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7. Abstract
This document is a plan which serves as the contractual agreement between the Characterization Program, Sampling Operations, and WHC 222-S Laboratory. The scope of this plan is to provide guidance for the sampling and analysis of samples for tank 241-BX-106.

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Tank 241-BX-106
Tank Characterization Plan

Prepared for the U.S. Department of Energy
Office of Environmental Restoration
and Waste Management

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LIST OF ABBREVIATIONS

ACL	Analytical Chemistry Laboratory
BX-106	Tank 241-BX-106
DOE	Department of Energy
DQO	Data Quality Objective
DSC	Differential Scanning Calorimetry
DST	Double-Shell Tank
GEA	Gamma Energy Analysis
HPGE/MCA	High Purity Germanium/Multichannel Analysis
IC	Ion Chromatography
ICP	Inductively Coupled Plasma - atomic emission spectroscopy
LIMS	Laboratory Information Management Systems
PNL	Pacific Northwest Laboratory
RCRA	*Resource Conservation and Recovery Act of 1976*
SST	Single-Shell Tank
TCP	Tank Characterization Plan
TGA	Thermogravimetric Analysis
TOC	Total Organic Carbon
TWRS	Tank Waste Remediation System
USQ	Unreviewed Safety Question
WHC	Westinghouse Hanford Company

1.0 SPECIFIC TANK OBJECTIVES

1.1 RELEVANT SAFETY ISSUES

The Double-Shell Tank (DST) System currently receives waste from the Single-Shell Tank (SST) System in support of SST stabilization efforts or from other on-site facilities which generate or store waste. Waste is also transferred between individual DSTs. The mixing or commingling of potentially incompatible waste types at the Hanford Site must be addressed prior to any waste transfers into the DSTs. The primary goal is to prevent the formation of an unreviewed safety question (USQ) as a result of improper waste management.

Tank 241-BX-106 is a non-Watch List SST. The Waste Compatibility Program is concerned with sampling the SST liquid to determine where and/or if that liquid waste can be transferred in order to support the interim stabilization of tank BX-106. Two issues related to the overall problem of waste compatibility must be evaluated:

- Assurance of continued operability during waste transfer and waste concentration.
- Assurance that we shall not create safety problems as a result of commingling wastes under interim storage.

The results of the grab sampling activity prescribed by this Sampling and Analysis Plan shall help determine which DST shall receive waste from tank BX-106 without creating safety or operational problems. The potential for four kinds of safety problems shall be addressed: criticality, flammable gas accumulation, energetics, and corrosion and leakage. Operational problems include plugged pipelines and equipment, exceeding the heat load limits of the receiving tank, and transuranic segregation.

1.1.1 Tank BX-106 Characterization Objectives

The characterization efforts applicable to this Sampling and Analysis Plan are focused on the preparation of future tank stabilization activities, including the resolution of the waste compatibility issue of tank BX-106. To identify a potential receiver tank, analyses shall be performed on the grab samples obtained from tank BX-106. These analyses are discussed in Section 4.0. Only decisions based on sampling and analysis of liquid waste from tank BX-106 will be addressed within this document; issues such as plugged pipelines and equipment problems are not within the scope of this Sampling and Analysis Plan. Once the characterization of tank BX-106 has been performed, the waste compatibility assessment shall be conducted. This effort is discussed in *Tank Farm Waste Compatibility Program* (Sutey 1994a).

1.1.2 Waste Compatibility Program Data Quality Objective

The document, *Data Quality Objectives for the Waste Compatibility Program* (Carothers 1994), describes the process used to develop a data quality objective (DQO) for the waste compatibility issue, as well as the analytical requirements for determining waste compatibility. Since the grab samples shall be taken only for waste compatibility, the waste compatibility program DQO (Carothers 1994) is the only applicable DQO for this sampling event.

2.0 TANK STATUS AND SAMPLING INFORMATION

2.1 TANK STATUS

As of November 1994, tank BX-106 contained approximately 174 kL (46 kgals) of waste. The waste consists of 57 kL (15 kgals) of supernate and 117 kL (31 kgals) of sludge, of which 57 kL (15 kgals) is drainable interstitial liquid. This tank volume is equivalent to about 30 cm (12 in.) of waste. Tank BX-106 is considered sound with respect to tank integrity and it is currently a non-Watch List tank (Hanlon).

