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Field Sampling and Analysis Plan of Soil Samples in Support of an Interim Barrier at SX Farm

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Abstract: The U.S. Department of Energy and Washington State Department of Ecology have agreed to create a Resource Conservation and Recovery Act Corrective Action Project with explicit milestones. This program includes collection of subsurface vadose zone data. Current planning includes placement of interim surface barriers at certain single-shell tank farms. The first of such barriers was placed over a portion of T Farm. T Farm contained the largest inventory of mobile contaminants released to the vadose zone. The next largest unplanned releases to the vadose zone occurred at SX Farm, which makes SX Farm the next tank farm in need of a barrier. 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.

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FIELD SAMPLING AND ANALYSIS PLAN OF SOIL SAMPLES IN SUPPORT OF AN INTERIM BARRIER AT SX FARM

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Washington River Protection Solutions LLC

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ABBREVIATIONS AND ACRONYMS

10 CFR	Title 10, *Code of Federal Regulations*
ALARA	as low as reasonably achievable
ATL	Advanced Technologies and Laboratories International, Inc.
bgs	below ground surface
CCN	Characterization Change Notice
DOE	U.S. Department of Energy
CHPRC	CH2M HILL Plateau Remediation Company
DRF	Document Revision Form
Ecology	Washington State Department of Ecology
EDDPRO	Electronic Data Deliverable Processor
EPA	U.S. Environmental Protection Agency
FSAP	field sampling and analysis plan
FY	Fiscal Year
HASQARD	*Hanford Analytical Services Quality Assurance Requirements Documents*
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
MS	matrix spike
MSD	matrix spike duplicate
ORP	U.S. Department of Energy, Office of River Protection
QA	quality assurance
QAPjP	quality assurance project plan
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
SDT	Sample Data Tracking software
SDM	Sample Data Management
SGE	surface geophysical exploration

SST	single-shell tank
SOW	statement of work
TOC	Tank Operations Contractor
Vadose	Operations Support – Vadose program
WMA	Waste Management Area
WRPS	Washington River Protection Solutions LLC

1. SAMPLING AND ANALYSIS OBJECTIVES

The U.S. Department of Energy, Office of River Protection (ORP) and the Washington State 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 Operations Support - Vadose (Vadose) program 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 certain single-shell tank (SST) farms. The first of such barriers was placed in Fiscal Years (FY) 2007 and 2008 over a portion of T Farm. T Farm contained the largest inventory of mobile contaminants (primarily ^{99}Tc, nitrate, and chromium) released to the vadose zone. The next largest unplanned releases to the vadose zone occurred at SX Farm, which makes SX Farm the next tank farm in need of 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 installation of the SX interim barrier is planned for Calendar Year 2011 or 2012. Given the amount of design effort required for this interim barrier because of its size, additional vadose zone data will be obtained in FY 2009 to support this design effort.

The Tank Operations Contractor (TOC) has (through a data quality objective process; see RPP-ENV-38696, *Data Requirements for Characterization Supporting Near-Term Interim Barriers*) determined that additional vadose characterization information is required prior to final design and placement 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. 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 determines 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).

This field sampling and analysis plan (FSAP) provides direction and specifies requirements for field sampling, laboratory analysis, and data reporting for soil samples that will be taken in and around WMA SX in support of the planned interim barrier at SX Farm. A multidiscipline team consisting of TOC personnel, other subcontractors, and Energy*Solutions* Federal Services, Inc., Northwest Operations (Energy*Solutions*), 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 the SX interim barrier. 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 fast turnaround analysis [a.k.a. Quick Turn (less than 48 hours)] on two mobile contaminants (^{99}Tc and nitrate) to determine where the next set of samples should be taken and whether a Tier 1 analysis (see Section 4.2) should be completed on the sample. Following the reporting of the results for the “Quick Turn,” a meeting is held with representatives from TOC; ORP; U.S. Department of Energy, Richland Operations Office (RL); Ecology, and the U.S. Environmental Protection Agency (EPA) to determine the next sample location both horizontally and vertically and if a Tier 1 analysis should be completed on the rest of the “Quick Turn” sediment sample.

2. FACILITY DESCRIPTION

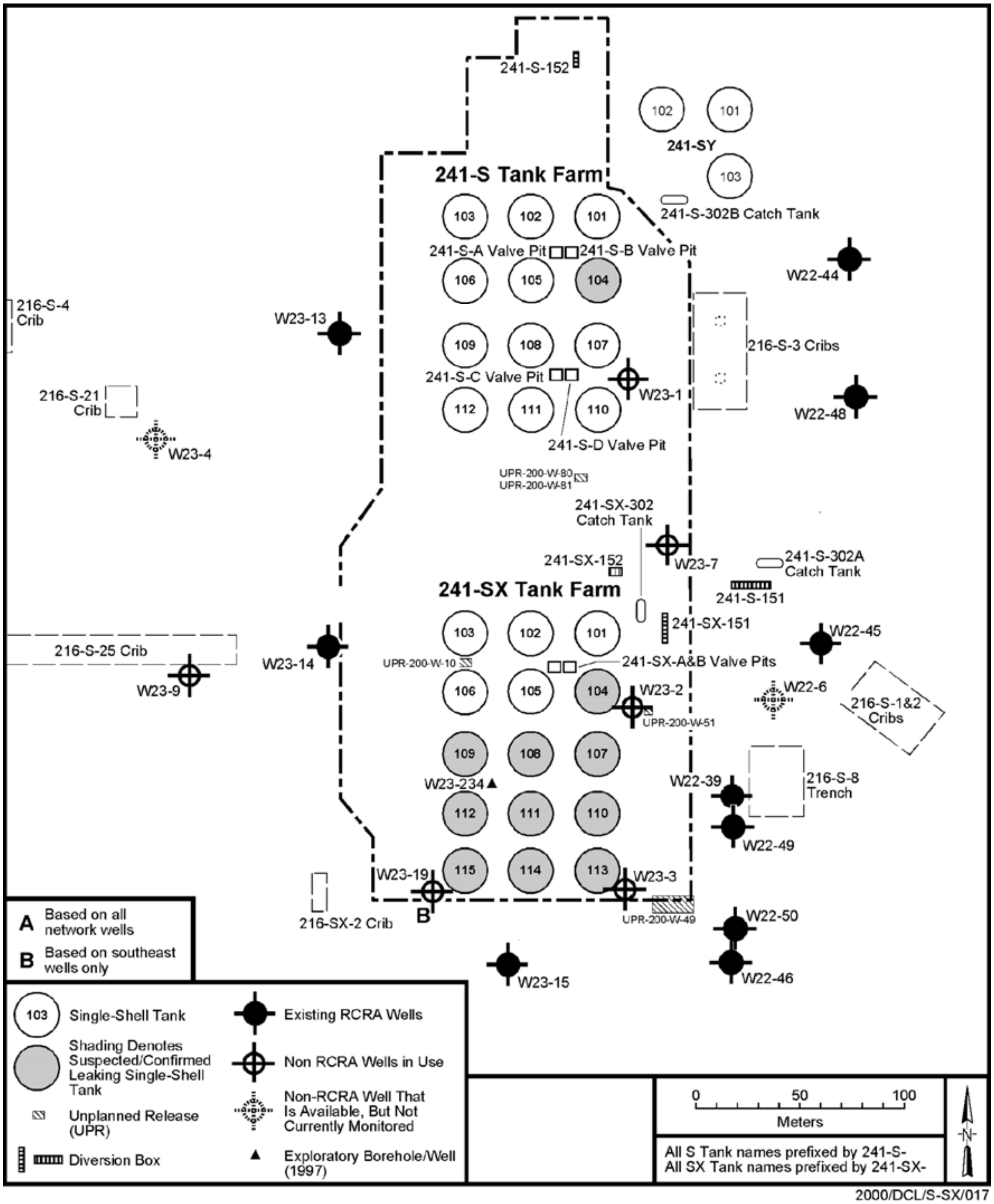
SX Farm is one of two tank farms that make up WMA S-SX, which is located in the southwest portion of the 200 West Area near the Reduction-Oxidation (REDOX) plant. In general, the WMA S-SX boundary is represented by the combined fencelines surrounding the S and SX Farms (Figure 2-1). The S and SX Farms 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 for 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 (FIR) was published to document the results of those investigations (RPP-7884, *Field Investigation Report for Waste Management Area S-SX*).

