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Field Sampling and Analysis Plan for Soil Samples in Support of an Interim Barrier Southeast of S Farm, Bordering SX Farm

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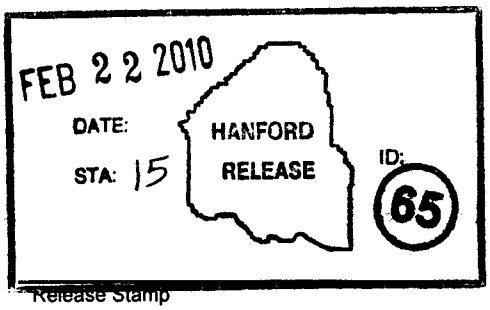
Abstract: This Field Sampling and Analysis Plan provides direction and specifies requirements for field sampling, laboratory analysis, and data reporting for soil samples that will be taken southeast of 241-S Tank Farm.



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FIELD SAMPLING AND ANALYSIS PLAN FOR SOIL SAMPLES IN SUPPORT OF AN INTERIM BARRIER SOUTHEAST OF S FARM, BORDERING SX FARM

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ABBREVIATIONS AND ACRONYMS

ATL	Advanced Technologies and Laboratories International, Inc.
bgs	below ground surface
CCN	Characterization Change Notice
CFR	*Code of Federal Regulations*
CHPRC	CH2M HILL Plateau Remediation Company
CVAA	cold vapor atomic absorption
DOE	U.S. Department of Energy
DRF	Document Revision Form
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FSAP	field sampling and analysis plan
FY	Fiscal Year
HEIS	Hanford Environmental Information System
HFFACO	*Hanford Federal Facility Agreement and Consent Order*
IC	ion chromatography
ICP/AES	inductively coupled plasma/atomic emission spectroscopy
ICP/MS	inductively coupled plasma/mass spectroscopy
MSD	matrix spike duplicate
ORP	U.S. Department of Energy, Office of River Protection
QA	quality assurance
QC	quality control
RCRA	*Resource Conservation and Recovery Act of 1976*
REDOX	Reduction-Oxidation (plant)
RL	U.S. Department of Energy, Richland Operations Office
RPD	relative percent difference
SAF	Sample Authorization Form
SDG	Sample Delivery Group
SDM	Sample Data Management
SDT	Sample Data Tracking software
SGE	surface geophysical exploration
SST	single-shell tank
TOC	Tank Operations Contractor
TSAP	tank sampling and analysis plan
WMA	Waste Management Area
WRPS	Washington River Protection Solutions LLC
Wt%	weight percent

1. BACKGROUND

The U.S. Department of Energy (DOE), Office of River Protection (ORP) and the State of Washington Department of Ecology (Ecology) [the regulator for *Resource Conservation and Recovery Act of 1976* (RCRA) treatment, storage, and disposal facilities] have agreed to create a RCRA Corrective Action Project with explicit milestones. These milestones are part of the *Hanford Federal Facility Agreement and Consent Order* (HFFACO) (part of the M45 milestone series) (Ecology et al. 1989). The Closure and Corrective Measures program (formerly Operations Support – Vadose) is managing the RCRA Corrective Action Program. This program includes collection of subsurface vadose zone data.

Current planning includes placement of interim surface barriers at several single-shell tank (SST) farms. The first of such barriers was placed in fiscal years (FY) 2007 and 2008 over a portion of 241-T Tank Farm. T Farm contained the largest inventory of mobile contaminants (primarily ^{99}Tc, nitrate, and chromium) released to the vadose zone. A barrier is under construction over 241-TY Tank Farm, where releases from tanks and pipelines have occurred. The next largest recorded unplanned releases to the vadose zone occurred at 241-SX Tank Farm, which makes SX Farm a high priority tank farm to be considered for a barrier. In terms of inventory, tanks 241-SX-108, 241-SX-107, 241-SX-115, and 241-SX-104 were consistently ranked in the top 10 for the mobile constituents of all SSTs with unplanned releases to the vadose zone. An interim surface barrier has been proposed at SX Farm to mitigate the transport of contaminants from unplanned releases at these tank farms to groundwater.

Interim measures have been implemented at Waste Management Area (WMA) S-SX to minimize the infiltration from manmade water sources. These measures include capping monitoring wells, isolating water pipelines, and building berms around the tank farm boundaries. The purpose of placing an interim barrier is to prevent precipitation from infiltrating into the vadose zone and moving mobile contaminants within the vadose zone to groundwater.

The Tank Operations Contractor (TOC) has (through a data quality objective [DQO] process; see RPP-ENV-38696, *Data Requirements for Characterization Supporting Near-Term Interim Barriers*) collected vadose characterization information in FY 2009 prior to design of the proposed interim barrier in SX Farm. To design the interim surface barrier, the geographic extent of the subsurface mobile contaminant plume must be known. Twelve locations were investigated in FY 2009 in SX Farm to define this subsurface plume.

During FY 2009, ORP, Ecology and WRPS met to prioritize additional sites for characterization in support of barrier design. In addition to the known historic releases from tanks, the team recommended considering:

- sites where multiple transfers through pipelines were known to have occurred,
- sites adjacent to other existing or proposed barriers, and
- sites where little or no soil characterization data has been collected.

Geophysical anomalies documented in RPP-RPT-42513, *Surface Geophysical Exploration of the SX Tank Farm at the Hanford Site*, located southeast of 241-S Tank Farm and northeast of

SX Farm require additional investigation to help with placement of one or more barriers at S-SX Farm. Although not ranked as a high priority due to known historic releases from tanks, this area warrants investigation due to the waste transfers associated with pipelines, diversion boxes and catch tanks located here. This Field Sampling and Analysis Plan (FSAP) provides the direction and requirements for five direct push sampling locations in this area southeast of S Farm.

In FY 2009, through the DQO process a tank farm interim barrier DQO was developed. This DQO, RPP-43551, *Tank Farm Interim Barrier Data Quality Objectives*, will be applied to the FY 2010 vadose zone soil sampling in support of interim barriers. This DQO identifies the following four data inputs:

- gamma radiation from direct push logs
- moisture content from direct push logs
- nitrate (NO_3^-) from soil samples
- technetium (^{99}Tc) from soil samples.

These inputs were chosen because gamma radiation and moisture content indicate the potential for the presence of tank waste and the concentrations of NO_3^- and ^{99}Tc indicate the amount of mobile contaminants remaining at the location sampled. Nitrate and ^{99}Tc are among the most mobile contaminants.

As characterization of the vadose zone is necessary before a final decision can be made on how this and other sites will be dispositioned for cleanup and closure, DQO RPP-RPT-38152, *Data Quality Objectives Report Phase 2 Characterization for Waste Management Area C RCRA Field Investigation/Corrective Measures Study* will also be applied opportunistically. All the analytical parameters are being requested from this DQO except for the organic chemicals.

Additional useful information that could be obtained during a characterization campaign is as follows.

a. The depth of the center of the mobile contaminant plume, which affects the geographic size and effectiveness of the surface barrier.

b. The waste stream type. Documenting the waste type from collected subsurface samples will help determine what inventory was released.

c. Concentrations of contaminants in the subsurface based on results from the soil sampling. This information will assist in evaluation of the accuracy of surface geophysical exploration (SGE).

2. SAMPLING AND ANALYSIS OBJECTIVES

This FSAP provides direction and specifies requirements for field sampling, laboratory analysis, and data reporting for soil samples that will be taken southeast of S Farm. A multidiscipline team consisting of TOC personnel, other subcontractors, and Energy*Solutions* Federal Services, Inc., Northwest Operations, is planning to implement the field activities to provide subsurface soil samples to aid in providing the required information.

The focus of this effort is to collect sediment samples using direct push technology to determine the possible geographic extent of contaminants southeast of S farm. To do this efficiently, results from the sampling must feed back into a characterization effort to assist in determining where geographically and vertically the next sample should be taken. The sampling effort will use geophysical logging along with fast turnaround analysis on two mobile contaminants (^{99}Tc and nitrate) to help determine where the next set of samples should be taken. Initially three of the five sites will be investigated. Following the reporting of the results for the "Quick Turn" on the first three locations a meeting will be held with representatives from TOC, ORP, DOE Richland Operations Office (RL), and Ecology, to determine the next sample locations both horizontally and vertically.

3. FACILITY DESCRIPTION

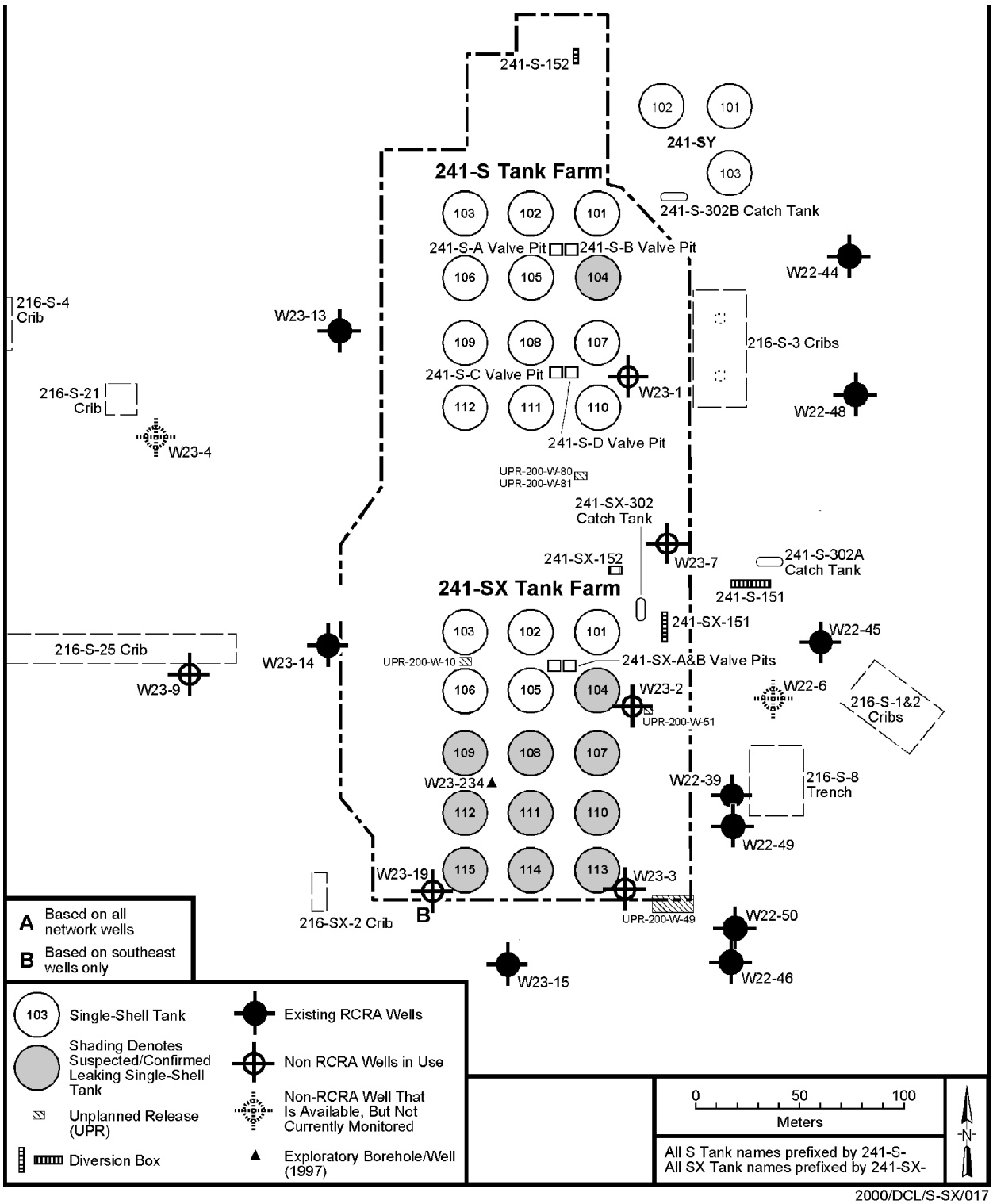
Two tank farms make up WMA S-SX, which is located in the southwest portion of the 200 West Area near the Reduction-Oxidation (REDOX) plant. In general, the WMA S-SX boundary is represented by the combined fence lines surrounding the S and SX Farms (Figure 3-1). The S and SX Farms were constructed in the 1950s to support operations at the REDOX plant, which operated from 1952 through 1967. The S Farm contains twelve 100-series SSTs that were constructed between 1950 and 1951 and put into service in 1951. The SX Farm contains fifteen 100-series SSTs that were constructed between 1953 and 1954 and put into service in 1954. The two tank farms were used to store and transfer waste until the late 1970s and early 1980s.

