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MAR 1 1 2013

13-TF-0013

Ms. Jane A. Hedges, Program Manager
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Ms. Hedges:

THE U. S. DEPARTMET OF ENERGY, OFFICE OF RIVER PROTECTION (ORP) SUBMITTAL OF THE SAMPLING AND ANALYSIS PLAN (SAP) FOR SOIL SAMPLES IN SUPPORT OF INTERIM MEASURE PLANNING AT THE 241-TX TANK FARM IN COMPLETION OF HANFORD FEDERAL FACILITIES AGREEMENT AND CONSENT ORDER (HFFACO) MILESTONE M-045-21

This letter provides the attached RPP-PLAN-54376, Sampling and Analysis Plan for Soil Samples in Support of Interim Measure Planning at the 241-TX Tank Farm. This plan is submitted in completion of the HFFACO Milestone M-045-21, which requires ORP submit to the Washington State Department of Ecology for review and approval as a primary document, a SAP for the soil samples to be obtained as part of the initial direct push soil investigation in the 241-TX Tank Farm. Drafts of the attachment have been discussed with your staff and their comments have been incorporated.

If you have any questions, please contact me, or your staff may contact Joni F. Grindstaff, Federal Project Director Retrieval and Closure Projects, (509) 376-6202.

Thomas W. Fletcher, Assistant Manager
for Tank Farms Project

TF: RDH

Attachment

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ATTACHMENT

13-TF-0013

RPP-PLAN-54376, SAMPLING AND ANALYSIS PLAN FOR SOIL SAMPLES IN SUPPORT OF INTERIM MEASURE PLANNING AT THE 241-TX TANK FARM

DOCUMENT RELEASE FORM

(1) Document Number:	RPP-PLAN-54376	(2) Revision Number: 0	(3) Effective Date: 02/25/2013
(4) Document Type:	☐ Digital Image ☐ Hard copy ☒ PDF ☐ Video	(a) Number of pages (including the DRF) or number of digital images	97
(5) Release Type	☒ New ☐ Cancel	☐ Page Change	☐ Complete Revision
(6) Document Title:	Sampling and Analysis Plan for Soil Samples in Support of Interim Measure Planning at the 241-TX Tank Farm	(7) USQ No.: R- ☒ N/A USQ Evaluator Sign/Date	
(8) Change/Release Description:	Initial release		
(9) Change Justification:	N/A		

(10) Associated Structure, System, and Component (SSC) and Building Number:			
(a) Structure Location: N/A		(c) Building Number: N/A	(e) Project Number: N/A
(b) System Designator: N/A		(d) Equipment ID Number (EIN): N/A	

(11) Impacted Documents:	(a) Document Type	(b) Document Number	(c) Document Revision
	N/A	N/A	N/A

(12) Approvals:

(a) Author (Print/Sign): C. L. Tabor Date: 2/25/13

(b) Reviewer (Optional, Print/Sign): N/A

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DATE: Feb 25, 2013 HANFORD RELEASE

(14) Clearance	(a) Cleared for Public Release	(b) Restricted Information?	(c) Restriction Type:
	☒ Yes ☐ No	☐ Yes ☒ No	

(15) Clearance Review (Print/Sign): APPROVED By Julia Raymer at 12:47 pm, Feb 25, 2013 Date:

A-6003-881 (REV 4)

Sampling and Analysis Plan for Soil Samples in Support of Interim Measure Planning at the 241-TX Tank Farm

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U.S. Department of Energy Contract DE-AC27-08RV14800

EDT/ECN:	DRF	UC:	
Cost Center:		Charge Code:	
B&R Code:		Total Pages:	97

Key Words: 241-TX Tank Farm, TX Farm, atomic emission spectroscopy, direct push, Field Sampling and Analysis Plan, inductively coupled plasma, mass spectroscopy, interim surface barrier, laboratory control sample, Quality Assurance Program Description, Sampling and Analysis Plan, surface geophysical exploration, single-shell tank, unplanned release, Waste Management Area, WMA TX-TY

Abstract: This plan documents the sampling and analysis activities that will be conducted to continue characterization and evaluation efforts at 241-TX Tank Farm. The overall objective of this effort is to gather data to support a determination regarding whether undertaking an interim measure is merited either to curtail transport of the mobile contaminants or to remove them, if possible. Completion of this plan fulfills Hanford Federal Facility Agreement and Consent Order Milestone M-045-21, which calls for the submittal of a sampling and analysis plan for the soil samples to be obtained as part of a direct push soil investigation in 241-TX Tank Farm.

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By Julia Raymer at 12:48 pm, Feb 25, 2013

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RPP-PLAN-54376
Revision 0

Sampling and Analysis Plan for Soil Samples in Support of Interim Measure Planning at the 241-TX Tank Farm

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Washington River Protection Solutions, LLC

Date Published
February 2013

Prepared for the U.S. Department of Energy
Office of River Protection

Contract No. DE-AC27-08RV14800

Approved for Public Release;
Further Dissemination Unlimited

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Acronyms/Abbreviations

ATL	Advanced Technologies and Laboratories International, Inc.
bgs	below ground surface
CFR	*Code of Federal Regulations*
CHPRC	CH2M HILL Plateau Remediation Company
DOE	U.S. Department of Energy
DOECAP	U.S. Department of Energy Consolidated Audit Program
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FEAD	Format for Electronic Analytical Data
FSAP	Field Sampling and Analysis Plan
HASQARD	*Hanford Analytical Services Quality Assurance Requirements Documents*
HEIS	Hanford Environmental Information System
HFFACO	*Hanford Federal Facility Agreement and Consent Order*
ICP/AES	inductively coupled plasma/atomic emission spectroscopy
ICP/MS	inductively coupled plasma/mass spectroscopy
LCS	laboratory control sample
NA	not applicable
ORP	U.S. Department of Energy, Office of River Protection
QA	quality assurance
QC	quality control
QSAS	*Quality Systems for Analytical Services*
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
SAP	Sampling and Analysis Plan
SGE	surface geophysical exploration
UPR	unplanned release
WAC	*Washington Administrative Code*
WMA	Waste Management Area
WRPS	Washington River Protection Solutions LLC

Units

°C	degrees Celsius
Ci	curies
ft	feet
g	gram
gal	gallon
L	liter
m	meter
mg/kg	milligram per kilogram
mL	milliliter
pCi/g	picocuries per gram

1.0 SAMPLING AND ANALYSIS OBJECTIVES

This section describes the objectives and scope of planned characterization and evaluation actions at the 241-TX Tank Farm (TX Farm).

1.1 PURPOSE

This plan documents the sampling and analysis activities that will be conducted to continue characterization and evaluation efforts at TX Farm. The overall objective of this effort is to gather data to support a determination regarding whether undertaking an interim measure is merited to attempt either to curtail transport of the mobile contaminants or to remove them. Completion of this plan fulfills *Hanford Federal Facility Agreement and Consent Order* (HFFACO) (Ecology et al. 1989) Milestone M-045-21, which calls for the submittal of a sampling and analysis plan (SAP) for the soil samples to be obtained as part of a direct push soil investigation in TX Farm, as described in RPP-PLAN-53808, *200 West Area Tank Farms Interim Measures Investigation Work Plan.*

Near-surface soils at the TX Farm are contaminated as a result of past waste releases. There has been extensive characterization work conducted in Waste Management Area (WMA) TX-TY as part of the Phase 1 characterization effort (RPP-23752, *Field Investigation Report for Waste Management Areas T and TX-TY*) and in support of the installation of an interim surface barrier over the 241-TY Tank Farm. Information gathered during those characterization efforts indicates that TX Farm contaminant transport could be reduced or removed by an interim measure. It is postulated that either an interim surface barrier could be placed over TX Farm to reduce moisture infiltration rate into the soil, thereby reducing the migration of soluble contaminants to the groundwater, or a remedial technology could be deployed to remove contaminants from the subsurface. In either case, the geographic extent of the vadose contamination at TX Farm needs be determined to ensure the proper design of the interim measure. It is also possible that data collected may help formulate the basis for future *Resource Conservation and Recovery Act of 1976* (RCRA) Phase 2 characterization activities at TX Farm. However, the latter data use would be opportunistic, and is not a requirement for this SAP. The requirements to support interim measures planning are based on the following documents:

- RPP-ENV-53773, *Data Requirements for Characterization Supporting Interim Measures in TX Farm*
- RPP-43551, *Tank Farm Interim Barrier Data Quality Objectives.*

On September 6, 2012, representatives from the Washington State Department of Ecology (Ecology), U.S. Department of Energy (DOE) Office of River Protection (ORP), Pacific Northwest National Laboratory, and Washington River Protection Solutions, LLC (WRPS) met to discuss characterization activities necessary for the design of the interim measure at TX Farm. During this meeting, waste release characterization information about TX Farm was presented to further the understanding on the need for an interim measure. Appendix A contains minutes from this meeting. Known sources of contamination identified in RPP-54073, *TX Tank Farm*

Leak Inventory Assessment Meeting Summaries were discussed in this meeting. An update to the estimated soil contamination in TX Farm is being prepared, through the process described in RPP-32681, *Process to Assess Tank Farm Leaks in Support of Retrieval and Closure Planning*. However, at the time that this SAP was developed, the update had not been completed.

After data from this SAP is collected and reviewed, a characterization report will be developed in accordance with HFFACO Milestone M-045-22-T01. Results contained in this characterization report and in other reports required under M-045-22 will be reviewed and evaluated by DOE and Ecology to determine whether further interim actions should be undertaken at the relevant tank farms. If DOE and Ecology agree to modify work remaining under HFFACO Milestone M-045-92, DOE will propose a modification to that milestone.

1.2 SCOPE

The characterization activities in TX Farm will include using the direct push hydraulic hammer unit to place an initial probe hole, logging the initial probe hole, then pushing an adjacent probe hole for sampling using the logging results from the initial probe hole. Deep electrodes are also placed in each direct push logging hole during decommissioning. The deep electrodes will be available for use in future electrical resistivity studies; however, such studies are beyond the scope of this SAP. A multidiscipline team comprised of WRPS personnel and supporting subcontractors will implement the field activities.

This SAP provides the direction and requirements for the field sampling, laboratory analysis, and data reporting for soil sampling for twelve direct push locations in TX Farm. Information is provided in the following sections:

- Facility Description (Section 2.0)
- Sampling Requirements (Section 3.0)
- Sample Analysis Requirements (Section 4.0)
- Quality Assurance and Quality Control (Section 5.0)
- Data Reporting (Section 6.0)
- Change Control (Section 7.0)
- Documents and Records (Section 8.0)
- Project Organization (Section 9.0)
- References (Section 10.0).

The quality assurance (QA) plan objectives are met through implementation of all sections of this SAP.

Twelve direct push sites have been allotted for TX Farm interim measure evaluation efforts. The first eight locations will be pushed to outline the area of interest. The remaining four sites will be selected after the initial results (i.e., logging and quick turn-around results) are reviewed. The latter four locations will be selected to further define vadose zone contamination. It is anticipated that depths up to 130 feet (ft) below ground surface (bgs) will be reached; however, it

is likely that the Cold Creek unit will be a barrier to the direct push, and the direct push will stop at the Cold Creek unit (~100 to ~132 ft bgs).

With respect to direct push efforts in TX Farm, sample locations have been selected by targeting the following areas:

- where there have been known and possible waste releases and leaks [i.e., tanks 241-TX-105, 241-TX-107, 241-TX-117, and unplanned release (UPR) UPR-200-W-100] detected by drywell monitoring
- suspected vadose zone plume areas southwest of tanks 241-TX-104 and 241-TX-101
- surface geophysical exploration (SGE) anomalies between tanks 241-TX-108 and 241-TX-112 and between tanks 241-TX-115 and 241-TX-118
- along the outer edges of tank locations to assist in identifying the boundary of the contaminated vadose zone underneath TX Farm.

Table 1-1 identifies the reasons for selecting the sampling locations.

Direct push placement locations avoid contact and pushing through existing infrastructure (whether on the surface or in the subsurface; e.g., tanks, pipes, diversion boxes). Figure 1-1 shows the topography in and around WMA TX-TY and the initial eight direct push locations for the TX Farm. These direct push locations were recommended in a meeting held on September 6, 2012 (Appendix A).

The direct push probe will be driven to depths of ~130 ft bgs, and soil samples will be collected at an average of three depths from each sample probe hole. Samples will be analyzed for constituents identified in RPP-ENV-53773 and RPP-PLAN-53808, excluding the organic analyses (see Sections 3.0 and 4.0 for further constituent information). Geophysical logging along with available quick turnaround analysis ("quick turn") of two mobile contaminants (^{99}Tc and nitrate) will be used to aid in determining sample depths. After this information is obtained, meetings will be held with, or e-mails will be sent to, representatives from WRPS, DOE, ORP, DOE Richland Operations Office (RL), and Ecology, to gain a consensus on sample depths.

Because no staff attending the September 26, 2012 meeting had been to TX Farm in some time, a field trip was arranged with the same participants to visit the site to ensure that the recommended locations were accessible. That field trip occurred on the morning of September 18, 2012, with a follow-up meeting in the afternoon (refer to Appendix B for meeting minutes). At the field trip it was recognized that the direct push close to tank TX-105 and UPR-200-W-100 (Site #1) could not be located as recommended because of the topography; three alternative sites (1A, 1B, and 1C) were identified. All other sites appeared accessible from the surface; however, it was noted that the sites might not be accessible due to underground infrastructure.

In December 2012 and January 2013, ground penetrating radar was performed and evaluated. Ground penetrating radar results indicate that locations 2 through 8 are accessible. Ground

penetrating radar results also indicate that location 1B is the most accessible of the 1 locations (i.e., 1A, 1B, 1C – refer to Appendix B for location map). This was identified in the January 16, 2013 meeting with WRPS, Ecology and DOE-ORP. In this meeting, it was also agreed that 1B would be referred to as 1 (refer to Appendix C for meeting minutes). Table 1-1 identifies the eight location numbers and the general logic for selecting these direct push locations. Figure 1-2 shows the results from ground penetrating radar and the general locations for the first eight pushes.

Table 1-1. Direct Push Location Strategy for 241-TX Tank Farm. (2 sheets)

Site #	Approximate Location	Input Factors Associated with Location[a] **Reason for Sampling with Respect to Interim Measure**
1	Southeast of tank 241-TX-105 (TX-105)	• Tank TX-105 currently designated as a leaker (at least 150,000 gal) • Nearby diversion boxes and pipelines • Process records indicate it was overfilled in 1952 and between 1961 and 1964 • Gross gamma activity detected in drywells 51-05-01, 51-05-03, and 51-05-05 on East – Southeast side of tank • UPR-200-W-100 is also to the east of tank TX-105 **Further assess the path and inventory of tank TX-105 and UPR-200-W-100 releases (see Figure 2-4 for uranium plume map[b])**
2	Southwest of tank 241-TX-101	• Releases associated with tank TX-105 and UPR-200-W-100 appear to be trending to the southwest (see Figure 2-4[b]) • Tc-99 groundwater plume is to the south of 241-TX Tank Farm (TX Farm) (see Figure 2-10[b]) **Further assess the nature and depth of migration of releases near tank TX-105 and UPR-200-W-100; also to attempt to define a boundary for the migration**
3	South of tank 241-TX-103	• Tank 241-TX-107 currently designated as a leaker (1,300 gal) • Noted Co-60 and Eu-154 activity in drywells 51-07-07 and 51-07-18, and in drywells between tanks 241-TX-107 and 241-TX-103 • Tc-99 groundwater plume is to the south of TX Farm (Figure 2-10[b]) **Confirm Previous Results: Gather additional data to assist in determining nature and extent of contamination (i.e., Tc-99) south of the TX Farm tanks, also to attempt to define boundary to vadose zone contamination**
4	South of tank 241-TX-104	• Tank 241-TX-104 currently designated as sound pending further evaluation • Uranium vadose zone plume to the east and south of tank 241-TX-104; may be the result of a transfer line or cascade line leak • Tc-99 groundwater plume is to the south of TX Farm (Figure 2-10[b]) **Confirm Previous Results: Gather additional data to assist in determining nature and extent of contamination (i.e., Tc-99) south of the TX Farm tanks, also to attempt to define boundary to vadose zone contamination**

Table 1-1. Direct Push Location Strategy for 241-TX Tank Farm. (2 sheets)

Site #	Approximate Location	Input Factors Associated with Location[a] **Reason for Sampling with Respect to Interim Measure**
5	In between tanks 241-TX-108 and 241-TX-112 and slightly to the west of the centerline between these tanks	• Higher conductivity area based on resistivity information in this area (Figure 2-9[b]) **Explore surface geophysical exploration (SGE) anomaly close to tanks 241-TX-108 and 241-TX-112. Gather data to assist in determining nature and extent of contamination (i.e., Tc-99).**
6	In between tanks 241-TX-115 (TX-115) and 241-TX-118 and to the NW of tank TX-115	• Tank TX-115 was declared "questionable integrity" in 1977 based on gamma activity in drywell 51-15-04 and arbitrarily assigned a leak volume of 8,000 gal • May have been overfilled in the early 1950s • SGE anomaly to the north and northwest of tank TX-115 **Explore SGE anomaly close to tanks TX-115 and 241-TX-118. Gather data to assist in determining nature and extent of contamination (i.e., Tc-99).**
7	North of tank 241-TX-117	• Tank 241-TX-117 was declared "questionable integrity" in 1977 based on gamma activity detected during scans of nearby vadose zone drywells and arbitrarily assigned a leak volume of 8,000 gal • Tc-99 in groundwater in this vicinity (Figure 2-10[b]) **Gather data to assist in determining nature and extent of contamination (i.e., Tc-99) and to attempt to define boundary to vadose zone contamination**
8	East of tank 241-TX-113 and 241-TX-116	• Tank 241-TX-113 was declared "questionable integrity" in 1977 based on gamma activity detected during scans of nearby vadose zone drywells and arbitrarily assigned a leak volume of 8,000 gal • Historical transfer records show that the tank 241-TX-113 was filled above the cascade outlet as a result of cascade plugging of the cascade lines and in-tank photographs show the waste level was well above the cascade line, indicating the potential for releases from the cascade lines or spare inlet ports • Tank 241-TX-116 was declared "questionable integrity" in 1977 based on gamma activity detected during scans of nearby vadose zone drywells and arbitrarily assigned a leak volume of 8,000 gal **Gather data to assist in determining nature and extent of contamination (i.e., Tc-99) and to attempt to define boundary to vadose zone contamination**

[a] Tank leak and pipeline failure information is provided in RPP-54073, *TX Tank Farm Leak Inventory Assessment Meeting Summaries* and HNF-EP-0182, *Waste Tank Summary for Month Ending October 31, 2012.*

[b] Reference figures are provided in RPP-PLAN-53808, *200 West Area Tank Farms Interim Measures Investigation Work Plan.*

Note that in the January 16, 2013 meeting, it was also agreed upon that the locations of the additional four direct push boreholes will be determined following review of available results from the initial eight locations by WRPS, DOE and Ecology. The interagency agreement on the

final four borehole locations will be documented in meeting minutes that will be placed in the Administrative Record associated with the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989). The methodologies to be used and the constituents to be analyzed will be the same for the final four boreholes as the first eight.