Figure 2-1. Location Map of Waste Management Area S-SX and Surrounding Facilities



3. 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 and the chain-of-custody records for the sampling events.

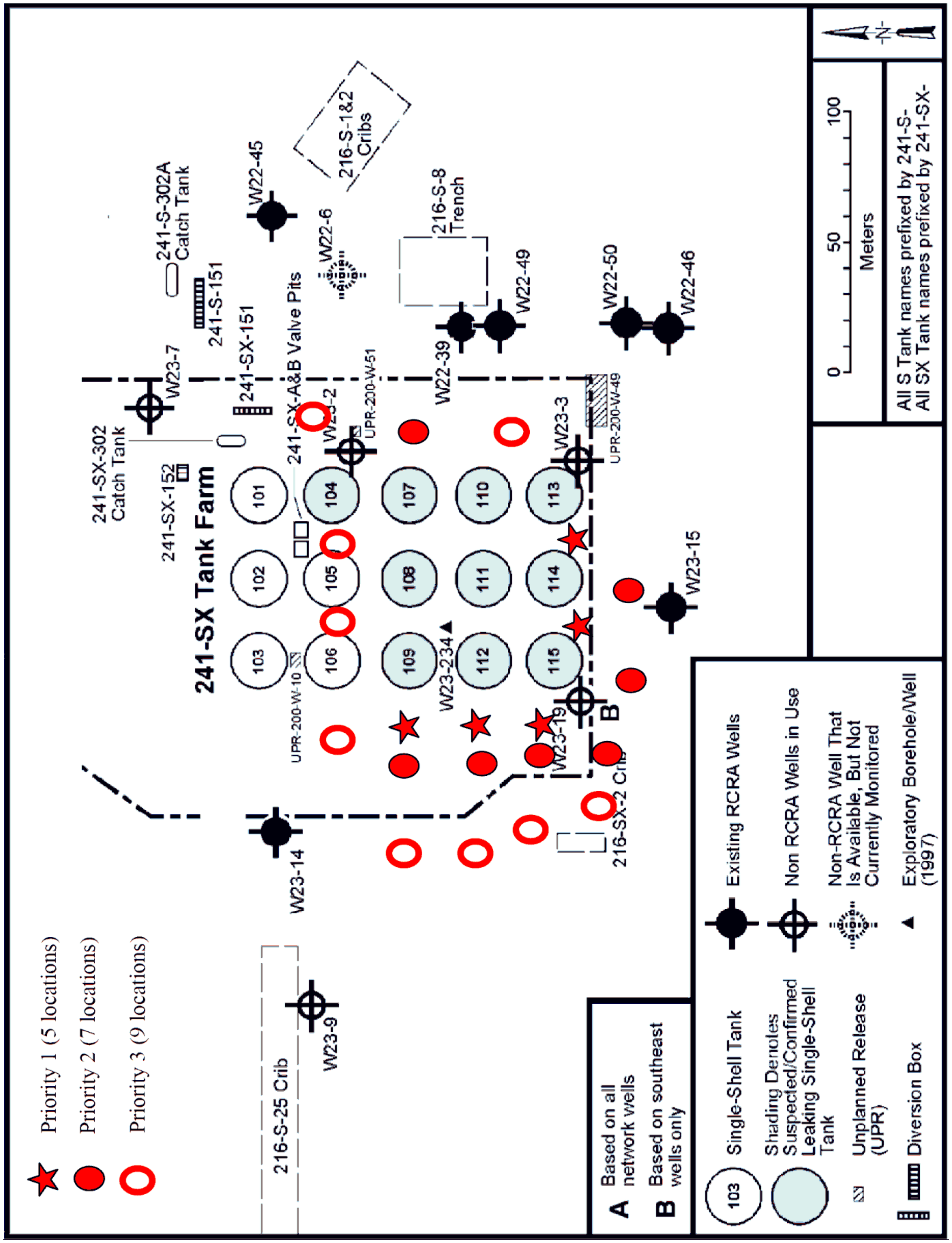
Soil sampling services for this work will be contracted through the CH2M HILL Plateau Remediation Company (CHPRC) or Washington River Protection Solutions LLC (WRPS) samplers will be used. The soil samplers shall follow CHPRC or WRPS sampling protocols and procedures, which cover items such as cleaning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

3.1 SOIL SAMPLING DESIGN

PPP-ENV-38696 states that up to 21 sample sites (ranked into three groups) would be investigated (Figure 3-1). 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 bgs). The samples will be taken using the direct push sampling method. The first priority group contains five sites that are to the west and south of the tanks with large known leaks. The second priority group contains seven sites. Six of these sites in the second priority group are farther from known sources. The seventh site in second priority group was located to investigate the SGE results east of tank SX-107 and the possible contamination from 200-UPR-W-51. It should be noted that two of the second priority group sample sites are in a pit (approximately 30 feet deep). These two sites are located south of SX-115 and may be sampled with either vertical and/or slant drilling methods depending on the analytical results of the locations just inside the farm north of them. The third priority group contains nine possible sites which will be used to investigate outward from the tanks to the west, to the north, and to the east. Results from the first priority group sites will determine which, if any, of the priority two and priority three sites will be investigated. It is expected that not all of the 21 sites will be investigated. For planning purposes, 15 sites are used.

Although cascade line overflows and pipeline leaks are typically potential sources of near surface contamination, these potential sources at SX Farm were evaluated as part of the process developed jointly by the TOC, ORP, and Ecology to reassess selected tank leak estimates (volumes and inventories) and to update SST leak and unplanned releases volumes, and inventory estimates as emergent field data is obtained (RPP-32681, *Process to Estimate Tank Farm Vadose Zone Inventories*). The waste surface levels summarized in LA-UR-97-311, *Waste Status and Transfer Record Summary*, and tank waste summary reports indicated these waste surface levels did not reach the height of the cascade overflow pipe for any of the SX-Farm tanks nor were there other shallow unplanned releases in SX Farm. Since that process indicted that overflows did not take place at SX Farm, this sampling design did not target possible releases at those potential sources.

