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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-C-101.

8. RELEASE STAMP

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Tank 241-C-101 Tank Characterization Plan

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LIST OF ABBREVIATIONS

C-101	Tank 241-C-101
DOE	U.S. Department of Energy
DNFSB	Defense Nuclear Facilities Safety Board
DQO	Data Quality Objective
DST	Double Shell Tank
HEPA	High-Efficiency Particulate Air Filter
PUREX	plutonium-uranium extraction
RCRA	Resource Conservation and Recovery Act of 1976
SST	Single Shell Tank
TBP	tributyl phosphate
TCP	Tank Characterization Plan
TPA	Federal Facility Agreement and Consent Order (Tri-Party Agreement)
TWRS	Tank Waste Remediation System
WHC	Westinghouse Hanford Company

1.0 INTRODUCTION

The Defense Nuclear Facilities Safety Board (DNFSB) has advised the U.S. Department of Energy (DOE) to concentrate the near term sampling and analysis activities on identification and resolution of safety issues (Conway 1993). The data quality objective (DQO) process was chosen as a tool to identify sampling and analytical needs for the resolution of safety issues. As a result, a revision in the Federal Facility Agreement and Consent Order (Tri-Party Agreement or TPA) milestone M-44 has been made, which states that "A Tank Characterization Plan (TCP) will be developed for each double shell tank (DST) and single shell tank (SST) using the DQO process ... Development of TCPs by the DQO process is intended to allow users (e.g., Hanford Facility user groups, regulators) to ensure their needs will be met and that resources are devoted to gaining only necessary information" (Ecology et al. 1994). This document satisfies that requirement for tank 241-C-101 (C-101) sampling activities.

2.0 DATA QUALITY OBJECTIVES APPLICABLE TO TANK 241-C-101

The sampling and analytical needs associated with the Hanford Site underground storage tanks on one or more of the four Watch Lists (ferrocyanide, organic, flammable gas, and high heat) and the safety screening of all 177 tanks have been identified through the DQO process. A DQO identifies the information needed by a program group concerned with safety issues, regulatory requirements, tank waste processing, or the transport of tank waste. As of January 1995, the DQOs that have been completed and apply to tank C-101 are discussed in the following paragraphs.

2.1 SAFETY SCREENING DATA QUALITY OBJECTIVES

The *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994) describes the sampling and analytical requirements that are used to screen waste tanks for unidentified safety issues. Both Watch List and non-Watch List tanks will be sampled and evaluated to classify waste tanks in one of three categories (SAFE, CONDITIONALLY SAFE, or UNSAFE). The safety screening DQO identifies the guidelines to determine to which classification a tank belongs based on analyses that indicate if certain measurements are within established parameters. The primary analytical requirements for the safety screening of a tank are energetics, total alpha activity, moisture content, and flammable gas concentration. If a specified parameter is exceeded, further analyses may be required to classify a tank. A tank can be removed from a Watch List if it is classified as SAFE. Tank C-101 is not on a Watch List.

This DQO requires that a vertical profile of the tank waste be obtained from at least two widely spaced risers. This vertical profile may be obtained using core, auger, or grab samples. The safety screening analyses shall be applied to all core samples, DST Resource Conservation and Recovery Act (RCRA) samples, and auger samples, except those taken exclusively to assess the flammable gas crust burn issue.

3.0 TANK AND WASTE INFORMATION

This section summarizes the available historical information on tank C-101. Included are the age of the tank, process history, and the expected contents of the tank based on the latest information. The fill history information is available in *A History of the 200 Area Tank Farms* (Anderson 1990).

3.1 1995 TANK STATUS

Tank C-101 was classified as a possible leaker in 1970 and a suspect leaker in 1973. In 1980, the tank was declared an assumed leaker with a leak volume of 75,000 liters (20,000 gallons). The tank is passively ventilated, interim stabilized, and intrusion prevention measures have been completed. Approximately 333,000 liters (88,000 gallons) of waste is contained in the tank. The waste is comprised of 333,000 liters (88,000 gallons) of sludge, and no supernatant. 11,000 liters (3,000 gallons) of drainable liquid remains within the waste (Hanlon 1995). The total volume of waste in the tank corresponds to a depth of about 61 centimeters (24 inches). The latest photograph shows a black and white sludge surface with no visible liquid. Tank C-101 is classified as a low heat tank and the available data shows a median temperature of 30°C (86°F).