Figure 1-1. Topography and Proposed Initial Direct Push Sites at 241-TX Tank Farm.

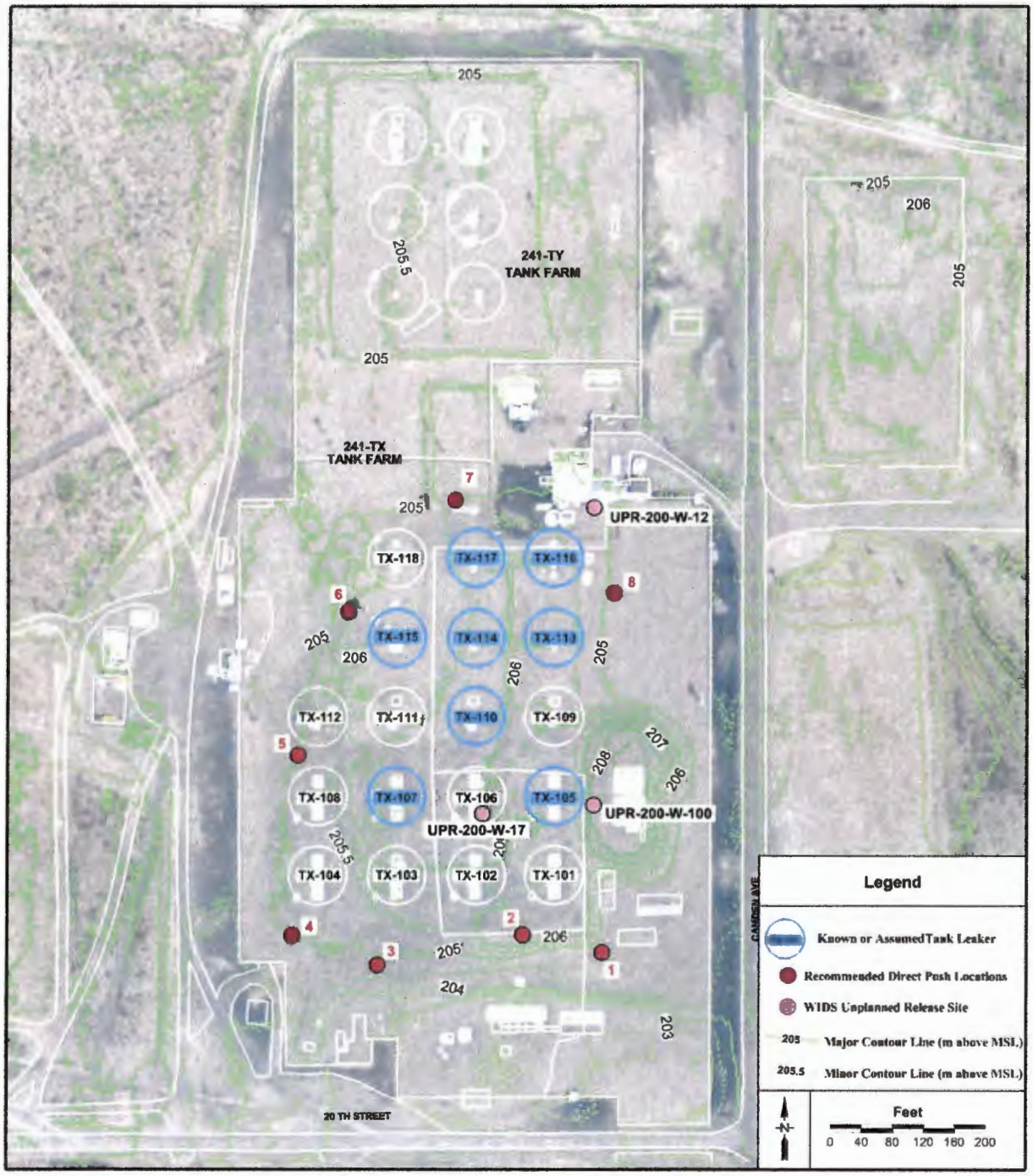
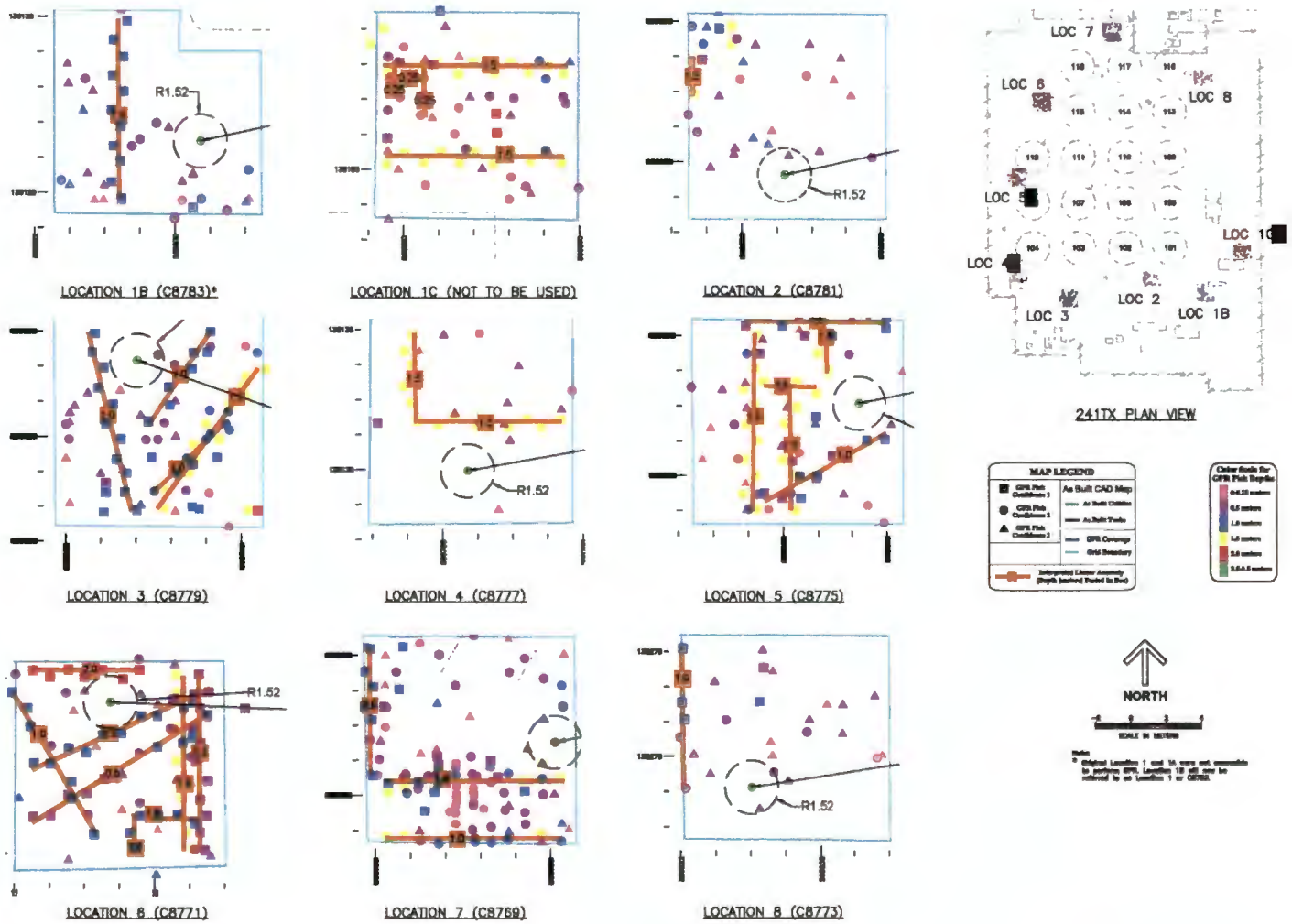


Figure 1-2. 241-TX Tank Farm Ground Penetrating Radar and Eight Direct Push Locations.



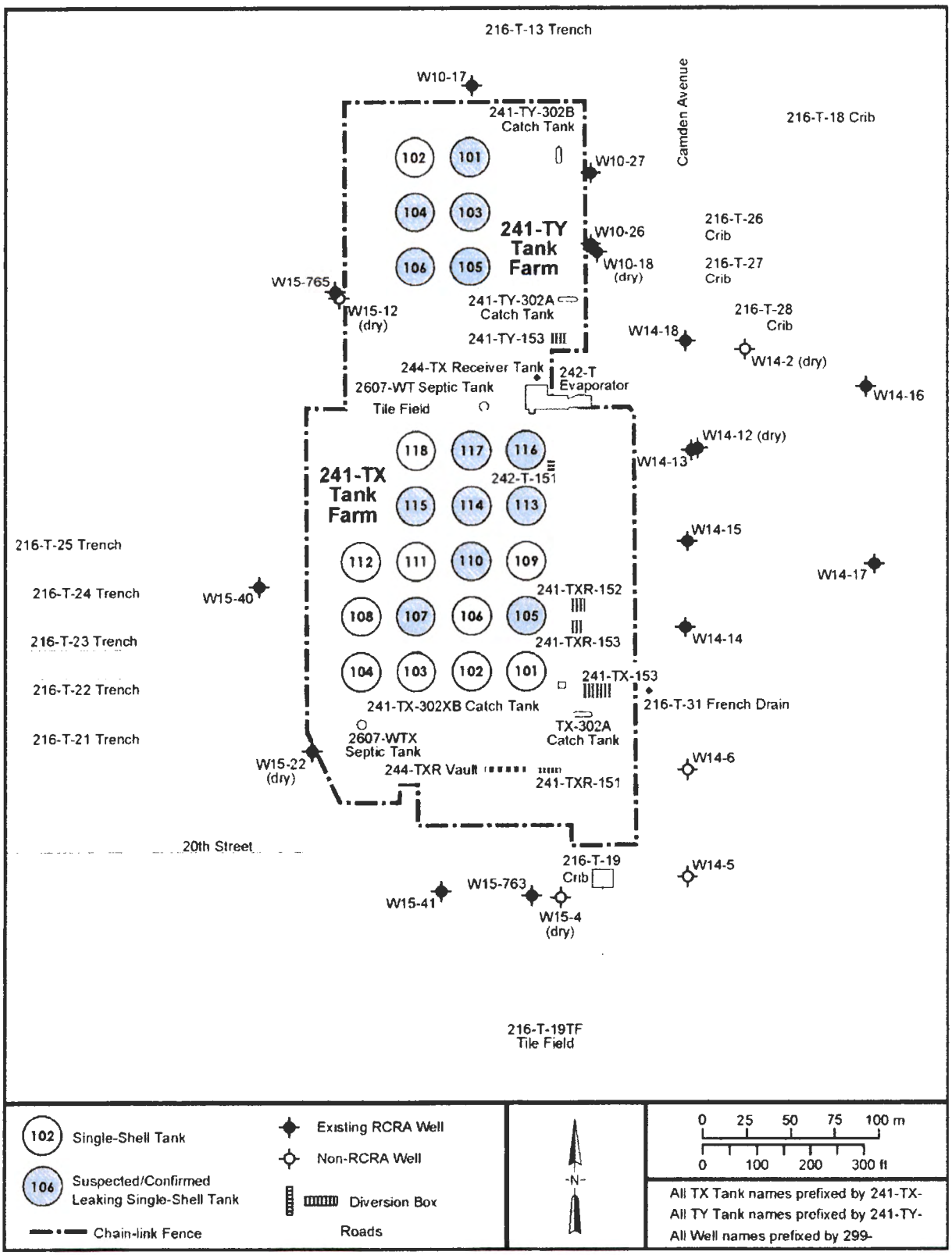
2.0 FACILITY DESCRIPTION

The TX Farm was constructed between 1947 and 1948 in the 200 West Area and consists of 18 100-series single-shell tanks, diversion boxes, pipelines, and other ancillary equipment (Figure 2-1). The tanks have a capacity of 758,000 gal, a diameter of 75 ft, and an operating depth of 23 ft. The tanks were used to store various waste types and constructed at different elevations with connecting overflow lines that allowed waste to cascade from tank to tank. The first two cascades (tanks 241-TX-101 through 241-TX-108) were filled with T Plant metal waste. During the 1950s, six of the tanks were sluiced until empty and started receiving Reduction-Oxidation (REDOX) (S Plant) waste. Tanks 241-TX-103 and 241-TX-108 were used for tributyl phosphate waste after sluicing. These tanks were used as evaporator bottoms waste feeder tanks and recycled for the 242-T Evaporator in later years. The third cascade (tanks 241-TX-109 through 241-TX-112) stored first-cycle decontamination waste before use with the 242-T Evaporator. The last six tanks were not used until the early 1950s, and were used in combination with the 242-T Evaporator, as feed, bottoms and recycle waste tanks.

A full description of the TX Farm history, equipment, soil, and groundwater is provided in RPP-PLAN-53808 and RPP-ENV-53773. The TX Farm has been completely interim stabilized and isolated. All raw water is cut off at the farm edge; however, minimal air and electrical supplies remain within the tank farm.

Figure 2-1 shows the layout of WMA TX-TY. Note that the WMA boundary identified in Figure 2-1 is associated with groundwater monitoring and is essentially the perimeter fence, which is a security construct. The WMA for closure and corrective measures may include areas beyond the current perimeter fence(s) that have been affected by releases from single-shell tanks or ancillary equipment (e.g., pipeline breaks outside the fence line).

Figure 2-1. Waste Management Area TX-TY and Surrounding Facilities.



3.0 SAMPLING REQUIREMENTS

All field sampling activities shall be conducted in accordance with this SAP and the appropriate procedures and work packages. Soil sampling services for this work will be contracted through the CH2M HILL Plateau Remediation Company (CHPRC) or performed by WRPS sampling personnel (e.g., nuclear chemical operators). The soil sampling personnel shall follow CHPRC or WRPS sampling protocols and procedures, which cover items such as cleaning of sampling devices, chain of custody, etc.

3.1 SOIL SAMPLING TECHNIQUE, STRATEGY, AND DESIGN

This section provides details about sampling techniques, strategy, and design.

3.1.1 Sampling Technique

Sampling at TX Farm will be conducted using a hydraulic hammer direct push rig technology using the dual-string sampling system, which 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 ~10% more than the targeted sample interval in order to secure the material in the sampler.

The sampler body holds three stainless steel liners. 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 "dummy" tip is reattached to the inner string and returned to 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.

Upon completion of the final sample extraction, or upon meeting refusal, the dummy tip or sampler is removed, and the borehole is decommissioned per requirements of *Washington Administrative Code* 173-160, "Minimum Standards for Construction and Maintenance of Wells."

3.1.2 Sampling Strategy and Design

As indicated in the scope of this effort (Section 1.2), the first eight locations were selected for the reasons identified in Table 1-1. The probe locations will be drilled to depths of ~130 ft bgs or refusal, and soil samples will be collected at an average of three depths from each location. Three depths were chosen to assist in defining the extent of the vertical boundaries of

contamination in TX Farm. Note that if additional sampling is warranted, more samples (i.e., more than three per location) may be collected. Sampling strategy at each direct push site is summarized as follows.

- A minimum of two direct push probe holes will be completed at each location. The initial probe hole will be logged for both gross gamma and neutron moisture (i.e., geophysical logging). Following logging, deep electrodes will be installed for possible future SGE, and the hole will be decommissioned per *Washington Administrative Code* 173-160. The second push will be for soil sampling.

- The depth of the first probe hole will be ~130 ft bgs or refusal (whichever comes first).

- Deep electrodes will be placed near the bottom of the initial probe hole and at 20-ft intervals up to ~40 ft bgs. Five to nine electrode intervals will be available in each probe hole.

- The depth for sampling individual horizons will be selected by reviewing the gamma and moisture logs of the first probe hole and the following information: any leak loss inventory information pertinent to the site, geologic summary of the area, operational history, historical characterization data at that site, and available "quick turn" (^{99}Tc and nitrate) data. Note that ^{99}Tc and nitrate "quick turn" data may become available from some of the probe holes identified in this plan as the work progresses. As the data becomes available, it may be used to help select sample depths for later probe hole locations. The sampling horizons will be selected in meetings with or via e-mails to WRPS, DOE-ORP, DOE-RL, CHPRC and Ecology.

Note: Depths are subject to constraints in the field and may be modified if necessary.

3.2 SAMPLE COLLECTION, HANDLING, AND SHIPPING

As previously indicated, the dual-string sampler used to collect soil samples 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. The material in the shoe shall be collected in a 500-mL glass jar. Stainless steel liner A is the liner closest to the shoe. The next or middle liner is liner B, and the topmost stainless steel liner is liner C. Each liner needs to be marked to indicate its bottom (labeled B) and top (labeled T) to signify the position of the sample prior to shipping and transport.

Trained sampling personnel document recovery, sample condition, and volume recovery percent. They then package and transport the sample under chain-of-custody control to the laboratory for analysis.

Analysis methods and holding times for radiological and chemical analytes are shown in Table 3-1. Sample preservation and containers are also discussed in the footnotes to Table 3-1. Field quality control (QC) samples, specifically equipment rinsates (blanks) and field blanks will

be collected to evaluate the potential for cross-contamination and laboratory performance. Sample preservation, containers, and holding times for the field QC samples are shown in Table 3-2.

Soil samples shall be maintained and shipped at/or below 6 °C as specified in Tables 3-1 and 3-2. 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 may be stored and transported in shielded shipping containers that may not allow the samples to be maintained below 6 °C. Samples not meeting temperature or holding time requirements will be identified as they occur and discussed in the laboratory data report. The impact on subsequent use or interpretation of these data will be evaluated by the WRPS personnel.

Radiological control technician(s) will measure the dose rates of each sample container (i.e., jar and liners). The radiological control technician(s) also will measure radiological activity on the outside of the sample container (through the container) and will document the highest contact radiological reading in millirem per hour. This information, along with other data, will be used to select proper packaging, marking, labeling, and shipping paperwork in accordance with U.S. Department of Transportation regulations [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.