The SX Farm tanks were designed to withstand pH values of 8 to 10 and to hold self boiling waste, with temperatures up to 250 °F for a period of 1 to 5 years. The S Farm tanks were designed to withstand pH values of 8 to 10 and fluid temperatures up to 220 °F. The SX Farm tanks were the first SSTs designed for self-boiling (self-concentrating) waste; however, the S Farm tanks also received REDOX waste that self-boiled.

The REDOX high-level waste stream going to the S and SX Farms contained high concentrations of short-lived radionuclides that generated considerable heat. Management of that heat dominated the operational history of the S and SX Farms. Many tank farm facility modifications were implemented during the period of REDOX plant operations to address high-heat issues; a number of tank failures were directly related to these high-heat issues.

Detailed discussion of S and SX Farms construction and operations, along with historical information on soil surface and vadose zone contamination in WMA S-SX, is provided in HNF-SD-WM-ER-560, *Historical Vadose Zone Contamination from S and SX Tank Farm Operations*. A detailed description of contaminant occurrences and environmental conditions at WMA S-SX is provided in HNF-4936, *Subsurface Conditions Description of the S-SX Waste Management Area*. Vadose zone field characterization activities were conducted at WMA S-SX during FYs 1998 through 2000 and a field investigation report was published to document the results of those investigations (RPP-7884, *Field Investigation Report for Waste Management Area S-SX*).

Figure 3-1. Location Map of Waste Management Area S-SX and Surrounding Facilities



4. SAMPLING EVENT REQUIREMENTS

All field sampling activities shall be conducted in accordance with this FSAP and the appropriate TOC procedures and work packages. If changes to the sampling requirements must be made, the change must be recorded and approved by the Characterization Task Lead before sampling. The change may be recorded on a permanent data sheet, recorded directly in the work package(s), or a Characterization Change Notice (CCN) or a Document Revision Form (DRF). Additional clarification or direction may be provided to the laboratory via e-mail. The work package(s) contain(s) the operating procedures required for the sampling events.

Soil sampling services for this work will be contracted through the CH2M HILL Plateau Remediation Company (CHPRC) or Washington River Protection Solutions LLC (WRPS) samplers will be used. The soil samplers shall follow CHPRC or WRPS sampling protocols and procedures, which cover items such as cleaning of sampling devices, chain of custody etc. Cleaned sampler devices/tools shall be kept in the wrapping until they are used for sampling. Samples shall be delivered to the 222-S Laboratory for analysis.

4.1 SOIL SAMPLING DESIGN

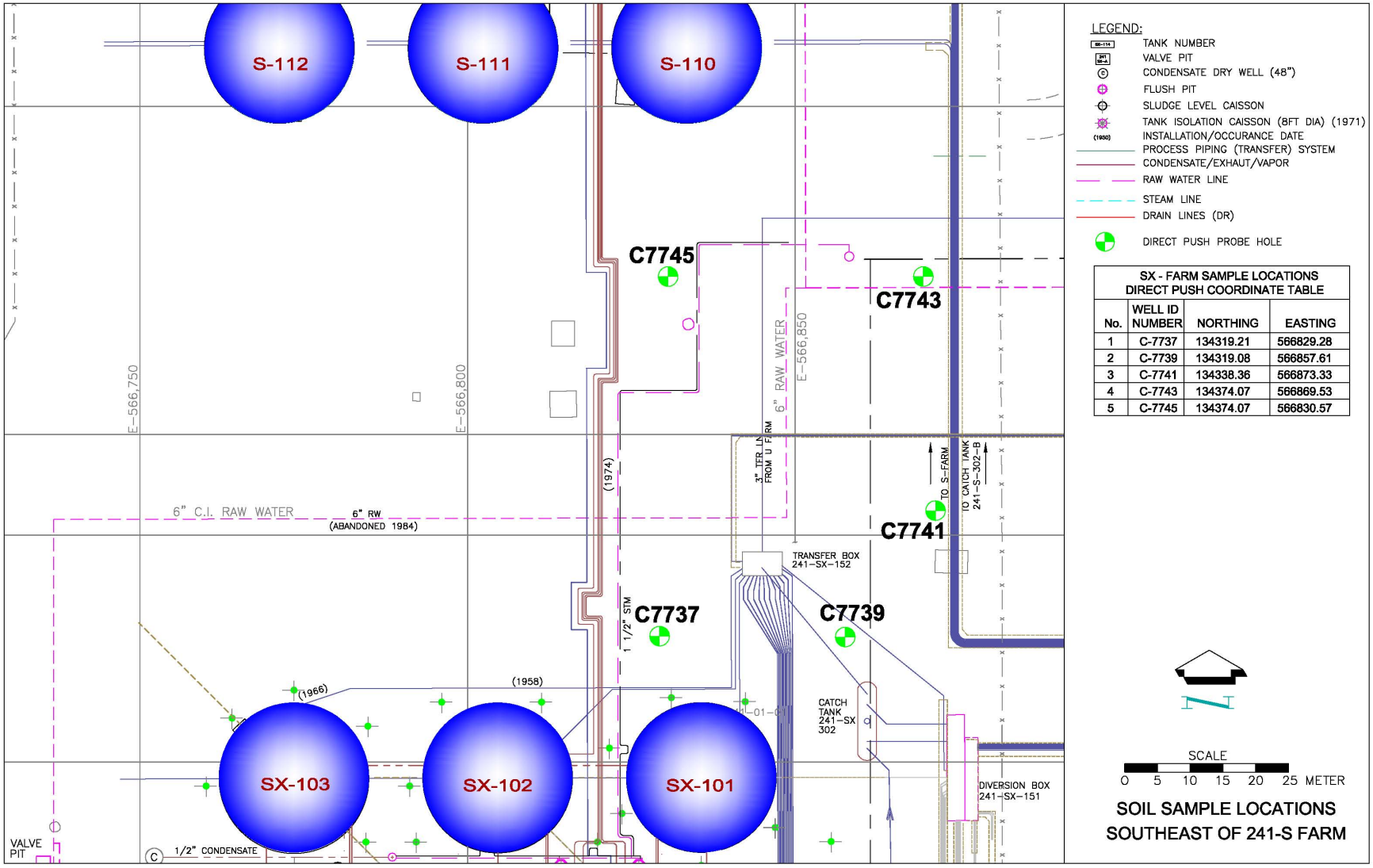
Current planning documents state that up to five sample sites will be investigated. These five locations are shown in Figure 4-1. The goal for all the sample sites is to reach the top of the lower zone of the Cold Creek Unit (about 130 to 150 feet below ground surface [bgs]). The samples will be taken using the direct push sampling method. Three samples will be collected at each site. A meeting held on December 11, 2010 recommended a phased approach. Locations C7737, C7739 and C7741 will be logged and soil samples collected first, prior to starting the other two sites. A copy of the meeting minutes can be found in Appendix B.

If significant contamination is found that indicates a contaminant source outside the tank farm boundaries, assistance from CHPRC and RL may be required to determine if additional direct push characterization will be performed. The results of any decisions will be documented in meeting minutes. If additional characterization is needed, this document will be revised.

4.2 SOIL SAMPLING USING DIRECT PUSH TECHNOLOGY

Sampling will be conducted using a hydraulic hammer direct push rig technology with the capability to push vertically as well as on a slant. Primarily vertical direct pushes will be used in the field characterization effort; however, there may be a need to do some slant direct pushes. The direct push technology has been capable of obtaining a sample as deep as the Cold Creek Unit in the 200 West Area. No field duplicate samples are required for direct push samples.

Figure 4-1. Direct Push Locations Southeast of 241-S Tank Farm



SX - FARM SAMPLE LOCATIONS
DIRECT PUSH COORDINATE TABLE

No.	WELL ID NUMBER	NORTHING	EASTING
1	C-7737	134319.21	566829.28
2	C-7739	134319.08	566857.61
3	C-7741	134338.36	566873.33
4	C-7743	134374.07	566869.53
5	C-7745	134374.07	566830.57

4.2.1 Sampling Techniques

After completion of ground penetrating radar survey(s), identified sites will be logged by the use of a small-diameter single-string system attached to the hydraulic hammer direct push rig. This tubing will be pushed to the target depth (top of the Cold Creek Unit) or refusal, and logged with modified bismuth germinate oxide or sodium iodine for gross-gamma and neutron-neutron moisture instrumentation.

If sampling of the site is required, a second probe hole is pushed using a dual-string system. The dual-string sampling system consists of inner and outer strings that are deployed by small-diameter push rods. When the targeted sampling depth is achieved, the rods are pulled back and the removable tip is removed from the inner rods. A sampler is attached to the inner string and 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 by use of a proprietary method, and the entire assembly is advanced through the targeted sample interval. The sampler contains three liners and a shoe to collect material. After each sampling event, the "dummy" tip is reattached to the inner string and returned to the bottom and placed in the casing shoe, and the entire assembly is advanced to the next designated sample depth. This process is repeated until all sample depths are achieved or the tubing meets refusal.

4.2.2 Sampling Strategy

Sampling strategy at each vertical direct push site is summarized in the following. Note that the specified depths are only approximate and are subject to constraints in the field.

a. A minimum of two direct push probe hole pushes will be completed at each location. The initial probe hole is logged for both gross gamma and neutron moisture. Following logging, deep electrodes are installed for SGE. The second push is for soil sampling based on the data derived from the first push.

b. The depth of the first push will be approximately 130 to 150 feet bgs (into or through the Upper Cold Creek Unit) or refusal. Refusal in the 200 West Area usually occurs at the top of the Lower Cold Creek Unit.

c. Deep electrodes are placed at the bottom of the initial probe hole and at 20 ft intervals up to approximately 40 feet bgs. Five to six electrodes will be installed in each probe hole.

d. The depth location for sampling individual horizons will be selected by reviewing the gamma and moisture logs of the first direct push and any leak loss inventory information pertinent to the site, geologic summary of the area, operational history, and historical characterization data at that site. The sampling horizons will be selected in an open meeting in which WRPS staff, DOE, Ecology, and other site contractors are invited.

   NOTE: Specified depths are only approximate and are subject to constraints in the field.

As indicated in Section 1.2, three direct pushes (Locations C7737, C7739 and C7741) will be drilled and logged before any sampling direct pushes. This is to allow modification of the lateral

locations for direct pushes drilled later. Following the geophysical logging of this first set of direct pushes, a meeting to address item d. will occur to determine sample depths and if it is necessary to move or add other direct push locations. Meetings will be held to address these issues as necessary.