3.2 TANK CONFIGURATION

Single shell tank C-101 was constructed between 1943 and 1944 and is located in the 200 East Area. Tank C-101 is 23 meters (75 feet) in diameter and has a design capacity of 2,006,000 liters (530,000 gallons). The tank is first in a cascade flow series consisting of tanks C-101, 241-C-102, and 241-C-103. A cascade system consists of tanks connected in series by pipes. When the primary tank in the system became full, the waste would then flow to the secondary tanks in the system.

3.3 TANK HISTORY

Tank C-101 entered service in March 1946 when it began receiving metal waste. During the second quarter of 1952, the metal waste was sluiced to recover uranium and the tank contained U Plant waste until the fourth quarter of 1962. During this period, the overflow outlet to tank 241-C-102 was plugged (second quarter of 1954), the tank was scavenged (last two quarters of 1956), and it served as the feed tank for scavenging operations (second quarter of 1957). The tank contained coating waste from the fourth quarter of 1960 until the third quarter of 1963 and PUREX waste from the fourth quarter of 1963 until the first quarter of 1976. The tank was noted as a possible leaker in 1970 and as a suspect leaker in 1973. In 1976, it was removed from service and a saltwell pump was installed. Primary stabilization and pumping were completed in 1978 and 1979, respectively. The tank was classified as an assumed leaker in 1980 with a leak volume of 75,000 liters (20,000 gallons). A level adjustment was made in April 1982 and intrusion prevention was completed in December 1982. Interim stabilization was completed administratively and a level adjustment was made in November 1983 (Brevick 1994). Figure 3-1 summarizes the influx and effluent history of tank C-101.

3.4 EXPECTED TANK CONTENTS

Tank C-101 is expected to have two primary layers of waste. The bottom layer should be the tributyl phosphate from the uranium recovery process and the upper layer should be the cladding waste from the plutonium-uranium extraction (PUREX) waste streams. Sodium, aluminum, iron, hydroxide, nitrate, nitrite, carbonate, sulfate, phosphate, uranium, and strontium were present in high concentrations (Brevick 1994). An estimated inventory based on historical sample and analysis data is shown in Table 3-1 (Brevick 1994).

Table 3-1: Tank C-101 Solids Composite Inventory Estimate

Physical Properties			
Total Solid Waste	Mass = 5.39E+05 kg; Volume = 333kL (88 kgal)		
Heat Load	0.16 kW (5.49E+02 BTU/hr)		
Bulk Density	1.62 (g/cc)		
Void Fraction	0.38		
Water wt%	28.74		
Chemical Constituents	moles/L	$\mu\text{g/g}$	kg
Na ⁺	6.99E+00	9.93E+04	5.35E+04
Al ³⁺	2.24E+00	3.73E+04	2.01E+04
Fe ³⁺	3.60E-01	1.25E+04	6.72E+03
OH ⁻	7.96E+00	8.36E+04	4.51E+04
NO ₃ ⁻	6.00E-01	2.30E+04	1.24E+04
NO ₂ ⁻	7.14E-02	2.03E+03	1.09E+03
CO ₃ ²⁻	1.10E-01	4.06E+03	2.19E+03
PO ₄ ³⁻	1.00E+00	5.85E+04	3.15E+04
SO ₄ ²⁻	1.56E+00	9.24E+04	4.99E+04
Cl ⁻	3.12E-03	6.82E+01	3.68E+01
Radiological Constituents	Ci/L	$\mu\text{Ci/g}$	Ci
Pu	1.70E-03	1.05E+00	9.43E+00
U	2.82E-02 (M)	4.15E+03 ($\mu\text{g/g}$)	2.24E+03 (kg)
Cs	1.05E-03	6.50E-01	3.51E+02
Sr	7.09E-02	4.38E+01	2.36E+04

Figure 3-1: F111 History for Tank 241-C-101

4.0 TANK C-101 SCHEDULED SAMPLING EVENTS

Tank C-101 is scheduled for auger sampling in April 1995. No other sampling is scheduled through Fiscal Year 1997 (Stanton 1995). Auger sampling shall be conducted in accordance with the *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994). Sampling and analytical requirements from this DQO are summarized in Table 4-1. A more complete list of analytical requirements is given, as an appended revision, in the appropriate sampling and analysis plan.