3.3 SAMPLE IDENTIFICATION

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

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

Due to space limitation on sample labels, it is not possible to list all analytes; however, the laboratory is provided all necessary information to complete analysis. This information is provided in Section 4.0, which identifies the full list of analytes, appropriate analysis methods, and additional analysis information (e.g., detection limits).

Table 3-1. Soil Sampling Requirements for 241-TX Tank Farm[a]. (2 sheets)

Analysis Type	Primary Analysis	Constituent	Holding Time
"Quick Turn"	ICP/MS	Technetium-99	6 months
	9056 Ion chromatography	Nitrate	48 hours after digestion
	9045	pH	24 hours (or as soon as possible)
	9050	Conductivity	28 days
Standard	6010 ICP/AES	Aluminum, Barium, Beryllium, Calcium, Chromium, Copper, Iron, Lead, Lithium, Manganese, Magnesium, Molybdenum, Phosphorous, Potassium, Sodium, Strontium, Zinc, Boron, Bismuth, Cerium, Europium, Lanthanum, Neodymium, Niobium, Palladium, Praseodymium, Rubidium, Rhodium, Ruthenium, Samarium, Silicon, Tin, Sulfur, Tantalum, Tellurium, Thorium, Titanium, Tungsten, Yttrium, Zirconium	6 months
	6020 ICP/MS	Antimony, Arsenic, Cadmium, Cobalt, Nickel, Selenium, Silver, Thallium, Uranium[b], Vanadium	6 months
	7471 Cold vapor atomic absorption	Mercury	28 days
	9056 Ion chromatography	Fluoride, Nitrite, Nitrate, Chloride, Sulfate, Acetate, Formate, Glycolate, Oxalate, Bromide, Phosphate	28 days/48 hours[c]
	Ion chromatography EPA 300.7	Ammonium	7 days to distillation/28 days for preserved distillate
	9014 Spectrophotometric	Cyanide	14 days
	Gamma energy analysis	Cesium-137, Cobalt-60, Antimony-125, Europium-152, Europium-154, Europium-155, Thorium-228, Thorium-234	6 months
	Low energy gamma counting	Iodine-129	6 months
	ICP/MS	Techenetium-99, Tin-126, Uranium-233, Uranium-234, Uranium-235, Uranium-236, Uranium-238, Neptunium-237, Thorium-230, Thorium-232	6 months
	Liquid scintillation	Carbon-14, Tritium, Nickel-63, Selenium-79	6 months

Table 3-1. Soil Sampling Requirements for 241-TX Tank Farm[a]. (2 sheets)

Analysis Type	Primary Analysis	Constituent	Holding Time
Standard	Alpha energy analysis	Plutonium-238, Plutonium-239/240, Americium-241, Curium-242, Curium-243/244	6 months
	Beta proportional counting	Strontium-90	6 months
	Gravimetric	Percent solids	None
	Gravimetric	Percent water	None
	Gravimetric	Bulk density	None

[a] Sampling personnel will place the shoe material in a 500-mL glass bottle. The samples will be cooled to ≤ 6 °C. Available material from the shoe and liners (A, B, and C) are composited by the laboratory and the composited material is used in the "quick turn" and standard analysis.

[b] Uranium analysis will be met through the uranium-238 analysis.

[c] 48-hour hold time (after preparation) is for nitrate, nitrite, and phosphate.

EPA = U.S. Environmental Protection Agency
ICP/AES = inductively coupled plasma/atomic emission spectroscopy
ICP/MS = inductively coupled plasma/mass spectroscopy

Reference: EPA/600/S4-86/024, 1986, *Development of Standard Methods for the Collection and Analysis of Precipitation*, "Method 300.7, Dissolved Sodium, Ammonium, Potassium, Magnesium, and Calcium in Wet Deposition by Chemically Suppressed Ion Chromatography," U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Office of Research and Development, Cincinnati, Ohio.

Table 3-2. Field Quality Control Requirements for 241-TX Tank Farm[a].

Primary Analysis Method	Constituent	Container	Preservative	Holding Time
6010 Inductively coupled plasma/atomic emission spectroscopy	Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Lithium, Magnesium, Manganese, Molybdenum, Nickel, Phosphorous, Potassium, Selenium, Silver, Sodium, Strontium, Thallium, Vanadium, Zinc, Boron, Bismuth, Cerium, Europium, Lanthanum, Neodymium, Niobium, Palladium, Praseodymium, Rubidium, Rhodium, Ruthenium, Samarium, Silicon, Tin, Sulfur, Tantalum, Tellurium, Thorium, Titanium, Tungsten, Yttrium, Zirconium, Uranium[b]	Glass/plastic 500 mL	HNO_3 to pH<2	6 months (28 days for Mercury)
Inductively coupled plasma/ mass spectroscopy	Technetium-99, Tin-126, Uranium-233, Uranium-234, Uranium-235, Uranium-236, Uranium-238, Neptunium-237, Thorium-230, Thorium-232			
7470 Cold vapor atomic absorption	Mercury			
Ion chromatography EPA 300.7	Ammonium	Glass/plastic 250 mL	H_2SO_4 to pH<2/ Cool to 6 °C	7 days
9056 Ion chromatography	Fluoride, Nitrite, Nitrate, Chloride, Sulfate, Acetate, Formate, Glycolate, Oxalate, Bromide, Phosphate	Glass/plastic 500 mL	Cool to 6 °C	28 days/ 48 hours[c]
9014 Spectrophotometric	Cyanide	Glass/plastic 60 mL	NaOH to pH≥12/ Cool to 6 °C	14 days
Gamma energy analysis	Cesium-137, Cobalt-60, Antimony-125, Europium-152, Europium-154, Europium-155, Thorium-228, Thorium-234	Glass/plastic 2×1,000 mL	HNO_3 to pH<2	6 months
Alpha energy analysis	Plutonium-238, Plutonium-239/240, Americium-241, Curium-242, Curium-243/244			
Liquid scintillation	Nickel-63, Selenium-79			
Beta proportional counting	Strontium-90			
Liquid scintillation	Carbon-14, Tritium	Glass/plastic 1,000 mL	None	6 months
Low energy gamma counting	Iodine-129			

[a] Percent moisture, percent solids, conductivity, pH, and bulk density will not be measured/analyzed on field quality control samples.

[b] Uranium analysis will be met through the uranium-238 analysis.

[c] 48-hour hold time (after preparation) is for nitrate, nitrite, and phosphate.

Reference: EPA 600/S4-86/024, 1986, *Development of Standard Methods for the Collection and Analysis of Precipitation*, "Method 300.7, Dissolved Sodium, Ammonium, Potassium, Magnesium, and Calcium in Wet Deposition by Chemically Suppressed Ion Chromatography," U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Office of Research and Development, Cincinnati, Ohio.

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

3.4 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:

- Project name
- Signature of the collector
- Date and time of collection
- Sample type (e.g., soil)
- Sample preservation information
- Requested analysis or provide a reference for sample analysis
- Signatures of persons involved in the chain of possession
- Date and time relinquished to the laboratory
- Unique HEIS sample identification number assigned to the sample
- Sample location (direct push hole number and depth of collection)
- A notation of pertinent sampling information including unusual characteristics or sampling problems
- A brief description of the sample matrix, such as color or consistency, if possible.

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

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4.0 SAMPLE 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 will verify the identification number on each sample container and ensure it matches the sample seal on the sample container and the chain of custody. Laboratory sample identification numbers will be affixed to each container that is retained past initial receipt. Residual sample material remaining after analysis will be maintained in refrigerated storage until directed otherwise by the Primary Laboratory Contact.

After the samples are received at the laboratory, the samples will be prepared and analyzed in accordance with this SAP. Table 4-1 identifies the following information:

- Constituent (analyte)
- Required detection limit and/or target detection limit
- Primary and alternate analytical method including preparation information
- Quality control acceptance requirements for the various primary methods.

"Quick turn" constituents are bolded in Table 4-1. In addition to the required constituents listed in Table 4-1, the analytical methods are capable of detecting other constituents. Although not required, other constituents will be reported in the data package if they are detected.

Section 4.1 provides sample handling and preparation requirements and analytical requirements. Direction for addressing insufficient sample recovery is provided in Section 4.2. The laboratory shall use the least possible dilution to obtain the lowest practical detection limits for all requested analytes.

Table 4-1. Analytical Requirements for 241-TX Tank Farm. (6 sheets)

Constituent	Required Detection Limit (Target Detection Limit)[a, b]	Analytical Method (prep)	Alternate Method (prep)	QC Acceptance Requirements[c, d]		
				LCS % Recovery	Spike % Recovery	% RPD
Aluminum – Al	5 (5)	6010 ICP/AES (acid)	6020 ICP/MS (acid)	80-120%	75-125%	≤30%
Barium – Ba	10.2 (20)					
Beryllium – Be	1 (0.5)					
Calcium[e] – Ca	- (-)					
Chromium – Cr	0.15 (1)					
Copper – Cu	5 (1)					
Iron – Fe	- (5)					
Lead – Pb	5 (5)					
Lithium[e] – Li	3.5 (-)					
Manganese – Mn	110 (1.9)[f]					
Magnesium[e] – Mg	- (-)					
Molybdenum[e] – Mo	4 (19)[f]					
Phosphorus[e] – P	- (-)					
Potassium[e] – K	- (-)					
Sodium[e] – Na	- (-)					
Strontium – Sr	- (1)					
Zinc – Zn	8.6 (1)					
Boron – B	6 (-)		NA			
Bismuth – Bi	- (-)					
Cerium – Ce	- (-)					
Europium – Eu	- (-)					
Lanthanum – La	- (-)					

Table 4-1. Analytical Requirements for 241-TX Tank Farm. (6 sheets)

Constituent	Required Detection Limit (Target Detection Limit)[a, b]	Analytical Method (prep)	Alternate Method (prep)	QC Acceptance Requirements[c, d]		
				LCS % Recovery	Spike % Recovery	% RPD
Neodymium – Nd	- (-)	6010 ICP/AES (acid)	NA	80-120%	75-125%	≤30%
Niobium – Nb	- (-)					
Palladium – Pd	- (-)					
Praseodymium – Pr	- (-)					
Rubidium – Rb	- (-)					
Rhodium – Rh	- (-)					
Ruthenium – Ru	- (-)					
Samarium – Sm	- (-)		6020 ICP/MS (acid)			
Silicon – Si	- (-)					
Tin – Sn	6 (-)					
Sulfur – S	- (-)					
Tantalum – Ta	- (-)					
Tellurium – Te	- (-)					
Thorium – Th	- (-)					
Titanium – Ti	- (-)					
Tungsten – W	- (-)					
Yttrium – Y	- (-)					
Zirconium – Zr	- (-)					
Antimony – Sb	0.5 (1)	6020 ICP/MS (acid)	6010 ICP/AES (acid)	80-120%	75-125%	≤30%
Arsenic[g] – As	0.7 (1)					
Cadmium – Cd	0.4 (0.5)					
Cobalt – Co	2 (2)					

Table 4-1. Analytical Requirements for 241-TX Tank Farm. (6 sheets)

Constituent	Required Detection Limit (Target Detection Limit)[a, b]	Analytical Method (prep)	Alternate Method (prep)	QC Acceptance Requirements[c, d]		
				LCS % Recovery	Spike % Recovery	% RPD
Nickel – Ni	3 (4)	6020 ICP/MS (acid)	6010 ICP/AES (acid)	80-120%	75-125%	≤30%
Selenium[h] – Se	0.03 (1)					
Silver – Ag	0.2 (2)					
Thallium – Tl	0.1 (0.5)					
Uranium[i] – U	0.5 (1)					
Vanadium – V	0.2 (2.5)					
Mercury – Hg	0.01 (0.2)	7471 Cold vapor atomic absorption (acid)	6020 ICP/MS (acid)	80-120%	75-125%	≤30%
Ammonium – NH_4^+	- (0.5)	Ion Chromatography EPA 300.7 (distillation)	NA	80-120%	75-125%	≤30%
pH	-	9045	NA	± 0.1 pH units	NA	NA
Fluoride – F^-	20 (5)	Ion Chromatography 9056 (water)	NA	80-120%	75-125%	≤30%
Nitrite – NO_2^-	- (2.5)					
Nitrate – NO_3^-	- (2.5)					
Chloride – Cl^-	- (0.3)[f]					
Sulfate – SO_4^{-2}	- (2.7)[f]					
Acetate – $C_2H_3O_2^-$	- (4.5)[f]					
Formate – CHO_2^-	- (10.0)[f]					
Glycolate – $C_2H_3O_3^-$	- (3.8)[f]					
Oxalate – $C_2O_4^{-2}$	- (2)[f]					
Bromide[j] – Br	1 (-)					
Phosphate – PO_4^{-3}	- (-)					

Table 4-1. Analytical Requirements for 241-TX Tank Farm. (6 sheets)

Constituent	Required Detection Limit (Target Detection Limit)[a, b]	Analytical Method (prep)	Alternate Method (prep)	QC Acceptance Requirements[c, d]		
				LCS % Recovery	Spike % Recovery	% RPD
Cyanide – CN^-	- (0.5)	9014 Spectrophotometric (distillation)	9012 Colormetric	80-120%	75-125%	≤30%
Cesium-137 – Cs^{137}	2.1 (0.1)	Gamma energy analysis (direct)	NA	80-120%	N/A	≤30%
Cobalt-60 – Co^{60}	69 (0.05)					
Antimony-125 – Sb^{125}	350 (0.3)					
Europium-152 – Eu^{152}	150 (0.1)			NA	NA	≤30%
Europium-154 – Eu^{154}	130 (0.1)					
Europium-155 – Eu^{155}	1,600 (0.1)					
Thorium-228 – Th^{228}	53 (1)			NA	NA	NA
Thorium-234 – Th^{234}	- (-)			NA	NA	≤30%
Iodine-129 – I^{129}	570 (2)	Low energy gamma counting (fusion)	NA	80-120%	NA	≤30%
Technetium-99 – Tc^{99}	450 (1)	ICP/MS (water)	Liquid scintillation (water)	80-120%	75-125%	≤30%
Technetium-99 – Tc^{99}	450 (20)	ICP/MS (acid)	Liquid scintillation (acid)	80-120%	75-125%	≤30%
Tin-126 – Sn^{126}	- (-)		NA	80-120%	75-125%	≤30%
Uranium-233 – U^{233}	480 (1)			NA	NA	≤30%
Uranium-234 – U^{234}	510 (1)			NA	NA	≤30%
Uranium-235 – U^{235}	280 (1)			80-120%	75-125%	≤30%
Uranium-236 – U^{236}	- (-)			NA	NA	≤30%
Uranium-238 – U^{238}	160 (1)			80-120%	75-125%	≤30%
Neptunium-237 – Np^{237}	390 (1)		Alpha energy analysis (acid)	80-120%	75-125%	≤30%

Table 4-1. Analytical Requirements for 241-TX Tank Farm. (6 sheets)

Constituent	Required Detection Limit (Target Detection Limit)[a, b]	Analytical Method (prep)	Alternate Method (prep)	QC Acceptance Requirements[c, d]		
				LCS % Recovery	Spike % Recovery	% RPD
Thorium-230 – Th^{230}	1,000 (1)	ICP/MS (acid)	NA	NA	NA	≤30%
Thorium-232 – Th^{232}	150 (1)			80-120%	75-125%	≤30%
Carbon-14 – C^{14}	480 (1)	Liquid scintillation (water)	NA	80-120%	75-125%	≤30%
Tritium – H^{3}	17,000 (30)	Liquid scintillation (water)	NA	80-120%	75-125%	≤30%
Nickel-63 – Ni^{63}	4.67E7 (30)	Liquid scintillation (acid)	NA	80-120%	NA	≤30%
Selenium-79 – Se^{79}	- (10)			Not performed	NA	≤30%
Plutonium-238 – Pu^{238}	530 (1)	Alpha energy analysis (acid)	ICP/MS (acid)	NA	NA	≤30%
Plutonium-239/240 – $Pu^{239/240}$	610 (1)			80-120%	NA	≤30%
Americium-241 – Am^{241}	390 (1)					
Curium-242 – Cm^{242}	210 (1)					
Curium-243/244[k] – $Cm^{243/244}$	410 (1)					
Strontium-90 – Sr^{90}	2.3 (1)	Beta proportional counting (acid)	NA	80-120%	NA	≤30%
Percent water	- (-)	Gravimetric	NA	80-120%	NA	≤30%
Percent solids	- (-)	Gravimetric	NA	NA	NA	NA
Conductivity	- (-)	9050	NA	NA	NA	NA
Bulk density	- (-)	Gravimetric	NA	NA	NA	≤30%

Note: All analyses are performed on composite samples. Data packages will be provided by the laboratory in Format VI. "Quick turn" analyses (excluding pH and conductivity) will be provided via e-mail to the Characterization Lead but will also be available in the data package for loading into Hanford Environmental Information System.
Bold constituents are "quick turn" constituents.
Italicized constituents are considered secondary constituents per RPP-23403, *Single-Shell Tank Component Closure Data Quality Objectives.*

[a] Detection limits for non-radiological constituents are in mg/kg and detection limits for radiological constituents are in pCi/g.
[b] "–" indicates that there is no required detection limit and/or target detection limit. If there is no required detection limit or target detection limit, then the laboratory will use the associated method detection limit.

Table 4-1. Analytical Requirements for 241-TX Tank Farm. (6 sheets)

Constituent	Required Detection Limit (Target Detection Limit)[a, b]	Analytical Method (prep)	Alternate Method (prep)	QC Acceptance Requirements[c, d]		
				LCS % Recovery	Spike % Recovery	% RPD

[c] Laboratory quality acceptance requirements are based on RPP-43551, *Tank Farm Interim Barrier Data Quality Objectives*, RPP-RPT-38152, *Data Quality Objectives Report Phase 2 Characterization for Waste Management Area C RCRA Field Investigation/Corrective Measures Study*, and ATL-MP-1011, *ATL Quality Assurance Project Plan for 222-S Laboratory*. The laboratory quality control samples will be analyzed at a frequency of no less than 1 of 20 samples (1 per batch) with the following exceptions:

- Duplicates are not applicable (NA) for Hg analysis.
- Matrix spikes are NA for percent water, percent solids, constituents analyzed per gamma energy analysis, pH, conductivity, Sr-90, Am-241, isotopic curiums and plutoniums, Ni-63, and Se-79.
- Matrix spike duplicates are NA for all analyses except Hg analysis.
- Blanks are NA for percent water, percent solids, and pH.
- Laboratory control samples are NA for percent water, percent solids analyses, Sn-126, Th-230, U-234, U-236, isotopic Cm, and Se-79.
- The LCS for gamma energy analysis contains only Cs-137 and Co-60.