2.2 SAMPLING INFORMATION

Tank BX-106 is scheduled to be grab sampled to prepare for stabilization. Two 100 mL samples shall be taken from riser 2 using a typical weighted-bottle sampler. The samples shall be taken from two different depths (Table 1). If, for some reason, the riser to be sampled or the sample depths must be altered, this change must be authorized by the sampling cognizant engineer and documented in either a data sheet or directly into the work package. For detailed information regarding the tank BX-106 grab sampling activities, refer to work package WS-94-905. This work package contains all the applicable operating procedures and the chain-of-custody records for this sampling event.

With respect to sampling quality control, no field/trip blank shall be taken during this sampling event due to the high concentration levels expected in the analyte results. Cross contamination should not have a significant effect on the analytical results (Sutey 1994b).

Table 1: Tank BX-106 Grab Sampling Depths

Sample Number	Sample Type	Sample Location	Sample Elevation[1]
6BX-95-1	Supernate	Riser 2	near surface
6BX-95-2	Supernate	Riser 2	near bottom

[1]Sample elevation is defined as the distance from the tank bottom to the mouth of the sample bottle.

3.0 LABORATORY SAMPLE RECEIPT AND ANALYSIS INSTRUCTIONS

A flowchart showing the general analysis scheme for tank BX-106 is presented in Figure 1. The steps are described in detail to provide the laboratory chemist with specific sample analysis guidance, and may be altered by the performing laboratory as necessary. All changes, with justification, must be included in the data report. Grab sample analyses may not need to be performed in the hot cell (based on radioactivity). If the samples must be analyzed in the hot cell, a hot cell blank should be performed; otherwise, no hot cell blank is necessary. The reporting levels for analyses are contained in Table 2 and are detailed in Section 7.0 of this document.

As a precautionary measure, the Safety and Analysis Report Packaging (SARP) has been reviewed for any safety issues involved with transportation of grab samples. **For grab samples, the shipping containers must be vented every four days to release retained gas.** However, Sampling Operations has a maximum of three days to ship the containers. Since the containers are opened at the time the samples are received at the laboratory, no safety issues should exist for grab samples with respect to transportation.

Step 1 — Receive grab samples. The discussion of sample receipt is presented in Section 4.2.3, "Sample Custody" of this document.

Step 2 — Record visual observations such as color and clarity of the liquid, and the presence of any solid particles in the liquid sample.

Step 3 — Closely inspect the liquid samples for the presence and approximate volume of any solids. If no solids exist, proceed to Step 5. However, if solids are detected in the liquid, go to Step 4A.

Step 4A — Remove a portion of the liquid sample and determine the volume percent solids by centrifugation.

Step 4B — Filter the liquid sample. If greater than 1 gram of solid sample is recovered, archive these solids for possible future analyses (Bratzel 1994).

Step 5 — Closely inspect the liquid sample for the presence and approximate volume of any potential organic layers. If potential organic liquid layers exist, proceed to Step 6. If potential organic layers do not exist, go to Step 7.

Step 6 — Any potential organic layer shall be reported immediately by Format I reporting (see Section 7.1). The potential organic layer shall be separated and retained in a jar for possible future analysis.

Step 7 — Remove sufficient aliquots and perform analyses in Table 2.

Step 8 — Retain 40 mL of any remaining liquid sample as the liquid archive (Bratzel 1994).