1 **Figure 3-1. Possible SX Tank Farm Direct Push Locations**



If significant contamination is found at the outer direct push sites, a meeting will be held with representatives from TOC, ORP, RL, and Ecology to determine if additional direct push characterization shall be held. The results of the meeting will be documented in meeting minutes. If additional characterization is needed, this document will be revised.

3.2 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.

3.2.1 Sampling Techniques

After completion of geophysical 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.

3.2.2 Sampling Strategy

Sampling strategy at each vertical direct push site is summarized in the following (RPP-ENV-38838, *Tank Farm Vadose Zone Program Characterization Processes*). 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. 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 ft bgs (top of the Cold Creek Unit) or refusal. Refusal in the 200 West Area usually occurs at the top of the Cold Creek Unit

c. Deep electrodes are placed at the bottom of the initial probe hole and at a depth of approximately 55 ft bgs.

d. The depth location for sampling individual horizons will be selected by reviewing the gamma 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. The sampling horizons will be selected in an open meeting in which TOC staff, DOE, Ecology, EPA, and other site contractors are invited in accordance with the process given in RPP-ENV-38838.

For the work at SX Farm, a number of geophysical direct pushes will be drilled before any sampling direct pushes. This is to allow modification of the lateral locations for direct pushes drilled later. This first set of direct pushes for geophysical logging will be mainly from the first priority group sites identified in Section 3.1, but a few may come from the other priority groups. Following the geophysical logging of this first set of direct pushes, the meeting identified in item d. will occur to identify sample depths and the necessity of moving or adding other direct push locations. This process will repeat itself as necessary.

3.3 SAMPLE COLLECTION

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. The dual-string sampler will be used to collect sediment samples at the location and depth specified in item d. of Section 3.2.2. 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 sample-handling technicians 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 either a 500- or 250-mL jar with a Teflon[1] cap. It should have a separate Hanford Environmental Information system (HEIS) number and marked as “Quick Turn.” Sleeve A stainless-steel liner is the liner closest to the shoe. The next or middle liner is sleeve B, and the topmost stainless-steel liner is sleeve C. Each sleeve 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. All three liners will have the same HEIS number. Material in liners B and C are to be used if insufficient sample material is collected in liner A.

One field blank is required. The blank shall be filled at the laboratory with deionized, filtered water before it is brought to the field. The field work supervisor or designee shall verify that the field blank is properly prepared and shipped. Analysis of the field blank is required only if contamination is found in the samples.

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

Sample preservation, containers, and holding times for radiological and nonradiological analytes are shown in Table 3-1.

Table 3-1. Sample Preservation, Container, and Holding Time Guidelines

Analytes	Matrices	Bottle		Preservation	Packing Requirements	Holding Time
		Type	Lid			
Radionuclides	Soil/sludge/ sediment/scale	250 or 500-mL G/P	Teflon-lined cap	None	None	6 months
IC anions	Soil/sludge/ sediment/scale	250 or 500-mL G/P	Teflon-lined cap	Cool ≤ 6 °C?	Cool ≤ 6 °C	48 hours after sample preparation
ICP metals	Soil/sludge/ sediment/scale	250 or 500-mL G/P	Teflon-lined cap	None	None	6 months
Alkalinity	Soil/sludge/ sediment/scale	250 or 500-mL G/P	Teflon-lined cap	None	None	14 days
pH (soil)	Soil/sludge/ sediment/scale	250 or 500-mL G	Teflon-lined cap	None	None	As soon as possible*

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

3.4 SAMPLE HANDLING AND SHIPPING

Whenever required, soil samples shall be maintained and shipped at 6 °C or below. The samples shall be shipped to the laboratory as soon as possible to meet applicable holding times. 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 at or 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 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. 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 the TOC.

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. It is also to be recorded in the sample logbooks.

3.5 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 radiological/nonradiological and physical properties 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. In addition to the sampler's field logbook, a Field Characterization Soil/Other Solids Sampling Report shall be filled out. This report identifies the sample analysis form, sample location, logbook/page, depth of samples, etc.

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 4.1 provides the appropriate analyses and additional guidance for preparing the sample for analysis. **Note: The material in the shoe has a separate HEIS number from the liners and is to be marked "Quick Turn." The liners can share the same sample number.**

3.6 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. Signature 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 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 comments section of the chain-of-custody form. Each sample will be shipped to the laboratories 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.

4. 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 the customer. The shoe portion of samples designated as "Quick turn" by the program will be examined and sample preparation will begin as soon as possible after receipt of the samples at the laboratory. Quick Turn is an expedited report format (e-mail), generally understood as a 48-hour turnaround on sample results, excluding weekends. The liners from each sample will be refrigerated until designated for "Tier 1" analyses or archived.

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 4.1 and 4.2 provide sample handling and preparation requirements and analytical requirements. Direction for addressing insufficient sample recovery is provided in Section 4.3. All analyses shall be conducted in accordance with this FSAP. Any analytical changes shall be approved by the Vadose program point of contact before analyses are performed and documented on a CCN or a DRF.

4.1 DIRECTION FOR SAMPLE HANDLING AND PREPARATION

The following steps shall be performed on the shoe portion of each sample designated as "Quick Turn" by the Vadose program as soon as possible after receipt.

a. Remove sample material from the container and place in plastic tray. Individual samples will be documented photographically immediately after extrusion and before subsampling. 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. The sediment descriptions are recorded and used to classify the sediment texture on a modified Folk/Wentworth diagram.

b. Subsample a representative portion (10-15 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 weighings until a constant weight is achieved (less than 0.01 g change on successive weighings). 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.

c. Subsample a sufficient amount of sample sediment to perform the required analysis specified in Table 4-1 and contact with an equal portion of deionized water. Initially, the amount of moisture in the sediment will be assumed to be 5% to calculate the amount of water needed to make up a 1:1 ratio of water to dry solids. This assumed leach factor 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 supernatants will be used for pH measurement.

d. Perform analysis for alkalinity, pH, nitrate 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 analysis; however, due to the need for immediate data, if QC problems occur, results may still be reported with the appropriate qualifiers. Alkalinity and pH results will be held and reported with the Tier 1 analysis report. These analyses were added to the quick turn sample to enable the laboratory to meet the short hold times.

4.2 REQUIREMENTS FOR TIER 1 ANALYSIS

At the conclusion of the field sampling effort, the Vadose program may designate several of the liner samples received for “Tier 1” analyses. For each sample designated for Tier 1 analysis, the following steps will be performed on each specified liner(s) from each sample.

a. Remove sample material from the liner 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, a scoop or spatula will be used to dislodge the sediment from the tube. Place the extruded sample material in plastic tray. Individual samples will be documented photographically immediately after extrusion and before subsampling. 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. The sediment descriptions are recorded and used to classify the sediment texture on a modified Folk/Wentworth diagram.

b. Subsample a representative portion (10-15 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 weighings until a constant weight is achieved (less than 0.01 g change on successive weighings). 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.