[d] Secondary analytes will be reported when detected. All QC failures associated with secondary analytes will be discussed in the report narrative and qualified appropriately in the data package. Note that if there are QC failures associated with secondary analytes, reanalysis will not be required. The laboratory is not required to report secondary constituents if they believe the results are invalid (i.e., false positive or false negative).

[e] With respect to RPP-23403, 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.

[f] Target detection limit for this constituent is not specified in D&D-30262, *Data Quality Objectives Summary Report for the 200-IS-1 Operable Unit Pipelines and Appurtenances*. It is based on detection limits achieved in the analyses of soil samples taken near tank 241-S-102 (RPP-RPT-36439, *Final Report for the Contaminated Soil Samples at Tank 241-S-102 in Support of the Type A Investigation of the Tank Waste Spill*).

[g] The detection limit for arsenic is based on arsenic III (0.7 mg/kg).

[h] The laboratory is currently unable to meet the required detection limit for Se. At best, they are able to achieve 0.2 μg/g; however, they will continue to try to achieve lower detection limits.

[i] Uranium analysis will be met through the U-238 analysis.

[j] The detection limit for bromide is based on bromine (1 mg/kg).

[k] Curium-243/244 detection limit is based on Curium-244.

EPA = U.S. Environmental Protection Agency
ICP/AES = inductively coupled plasma/atomic emission spectroscopy
ICP/MS = inductively coupled plasma/mass spectroscopy
LCS = laboratory control sample
NA = not applicable
QC = quality control
RPD = relative percent difference

4.1 DIRECTION FOR SAMPLE HANDLING AND PREPARATION

The following steps shall be performed on each sample, as soon as the sample from the last interval for each probe hole has been received (batching will be done per probe hole). The steps shall be performed within one probe hole in the order in which they were taken.

A. Remove sample material from each liner (Liners A, B and C) and the shoe, then place each in a separate plastic tray. Sample material from the liners may be removed 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 hydraulic extruder, scoop, or spatula to dislodge the sediment from the tube. Document the samples photographically, immediately after extrusion. 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. Note that bulk density is measured for each liner.

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

C. Subsample a representative portion (10 to 15 g) of the composited material and place into a pre-weighed jar on a calibrated balance, as soon as possible after extrusion and compositing. Place the jar with sample in an oven set to 105 °C overnight. Cool the sample and weigh; calculate the percent moisture content by weight. Return the sample to the oven for at least 2 hours of additional heating. Reweigh the sample after cooling and calculate the cumulative weight loss. Repeat this process with additional weighing until a constant weight is achieved (less than 0.01 g change on successive weighing). 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 the composited material to perform the required "quick turn" analysis specified in Table 4-1 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 will be mathematically corrected prior to reporting results, once the percent moisture results are complete. Approximately a 3-mL aliquot of the unfiltered 1:1 sediment.

E. Perform analysis for nitrate, conductivity and ^{99}Tc on the 1:1 water digest. The nitrate and ^{99}Tc results are to be reported to the Primary Laboratory Contact within an expedited time frame, typically within one week of sample receipt at 222-S Laboratory. If requested by the Primary Laboratory Contact, the data will be provided within 48 hours. Standard laboratory QC requirements are applied to these analyses (i.e., laboratory blank, laboratory control sample, and duplicate). pH is also a quick turn constituent that is

analyzed via method 9045. The pH and conductivity results will be held and reported in the standard data package.

F. Subsample sufficient amount of the composited material to perform all remaining analyses identified in Table 4-1.

The required methods of analysis for analytes are identified in Table 4-1 and are methods included in SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, Third Edition as amended. It will be necessary for the laboratory to contact the Primary Laboratory Contact to deviate from the methods identified in Table 4-1. It is understood that the laboratory analytical procedures may have changes to the SW-846 methods to accommodate analysis of samples that are contaminated with Hanford tank waste and/or to reduce radiological exposure to the analysts. It is also understood that those changes and their effect on method performance will be and 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 QA or DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Documents* (HASQARD) requirements for documenting procedure modifications should also be followed.

4.2 INSUFFICIENT RECOVERY OF SAMPLE MATERIAL

If the quantity of sample material is insufficient to perform the analyses requested in this SAP, the laboratory shall notify the Primary Laboratory Contact within 1 working day. The Primary Laboratory Contact will identify the analyses priority based on available sample material and discussion with project personnel (e.g., Project Manager). Any analyses prescribed by this SAP, but not performed, shall be identified in the data report and through the change notice process described in Section 7.0, Change Control.

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5.0 QUALITY ASSURANCE AND QUALITY CONTROL

DOE/RL-96-68 identifies the quality requirements for environmental data collection, including sampling, field measurements, and laboratory analysis, and complies with the requirements of:

a) DOE O 414.1C, *Quality Assurance*

b) Title 10, *Code of Federal Regulations*, Part 830, "Nuclear Safety Management," Subpart A—Quality Assurance Requirements, § 830.120, "Scope" (10 CFR 830.120)

c) EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans EPA QA/R-5*.

Hanford onsite laboratories performing analyses in support of this SAP will have approved and implemented 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 QA program shall comply with *Quality Systems for Analytical Services* (QSAS), or be scheduled for DOE Consolidated Audit Program (DOECAP) certification. A commercial laboratory off the Hanford Site is subject to WRPS audit and QA Program approval.

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 SAP. 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, at a minimum, the following training before starting work:

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

- 8-hour hazardous waste worker refresher training (as required)

- Radiological worker training.

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

5.1 QUALITY CONTROL REQUIREMENTS 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 requires the collection of field duplicates, equipment rinsate blank, field blanks, and/or trip blank samples, where appropriate. This SAP requires equipment rinsates and field blanks. Field duplicates (i.e., samples taken at the same location), which are used to evaluate precision of the sampling process, will not be collected as it is not possible to obtain direct pushes exactly at the same location. Trip blanks, which are blank samples that travel with sample containers to the sampling site and return unopened to the laboratory with the samples, usually consist of carbon-free, deionized water. Trip blanks measure contamination during sample transport and are typically only analyzed for volatile organic compounds. Because there are no volatile organic compounds on the sample list (Tables 3-1 and 4-1), no trip blanks will be collected and analyzed for this SAP.

5.1.1 Equipment Rinsate Blanks

Sampling personnel from CHPRC or WRPS will prepare the equipment rinsates. Equipment rinsates are usually prepared after the sampling equipment is cleaned; they are used to verify the adequacy of sampling equipment decontamination procedures, and shall be collected for each sampling method or type of equipment used. Equipment rinsates shall consist of deionized water washed through decontaminated sampling equipment. Equipment rinsates are to be run every 20 samples for the analytes listed in Table 3-2, which also provides the list of the required sample bottles. The total number of samples for the first eight locations is expected to be 24 (8 locations with an average of 3 samples per location). Therefore, two equipment rinsates are expected to be collected for these locations. The total number of samples for the next four locations is expected to be 12 (4 locations with an average of 3 samples per location). Therefore, one equipment rinsates is expected to be collected for these locations.

5.1.2 Field Blanks

Sampling personnel from CHPRC or WRPS will prepare the field blanks. Field blanks are samples prepared in the field at the sample collection site and returned to the laboratory with the samples to be analyzed. They are primarily used to test for contamination from the atmosphere. Field blanks shall consist of deionized water. Field blanks are to be run every 20 samples for the analytes listed in Table 3-2, which also provides the list of the required sample bottles. The total number of samples for the first eight locations is expected to be 24 (8 locations with an average of 3 samples per location). Therefore, two field blanks are expected to be collected for these locations. The total number of samples for the next four locations is expected to be 12 (4 locations with an average of 3 samples per location). Therefore, one field blank is expected to be collected for these locations.

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.

- Improperly storing or transporting sampling equipment and sample containers.
- Contaminating the equipment or sample bottles by setting them on or near potential contamination sources, such as uncovered ground. Samples should not be collected or stored in the presence of exhaust fumes.
- 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 sampling personnel's gloves.
- Improperly decontaminating equipment before sampling or between sampling events.

5.2 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS FOR LABORATORY ANALYSIS

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 5-1. 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 5-1. Data Quality Definitions.

Data Quality Term	Definition
Representativeness	Representativeness is the degree to which data accurately and precisely represents a characteristic of a population, a parameter variation at a sampling point, a process condition, or an environmental condition.
Comparability	Comparability is the confidence with which one data set can be compared to another.
Accuracy	Accuracy represents the degree to which a measurement agrees with an accepted reference or true value.
Precision	Precision represents a measure of the degree of reproducibility of measurements under prescribed similar conditions.

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 at 222-S Laboratory by WRPS will be governed by ATS-MP-1032, *222-S Laboratory Quality Assurance Plan*. All analyses shall be performed in accordance with these requirements.

Laboratories performing analyses in support of this SAP shall have approved and implemented QA plans. These QA plans shall meet HASQARD minimum requirements as the baseline for laboratory quality systems.

The analytical/laboratory QC requirements (duplicates, spikes, etc.) are identified in Table 4-1. The laboratory shall also use calibration and calibration check standards appropriate for the analytical instrumentation being used (see HASQARD 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 Quality Assurance personnel 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.

5.2.1 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 that 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, spike duplicates are not required. Minimally, a duplicate and spike (or spike duplicate) is required per laboratory batch.

5.2.2 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 HASQARD.

Consumables, supplies, and reagents will be reviewed in accordance with SW-846 requirements and will be appropriate for their use.

6.0 DATA REPORTING

This section describes the laboratory reporting requirements for TX Farm soil samples. Section 6.1 identifies "quick turn" reporting requirements, and Section 6.2 identifies how all the analyses other than the "quick turn" will be reported. Note that "quick turn" constituents are bolded in Table 4-1, and secondary constituents are italicized. Secondary constituents will only be reported in the Format VI data package if they are detected.

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 SAP. The 222-S Laboratory will prepare a statement of work authorizing the subcontracted laboratory to perform the analyses. The statement of work shall be reviewed and approved by the Primary Laboratory Contact, the Quality Assurance personnel, and Data Management Lead prior to commencement of laboratory analysis.

6.1 "QUICK TURN" REPORTING

The "quick turn" ^{99}Tc and nitrate analyses will be reported as preliminary results on an expedited time frame (typically within one week of the last sample receipt batched together; however, upon request it will be reported within 48 hours). The results are transmitted via e-mail to the Primary Laboratory Contact, Characterization Task Lead, and Data Management Lead. They will also be reported in the standard data package so the information will be available to load into HEIS.

6.2 FORMAT VI REPORTING

Analysis performed at the 222-S Laboratory will be provided in Format VI data packages. Analysis performed at other laboratories will be provided in a format equivalent to a 222-S Laboratory Format VI report.

Format VI Report with QA Verification includes the following.

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

A Format VI data package is subject to internal laboratory QA verification and review including peer review prior to release.

The final data package will be provided to the Primary Laboratory Contact. The laboratory shall issue the data package within 180 calendar days following receipt of the last samples. Preliminary results shall be available within 90 days following receipt of the last sample. As indicated in Section 5.0, laboratory changes will be communicated to the Primary Laboratory Contact and documented in the laboratory report(s) narrative.

In addition to this data package, an electronic version of the analytical results, including tentatively identified compounds, shall be uploaded to HEIS within 28 calendar days of release of the data package. The electronic data shall be in the standard electronic format for HEIS [CP-15383, *Common Requirements of the Format for Electronic Analytical Data (FEAD)*].

Note that data will be made available electronically to Ecology (e.g., HEIS, data disks).

6.3 DATA VERIFICATION AND ASSESSMENT

The data quality verification and 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 is of the correct type and is 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, QA00 Update*.

It should be noted that both the laboratory and Closure and Corrective Measures organizations have data review, verification and/or validation procedures and plans (ATL-312, Section 8.07, *Data Review* and TFC-PLN-134, "Vadose Zone Data Management Plan"). DOE/RL-96-68 (HASQARD) also identifies data assessment requirements and specifications. Data associated with this project will undergo a thorough verification and assessment process as identified in the above plans and procedures.

7.0 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 circumstances. Changes to work scope may result in modifications to this SAP. Work scope changes that do not result in deviation from the SAP requirements can be made in the field or laboratory with the approval of the project manager or assigned task lead. These work scope changes will be documented in the sampling work package and/or Format VI laboratory report(s). Justification for the changes to work scope shall be provided in sufficient detail to understand the basis for the change. Alternately, if field or laboratory conditions result in substantial work scope changes, the SAP may be revised with DOE and Ecology approval.

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 to the SAP will be judged as they are identified to determine if revisions to the SAP will be necessary. Ecology, DOE, and its contractors will participate in the SAP update evaluation process and any subsequent revisions to the SAP.

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8.0 DOCUMENTS AND RECORDS

All information pertinent to field sampling 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 will be followed.

Logbooks are required for field activities. A logbook must be identified with a unique project name and number. The individual(s) responsible for logbooks will be identified in the front of the logbook, and only authorized persons may make entries in logbooks. Logbooks will be signed by the field manager, supervisor, cognizant scientist/engineer, or other responsible individual. Logbooks will be permanently bound, waterproof, and ruled with sequentially numbered pages. Pages will not be removed from logbooks for any reason. Entries will be made in indelible ink. Corrections will be made by marking through the erroneous entry with a single line, entering the correct information, and initialing and dating the changes.

The Project Manager is responsible for ensuring that a project file is properly maintained. The project file will contain the records or references to their storage locations. The project file will include the following, as appropriate:

- Field logbooks or operational records
- Data Forms
- Chain-of-custody forms
- Sample receipt records.

The laboratory will follow their own procedures with respect to documents and records. Audits will be periodically conducted by WRPS QA to ensure their practices are following requirements. All WRPS records are put into the Integrated Document Management System, the Hanford Site record repository.

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9.0 PROJECT ORGANIZATION

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 project organization is described in Table 9-1. Project management and QA may conduct random surveillance and assessments to verify compliance with the requirements outlined in this SAP, 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 WRPS policy and procedures. Management will be made aware of deficiencies identified by assessments and surveillances and subsequent corrective actions.

Table 9-1. Key Personnel. (3 sheets)

Title	Responsibility	Primary Contact	Alternate Contact
Project Manager	• Coordinates the preparation of data quality objectives, data requirements plans, work plans, Sampling and Analysis Plans, and Field Sampling and Analysis Plans, as required. • Coordinates with U.S. Department of Energy and Washington State Department of Ecology.	Dan Parker	Susan Eberlein
Characterization Task Lead	• Prepares Sampling and Analysis Plans and/or Field Sampling and Analysis Plans and documents required change notices, as necessary. • Coordinates with Field Team Lead to identify reporting schedule requirements. • Coordinates with team members to ensure that project requirements are understood. • Determines where quality control samples will be taken to meet plan requirements. • Reviews paperwork to ensure plan requirements are being achieved. • 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 laboratory or shipping center. • Reviews field paperwork to ensure that it has been completed correctly. • Directs training, mock-ups, and practice sessions to ensure that the sampling design is understood. • Identifies resources needed for sampling; develops and revises sampling procedures and training material; and performs training, as necessary. • Ensures equipment and materials (e.g., bottles) associated with sampling are available and ensures that equipment receives preventative maintenance as required.	Cindy Tabor	Harold Sydnor
Field Team Lead	• Develops information to be included in work packages. • Provides direction to Field Work Supervisor regarding field scope, schedule, and priorities. • Provides direction regarding drilling activities to field personnel including subcontractors. • Prepares work package information for all field activities. • Plans, coordinates, and oversees field drilling activities. • Coordinates with necessary organizations to ensure field drilling activities are conducted safely and correctly. • Communicates with the Characterization Task Lead, Primary Laboratory Contact, and Data Management Lead to identify field constraints that could affect sampling design or that would necessitate a change notice. • Leads the effort of determining sample depth for each probe hole. • Ensures field activities are documented in direct push completion reports.	Harold Sydnor	Cindy Tabor

Table 9-1. Key Personnel. (3 sheets)

Title	Responsibility	Primary Contact	Alternate Contact
Field Work Supervisor	• Acts as the key field interface for daily field activities. • Conducts daily briefings and goes over the daily plan. • Ensures work activities are performed in a safe and productive manner and in accordance with all applicable administrative and technical procedures. • Ensures that work does not commence until all personnel involved with the field work understand their roles and responsibilities. • Applies the work planning process, including conducting pre-job briefings and post-job reviews. • Oversees personnel performing low/medium risk, self-directed tasks with supervision only on an as-needed basis. • Identifies, recognizes, mitigates, and controls hazards.	Rick Franzen, Sr.	Chuck Peoples, Manager
Primary Laboratory Contact and Data Management Lead	• Acts as the primary laboratory interface. • Selects laboratory to perform the analyses and requests assessments/surveillances of the laboratories. • Works with the laboratory to resolve data quality issues and to ensure plan requirements are achieved. • Assists with resolving Data Validation issues and performs technical review of third party Data Validation results. • Assists in laboratory surveillances. • Ensures Sample Data Tracking system is set up to meet sampling and analysis objectives and ensures paperwork is generated for sampling events. • Oversees all Sample Data Tracking efforts in order to prioritize data management efforts and to ensure that project requirements are achieved. • Ensures the data verification process is completed and that data is reviewed against existing knowledge and data quality assessment guidelines. • Ensures that data is loaded into Hanford Environmental Information System correctly.	Cindy Tabor	Ann Shrum
Quality Assurance	• Provides oversight to ensure data integrity. • Performs assessments and surveillance, as necessary. • Reviews documentation generated through implementation of Sampling and Analysis Plans and/or Field Sampling and Analysis Plans. • Performs Quality Assurance review of third party Data Validation results. • Reviews changes to data documents and forms. • Reviews issues identified during data processes for corrective actions. • Identifies Quality Assurance hold points or best management practices, as needed.	Larry Markel	Cris Lungu

Table 9-1. Key Personnel. (3 sheets)

Title	Responsibility	Primary Contact	Alternate Contact
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: 373-1986	
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: Mike Powers Phone: 376-5597	
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	

10.0 REFERENCES

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APPENDIX A

MEETING NOTES: DATA REQUIREMENTS FOR 241-TX TANK FARM DIRECT PUSH LOGGING AND SAMPLING, SEPTEMBER 6, 2012 MEETING

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APPENDIX A
MEETING NOTES: DATA REQUIREMENTS FOR 241-TX TANK FARM DIRECT PUSH LOGGING AND SAMPLING, SEPTEMBER 6, 2012 MEETING

Meeting Notes

Data Requirements for 241-TX Farm Direct Push Logging and Sampling

Meeting Date:	Thursday September 6, 2012
Location:	Ecology Building, room 3A
Purpose:	Discuss data requirements for the direct push logging and sampling that will be performed at 241-TX tank farm to evaluate potential interim measures
Attendees:	Joe Caggiano (Ecology), Maria Skorska (Ecology), Jared Mathey (Ecology) , Chris Kemp (ORP), Mark Triplett (PNNL), Mike Connelly (WRS), Susan Eberlein (WRPS), Harold Sydnor (WRPS)

Topics of Discussion:

- Mike Connelly discussed the general approach to defining data requirements for a direct push field activity (State the problem, Identify the decision, Identify inputs to the decision, Define study boundaries, Develop a decision rule, Optimize the direct push locations).
- It was noted that the purpose of this direct push campaign is to determine if an interim surface barrier or other interim measure would be beneficial at TX farm. Future characterization will be required for a complete Phase 2 RCRA Facility Investigation/Corrective Measures Study, beyond the scope of the current activity.
- Mike summarized the body of information that led to the conclusion that TX tank farm contains vadose zone contaminants (see attachment 1 for summary information from previous studies).
- Joe Caggiano noted that although many of the TX farm tanks are designated as "assumed leakers", the designation may be the result of an overfill or other loss, rather than a loss of tank integrity.
- Joe noted that the TX tanks served as feed and receiver tanks for the 242-T evaporator, with the result that there were many transfers of waste through pipelines, which could have resulted in undocumented losses.
- Mark Triplett raised a question about the soil inventory estimate used in the draft Tank Closure and Waste Management (TC&WM) Environmental Impact Statement (EIS). Mark subsequently confirmed that in the publicly available draft, TX farm has the highest estimated leak inventory for Tc-99 and Nitrate of all of the farms. (See Table D-26 in the draft.) They used an inventory of 107 Ci of Tc-99. T Farm was 2nd with 67 Ci and C farm 3rd with 56 Ci. The estimate may be revised in the final.

