. In the second sluicing campaign conducted from August 1970 through November 1970, a 1-Molar inhibited sulfuric acid was sprayed onto the sludge in Tank A-105, and waste was sluiced using cesium-denuded supernate generated in B Plant. From November 1970 through December 1978, cooling water was added to Tank A-105. Based on evaporation estimates, it is possible some of the cooling water may have leaked from the tank.

Lateral data obtained from 1963 to 1986, showing elevated gamma activity and high temperatures below Tank A-105, clearly indicate the existence of a tank liner leak. In-tank surface level changes and video observation of a bulge and ripped liner confirm that the tank leaked. Based on the dates that increased gamma activity was detected in the laterals, the waste type leaked from Tank A-105 was determined to be a combination of the Plutonium-Uranium Extraction Plant supernatant waste with a cesium-137 concentration of 30.7 Ci/gal (as of May 1965 [ARH-78]) and B Plant ion exchange waste with a cesium-137 concentration of 1.38 Ci/gal (as of June 1968 [Interoffice Memo 7G420-06-004, "Estimation of Tank 241-A-105 Supernatant Cesium-137 Concentration During Sluicing in August 1968"]).

Leak locations depicted in Figure 1-3 are based on peak readings and are a representation of possible initial and subsequent boundaries of radioactivity. Based on gamma activity measured in the laterals, and the ripped liner on the tank perimeter at the base of the tank, the tank likely leaked from around the tank perimeter at the tank base. The estimated volume of waste released from Tank A-105 is ~7,570 L (2,000 gal).

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2.0 PROJECT ORGANIZATION

The project organization information is presented in the following sections and in Figure 2-1.

2.1 PROJECT MANAGER

The Project Manager (or designee) is responsible for the project-related activities including coordinating with DOE, regulators, and contactors in support of field activities to ensure work is performed safely and cost effectively. The Project Manager (or designee) coordinates the preparation and updates to the DQO, work plan, and SAPs, as required. In addition, the Project Manager (or designee) is also responsible for managing sampling documents and requirements, field activities, subcontracted tasks, and for ensuring the project file is properly maintained.

2.2 WASTE MANAGEMENT

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

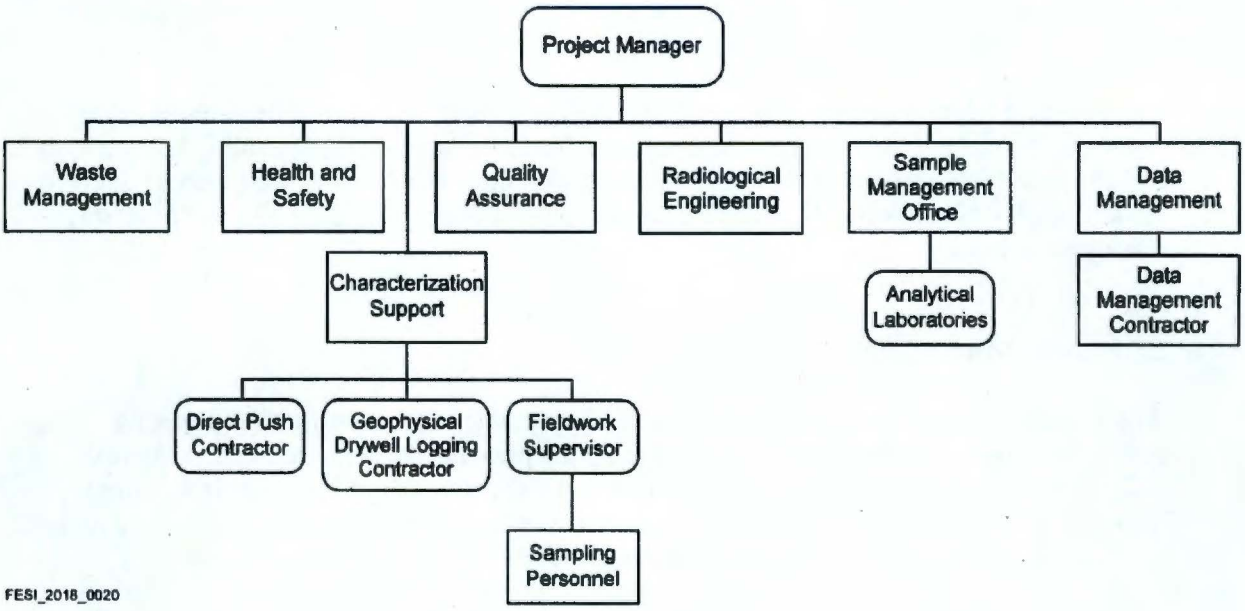
2.3 HEALTH AND SAFETY

The Health and Safety organization is responsible for coordinating industrial health and safety support within the project as per required health and safety plan, job hazard analyses, and other pertinent safety documents; providing assistance to ensure compliance with applicable health and safety standards/requirements; and coordinating with Radiological Engineering to determine personal protective clothing requirements.

2.4 QUALITY ASSURANCE

The quality assurance (QA) point of contact provides independent oversight and is responsible for addressing QA issues on the project. The QA point of contact performs assessments and surveillance, as necessary; reviews documentation generated through implementation of field, data management, and/or laboratory activities; and identifies quality assurance hold points or best management practices, as needed.

Figure 2-1. Project Organization



2.5 RADIOLOGICAL ENGINEERING

Radiological Engineering is responsible for conducting As Low As Reasonably Achievable reviews, exposure and release modeling, and radiological control optimization; identifying that appropriate controls are implemented to maintain worker safety; interfacing with Health and Safety; and planning and directing radiological control technicians that support field activities.

2.6 SAMPLE MANAGEMENT OFFICE

The Sample Management Office (SMO) 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. SMO also coordinates with Data Management and associated contractor if issues arise with performing analyses.

The analytical laboratories analyze samples in accordance with established procedures and the requirements of this plan, and provide necessary laboratory data reports containing analytical and quality control (QC) results. Laboratories provide explanations of results to support data review and in response to resolution of analytical issues, and coordinate with the SMO and the Data Management Lead.

2.7 DATA MANAGEMENT

Data Management and associated contractor are responsible for generating field sampling documents, labels, and instructions for field sampling personnel and developing the sample authorization form, which provides information and instruction to the analytical laboratories. Data Management and the associated contractor ensure that field sampling documents are revised to reflect approved changes and coordinates with the SMO on project requirements.

Data Management and the associated contractor receive analytical data from the laboratories, ensure it is appropriately reviewed, perform data entry into the Hanford Environmental Information System (HEIS) database, and arrange for data validation and recordkeeping. Data Management and the associated contractor are also responsible for resolving sample documentation deficiencies or issues associated with field activities, laboratories, or other entities. The Data Management Lead is responsible for informing the Project Manager of any issues reported by the analytical laboratories.

2.8 CHARACTERIZATION SUPPORT

Characterization Support personnel convey field requirements and schedule information to various supporting organizations including the Direct Push Contractor, the geophysical drywell logging contractor, and the Field Work Supervisor (FWS). The direct push and geophysical drywell logging contractors will work under the supervision of Characterization Support

personnel. The Characterization Support personnel will also act as the Sampling Lead and coordinate with nuclear chemical operators (sampling personnel), as necessary.

The FWS directs the sampling personnel, who collect samples in accordance with this SAP, corresponding standard methods, work packages, and procedures. 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 sampling personnel are appropriately trained and available. Sampling personnel collect samples in accordance with sampling documentation; complete field logbooks, chain-of-custody forms, and any necessary shipping paperwork; and deliver samples to the analytical laboratory.

3.0 QUALITY ASSURANCE AND QUALITY CONTROL REQUIREMENTS

Quality assurance plan objectives are met through implementation of all sections of this SAP. This SAP establishes the quality requirements for environmental data collection, including planning, implementation, and assessment of sampling, field measurements, and laboratory analysis. This SAP has been developed to comply with the requirements of the following:

- DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Documents* (HASQARD)
- DOE 0 414. 1D, *Quality Assurance*
- EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans*

This SAP is also compliant with Ecology et al. 1989, *Hanford Federal Facility Agreement and Consent Order* (HFFACO) Action Plan, Section 6.5, Quality Assurance.

The HASQARD establishes the quality requirements for environmental data collection, including sampling and analysis, in support of the single-shell tank *Resource Conversation and Recovery Act of 1976* Corrective Action Program. The HASQARD applies to field and laboratory activities and identifies the QC requirements for environmental data collection, including sampling, field measurements, and laboratory analysis.

Hanford Site onsite laboratories performing analyses in support of this SAP will have approved and implemented QA plans. These QA plans will meet the minimum requirements of HASQARD as the baseline for laboratory quality systems. Any analytical work subcontracted to a commercial laboratory off the Hanford Site shall comply with the DOE Consolidated Audit Program Quality Systems manual, or the laboratory be shall be scheduled for a DOE Consolidated Audit Program accreditation audit. A commercial laboratory off the Hanford Site is subject to Washington River Protection Solutions (WRPS) audit and QA Program approval.

Project management and QA may conduct random surveillance and assessments to verify compliance with the requirements outlined in this SAP, project work packages, procedures, and regulatory requirements. Deficiencies identified by these assessments shall be reported in accordance with existing programmatic requirements. Corrective actions will be implemented as required by WRPS policy and procedures. Management will be made aware of deficiencies identified by assessments and surveillances and subsequent corrective actions.

All sampling and analysis activities will be performed using approved methods, procedures, work packages, and plans. The methods, procedures, work packages, and plans are written to meet regulatory, operational, and/or laboratory QA plan requirements.

Sampling and analysis activities shall be performed by qualified personnel using properly maintained and calibrated equipment. Sampling and laboratory personnel shall complete the necessary training and must receive appropriate certification to perform assigned tasks in support

of the project. 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, at a minimum, 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)
- Radiological worker training.

A graded approach is used to ensure that workers receive a level of training commensurate with their responsibilities that complies with applicable DOE orders and government regulations. Specialized employee training includes pre-job briefings, on-the-job training, emergency preparedness, plan-of-the-day activities, and facility/worksite orientations.

3.1 QUALITY CONTROL REQUIREMENTS FOR FIELD SAMPLING

Prior to sampling, sampling equipment shall be cleaned using a procedure that is consistent with SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, sampling equipment cleaning protocol. Only new (unused), pre-cleaned, quality assured sample containers shall be used for sample collection. Field QC samples shall be collected to evaluate the potential for cross-contamination and provide information pertinent to field sampling variability. Field QC samples will include the collection of field duplicates, field blanks, and equipment rinsate blanks, where appropriate. Sampling personnel will prepare field QC samples.

3.1.1 Field Duplicates

Field duplicates are independent samples collected as close as possible to the same time and same location, and intended to be identical. Field duplicates are used to determine precision for both sampling and laboratory requirements. It is not possible to collect field duplicates for direct push. For this reason, field duplicates will not be required for subsurface samples; however, field duplicates will be collected for surface soil samples (i.e., first 31 cm [12 in.]).
The duplicate samples shall be shipped to the laboratory in the same manner as the primary samples. Per HASQARD, field duplicates are normally collected at a frequency of 5 to 10% of the samples collected per matrix (e,g., soil). The DQO Report identified that field duplicates for surface samples will be collected at a frequency of 25%.