3.1 INSUFFICIENT LIQUID GRAB SAMPLE

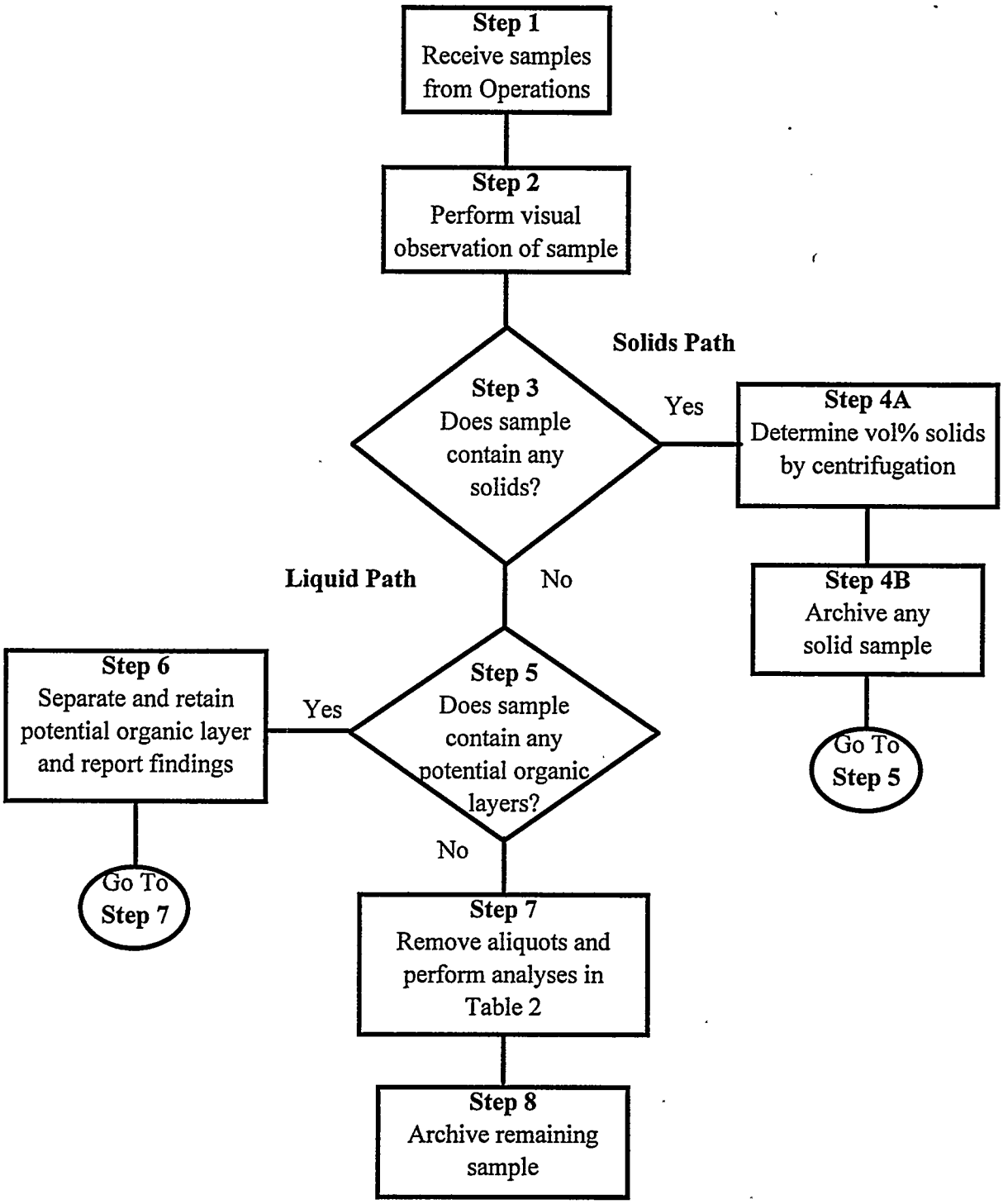
In the event that the sample volume from tank BX-106 is found to be insufficient to perform the requested analyses in Table 2, Characterization Support and Analytical Services, Program Management and Integration shall be notified (for points of contact, see Section 5.0, Table 3). A prioritization of the analyses required in this Sampling and Analysis Plan is given in Section 3.2. Any analyses prescribed by this document, but not performed, shall be identified in the appropriate data report, with justification for non-performance.