Table 4-1. Chemical and Physical Analysis: Soil

Program	Program Contacts	Comments	Reporting Levels	
A. Quick Turn Sample	See Table 7-1 and tank-specific appendix.	Field Blank Required	Quick Turn[a]	Early Reporting[a]
B. Tier 1 Analyses	See Table 7-1 and tank-specific appendix.	Trip 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	Shoe	w	1/batch	N/A	1/batch	1/batch	1/batch	pCi/g	Early
A	IC	NO_3^-	Shoe	w	1/batch	N/A	1/batch	1/batch	1/batch	µg/g	Early
B	Percent water	Weight percent water	Liner A	d	1/batch	N/A	N/A	N/A	N/A	wt%	VI
B	Grav % solids	Weight percent solids	Liner A	d	1/batch	N/A	N/A	N/A	N/A	wt%	VI
B	GEA	^{60}Co, ^{125}Sb, ^{137}Cs , ^{152} Eu, ^{154} Eu, ^{155}Eu	Liner A	d	1/batch	N/A	NA	1/batch	1/batch	pCi/g	VI
B	pH	$[H^+]$	Shoe	w[b]	1/batch	N/A	N/A	N/A	1/batch	pH	VI
B	Conductivity	Conductivity	Liner A	w[b]	1/batch	N/A	N/A	N/A	1/batch	µS/cm	VI
B	Alkalinity		Shoe	w	1/batch	N/A	N/A	1/batch	1/batch	meq/g	VI
B	IC	Br^-,Cl^-, F^-, PO_4^{-3}, SO_4^{-2}, NO_3^-, NO_2^-	Liner A	w	1/batch	N/A	1/batch	1/batch	1/batch	µg/g	VI
B	ICP/AES	Al, As, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Ni, P, Pb, Se, Sr, Tl, U, V, Zn, Na, Si, S, Ti, Zr, Ag, Sb, Sn, Y	Liner A	a, w	1/batch	N/A	1/batch	1/batch	1/batch	µg/g	VI
B	ICP/AES	Re	Liner A	a, w	1/batch	N/A	1/batch	1/batch	1/batch	µg/g	VI
B	ICP/MS[c]	^{99}Tc, ^{129}I, ^{238}U, ^{52}Cr, ^{53}Cr, ^{63}Cu, ^{65}Cu, ^{75}As, ^{82}Se, ^{95}Mo, ^{97}Mo, ^{98}Mo, ^{101}Ru, ^{102}Ru, ^{104}Ru, ^{107}Ag, ^{109}Ag, ^{111}Cd, ^{114}Cd, ^{121}Sb, ^{123}Sb, ^{206}Pb, ^{208}Pb	Liner A	w	1/batch	N/A	1/batch	1/batch	1/batch	µg /g	VI
B	ICP/MS	^{99}Tc, ^{238}U, ^{237}Np, ^{239}Pu, ^{241}Am	Liner A	a	1/batch	N/A	1/batch	1/batch	1/batch	µg /g	VI
B	Liquid scintillation.	gross α/gross β	Liner A	a, w	1/batch	N/A	N/A	1/batch	1/batch	pCi/g	VI

Notes:

a = acid digestion, vadose
BLK = blank
d = direct
DUP = duplicate
GEA = gamma energy analysis
IC = ion chromatography
ICP/AES = inductively coupled plasma/atomic emission spectroscopy
ICP/MS = inductively coupled plasma/mass spectroscopy
LCS = laboratory control sample
Meq/g = milliequivalence per gram
µS/cm = microSiemens per centimeter
MS = matrix spike
MSD = matrix spike duplicate
N/A = not applicable
PREP = sample preparation
w = 1:1 water digest,
wt% = weight percent

[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.

c. Water-soluble inorganic constituents will be determined using a 1:1 sediment:deionized-water extract method. This method is chosen since the sediment is expected to be too dry to easily extract vadose zone pore water. The extracts will be prepared by adding a precise weight of deionized water to approximately 60 to 80 g of sediment subsampled from each sample. One approximately 3-mL aliquot of the unfiltered 1:1 sediment:water extract supernatants will be used for the conductivity measurements.

d. Perform analysis on the 1:1 water digest as specified in Table 4-1.

e. Approximately 10 g of oven-dried sediment will be contacted with 8 M nitric acid at a ratio of approximately three parts acid to one part sediment. The slurries will be heated to about 90-95 °C for 4 hours; then the fluid will be separated by filtration through 0.45-µm membranes. Approximately 1 to 2 mL of the extract is reserved to perform a specific gravity analysis.

f. Perform analysis on the acid digest as specified in Table 4-1. Not all of the analyses listed in Table 4-1 are required for all samples.

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 have changes to the 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* (HASQARD), requirements for documenting procedure modifications should also be followed.

4.3 INSUFFICIENT RECOVERY OF SAMPLE MATERIAL

If sample materials taken from the direct push sampling event are 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 vadose zone 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 the lack of sufficient 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.

5. QUALITY ASSURANCE AND QUALITY CONTROL

The quality assurance project plan (QAPjP, Appendix A) establishes the quality requirements for environmental data collection, including sampling, field measurements, and laboratory analysis. The QAPjP complies with the requirements of the following:

a. DOE O 414.1C, *Quality Assurance*.

b. 10 CFR 830.120, "Quality Assurance Requirements."

c. EPA QA/R-5, *EPA Requirements for Quality Assurance Project Plans*.

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 typically will have completed the following training before starting work:

a. Occupational Safety and Health Administration 40-hour hazardous waste worker training and supervised 24-hour hazardous waste site experience.

b. Eight-hour hazardous waste worker refresher training (as required).

c. Hanford General Employee Training.

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

5.1 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 field duplicates, equipment rinsate blank, and trip blank samples, where appropriate. Field QC sample types and frequency for collection are described in Sections 5.1.1 through 5.1.4.

5.1.1 Field Duplicates

Field duplicates (i.e., samples taken at the same location) are used to evaluate precision of the sampling process. However, it is not possible to obtain direct pushes exactly at the same location. Therefore, field duplicates are not required for direct push samples.

5.1.2 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 deionized water washed through decontaminated sampling equipment. Equipment rinsate blanks are to be run every 20 samples for the Tier 1 analytes. CHPRC or WRPS samplers will prepare the equipment rinsate blanks.

5.1.3 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 5.2 and 5.3.

5.2 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. 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. Each of these is addressed in Sections 5.2.1 through 5.2.4.

5.2.1 Representativeness

Representativeness is a measure of how closely the results reflect the actual concentration and distribution of the chemical and radiological constituents in the matrix sampled. Sampling design has been developed and sampling techniques have been selected with the goal of optimizing representativeness of the samples.

5.2.2 Comparability

Comparability expresses the confidence with which one data set can be compared to another. Data comparability will be maintained using standard procedures and consistent methods and units.

5.2.3 Accuracy

Accuracy is an assessment of the closeness of the measured value to the true value. Accuracy of chemical test results is assessed by spiking samples with known standards and establishing the average recovery. A matrix spike is the addition to a sample of a known amount of a standard compound similar to the compounds being measured. Sample accuracy is expressed as the percent recovery of a spiked sample. Table 5-1 provides the accuracy criteria for laboratory analyses.

5.2.4 Precision

Precision is a measure of the data reproducibility when more than one measurement has been taken on the same sample. Precision can be expressed as the relative percent difference for duplicate measurements or relative standard deviation for triplicates. Table 5-1 lists the analytical precision criteria for fixed laboratory analyses.

5.3 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*. 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.