3.1.2 Field Blanks

Field blank samples are samples prepared in the field at the sample collection site and returned to the laboratory with the samples to be analyzed. They are primarily used to test for contamination from the atmosphere. Field blank samples shall consist of deionized water. Field blank samples are samples prepared in the field at the sample collection site and returned to the laboratory with the samples to be analyzed. HASQARD does not identify a frequency for collection of field

blanks but does suggest a frequency of not less than 5%. For this project, field blank samples will be collected for every 20 samples (i.e., frequency of 5%).

3.1.3 Equipment Rinsate Blanks

Equipment rinsate blanks are prepared after the sampling equipment is cleaned; they are used to verify the adequacy of sampling equipment decontamination procedures and shall be collected for each sampling method or type of equipment used. Equipment rinsate blank samples shall consist of deionized water washed over or through decontaminated sampling equipment. Per HASQARD, equipment rinsate blanks shall be collected in the field and at the rate specified by the project. For this project, equipment rinsate blanks will be collected for every 20 samples (i.e., frequency of 5%).

3.1.4 Prevention of Cross-Contamination

Special care shall be taken to prevent cross-contamination of samples. Particular care will be exercised 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 them on or near potential contamination sources, such as uncovered ground. Samples shall not be collected or stored in the presence of exhaust fumes.
- Handling bottles or equipment with dirty hands. Sample containers shall be filled with care to prevent any portion of the collected sample from coming in contact with the sampling personnel's gloves.
- Improperly decontaminating equipment before sampling or between sampling events.

3.2 REQUIRED QUALITY CONTROL FOR ANALYSIS

The QA objective of this plan is to develop implementation guidance that will provide data of known and appropriate quality and that are suitable for the intended use. Data quality is assessed, in part, by evaluation of precision, accuracy, representativeness, comparability, completeness, bias, and sensitivity. These terms (i.e., data quality indicators) are defined in Table 3-1.

Table 3-1. Data Quality Indicators

Data Quality Indicator (QC Element)[a]	Definition	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.	Use the same analytical instrument to make repeated analyses on the same sample. Use the same method to make repeated measurements of the same sample within a single laboratory. Acquire replicate field samples for information on sample acquisition, handling, shipping, storage, preparation, and analytical processes and measurements.	If duplicate data do not meet objective: • Evaluate apparent cause (e.g., sample heterogeneity). • Request reanalysis or re-measurement. • Qualify the data before use.
Accuracy (laboratory control samples, matrix spikes, and surrogates)	Accuracy is the closeness of a measured result to an accepted reference value. Accuracy is usually measured as a percent recovery. QC analyses used to measure accuracy include standard recoveries, laboratory control samples, spiked samples, and surrogates.	Analyze a reference material or reanalyze a sample to which a material of known concentration or amount of pollutant has been added (a spiked sample).	If recovery does not meet objective: • Qualify the data before use. • Request reanalysis or remeasurement.
Representativeness (field duplicates)	Sample representativeness expresses the degree to which data accurately and precisely represent 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 that the approved plans were followed during sampling and analysis.	Evaluate whether measurements are made and physical samples 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.

Table 3-1. Data Quality Indicators

Data Quality Indicator (QC Element)[a]	Definition	Determination Methodologies	Corrective Actions
			• Redefine sampling and measurement requirements and protocols. • Resample and reanalyze, as appropriate.
Comparability (field duplicate, 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 collection and handling methods, sample preparation and analytical methods, holding times, and QA protocols.	If data are not comparable to other data sets: • Identify appropriate changes to data collection and/or analysis methods. • Identify quantifiable bias, if applicable. • Qualify the data as appropriate. • Resample and/or reanalyze if needed. • Revise sampling/analysis protocols to ensure future comparability.
Completeness (no QC element; addressed in data quality assessment)	Completeness is a measure of the amount of valid data collected compared to the amount planned. Measurements are considered to be valid if they are unqualified or qualified as estimated data during validation. Field completeness is a measure of the number of samples collected versus the number of samples planned. Laboratory completeness is a measure of the number of valid measurements compared to the total number of measurements planned.	Compare the number of valid measurements completed (samples collected or samples analyzed) with those established by the project's quality criteria (data quality objectives or performance/ acceptance criteria).	If data set does not meet 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.
Bias (equipment blanks, field 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	Sampling bias may be revealed by analysis of replicate samples. Analytical bias may be assessed by comparing a measured value in a sample of	For sampling bias: • Properly select and use sampling tools. • Institute correct sampling and subsampling practices to limit preferential

Table 3-1. Data Quality Indicators

Data Quality Indicator (QC Element)[a]	Definition	Determination Methodologies	Corrective Actions
	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.	known concentration to an accepted reference value or by determining the recovery of a known amount of contaminant spiked into a sample (matrix spike).	selection or loss of sample media. • Use sample handling practices, including proper sample preservation, that limit the loss or gain of constituents to the sample media. • Analytical data that are known to be affected by either sampling or analytical bias are flagged to indicate possible bias. • Laboratories that are known to generate biased data for a specific analyte are asked to correct their methods to remove the bias as best as practicable. Otherwise, samples are sent to other laboratories for analysis.
Sensitivity (method detection limit, practical quantitation limit, and relative percent difference)	Sensitivity is an instrument's or method's minimum concentration that can be reliably measured (i.e., instrument detection limit or limit of quantitation).	Determine the minimum concentration or attribute to be measured by an instrument (instrument detection limit) or by a laboratory (limit of quantitation). The lower limit of quantitation[b] is the lowest level that can be routinely quantified and reported by a laboratory.	If detection limits do not meet objective: • Request reanalysis or re-measurement using methods or analytical conditions that will meet required detection or limit of quantitation. • Qualify/reject the data before use.

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

a. QC acceptance requirements are provided in Table 6-1.

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

All analyses shall be performed in accordance with these requirements. Laboratories performing analyses in support of this SAP shall have approved and implemented QA plans. These QA plans shall meet HASQARD minimum requirements.

The laboratory shall also use calibration blanks and calibration check standards appropriate for the analytical instrumentation being used (see HASQARD for definitions of QC samples and standards). The criteria presented are goals for demonstrating reliable method performance. The laboratory will use its internal QA system for addressing any QC failures. QC failures will be brought to the immediate attention of the SMO and the Data Management Lead. Additionally if the QC failures are systematic and cannot be resolved by the internal protocols, the SMO and the Data Management Lead shall be consulted to determine the proper action. The laboratory should suggest a course of action at that time. Data not meeting the QC requirements shall be properly noted, and the associated QC failures shall be discussed in the narrative of the laboratory data report.

3.2.1 Laboratory Quality Control

Laboratory QC samples estimate precision and accuracy of the analytical data. The laboratory method blanks, duplicates, laboratory control sample/blank spike, and matrix spikes are defined in Chapter 1 of SW-846. In the event that sample material is not sufficient to perform all analyses, analyses will be prioritized and sample material allocated to complete as many analyses as possible in priority order (refer to Section 6.2). If insufficient sample is available for completion of laboratory QC analyses, the laboratory will make note of the condition in the data package (i.e., laboratory data report) narrative, and the associated data results will have laboratory qualifiers added as appropriate. If sample volume is insufficient to run all method-required QC, where spike duplicates are required, duplicates do not need to be analyzed, and where duplicates are required, spike duplicates are not required. Minimally, a duplicate and spike (or spike duplicate) is required per laboratory batch.

3.2.2 Instrument/Equipment Testing, Inspection, and Maintenance

Measurement and testing equipment used in the field or in the laboratory, which directly affects the quality of analytical data, will be subject to preventive maintenance measures to ensure minimization of measurement system downtime. Laboratories and onsite measurement organizations must maintain and calibrate their equipment as specified by the manufacturer or other applicable guidelines. Maintenance requirements (such as parts lists and documentation of routine maintenance) will be included in the individual laboratory and the onsite organization QA plan or operating procedures (as appropriate). Analytical laboratory instruments are calibrated in accordance with the laboratory's QA plan and applicable Hanford Site requirements.

Supplies and consumables used in support of sampling and analysis activities are procured in accordance with internal work requirements. 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.

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4.0 DRYWELL LOGGING

This section identifies the drywells designated in the DQO Report for geophysical logging to support the characterization of Focus Area 1, around Tanks A-104 and A-105. Specifically, 18 drywells within the focus area around Tanks A-104 and A-105 (Table 4-1 and Figure 4-1) were identified for logging of spectral gamma, neutron moisture, and temperature.

Logging tools will be used to aid in locating areas of increased gamma activity and to develop current temperature and moisture profiles in the vadose zone. A contractor, under the supervision of Characterization Support personnel, will perform geophysical logging of drywells. The contractor will maintain logging procedures and calibration certifications to ensure quality data collection. Table 4-1 and Figure 4-1 include the drywells to be logged.

Additional background information about drywell logging activities is included in Appendix C of the DQO Report.

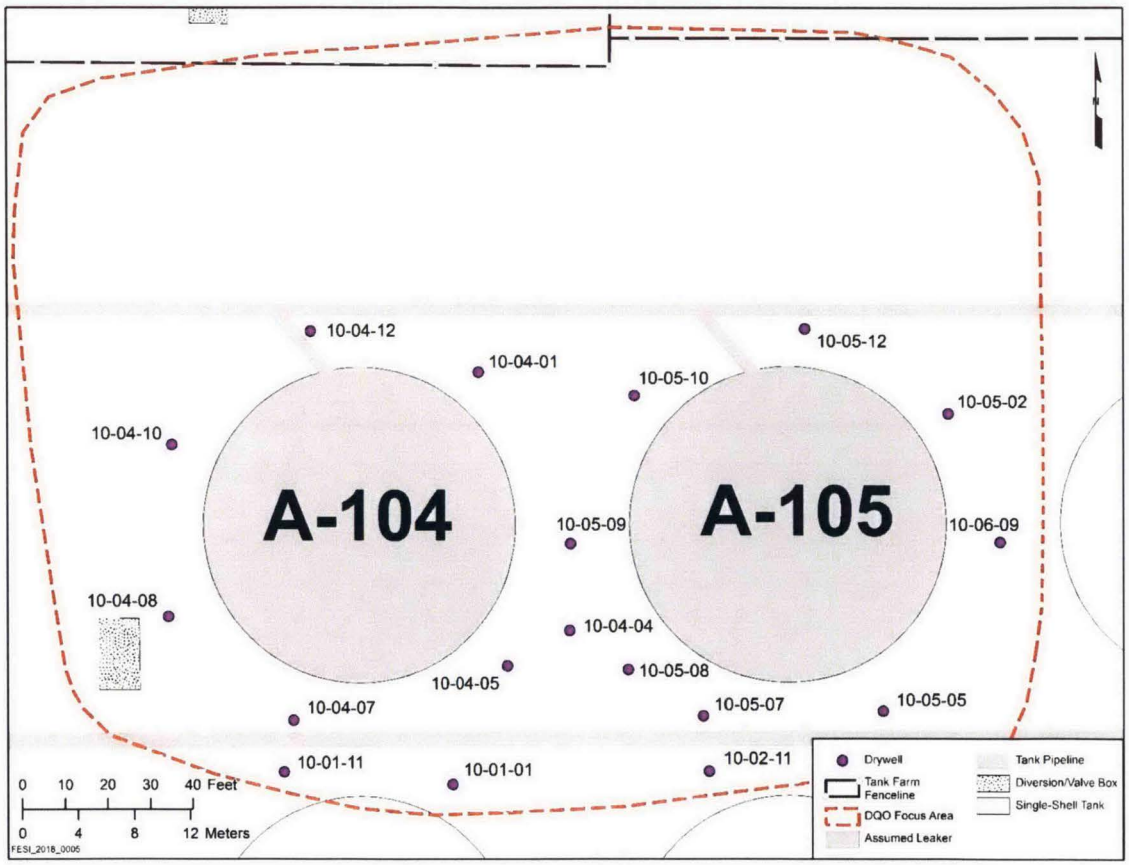
Table 4-1. Drywells Selected for Geophysical Logging Within WMA A-AX Focus Area 1