3.2 PRIORITIES FOR TANK BX-106

In order to complete the compatibility assessment for tank BX-106, results from all of the analyses in Table 2 must be received. Therefore, if insufficient sample is retrieved, the tank shall need to be resampled at a later date. However, analyses are still requested on any sample obtained, and should be performed in the following order:

(1) Corrosion Purposes: OH^-, IC, and pH
(2) Energetics: DSC/TGA, separable organics
(3) Flammable Gas Accumulation: Specific Gravity
(4) Criticality Analyses: Pu-239/240, Am-241, ICP (Fe), and volume percent solids
(5) TOC
(6) Heat Generation: Sr-90 and Cs-137
(7) Other analyses listed in Table 2

Figure 1: Test Plan Flow Chart for Tank BX-106



4.0 SPECIFIC ANALYTE, QUALITY ASSURANCE, AND DATA CRITERIA

4.1 SPECIFIC METHODS AND ANALYSES

Table 2 summarizes the analyses to be performed on the tank BX-106 grab samples. The laboratory procedure numbers which shall be used in the analyses are included in the table. These analyses are based on the Waste Compatibility DQO (Carothers 1994).

4.2 QUALITY ASSURANCE

4.2.1 Laboratory Operations

The 222-S Laboratory has a quality assurance program plan (Meznarich 1994) and a quality assurance project plan (Taylor 1993) that shall provide the quality assurance involved in analyzing the tank BX-106 waste samples. Additionally, the *Hanford Analytical Services Quality Assurance Plan* (DOE 1994), when implemented (August 31, 1995), shall be used as quality assurance guidance.

Method specific quality control, such as calibrations and blanks, are also found in the analytical procedures. Sample quality control (duplicates, spikes, standards) are identified in Table 2. If no criteria are provided in Table 2, the performing laboratory shall perform to its quality assurance plan(s).

4.2.2 Sample Collection

Two grab samples from tank BX-106 are to be taken and shipped to the performing laboratory by Sampling Operations in accordance with work package WS-94-905. That work package shall initiate the chain-of-custody for the samples. The following documents will be used as guidance in the handling and shipment of the tank BX-106 grab samples:

- TO-100-052, "Segregate, Package, and Inventory Radioactive Waste."
- WHC-CM-2-14, "Responsibilities and Procedures for all Hazardous Material Shipments."
- WHC-SD-TP-SARP-001, "Sample Pig Transport System Safety Analysis Report for Packaging (on-site)."
- WHC-SD-WM-HSP-002, "Tank Farm Health and Safety Plan."

Samples shall be identified by a unique number before being shipped to the laboratory (Table 1). The sampling team is responsible for documenting any problems and procedural changes affecting the validity of the sample in a field notebook. Sampling Operations shall enter this information in the comment section of the chain-of-custody form for addition to the data reports.

Sampling Operations should send the samples to the laboratory within 1 day of removing the samples from tank BX-106, but must transfer the samples within 3 calendar days. Sampling Operations is responsible for verbally notifying the shift manager at the WHC 222-S Laboratory (373-2435) at least 24 hours in advance of an expected shipment.

4.2.3 Sample Custody

The chain-of-custody form is initiated by the sampling team as described in the work package. Grab samples are shipped in a bottle and sealed with a Waste Tank Sample Seal. All sample shipments are to be labeled with the following information:

WASTE TANK SAMPLE SEAL

Supervisor	Sample No.
Date of Sampling	Time of Sampling
Shipment No.	Serial No.

The sealed and labeled samples are shipped to the laboratory along with the chain-of-custody form. The receipt and control of samples in the Westinghouse Hanford 222-S Laboratory is described in LO-090-101.

Table 2: Tank BX-106 Chemical, Radiological, and Physical Analytical Requirements

Project Name	BX-106 Grab Sample	COMMENTS	REPORTING LEVELS
Plan Number	WHC-SD-WM-TP-240, REV. 0	Homogenization Test - Not Required	FORMAT I — Early Notify
		Field Blank - Not Required	FORMAT II — Process Control
PROGRAM	PROGRAM CONTACTS	Hot Cell Blank - Performed as Necessary	FORMAT III — Safety Screen
C. Waste Compatibility	Waste Compatibility — J. M. Jones		FORMAT IV — Waste Management
	TWRS — R. D. Schreiber	TANK: BX-106 / #SAMPLES: 2	FORMAT V — RCRA Compliance
	222-S Laboratory — M. E. Rollison		FORMAT VI — Special