4.3 SAMPLE COLLECTION

The soil samplers shall follow CHPRC or WRPS sampling protocols and procedures, which cover items such as soil sample collection, chain of custody sample shipping, etc. The dual-string sampler will be used to collect sediment samples at the location and depth specified in item d. of Section 4.2.2. The dual-string sampler body holds three stainless-steel liners and a shoe to collect samples during the direct push. The liners are removed from the sampler body and surveyed. Trained samplers document recovery, sample condition, and volume recovery percent. They then package and transport the sample under chain-of-custody control to the selected laboratory for analysis. The material in the shoe shall be collected in a 500 mL glass jar with a Teflon[1] cap. 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 needs to be marked for its bottom (labeled B) and top (labeled T) to signify the position of the sample prior to shipping and transport. The material in the shoe and all three liners will have the same Hanford Environmental Information System (HEIS) number.

Sample preservation, containers, and holding times for radiological and nonradiological analytes are shown in Table 4-1. The only sample that will be containerized is the shoe material; this material will be placed in one 500-ml bottle. Table 4-1 shows that it is acceptable to use a 500 ml glass bottle for the shoe material and that the sample will be preserved by cooling at ≤ 6 °C.

4.4 SAMPLE HANDLING AND SHIPPING

Whenever required, soil samples shall be maintained and shipped at or below 6 °C. The samples shall be shipped to the laboratory (222-S) as soon as possible to meet applicable holding times. Samples not meeting temperature or holding time requirements shall be discussed in the laboratory data report and sample logbook. The impact on subsequent use or interpretation of these data will be evaluated on a case-by-case basis by WRPS personnel.

However, it is recognized that some samples may have elevated levels of radioactivity. These samples must be stored and transported in shielded shipping containers that may not allow the samples to be maintained below 6 °C. Also, fewer samples may be shipped to the laboratory in a shipment. The additional shipments may jeopardize sample holding times recommended in SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. To minimize the impact on sample integrity, these highly radioactive samples shall not be exposed to high temperatures, and they shall be shipped to the laboratory for analysis as soon as possible.

[1] Teflon® is a registered trademark of I. E. du Pont de Nemours and Company, Wilmington, Delaware.

Table 4-1. Sample Preservation, Container, and Holding Time Guidelines

Analytes	Matrices	Bottle		Preservation	Holding Time
		Type	Lid		
Radionuclides	Soil	500-mL G/P[1]	Teflon-lined cap	None	6 months
IC anions	Soil	500-mL G/P[1]	Teflon-lined cap	Cool ≤6 °C	48 hours after sample preparation
ICP metals	Soil	500-mL G/P[1]	Teflon-lined cap	None	6 months
Mercury	Soil	500-mL G[1]	Teflon-lined cap	None	28 days
Total cyanide	Soil	500-mL G[1]	Teflon-lined cap	Cool ≤6 °C or freeze	14 days
pH (soil)	Soil	500-mL G[1]	Teflon-lined cap	None	As soon as possible
Sulfides	Soil	500-mL G[1]	Teflon-lined cap	Cool ≤6 °C or freeze	7 days
Ammonium	Soil	500-mL G[1]	Teflon-lined cap	Cool ≤6 °C or freeze	7 days

G = glass G/P = glass or plastic GC = gas chromatography
IC = ion chromatography ICP = inductively coupled plasma
[1] Shoe material: Only one 500-ml glass bottle is required for all the analyses.

Radiological control technician(s) will measure contamination levels on the outside of each sample jar and dose rates on each sample jar. 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 [Title 49, *Code of Federal Regulations*, "Transportation" (49 CFR)], and to verify that the sample can be received by the analytical laboratory in accordance with the laboratory's acceptance criteria.

4.5 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 sampler's field logbook.

Each sample container will be labeled with the following information using a waterproof marker on firmly affixed water-resistant labels.

a. Sample identification number.

b. Sample collection date and time.

c. Name or initials of person collecting the sample.

d. Preservation method (if applicable).

e. Sample location (direct push hole number and depth of collection).

A list of sample analyses is not required for sample labels because the list could be quite large. Section 5.1 provides the appropriate analyses and additional guidance for preparing the sample for analysis.

4.6 SAMPLE CUSTODY

The sampling team 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.

a. Project name.

b. Name of the collector.

c. Date and time of collection.

d. Sample type (e.g., soil, etc.).

e. Requested analysis or provide a reference for sample analysis.

f. Signatures of persons involved in the chain of possession.

g. Date and time of sampling and when the sample is relinquished to the laboratory.

h. Unique HEIS sample identification number assigned to the sample.

i. Sample location (direct push hole number and depth of collection).

j. A notation of pertinent sampling information including unusual characteristics or sampling problems.

k. 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 “Special Instructions” section of the chain-of-custody form. Each sample will be shipped to the 222-S Laboratory 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. LABORATORY ANALYSIS REQUIREMENTS

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 verifies the identification number on each sample container and ensures it matches the sample seal on the sample container and the chain of custody. Laboratory sample identification numbers are 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 WRPS project personnel. Liner A, B, C and the shoe material will be composited prior to any analysis. A sub-sample of this composite for ^{99}Tc and nitrate will be analyzed as "Quick Turn" by the program and sample preparation will begin as soon as possible after receipt of the samples at the laboratory. The results of Quick Turn analyses shall be sent in an expedited report format (e-mail), and are generally understood to be a 48-hour turnaround on sample results, excluding weekends. The 48-hour turnaround starts at the direction of the field and often starts at the conclusion of sampling at a specific location.

After the samples are received at the laboratory, the samples shall be prepared and analyzed according to the direction and requirements specified in this section. Sections 5.1 and 5.2 provide sample handling and preparation requirements and analytical requirements. Direction for addressing insufficient sample recovery is provided in Section 5.3. All analyses shall be conducted in accordance with this FSAP. The laboratory shall use the least possible dilution to obtain the lowest practical detection limits for all requested analytes. Any analytical changes shall be approved by the Characterization Task Lead before analyses are performed and documented on a CCN, a revision to this document, or change request form.

5.1 DIRECTION FOR SAMPLE HANDLING AND PREPARATION

The following steps shall be performed on each sample, as soon as possible after receipt. The steps shall be performed within one borehole in the order in which they were taken.

a. Remove sample material from each liner (Liners A, B, and C) and the shoe material and place each in a separate plastic tray. Remove sample material from the liners by inserting a push rod in one end of the core tube and forcing the sediment out of the other end onto a flat smooth surface. If the sediment is packed into the core tube too tightly to be extruded in this fashion, use a scoop or spatula to dislodge the sediment from the tube. Document the samples photographically, immediately after extrusion and before subsampling or compositing. The photographs are to be recorded and transmitted in the same format. A licensed geologist with Hanford experience will describe the samples. Visual inspection and simple 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. The sediment descriptions are recorded and used to classify the sediment texture on a modified Folk/Wentworth diagram.

b. Composite the material from Liners A, B, C and the shoe and homogenize. Photograph composited material.

c. Subsample a representative portion (10 to 15 g) of each sample into a pre-weighed jar on a calibrated balance as soon as possible after extrusion of the sample. The jar with sample is placed in an oven set to 105 °C overnight. The sample is cooled and weighed and the percent moisture content by weight is calculated. The sample is returned to the oven for at least 2 hours of additional heating. The sample is reweighed after cooling and the cumulative weight loss is calculated. This process is repeated with additional weighing until a constant weight is achieved (less than 0.01 g change on successive weighing). When no additional weight loss has occurred, the analysis is complete and the cumulative weight loss on drying is used to calculate the moisture content by weight and the percent dry solids by weight.

d. Subsample a sufficient amount of sample sediment to perform the required analysis specified in Table 5-1 and contact with an equal portion of deionized water. Initially, assume the amount of moisture in the sediment is 5%, to calculate the amount of water needed to make up a 1:1 ratio of water to dry solids. The assumed leach factors (measured in Step d, below), will be mathematically corrected prior to reporting of any results, once the % moisture results are complete. One approximately 3-mL aliquot of the unfiltered 1:1 sediment:water extract supernates will be used for pH measurement.

e. Perform analysis for pH, nitrate, conductivity and ^{99}Tc on the 1:1 water digest. The nitrate and ^{99}Tc results are to be reported to the customer within an expedited time frame, typically, within 48 working hours of receipt of the sample at 222-S Laboratory. Standard laboratory quality control (QC) requirements are applied to these analyses; however, due to the need for immediate data, if QC problems occur, results may still be reported with the appropriate qualifiers. pH results will be held and reported with the Tier 1 analysis report. This analysis was added to the Quick Turn sample to enable the laboratory to meet the short hold times.

5.2 REQUIREMENTS FOR ADDITIONAL ANALYSIS

For the remaining composited material perform the analyses per Table 5-1.

The preferred methods of analysis for analytes listed in this document are SW-846 or other approved standardized methods. Where no approved regulatory methods exist, such as for radionuclide analyses, the laboratory should use the technique specified in the analysis tables. It is understood that the laboratory analytical procedures may deviate from SW-846 methods to accommodate analysis of samples contaminated with Hanford tank waste and to reduce radiological exposure to the analysts. It is also understood that those changes and their effect on method performance have been documented to demonstrate that procedures can provide satisfactory performance for the intended use of the data. 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 by authorized representatives of regulatory authorities and WRPS. Additional regulatory quality assurance or DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Documents*, requirements for documenting procedure modifications should also be followed.

Table 5-1. Chemical and Physical Analysis: Soil (2 sheets)

Program	Program Contacts	Comments	Reporting Levels	
A. RPP-43551 Quick Turn Sample	See Table 7-1.	Equipment Blank Required	Quick Turn[a]	Early Reporting[a]
B. RPP-RPT-38152	See Table 7-1.	Trip/Field Blank Not Required	Format VI	Special

Program	Primary Analyses				Quality Control						Report
	Method	Analysis	Sample	Prep	DUP	MSD	MS	BLK	LCS	Units	Format
A	ICP/MS	^{99}Tc	Composite	w (1:1)	1/batch	N/A	1/batch	1/batch	1/batch	pCi/g	Early, VI
A	IC	NO_3^-	Composite	w (1:1)	1/batch	N/A	1/batch	1/batch	1/batch	µg/g	Early, VI
B	Percent water	Weight percent water	Composite	d	1/batch	N/A	N/A	N/A	N/A	wt%	VI
B	Grav % solids	Weight percent solids	Composite	d	1/batch	N/A	N/A	N/A	N/A	wt%	VI
B	GEA	^{129}I, ^{60}Co, ^{125}Sb, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, ^{228}Th	Composite	d	1/batch	N/A	NA	1/batch	1/batch	pCi/g	VI
B	pH	$[H^+]$	Composite	w (1:1)[b]	1/batch	N/A	N/A	N/A	1/batch	pH	VI
B	Conductivity	Conductivity	Composite	w (1:1)[b]	1/batch	N/A	N/A	N/A	1/batch	µS/cm	VI
B	Cold vapor atomic absorption	Hg	Composite	d	N/A	1/batch	N/A	N/A	1/batch	µg/g	VI
B	IC	Br^-, Cl^-, F^-, PO_4^{-3}, SO_4^{-2}, NO_3^-, NO_2^-, $C_2H_3O_3$, $C_2O_4^-$, $C_2H_3O_2$, CHO_2	Composite	w	1/batch	N/A	1/batch	1/batch	1/batch	µg/g	VI
B	IC	NH_4^+	Composite	s	1/batch	N/A	1/batch	1/batch	1/batch	µg/g	VI
B	ISE	S^-	Composite	d	1/batch	N/A	1/batch	1/batch	1/batch	µg/g	VI
B	ICP/MS	Sb, As, Cd, Co, Ni, Ag, Tl, U, V	Composite	a	1/batch	N/A	1/batch	1/batch	1/batch	µg/g	VI
B	Liquid scintillation	^{79}Se, ^{63}Ni	Composite	a	1/batch	N/A	1/batch	1/batch	1/batch	pCi/g	VI
B	ICP/MS[c]	^{99}Tc, ^{238}U, ^{126}Sn, ^{236}U, ^{235}U, ^{234}U, ^{233}U, ^{237}Np, ^{230}Th, ^{232}Th	Composite	a[d]	1/batch	N/A	1/batch	1/batch	1/batch	pCi/g	VI