Drywell Identification Number	Well Identification Number	Well Name	Total Depth (ft bgs)
10-01-01	A6532	299-E25-97	130
10-01-11	A5928	299-E24-73	130
10-02-11	A6528	299-E25-89	130
10-04-01	A6500	299-E25-61	75
10-04-04	A6045	299-E25-56	151
10-04-05	A6502	299-E25-63	75
10-04-07	A5921	299-E24-66	75
10-04-08	A5922	299-E24-67	130
10-04-10	A5923	299-E24-68	130
10-04-12	A5924	299-E24-69	75
10-05-02*	A6507	299-E25-68	121
10-05-05	A6509	299-E25-70	75
10-05-07	A6510	299-E25-71	75
10-05-08	A6533	299-E25-98	56
10-05-09	A6501	299-E25-62	75
10-05-10*	A6505	299-E25-66	130
10-05-12	A6506	299-E25-67	75
10-06-09	A6508	299-E25-69	130

* Drywell will be evaluated during the field investigation to determine if logging is possible (e.g., via field and/or camera inspection).

bgs = below ground surface

Figure 4-1. Locations of Drywells Selected for Geophysical Logging Within WMA A-AX Focus Area 1



5.0 FIELD SAMPLING PLAN

This section provides direction for the field activities associated with soil sampling at five locations around Tanks A-104 and A-105 (Figure 5-1). At each of the five locations, surface samples will be collected. Each location will be comprised of two pushes, the first for geophysical logging and placement of deep electrodes, and the second for collecting soil samples. All field sampling activities shall be conducted in accordance with this SAP and the appropriate procedures and work packages to ensure data is of known and appropriate quality. Soil sampling services for this work will be performed by sampling personnel (e.g., nuclear chemical operators). The sampling personnel shall follow sampling protocols and procedures.

5.1 SAMPLING DESIGN AND STRATEGY

As identified in the DQO Report, a random sampling strategy cannot be applied in WMA A-AX because of the extensive amount of interferences and obstructions. Therefore, a non-probabilistic (or judgmental) sampling strategy that targets locations based on existing knowledge is used. This approach provides the highest potential for confirming and characterizing known and suspected releases in and around WMA A-AX, and will help refine the WMA A-AX conceptual site models.

Selection of the five direct push locations was based on information about releases from Tanks A-104 and A-105, including their possible leak locations and other indicators as briefly described in Section 1.2 (refer to Appendix C of the DQO Report for additional details). From these five direct push locations, it will be possible to obtain surface soil samples near the leak sources (the tanks) and soil samples through the vadose zone to the groundwater interface. Despite the existence of considerable physical interferences in the focus area (i.e., buried infrastructure and topographic constraints), the direct push locations were selected to gain vadose zone soil characterization data to quantify the impact of releases from Tanks A-104 and A-105.

Field activities include:

- Soil sampling at ground surface (i.e., first 31 cm [12 in.])
- Soil sampling using a vertical push with direct push technology
- Soil sampling using an angle push with direct push technology
- Geophysical logging (gross gamma, spectral logging, neutron moisture, temperature, and gyroscope).

Direct push locations, a summary of sampling rationale, and targeted depths are included in Table 5-1. During the development of this SAP, the values for direct push target depths, angles, pipe run lengths, and distances from the tank identified in Table 5-1 have been modified from those identified in the DQO Report to accommodate existing infrastructure and planned retrieval program needs. Data from these modified direct pushes will meet the objectives identified for this focus area. Further modifications may be required after field walk downs are conducted, during work package development, and/or if an obstruction occurs during pushing. Changes in direct push locations will require notification and approval of the Project Manager or designee.

If a borehole meets refusal prior to achieving total depth, the Direct Push Contractor will temporarily suspend work and will contact Characterization Support personnel. The Characterization Support personnel will determine the appropriate path forward. Changes to the SAP will be documented as noted in Section 8.0.

5.2 SOIL SAMPLE COLLECTION INFORMATION

Field work in WMA A-AX Focus Area 1 involves placement of one vertical direct push (C9385/C9386) and four angle direct pushes (C9387/C9388, C9391/C9392, C9395/C9396, and C9393/C9394) for geophysical logging, soil sampling, and deep electrode placement. There will be two direct pushes at each location, the first for geophysical logging and placement of deep electrodes, and the second for collecting soil samples. This logging and sampling work will be followed by geophysical exploration using surface and deep electrodes. This work will be performed by the Direct Push Contractor, under the supervision of Characterization Support personnel. The contractor will maintain procedures and calibration certifications to ensure quality data collection.

Geophysical logging data along with any available quick turnaround analysis results ("quick turn") for two mobile contaminants (technetium-99 and nitrate) will be used to aid in determining subsurface sample depths. The subsurface sampling horizons will be selected in an open meeting to which WRPS staff, DOE, Ecology, U.S. Environmental Protection Agency (EPA), and other site contractors shall be invited.

To characterize Focus Area 1, three samples will be collected at shallow depths (ground surface to 4.6 m [15 ft] below ground surface [bgs]), and at least seven samples will be collected at deep depths (>4.6 m [15 ft] bgs to total depth of the direct push), from each of the five sampling locations. Additional criteria are identified below.

- Each sampling location consists of one surface sample, two additional shallow (≤4.6 m [15 ft] bgs) samples, and at least seven deep (>4.6 m [15 ft] bgs) samples.
- A duplicate sample will be collected at 25% of the surface sample locations. Therefore, a total of two surface duplicate samples will be collected from the five sampling locations.
- Shallow samples will be collected at approximately 2.1 to 2.7 m (7 to 9 ft) bgs and approximately 3.7 to 4.3 m (12 to 14 ft) bgs. The purpose of collecting samples in the first 4.6 m (15 ft) is to provide data for the direct exposure pathway and to provide initial data for ecological risk.
- Deep samples will be collected from depths >4.6 m (15 ft) bgs to depths ranging from approximately 73.2 to 86.9 m (240 to 285 ft) bgs or refusal. The depths for sampling individual horizons will be selected by reviewing the gamma, temperature, and moisture logs of the first direct push and the following information: any leak loss inventory information pertinent to the site, geologic summary of the area, operational history, and historical characterization data at that site.

Figure 5-1. Direct Push Locations for WMA A-AX Focus Area 1

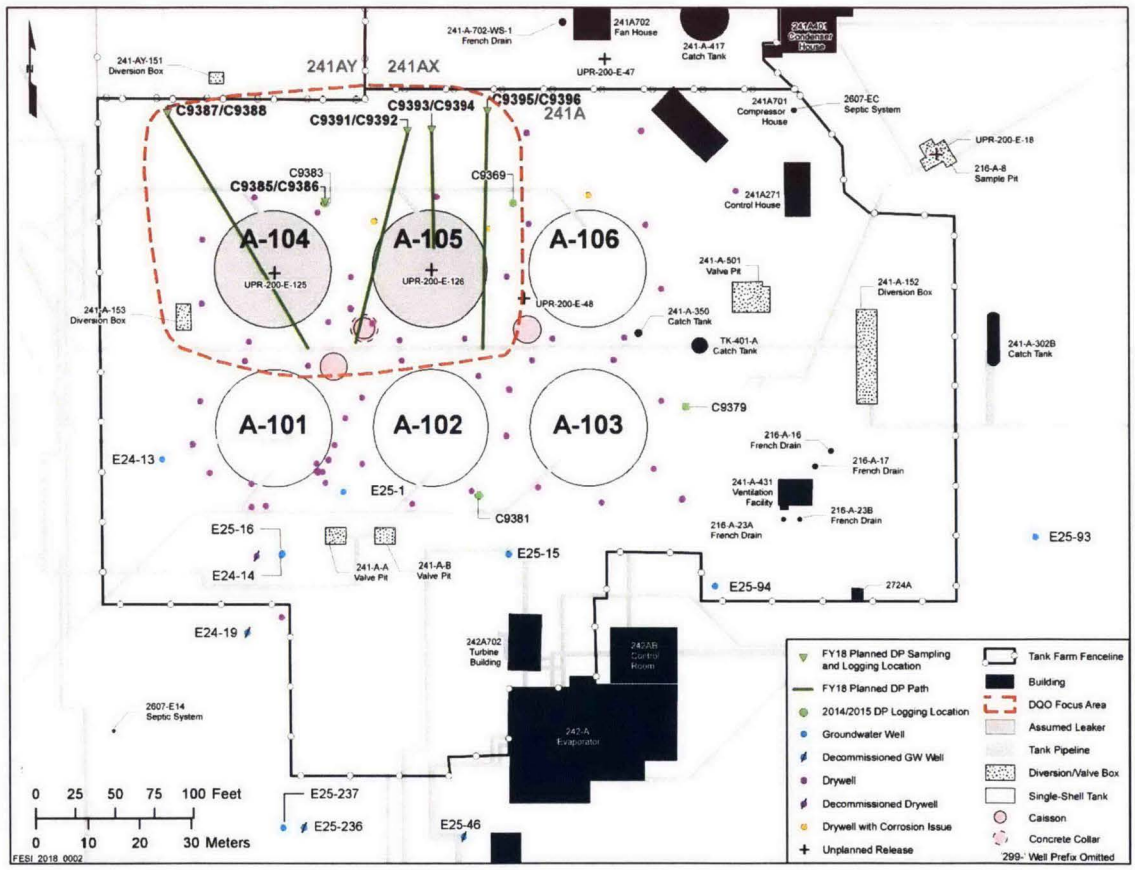


Table 5-1. Direct Push Location Strategy for WMA A-AX Focus Area 1

Location # (DQO Designation)	Direct Push Identification #[a]	Approximate Location	Input Factors Associated with Location Reason for Sampling	Target Depth (bgs) Angle[b] Pipe Run *Minimum distance from Tank*
1[c]	C9387/C9388	Northwest of Tank A-104 (Angle push going southeast and directly under the tank)	• Tank A-104 designated as a leaker (~2,000 gallons) • Possible leak location area (Figure 1-2) • Higher temperature and gross gamma readings in laterals (14-04-01 and 14-04-02) • Higher temperature and gross gamma readings in drywells (10-04-04 and 10-04-05) • Higher surface geophysical exploration conductivity area **Assess Tank A-104 - magnitude and pathway of contamination for modeling, risk, and nature and extent.**	242 ft **35** 295 ft *28 ft*
2	C9385/C9386	North and between Tanks A-104 and A-105 (Vertical push)	• Tanks A-104 and A-105 designated as a leaker (~2,000 gallons and ~2,000 to 40,000 gallons, respectively) • Direct push log at Location C9383, temperature of ~120 °F, ~50 ft bgs • Possible location for deep push ~285 ft bgs **Assess Tanks A-104 and A-105 - magnitude and pathway of contamination for modeling, risk, and nature and extent.**	285 ft[d] **None** 285 ft *54 ft*