Table 5-1. Quality Control Parameters

		QC Acceptance Criteria		
Analytes	Suggested Analytical Technique	LCS % Recovery[a]	Spike % Recovery[b]	Duplicate RPD[c]
See Table 4-1	ICP/AES	80 - 120%	75 - 125%	≤30%
See Table 4-1	IC	80 - 120%	75 - 125%	≤30%
	alkalinity	80 - 120%	75 - 125%	≤30%
	conductivity	80 - 120%	75 - 125%	≤30%
pH	$[H^+]$	$\pm$ 0.1 pH units	N/A	N/A
Wt% H_2O	Thermogravimetric	N/A	N/A	≤30%
Gross alpha/beta	LSC	80 - 120%	N/A	≤30%
^{137}Cs	GEA	80 - 120%	N/A	≤30%
^{99}Tc, ^{129}I, ^{131}I, ^{238}U, ^{237}Np, ^{239}Pu, ^{241}Am	ICP/MS	80 - 120%	75 - 125%	≤30%

Notes:

GEA = gamma energy analysis
LSC = liquid scintillation counting
IC = ion chromatography
ICP/AES = inductively coupled plasma/atomic emission spectroscopy
ICP/MS = inductively coupled plasma/mass spectroscopy
LCS = laboratory control sample
N/A = Not applicable
RPD = Relative percent difference
Wt% = weight percent

[a] LCS = Laboratory control sample. An LCS is a sample of similar matrix to the samples being analyzed to which has been added a known amount(s) of the analyte(s). The sample is carried through the entire analytical process. The accuracy of a method is expressed as the percent recovery of the LCS analyte(s). The percent recovery equals the amount measured divided by the known or expected amount times 100.

[b] The effect of the sample matrix on analytical accuracy is estimated from the matrix spike. A matrix spike is an aliquot of the sample to which a known amount of the analyte(s) has been added. The recovery of the matrix spike is calculated by subtracting the amount found in the sample from the amount found in the spike, dividing by the amount added and multiplying by 100. Samples are batched with similar matrices.

[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% RPD if the sample result is at least 10 times the instrument detection limit.

The analytical QC requirements (duplicates, spikes, blanks, laboratory control samples) are identified in Tables 4-1 and 5-1. 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 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.

5.3.1 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.

5.3.2 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 5.1.

5.4 ANALYTICAL DETECTION LIMITS

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

6. DATA REPORTING AND ELECTRONIC DATA MANAGEMENT

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

6.1 QUICK TURN REPORTING

This format requires reporting of ^{99}Tc and nitrate on a 1:1 water leach 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 Vadose program point of contact.

6.2 FORMAT II REPORTING

Results of the study will be issued as a Format II document. This document, which describes methods, results, and conclusions, will be issued within 4 months of the receipt of the last sample of the campaign or within 4 months of final instruction on sample selection for Tier 1. Sample analysis data will be reviewed by laboratory QA and chemists prior to issuance of the draft report. Table 6-1 shows the distribution of the final report.

Table 6-1. Final Report Distribution

Recipient	MSIN	Text with Attachments
S. J. Eberlein	S7-66	X
M. P. Connelly	S7-66	X
K. J. Dunbar	S7-66	X
F. M. Mann	S7-66	X
H. A. Sydnor	S7-66	X
A. M. Templeton	S7-66	X
D. M. Nguyen	R2-58	X
S. A. Lynch	R3-50	X
C. P. Mangano	H8-51	X
DOE Reading Room	H2-53	$H_{(hard\ copy)}$

In addition to this data package, an electronic version of the analytical results, including tentatively identified compounds, shall be uploaded to the altered side of the 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)*].

6.3 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 4-1 unless formally requested by the tank coordinator. For gamma energy analysis, the large library will be used but only detected results (results exceeding the laboratory MDL) will be reported.

6.4 CLARIFICATIONS AND ASSUMPTIONS

It is anticipated that the 222-S Laboratory will perform all of the analyses. If necessary, the laboratory 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 (SOW) authorizing the subcontracted laboratory to perform the analyses. The SOW shall be reviewed and approved by the Characterization Task Lead and TOC Quality Assurance prior to commencement of laboratory analysis.

6.5 ELECTRONIC DATA MANAGEMENT

All sampling and analytical results from sampling at SX Farm will be entered into the HEIS database. The overall process for entering sample/result data into HEIS is shown in Figure 6-1; 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 6-2.

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 (SAF), and sample information are correctly entered into Sample Data Tracking software (SDT).