Table 5-1. Chemical and Physical Analysis: Soil (2 sheets)

Program	Primary Analyses				Quality Control						Report
B	ICP/AES	Al, B, Ba, Be, Bi, Ca, Ce, Cr, Cu, Eu, Fe, K, La, Li, Mg, Mn, Mo, Nb, Nd, P, Pb, Pd, Pr, Rb, Rh, Ru, Se, Sm, Sr, Ta, Te, Th, Tl, U, V, Zn, Na, Si, S, Ti, Zr, Sn, Y	Composite	a	1/batch	N/A	1/batch	1/batch	1/batch	µg/g	VI
B	Spectrophotometric	Cn, $F(CN)_6^{4-}$	Composite	d	1/batch	N/A	1/batch	1/batch	1/batch	µg/g	VI
B	Beta Prop. Counting	^{90}Sr	Composite	a	1/batch	N/A	NA	1/batch	1/batch	pCi/g	VI
B	Liquid scintillation	^{14}C, ^{3}H	Composite	w	1/batch	N/A	NA	1/batch	1/batch	pCi/g	VI
B	Alpha energy analysis	^{238}Pu, $^{239/240}Pu$, ^{244}Cm, ^{243}Cm, ^{242}Cm, ^{241}Am	Composite	a	1/batch	N/A	1/batch	1/batch	1/batch	µg /g	VI
B	Liquid scintillation	gross α/gross β by liquid scintillation counting	Composite	a, w	1/batch	N/A	N/A	1/batch	1/batch	pCi/g	VI

Notes:
[a] Results reported within 48 hours, or as directed by the customer, and consist of preliminary data, delivered via e-mail.
[b] Analyses performed on unfiltered water digest.
[c] If any anomalous values are detected using ICP/MS, those results may be verified using radiochemical methods.
[d] Appropriate acid digest to be chose by laboratory.

Abbreviations:

Method
GEA = gamma energy analysis
IC = ion chromatography
ICP/AES = inductively coupled plasma/atomic emission spectroscopy
ICP/MS = inductively coupled plasma/mass spectroscopy

Prep
a = acid digestion
d = direct
PREP = sample preparation
s = distillation
w = water digest

Quality Control
BLK = blank
DUP = duplicate
LCS = laboratory control sample
MSD = matrix spike duplicate
N/A = not applicable
wt% = weight percent
µS/cm = microSiemens per centimeter

5.3 INORGANIC ANALYTES

Inorganic chemicals will be analyzed using the following methods: inductively coupled plasma/atomic emission spectroscopy (ICP/AES) and inductively coupled plasma/mass spectroscopy (ICP/MS) for cations, ion chromatography (IC) for anions and ammonium, cold vapor atomic absorption (CVAA) for mercury, spectrophotometric analysis for cyanide, ion selective electrode for sulfide, and pH. The ICP/AES and IC methods are capable of analyzing multiple constituents. Primary and secondary constituents for these methods are shown in Tables 5-2 and 5-3. Secondary constituents will only be reported when found above the detection limit.

Table 5-2. Primary Inorganic Constituents and Analytical Methods (2 sheets)

Constituent	Analytical Method[a]	Alternate Method[a]
Aluminum – Al	6010 (ICP/AES)	6020 (ICP/MS)
Antimony – Sb	6010 (ICP/MS)	6020 (ICP/AES)
Arsenic – As	6010 (ICP/MS)	6020 (ICP/AES)
Barium – Ba	6010 (ICP/AES)	6020 (ICP/MS)
Beryllium – Be	6010 (ICP/AES)	6020 (ICP/MS)
Cadmium – Cd	6010 (ICP/MS)	6020 (ICP/AES)
Calcium[b] – Ca	6010 (ICP/AES)	6020 (ICP/MS)
Chromium – Cr	6010 (ICP/AES)	6020 (ICP/MS)
Cobalt – Co	6010 (ICP/MS)	6020 (ICP/AES)
Copper – Cu	6010 (ICP/AES)	6020 (ICP/MS)
Iron – Fe	6010 (ICP/AES)	6020 (ICP/MS)
Lead – Pb	6010 (ICP/AES)	6020 (ICP/MS)
Lithium[b] – L	6010 (ICP/AES)	6020 (ICP/MS)
Manganese – Mn	6010 (ICP/AES)	6020 (ICP/MS)
Magnesium[b] – Mg	6010 (ICP/AES)	6020 (ICP/MS)
Molybdenum[b] – Mo	6010 (ICP/AES)	6020 (ICP/MS)
Nickel – Ni	6010 (ICP/MS)	6020 (ICP/AES)
Phosphorus[b] – P	6010 (ICP/AES)	6020 (ICP/MS)
Potassium[b] – K	6010 (ICP/AES)	6020 (ICP/MS)
Selenium – Se	6010 (ICP/AES)	6020 (ICP/MS)
Silver – Ag	6010 (ICP/MS)	6020 (ICP/AES)
Sodium[b] – Na	6010 (ICP/AES)	6020 (ICP/MS)

Table 5-2. Primary Inorganic Constituents and Analytical Methods (2 sheets)

Constituent	Analytical Method[a]	Alternate Method[a]
Strontium – Sr	6010 (ICP/AES)	6020 (ICP/MS)
Thallium – Tl	6010 (ICP/MS)	6020 (ICP/AES)
Uranium – U	6010 (ICP/MS)	6020 (ICP/AES)
Vanadium – V	6010 (ICP/MS)	6020 (ICP/AES)
Zinc – Zn	6010 (ICP/AES)	6020 (ICP/MS)
Mercury – Hg	7470, 7471 (CVAA)	6020 (ICP/MS)
Fluoride – F^-	9056 (IC)	
Nitrite – NO_2^-	9056 (IC)	
Nitrate – NO_3^-	9056 (IC)	
Chloride – Cl^-	9056 (IC)	
Sulfate – SO_4^{2-}	9056 (IC)	
Acetate[c] – $C_2H_3O_2^-$	9056 (IC)	
Formate[c] – CHO_2^-	9056 (IC)	
Glycolate[c] – $C_2H_3O_3^-$	9056 (IC)	
Oxalate[c] – $C_2O_4^{2-}$	9056 (IC)	
Cyanide – CN^-	9014 (spectrophotometric)	9012 (colormeteric)
Ferrocyanide – $Fe(CN)_6^{4-}$	Estimated from total cyanide	
Sulfide – S^{2-}	9215 (ion selective electrode)	9034 (titration)
Ammonium – NH_4^+	EPA 300.7 (IC)	
pH	9045	

[a] Most recently 222-S Laboratory implemented SW-846 method revision, and revision is documented in the data package.
[b] Calcium, lithium, molybdenum, magnesium, sodium, phosphorous, and potassium were moved from secondary constituents to primary at the request of Ecology to help in the evaluation of whether or not tank fluids have passed through the sediments.
[c] Acetate, formate, glycolate, and oxalate are technically organic anions but are included in this table because they can be analyzed by the same method as some inorganic anions.

CVAA = cold vapor atomic absorption IC = ion chromatography
EPA = U.S. Environmental Protection Agency
ICP/AES = inductively coupled plasma/atomic emission spectroscopy
ICP/MS = inductively coupled plasma/mass spectroscopy

Note that chromium and cyanide data will be used as conservative estimates of hexavalent chromium and ferrocyanide, respectively.

Table 5-3. Secondary Inorganic Constituents

Method 6010 (ICP/AES)* Constituent	
Bismuth – Bi	Samarium – Sm
Boron – B	Silicon – Si
Cerium – Ce	Sulfur – S
Europium – Eu	Tantalum – Ta
Lanthanum – La	Tellurium – Te
Neodymium – Nd	Thorium – Th
Niobium – Nb	Tin – Sn
Palladium – Pd	Titanium – Ti
Praseodymium – Pr	Tungsten – W
Rhodium – Rh	Yttrium – Y
Rubidium – Rb	Zirconium – Zr
Ruthenium – Ru	
Method 9056 (IC) Constituent	
Bromide – Br^-	Phosphate – PO_4^{3-}

* Most recently 222-S Laboratory implemented SW-846 method revision, and revision is documented in the data package.

IC = ion chromatography
ICP/AES = inductively coupled plasma/atomic emission spectroscopy

5.4 RADIOLOGICAL PARAMETERS

Radionuclides will be analyzed by the following methods: gamma energy analysis (GEA) for gamma emitters; ICP/MS for ^{99}Tc, ^{126}Sn, uranium, and neptunium isotopes; liquid scintillation for AEA for plutonium, americium, and curium isotopes; liquid scintillation for ^{14}C, tritium, and ^{79}Se; separation and GEA for ^{129}I, and beta counting for ^{90}Sr. Primary constituents for these methods are shown in Table 5-4.

The only truly multiple constituent analytical method for radiochemistry is GEA. Therefore, the secondary constituents are those found in the GEA library. If a constituent in the GEA library is detected, the concentration will be reported.

Thorium-230 and ^{232}Th can be determined by AEA but are normally measured by ICP/MS because of their long half-life. Thorium-228 concentration is generally determined by AEA or GEA or by calculation based on ^{232}Th and ^{232}U concentrations.

Table 5-4. Primary Radiological Parameters

Constituent	Analytical Method	Alternate Method
^{137}Cs	GEA	
^{60}Co	GEA	
^{152}Eu	GEA	
^{154}Eu	GEA	
^{155}Eu	GEA	
^{14}C	Water leach followed by liquid scintillation counting	
^{3}H	Water leach followed by liquid scintillation counting	
^{129}I	Low energy gamma counting	ICP/MS
^{63}Ni	Separation by complex formation followed by liquid scintillation counting	
^{90}Sr	Beta proportional counting	
^{99}Tc	ICP/MS	Acid leach followed by liquid scintillation counting
^{125}Sb	GEA	
^{79}Se	Precipitation/ion exchange followed by liquid scintillation counting	
^{126}Sn	ICP/MS	
^{233}U	ICP/MS	
^{234}U	ICP/MS	
^{235}U	ICP/MS	
^{236}U	ICP/MS	
^{238}U	ICP/MS	
^{237}Np	ICP/MS	Alpha counting
^{238}Pu	Chemical separation followed by AEA	ICP/MS
$^{239/240}Pu$	Chemical separation followed by AEA	ICP/MS as ^{239}Pu and ^{240}Pu
^{241}Pu	Calculate from ^{238}Pu and $^{239/240}Pu$	Extraction followed by AEA
^{241}Am	Chemical separation followed by AEA	ICP/MS
^{242}Cm	Chemical separation followed by AEA	
^{243}Cm	Chemical separation followed by AEA	
^{244}Cm	Chemical separation followed by AEA	
^{228}Th	GEA	GEA
^{230}Th	ICP/MS	
^{232}Th	ICP/MS	
^{234}Th	Assume in equilibrium with ^{238}U	Chemical separation followed by gas proportional counting

AEA = alpha energy analysis
GEA = gamma energy analysis
ICP/MS = inductively coupled plasma/mass spectroscopy

5.5 INSUFFICIENT RECOVERY OF SAMPLE MATERIAL

If sample material is insufficient to perform the analyses requested in this FSAP, the laboratory shall notify the Characterization Task Lead within 1 working day. The amounts of material available and the amounts required for the individual analyses shall be provided at that time. The Characterization Task Lead will determine priorities for the analyses based on available sample material and discussion with the Closure and Corrective Measures Program Manager. Additionally, the Characterization Task Lead shall also inform Ecology of the lack of sample material and which analyses would likely not be performed due to insufficient sample material. Any analyses prescribed by this FSAP, but not performed, shall be identified in the data report. In addition, justification for not performing the analyses shall be provided.