PROGRAM	PRIMARY ANALYSES: METHOD	ANAL.	WHC PROCEDURE	SAMPLE: LIQUID	PREP[1]	QUALITY CONTROL[2]: DUP	SPK/ MSD	BLK	CALIB STD	PR	AC	CRITERIA: UNITS	NOTIFICATION LIMIT[3]	EXPECTED RANGE[3]	FOR-MAT
C	DSC/TGA	Net Exo. Energy	LA-514-113 LA-560-112	X	d	ea smpl	N/A	N/A	ea AB	±20	80-120	J/g	net > 0[7]	unknown	I, II
C	Furnace Oxidation	TOC	LA-344-105	X	d[6]	ea smpl	1/mtrx	ea AB	ea AB	±20	80-120	µgC/mL	> 10,000	unknown	I, II
C	HPGC / MCA	GEA [137]Cs	LA-548-121	X	d[6]	ea smpl	N/A	ea AB	ea AB	±20	80-120	µCi/mL	none	unknown	II
C	Sep. & β counting	^{90}Sr	LA-220-101	X	d[6]	ea smpl	1/mtrx[5]	ea AB	ea AB	±20	80-120	µCi/mL	none	unknown	II
C	ICP	Al Fe Na	LA-505-151	X	d[6]	ea smpl	See [4]	ea AB	ea AB	±20	80-120	µg/mL	none none none	unknown unknown unknown	II
C	Titration[8]	OH^-	LA-661-103	X	d[6]	ea smpl	N/A	ea AB	ea AB	±20	80-120	µg/mL	none	unknown	I, II
C	IC	Cl^- F^- PO_4^{3-} SO_4^{2-}	LA-533-105	X	d[6]	ea smpl	1/mtrx	ea AB	ea AB	±20	80-120	µg/mL	none none none none	unknown unknown unknown unknown	II
C	IC	NO_3^- NO_2^-	LA-533-105	X	d[6]	ea smpl	1/mtrx	ea AB	ea AB	±20	80-120	µg/mL	none	unknown unknown	I,II
C	pH	[H+]	LA-212-102	X	d[6]	ea smpl	N/A	N/A	ea AB	±20	80-120	pH	none	unknown	II
C	Furnace Oxidation	TIC	LA-344-105	X	d[6]	ea smpl	N/A	ea AB	ea AB	±20	80-120	µgC/mL	none	unknown	II
C	Sep. & α counting	$^{239/240}Pu$	LA-503-156	X	d[6]	ea smpl	1/mtrx[5]	ea AB	ea AB	±20	80-120	µCi/mL	> 0.8	unknown	I, II
C	Sep. & α counting	^{241}Am	LA-953-103	X	d[6]	ea smpl	1/mtrx[5]	ea AB	ea AB	±20	80-120	µCi/mL	> 0.1	unknown	I, II
C	SpG	Density	LA-510-112	X	d	ea smpl	N/A	N/A	N/A	±20	80-120	g/mL	> 1.3	unknown	I, II
C	Centrifugation	% Solids	LA-519-132	X	d	ea smpl	N/A	N/A	N/A	±20	80-120	%	none	unknown	II
C	Visual	Organic Layer	LA-519-151	X	d	N/A	N/A	N/A	N/A	N/A	N/A	none	presence	unknown	I, II

[1]d-direct, f-fusion, a-acid, w-water

[2]PR-precision, AC-accuracy, ea-each, smpl-sample, DUP-duplicate, SPK/MSD-spike and matrix spike duplicate, AB-analytical batch, N/A-not applicable, mtrx-matrix

[3]Units for notification limits and expected ranges are those listed in the "units" column.

[4]Either serial dilutions or matrix spikes will be performed.

[5]Tracer or carrier may be used in place of a spike and results corrected for recovery.

[6]Direct liquid samples may be diluted in acid or water to adjust to proper sample size and/or pH.

[7]Action limit is applicable up to 500 °C. If the energetics action limit is exceeded, laboratory personnel and East Sytems Engineering will decide if adiabatic calorimetry shall be performed.

[8]OH^- will not be run if pH < 12.

5.0 ORGANIZATION

The organization and responsibility of key personnel involved in this tank BX-106 characterization project are listed in Table 3.