Table 4-1: Integrated DQO Requirements

Sampling Event	Applicable DQO	Sampling Requirements	Analytical Requirements
Auger	Tank Safety Screening	Samples from a minimum of 2 risers separated radially to the maximum extent possible	▪Energetics ▪Moisture Content ▪Total Alpha ▪Gas Composition

5.0 REFERENCES

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APPENDIX A

**SAMPLING AND ANALYSIS PLAN FOR AUGER
SAMPLING IN FISCAL YEAR 1995**

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LIST OF ABBREVIATIONS FOR APPENDIX A

C-101	Tank 241-C-101
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 - multi channel analysis
IC	ion chromatography
ICP	inductively coupled plasma
NCPLX	non complex waste
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
RSST	reactive system screening tool - adiabatic calorimetry
SST	single shell tank
TCP	Tank Characterization Plan
TGA	thermogravimetric analysis
TIC	total inorganic carbon
TOC	total organic carbon
TWRS	Tank Waste Remediation System
USQ	unreviewed safety question
WHC	Westinghouse Hanford Company

A1.0 SPECIFIC TANK CHARACTERIZATION OBJECTIVES

This Sampling and Analysis Plan will identify characterization objectives pertaining to sample collection, hot cell sample breakdown, and laboratory analytical evaluation and reporting requirements in accordance with the *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994).

The sampling criteria for safety screening require that "a vertical profile of the waste be obtained from at least two widely-spaced risers ... assuming the quality of the data obtained supports appropriate safety classifications of the tank. Such sampling can be done by core drilling, by auger sampling (for shallow tanks), and/or by obtaining liquid supernate samples at several levels" (Babad and Redus 1994). Tank C-101 shall be sampled for safety screening purposes using the auger sampling method. Two samples shall be taken from existing installed risers that are separated radially to the maximum extent possible (see Section A2.0).

The analytical requirements for the safety screening of a tank specify sample analyses to be performed on half-segments and include the identification of the content of a common set of primary analytes and waste characteristics. These analytes are energetics, total alpha, percent moisture, and flammable gas concentrations. If notification limits are exceeded for these analytes, further analysis of a secondary set of analytes and a possible Watch List tank classification would be warranted. Currently, flammable gas concentrations are measured by in-tank monitoring devices. This Sampling and Analysis Plan identifies procedures and requirements, in accordance with the safety screening DQO and the Characterization Program, for collecting and characterizing samples from tank C-101 by the auger sampling method.

A2.0 TANK STATUS AND SAMPLING INFORMATION

A2.1 TANK STATUS

Tank C-101 was classified as a possible leaker in 1970 and a suspect leaker in 1973. In 1980, the tank was declared an assumed leaker with a leak volume of 75,000 liters (20,000 gallons). The tank is passively ventilated, interim stabilized, and intrusion prevention measures have been completed. Approximately 333,000 liters (88,000 gallons) of waste is contained in the tank. The waste is comprised of 333,000 liters (88,000 gallons) of sludge, and no supernatant. Approximately 11,000 liters (3,000 gallons) of drainable liquid remains within the waste (Hanlon 1995). The total volume of waste in the tank corresponds to a depth of about 61 centimeters (24 inches). The latest photograph shows a black and white sludge surface with no visible liquid. Tank C-101 is classified as a low heat tank and the available data shows a median temperature of 30°C (86°F). Tank C-101 is not on any Watch List and there are no unreviewed safety questions (USQ) associated with the tank at this time.

A2.2 SAMPLING INFORMATION

Tank C-101 is currently scheduled to be sampled by the auger sampling method. Samples are expected to be taken from risers 1 and 8. If a different riser is necessary to meet sampling and analysis requirements, this change must satisfy the

intent of the applicable DQOs and must be recorded and approved by the cognizant engineer before sampling. The risers used may be recorded on a permanent data sheet or recorded directly in the work package. Sampling shall be conducted following procedures and documentation included in tank C-101 work package ES-95-00077. If the sampling depth is within ± 5 inches of the current depth information, one 20-inch auger bit will be used for the sampling of the riser. In the event that the current depth information is incorrect, a different sized auger bit may be used. The objective of the sampling event is to reach the inner bottom of the tank (bottom of the waste), and the number of samples might change depending on the depth of the waste in the tank.