6. QUALITY ASSURANCE AND QUALITY CONTROL

DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Documents* identifies the quality requirements for environmental data collection, including sampling, field measurements, and laboratory analysis and complies with the requirements of:

a. DOE Order 414.1C, *Quality Assurance*

b. Title 10 *Code of Federal Regulations*, Part 830, "Quality Assurance Requirements," subpart 120, "Scope" (10 CFR 830.120)

c. U.S. Environmental Protection Agency (EPA) guidance document EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans EPA QA/R-5*.

Quality requirements for SX Farm soil sampling and analysis are described in DOE/RL-96-68. Hanford onsite laboratories performing analyses in support of this FSAP will have approved and implemented quality assurance (QA) plans. As required by TFC-PLN-02, *Quality Assurance Program Description*, these QA plans will meet the minimum requirements of DOE/RL-96-68 as the baseline for laboratory quality systems. If subcontracting any portion of the analytical requirements to a commercial laboratory off the Hanford Site, the subcontractor's implementing quality assurance program shall comply with DOECAP, *Consolidated Audit Program Quality Systems for Analytical Services*, or be scheduled for DOECAP certification.

All sampling and analysis activities will be performed using approved methods, procedures, and work packages that are written in accordance with approved operational and laboratory QA plans, which are consistent with the requirements of this FSAP. 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 characterization project. The environmental safety and health training program provides workers with the knowledge and skills necessary to safely execute assigned duties. Field personnel will have completed the required training for access to radiological or field locations before starting work.

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 prejob briefings, on-the-job training, emergency preparedness, plan-of-the-day activities, and facility/worksite orientations.

6.1 QUALITY CONTROL FOR FIELD SAMPLING

Prior to sampling, sampling equipment shall be cleaned using a procedure that is consistent with SW-846 sampling equipment cleaning protocol. Only new (unused) pre-cleaned, quality assured sample containers or containers cleaned onsite in accordance with the SW-846 protocol shall be used for sampling.

Field QC samples shall be collected to evaluate the potential for cross-contamination and laboratory performance. Soil sampling will require the collection of equipment rinsate blanks. Field QC sample types and frequency for collection are described below. Field blanks and trip blanks are not required because volatile organic compound analysis is not required. Field duplicates are not required because it is not possible to obtain direct pushes at the same exact location. Therefore, field duplicates are not required and will not be taken for this project.

6.1.1 Equipment Rinsate Blanks

Equipment rinsate blanks are usually prepared in the laboratory after cleaning the sampling equipment and 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 blanks shall consist of reagent grade, organic free water washed through decontaminated sampling equipment. Equipment rinsate blanks are to be run every 20 samples for the analytes listed in Table 5-1. CH2M HILL Plateau Remediation Company or WRPS samplers will prepare the equipment rinsate blanks. All equipment blanks will be analyzed. A list of the required analysis and sample bottles can be found in Table 6-1.

Table 6-1. Equipment Blank Sample Preservation, Container, and Holding Time Guidelines

Parameter/Analysis	Reference Method	Container/ Volume	Preservation	Holding Time
ICP Metals - 6010 (SW-846) (TF), RADISO_ICPMS (TF)	6010_METALS_ICP, 7470_HG_CVAA, RADISOTOPES_ICPMS	G 500 mL Full QC HNO3 (ULTREX) to pH <2	QC HNO_3 to pH <2	6 Months/ 28 Days
IC Anions - 9056, pH (Water) - 9040 (TF)	9056_ANIONS_IC, 9040_PH P 125 mL	G/P 500 mL	Cool~4C	28 Days/ 48 Hours/ ASAP
GAMMA ENERGY ANALYSIS (TF), Americium-241 (TF), CURIUM, Nickel-63 (TF), Selenium-79 (TF), Strontium-89,90, Plutonium-239/240, Plutonium-238	GAMMA_GS, AMCMISO_EIE_PLT_AEA, NI63_LSC, SE79_SEP_IE_LSC, Sr-90 SRISO_SEP_PRECIP_GPC, Isotopic Plutonium PUISO_PLATE_AEA	G/P 2 1000 mL	HNO_3 to pH <2 6 Months	6 Months
C-14, H3 - TRITIUM, I129_SEP_GEA (TF)	C14_LSC, TRITIUM_DIST_LSC, I129_SEP_GEA	G/P 1 1000 mL	None	6 Months

* Samples will be run as soon as possible, taking into account batching efficiencies as directed by the program.
G = glass G/P = glass or plastic IC = ion chromatography
ICP = inductively coupled plasma MS = mass spectroscopy

6.1.2 Prevention of Cross-Contamination

Special care should be taken to prevent cross-contamination of soil samples. Particular care will be exercised to avoid the following common ways in which cross-contamination or background contamination may compromise the samples.

a. Improperly storing or transporting sampling equipment and sample containers.

b. Contaminating the equipment or sample bottles by setting them on or near potential contamination sources, such as uncovered ground.

c. Handling bottles or equipment with dirty hands. Sample containers should be filled with care so as to prevent any portion of the collected sample coming in contact with the sampler's gloves.

d. Improperly decontaminating equipment before sampling or between sampling events. Samples should not be collected or stored in the presence of exhaust fumes.

e. Overall QA and QC requirements for characterization are discussed in Sections 6.2 and 6.3.

6.2 QUALITY ASSURANCE OBJECTIVE

The QA objective of this plan is to develop implementation guidance that will provide data of known and appropriate quality. Data quality is assessed by representativeness, comparability, accuracy, and precision. These terms are defined in Table 6-2. The applicable QC guidelines, quantitative target limits, and levels of effort for assessing data quality are dictated by the intended use of the data and the nature of the analytical method.

Table 6-2. Data Quality Definitions

Data Quality Term	Definition
Representativeness	Measure of how closely results match actual concentrations
Comparability	Measure of confidence with which one data set can be compared to another
Accuracy	Measure of how close value is to true value
Precision	Measure of the data reproducibility (e.g., duplicate sample)

6.3 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS FOR LABORATORY ANALYSIS

ATL-MP-1011, *ATL Quality Assurance Project Plan for 222-S Laboratory*, specifies the requirements for ensuring the quality of sample analyses performed by Advanced Technologies and Laboratories International, Inc, (ATL) at the 222-S Laboratory. Analyses performed by ATL shall be governed by ATS-MP-1032, *222-S Laboratory Quality Assurance Plan*, and

ATL-MP-1002, *Quality Assurance Program Description (QAPD)*. All analyses shall be performed in accordance with these requirements. Laboratories performing analyses in support of this FSAP shall have approved and implemented QA Plans. These QA plans shall meet DOE/RL-96-68 minimum requirements as the baseline for laboratory quality systems.

The analytical QC requirements (duplicates, spikes, blanks, laboratory control samples) are identified in Tables 5-1 and 6-3. The laboratory shall also use calibration and calibration check standards appropriate for the analytical instrumentation being used (see DOE/RL-96-68 for definitions of QC samples and standards). The criteria presented in the tables are goals for demonstrating reliable method performance. The laboratory will use its internal QA system for addressing any QC failures. If the QC failures are systematic and cannot be resolved by the internal protocols, the Characterization Task Lead and QA Task Lead shall be consulted to determine the proper action. The laboratory should suggest a course of action at that time. All data not meeting the QC requirements shall be properly noted, and the associated QC failures shall be discussed in the narrative of the data report.

Table 6-3. Quality Control Parameters for Constituents (2 sheets)

Constituents	Method	Quality Control Acceptance Criteria		
		LCS % Recovery[a]	Spike % Recovery[b]	% RPD[c]
Al, Ag, As, Ba, Be, Cd, Co, Cr, Cu, Fe, Pb, Mn, Ni, Sb, Se, Sr, Tl, U, V, Zn	Inductively coupled plasma/atomic emission spectroscopy	80–120%	75–125%	≤30%
Hg	Cold vapor atomic absorption	80–120%	75–125%	≤30%
F^-, NH_4^+, NO_2^-, NO_3^-, Cl^-, SO_4^{2-}, $C_2H_3O_2^-$, CHO_2^-, $C_2H_3O_3^-$, $C_2O_4^{2-}$	Ion chromatography	80–120%	75–125%	≤30%
CN^-	9014 (spectrophotometric)	80–120%	75–125%	≤30%
S^{2-}	9215	80–120%	75–125%	≤30%
pH	pH	± 0.1 pH Units	N/A	N/A
% H_2O	Gravimetric	80–120%	N/A	≤30%
Bulk Density	Gravimetric	N/A	N/A	≤30%
^{235}U, ^{238}U, ^{237}Np, ^{232}Th, ^{126}Sn	ICP/MS	80–120%	75–125%	≤30%
^{233}U, ^{234}U, ^{236}U, ^{230}Th, ^{234}Th	ICP/MS	N/A[e]	N/A[e]	≤30%
^{228}Th	Calculation	N/A	N/A	N/A
^{60}Co, ^{137}Cs, ^{125}Sb	Gamma energy analysis	80–120%	N/A[f]	≤30%
^{152}Eu, ^{154}Eu, ^{155}Eu	Gamma energy analysis	N/A	N/A[f]	≤30%
^{129}I	Gamma energy analysis	80–120%	N/A[g]	≤30%

Table 6-3. Quality Control Parameters for Constituents (2 sheets)

Constituents	Method	Quality Control Acceptance Criteria		
		LCS % Recovery[a]	Spike % Recovery[b]	% RPD[c]
^{14}C, ^{3}H	Liquid scintillation counting	80–120%	75–125%	≤30%
^{63}Ni	Liquid scintillation counting	80–120%	N/A[g]	≤30%
^{90}Sr	Beta counting	80–120%	N/A[g]	≤30%
^{99}Tc	Liquid scintillation counting	80–120%	75–125%	≤30%
^{79}Se	Liquid scintillation counting	NP	N/A[g]	≤30%
^{238}Pu	Alpha counting	N/A[(f)]	N/A[g]	≤30%
$^{239/240}Pu$	Alpha counting	80–120%	N/A[g]	≤30%
^{241}Pu	Calculation from ^{238}Pu and $^{239/240}Pu$	N/A	N/A	N/A
^{241}Am	Alpha counting	80–120%	N/A[g]	≤30%
^{242}Cm, $^{243/244}Cm$	Calculation from ^{241}Am	N/A	N/A	N/A

ICP/MS = inductively coupled plasma/mass spectroscopy
N/A = not applicable
NP = not performed

[a] LCS = Laboratory control sample. This sample is carried through the entire analytical method. The accuracy of a method is usually expressed as the percent recovery of the LCS. The LCS is a matrix with known concentration of constituents processed with each preparation and analyses batch. It is expressed as percent recovery; i.e., the amount measured, divided by the known concentration, times 100.

[b] For some methods, the sample accuracy is expressed as the percent recovery of a matrix spike sample. It is expressed as percent recovery; i.e., the amount measured, less the amount in the sample, divided by the spike added, times 100. One matrix spike is performed per analytical batch. Samples are batched with similar matrices. For other constituents, the accuracy is determined based on use of serial dilutions.