- Joe noted that the depth of plumes and the mobility of the contaminants will determine how effective an interim surface barrier would be.
- Joe recommended that we review history of any large liquid releases (e.g. water line leaks) in the area.
- The approach to direct push logging and sampling was briefly summarized:
    - A first direct push bore hole is pushed to refusal, and is logged for gamma and moisture.
    - The logging results are used to select appropriate sampling depths. Mobile contaminants are likely to accumulate in the same regions as the higher moisture.
    - The first probe hole is decommissioned, placing multiple electrodes for use in subsequent resistivity work if needed.
    - A second direct push probe hole is pushed adjacent to the first (a few feet away). Approximately 3 samples are taken during pushing of the second probe hole. Each sample is approximately 18 inches in length, and about 600-700 g of soil.
    - Sample analysis is performed on a "quick turnaround" basis (about 1 week) for a few key analytes. A more complete suite of analyses is performed over a longer time period.
- It was proposed that the direct push sites be selected in 2 phases. In the first phase, about 8 locations should be identified to get the approximate outline of the area of interest. Based on the results of logs and quick-turnaround samples from the first locations, an additional 4 locations should be chosen to better define the area of interest.
- The group selected 8 tentative locations for the first round of direct push (see page 17 of attachment 1 – red triangles indicate proposed locations). Each proposed location will have a logging probe hole and a sampling probe hole.
- The proposed locations will be subject to some adjustment once ground penetrating radar is completed, to avoid contact with sub-surface structures.
- The final 4 locations will be selected based on results from the first 8 locations. It was agreed that the details for the final 4 would not be included in the work plan, but only a general outline of potential areas (see attachment 1, page 17, areas noted as "Round 2").
- The group will meet again in approximately 2 weeks, following opportunities to review additional information and address questions. At that meeting, the proposed 8 locations will be reviewed again to determine if any changes are needed.
- Proposed analytes for the sample analysis were discussed. Pages 18 and 19 include tables of analytes that had been included for the interim surface barrier investigation at S farm. Attendees were asked to review the tables to identify if any changes were needed before the next meeting.

Actions:

1. Provide meeting notes with summary of proposed direct push locations (Eberlein)
2. Review historic records to determine if any large liquid releases (e.g. water line leaks) occurred in the area of TX farm (Connelly).
3. Review notes and background information (as needed) to determine if any changes should be proposed for the initial 8 locations, shown on attachment 1 page 17 (all attendees).
4. Review tables of proposed analytes (attachment 1, pages 18-19) to determine if any changes are warranted (all attendees).
5. Schedule field trip and follow-on meeting to finalize plans, tentatively the week of September 17 (Eberlein)

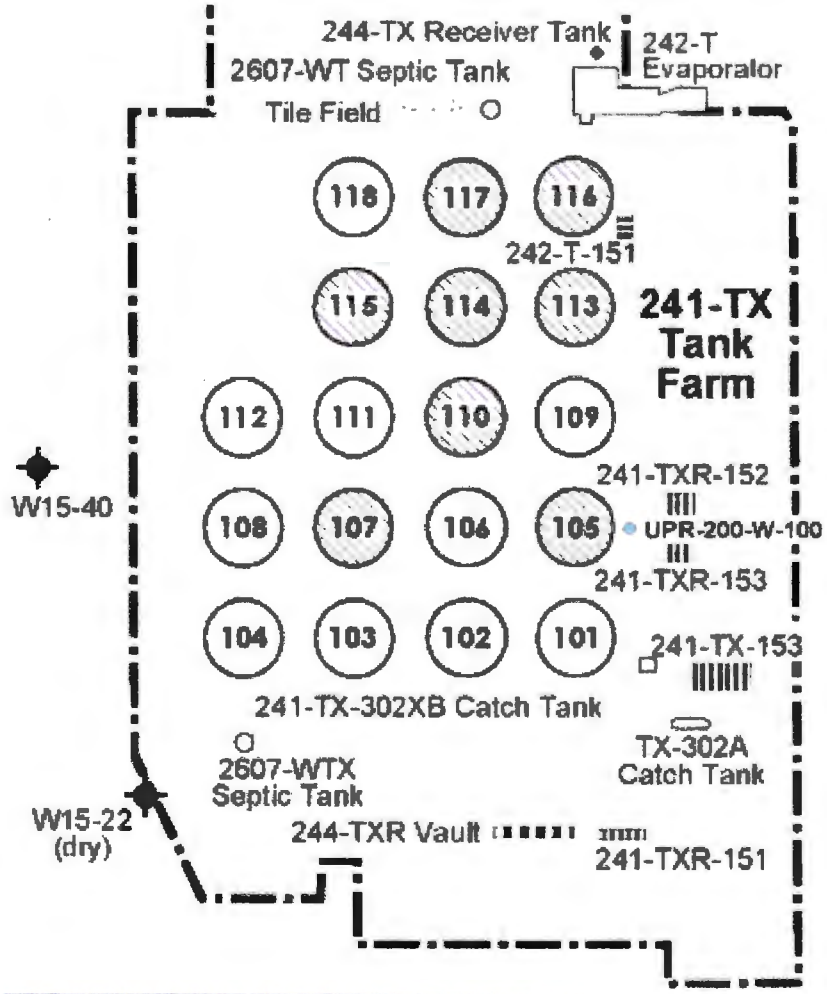
Concurrence:

CJ Kemp 10-23-12		Mike W Barnes 10-30-12	
C.J. Kemp, ORP	Date	Jeff Lyon, Ecology	Date

Proposed TX Farm Interim Measure Data Requirements Outline

- STATE THE PROBLEM
- IDENTIFY THE DECISION
- IDENTIFY INPUTS TO THE DECISION
  - Leak Assessment Information
  - Geology, Stratigraphy, and Hydrology
  - Existing Characterization Input
- DEFINE THE STUDY BOUNDARIES
  - Spatial Boundaries
  - Temporal Boundaries
  - Parameters of Interest and Action Levels
  - Scale of Decision Making
- DEVELOP A DECISION RULE
- OPTIMIZE DIRECT PUSH LOCATIONS
- ADDITIONAL ANALYTES

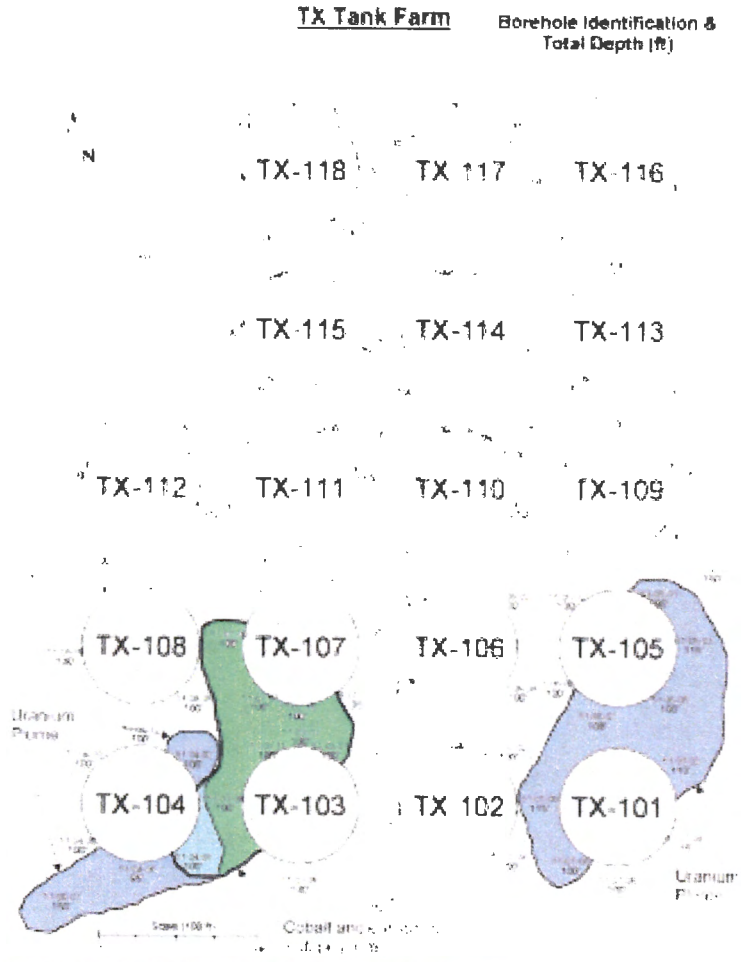
State the Problem



TX Tank Farm Contains Vadose Zone Contamination

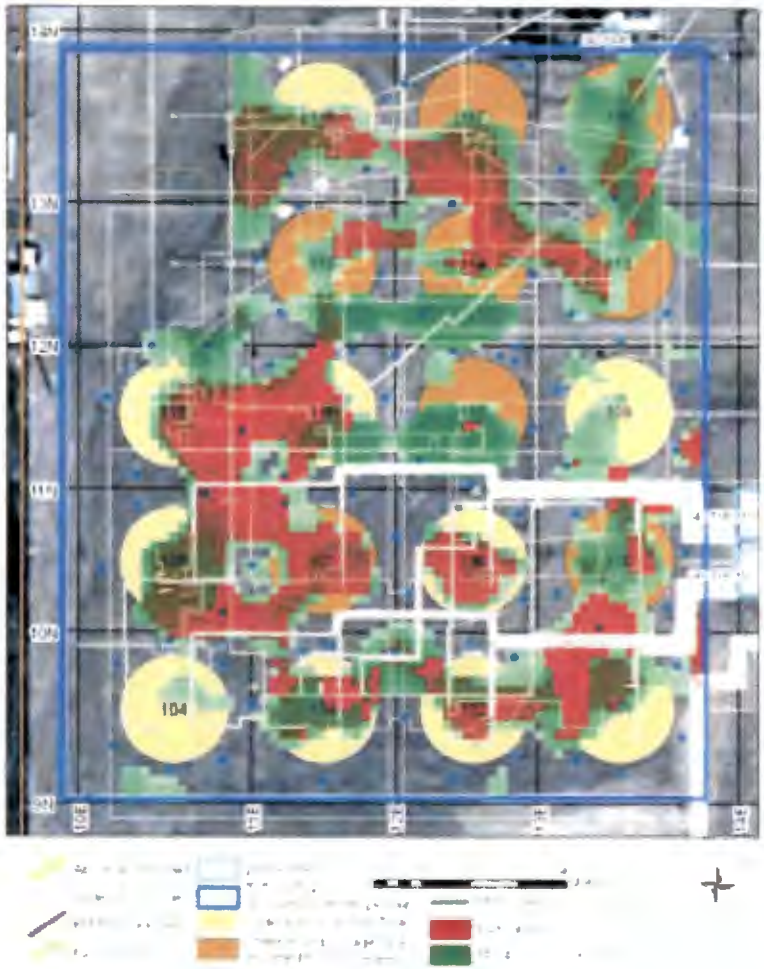
- **Known Leaker TX-107 → 1975 – 1977; 8,000 gal**
- **All Other TX-Tanks identified as leakers**
  - RPP-23405 Category 4 Tanks →TX-105, TX-110, TX-113, TX-114, TX-115, TX-116, and TX-117 Little information to support leak estimate; arbitrarily assigned 8,000 gal based on leaks at other tanks. Small levels of contamination are found by these tanks (is it a tank or pipeline?)
  - RPP-23752 Field Investigation identified uranium plumes around TX-104 and TX-105
- **Unplanned Releases**
  - UPR-200-W-12 → RPP-23405 estimate of 5 gal, near 242-T Evaporator
  - UPR-200-W- 17 → RPP-23405 no basis for volume estimate, appears negligible. Occurred during pump removal at TX-106
  - UPR-200-W-100 → RPP-23405 estimate of ~2,500 gal of 1C2 Waste

State the Problem (cont'd)



RPP-ENV-41309, *Criteria for Prioritizing Hanford Site Tank Farm Interim Surface Barriers and for Evaluating Their Performance* Ranked TX-107 + UPR-200-W-100 Seventh of Top 15 Barriers sites over groups of Tanks/UPRs

State the Problem (cont'd)



Subsurface Geophysical Exploration (SGE) may indicate more widespread vadose zone contamination

Identify the Decision

- Main purpose of the field work in TX Farm is to gather data to help determine if the conditions are such that an interim barrier will be beneficial
  - Areal extent of subsurface soluble contaminant
  - Vertical extent
  - Possible effective depth
- Secondary Purpose
  - Effort will be used to further characterize the vadose zone in TX Farm
  - May help to form the basis of Phase 2 characterization at TX Farm

IDENTIFY INPUTS TO THE DECISION

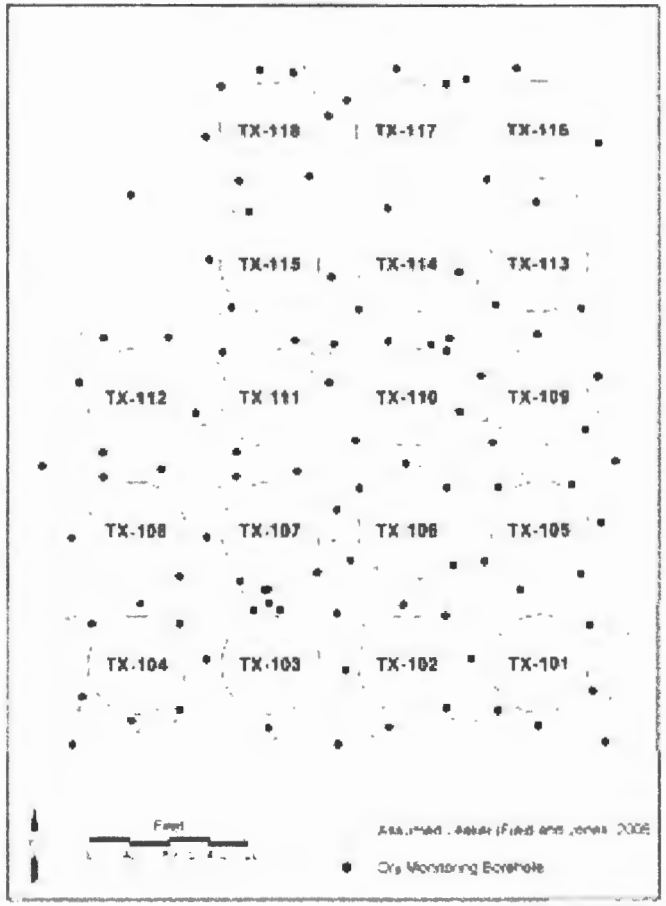
- Leak Assessment Information
- Geology, stratigraphy, and hydrology of the area
- Previous Characterization Input

Leak Assessment Information

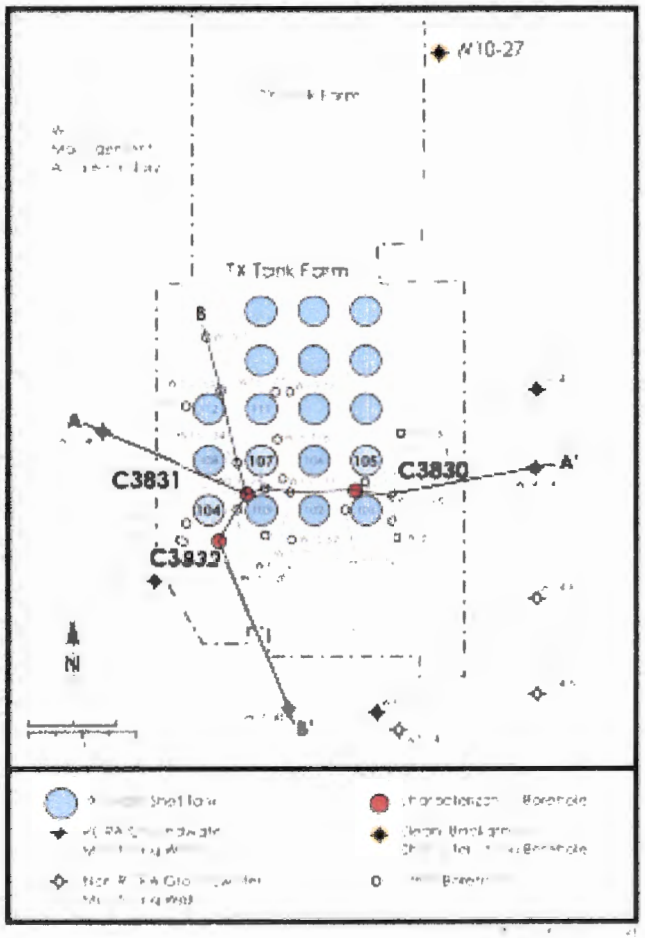
- When and Where Leak occurred or could have occurred
- Type of waste stream (Metals, Redox, etc.)
- Inventories of mobile constituents
- Nearby Facilities and event histories
- Leak Assessment Documents for TX Tank Farm
  - Updated Leaks Assessment for TX has been started presently on hold due to funding
  - RPP-23405 → *Tank Farm Vadose Zone Contamination Volume Estimates*
  - *RPP-23752 Field Investigation Report for T and TX/TY WMAs*
  - RPP-7123 *Subsurface Conditions Report for T and TX/TY WMAs*