A3.0 LABORATORY SAMPLE RECEIPT AND ANALYSIS INSTRUCTIONS

A3.1 TANK-SPECIFIC ANALYTICAL PROCEDURES

Flowcharts depicting the general safety screening sample breakdown and analysis scheme are presented in Figures A-1, A-2, and A-3. These steps are described in detail to provide the hot cell and laboratory chemists with guidance for the breakdown of the samples and may be altered as appropriate by the performing laboratory. Several analyses listed in Table A-1 require a 45-day reporting time, as noted. The 45-day reporting format, Format III, is explained in Section A7.3.

Any decisions, observations, or deviations and justifications made to this work plan or during the sample breakdown shall be documented in writing. These decisions and observations shall also be reported in the data report. The reporting formats for analyses are contained in Table A-1.

It should be noted that, in accordance with the Safety and Analysis Report for Packaging (SARP), auger samples from tank C-101 must be vented every fifteen days from the time of cask sealing to allow any retained gas to escape.

- Step 1 Receive auger samples at the laboratory in accordance with approved procedures.
- Step 2 Conduct the following on the material from each auger sample:
 - ▶ Perform a visual examination of the sample(s)
 - ▶ Record observations. This may include a sketch of the auger sample in addition to written documentation of pertinent descriptive information such as color, texture, homogeneity, and consistency.
 - ▶ Note the color and clarity of any drainable liquids.
 - ▶ Take color photographs and/or a videotape to visually document the auger samples.
- Step 3 Does the sample contain drainable liquids?
 - Yes: Proceed to Step 4A
 - No: Proceed to Step 5A

- Step 4A Separate any drainable liquids from the solids. Measure and record the volume. Retain drainable liquids for further processing.
- Step 4B Is the sample 100% drainable liquids?
- Yes: Proceed to Step 11
No: Proceed to Step 5A

SOLIDS PATH

- Step 5A Is there a hard, dry layer on the top of the auger sample?
- Yes: Proceed to Step 5B
No: Proceed to Step 5C
- Step 5B Separate the hard, dry layer and retain for analysis.
- Step 5C Divide each auger sample into two subsamples (i.e., half segments).
- Step 6 Homogenize each subsample using the appropriate approved procedure.
- Step 7 Will a homogenization test be performed?
- Yes: Proceed to Step 8
No: Proceed to Step 9
- NOTE:** One subsample per core, at a minimum, should be used if a homogenization test is done. Additional tests may be performed at the laboratory's discretion.
- Step 8 Conduct the homogenization test by taking 1 to 2 g aliquot from widely separated locations of the homogenized subsample. Conduct the homogenization test in accordance with (Bell 1993).
- Step 9 Collect sufficient aliquots from each homogenized subsample to perform the appropriate preparations and analyses listed in Table A-1.
- NOTE:** If there is an insufficient amount of sample available in any subsample to perform all required analyses, notify the Characterization Program within one business day and follow the prioritization of analyses given in Section A3.3.
- Step 10 Remove at least 20 mL and up to 40 mL of each homogenized subsample for the archive sample (Bratzel 1994).

LIQUIDS PATH

- Step 11 Closely inspect the liquid sample for the presence and approximate volume of any potential organic layers. Does the sample contain any immiscible (potentially organic) layers?

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Yes: Proceed to Step 12A

No: Proceed to Step 13

Step 12A Report any visually observed immiscible (potential organic) layer immediately by the early notification system (Section A7.2).

Step 12B Separate and retain the potential organic layer for possible future analysis.

NOTE: Steps 13 through 17 shall be performed on the remaining (probable aqueous) liquid layer only.

Step 13 Filter the remaining liquid sample through a 0.45 micron filter.

Step 14 Is there greater than 1 gram of solid on the filter?

Yes: Proceed to Step 15

No: Proceed to Step 16

Step 15 Archive the solids for possible future analysis (Bratzel 1994).

Step 16 Remove sufficient aliquots from the liquid sample to perform the appropriate analyses listed in Table A-1 in duplicate.

Step 17 Archive at least 20 mL and up to 40 mL of the drainable liquid as the liquid archive (Bratzel 1994).

PRIMARY ANALYSIS PATH

Step 18 Perform primary analyses as listed in Table A-1.

Step 19 Compare the primary analysis data with notification limits.

Step 20A Do the results exceed the notification limits (Table A-1)?

Yes: Proceed to Step 20B.

No: Proceed to Step 23.

Step 20B Report results exceeding the notification limits using Format I reporting deliverable requirements as listed in Section A7.2.

SECONDARY ANALYSIS PATH

Step 21 Perform secondary analyses according to Table A-1.