[c] RPD = Relative percent difference between the samples. Sample precision is estimated by analyzing duplicates taken separately through preparation and analysis. Acceptable sample precision is usually ≤ 30% if the sample result is at least 10 times the instrument detection limit.
RPD = [(absolute difference between primary and duplicate)/mean] × 100.

[d] reserved.

[e] No standards are run for these constituents.

[f] The measurement is a direct reading of the energy and the analysis is not affected by the sample matrix; therefore, a matrix spike is not required.

[g] Matrix spike analyses are not required for this method because a carrier or tracer is used to correct for constituent loss during sample preparation and analysis. The result generated using the carrier or tracer accounts for any inaccuracy of the method on the matrix. The reported results reflect this correction.

6.3.1 Laboratory Quality Control

The laboratory method blanks, duplicates, laboratory control sample/blank spike, and matrix spikes are defined in Chapter 1 of SW-846 and will be run at the frequency specified in Chapter 1 of SW-846. In the event sample material is not sufficient to perform all analyses,

sample quantity will be prioritized and allocated to completion of the method analysis. If insufficient sample is available for completion of laboratory QC analyses, the laboratory will make note of the condition in the data package narrative, and the associated data results will have laboratory qualifiers added as appropriate. Where spike duplicates are required, duplicates do not need to be analyzed and where duplicates are required, spiked duplicates are not required. Minimally, a duplicate and spike (or spike duplicate) is required per laboratory batch.

6.3.2 Instrument/Equipment Testing, Inspection, and Maintenance

Measurement and testing equipment used in the field or in the laboratory that 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 specified by 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). Calibration of laboratory instruments will be performed in a manner consistent with SW-846 or DOE/RL-96-68.

Consumables, supplies, and reagents will be reviewed in accordance with SW-846 requirements and will be appropriate for their use. Note that contamination is monitored by the QC samples discussed in Section 6.1.

6.4 ANALYTICAL DETECTION LIMITS

The laboratory shall use the least possible dilution to obtain the lowest practical detection limits for all requested analytes.

Required detection limits as specified in the WMA C DQO are shown in Tables 6-4 and 6-5 for waste classification and ecological risk assessment, respectively. Where multiple required detection limits are specified for a single analyte, the laboratory shall meet the lower limit. Target detection limits are shown in Tables 6-5 and 6-6. Basis for the target detection limits is provided in the DQO. The laboratories are required to meet the required detection limits and shall strive to meet the target detection limits whenever possible.

Table 6-4. Required Detection Limits for Radionuclides

Analyte	Analytical Method	Alternate Analytical Method	Source 10 CFR 61.55 Class C Waste (pCi/g)	Biota Concentration Guide for Terrestrial Animal (pCi/g)	Required Detection Limits (pCi/g)
^{241}Am	Alpha counting	Not available	9.00E+03	3.9E+03	3.9E+02
^{14}C	Liquid scintillation counting	Not available	5.33E+06	4.8E+03	4.8E+02
^{242}Cm	Alpha counting	Not available	9.00E+03	2.1E+03	2.1E+02
^{243}Cm	Alpha counting	Not available	9.00E+03	Not available	9.00E+02
^{244}Cm	Alpha counting	Not available	9.00E+03	4.1E+03	4.1E+02
^{60}Co	GEA	Not available	Not available	6.9E+02	6.9E+01
^{137}Cs	GEA	Not available	3.07E+09	2.1E+01	2.1
^{152}Eu	GEA	Not available	Not available	1.5E+03	1.5E+02
^{154}Eu	GEA	Not available	Not available	1.3E+03	1.3E+02
^{155}Eu	GEA	Not available	Not available	1.6E+04	1.6E+03
^{3}H	Liquid scintillation counting	Not available	Not available	1.7E+05	1.7E+04
^{129}I	Low energy gamma counting	Not available	5.33E+04	5.7E+03	5.7E+02
^{63}Ni	Liquid scintillation counting	Not available	4.67E+08	Not available	4.67E+07
^{237}Np	ICP/MS	Alpha Counting	9.00E+03	3.9E+03	3.9E+02
^{238}Pu	Alpha counting	ICP/MS	9.00E+03	5.3E+03	5.3E+02
^{239}Pu	Alpha counting	ICP/MS	9.00E+03 (as $^{239/240}$Pu)	6.1E+03	6.1E+02 (as $^{239/240}$Pu)
^{240}Pu	Alpha counting	ICP/MS	9.00E+03 (as $^{239/240}$Pu)	Not available	9.00E+02 (as $^{239/240}$Pu)
^{241}Pu	Calculate from ^{238}Pu and $^{239/240}$Pu	ICP/MS	3.50E+09	Not available	3.50E+08
^{125}Sb	GEA	Not available	Not available	3.5E+03	3.5E+02
^{79}Se	Liquid scintillation counting	Not available	Not available	Not available	Not available
^{90}Sr	Beta proportional counting	Not available	4.67E+09	2.3E+01	2.3
^{99}Tc	Liquid scintillation counting	ICP/MS	2.00E+06	4.5E+03	4.5E+02
^{126}Sn	ICP/MS	Not available	Not available	Not available	Not available
^{228}Th	Calculation	GEA	Not available	5.3E+02	5.3E+01
^{230}Th	ICP/MS	Not available	Not available	1.0E+04	1.0E+03
^{232}Th	ICP/MS	Not available	Not available	1.5E+03	1.5E+02
^{233}U	ICP/MS	Not available	9.00E+03	4.8E+03	4.8E+02
^{234}U	ICP/MS	Not available	9.00E+03	5.1E+03	5.1E+02
^{235}U	ICP/MS	Not available	9.00E+03	2.8E+03	2.8E+02
^{236}U	ICP/MS	Not available	Not available	Not available	Not available
^{238}U	ICP/MS	Not available	9.00E+03	1.6E+03	1.6E+02

Reference: 10 CFR 61.55, "Waste Classification," *Code of Federal Regulations*, as amended.

GEA = gamma energy analysis ICP/MS = inductively coupled plasma/mass spectroscopy

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Table 6-5. Required Detection Limits for Non-Radionuclides[1]

Analyte	Soil Concentration for Protection of Terrestrial (mg/kg)			SST Priority [2]	Required Detection Limit(mg/kg)
	Plants	Soil Biota	Wildlife		
METALS:					
Aluminum (soluble salts)	50			Primary	5
Antimony	5			Primary	0.5
Arsenic III[3]			7	Primary	0.7
Arsenic V[3]	10	60	132	Primary	1
Barium	500		102	Primary	10.2
Beryllium	10			Primary	1
Boron	0.5			Secondary	6
Bromine[4]	10			Primary	1
Cadmium	4	20	14	Primary	0.4
Chromium (total)	42	42	67	Primary	0.15[10]
Cobalt	20			Primary	2
Copper	100	50	217	Primary	5
Fluorine[5]	200			Primary	20
Iodine[6]	4				
Lead	50	500	118	Primary	5
Lithium	35			Secondary	3.5
Manganese	1,100		1,500	Primary	110
Mercury, inorganic	0.3	0.1	5.5	Primary	0.01
Molybdenum	2		7	Secondary	4
Nickel	30	200	980	Primary	3
Selenium	1	70	0.3	Primary	0.25
Silver	2			Primary	0.2
Technetium[6]	0.2				
Thallium	1			Primary	0.1
Tin	50			Secondary	6
Uranium	5			Primary	0.5
Vanadium	2			Primary	0.2
Zinc	86	200	360	Primary	8.6

[1] Blank cells indicate that no value is available.
[2] Only Primary and Secondary contaminants from the single-shell tank (SST) data quality objective (DQO) (RPP-23403, Rev. 3) are included in this table except for pesticides where all pesticides listed Washington Administrative Code (WAC) 173-340-900, "Tables," Table 749-3 are included. For primary analytes, if detected a numerical value is reported, if not detected, analyte is reported with a less than minimum detection limit. For secondary organic analytes, if detected a numerical value is reported as an estimate, if not detected, the analyte is not reported. This is the same process used in SST DQO RPP-23403, Rev. 3.
[3] Total arsenic is reported (same as SST DQO [RPP-23403, Rev. 3]).
[4] Bromine is reported as bromide (same as SST DQO [RPP-23403, Rev. 3], where it was classed as secondary).
[5] Fluorine is reported as fluoride (same as SST DQO [RPP-23403, Rev. 3], where it was classed as primary).
[6] Included in the radionuclide analysis, radionuclide will be converted from radioactivity to mass using specific activity. Iodine-129 and Technetium-99 were both classed as primary in SST DQO (RPP-23403, Rev. 3).
[7] In addition to the semivolatile organics analysis, U.S. Environmental Protection Agency Method 8081 for pesticides will also be performed to meet the reporting requirements for ecological indicator soil concentrations.
[8] Polychlorinated biphenyls reported as individual Arochlors and total polychlorinated biphenyl.
[9] Petroleum contaminants are not included in the SST DQO but will be measured in soil for ecological risk assessment.
[10] This required detection limit is based on a maximized sample size. If a maximized sample size cannot be collected, the detection limit will be higher than indicated.

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Table 6-6. Target Detection Limits for Primary Radionuclides

CAS# or Constituent Identifier	Analyte	Survey or Analytical Method	Target Detection Limits (pCi/g)
14234-35-6	Antimony-125	Gamma GS	0.3
14596-10-2	Americium-241	^{241}Am alpha energy analysis	1
14762-75-5	Carbon-14	C-14 LSC (low level)	1
10045-97-3	Cesium-137	Gamma GS	0.1
10198-40-0	Cobalt-60	Gamma GS	0.05
15510-73-3	Curium-242	^{241}Am/^{244}Cu alpha energy analysis	1.0
15757-87-6	Curium-243	^{241}Am/^{244}Cu alpha energy analysis	1.0
13981-15-2	Curium-244	^{241}Am/^{244}Cu alpha energy analysis	1.0
14683-23-9	Europium-152	Gamma GS	0.1
15585-10-1	Europium-154	Gamma GS	0.1
14391-16-3	Europium-155	Gamma GS	0.1
15046-84-1	Iodine 129	^{129}I LSC	2
13994-20-2	Neptunium-237	ICP/MS	1
13981-37-8	Nickel-63	^{63}Ni LSC	30
13981-16-3	Plutonium-238	Alpha energy analysis	1
Pu-239/240	Plutonium-239/240	Alpha energy analysis	1
13982-63-3	Radium-226	Gamma GS	0.2
15758-85-9	Selenium-79	^{79}Se LSC	10
Rad-Sr	Strontium-90	^{89,90} Sr total Sr - gas proportional counting	1
14133-76-7	Technetium-99	Liquid scintillation counting	1
14274-82-9	Thorium-228	TBD	1
14269-63-7	Thorium-230	ICP/MS	1
Th-232	Thorium-232		1
10028-17-8	Tritium	Tritium – H-3 LSC(mid level)	30
13966-29-5	Uranium-233/234	ICP/MS	1
15117-96-1	Uranium-235		1
U-238	Uranium-238		1

CAS = Chemical Abstracts Service
GS = gamma spectroscopy.
LSC = liquid scintillation counter.
ICP/MS = inductively coupled plasma/mass spectrometry
TBD = to be determined

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7. DATA REPORTING AND ELECTRONIC DATA MANAGEMENT

This chapter describes the laboratory reporting requirements for the soil samples taken at characterization effort for possible interim barriers southeast of S Farm, as well as the entering of the sampling data into the HEIS.

7.1 QUICK TURN REPORTING

This format requires reporting of ^{99}Tc and nitrate on a 1:1 water digest within an expedited time frame (typically within 48 hours of the last sample receipt batched together). The results are transmitted via e-mail to the Characterization Task Lead. A Format VI data package is subject to internal laboratory QA verification and review including peer review prior to release.