Table 3: Tank BX-106 Tank Project Key Personnel List

Individual	Organization	Responsibility
J. G. Kristofzski	222-S Analytical Operations	Program Support Manager of Analytical Operations
R. D. Schreiber	TWRS Characterization Support	Tank BX-106 Tank Characterization Plan Cognizant Engineer
J. M. Jones	East Systems Engineering	Sampling and Compatibility Cognizant Engineer
J. L. Deichman	Analytical Services	Manager of Analytical Services Program Management and Integration
East Tank Farm Operations Shift Manager	Tank Farm Operations	200 East Tank Farm Point of Contact if Action Limit is Exceeded (373-2689)

6.0 EXCEPTIONS FOR TANK BX-106

In the Waste Compatibility DQO, several necessary specifications concerning sampling and analysis were omitted. These clarifications are addressed in (Sutey 1994b).

In (Sutey 1994b), accuracy requirements are specified in terms of spike recovery. However, the laboratory can also assess accuracy via standards. Therefore, it was presumed that the Waste Compatibility Program would like to have information on accuracy for those analyses for which spikes are not performed, and would specify accuracy requirements as 80-120% regardless of the method of accuracy determination (Table 2).

Since historical information exists to adequately address the potential for line plugging and precipitation of solids during the transfer of waste, no viscosity or cooling curve analysis shall be required during this analysis activity.

7.0 DELIVERABLES

All analyses of tank BX-106 waste material will be reported as Formats I and II as shown in Table 2. The Waste Compatibility Program may have requested progress reports from the laboratory regarding the analyses. However, due to the rapid turn around time required for the BX-106 analyses (see Section 7.2), no special progress reports for this tank characterization project shall be required from the laboratory. All reports generated as part of normal operations (e.g., monthly reports) shall still be done. The data shall be reported in the units given by Table 2, and all procedure and revision numbers used in the analyses shall be included in the report. Additional information regarding reporting formats is given in Schreiber (1994a).

7.1 FORMAT I REPORTING

Table 2 contains the notification limits for each analyte. Any results that exceed the notification limits defined in the DQO processes, shall be reported immediately by calling the East Tank Farm Operations Shift Manager at 373-2689 and the Characterization Program Office (Schreiber 1994b). This verbal communication must be followed within 24 hours by written notification to East Systems Engineering, Characterization Program Office, Waste Tanks Process Engineering, Analytical Services, and Characterization Support documenting the observations. Points of contact within each program/project are defined by Schreiber (1994c). Additional analyses for verification purposes may be contracted between the performing laboratory and the above contacts either by a revision to this document or by letter of instruction.

7.2 FORMAT II REPORTING

The data found from these analyses shall determine whether or not waste from tank BX-106 is compatible with the waste in the DSTs. Due to the immediate necessity of the data, the WHC 222-S Laboratory has agreed to have the analyses completed and results reported no later than two weeks after receipt of the sample at the laboratory loading dock. The results shall be reported electronically, or by using a Laboratory Information Management Systems (LIMS) report to East Systems Engineering. Although no data validation, supporting raw data, or quality control results are to be included, the results still require review and approval by the cognizant scientist or manager of the laboratory operation. In addition to the LIMS/electronic report, a letter report shall be sent to Characterization Support, Characterization Program Office, Los Alamos Technical Associates (LATA), East Systems Engineering, Tank Characterization Database, and Tank Characterization Resource Center representatives summarizing the results. Any observations taken during the receipt and analyses of the grab samples should be included in this letter report.

8.0 CHANGE CONTROL

Under certain circumstances, it may become necessary for the performing laboratory to make decisions concerning a sample without review of the data by the customer or the Characterization Program. These changes shall be documented through the use of internal characterization change notices or analytical deviation reports for minor low-impact changes and documented in applicable laboratory reports. All significant changes (such as changes in scope) shall be documented by Characterization Support via an Engineering Change Notice to this Tank Characterization Plan. All changes shall also be clearly documented in the final data report.

Additional analyses of grab sample material from this characterization project at the request of the Characterization Program shall be performed according to a revision of this Tank Characterization Plan.

9.0 REFERENCES

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