Step 22A Do the secondary analyses exceed the notification limits?

Yes: Proceed to Step 22B

No: Proceed to Step 23

Step 22B Report results exceeding the notification limits using Format I

reporting deliverable requirements as listed in Section A7.2.

Step 23 Report results as listed in Section A7.0.

A3.2 INSUFFICIENT SAMPLE RECOVERY

If the amount of material recovered from the auger samples taken from tank C-101 is insufficient to perform the analyses requested and permit a minimum 10 mL archive per sample, the laboratory shall notify the Tank Cognizant Engineer within one working day (See Table A-2). A prioritization of the analyses requested in this document is given in Section A3.3. Any analyses prescribed by this document, but not performed, shall be identified in the appropriate data report, with justification for non performance.

A3.3 PRIORITIES OF REQUESTED ANALYSES

Confirmation of the priority levels or revision of sample breakdown procedures may be provided to the laboratory based upon the sample recovery, readily observable physical properties within the sample, and the requested sample breakdown procedures provided in Section A3.1. The priority of an analysis is specified by its designation as a primary or secondary analysis. Further ranking may be determined by the program on a DQO basis.

Figure A-1: Solid Analysis Flow Chart

Figure A-2: Liquid Analysis Flow Chart

ANALYSIS AND REPORTING PATH

Figure A-3: Sample Analysis and Reporting Flow Chart

A4.0 SPECIFIC ANALYTE, QUALITY ASSURANCE, AND DATA CRITERIA**A4.1 SPECIFIC METHODS AND ANALYSES**

The analyses in Table A-1 to be performed on the tank C-101 auger samples are based on the safety screening DQO referenced in Section A1.1.2. The laboratory procedure numbers, which shall be used for the analyses, are included in this table.

A4.2 QUALITY ASSURANCE/QUALITY CONTROL**A4.2.1 Laboratory Operations**

The WHC 222-S Laboratory has a quality assurance program plan (Meznarich 1994) and a quality assurance project plan (Taylor 1993) that shall provide the primary direction for quality assurance when analyzing the waste tank auger samples at the 222-S Laboratory. Additionally, the *Hanford Analytical Services Quality Assurance Plan* (DOE 1994), when implemented (scheduled for August 31, 1995), shall be used for quality assurance/quality control 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 A-1. If no criteria are provided in Table A-1, the performing laboratory shall perform to its quality assurance plan(s).

A4.2.2 Sample Collection

Two auger samples are to be taken from tank C-101 and shipped to the performing laboratory by Sampling Operations following work package ES-95-00077. That work package shall also initiate the chain-of-custody for the samples. Approved procedure T0-080-090 ("Load/Transport Sample Cask(s)") is to be used during the sampling event. Samples shall be identified by a unique number before being shipped to the performing laboratory. 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 transport each sample collected to the performing laboratory within one working day of removing the sample from the tank, but must transport each sample within three calendar days. Sampling Operations is responsible for verbally notifying the WHC 222-S Laboratory (373-2435) at least 24 hours in advance of an expected shipment.

A4.2.3 Sample Custody

The chain-of-custody form is initiated by the sampling team as described in work package ES-95-00077. Samples are shipped in a cask and sealed with a Waste Tank Sample Seal.

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 WHC 222-S Laboratory are described in laboratory procedure LO-090-101.

Table A-1: Tank C-101 Chemical, Radiological and Physical Analytical Requirements