Table 5-1. Direct Push Location Strategy for WMA A-AX Focus Area 1

Location # (DQO Designation)	Direct Push Identification #[a]	Approximate Location	Input Factors Associated with Location Reason for Sampling	Target Depth (bgs) Angle[b] Pipe Run *Minimum distance from Tank*
3	C9391/C9392	North of Tank A-105 (Angle push towards southwest-side of tank)	• Tanks A-104 and A-105 designated as a leaker (~2,000 gallons and ~2,000 to 40,000 gallons, respectively) • Possible leak location area (Figure 1-3) • Higher temperature and gross gamma readings in laterals (14-05-01,14-05-02, and 14-05-03) • Higher temperature readings in drywells (10-05-09, 10-04-04 and 10-04-05) • Drywell 10-05-10 indicated casing corrosion (~ 64 ft bgs) • Higher surface geophysical exploration conductivity area **Assess Tanks A-105 and A-104 - magnitude and pathway of contamination for modeling, risk, and nature and extent.**	241 ft **30** 279 ft *27 ft*
4[c]	C9395/C9396	Northeast of Tank A-105 (Angle push going south and under the east-side of tank)	• Tank A-105 designated as a leaker (~2,000 to 40,000 gallons) • Possible leak location area (Figure 1-3) • Higher temperature and gross gamma readings in laterals (14-05-01,14-05-02, and 14-05-03) • Higher temperature readings in drywell (10-05-05) • Drywell 10-05-02 indicated casing corrosion (~ 64 ft bgs) **Assess Tank A-105 - magnitude and pathway of contamination for modeling, risk, and nature and extent.**	139 ft **45** 197 ft *12 ft*

Table 5-1. Direct Push Location Strategy for WMA A-AX Focus Area 1

Location # (DQO Designation)	Direct Push Identification #[a]	Approximate Location	Input Factors Associated with Location / Reason for Sampling	Target Depth (bgs) Angle[b] Pipe Run *Minimum distance from Tank*
5	C9393/C9394	North of Tank A-105 (Angle push going under the north side of tank)	• Tank A-105 designated as a leaker (~2,000 to 40,000 gallons) • Higher temperature and gross gamma readings in laterals (14-05-01,14-05-02, and 14-05-03) • Corrosion observed at drywells 10-05-02 and 10-05-10 **Assess Tank A-105 - magnitude and pathway of contamination for modeling, risk, and nature and extent.**	285 ft[d] **15** 295 ft *31 ft*

Note: Supporting information is provided in Appendix C of the DQO Report.

[a] The identification numbers ending with an odd number (i.e., C9387) are for geophysical logging direct pushes. The identification numbers ending in an even number (i.e., C9388) are for soil sample collection direct pushes.

[b] Angle is defined as degrees from vertical (i.e., 90 degrees minus dip).

[c] Due to interferences caused by existing and planned infrastructure, the angle at this location differs from the value identified in the DQO.

[d] This target depth may be near groundwater.

bgs = below ground surface

The DQO Report describes the process by which chemical and radiological constituents and physical properties were identified and retained for further evaluation in this focus area. Table 5-2 identifies those constituents and physical properties that are to be analyzed and measured in vadose zone soil samples. Table 5-2 also identifies those constituents that the laboratory will analyze or measure as "quick turn."

There are five soil sampling locations associated with this focus area, each having 10 soil sample intervals. Additionally, soil QC samples (field duplicates) associated with surface soil sampling, will be collected at a frequency of 25% (refer to Section 3.1.1), for a total of two field duplicates. Therefore, it is anticipated that 52 vadose zone soil samples will be collected and analyzed/measured for the constituents and physical properties identified in Table 5-2.

Additional QC samples (field blanks and equipment rinsate blanks), which are associated with surface and subsurface sampling, will be collected as identified in Sections 3.1.2 and 3.1.3, respectively. These blanks will be collected to evaluate for potential cross-contamination and laboratory performance. Table 5-3 shows the required analysis, sample preservation, containers, and holding times for these field QC samples. Based on the sample frequency for these QC samples, it is anticipated that three field blanks and three equipment rinsate blanks will be collected for this focus area.

The following subsections provide additional sample collection information:

- Surface sample collection (Section 5.2.1)
- Subsurface sample collection (Section 5.2.2).

5.2.1 Surface Sample Collection

Prior to ground surface sampling, sampling tools shall be vendor-certified cleaned or cleaned in accordance with procedures compliant with SW-846 protocol. The cleaned samplers shall be kept in the wrapping until they are used for sampling.

Surface soil samples will be collected at the locations where direct push samples are planned. Soil in the top 31 cm (12 in.) will be collected using spatula, scoop, or miniature core samplers and placed in a 500 mL (16 oz) glass jar.

The gravel surface in tank farms may prevent collection of a sample because larger soil particles (i.e., gravel/rocks greater than 6.4 mm [0.25 in.] in diameter), typically cannot be used for analysis. For this reason, these larger soil particles should not be collected. Preferably, soil particles less than 2 mm (0.08 in.) in diameter (i.e., fine material), should be collected. As sample material is collected, samplers may remove rock and stones to maximize the amount of soil captured for analysis. Additionally, sample material may be sieved, as needed.

Table 5-2. Soil Sampling Requirements for WMA A-AX Focus Area 1[a]

Analysis Type	Primary Method[b]	Constituent/Physical Properties	Holding Time
"Quick Turn"	ICP/MS (water extraction)	Technetium-99	6 months
	9056 Ion chromatography	Nitrate[c]	48 hours
	9045	pH	24 hours (or as soon as possible) after receipt by laboratory
	9050	Specific Conductance	28 days
Standard	6010 ICP/AES	Aluminum, Barium, Beryllium, Bismuth, Boron, Calcium, Cerium, Chromium, Copper, Iron, Lanthanum, Lead, Lithium, Magnesium, Manganese, Molybdenum, Neodymium, Phosphorous, Potassium, Rhodium, Silicon, Sodium, Strontium, Sulfur, Tantalum, Thorium, Tin, Tungsten, Zinc, Zirconium	6 months
	6020 ICP/MS	Antimony, Arsenic, Cadmium, Cobalt, Nickel, Selenium, Silver, Thallium, Uranium, Vanadium	6 months
	Calculation	Uranium[d]	6 months
	7471 Cold vapor atomic absorption	Mercury	28 days
	7196 Colorimetric	Hexavalent Chromium	30 days
	9056 Ion chromatography	Bromide, Chloride, Fluoride, Nitrate[c], Nitrite[c], Phosphate, Sulfate, Acetate, Formate, Glycolate, Oxalate	28 days/48 hours[e]
	Ion chromatography EPA 300.7	Ammonium	7 days/28 days[f]
	9014 Spectrophotometric	Cyanide	14 days
	9060	Total Organic Carbon	28 days

Table 5-2. Soil Sampling Requirements for WMA A-AX Focus Area 1[a]

Analysis Type	Primary Method[b]	Constituent/Physical Properties	Holding Time
	8081 GC/ECD	4,4'-DDD, 4,4'-DDE, 4,4'-DDT, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, Chlordane, Dieldrin, Endrin, Heptachlor, Heptachlor epoxide, Hexachlorobenzene,	14 days/40 days[g]
	8082 GC/ECD	Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, Aroclor-1260	None
Standard	8270 GC/MS	bis(2-Ethylhexl)phthalate, Tributyl phosphate	14 days/40 days[g]
	Gamma energy analysis	Antimony-125, Cesium-137, Cobalt-60, Europium-152, Europium-154, Europium-155, Radium-226	6 months
	Low energy gamma counting	Iodine-129	6 months
	ICP/MS (acid extraction)	Neptunium-237, Technetium-99, Tin-126, Thorium-232, Uranium-233, Uranium-234, Uranium-235, Uranium-236, Uranium-238	6 months
	Liquid scintillation	Carbon-14, Nickel-63, Plutonium-241, Selenium-79, Tritium	6 months
	Alpha energy analysis	Americium-241, Curium-242, Curium-243/244, Plutonium-238, Plutonium-239/240	6 months
	Beta gas proportional counting	Strontium-90	6 months
	Gravimetric[h]	Percent solids	None
	Gravimetric[h]	Percent water	None
	Gravimetric[i]	Bulk (sediment) density[g]	None
	ASTM D7928 ASTM D6913	Particle size distribution[j]	None

Note: The most current version/revision of methods and/or test plans will be used.

[a] Sampling personnel will place the shoe material in a 500 mL (16 oz) glass jar. The samples will be cooled to ≤6°C (≤43°F).

[b] Equivalent methods may be used by the laboratory with prior approval by the Data Management Lead.

[c] Analysis for nitrate (CAS number 14797-55-8) and nitrite (CAS number 14797-65-0) will be performed by the laboratory. Nitrogen in nitrate and nitrogen in nitrite will be determined from nitrate and nitrite results.

Table 5-2. Soil Sampling Requirements for WMA A-AX Focus Area 1[a]

Analysis Type	Primary Method[b]	Constituent/Physical Properties	Holding Time

[d] Uranium result will be calculated using isotopic uranium analysis results. The holding time listed is applicable to the analysis of samples for isotopic uranium.

[e] 48-hour hold time is for nitrate, nitrite, and phosphate.

[f] Holding time is 7 days from collection to extraction/distillation and 28 days from distillation to analysis of preserved distillate.

[g] Holding time is 14 days from collection to extraction and 40 days from extraction to analysis.

[h] Performed using ASTM D2216 with minor modification of the target temperature to 105°C (221°F) and a 1% criteria for final mass difference (Method A).

[i] Bulk (sediment) density will be measured on only subsurface samples and will be determined as described in Interoffice Memorandum WRPS-0900155, Rev. 2, "Test Plan for Sample Breakdown and Analysis of Sediment Samples Obtained as Part of the Vadose Zone Project." Bulk density cannot be determined using ASTM D2937 due to the compaction that occurs using the direct push sampling technique. The reported results using WRPS-0900155 will not be a true bulk density, but rather, a sediment density measurement.

[j] Particle size distribution will be performed by the laboratory, if sample volume is sufficient.

ASTM = American Society for Testing and Materials
CAS = Chemical Abstracts Service
GC/ECD = gas chromatography/electron capture detector
GC/MS = gas chromatography/mass spectroscopy
ICP/AES = inductively coupled plasma/atomic emission spectroscopy
ICP/MS = inductively coupled plasma/mass spectroscopy

References:

ASTM D2216, *Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.*

ASTM D2937, *Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.*

ASTM D6913, *Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.*

ASTM D7928, *Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis.*

EPA 600/S4-86/024, *Development of Standard Methods for the Collection and Analysis of Precipitation,* "Method 300.7, Dissolved Sodium, Ammonium, Potassium, Magnesium, and Calcium in Wet Deposition by Chemically Suppressed Ion Chromatography."

SW-846, *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods.*

WRPS-0900155, Rev. 2, "Test Plan for Sample Breakdown and Analysis of Sediment Samples Obtained as Part of the Vadose Zone Project."