Figure 6-1. Overall Process for Entering Data into HEIS

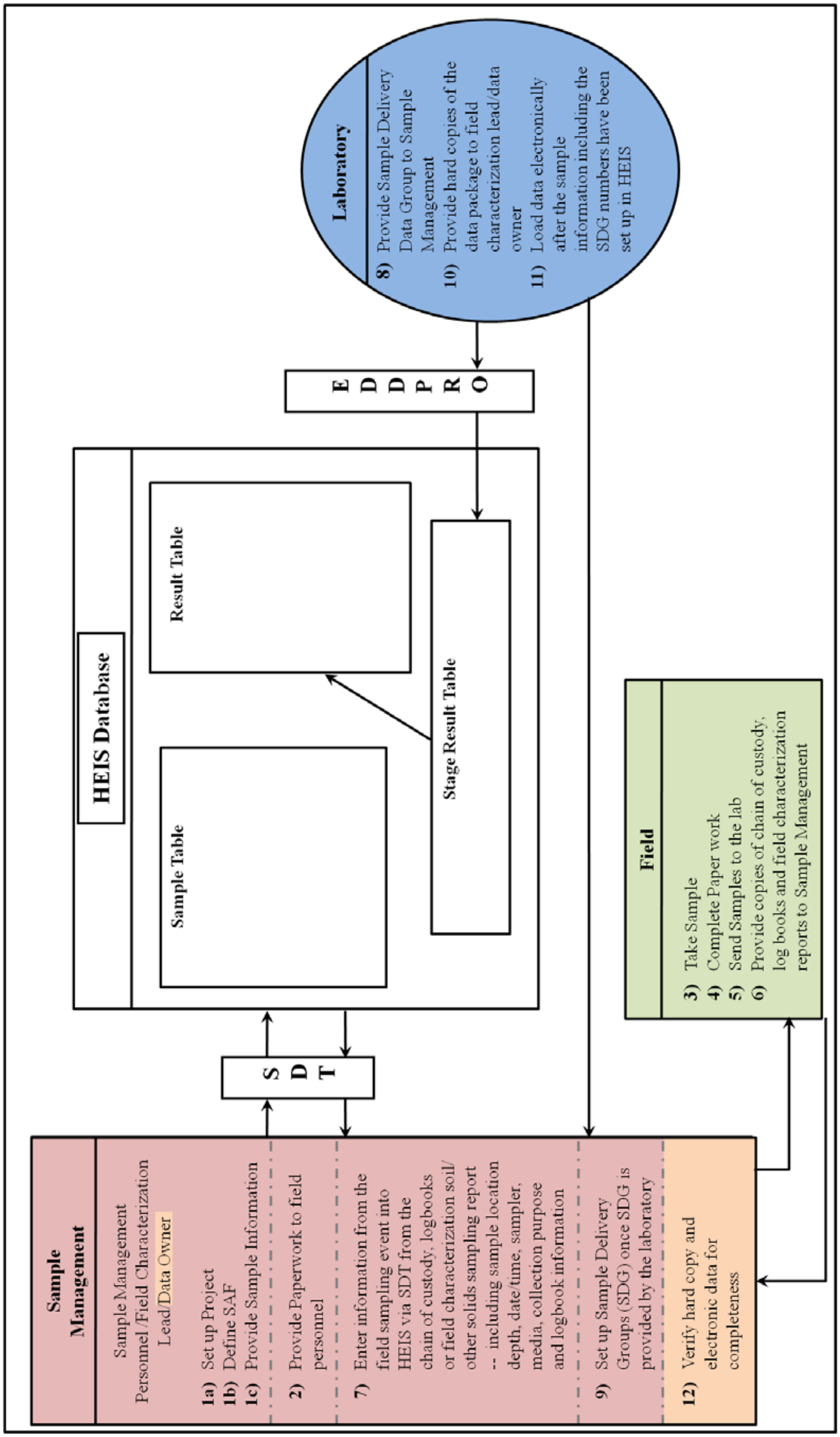


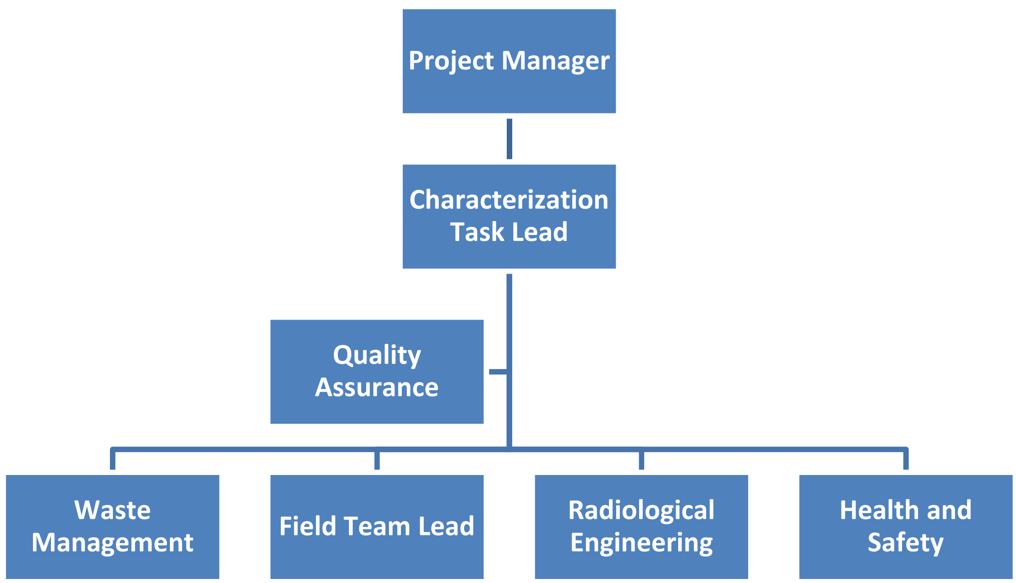
Table 6-2. Process Steps for Ensuring Sample/Result Data Entry into HEIS

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 FSAP. 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 SDM personnel and Characterization Task Lead.
7	SDM personnel or Characterization Task Lead enters information from the field sampling event into HEIS via the SDT. This includes sample location, sample date/time, sampler, media depth, collection purpose, and any logbook information.
8	Laboratory provides Sample Delivery Group (SDG) number to SDM personnel or Characterization Task Lead.
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 (EDDPRO).
12	Data owner/Characterization Task Lead verifies both hard copy and electronic data for completeness and accuracy.

7. 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 Sections 7.1 through 7.7 and is shown in Figure 7-1. 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.

Figure 7-1. Project Organization



7.1 PROJECT MANAGER

The Project Manager provides oversight for all activities and coordinates with DOE and Ecology in support of sampling activities. In addition, support is provided to the task lead to ensure that the work is performed safely and cost effectively.

7.2 CHARACTERIZATION TASK LEAD

The Characterization Task Lead is responsible for direct management of sampling documents and requirements, field activities, and subcontracted tasks. The Characterization Task Lead ensures that the Field Team Lead, samplers, and others responsible for implementation of this FSAP and the QAPjP are provided with current copies of this document and any revisions thereto. The Characterization Task Lead works closely with Quality Assurance, Health and

Safety, and the Field Team Lead to integrate these and the other lead disciplines in planning and implementing the work scope. The Characterization Task Lead also coordinates with and reports to DOE, Ecology, and the TOC on all sampling activities.

The Characterization Task Lead is responsible for selecting the laboratories that perform the analyses and requests assessments/surveillances of the laboratories. The Characterization Task Lead receives the analytical data from the laboratories and arranges for data entry into the HEIS database. The Characterization Task Lead is also responsible for a review of sample data against existing knowledge and data quality assessments according to guidelines in EPA QA/G-9, *Guidance for Data Quality Assessment*.

7.3 QUALITY ASSURANCE

Quality Assurance is responsible for QA issues on the project. Responsibilities include oversight of implementation of the project QA requirements; review of project documents, including FSAPs (and the QAPjP), and participation in QA assessments and surveillances on sample collection and analysis activities, as appropriate. The QA 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. A total program to generate data of acceptable quality should include both a QA component, which encompasses the management procedures and controls, as well as an operational day-to-day QC component.

7.4 WASTE MANAGEMENT

The Waste Management lead communicates policies and procedures and ensures project compliance for storage, transportation, disposal, and waste tracking in a safe and cost-effective manner. Other responsibilities include identifying waste management sampling/characterization requirements to ensure regulatory compliance interpretation [e.g., with *Washington Administrative Code* (WAC) 173-303, “Dangerous Waste Regulations”] of the characterization data to generate waste designations, profiles, and other documents that confirm compliance with waste disposal requirements.

7.5 FIELD TEAM LEAD

The Field Team Lead has the overall responsibility for the planning, coordination, and execution of the field sampling activities. Specific responsibilities include converting the sampling design requirements into field work plans or task instructions that provide specific direction for field activities. Responsibilities also include directing training, mock-ups, and practice sessions with field personnel to ensure that the sampling design is understood and can be performed as specified. The Field Team Lead communicates with the Characterization Task Lead to identify field constraints that could affect the sampling design. In addition, the Field Team Lead directs the procurement and installation of materials and equipment needed to support the field work.

The Field Team Lead oversees field sampling activities that include sample collection, packaging, provision of certified clean sampling bottles/containers, documentation of sampling activities in controlled logbooks, chain-of-custody documentation, and packaging and transportation of samples to the laboratory or shipping center.

7.6 RADIOLOGICAL ENGINEERING

The Radiological Engineering lead is responsible for radiological engineering and health physics support within the project. Specific responsibilities include conducting as low as reasonably achievable (ALARA) reviews, exposure and release modeling, and radiological controls optimization for all work planning. In addition, radiological hazards are identified and appropriate controls are implemented to maintain worker exposures to the hazards at levels ALARA. Radiological Engineering interfaces with the project Health and Safety representative and plans and directs radiological control technician support for all activities.

7.7 HEALTH AND SAFETY

Responsibilities include coordination of industrial health and safety support within the project as carried out through health and safety plans, job hazard analyses, and other pertinent safety documents required by Federal regulation or by internal TOC work requirements. In addition, assistance is provided to project personnel in complying with applicable health and safety standards and requirements. Personal protective clothing requirements are coordinated with Radiological Engineering.