SOLID ANALYSES																	
Project Name			C-101 Auger Sample				COMMENTS								REPORTING LEVELS		
Plan Number			WHC-SD-WM-TP-285, REV. 1				Homogenization Test - Per Laboratory Discretion								FORMAT I		Early Notify
							Field Blank - Not Required								FORMAT II		Process Control
PROGRAM			PROGRAM CONTACTS				Hot Cell Blank - Per Laboratory Discretion								FORMAT III		Safety Screen
A. Safety Screening			Safety Screening		H. Babad										FORMAT IV		Waste Management
			TWRS		R. D. Schreiber		TANK		#AUGERS						FORMAT V		RCRA Compliance
			222-S Laboratory		J. G. Kristofzski		C-101		2						FORMAT VI		Special
PROGRAM	PRIMARY ANALYSES			SAMPLE ¹		PREP ²	QUALITY CONTROL ³						CRITERIA			FORMAT	
	METHOD	ANAL.	WHC PROCEDURE	½ SEG SLDG	½ SEG SC		DUP	SPK/ MSD	BLK	CALIB STD	PR	AC	UNITS	NOTIFICATION LIMIT ⁴	EXPECTED RANGE ⁴		
A	DSC	Energy	LA-514-113	X	X	d	ea smpl	N/A	N/A	ea AB	±10	90-110	J/g ⁶	> 481	unknown	I, III	
A	TGA	% H ₂ O	LA-560-112	X	X	d	ea smpl	N/A	N/A	ea AB	±10	90-110	wt%	< 17	28.7	I, III	
A	Alpha	Total Alpha	LA-508-101	X		f or a	ea smpl	1/mtrx	ea PB	ea AB	±10	90-110	µCi/g	> 41	unknown	I, III	
PROGRAM	SECONDARY ANALYSES			SAMPLE ¹		PREP ²	QUALITY CONTROL ³						CRITERIA			FORMAT	
	METHOD	ANAL.	WHC PROCEDURE	½ SEG SLDG	½ SEG SC		DUP	SPK/ MSD	BLK	CALIB STD	PR	AC	UNITS	NOTIFICATION LIMIT ⁴	EXPECTED RANGE ⁴		
A	RSST ¹⁰	Energy	see 10 below	X	X	d	N/A	N/A	N/A	ea AB	±10	90-110	J/g	> 481	unknown	I, III	
A	Distillation ¹⁰	CN	LA-695-102	X	X	d	ea smpl	1/mtrx	ea AB	ea AB	±10	90-110	µg/g	> 39,000	unknown	I, III	
A	Hot Persulfate ¹⁰	TOC	LA-342-100	X	X	d	ea smpl	1/mtrx	ea AB	ea AB	±10	90-110	µg C/g	> 30,000	unknown	I, III	
A	Sep. & α counting ¹¹	Pu-239/240	LA-503-156	X		f	ea smpl	1/mtrx ⁸	ea PB	ea AB	±10	90-110	µCi/g	> 41	1.05	I, III	
A	ICP ¹¹	Fe Mn U	LA-505-151	X		f or a	ea smpl	see ⁹	ea PB	ea AB	±10	90-110	µg/g	none none none	12,500 unknown 4,150	III III III	

¹½ SEG SLDG-½ segment, sludge; ½ SEG SC-½ segment, saltcake²d-direct, f-fusion dissolution, a-acid dissolution, w-water dissolution³PR-precision, AC-accuracy, ea-each, smpl-sample, DUP-duplicate, SPK/MSD-spike and matrix spike duplicate, AB-analytical batch, PB-preparation blank, N/A-not applicable, mtrx-matrix⁴Units for notification limits and expected range are those listed in the "units" column.⁶Dry weight basis.⁶Direct liquid samples may be diluted in acid or water to adjust to proper sample size and/or pH.⁸Tracer or carrier may be used in place of a spike and results corrected for recovery.⁹Either serial dilutions or matrix spikes will be performed.¹⁰This analysis required if DSC exceeds notification limits. The RSST method, yet to be formalized, may be found in WHC-SD-WM-TP-104.¹¹Performed only if total alpha exceeds notification limit.

Table A-1: Tank C-101 Chemical, Radiological and Physical Analytical Requirements