Table 5-3. Field Quality Control Requirements for Field Blanks and Equipment Rinsate Blanks for WMA A-AX Focus Area 1 (Deionized Water Samples)

Primary Method[a]	Constituent	Container	Preservative	Holding Time
6010 Inductively coupled plasma/atomic emission spectroscopy	Aluminum, Barium, Beryllium, Bismuth, Boron, Calcium, Cerium, Chromium, Copper, Iron, Lanthanum, Lead, Lithium, Magnesium, Manganese, Molybdenum, Neodymium, Phosphorous, Potassium, Rhodium, Silicon, Sodium, Strontium, Sulfur, Tantalum, Thorium, Tin, Tungsten, Zinc, Zirconium	Glass/plastic 500 mL	HNO_3 to pH<2	6 months (28 days for Mercury)
6020 Inductively coupled plasma/mass spectroscopy	Antimony, Arsenic, Cadmium, Cobalt, Nickel, Selenium, Silver, Thallium, Uranium, Vanadium			
Calculation	Uranium[b]			
Inductively coupled plasma/ mass spectroscopy	Neptunium-237, Techenetium-99, Tin-126, Thorium-232, Uranium-233, Uranium-234, Uranium-235, Uranium-236, Uranium-238			
7471 Cold vapor atomic absorption	Mercury			
Ion chromatography EPA 300.7	Ammonium	Glass/plastic 250 mL	H_2SO_4 to pH<2/ Cool to ≤6°C	28 days
9056 Ion chromatography	Bromide, Chloride, Fluoride, Nitrate[c], Nitrite[c], Phosphate, Sulfate, Acetate, Formate, Glycolate, Oxalate	Glass/plastic 500 mL	Cool to ≤6°C	28 days/ 48 hours[d]
7196 Colorimetric	Hexavalent Chromium	Glass/plastic 500 mL	Cool to ≤6°C	24 hours
9014 Spectrophotometric	Cyanide	Glass/plastic 60 mL	NaOH to pH≥12/ Cool to ≤6°C	14 days
9060	Total Organic Carbon	Glass 500 mL	H_2SO_4 to pH≤2/ Cool to ≤6°C	28 days

Table 5-3. Field Quality Control Requirements for Field Blanks and Equipment Rinsate Blanks for WMA A-AX Focus Area 1 (Deionized Water Samples)

Primary Method[a]	Constituent	Container	Preservative	Holding Time
8081 GC/ECD	4,4'-DDD, 4,4'-DDE, 4,4'-DDT, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, Chlordane, Dieldrin, Endrin, Heptachlor, Heptachlor epoxide, Hexachlorobenzene	Glass 2 x 1,000 mL	Cool to ≤6°C C	14 days/ 40 days[e]
8082 GC/ECD	Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, Aroclor-1260	Glass 2 x 1,000 mL	Cool to ≤6°C	14 days/ 40 days[e]
8270 GC/MS	bis(2-Ethylhexl)phthalate, Tributyl phosphate	Glass 2 x 1,000 mL	Cool to ≤6°C	14 days/ 40 days[e]
Gamma energy analysis	Antimony-125, Cesium-137, Cobalt-60, Europium-152, Europium-154, Europium-155, Radium-226	Glass/plastic 2×1,000 mL	HNO_3 to pH<2	6 months
Alpha energy analysis	Americium-241, Curium-242, Curium-243/244, Plutonium-238, Plutonium-239/240			
Liquid scintillation	Nickel-63, Plutonium-241, Selenium-79			
Beta gas proportional counting	Strontium-90			
Liquid scintillation	Carbon-14, Tritium	Glass/plastic 1,000 mL	None	6 months
Low energy gamma counting	Iodine-129			

Note: The most current version/revision of methods and/or test plans will be used.

[a] Equivalent methods may be used by the laboratory with prior approval by the Data Management Lead.

[b] Uranium result will be calculated using isotopic uranium analysis results.

[c] Analysis for nitrate (CAS number 14797-55-8) and nitrite (CAS number 14797-65-0) will be performed by the laboratory. Nitrogen in nitrate and Nitrogen in nitrite will be determined from nitrate and nitrite results.

[d] 48-hour hold time is for nitrate, nitrite, and phosphate.

[e] Holding time is 14 days from collection to extraction and 40 days from extraction to analysis.

Table 5-3. Field Quality Control Requirements for Field Blanks and Equipment Rinsate Blanks for WMA A-AX Focus Area 1 (Deionized Water Samples)

Primary Method[a]	Constituent	Container	Preservative	Holding Time

CAS = Chemical Abstracts Service
GC/ECD = gas chromatography/electron capture detector
GC/MS = gas chromatography/mass spectroscopy

References:

EPA 600/S4-86/024, *Development of Standard Methods for the Collection and Analysis of Precipitation*, Method 300.7, "Dissolved Sodium, Ammonium, Potassium, Magnesium, and Calcium in Wet Deposition by Chemically Suppressed Ion Chromatography."

SW-846, *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods*.

If a sample cannot be collected because there is not enough fine material for analysis (full 500 mL [16 oz] glass jar), then Characterization Support personnel will be contacted by the FWS for directions. If a sample is not collected, then pictures of the sampling site will be taken to show the gravelly nature of the land surface. Additionally, the reason a sample could not be collected will be documented in direct push completion reports and noted in the logbook. Co-located samples will be collected as field duplicate samples. Field duplicate samples shall be analyzed for the constituents identified in Table 5-2.

5.2.2 Subsurface Sample Collection

Subsurface sampling will be conducted using hydraulic hammer direct push rig technology with dual-string sampling system consisting of inner and outer strings deployed by small-diameter push rods. When the target sampling depth is reached, the rods are pulled back and the "dummy" tip is removed from the inner rods. A sampler is attached to the inner string, returned to the bottom of the outer casing/push tubing, and positioned against the inner receiver face of the drive shoe. The inner and outer tubing strings are "locked" together using a proprietary method. The entire assembly is advanced approximately 10% deeper than the targeted sample interval in order to secure the material in the sampler.

The sampler body holds three stainless steel liners. After sample collection, the liners will be removed from the sampler body and surveyed. Sampling personnel document recovery, sample condition, and estimated volume recovery percent. They then package and transport the sample under chain-of-custody control to the laboratory for analysis. The "dummy" tip is reattached to the inner string, placed in the casing shoe, and the entire assembly is advanced to the next sample depth. This process is repeated until all samples are collected or the tubing meets refusal. If an insufficient amount of soil is recovered (approximately less than 75% of expected volume), Characterization Support personnel will be contacted to determine if back-to-back samples will be collected to achieve the necessary sample volume for the laboratory analyses.

After sample collection, the liners are removed from the sampler body and surveyed. The material in the shoe shall be placed in a 500 mL (16 oz) glass jar. Stainless steel Liner A is the liner closest to the shoe. The next or middle liner is Liner B, and the topmost stainless steel liner is Liner C. Each liner shall be marked to indicate its bottom (labeled B) and top (labeled T) to signify the position of the sample prior to shipping and transport. Sampling personnel will cap the liners and label the samples in accordance with Section 5.3. They will then package and transport the sample under chain-of-custody control to the laboratory for analysis.

Upon completion of the final sample extraction, or upon meeting refusal, the dummy tip or sampler is removed, and the direct pushes are decommissioned per requirements of WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells." Electrodes will be installed into direct push logging locations at the time of decommissioning to allow for their use in the future.

5.3 SAMPLE IDENTIFICATION

The HEIS database will be the electronic repository for the laboratory analytical results. The HEIS sample numbers will be issued to the sampling organization for this project in accordance with onsite organizational procedures. Each sample will be identified and labeled with a unique HEIS sample number. The sample location, depth, and corresponding HEIS numbers will be documented in the sampling personnel's field logbook. The shoe material placed in a 500 mL (16 oz) glass jar and the three liners will each have a unique HEIS number. Each sample container will be labeled with the following information using a waterproof marker on firmly affixed water-resistant labels:

- Sample identification number
- Sample collection date and time
- Name or initials of person collecting the sample
- Preservation method (if applicable)
- Sample location (direct push location identification number and depth of collection).

Due to limited space on sample labels, it is not possible to list all analytes; however, the laboratory is provided all necessary information to complete analysis. This information is provided in Section 6.0, which identifies the full list of analytes, appropriate analysis methods, and additional analysis information (e.g., "quick turn" analyses).

Additionally, coordinate and elevation information for each sample location will be stored in HEIS. The coordinates will be in state plane *North American Datum 83/91*, and elevations (e.g., ground surface, sample depths) will be in metric units.

5.4 SAMPLE CUSTODY

Sampling personnel shall initiate a chain-of-custody form for each sample. The chain-of-custody form shall accompany each sample. At a minimum, the following sampling information shall be included on the chain-of-custody form:

- Project name
- Signature of the collector
- Date and time of collection
- Sample type (e.g., soil)
- Sample preservation information
- Requested analysis or provide a reference for sample analysis
- Signatures of persons involved in the chain of possession

- Date and time relinquished to the laboratory
- Unique HEIS sample identification number assigned to the sample
- Sample location (direct push location identification number and depth of collection)
- A notation of pertinent sampling information including unusual characteristics or sampling problems
- A brief description of the sample matrix, such as color or consistency, if possible.

Any pertinent sampling information (recovery, unusual characteristics, or sampling problems) shall be recorded in the sampling logbook. Each sample will be shipped to 222-S Laboratory (or alternate laboratory, if necessary) in an approved shipping container in accordance with approved procedures. Each sample will be sealed with a sample seal to demonstrate that the samples have reached the laboratory without alteration.

5.5 SAMPLE HANDLING AND SHIPPING

All samples shall be stored and shipped at a temperature of ≤ 6°C (43°F). To meet applicable holding time requirements, the samples shall be shipped to the laboratory as soon as possible, typically the same day as collected. However, it is recognized that some samples may have elevated levels of radioactivity. These samples may need to be stored and transported in shielded shipping containers that might not allow the samples to be maintained at ≤ 6°C (43°F). Sample shipments not meeting temperature or holding time requirements will be identified as they occur, brought to the immediate attention of the Data Management Lead, and discussed in the laboratory data report. The impact on subsequent use or interpretation of these data will be evaluated by the Project Manager.

Radiological control technician(s) will measure the dose rates of each sample container (i.e., glass jar and liners). The radiological control technician(s) also will measure radiological activity on the outside of the sample container (through the container) and will document the highest contact radiological reading in millirem per hour. This information, along with other data, will be used to select proper packaging, marking, labeling, and shipping paperwork in accordance with U.S. Department of Transportation regulations (49 CFR, "Transportation"), and to verify that the sample can be received by the analytical laboratory in accordance with the laboratory's acceptance criteria.

6.0 SAMPLE ANALYSIS REQUIREMENTS

This section provides direction to the laboratory for sample preparation and analytical requirements for samples collected from the surface and subsurface. The analytical methods are identified in Table 6-1.

After the samples are received at the laboratory, the samples will be prepared and analyzed in accordance with this SAP. Table 6-1 identifies the following information:

- Constituent (analyte)/physical properties
- Required detection limit
- Primary and alternative method of analysis
- QC acceptance requirements for the primary methods
- Holding times.

"Quick turn" constituents for soil samples are bolded in Table 6-1 and include technetium-99, nitrate, pH, and specific conductance. Results for "quick turn" constituents will be reported for each sample, provided sufficient sample material is obtained to perform all analyses.

Changes to the approved laboratory analytical procedures or methods may be required to accommodate analysis of samples that are contaminated with Hanford Site tank waste and/or to reduce radiological exposure to the analysts. Documentation will be provided in the laboratory data report to reaffirm these changes will not affect the quality of the data or its intended use. The documentation of changes (e.g., substitutions, deviations, or modifications) to the methods shall be in writing, maintained at the laboratory, and available for inspection on request. Additional regulatory QA or HASQARD requirements for documenting procedure modifications shall also be followed. Note that prior to deviating from the methods identified in Table 6-1, the Data Management Lead must be contacted.