7.8 DOCUMENTS AND RECORDS

All information pertinent to field sampling and surveying will be recorded in field checklists and bound logbooks in accordance with existing sample collection protocols. 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 within the TOC will be followed.

7.8.1 Data Review, Verification, and Validation

The Characterization Task Lead will be responsible for checking 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. Third-party data validation is required for 5% of the soil samples taken.

7.8.2 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.

8. CHANGE CONTROL

The project coordinator and Vadose program point of contact shall document significant changes to the analytical requirements in the FSAP (changes impacting scope, cost, or budget) with a DRF. Minor changes (as determined by the project coordinator) may be made by the Vadose program point of contact or project coordinator using a CCN. All changes shall be clearly documented in the final data report. The final data report shall include copies of any CCN applicable to that sampling and analysis event. The Vadose program point of contact 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 TSAP are made.

Clarifications to requirements may be made by e-mail.

9. REFERENCES

10 CFR 830.120, "Quality Assurance Requirements," *Code of Federal Regulations* .

49 CFR, "Transportation," *Code of Federal Regulations*, as amended.

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APPENDIX A.

QUALITY ASSURANCE PROJECT PLAN FOR SOIL CHARACTERIZATION IN SUPPORT OF AN INTERIM BARRIER AT SX FARM

QUALITY ASSURANCE PROJECT PLAN FOR SOIL CHARACTERIZATION IN SUPPORT OF AN INTERIM BARRIER AT SX FARM

The quality assurance project plan (QAPjP) establishes the quality requirements for environmental data collection, including sampling, field measurements, and laboratory analysis. The QAPjP complies with the requirements of the following:

a. DOE O 414.1C, *Quality Assurance*.

b. 10 CFR 830.120, "Quality Assurance Requirements."

c. EPA QA/R-5, *EPA Requirements for Quality Assurance Project Plans*.

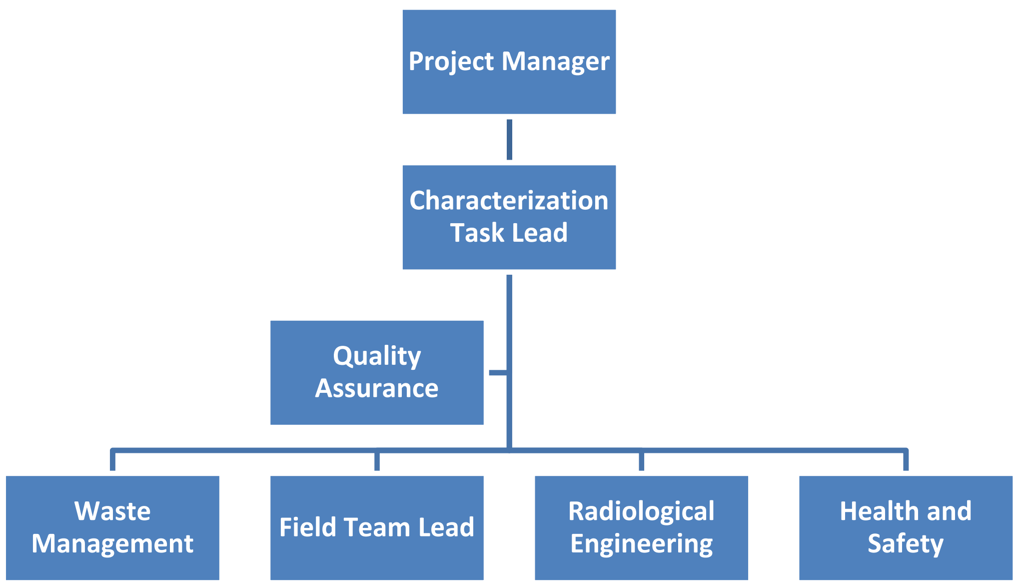
A1. PROJECT MANAGEMENT

This section addresses the basic areas of project management, and it 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 QAPjP is organized according to the elements described in EPA QA/R-5.

A1.1 PROJECT/TASK ORGANIZATION

The project organization is described in the subsections that follow and is shown in Figure A-1.

Figure A-1. Project Organization



A1.1.1 Project Manager

The Project Manager provides oversight for all activities and coordinates with DOE and Ecology in support of sampling activities. In addition, support is provided to the task lead to ensure that the work is performed safely and cost-effectively.

A1.1.2 Characterization Task Lead

The Characterization Task Lead is responsible for direct management of sampling documents and requirements, field activities, and subcontracted tasks. The task lead ensures that the field team lead, samplers, and others responsible for implementation of this field sampling and analysis plan (FSAP) and the QAPjP are provided with current copies of this document and any revisions thereto. The task lead works closely with quality assurance, health and safety, and the field team leader to integrate these and the other lead disciplines in planning and implementing the work scope. The task lead also coordinates with and reports to DOE, Ecology, and the Tank Operations Contractor (TOC) on all sampling activities.

The task lead is responsible for selecting the laboratories that perform the analyses and requests assessments/surveillances of the laboratories. The task lead receives the analytical data from the laboratories, and arranges for data entry into the Hanford Environmental Information System (HEIS) database. The task lead is also responsible for a review of sample data against existing knowledge and data quality assessments according to guidelines in EPA QA/G-9, *Guidance for Data Quality Assessment*.

A1.1.3 Quality Assurance

Quality Assurance (QA) is responsible for quality assurance issues on the project. Responsibilities include oversight of implementation of the project quality assurance requirements; review of project documents, including SAPs (and the QAPjP); and participation in quality assurance assessments and surveillances on sample collection and analysis activities, as appropriate. The QA 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. A total program to generate data of acceptable quality should include both a QA component, which encompasses the management procedures and controls, as well as an operational day-to-day quality control (QC) component.

A1.1.4 Waste Management

The Waste Management lead communicates policies and procedures and ensures project compliance for storage, transportation, disposal, and waste tracking in a safe and cost-effective manner. Other responsibilities include identifying waste management sampling/characterization requirements to ensure regulatory compliance interpretation (e.g., with *Washington Administrative Code* (WAC) 173-303, "Dangerous Waste Regulations," of the characterization data to generate waste designations, profiles, and other documents that confirm compliance with waste disposal requirements.

A1.1.5 Field Team Leader

The field team leader has the overall responsibility for the planning, coordination, and execution of the field sampling activities. Specific responsibilities include converting the sampling design requirements into field work plans or task instructions that provide specific direction for field activities. Responsibilities also include directing training, mock-ups, and practice sessions with field personnel to ensure that the sampling design is understood and can be performed as specified. The field team leader communicates with the Characterization Task Lead to identify field constraints that could affect the sampling design. In addition, the field team leader directs the procurement and installation of materials and equipment needed to support the field work.

The field team leader oversees field-sampling activities that include sample collection, packaging, provision of certified clean sampling bottles/containers, documentation of sampling activities in controlled logbooks, chain-of-custody documentation, and packaging and transportation of samples to the laboratory or shipping center.