Geology, Stratigraphy, and Hydrology of the Area → Past Characterization Activities

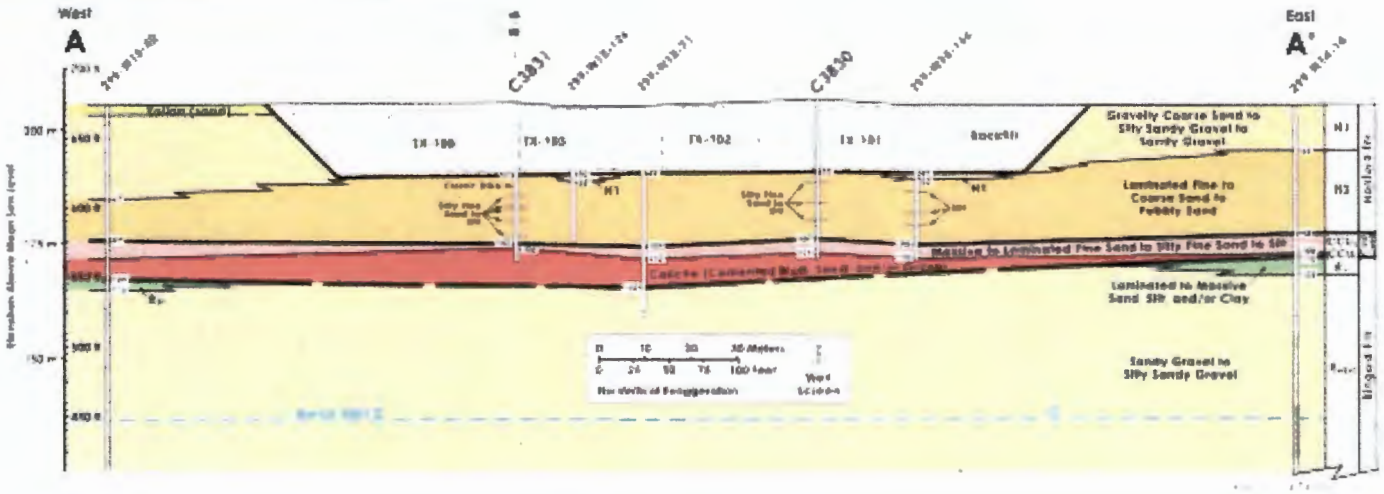
Geophysical Logging

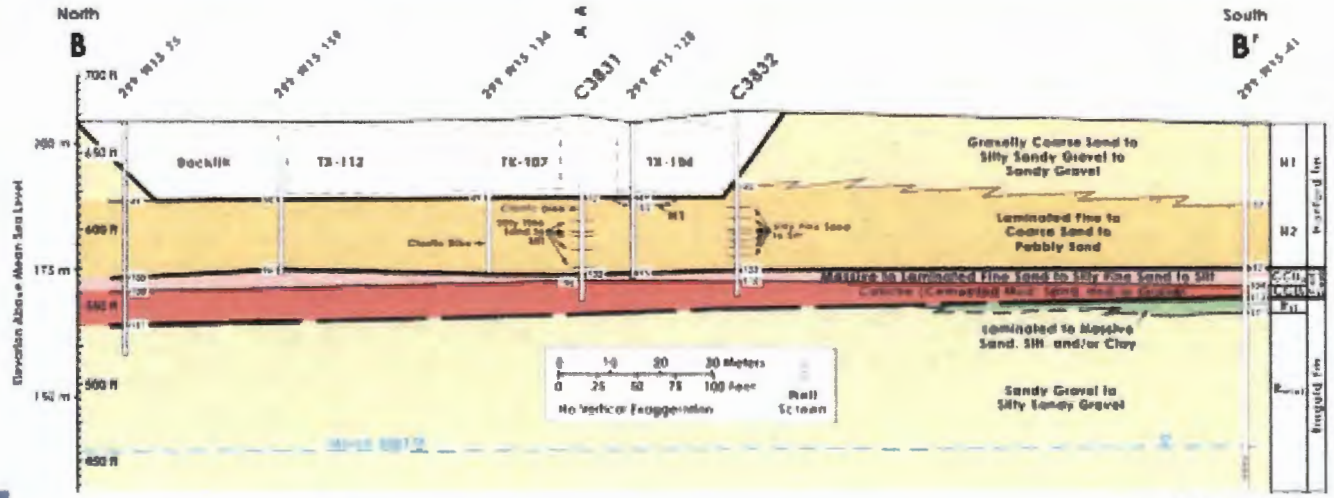


Sampling



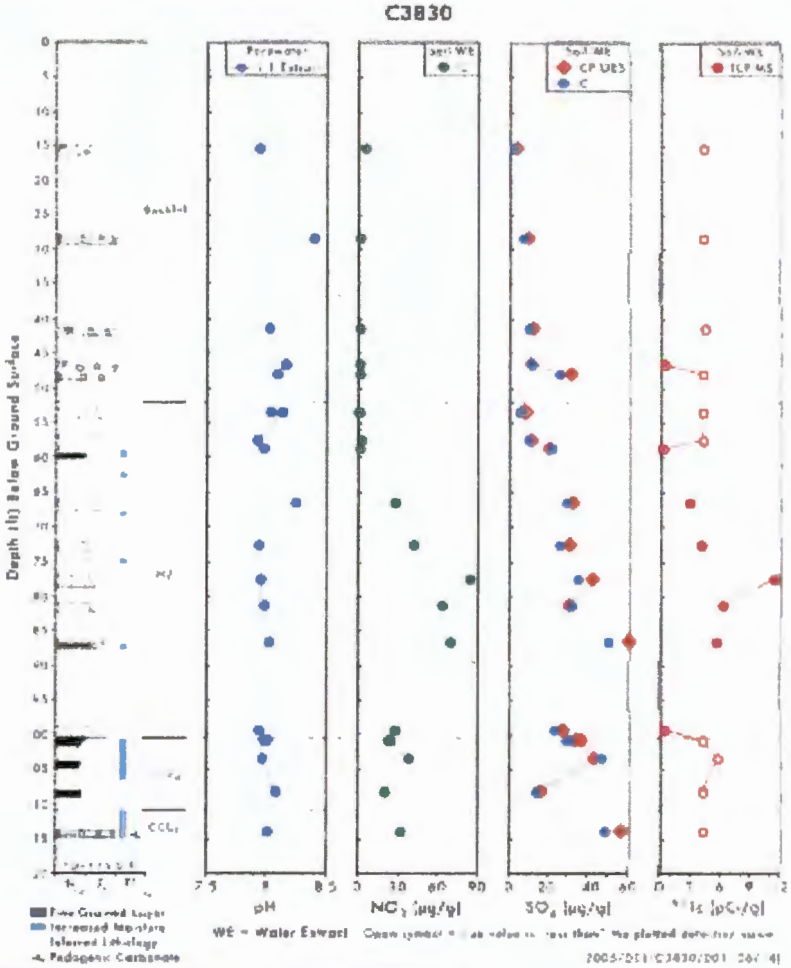
Stratigraphy, Geology, Hydrology

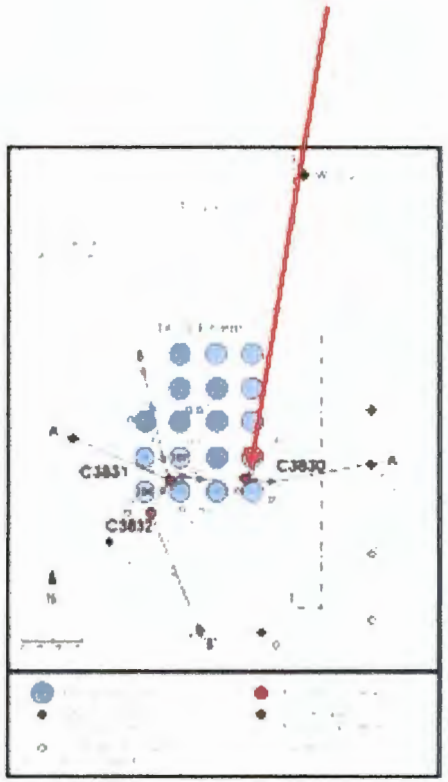




Characterization Results

Distribution of Major Tank Waste Constituents in Borehole C 3830

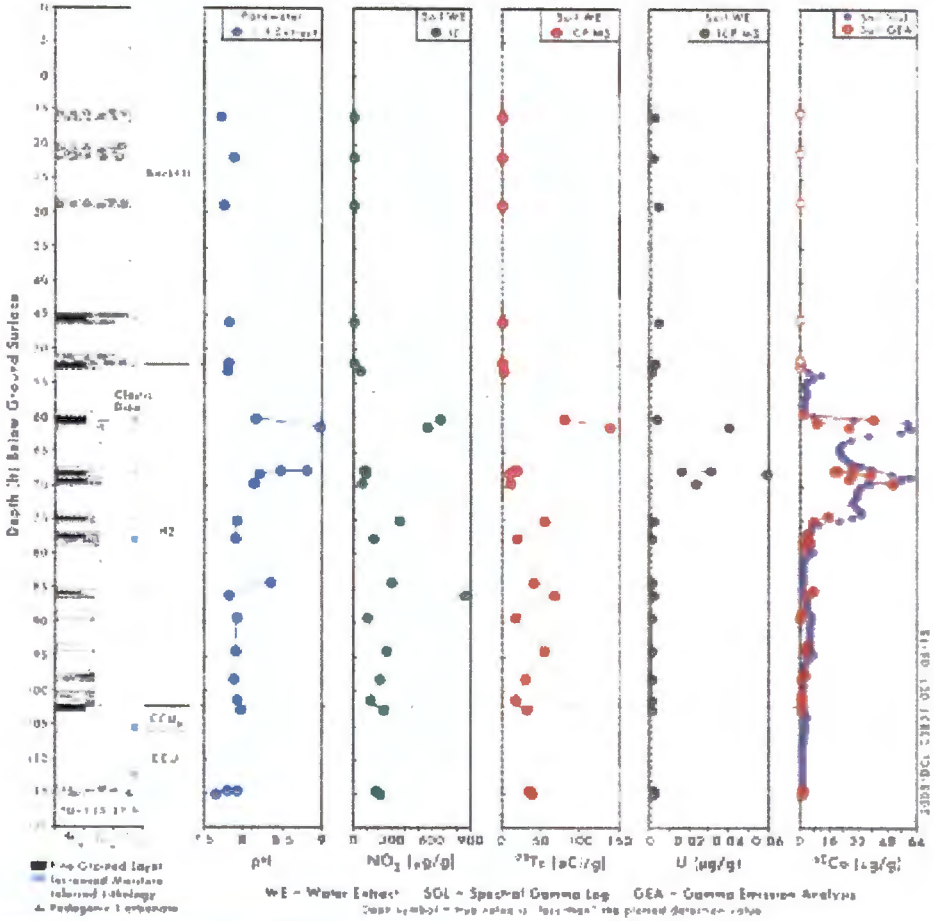


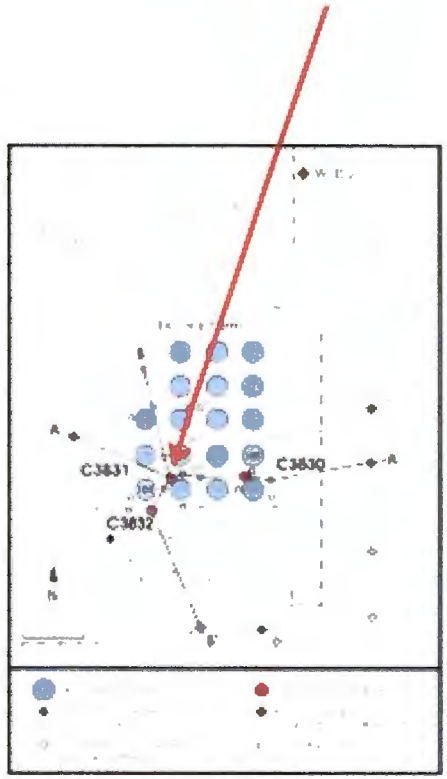


Characterization Results

Distribution of Major Tank Waste Constituents in Borehole C3831

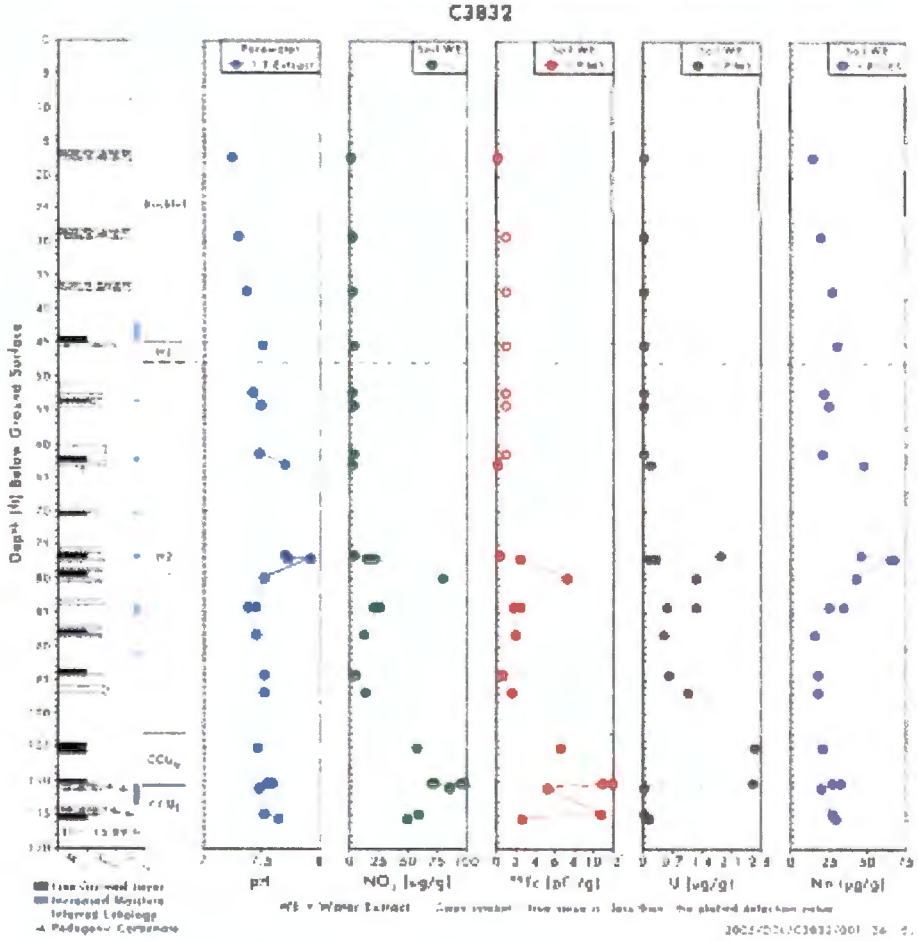
C3831

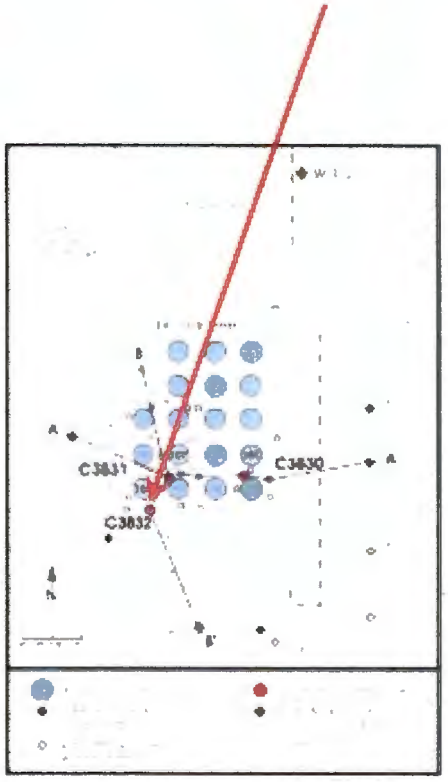




Characterization Results

Distribution of Major Tank Waste Constituents in Borehole C3832



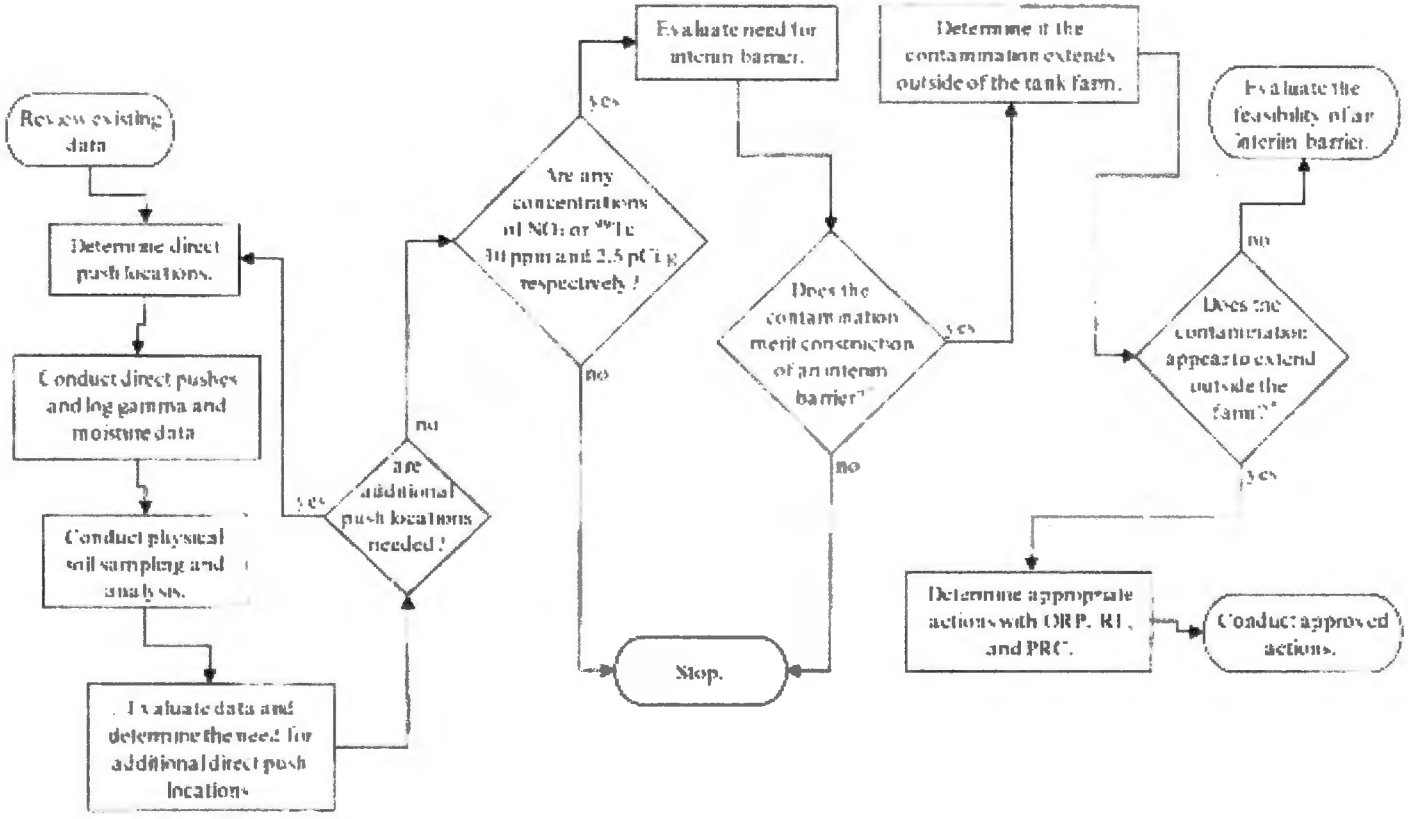


Boundaries

- Spatial Boundaries
  - Twelve Direct Push have been allotted for TX Farm interim barrier evaluation
  - Expected refusal at ~100 ft bgs
  - Past direct push for interim barriers selected three depth intervals were chosen to sample.
- Temporal Boundaries
  - Allow for the scheduling of sampling and analytical activities, collection of samples, and processing of analytical data when received
- Parameters of Interest and action levels
  - Past sampling for interim barriers selected nitrate at 10 ppm (i.e., µg/g) and Tc-99 at 2.5 pCi/g