6.1 DIRECTIONS FOR SAMPLE PREPARATION AND ANALYSIS

Samples are normally received from the field at door 13 of the 222-S Laboratory Multicurie Section. Samples transported in coolers will be stored under refrigeration until they are processed. On receipt, the sample custodian will verify the identification number on each sample container and ensure it matches the sample seal on the sample container and the chain-of-custody form. Laboratory sample identification numbers will be affixed to each container that is retained past initial receipt. Residual sample material remaining after analysis will be maintained in refrigerated storage until directed otherwise by the Data Management Lead.

Table 6-1. Analytical and Quality Control Requirements for WMA A-AX Focus Area 1

Constituent/Physical Properties	Required Detection Limit[a]	Primary Method[b, c] (prep)	Alternative Method[b] (prep)	QC Acceptance Requirements[d, e]			Holding Times
				LCS %Recovery	Spike %Recovery	RPD	
Aluminum	2.75	6010 ICP/AES (acid)	6020 ICP/MS (acid)	80-120%	75-125%	≤30%	6 months
Barium	10.2						6 months
Beryllium	0.5						6 months
Calcium	6.25						6 months
Chromium	0.15						6 months
Copper	1						6 months
Iron	5						6 months
Lead	5						6 months
Lithium	0.9						6 months
Magnesium	26.3						6 months
Manganese	0.55						6 months
Molybdenum	0.47[e]						6 months
Phosphorus	9.8						6 months
Potassium	157						6 months
Silicon	5.05						6 months
Sodium	22.4						6 months
Strontium	0.55						6 months
Sulfur	11.4						6 months
Tantalum	25.5						6 months
Thorium	4.85						6 months
Tin	6						6 months
Tungsten	42.9						6 months
Zinc	1						6 months

Table 6-1. Analytical and Quality Control Requirements for WMA A-AX Focus Area 1

Constituent/Physical Properties	Required Detection Limit[a]	Primary Method[b, c] (prep)	Alternative Method[b] (prep)	QC Acceptance Requirements[d, e]			Holding Times
				LCS %Recovery	Spike %Recovery	RPD	
Zirconium	1.2						6 months
Bismuth	25.8						6 months
Boron	6						6 months
Cerium	10.5		NA				6 months
Lanthanum	2.75						6 months
Neodymium	5.05						6 months
Rhodium	25.8						6 months
Antimony	0.13[f]						
Arsenic	0.2						
Cadmium	2.02E-2						
Cobalt	2						
Nickel	3	6020 ICP/MS (acid)	6010 ICP/AES (acid)	80-120%	75-125%	≤30%	6 months
Selenium	0.02						
Silver	6.00E-04						
Thallium	4.00E-04						
Vanadium	6.00E-03						
Uranium	0.5						
Uranium[g]	0.5	Calculated from Isotopic Uranium Results	NA	80-120%	75-125%	≤30%	6 months
Mercury	0.01[f]	7471 Cold vapor atomic absorption (acid)	6020 ICP/MS (acid)	80-120%	75-125%	≤30%	28 days
Hexavalent Chromium	0.09	7196 Colorimetric (water)	NA	80-120%	75-125%	≤30%	30 days

Table 6-1. Analytical and Quality Control Requirements for WMA A-AX Focus Area 1

Constituent/Physical Properties	Required Detection Limit[a]	Primary Method[b, c] (prep)	Alternative Method[b] (prep)	QC Acceptance Requirements[d,e]			Holding Times
				LCS %Recovery	Spike %Recovery	RPD	
Ammonium	0.5	Ion Chromatography EPA 300.7 (distillation)	NA	80-120%	75-125%	≤30%	7 days/28 days[h]
pH	-	9045	NA	± 0.1 pH units	NA	NA	24 hours (or as soon as possible) after receipt by laboratory
Bromide	1	Ion Chromatography 9056 (water)	NA	80-120%	75-125%	≤30%	28 days
Chloride	0.3						28 days
Fluoride	2.81[f]						28 days
Nitrate[i]	2.5						48 hours
Nitrite[i]	2.5						48 hours
Phosphate	0.785[f]						48 hours
Sulfate	2.7						28 days
Acetate	4.5						28 days
Formate	10.0	Ion Chromatography 9056 (water)	NA	80-120%	75-125%	≤30%	28 days
Glycolate	3.8						28 days
Oxalate	2						28 days
Cyanide	0.5	9014 Spectrophoto-metric (distillation)	9012 Colorimetric	80-120%	75-125%	≤30%	14 days
Total Organic Carbon	20	9060	NA	85-115%	70-130%	≤30%	28 days

Table 6-1. Analytical and Quality Control Requirements for WMA A-AX Focus Area 1

Constituent/Physical Properties	Required Detection Limit[a]	Primary Method[b, c] (prep)	Alternative Method[b] (prep)	QC Acceptance Requirements[d,e]			Holding Times
				LCS %Recovery	Spike %Recovery	RPD	
4,4'-DDD	0.025[j]	8081 GC/ECD (acid)	8270 GC/MS	70-130%	70-130%	≤30%	14 days/ 40 days[k]
4,4'-DDE	0.025[j]						14 days/ 40 days[k]
4,4'-DDT	0.025[j]						14 days/ 40 days[k]
Aldrin	0.01						14 days/ 40 days[k]
alpha-BHC[l]	NA						14 days/ 40 days[k]
beta-BHC[l]	NA						14 days/ 40 days[k]
gamma-BHC[l]	0.6						14 days/ 40 days[k]
Chlordane	0.1						14 days/ 40 days[k]
Dieldrin	0.007						14 days/ 40 days[k]
Endrin	0.02						14 days/ 40 days[k]
Heptachlor	0.04						14 days/ 40 days[k]
Heptachlor epoxide	0.04						14 days/ 40 days[k]
Hexachlorobenzene	1.70						14 days/ 40 days[k]

Table 6-1. Analytical and Quality Control Requirements for WMA A-AX Focus Area 1

Constituent/Physical Properties	Required Detection Limit[a]	Primary Method[b, c] (prep)	Alternative Method[b] (prep)	QC Acceptance Requirements[d,e]			Holding Times
				LCS %Recovery	Spike %Recovery	RPD	
Aroclor-1016	0.02	8082 GC/ECD (acid)	NA	70-130%	70-130%	≤30%	None
Aroclor-1221	0.02						None
Aroclor-1232	0.02						None
Aroclor-1242	0.02						None
Aroclor-1248	0.02						None
Aroclor-1254	0.02						None
Aroclor-1260	0.02						None
bis(2-Ethylhexyl)phthalate	2.95	8270 GC/MS (acid)	NA	70-130%	70-130%	≤30%	14 days/ 40 days[k]
Tributyl phthalate	3.3						14 days/ 40 days[k]
Antimony-125 – ^{125}Sb	0.3	Gamma energy analysis (direct)	NA	80-120%	N/A	≤30%	6 months
Cesium-137 – ^{137}Cs	0.1						6 months
Cobalt-60 – ^{60}Co	0.01[f]						6 months
Radium-226 – ^{226}Ra	0.2[f]			NA	75-125%		6 months
Europium-152 – ^{152}Eu	0.1[f]				NA		6 months
Europium-154 – ^{154}Eu	0.03[e,f]						6 months
Europium-155 – ^{155}Eu	0.05[e,f]						6 months
Iodine-129 – ^{129}I	2	Low energy gamma counting (fusion)	ICP/MS (acid)	80-120%	NA	≤30%	6 months
Technetium-99[m] – ^{99}Tc	1	ICP/MS (water)	NA	80-120%	75-125%	≤30%	6 months

Table 6-1. Analytical and Quality Control Requirements for WMA A-AX Focus Area 1

Constituent/Physical Properties	Required Detection Limit[a]	Primary Method[b, c] (prep)	Alternative Method[b] (prep)	QC Acceptance Requirements[d,e]			Holding Times
				LCS %Recovery	Spike %Recovery	RPD	
Technetium-99[m]– ^{99}Tc	1	ICP/MS (acid)	Liquid scintillation (acid)	80-120%	75-125%	≤30%	6 months
Tin-126[n]– ^{126}Sn	400		NA				6 months
Uranium-233 – ^{233}U	0.174			NA	NA		6 months
Uranium-234 – ^{234}U	3.75E-02						6 months
Uranium-235 – ^{235}U	4.32E-05			80-120%	75-125%		6 months
Uranium-236 – ^{236}U	5.18E-04			NA	NA		6 months
Uranium-238 – ^{238}U	4.37E-04			80-120%	75-125%		6 months
Thorium-232 – ^{232}Th	4.40E-05						6 months
Neptunium-237 – ^{237}Np	3.80E-02		Alpha energy analysis (acid)				6 months
Tritium – ^{3}H	30	Liquid scintillation (water[o])	NA	80-120%	75-125%	≤30%	6 months
Carbon-14 – ^{14}C	1	Liquid scintillation (acid)	NA	80-120%	75-125%	≤30%	6 months
Nickel-63 – ^{63}Ni	30			80-120%	NA	≤30%	6 months
Selenium-79 – ^{79}Se	10			NA	NA	≤30%	6 months
Plutonium-241 – ^{241}Pu	1.65E+04		Calculation (from Pu^{238} and $Pu^{239/240}$)	80-120%	75-125%	≤30%	6 months
Plutonium-238 – ^{238}Pu	1	Alpha energy analysis (acid)	ICP/MS (acid)	NA	NA	≤30%	6 months
Plutonium-239/240 – $^{239/240}Pu$	0.03[f]			80-120%			6 months
Americium-241 – ^{241}Am	1						6 months
Curium-242 – ^{242}Cm	1			NA		NA	6 months
Curium-243/244 – $^{243/244}Cm$	1						6 months

Table 6-1. Analytical and Quality Control Requirements for WMA A-AX Focus Area 1

Constituent/Physical Properties	Required Detection Limit[a]	Primary Method[b, c] (prep)	Alternative Method[b] (prep)	QC Acceptance Requirements[d,e]			Holding Times
				LCS %Recovery	Spike %Recovery	RPD	
Strontium-90 – ^{90}Sr	0.18[f]	Beta gas proportional counting (acid)	NA	80-120%	75-125%	≤30%	6 months
Percent water	-	Gravimetric[p]	NA	80-120%	NA	≤30%	None
Percent solids	-	Gravimetric[p]	NA	NA	NA	NA	None
Specific Conductance	-	9050	NA	NA	NA	NA	28 days
Bulk (sediment) density[q]	-	Gravimetric[q]	NA	NA	NA	≤30%	None
Particle size distribution[r]	-	ASTM D7928 ASTM D6913	NA	NA	NA	NA	None

Note 1: All standard analyses are performed on composite samples. The laboratory data report will be provided by the laboratory in Format VI. "Quick turn" analyses (excluding pH and specific conductance) will be provided via e-mail to the Data Management Lead and will also be available in the laboratory data report for loading into Hanford Environmental Information System (HEIS).

Note 2: The most current version/revision of methods and/or test plans will be used.

Note 3: **Bold** constituents are "quick turn" constituents. These constituents are also analyzed as part of the standard analyses. Technetium-99 is listed twice in the table because the preparation method is different for "quick turn" and standard analysis.