7.2 FORMAT VI REPORTING

If soil sample analysis is performed at the 222-S Laboratory, the data report(s) will be in Format VI. A Format VI report is a customer-defined data report. Additional details on reporting are provided in ATL-MP-1011.

Format VI Report with QA Verification includes the following.

- Narrative – contains a description of sample receipt and sample breakdown, and has a section corresponding to each method describing any analytical/QC deviations from the work plan.

- 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, chains of custody, and geologist's descriptions.

- Section that contains all e-mail correspondence documenting issues that arose during sampling and analysis, and subsequent decisions that affected initial work instructions.

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

If sample analysis is performed at other laboratories, the format for the data reports will be equivalent to a 222-S Laboratory Format VI report.

In addition to the analytical chemical parameters, percent moisture and calculated bulk density will also be reported.

The final data package will be provided to the Characterization Task Lead via hardcopy. The laboratory shall issue the data package within 120 calendar days following receipt of the last samples. Preliminary results shall be available within 60 days following receipt of the last sample. As indicated in Section 5.0, laboratory changes will be communicated to the Characterization Task Lead and documented in the laboratory report(s) narrative.

Table 7-1 shows the distribution of the final data report.

Table 7-1. Final Report Distribution

Recipient	MSIN	Text with Attachments
S. J. Eberlein	E6-31	X
M. P. Connelly	E6-31	X
K. J. Dunbar	E6-31	X
C. L. Tabor	E6-31	X
H. A. Sydnor	E6-31	X
A. M. Templeton	E6-31	X
L. A. Fort	E6-31	X
M. P. Bergeron	E6-31	X
R. W. Lober	H6-60	X
DOE Reading Room	H2-53	$H_{(hard\ copy)}$

In addition to this final data report, an electronic version of the analytical results, including tentatively identified compounds, shall be uploaded to HEIS within 14 calendar days of release of the data package. The electronic version shall be in the standard electronic format for HEIS [CP-15383, *Common Requirements of the Format for Electronic Analytical Data (FEAD)*].

7.3 EXCEPTIONS TO DATA QUALITY OBJECTIVE REQUIREMENTS

The laboratory shall report all analytical results recovered from ICP/AES and IC analyses, even though only specific analytes are requested. These nonrequested analytes will be reported only if no additional preparatory work is required and the associated errors are reported. No reruns or additional analyses will be performed to improve recovery for analytes not specified in Table 5-1 unless formally requested by the Characterization Task Lead. For gamma energy analysis, the large library will be used but only detected results (results exceeding the laboratory minimum detection limit) will be reported.

7.4 CLARIFICATIONS AND ASSUMPTIONS

It is anticipated that the 222-S Laboratory will perform all of the analyses. If necessary, WRPS may subcontract certain analyses to another qualified laboratory. The subcontracted laboratory shall meet all QA/QC requirements in this FSAP. 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 Characterization Task Lead and TOC Quality Assurance prior to commencement of laboratory analysis.

7.5 ELECTRONIC DATA MANAGEMENT

All sampling and analytical results from sampling southeast of S Farm will be entered into the HEIS database. The overall process for entering sample/result data into HEIS is shown in Figure 7-1; however, not all steps/details are shown and it is up to the Characterization Task Lead to ensure that the process is complete. The sequential steps to the process and a brief description of each step are provided in Table 7-2.

To ensure this process is followed, a meeting will be held prior to sampling at SX Farm, which will include representatives from all organizations to ensure the Project, Sample Authorization Form, and sample information are correctly entered into Sample Data Tracking.

Figure 7-1. Overall Process for Entering Data into Hanford Environmental Information System

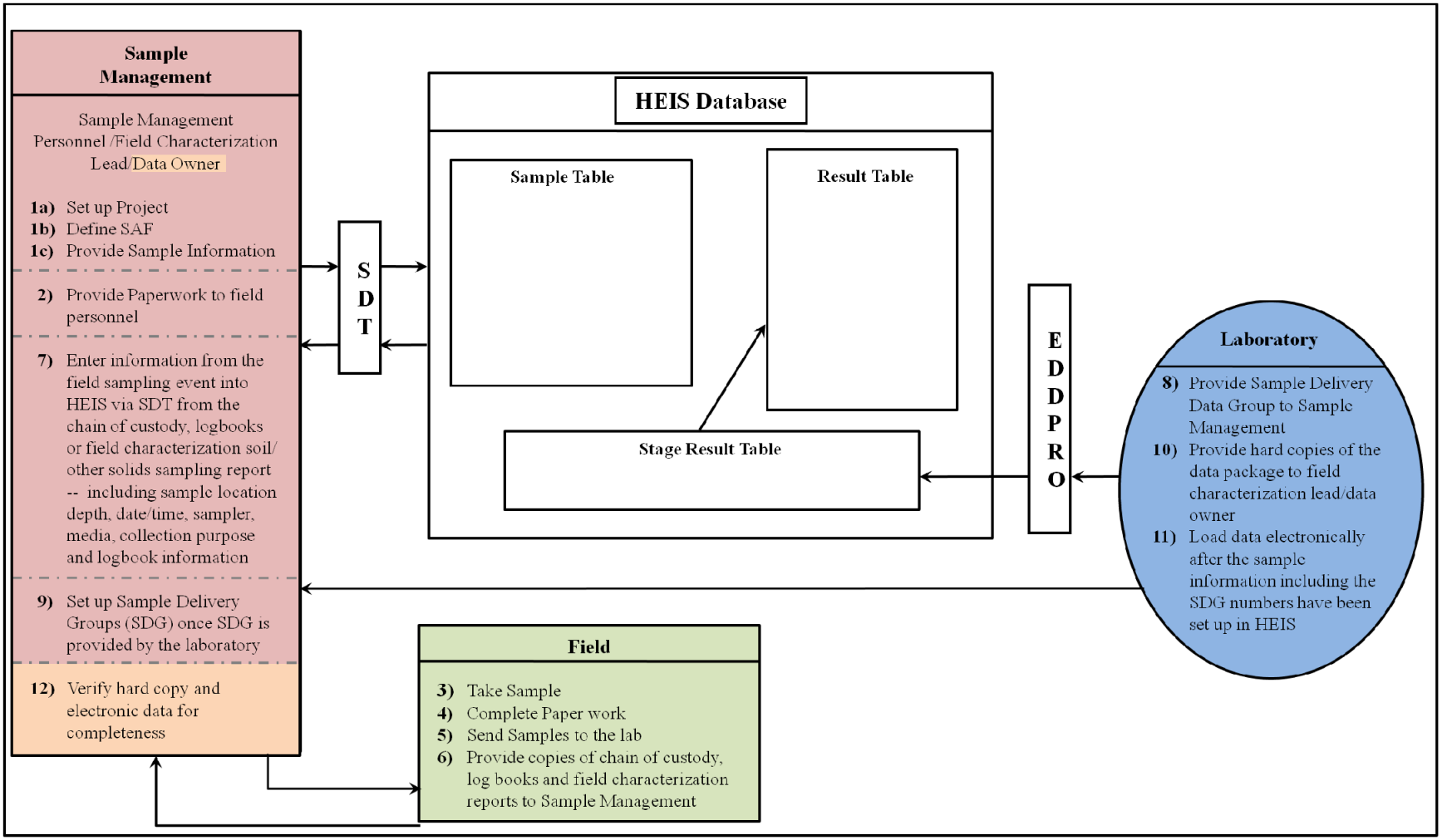

Table 7-2. Process Steps for Ensuring Sample/Result Data Entry into Hanford Environmental Information System

1a	Sample Data Management (SDM) personnel or Characterization Task Lead uses the Sample Data Tracking software (SDT) [HNF-23038, *Sample Data Tracking (SDS) Application User Document*] set up the project.
1b	SDM personnel or Characterization Task Lead creates the Sample Authorization Form (SAF) based on this Field Sampling and Analysis Plan. The SAF is used to generate the paperwork for sampling.
1c	SDM personnel or Characterization Task Lead generates sample information for the field personnel and laboratory.
2	SDM personnel or Characterization Task Lead provides the paperwork generated by the SAF to the field personnel.
3	Field personnel take the sample.
4	Field personnel complete the paperwork (chain of custody, field logbooks, field characterization soil/other solids sampling report, etc.).
5	Field personnel send samples to the laboratory.
6	Field personnel provide copies of paperwork to lab personnel and Characterization Task Lead.
7	Laboratory provides Sample Delivery Group (SDG) number to SDM personnel or Characterization Task Lead.
8	SDM personnel or Characterization Task Lead enters information from the field sampling event into Hanford Environmental Information System (HEIS) via the SDT. This includes sample location, sample date/time, sampler, media depth, collection purpose, and any logbook information.
9	SDM personnel or Characterization Task Lead enters SDG number for samples into HEIS via SDT.
10	Laboratory provides hard copies of the data package to the characterization lead/data owner.
11	Laboratory loads data into HEIS using the format specified by CP-15383, *Common Requirements of the Format for Electronic Analytical Data (FEAD)*, via the web interface Electronic Data Deliverable Processor.
12	Data owner/Characterization Task Lead verifies both hard copy and electronic data for completeness and accuracy.

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8. PROJECT/TASK ORGANIZATION

This section addresses the basic areas of project management and ensures that the project has a defined goal, that the participants understand the goal and approach to be used, and that the planned outputs have been appropriately documented. The project organization is described in Table 8-1. Project management and Quality Assurance may conduct random surveillance and assessments to verify compliance with the requirements outlined in this FSAP, project work packages, the project quality management plan, 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 the TOC policy and procedures. Management will be made aware of deficiencies identified by assessments and surveillances and subsequent corrective actions.

8.1 DOCUMENTS AND RECORDS

All information pertinent to field sampling and surveying will be recorded in field checklists and bound logbooks in accordance with sampling procedures. The sampling team 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.

8.1.1 Reconciliation with User Requirements

The data quality assessment process compares completed field sampling activities to those proposed in corresponding sampling documents and provides an evaluation of the resulting data. The purpose of the data evaluation is to determine if quantitative data are of the correct type and are of adequate quality and quantity to meet the project data quality objectives. Data quality assessment will be performed according to guidelines in EPA/600/R-96/084, *Guidance for Data Quality Assessment Practical Methods for Data Analysis, EPA QA/G-9*.