A1.1.6 Radiological Engineering

The Radiological Engineering lead is responsible for radiological engineering and health physics support within the project. Specific responsibilities include conducting as low as reasonably achievable (ALARA) reviews, exposure and release modeling, and radiological controls optimization for all work planning. In addition, radiological hazards are identified and appropriate controls are implemented to maintain worker exposures to the hazards at levels as low as reasonably achievable. Radiological Engineering interfaces with the project safety and health representative and plans and directs radiological control technician support for all activities.

A1.1.7 Health and Safety

Responsibilities include coordination of industrial safety and health support within the project as carried out through safety and health plans, job hazard analyses, and other pertinent safety documents required by Federal regulation or by internal TOC work requirements. In addition, assistance is provided to project personnel in complying with applicable health and safety standards and requirements. Personnel protective clothing requirements are coordinated with Radiological Engineering.

A1.2 PROBLEM DEFINITION/BACKGROUND

See Chapters 1 and 2 of the FSAP.

A1.3 PROJECT/TASK DESCRIPTION

See Chapters 3 and 4 of the FSAP.

A1.4 QUALITY OBJECTIVES AND CRITERIA

See Chapters 4 and 5 of the FSAP.

A1.5 SPECIAL TRAINING/CERTIFICATION

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 typically will have completed the following training before starting work:

a. Occupational Safety and Health Administration 40-hour hazardous waste worker training and supervised 24-hour hazardous waste site experience.

b. Eight-hour hazardous waste worker refresher training (as required).

c. Hanford general employee radiation training.

d. 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 U.S. Department of Energy 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.

A1.6 DOCUMENTS AND RECORDS

All information pertinent to field sampling and surveying will be recorded in field checklists and bound logbooks in accordance with existing sample collection protocols. 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 within the TOC will be followed.

Requirements for laboratory data reporting are discussed in Chapters 6 and 8 of the FSAP.

A2. DATA GENERATION AND ACQUISITION

A2.1 SAMPLING PROCESS DESIGN

See Section 3.1 of the FSAP.

A2.2 SAMPLING METHODS

See Section 3.2 of the FSAP.

A2.3 SAMPLE HANDLING AND CUSTODY

See Sections 3.3 through 3.6 of the FSAP.

A2.4 ANALYTICAL METHODS

See Table 4-1 of the FSAP.

A2.5 QUALITY CONTROL

Quality control sample requirements and acceptance criteria for these samples are specified in Chapter 5 of the FSAP. Overall quality assurance and quality control requirements for characterization are discussed in this section.

A2.5.1 Quality Assurance Objective

The quality assurance 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. 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. Each of these is addressed in Sections A2.5.1.1 through A2.5.1.6.

A2.5.1.1 Representativeness

Representativeness is a measure of how closely the results reflect the actual concentration and distribution of the chemical and radiological constituents in the matrix sampled. Sampling design has been developed and sampling techniques have been selected with the goal of optimizing representativeness of the samples.

A2.5.1.2 Comparability

Comparability expresses the confidence with which one data set can be compared to another. Data comparability will be maintained using standard procedures and consistent methods and units.

A2.5.1.3 Accuracy

Accuracy is an assessment of the closeness of the measured value to the true value. Accuracy of chemical test results is assessed by spiking samples with known standards and establishing the average recovery. A matrix spike is the addition to a sample of a known amount of a standard compound similar to the compounds being measured. Sample accuracy is expressed as the percent recovery of a spiked sample. Table 5-1 provides the accuracy criteria for laboratory analyses.

A2.5.1.4 Precision

Precision is a measure of the data reproducibility when more than one measurement has been taken on the same sample. Precision can be expressed as the relative percent difference for duplicate measurements or relative standard deviation for triplicates. Table 5-1 lists the analytical precision criteria for fixed laboratory analyses.

A2.5.1.5 Detection Limits

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

A2.5.1.6 Laboratory Quality Control

The laboratory method blanks, duplicates, laboratory control sample/blank spike, and matrix spikes are defined in Chapter 1 of SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, 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.

A2.5.2 Sample Preservation, Containers, and Holding Times

Sample preservation, containers, and holding times for radiological and nonradiological analytes are shown in Table 3-1 of the FSAP.

A2.5.3 Sample Collection Requirements

See Section 3.3 of the FSAP.

A2.6 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 per 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 quality assurance plan or operating procedures (as appropriate). Calibration of laboratory instruments will be performed in a manner consistent with SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, or DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Documents*.

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 Chapter 5 of the FSAP.

A2.7 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

See Section 5.2 of the FSAP and Section A2.6.

A2.8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

See Section A2.6.

A2.10 DATA MANAGEMENT

See Chapter 6 of the FSAP for data reporting requirements.

A3. ASSESSMENT AND OVERSIGHT

A3.1 ASSESSMENT AND RESPONSE ACTIONS

Project management and QA 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.

A3.2 REPORTS TO MANAGEMENT

Management will be made aware of deficiencies identified by assessments and surveillances and subsequent corrective actions.

A4. DATA VALIDATION AND USABILITY

A4.1 DATA REVIEW, VERIFICATION, AND VALIDATION

Sample analysis data will be reviewed by laboratory QA and chemists prior to issuance. The characterization task lead will be responsible for checking 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. Third-party data validation is required for 5% of the soil samples taken.

A4.2 VERIFICATION AND VALIDATION METHOD

See Section A4.1.

A4.3 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 QA/G-9, *Guidance for Data Quality Assessment, Practical Methods for Data Analysis*.

A5. QUALITY ASSURANCE PROJECT PLAN REFERENCES

10 CFR 830.120, “Quality Assurance Requirements,” Title 10, *Code of Federal Regulations*, as amended.

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

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

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

INFORMATION CLEARANCE REVIEW AND RELEASE APPROVAL

Part I: Background Information

Title: Field Sampling and Analysis Plan of Soil Samples in Support of an Interim Barrier at SX Farm

Publish to OSTI? ☐ Yes ☑ No

Information Category:
☐ Abstract ☐ Journal Article ☐ Summary
☐ Internet ☐ Visual Aid ☐ Software
☐ Full Paper ☐ Report ☑ Other Field Sampling and Analysis Plan

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

Document Number: RPP-PLAN-41491 Revision 0 — Date: July 2009

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Part IV: WRPS Internal Review

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Subject Matter Expert	WRPS	04/14/2020	Tabor, Cindy L Approved - IDMS data file att.
Responsible Manager	WRPS	04/09/2020	Rutland, Paul L Approved - IDMS data file att.
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Other: ORP SME	☒	☐	Blackwell, Becky Approved - IDMS data file att.

Comments Required for WRPS-Indicate Purpose of Document:

The U.S. Department of Energy and Washington State Department of Ecology have agreed to create a Resource Conservation and Recovery Act Corrective Action Project with explicit milestones. This program includes collection of subsurface vadose zone data. Current planning includes placement of interim surface barriers at certain single-shell tank farms. The first of such barriers was placed over a portion of 241-T Tank Farm. 241-T Tank Farm contained the largest inventory of mobile contaminants released to the vadose zone. The next largest unplanned releases to the vadose zone occurred at 241-SX Tank Farm, which makes 241-SX Tank Farm the next tank farm in need of a barrier. An interim surface barrier has been proposed at 241-SX Tank Farm to mitigate the transport of contaminants from unplanned releases at these tank farms to groundwater.

APPROVED
By Sarah Harrison at 8:01 am, Apr 21, 2020

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