Note 4: Detection limits may be lower than achievable. The laboratory shall report results to the lowest achievable detection limit while maintaining quality standards. Detection limits that were not achieved will be documented in the laboratory data report (e.g., narrative).

[a] Detection limits for non-radiological constituents are in mg/kg, and detection limits for radiological constituents are in pCi/g.

[b] Equivalent methods may be used by the laboratory with prior approval by the Data Management Lead.

[c] Sampling personnel will place the shoe material in a 500 mL (16 oz) glass jar. The samples will be cooled to ≤6°C (≤43°F). Directions for sample preparation are provided in Section 6.1.

[d] Laboratory quality acceptance requirements are based on RPP-23403, RPP-RPT-38152, and WHL-MP-1011.

[e] QC failures will be brought to the immediate attention of SMO and the Data Management Lead and will be discussed in the laboratory data report narrative. The associated result(s) qualified appropriately in the laboratory data report.

[f] Detection limit listed is Hanford Site background value. The laboratory shall attempt to achieve a detection limit less than Hanford background.

[g] Uranium result will also be calculated using isotopic uranium analysis results. The QC Acceptance Requirements and holding time listed is applicable to the analysis of samples for isotopic uranium.

[h] Holding time is 7 days from collection to extraction/distillation and 28 days from distillation to analysis of preserved distillate.

[i] Analysis for nitrate (CAS number 14797-55-8) and nitrite (CAS number 14797-65-0) will be performed by the laboratory. Nitrogen in nitrate and Nitrogen in nitrite will be determined from nitrate and nitrite results.

[j] In support of the ecological risk assessment, the detection limit identified in the DQO Report has been lowered.

[k] Holding time is 14 days from collection to extraction and 40 days from extraction to analysis.

[l] CAS number 319-84-6 is for alpha-Hexachlorocyclohexane and alpha-BHC. CAS number 319-85-7 is for beta-Hexachlorocyclohexane and beta-BHC (also known as beta-1,2,3,4,5,6-Hexachlorocyclohexane [beta-BHC] in HEIS). CAS number 58-89-9 is for gamma-Hexachlorocyclohexane (Lindane) and gamma-BHC.

Table 6-1. Analytical and Quality Control Requirements for WMA A-AX Focus Area 1

Constituent/Physical Properties	Required Detection Limit[a]	Primary Method[b, c] (prep)	Alternative Method[b] (prep)	QC Acceptance Requirements[d,e]			Holding Times
				LCS %Recovery	Spike %Recovery	RPD	

[a] The laboratory shall differentiate between water extraction and acid extraction ^{99}Tc results in both hard copy and electronic (HEIS) reporting. For HEIS upload, the extraction (WE [water] or AE [acid]) will be appended to the method name.

[a] The acceptance requirements listed are those for Tin-117 (^{117}Sn), which is used as a surrogate to estimate precision and accuracy of the method for ^{126}Sn.

[c] RPP-RPT-60227, *Data Quality Objectives for Vadose Zone Characterization at Waste Management Area A-AX*, erroneously identified water as the sample preparation method.

[b] Performed using ASTM D2216 with minor modification of the target temperature to 105°C (221°F) and a 1% criteria for final mass difference (Method A).

[d] Bulk (sediment) density will be measured on only subsurface samples and will be determined as described in Interoffice Memorandum WRPS-0900155, Rev. 2, "Test Plan for Sample Breakdown and Analysis of Sediment Samples Obtained as Part of the Vadose Zone Project." Bulk density cannot be determined using ASTM D2937 due to the compaction that occurs using the direct push sampling technique. The reported results using WRPS-0900155 will not be a true bulk density, but rather, a sediment density measurement.

[f] Particle size distribution will be performed by the laboratory, if sample volume is sufficient.

CAS = Chemical Abstracts Service
GC/ECD = gas chromatography/electron capture detector
GC/MS = gas chromatography/mass spectroscopy
ICP/AES = inductively coupled plasma/atomic emission spectroscopy
ICP/MS = inductively coupled plasma/mass spectroscopy
LCS = laboratory control sample
NA = not applicable
RPD = relative percent difference

References:

ASTM D2216, *Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.*

ASTM D2937, *Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.*

ASTM D6913, *Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.*

ASTM D7928, *Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis.*

EPA 600/S4-86/024, *Development of Standard Methods for the Collection and Analysis of Precipitation*, "Method 300.7, Dissolved Sodium, Ammonium, Potassium, Magnesium, and Calcium in Wet Deposition by Chemically Suppressed Ion Chromatography."

RPP-23403, *Single-Shell Tank Component Closure Data Quality Objectives.*

RPP-RPT-38152, *Data Quality Objectives Report Phase 2 Characterization for Waste Management Area C RCRA Field Investigation/Corrective Measures Study.*

SW-846, *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods.*

WHL-MP-1011, *Quality Assurance Project Plan for 222-S Laboratory.*

WRPS-0900155 Rev. 2, "Test Plan for Sample Breakdown and Analysis of Sediment Samples Obtained as Part of the Vadose Zone Project."

For each surface sample and subsurface sample liner, a licensed geologist with Hanford Site experience will photograph, examine, and describe the material from each glass jar and liner. Visual inspection and manual manipulations are performed to provide a geologic description of each sample. These descriptions shall provide estimates of the percentage of sand, fine sand, very fine sand, coarse to fine silt, and mud content per ASTM D2488, *Standard Practice for Description and Identification of Soils (Visual–Manual Procedure)*. The sediment descriptions are recorded and used to classify the sediment texture on a modified Folk/Wentworth diagram. Note that additional HEIS sample numbers will be assigned to the composite and "quick turn" samples, as needed.

Sections 6.1.1 and 6.1.2 describe surface and subsurface sample analysis, respectively. Particle size distribution will be performed per WRPS-0900155, "Test Plan for Sample Breakdown and Analysis of Sediment Samples Obtained as Part of the Vadose Zone Project" only if there is enough sample material.

6.1.1 Surface Sample Analysis

Surface samples will be photographed, geologically described, and subsampled per WRPS-0900155. Percent water and percent solids will also be determined per WRPS-0900155. Bulk (sediment) density will not be calculated on surface samples. Subsampled material will be used to perform the "quick turn" and standard analysis identified in Table 6-1.

Direction regarding insufficient sample material is provided in Section 6.2. Reporting of laboratory results is described in Section 7.0.

6.1.2 Subsurface Analysis

Subsurface samples are photographed, geologically described, and subsampled per WRPS-0900155. Percent water, percent solid, and bulk (sediment) density will also be determined per WRPS-0900155. Bulk (sediment) density is performed on the contents of only full liners. A visual inspection will be performed to determine the liner that contains the highest moisture content. The contents of this liner will be used for the "quick turn" analysis. Percent water and percent solids will be determined for the contents of this liner. The remaining material from this liner, the other liners, and the shoe will be composited, and percent water and percent solids will also be determined from the composited material. Subsampled composited material will be used to perform the standard analysis identified in Table 6-1.

Direction regarding insufficient sample material is provided in Section 6.2. Reporting of laboratory results is described in Section 7.0.

6.2 INSUFFICIENT RECOVERY OF SAMPLE MATERIAL

If the quantity of sample material is insufficient to perform the analyses required in this SAP, the laboratory and/or SMO shall notify the Data Management Lead within one working day to identify the path forward. The typical prioritization of analyses is listed in Table 6-2; however,

changes may be made based on specific data needs. The Data Management Lead will identify the analysis priority based on available sample material and discussion with project personnel (e.g., Project Manager). Changes to this prioritization will be documented in the laboratory data report. Additionally, if there is not sufficient sample available to perform laboratory QC analyses, the laboratory will make note of the condition in the laboratory data report narrative, and the associated data results will have laboratory qualifiers added as appropriate. Any analyses prescribed by this SAP, but not performed, shall be identified in the laboratory data report and through the characterization deviation form (refer to Section 8.0 and Appendix A).

Table 6-2. Analytical Priorities for WMA A-AX Focus Area 1

Priority	Analysis Type	Primary Method	Constituent/Physical Properties
1	"Quick Turn"	ICP/MS (water extraction)	Technetium-99
		9056 Ion chromatography	Nitrate
		9050	Specific Conductance
2		9045	pH
3	Standard	Gravimetric	Percent solids
		Gravimetric	Percent water
4		Gravimetric	Bulk (sediment) density
5		Gamma energy analysis	Antimony-125, Cesium-137, Cobalt-60, Europium-152, Europium-154, Europium-155, Radium-226
6		ICP/MS (acid extraction)	Technetium-99
7		6010 ICP/AES and 6020 ICP/MS	Aluminum, Barium, Beryllium, Bismuth, Boron, Calcium, Cerium, Chromium, Copper, Iron, Lanthanum, Lead, Lithium, Magnesium, Manganese, Molybdenum, Neodymium, Phosphorous, Potassium, Rhodium, Silicon, Sodium, Strontium, Sulfur, Tantalum, Thorium, Tin, Tungsten, Zinc, Zirconium Arsenic, Cadmium, Cobalt, Nickel, Selenium, Silver, Thallium, Uranium, Vanadium Neptunium-237, Thorium-232, Uranium-233, Uranium-234, Uranium-235, Uranium-236, Uranium-238
8		Low energy gamma counting	Iodine-129
9		Liquid scintillation	Selenium-79
10		ICP/MS (acid extraction)	Antimony, Tin-126
11		Beta gas proportional counting	Strontium-90

Table 6-2. Analytical Priorities for WMA A-AX Focus Area 1

Priority	Analysis Type	Primary Method	Constituent/Physical Properties
12	Standard	Liquid scintillation	Nickel-63
13		Liquid scintillation	Tritium
14		Liquid scintillation	Carbon-14
15		Liquid scintillation	Plutonium-241
16		Alpha energy analysis	Americium-241, Curium-242, Curium-243/244, Plutonium-238, Plutonium-239/240
17		7471 Cold vapor atomic absorption	Mercury
18		7196 Colorimetric	Hexavalent Chromium
19		9056 Ion chromatography	Bromide, Chloride, Fluoride, Nitrate, Nitrite, Phosphate, Sulfate, Acetate, Formate, Glycolate, Oxalate
20		Ion chromatography EPA 300.7	Ammonium
21		9060	Total Organic Carbon
22		8270 GC/MS	bis(2-Ethylhexl)phthalate, Tributyl phosphate
23		8081 GC/ECD	4,4'-DDD, 4,4'-DDE, 4,4'-DDT, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, Chlordane, Dieldrin, Endrin, Heptachlor, Heptachlor epoxide, Hexachlorobenzene
24		8082 GC/ECD	Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, Aroclor-1260
25		9014 Spectrophotometric	Cyanide
26		ASTM D7928 ASTM D6913	Particle size distribution

Table 6-2. Analytical Priorities for WMA A-AX Focus Area 1

Priority	Analysis Type	Primary Method	Constituent/Physical Properties

ASTM = American Society for Testing and Materials
CAS = Chemical Abstracts Service
GC/ECD = gas chromatography/electron capture detector
GC/MS = gas chromatography/mass spectroscopy
ICP/AES = inductively coupled plasma/atomic emission spectroscopy
ICP/MS = inductively coupled plasma/mass spectroscopy

References:

ASTM D6913, *Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.*

ASTM D7928, *Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis.*

EPA 600/S4-86/024, *Development of Standard Methods for the Collection and Analysis of Precipitation,* "Method 300.7, Dissolved Sodium, Ammonium, Potassium, Magnesium, and Calcium in Wet Deposition by Chemically Suppressed Ion Chromatography."