LIQUID ANALYSES																	
Project Name		C-101 Auger Sample				COMMENTS								REPORTING LEVELS			
Plan Number		WHC-SD-WM-TP-285, REV. 1				Homogenization Test - Per Laboratory Discretion								FORMAT I		Early Notify	
						Field Blank - Not Required								FORMAT II		Process Control	
PROGRAM		PROGRAM CONTACTS				Hot Cell Blank - Per Laboratory Discretion								FORMAT III		Safety Screen	
A. Safety Screening		Safety Screening		H. Babad										FORMAT IV		Waste Management	
		TWRS		R. D. Schreiber		TANK		#AUGERS						FORMAT V		RCRA Compliance	
		222-S Laboratory		J. G. Kristofzski		C-101		2						FORMAT VI		Special	
PROGRAM	PRIMARY ANALYSES			SAMPLE ¹	PREP ²	QUALITY CONTROL ³						CRITERIA			FORMAT		
	METHOD	ANAL.	WHC PROCEDURE	LIQUID		DUP	SPK/ MSD	BLK	CALIB STD	PR	AC	UNITS	NOTIFICATION LIMIT ⁴	EXPECTED RANGE ⁴			
A	DSC	Energy	LA-514-113	X	d	ea smp	N/A	N/A	ea AB	±10	90-110	J/g ⁶	> 481	unknown	I, III		
A	TGA	% H ₂ O	LA-560-112	X	d	ea smp	N/A	N/A	ea AB	±10	90-110	wt%	< 17	25 to 30	I, III		
A	Visual	Organic Layer	LA-519-151	X	d	N/A	N/A	N/A	N/A	N/A	N/A	none	presence	unknown	I, III		
PROGRAM	SECONDARY ANALYSES			SAMPLE ¹	PREP ²	QUALITY CONTROL ³						CRITERIA			FORMAT		
	METHOD	ANAL.	WHC PROCEDURE	LIQUID		DUP	SPK/ MSD	BLK	CALIB STD	PR	AC	UNITS	NOTIFICATION LIMIT ⁴	EXPECTED RANGE ⁴			
A	RSST ¹⁰	Energy	see 10 below	X	d	N/A	N/A	N/A	ea AB	±10	90-110	J/g ⁶	> 481	unknown	I, III		
A	Distillation ¹⁰	CN	LA-695-102	X	d ⁶	ea smp	1/mtrx	ea AB	ea AB	±10	90-110	µg/mL	> 39,000 ⁷	unknown	I, III		
A	Hot Persulfate ¹⁰	TOC	LA-342-100	X	d ⁶	ea smp	1/mtrx	ea AB	ea AB	±10	90-110	µg C/mL	> 30,000 ⁷	unknown	I, III		

²d-direct, f-fusion dissolution, a-acid dissolution, w-water dissolution³PR-precision, AC-accuracy, ea-each, smpl-sample, DUP-duplicate, SPK/MSD-spike and matrix spike duplicate, AB-analytical batch, PB-preparation blank, N/A-not applicable, mtrx-matrix⁴Units for notification limits and expected range are those listed in the "units" column.⁵Dry weight basis.⁶Direct liquid samples may be diluted in acid or water to adjust to proper sample size and/or pH.⁷Converted from weight basis to a volumetric basis assuming a liquid density of 1.0 g/mL.⁸Tracer or carrier may be used in place of a spike and results corrected for recovery.⁹Either serial dilutions or matrix spikes will be performed.¹⁰This analysis required if DSC exceeds notification limits. The RSST method, yet to be formalized, may be found in WHC-SD-WM-TP-104.

A5.0 ORGANIZATION

The organization and responsibility of key personnel involved with this tank C-101 characterization project are listed in Table A-2.

Table A-2: Tank C-101 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 C-101 Tank Characterization Plan Cognizant Engineer
H. Babad	Characterization Program	Safety Screening Point of Contact
East Area Shift Operations Manager	Tank Farm Operations	East Tank Farm Point of Contact if Notification Limit is Exceeded (373-2689)

A6.0 EXCEPTIONS, CLARIFICATIONS AND ASSUMPTIONS**A6.1 EXCEPTIONS TO DQO REQUIREMENTS**

It is specified in the safety screening DQO (Babad and Redus 1994) that cyanide analyses are to be run on a quarter-segment level and that the notification limit for the DSC analysis is 523 J/g (125 cal/g). The revised ferrocyanide DQO (Meacham et al. 1994) has changed the requirements such that the cyanide analysis is now to be run on a half segment level and the DSC notification limit is 481 J/g (115 cal/g dry weight basis). The change will be incorporated in the next revision to the safety screening DQO. Therefore, this Sampling and Analysis Plan specifies that cyanide analysis will be run on a half segment level and that notification shall be made if the DSC value exceeds 481 J/g dry weight basis (115 cal/g).

A6.2 CLARIFICATIONS AND ASSUMPTIONS

A number of clarifications and assumptions relating to the notification limits or decision thresholds identified in the applicable DQO efforts need to be made with respect to the analyses in Table A-1. Each of these issues are discussed below.

- Any exotherm (in cal/g or J/g) determined by differential scanning calorimetry (DSC) must be reported on a dry weight basis as shown in equation (1) using the weight percent water determined from Thermogravimetric Analysis.

$$\text{Exotherm (dry wt)} = \frac{[\text{exotherm (wet wt)} \times 100]}{(100 - \% \text{ water})} \quad (1)$$

NOTE: A large error in the DSC value may result when converting samples containing greater than 90% water to a dry weight basis. However, this conversion is still required.