Table 8-1. Key Personnel

Title	Responsibility	Primary Contact	Alternate Contact
Project Manager	• Provides oversight to ensure work is performed safely and cost effectively • Coordinates with U.S. Department of Energy and Ecology	Susan Eberlein	Mike Connelly
Characterization Task Lead	• Plans, coordinates, and oversees field sampling activities including sample collection, packaging, provision of certified clean sampling bottles/containers, documentation of sampling activities in controlled logbooks, chain-of-custody, and packaging and transporting of samples to the laboratory or shipping center • Directs training, mock-ups, and practice sessions to ensure that the sampling design is understood • Directs procurement and installation of materials and equipment needed to support sampling field activities • Select laboratory to perform the analyses and request assessments/surveillances of the laboratories • Responsible for checking completeness of data reports, reviewing results against any existing knowledge, and assessing the data to determine if they are adequate for the intended use. • Reviews sample data against existing knowledge and data quality assessment guidelines in EPA/240/B-01/003, *Guidance for Data Quality Assessment EPA QA/G-9*	Andrew Templeton	Cindy Tabor
Field Team Lead	• Provides direction to field personnel including subcontractors; plans, coordinates, and oversees field drilling activities • Ensures field requirements are met • Coordinates with necessary organizations to ensure field activities are conducted safely and correctly • Communicates with the Characterization Task Lead to identify field constraints that could affect sampling design • Directs procurement and installation of materials and equipment needed to support drilling field activities	Harold Sydnor	Dave Myers
Quality Assurance Lead	• Provides oversight to ensure data integrity • The Quality Assurance program is to ensure that all data be scientifically valid, defensible and of known precision and accuracy • The data should be of sufficient known quality to withstand scientific and legal challenge relative to the use for which the data are obtained • Performs assessments and surveillance, as necessary	Kathi Dunbar	Mike McElroy
Radiological Engineering Contact	• Conducts as low as reasonably achievable reviews, exposure and release modeling, and radiological control optimization • Identifies that appropriate controls are implemented to maintain worker safety • Interfaces with Health and Safety contact • Plans and directs radiological control technicians that support field activities	Field Team Lead contacts; Daren Christensen Phone #373-3748	
Health and Safety Contact	• Coordinates industrial health and safety support within the project as per required health and safety plan, job hazard analyses, and other pertinent safety documents • Provides assistance to ensure compliance with applicable health and safety standards/requirements • Coordinates with Radiological Engineering to determine personal protective clothing requirements	Field Team Lead contacts; Jason Randles Phone #373-3399	
Waste Management Contact	• Communicates policies and procedures to ensure project compliance with storage, transportation, disposal, and waste tracking requirements	Field Team Lead contacts; Keith Smith Phone #372-1322	

9. CHANGE CONTROL

Field activity and laboratory work scope changes may be required because of unexpected field conditions, new information, health and safety concerns, or other unplanned circumstances. These work scope changes will be documented on a CCN, a revision to this document or change request form. Any analytical changes shall be approved by the Characterization Task Lead before analyses are performed and documented in the Format VI laboratory report(s) narrative. Justification for the changes to work scope shall be provided in sufficient detail to understand the basis for the change. The Characterization Task Lead has the responsibility of exercising technical judgment in modifying the described work and in justifying the level of documentation required when changes to the described work in the FSAP are made.

Field sampling and survey methods and analytical strategies (e.g., constituent listings and data analysis) may be updated as new technologies or data become available. The impact of these updates will be judged as they are identified to determine if revisions to the FSAP will be necessary.

10. REFERENCES

10 CFR 61.55, "Waste Classification," *Code of Federal Regulations*, as amended.

10 CFR 830.120, "Quality Assurance Requirements – Scope," *Code of Federal Regulations*, as amended.

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ATL-MP-1002, 2009, *Quality Assurance Program Description (QAPD)*, Rev. 9, Advanced Technologies and Laboratories International, Inc., Richland, Washington.

ATL-MP-1011, 2009, *ATL Quality Assurance Project Plan for 222-S Laboratory*, Rev. 9, Advanced Technologies and Laboratories International, Inc., Richland, Washington.

ATS-MP-1032, 2009, *222-S Laboratory Quality Assurance Plan*, Rev. 4, Washington River Protection Solutions LLC, Richland, Washington.

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DOE/RL-96-68, 2007, *Hanford Analytical Services Quality Assurance Requirements Documents*, as revised, Rev. 3, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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DOE O 414.1C, 2005, *Quality Assurance*, U.S. Department of Energy, Washington, D.C.

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

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EPA/600/R-96/084, 2000, *Guidance for Data Quality Assessment Practical Methods for Data Analysis EPA QA/G-9*, QA00 Update, Office of Environmental Information, U.S. Environmental Protection Agency, Washington, D.C.

HNF-4936, 1999, *Subsurface Conditions Description of the S-SX Waste Management Area*, Rev. 0, Lockheed Martin Hanford Company, Richland, Washington.

HNF-SD-WM-ER-560, 2001, *Historical Vadose Zone Contamination from S and SX Tank Farm Operations*, Rev. 1, CH2M HILL Hanford Group, Inc., Richland, Washington.

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RPP-7884, 2002, *Field Investigation Report for Waste Management Area S-SX*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-23403, 2009, *Single-Shell Tank Component Closure Data Quality Objectives*, Rev. 4, Washington River Protection Solutions LLC, Richland, Washington.

RPP-43551, 2009, *Tank Farm Interim Barrier Data Quality Objectives*, Rev. 0, Washington River Protection Solutions LLC, Richland, Washington.

RPP-ENV-38696, 2009, *Data Requirements for Characterization Supporting Near-Term Interim Barrier*, Rev. 2, Washington River Protection Solutions, Richland, Washington.

RPP-RPT-38152, *Data Quality Objectives Report Phase 2 Characterization for Waste Management Area C RCRA Field Investigation/Corrective Measures Study*, Rev. 0, Cenibark International, Inc., Richland, Washington.

RPP-RPT-42513, 2009, *Surface Geophysical Exploration of the SX Tank Farm at the Hanford Site*, Rev. 0, Washington River Protection Solutions LLC, Richland, Washington.

SW-846, 1986, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, Third Edition as amended, U.S. Environmental Protection Agency, Washington, D.C.

TFC-PLN-02, 2008, *Quality Assurance Program Description*, Rev. F-1, Washington River Protection Solutions LLC, Richland, Washington.

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

WAC 173-340-900, "Tables," *Washington Administrative Code*, as amended.

APPENDIX A

CHARACTERIZATION CHANGE NOTICE

VADOSE ZONE
CHARACTERIZATION CHANGE NOTICE

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

Requestor: _____ **Date:** _____

Samples Impacted:

Proposed Change:

Reason for Change:

Date Change Effective: _____

Schedule Impact:

Authorization:

Closure and Corrective Measures POC (Print/Sign): **Date:**

_____ _____

Closure and Corrective Measures Quality Assurance (Print/Sign): **Date:**

_____ _____

222-S Project Coordinator (Print/Sign): **Date:**

_____ _____

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

r

_____ _____

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

_____ _____

Additional Distribution: S. J. Eberlein, K. M. Hall, Dana Stewart

APPENDIX B

MEETING MINUTES

S-SX Interim Barrier Investigative Probe Hole Locations 12/11/09

Attendees:

Maria Skorska, David Skoglie, Andrew Templeton, Jim Filed, David Myers, Cynthia Tabor and Bob Lober.

Background: The *Hanford Federal Facility Agreement and Consent Order* (HFFACO) M45 milestone series includes the performance of interim measures in the tank farms prior to final RCRA corrective actions. The placement of interim surface barriers is one of the interim measures under consideration for sites where tank waste has previously leaked into the soil. One barrier has been constructed in T farm and another is under construction in TY farm. During FY 2009, ORP, Ecology and WRPS met to prioritize additional sites for characterization in support of barrier design. In addition to the known historic releases from tanks, the team recommended considering:

a) sites where multiple transfers through pipelines were known to have occurred,
b) sites adjacent to other existing or proposed barriers, and
c) sites where little or no soil characterization data has been collected.

Geophysical anomalies documented in *Surface Geophysical Exploration of the SX Tank Farm at the Hanford Site*, RPP-RPT-42513, located southeast of S Farm and northeast of SX Farm require additional investigation to help with placement of one or more barriers at S-SX Farm. Although not ranked as a high priority due to known historic releases from tanks, this area warrants investigation due to the waste transfers associated with pipelines, diversion boxes and catch tanks located in this area. A characterization campaign consisting of direct push sampling and placement of deep electrodes, followed by resistivity measurement (incorporating surface and deep electrodes) was recommended for this area. This recommendation was communicated to Ecology in FY2009, as a priority for FY2010 action.

Meeting Objectives:

Identify investigative sites to determine if a barrier is warranted in the southeastern part of S tank farm/north part of SX tank and using known waste leak information and resistivity measurement.

Hand Outs:

Jim Field provided SX tank farm waste leak loss event information and ground water plume maps for Tc99, chromium and nitrates. Harold Sydnor provided 3 plan-view figures from Surface Geophysical Exploration of the SX Tank Farm at the Hanford Site, RPP-RPT-42513, Rev 0, identifying potential areas with conductive soil. In addition, Harold provided a figure show the ground-penetrating radar scan area with scan grid lines, interpreted underground features, and subsurface features identified on engineering drawings. The final drawing is a plan view figure showing underground features and proposed investigation sites.

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Meeting Notes:

Five locations (C7737, C7739, C7741, C7743, and C7745) were selected to determine if a barrier is may be beneficial in the area on the south east of S tank farm, border ing the north of SX tank farm. The probe holes are near subsurface infrastructure and located in a resistivity area that may indicate the presence of nitrate and technetium, based on the analytical results for nitrate and technetium-99 that were obtained during the SX farm characterization campaign in FY2009.

In addition to providing direct sample results, these soil samples will be compared to the resistivity results already obtained in this area. This comparison provides additional information about the capabilities and limitations of resistivity data as a site evaluation tool. Finally, these direct push locations will be used for placement of deep electrodes to support a subsequent resistivity campaign focusing on this area.

The group recommended a phased approach. Drive, log and collect soil samples at locations C7737, C7739, C7741 before starting the other two sites. The group would review the data and consider if the resistivity information is consistent with analytical results, and if a contaminant source outside the tank farm boundaries is contributing to the soil contamination in this area. If a potential contaminant source is outside the tank farm, assistance from PRC and RL may be required to define and implement interim corrective measures.

Prior to sampling any of these 5 locations, the previously obtained SX logging and analytical data, and draft geophysical logging data from the new sites will be reviewed and discussed for selection of soil sampling depth. The current process for selecting sampling depth will be continued.

1
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INFORMATION CLEARANCE REVIEW AND RELEASE APPROVAL

Part I: Background Information

Title: Field Sampling and Analysis Plan for Soil Samples in Support of an Interim Barrier Southeast of S Farm, Bordering SX Farm	Information Category: ☐ Abstract ☐ Journal Article ☐ Summary ☐ Internet ☐ Visual Aid ☐ Software ☐ Full Paper ☐ Report ☑ Other Field Sampling and Analysis Plan
Publish to OSTI? ☐ Yes ☑ No	

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

Document Number: RPP-PLAN-44162 Revision 0	Date: February 2010
Author: Tabor, Cindy L	

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 IDMS Data File att. 04/09/2020

Part IV: WRPS Internal Review

Function	*Organization*	*Date*	*Print Name/Signature/Date*
Subject Matter Expert	WRPS	04/20/2020	Tabor, Cindy L IDMS Data File att.
Responsible Manager	WRPS	04/09/2020	Rutland, Paul L 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 Janis D. Aardal at 1:53 pm, Apr 21, 2020 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	☒	☐	IDMS Data File att.	McKenna, Mark
WRPS Office of Chief Counsel	☒	☐	IDMS Data File att.	Peters, Amber D
DOE – ORP Public Affairs/Communications	☒	☐	IDMS Data File att.	Levardi, Yvonne M/Tyree, Geoff T
Other: ORP SME	☒	☐	IDMS Data File att.	Blackwell, Becky
Other: DOE OCC	☒	☐	IDMS Data File att.	Zelen, Benjamin J

Comments Required for WRPS-Indicate Purpose of Document:

This Field Sampling and Analysis Plan provides direction and specifies requirements for field sampling, laboratory analysis, and data reporting for soil samples that will be taken southeast of 241-S Tank Farm.

APPROVED
By Janis D. Aardal at 1:53 pm, Apr 21, 2020

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: 04/21/2020

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

Forward Copies of Completed Form to WRPS Originator

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        Interim Barrier Southeast of S Farm, Bordering SX Farm, submitted by
        Cynthia Tabor for expedited public release into the AR. (Rev. 0 released
        into SPF/IDMS on 2/22/10) Thank you, Janis Aardal Information
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