Suggested Decision Rule for Interim Barrier

Tank Farm Interim Barrier Evaluation Flowchart



* Additionally, is the contamination within the effective depth of a barrier

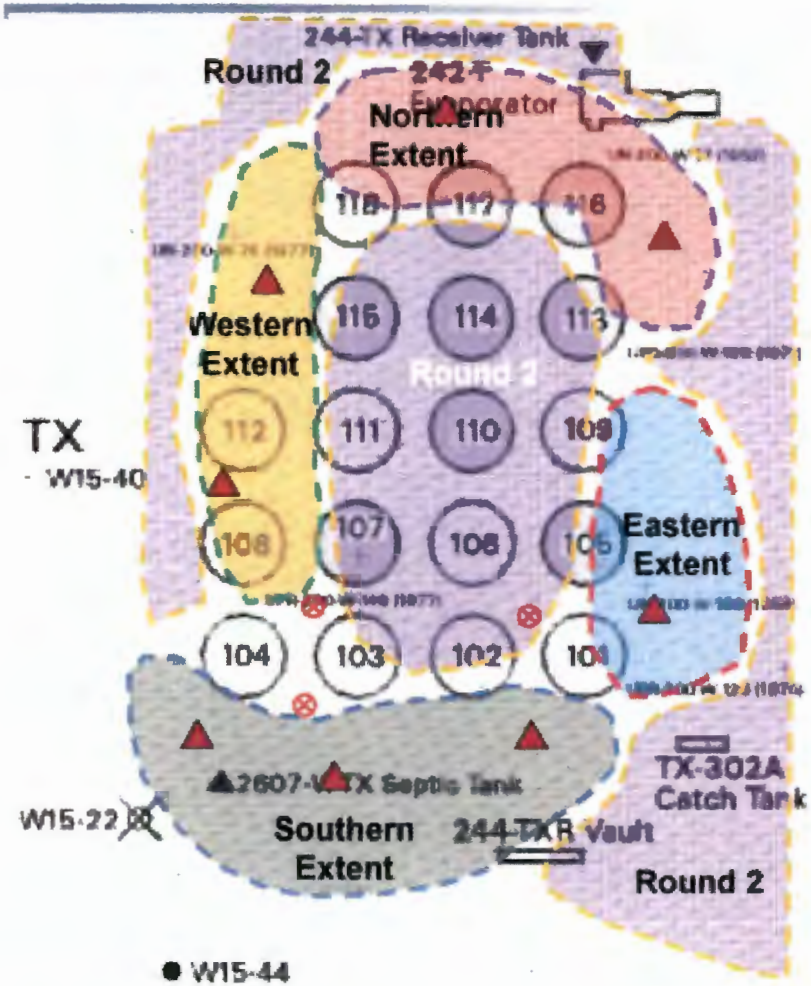
How to Optimize Design of Direct Push Locations

- Select Direct Push Locations Based On
  - Known and possible waste releases (i.e TX-107 and UPR-200-W-100)?
  - Near suspected leaking tanks with minor contamination (i.e. TX-105, TX-110, TX-113 to TX-117)?
  - Near suspected overfill events (i.e. TX-105)?
  - Where there are higher gamma levels from spectral logging?
  - Near low SGE low resistivity areas?

How to Optimize Design of Direct Push Vertical Samples

- Optimization efforts will also be instituted with regard to choosing sample depths
  - Moisture Logging
    - Areas of high moisture content
    - Areas of saturated moisture content
  - Gamma Logging → Areas of increased gamma radiation
  - Geology/Stratigraphy
    - Zones of interest
    - Sediment layers immediately above a layer with low hydraulic conductivity
    - Fine-grained sediment layers over coarse-grained layers
  - Analytical Information
    - Quick-Turnaround analytes (Tc-99 and Nitrate) from nearby direct push holes may also help determine borehole sample intervals.

Possible Areas to Apply Direct Push Locations



Northern Extent :

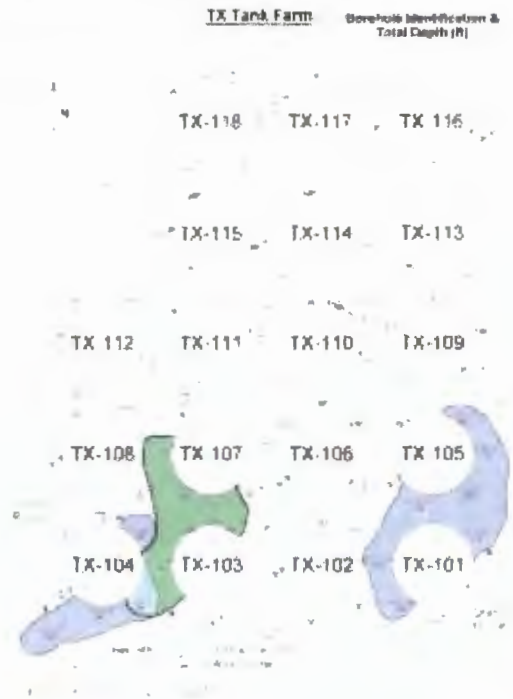
Western Extent :

Southern Extent :

Eastern Extent :

Round 2 Extent: multiple locations based on results of round 1.

Boreholes reported in RPP-23752



17

Analytes Select for the S Tank Farm Interim Barrier Direct Push (non-rads)

Analysis Type	Primary Analysis	Constituent	Holding Time
"Quick Turn"	ICP/MS	Technetium-99	6 months
	9056 Ion chromatography	Nitrate	28 days/48 hours after digestion
	9045	pH	As soon as possible
	9050	Conductivity	28 days
Standard	6010 ICP/AES	Aluminum, Barium, Beryllium, Calcium, Chromium, Copper, Iron, Lead, Lithium, Manganese, Magnesium, Molybdenum, Phosphorous, Potassium, Sodium, Strontium, Zinc, Boron, Bismuth, Cerium, Europium, Lanthanum, Neodymium, Niobium, Palladium, Praseodymium, Rubidium, Rhodium, Ruthenium, Samarium, Silicon, Tin, Sulfur, Tantalum, Tellurium, Thorium, Titanium, Tungsten, Yttrium, Zirconium	6 months
	6020 ICP/MS	Antimony, Arsenic, Cadmium, Cobalt, Nickel, Selenium, Silver, Thallium, Uranium[a], Vanadium	6 months
	7471 Cold vapor atomic absorption	Mercury	28 days
	9056 Ion chromatography	Fluoride, Nitrite, Nitrate, Chloride, Sulfate, Acetate, Formate, Glycolate, Oxalate, Bromide, Phosphate	28 days/48 hours
	Ion chromatography EPA 300.7	Ammonium	7 days to distillation/28 days for preserved distillate
	9215 Ion selective electrode	Sulfide	7 days
	9014 Spectrophotometric	Cyanide	14 days

Analytes Select for the S Tank Farm Interim Barrier Direct Push (Rads)

Analysis Type	Primary Analysis	Constituent	Holding Time
Standard	Gamma energy analysis	Cesium-137, Cobalt-60, Antimony-125, Europium-152, Europium-154, Europium-155, Thorium-228, Thorium-234	6 months
	Low energy gamma counting	Iodine-129	6 months
	ICP/MS	Technetium-99, Tin-126, Uranium-233, Uranium-234, Uranium-235, Uranium-236, Uranium-238, Neptunium-237, Thorium-230, Thorium-232	6 months
	Liquid scintillation	Carbon-14, Tritium, Nickel-63, Selenium-79	6 months
	Alpha energy analysis	Plutonium-238, Plutonium-239/240, Americium-241, Curium-242, Curium-243/244	6 months
	Beta proportional counting	Strontium-90	6 months
	Gravimetric	Percent solids	None
	Gravimetric	Percent water	None
	Gravimetric	Bulk density	None

APPENDIX B

MEETING NOTES: 241-TX TANK FARM FIELD TRIP TO VERIFY DIRECT PUSH SAMPLE LOCATIONS, SEPTEMBER 18, 2012 MEETING

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APPENDIX B
MEETING NOTES: 241-TX TANK FARM FIELD TRIP TO VERIFY DIRECT PUSH SAMPLE LOCATIONS, SEPTEMBER 18, 2012 MEETING

Meeting Notes

TX Field Trip to Verify Direct Push Locations with Follow-On Confirmation Meeting

Meeting Date:	Tuesday September 18, 2012
Location:	TX Tank Farm in the Morning Ecology Building, room 3A in the Afternoon
Purpose:	Verify selected locations for the direct push logging and sampling that will be performed at 241-TX Tank Farm to evaluate potential interim measures
Attendees:	Field Trip: Joe Caggiano (Ecology), Jared Mathey (Ecology), Chris Kemp (ORP), Jim Lynch (ORP), Doug Hildebrand (RL), Harold Sydnor (WRPS), Mike Connelly (WRPS), Marcel Bergeron (WRPS), Dan Glaser (WRPS) Follow-On Meeting: Joe Caggiano (Ecology), Jared Mathey (Ecology), Jeff Lyon (Ecology), Marysia Skorska (Ecology), Mark Triplett (PNNL), Doug Hildebrand (RL), Harold Sydnor (WRPS), Mike Connelly (WRPS), Dan Glaser (WRPS)

Topics of Discussion:

- Mike Connelly provided the field trip participants with a topographic map of TX-Tank Farm. There were labeling errors on the map, and Mike said he would provide an updated map with the labeling errors corrected (attached with these meeting notes).

- Field trip participants met on the southeast side of TX tank farm. It was recognized by everyone that the suggested direct push location on the SE side of TX-105 would not work. It was located on top of a hill close to the 241-TXR-152 and 241-TXR-153 diversion boxes. Harold indicated that he would not be able to get the direct push rig up the hill because of the limited space on top of the hill. It was also noted that space south and below the hill was limited due to chained off WIDS sites and the location of diversion box 241-TX-153. The chained off areas were due to two underground miscellaneous storage tanks (241-TX-302A and 241-TX-302XB). Both of these are catch tanks which are connected to the 241-TX-153 diversion box. WIDS reports are attached to these meeting notes. Since, the location on top of the hill was not accessible; a new location approximately 60 ft SSE of the original location was selected. This location is just to the NW of diversion box 241-TX-153. Since, the underground infrastructure will not be known until ground penetrating radar is completed over the area, two alternative locations were identified; one approximately 140 ft south of the original location (preferred alternative) and one approximately 100 ft ESE of the original location. All locations are shown on the updated topographic map.

- The field participants then walked around the farm and surveyed all other proposed locations. It appears that all other locations would be accessible to the direct push with one caveat there is an overhead power line for the location close to 241-TX-115 and 241-TX-118 tanks. Harold will check with the appropriate people and if that location has to be modified, the participants of the field trip and follow-on meeting will be notified. All locations are subject to relocation pending the outcome of GPR surveys to detect and locate underground structures that must be avoided.

- The follow-on meeting at Ecology's offices. In that meeting, the participants reviewed the observations at the tank farm and concurred with the direct push locations (see map on the following page).

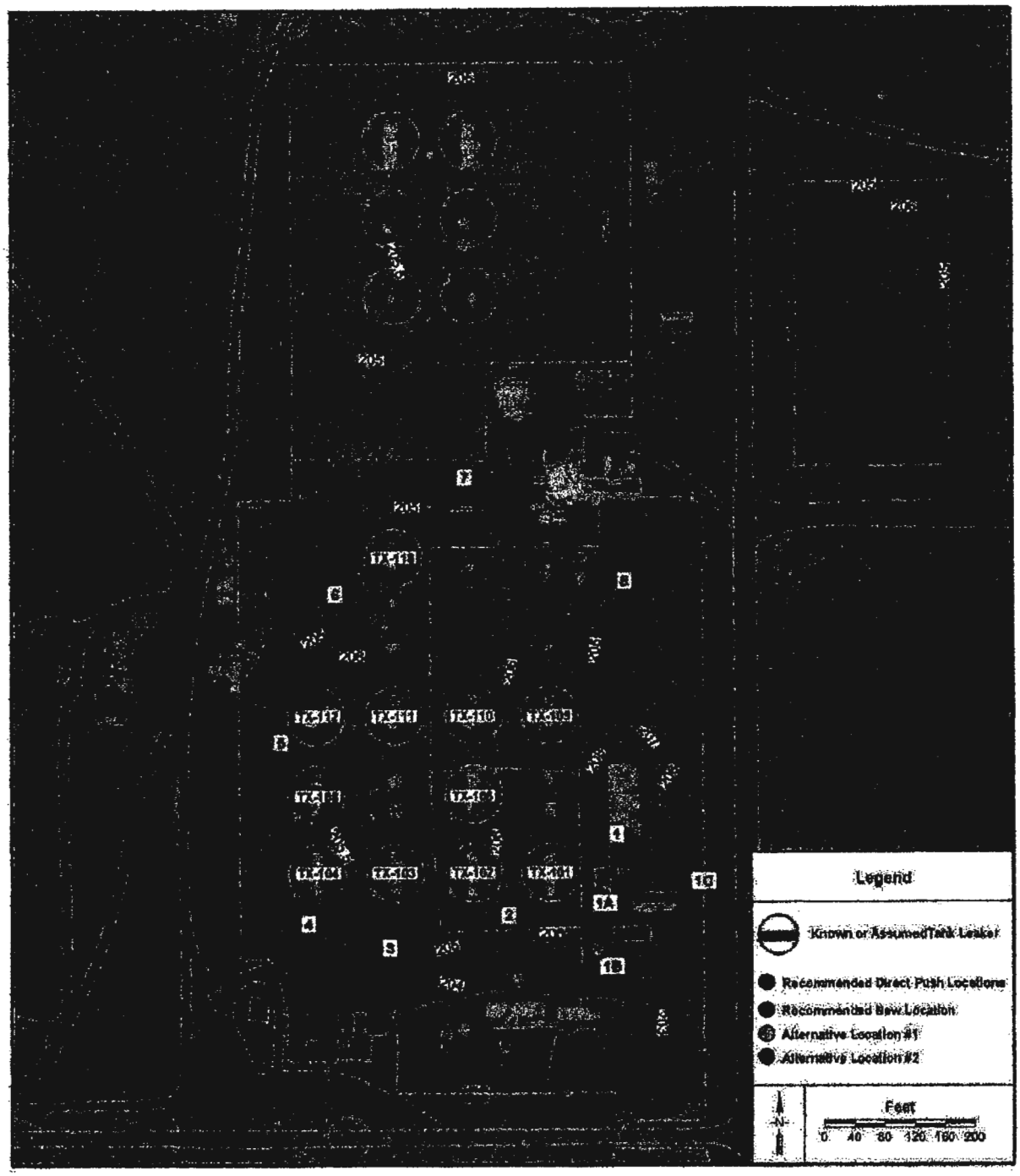
Actions:

1. Provide Meeting Notes for both the field trip and follow-on meeting (Connelly)
2. Provide update map showing the direct push locations and alternative sites if underground infrastructure interfered with the direct push location (Connelly). See following page for updated map.

Concurrence:

C J Kemp 10-23-12		Mike W Barn 10-30-12	
C.J. Kemp, ORP	Date	Jeff Lyon, Ecology	Date

Proposed Direct Push Locations Supporting Interim Measures at TX Tank Farm



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APPENDIX C

MEETING NOTES
200 WEST TANK FARMS INTERIM MEASURES INVESTIGATION WORK PLAN AND 241-TX TANK FARM SAMPLING AND ANALYSIS PLAN MEETING
JANUARY 16, 2013

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MEETING NOTES

200 West Tank Farms Interim Measures Investigation Work Plan
and
241-TX Tank Farm Sampling and Analysis Plan

MEETING DATE: January 16, 2013

LOCATION: Washington State Department of Ecology, Richland Office

ATTENDEES:

Mike Barnes (Ecology)	R.D. Hildebrand (DOE)
Joe Caggiano (Ecology)	Dan Parker (WRPS)
Mike Connelly (WRPS)	Julie Robertson (Freestone Environmental Services)
Susan Eberlein (WRPS)	Maria Skorska (Ecology)
Les Fort (WRPS)	Harold Sydnor (WRPS)
Dan Glaser (WRPS)	Cindy Tabor (WRPS)
Erika Garcia (Freestone Environmental Services)	

PURPOSE: This meeting was scheduled to provide a forum to discuss Ecology comments on *200 West Area Tank Farms Interim Measures Investigation Work Plan* (RPP-PLAN-53808, Revision 0) and also to introduce Ecology to the *Sampling and Analysis Plan for Soil Samples in Support of Interim Measure Planning at the 241-TX Tank Farm* (draft in preparation). **NOTE**: Following the meeting of January 16, 2013, the participating agencies agreed to participate in follow-on meetings to occur on an approximately monthly basis. A list of open and unresolved issues and the status of those issues will be tracked and documented in the notes of these meetings in the form of action items and pending resolutions.