SW-846, *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods.*

WRPS-0900155, Rev. 2, "Test Plan for Sample Breakdown and Analysis of Sediment Samples Obtained as Part of the Vadose Zone Project."

7.0 DATA MANAGEMENT

This section describes the reporting requirements for the WMA A-AX soil sample results. Section 7.1 identifies "quick turn" reporting requirements, and Section 7.2 identifies how all the analyses will be reported. "Quick turn" constituents are bolded in Table 6-1. Analytical results will be reported in Format VI data packages (i.e., laboratory data report).

It is anticipated that the 222-S Laboratory will perform all of the analyses. If necessary, the laboratory and/or SMO may subcontract certain analyses to another qualified laboratory. The subcontracted laboratory shall meet all QA/QC requirements in this SAP. The 222-S Laboratory will prepare a statement of work authorizing the subcontracted laboratory to perform the analyses. The statement of work shall be reviewed and approved by the QA personnel and Data Management Lead prior to commencement of laboratory analysis.

7.1 "QUICK TURN" REPORTING

The "quick turn" analyses will be reported as preliminary results on an expedited time frame (within 7 days of the last sample received for a batch; however, upon request, they will be reported within a shorter period of time, as negotiated with the laboratory and/or SMO prior to sample delivery). The "quick turn" results for nitrate and technetium-99 will be transmitted via e-mail to the Data Management Lead. They will also be reported in the laboratory data report, and the information will be loaded into HEIS. Specific conductance and pH are also "quick turn" constituents; however, the pH and specific conductance results will be reported with the "quick turn" analyses only if requested by the Data Management Lead.

7.2 FORMAT VI REPORTING AND DATA DELIVERABLES

Analysis performed by laboratories will be provided in Format VI laboratory data reports. A Format VI Report with QA verification includes the following:

- Narrative – contains a description of sample receipt, sample breakdown, and has a section corresponding to each method, describing any analytical/QC deviations
- Results Table (Data Summary Report) – printout containing sample and duplicate results, relative percent difference, standard and spike recoveries, blank results, and data qualifiers (flags)
- Sample section that contains sample breakdown diagrams, chain of custody forms, and geologist's descriptions
- Section that contains e-mail correspondence and/or characterization deviation forms (refer to Section 8.0 and Appendix A) that document issues that arose during sampling and analysis, and subsequent decisions that affected initial work instructions.

The laboratory will perform a QA review of the final report. Typical QA reviews require a minimum 10% review.

The laboratory data report will also include tentatively identified compounds found in the semi-volatile organic analyses. A discussion of the tentatively identified compound evaluation process shall be provided in the narrative. A Format VI laboratory data report is subject to internal laboratory QA verification and review, including peer review prior to release.

The laboratory data report will be provided to the Data Management Lead. The laboratory shall issue the report within 180 calendar days following receipt of the last samples. Preliminary results for "quick turn" data shall be available within 7 days, unless an expedited turnaround time is requested. Preliminary results for the remaining data shall be within 60 days following receipt of the last sample, unless the Data Management Lead is informed of QC failures that require re-extraction and/or reanalysis (e.g., within two times holding times). As indicated in Section 3.2, laboratory changes will be communicated to the Data Management Lead and documented in the laboratory data report(s) narrative. Sample raw data will be provided, upon request, to the Data Management Lead. Additionally, documentation of deviations to the SAP analysis requirements shall be appended to the final laboratory data report (e.g., change in specified methods, characterization deviation form [refer to Section 8.0 and Appendix A]). The Project Manager will identify personnel to be included on the distribution list for the final laboratory data report.

In addition to the laboratory data report, an electronic version of the analytical results shall be uploaded to HEIS within 14 calendar days of release of the report. The electronic data shall be in the standard electronic format for HEIS.

7.3 DATA REVIEW AND USABILITY

This section addresses the data management and QA activities that occur after data collection. These activities will primarily be subcontracted to CH2M HILL Plateau Remediation Company or current contractor. Implementation of these activities determines whether the data conform to the specified criteria, thus satisfying the project objectives. The Data Management Lead or designee will be responsible for ensuring the completeness of the data report(s), reviewing results against any existing knowledge, and assessing the data to determine if they are adequate for the intended use. A review will also be performed to verify all data were correctly loaded into HEIS.

7.3.1 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, 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.

Data reviews will be performed 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.

7.3.2 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 upon method blanks, recovery of various internal standards, correctness of uncertainty calculations, correctness of identification and quantification of analytes, and 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 Data Review*; and EPA-540-R-2017-002, *National Functional Guidelines for Organic Superfund Methods Data Review*, adjusted for use with SW-846, HASQARD, and radiochemistry methods.

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 analytes; and qualification of the results based on evaluation of analytical holding times, method blank 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 a minimum 50% of the data. Data validation will be performed on approximately 50% of this focus area's soil sample results by a party independent of both the data collector and the data user.

7.3.3 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 data quality assessment (DQA) process is the scientific and statistical evaluation of previously verified and validated data to determine if information obtained from environmental data operations are of the right type, quality, and quantity to support their intended use (usability). The DQA process uses the entirety of the collected data to determine usability for decision making. For judgmental (focused) sampling designs, data quality indicators such as precision, accuracy, representativeness, comparability, completeness, and sensitivity for the specific data sets (individual laboratory data packages) are evaluated in accordance with EPA/240/R-02/004, *Guidance on Environmental Data Verification and Data Validation*. Data verification and data validation are integral to both the statistical DQA data evaluation process and the data quality

indicator evaluation process. Guidelines from EPA/240/B-06/002, *Data Quality Assessment: A Reviewer's Guide,* and data assessment requirements and specifications in HASQARD will be followed, as applicable. Results of the DQA/data quality indicator processes will be used by the Project Manager to interpret the data and determine if the DQOs for this SAP have been met.

8.0 CHANGE CONTROL

Field activity and laboratory work scope changes may be required based on unexpected field conditions, new information, health and safety concerns, or other circumstances. Changes to work scope may result in modifications to this SAP. Work scope changes that do not result in deviation from the SAP requirements can be made in the field or laboratory with the approval of the Project Manager or designee. These work scope changes will be documented in the sampling work package and/or Format VI laboratory data report(s). Changes will also be summarized in SAP revisions, if revisions are needed. Justification for the changes to work scope shall be provided in sufficient detail to explain the basis for the change.

Version control is maintained by the administrative document control process. Three types of changes during the accomplishment of sampling and analysis that could affect compliance with the requirements in the SAP are as follows.

- A **fundamental change** is a change that does not meet the requirements set forth in the SAP or that incorporates characterization activities not defined in the scope of the SAP.

- A **significant change** generally involves a significant change to a component of the characterization that does not fundamentally alter the overall test approach.

- A **minor change** will not have a significant impact on the scope, schedule, or cost of the characterization. Minor field changes can be made by the person in charge of the field activity. These minor changes should be documented in the project file (for example, through interoffice memoranda or logbooks). Insignificant changes will not impact the requirements of the SAP.

The Project Manager will discuss the change with DOE. DOE will then discuss significant changes with Ecology, as needed, including changes described in Sections 9.3 and 12.0 of the HFFACO Action Plan. Appropriate documentation will follow, in accordance with the requirements for the type of change. The Project Manager or designee is responsible for communicating field corrective action requirements and ensuring immediate corrective actions are applied to field activities.

Characterization Support personnel are responsible for tracking all changes. Characterization Support personnel are also responsible for ensuring the field instructions are maintained and aligned with any revisions or approved changes to the SAP; for ensuring the current version of the SAP is being used; and for providing any updates to field personnel. Characterization Support personnel and/or the Data Management Lead will also ensure deviations from the SAP or problems encountered in the field are documented appropriately (e.g., in the field logbook or characterization deviation form). Appendix A provides a copy of the characterization deviation form.

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9.0 DOCUMENTS AND RECORDS

All information pertinent to field sampling will be recorded in bound logbooks in accordance with existing sample collection protocols. Sampling personnel will be responsible for recording all relevant sampling information. Entries made in the logbook will be dated and signed by the individual who made the entry. Program requirements for managing the generation, identification, transfer, protection, storage, retention, retrieval, and disposition of records will be followed.

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. Only authorized persons may make entries in logbooks. Logbooks will be signed by the field manager, supervisor, cognizant scientist/engineer, or other responsible individual. 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 entry with a single line, entering the correct information, and initialing and dating the changes.

The Project Manager is responsible for ensuring a project information is properly maintained. The following information will be maintained, as appropriate:

- Field logbooks
- Change notices
- Final reports (e.g., direct push completion and logging reports)
- Laboratory data report
- Verification and validation reports.

The laboratory will follow their own procedures with respect to documents and records. Audits will be periodically conducted by WRPS QA to ensure their practices are following requirements.

Records may be stored in either electronic or hard copy format. Documentation and records, regardless of medium or format, are controlled in accordance with internal work requirements and processes to ensure the accuracy and retrievability of stored records. Records required by the HFFACO, will be managed in accordance with the HFFACO requirements.

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10.0 MANAGEMENT OF WASTE

Waste generated by field activities will be managed consistent with the applicable waste management plan. Because this field investigation will principally use direct push technology, no waste to minimal waste will be generated.

Waste will be handled in accordance with the requirements of WAC 173-303, "Dangerous Waste Regulations," and as reflected in the site-specific waste management plan. Waste handling practices are based on minimizing the exposure of field personnel to both radiation and chemical pollutants to as low as reasonably achievable and comply with regulatory requirements.

If unused samples and associated laboratory waste for analysis are to be dispositioned, the process must adhere with the laboratory contract and agreements. In accordance with 40 CFR 300.440, "National Oil and Hazardous Substances Pollution Contingency Plan," "Procedures for Planning and Implementing Off-Site Response Actions," the Data Management Lead's approval is required before unused samples or waste is returned from offsite laboratories. Additionally, the Data Management's approval is required before disposal of unused sample material at onsite laboratories.

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11.0 HEALTH AND SAFETY PLAN

Field operations will be performed in accordance with health and safety requirements identified in appropriate procedures and plans. Work control documents will be prepared to provide further control of site operations. Safety documentation will include a job hazard analysis and, as applicable, radiological work permits. The sampling procedures and associated activities will implement as low as reasonably achievable practices to minimize the radiation exposure to the sampling and analytical teams, consistent with the requirements defined in 10 CFR 835, "Occupational Radiation Protection."

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12.0 REFERENCES

Note: The most current version/revision of methods and/or test plans will be used.

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APPENDIX A

CHARACTERIZATION DEVIATION FORM

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CHARACTERIZATION DEVIATION FORM

Document: _____ **Change Number:** _____ **ECN to TSAP Required?** Y / N

Requestor: _____ **Date:** _____

Original Requirement:

Samples Impacted:

Proposed Change:

Reason for Change:

Date Change Effective:

Schedule Impact:

Authorization:

Project Manager (Print/Sign): **Date:**

Quality Assurance (Print/Sign): **Date:**

222-S Sample Management Office (Print/Sign): **Date:**

Laboratory Project Coordinator (Print/Sign): **Date:**

Other (Optional, Print/Sign): **Date:**

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