DISCUSSION:

TX Farm SAP

Ms. Tabor provided a presentation describing the contents of the draft TX SAP (Attachment 1). Key discussion points are summarized below.

- The SAP will reference RPP-54073, *TX Tank Farm Leak Inventory Assessment Meeting Summaries*, regarding leak assessment information.
- The outline and content of the TX Farm SAP closely follow the outline and content of RPP-PLAN-49132, *Field Sampling and Analysis Plan for Soil Samples in Support of an Interim Barrier at S Farm.*
- The direct push investigation will initially focus on eight locations as agreed during meetings held on September 6 and September 18, 2012. The locations of an additional four direct push boreholes will be determined following review by DOE and Ecology of available results from the initial eight locations. The interagency agreement on the final four borehole locations will be documented in meeting minutes that will be placed in the Administrative Record associated with the *Hanford Federal Facility Agreement and Consent Order* (HFFACO). The methodologies to be used and

analytes will be the same for the final four boreholes as the first eight, as documented in the TX Farm SAP.

- Ecology asked whether available results from three boreholes installed in 1982 near TX-104, TX-105, and TX-106 were considered when locations were selected for the first eight boreholes. WRPS confirmed that data from those boreholes was considered during the selection process.
- Mr. Sydnor noted that during recent driller walk downs at TX Farm, it was concluded that drilling equipment accessibility issues preclude installation of a borehole at alternative site 1A. Additionally, there is significant underground infrastructure at alternative site 1C that precludes use of that location. Therefore, the site previously identified as alternative site 1B will be selected for borehole installation. **ACTION**: The body of the TX Farm SAP will be written to eliminate discussion of 1A/1B/1C and will simply identify the former site 1B as "Site 1."
- Sample depth locations will be selected as described in the attached presentation. Sample depth agreement meetings will be signed by DOE and Ecology and placed in the Administrative Record.
- Soil samples will be analyzed for constituents as shown in the presentation. The list excludes sulfide and identifies four analytes for quick-turn analysis (bold text). Levels of constituents shown in italicized text will be reported if they are detected.
- WRPS and DOE stated an intent to provide Ecology with a copy of the draft SAP in mid-February for informal review in the hopes that any significant issues could be identified and worked before the document is issued formally.
- Ecology stated that HFFACO text regarding data validation appeared to have been modified recently and that those changes might necessitate modification of the data validation text used in the SAP. **ACTION**: Ms. Tabor will follow-up with Mr. Barnes and Jerry Yokel (Ecology) to prepare data validation text.

200 West Interim Measures Work Plan

- Ms. Eberlein noted that per HFFACO primary document review requirements, Ecology's comments on the work plan (RPP-PLAN-53808, Rev. 0) must be provided by January 24, 2013. The parties discussed several options that could be used to fulfill this requirement, including provision of a formal letter and inclusion of the comments in the meeting minutes for the HFFACO monthly project managers' meeting scheduled for January 22, 2013. **ACTION**: Ecology staff will relay options to the Ecology project manager for his consideration.
- Ms. Tabor handed out a table listing informally-provided Ecology comments on the Rev. 0 work plan, along with potential resolutions. The parties discussed a limited number of comments they deemed higher priority, as described below:
  - ☐ Comments requesting inclusion of text and a new figure regarding tank Tc-99 inventory – WRPS agreed to include the requested text and provided a new figure illustrating contaminant inventories in the single-shell tanks. Ecology agreed the figure should be added.
  - ☐ Comment requesting additional 3D resistivity information – WRPS agreed to incorporate the requested information.
  - ☐ Comment requesting the document be updated to incorporate the latest tank system descriptions and tank leak loss values – WRPS agreed to incorporate the requested information.

ACTION: Ms. Tabor will update the table handed out at the meeting to reflect the discussion and will email it to Ecology for their use as desired to meet the HFFACO timeline to formally provide comments on the work plan by January 24, 2013.

ACTIONS: Refer to the following table. A date-based numbering system is being used to track the actions to completion. Actions will be removed from the list after DOE and Ecology have agreed to their completion.

R Douglas H. Idebrand	R [signature]	2-6-2013
DOE Project Manager (print)	DOE Project Manager (signature)	Date
Jeffery J Lyon	[signature]	2-11-2013
Ecology Project Manager (print)	Ecology Project Manager (signature)	Date

Item #	Topic/Title	Actionee	Description	Status
2013-01-16-1	Identification of TX Farm borehole site 1	Tabor	Update draft TX Farm SAP to eliminate discussion of 1A/1B/1C and simply identify the former site 1B as "Site 1."	(new)
2013-01-16-2	SAP data validation text	Tabor	Follow-up with Mike Barnes and Jerry Yokel to prepare SAP data validation text.	(new)
2013-01-16-3	Formal documentation of Ecology comments on work plan by 1/24/2013	Skorska	Discuss options for documenting Ecology comments with Jeff Lyon.	(new)
2013-01-16-4	Ecology comments on work plan	Tabor	Update table with Ecology comments on work plan and proposed resolutions.	(new)

Proposed TX Farm Interim Measure Sampling and Analysis Plan

- Purpose of SAP
- SAP Reference Materials
- Sample Locations
- Sample Depth Decision Process
- Analytical Constituents
- Schedule

Purpose of the TX SAP

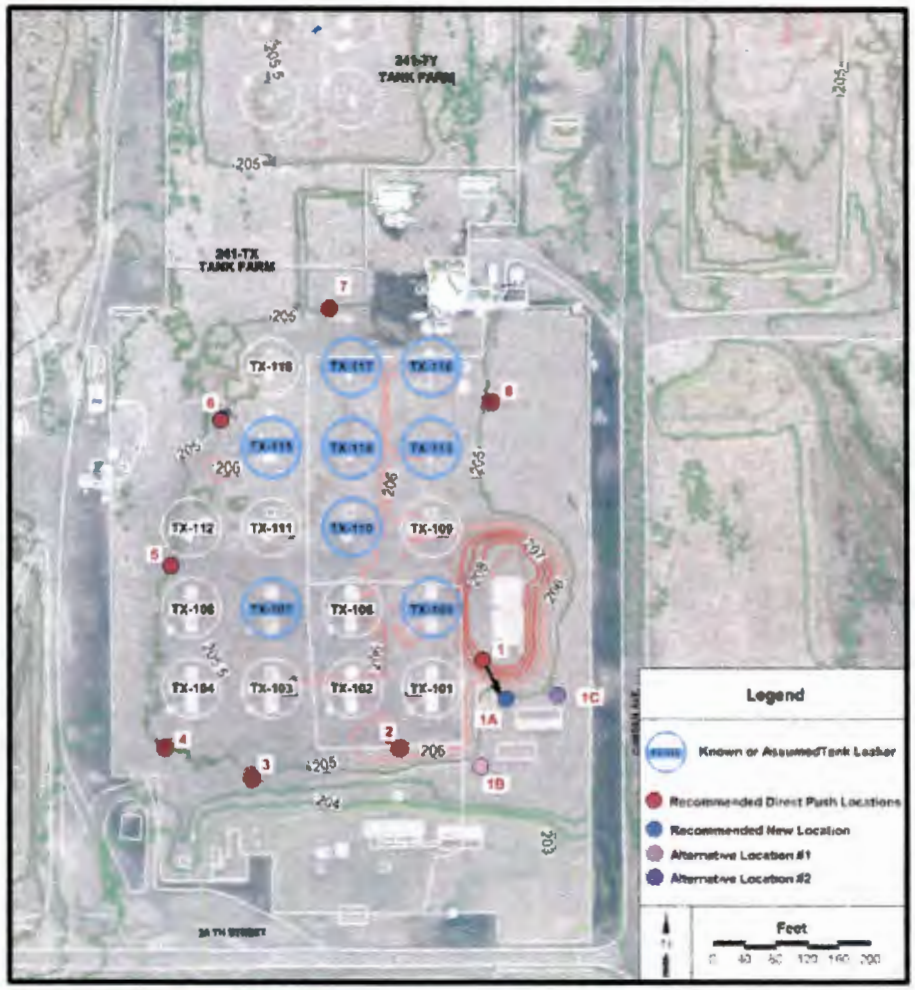
- Document sampling and analysis activities necessary to assist in determining
  - If an interim measure is merited at TX Farm
  - Geographic extent of vadose contamination at TX Farm
- Implement RPP-PLAN-53808, *200 West Area Tank Farms Interim Measures Investigation Work Plan*
- Fulfill Tri-Party Agreement Milestone M-045-21 (submit SAP) and gather data to support Target Date M-045-22-T01 (submit characterization report)
- Inform future RCRA Phase 2 characterization activities at TX Farm

TX Farm SAP Reference Documents

The following references are being used to develop the TX Farm SAP:

- RPP-43551, *Tank Farm Interim Barrier Data Quality Objectives*
- RPP-PLAN-53808, Interim Measures Investigation Work Plan
- RPP-23752, the T and TX-TY Field Investigation Report
- RPP 54073, *TX Tank Farm Leak Inventory Assessment Meeting Summaries*
- RPP-PLAN-49132, *Field Sampling and Analysis Plan for Soil Samples in Support of an Interim Barrier at S Farm*
- Minutes from September 6 and September 18, 2012 meetings regarding TX vadose zone sampling
- RPP-ENV-53773, *Data Requirements for Characterization Supporting Interim Measures in TX Farm*

Proposed Borehole Location Map



Hanford Site 200 West Area, 241-TX Tank Farm

Information based on September 18, 2012 field walk down.

Direct Push Location Strategy for TX Farm

- Push boreholes in 8 locations:
  1. SE of TX-105/E of TX-101 (further assess tank TX-105 and UPR-200-W-100 releases) – 1A
  2. SW of TX-101 (further assess releases near TX-105 and UPR-200-W-100)
  3. S of TX-103 (gather additional data on contamination south of the TX Farm tanks)
  4. S of TX-104 (gather additional data on contamination south of the TX Farm tanks)
  5. Between TX-108 and TX-112 (explore SGE anomaly)
  6. Between TX-115 and TX-118 (explore SGE anomaly)
  7. N of TX-117 (gather data near tank of questionable integrity)
  8. E of TX-113 and TX-116 (gather data near tanks of questionable integrity)
- Push boreholes in 4 additional locations TBD based on results from initial 8 locations

Sample Depth Decision Process

- Soil samples will be collected consistent with previous interim barrier support efforts
  - An average of three depths from each sample probe hole.
  - Geophysical logging and available quick turnaround analysis (^{99}Tc and nitrate) will be used to aid in determining sample depths.
  - Meetings will be held with, or e-mails will be sent to, representatives from WRPS, DOE, ORP, DOE-RL, and Ecology, to gain a consensus on sample depths.

Analytes Selected for the TX Farm Interim Measure Direct Push

Primary Analytical Method (prep)	Constituent
9045	**pH**
9050	**Conductivity**
6010 ICP/AES	Aluminum. Barium. Beryllium. Calcium. Chromium. Copper. Iron. Lead. Lithium. Manganese. Magnesium. Molybdenum. Phosphorous. Potassium. Sodium. Strontium. Zinc. *Boron. Bismuth. Cerium. Europium. Lanthanum. Neodymium. Niobium. Palladium. Praseodymium. Rubidium. Rhodium. Ruthenium. Samarium. Silicon. Tin. Sulfur. Tantalum. Tellurium. Thorium. Titanium. Tungsten. Yttrium. Zirconium*
6020 ICP/MS	Antimony. Arsenic. Cadmium. Cobalt. Nickel. Selenium. Silver. Thallium. Uranium. Vanadium
7471 Cold vapor atomic absorption	Mercury
9056 Ion chromatography	Fluoride. Nitrite. **Nitrate**. Chloride Sulfate. Acetate. Formate. Glycolate. Oxalate. *Bromide. Phosphate*
Ion chromatography EPA 300.7	Ammonium
9014 Spectrophotometric	Cyanide
Gamma energy analysis	Cesium-137. Cobalt-60. Antimony-125. Europium-152. Europium-154. Europium-155. Thorium-228. Thorium-234
Low energy gamma counting	Iodine-129
ICP/MS	**Techenetium-99**. Tin-126. Uranium-233 Uranium-234 Uranium-235. Uranium-236. Uranium-238. Neptunium-237. Thorium-230. Thorium-232
Liquid scintillation	Carbon-14. Tritium. Nickel-63. Selenium-79
Alpha energy analysis	Plutonium-238. Plutonium-239/240. Americium-241. Curium-242. Curium-243/244
Beta proportional counting	Strontium-90
Gravimetric	Percent solids
Gravimetric	Percent water
Gravimetric	Bulk density

Analytes are as proposed in September 6. 2012 meeting. except that sulfide has been deleted.

Schedule for TX Farm Work

	Fiscal Year 2013	Fiscal Year 2014	Fiscal Year 2015
241-TX Tank Farm			
Submit TX Sampling and Analysis Plan (M-045-21)	March 31, 2013		
Provide Field Work Completion Summary		March 31, 2014	
Provide TX Farm Interim Action Recommendations		June 30, 2014	
Submit Characterization Report (M-045-22-T01)			Sept. 30, 2014
Complete M-045-22 Milestone			Sept. 30, 2014
Submit Change Package to Modify M-045-92 Milestone			Sept. 30, 2014

Direct Push Location Strategy for TX Farm

Site #	Approximate Location	Input Factors Associated with Location[a]	Reason for Sampling with Respect to Interim Measure
1A (Agreed Upon Location – Refer to the 6th bullet in third column of this row)	Southeast of tank 241-TX-105 (TX-105)	• Tank TX-105 designated as a leaker (at least 150,000 gal.) • Nearby diversion boxes and pipelines • Process records indicate it was overfilled in 1952 and between 1961 and 1964 • Gross gamma activity detected in drywells 51-05-01, 51-05-03, and 51-05-05 on East – Southeast side of tank • UPR-200-W-100 is also to the east of tank TX-105 • Direct push initial location (1) cannot be reached due to topography; three alternative sites have been identified (1A, 1B, and 1C), all further to the south but in the vicinity of transfer lines and diversion boxes. Location 1A is the preferred alternative location based on site visit dated September 18, 2012. If 1A is not accessible, then 1B will be selected, and if 1B is not accessible, then 1C will be selected.	Further assess the path and inventory of tank TX-105 and UPR-200-W-100 Releases (see Figure 2-4 for uranium plume map[b])
2 (Agreed Upon Location)	Southwest of tank 241-TX-101	• Releases associated with tank TX-105 and UPR-200-W-100 appear to be trending to the southwest (see Figure 2-4[b]) • Tc-99 groundwater plume is to the south of 241-TX Tank Farm (TX Farm) (See Figure 2-10[b])	Further assess the nature and depth of migration of releases near tank TX-105 and UPR-200-W-100; also to attempt to define a boundary for the migration
3 (Agreed Upon Location)	South of tank 241-TX-103	• Tank 241-TX-107 is designated as a leaker (1,300 gal.) • Noted Co-60 and Eu-154 activity in drywells 51-07-07, 51-07-18 and in drywells between tanks 241-TX-107 and 241-TX-103 • Tc-99 groundwater plume is to the south of TX Farm (Figure 2-10[b])	Confirm Previous Results: Gather additional data to assist in determining nature and extent of contamination (i.e., Tc-99) south of the TX Farm tanks, also to attempt to define boundary to vadose zone contamination
4 (Agreed Upon Location)	South of tank 241-TX-104	• Tank 241-TX-104 is not designated as a leaker • Uranium vadose zone plume to the east and south of tank 241-TX-104, may be the result of a transfer line or cascade line leak • Tc-99 groundwater plume is to the south of TX Farm (Figure 2-10[b])	Confirm Previous Results: Gather additional data to assist in determining nature and extent of contamination (i.e., Tc-99) south of the TX Farm tanks, also to attempt to define boundary to vadose zone contamination

[a] Tank leak and pipeline failure information is provided in RPP-23405, *Tank Farm Vadose Zone Contamination Volume Estimates*.

[b] Reference figures are provided in RPP-PLAN-53808, *200 West Area Tank Farms Interim Measures Investigation Work Plan*.

Direct Push Location Strategy for TX Farm (Continued)

Site #	Approximate Location	Input Factors Associated with Location[a]	Reason for Sampling with Respect to Interim Measure
5 (Agreed Upon Location)	In between tanks 241-TX-108 and 241-TX-112 and slightly to the west of the centerline between these tanks	• Higher conductivity area based on resistivity information in this area (Figure 2-9[b])	Explore surface geophysical exploration (SGE) anomaly close to tanks 241-TX-108 and 241-TX-112. Gather data to assist in determining nature and extent of contamination (i.e., Tc-99).
6 (Agreed Upon Location)	In between tanks 241-TX-115 (TX-115) and 241-TX-118 and to the NW of tank TX-115	• Tank TX-115 was declared "questionably integrity" in 1977 based on gamma activity in drywell 51-15-04 and arbitrarily assigned a leak volume of 8,000 gal. • May have been overfilled in the early 1950s • SGE anomaly to the north and northwest of tank TX-115	Explore SGE anomaly close to tanks TX-115 and 241-TX-118. Gather data to assist in determining nature and extent of contamination (i.e., Tc-99).
7 (Agreed Upon Location)	North of tank 241-TX-117	• Tank 241-TX-117 was declared "questionably integrity" in 1977 based on gamma activity nearby vadose zone drywells and arbitrarily assigned a leak volume of 8,000 gal. • Tc-99 in groundwater in this vicinity (Figure 2-10[b])	Gather data to assist in determining nature and extent of contamination (i.e., Tc-99) and to attempt to define boundary to vadose zone contamination
8 (Agreed Upon Location)	East of tank 241-TX-113 and 241-TX-116	• Tank 241-TX-113 was declared "questionably integrity" in 1977 based on gamma activity nearby vadose zone drywells and arbitrarily assigned a leak volume of 8,000 gal. • Historical transfer records show that the tank 241-TX-113 was filled above the cascade outlet as a result of cascade plugging of the cascade lines and in-tank photographs show the waste level was well above the cascade line, indicating the potential for releases from the cascade lines or spare inlet ports • Tank 241-TX-116 was declared "questionably integrity" in 1977 based on gamma activity nearby vadose zone drywells and arbitrarily assigned a leak volume of 8,000 gal.	Gather data to assist in determining nature and extent of contamination (i.e., Tc-99) and to attempt to define boundary to vadose zone contamination

[a] Tank leak and pipeline failure information is provided in RPP-23405, *Tank Farm Vadose Zone Contamination Volume Estimates.*

[b] Reference figures are provided in RPP-PLAN-53808, *200 West Area Tank Farms Interim Measures Investigation Work Plan.*

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