- The safety screening DQO (Babad and Redus 1994) requires that additional analyses be performed if total alpha activity is greater than 1 g/L. Total alpha is measured in $\mu\text{Ci/g}$ rather than g/L. To convert the notification limit for total alpha into a number more readily usable by the laboratory, it was assumed that all alpha decay originates from Pu-239. The notification limit may then be calculated as shown in equation (2):

$$\left(\frac{1 \text{ g}}{\text{L}} \right) \left(\frac{1 \text{ L}}{10^3 \text{ mL}} \right) \left(\frac{1}{\text{density}} \frac{\text{mL}}{\text{g}} \right) \left(\frac{0.062 \text{ Ci}}{1 \text{ g}} \right) \left(\frac{10^6 \mu\text{Ci}}{1 \text{ Ci}} \right) = \frac{61.5}{\text{density}} \frac{\mu\text{Ci}}{\text{g}} \quad (2)$$

NOTE: If a density of 1.5 g/ml is assumed for solid material, the notification limit becomes 41 $\mu\text{Ci/g}$.

The safety screening DQO, upon which the analyses in Table A-1 are based, does not sufficiently address the analysis of any drainable liquids present. To adequately characterize the tank, all analyses performed on the solids for the safety screening DQO, with the exception of total alpha analyses, shall also be performed on any drainable liquids.

A7.0 DELIVERABLES

All analyses of tank C-101 waste material shall be reported as Formats I and/or III as indicated in Table A-1. Additional information regarding reporting formats is given in Schreiber (1994a).

A7.1 PROGRESS REPORTS

Each laboratory performing analyses on tank C-101 waste material from this sampling project shall provide monthly status reports to the Characterization Program. This report shall contain 1) an activity summary of analyses completed or started under the work package, 2) results of preliminary analyses, and 3) schedule and cost information on a DQO basis.

Monthly and cumulative costs will be compared to the budgeted costs as part of the status report. Monthly variances greater than 10% or \$10,000, and cumulative variances greater than \$50,000 from the budgeted costs or schedule must be explained in the report. Cost reporting shall consist of the following:

1. budgeted cost of work scheduled
2. monthly cost (actual cost of work performed)
3. year-to-date costs (actual cost of work performed)

Schedule reporting shall consist of the following:

1. monthly schedule
2. year-to-date schedule

A7.2 FORMAT I REPORTING

Table A-1 contains the notification limits for each analyte. Any results that exceed the notification limits defined in the DQO processes shall be reported by calling the East Tank Farm Operations Shift Manager at 373-2689 and the Characterization Program Office (Schreiber 1994b). This verbal notification must be followed within one working day by written communication to Analytical Services, Characterization Support, the Characterization Program Office, the Safety Screening Representative, and Waste Tanks Process Engineering, documenting the observations. Additional analyses for verification purposes may be contracted between the performing laboratory and the contacts above either by a revision to this document or by a letter of instruction.

A7.3 FORMAT III REPORTING

A Format III report, reporting the results of the primary safety screen analyses, shall be issued to the Safety Screening Representative, Characterization Support, Waste Tanks Process Engineering, the Characterization Program Office, Los Alamos Technical Associates, the Tank Characterization Resource Center, and the Tank Characterization Database representative (Schreiber 1994c) within 45 days of receipt of the last sample at the laboratory loading dock. The DSC and TGA scans have been requested due to the interpretive nature of these analyses. If analyses for the safety screening secondary analytes are required, these results shall be provided within 90 days of receipt of the last sample at the laboratory loading dock. No calibration data are requested for these reports. Detailed information regarding the contents of this reporting format are given in (Schreiber 1994a).

A8.0 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 notebooks. 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.

At the request of the Characterization Program, additional analysis of sample material from this characterization project shall be performed following a revision of this Tank Characterization Plan.

A9.0 REFERENCES

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- Bratzel, D. R., 1994, Letter to S. M. Joyce, "Archiving Requirements", 7E720-94-125, dated June 23, 1994.
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- Hill, J. G., W. J. Winters, and B. C. Simpson, 1991, *Waste Characterization Plan for the Hanford Site Single-Shell Tanks*, WHC-EP-0210, Rev. 3, Westinghouse Hanford Company, Richland, Washington.
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- Schreiber, R. D., 1994c, Letter to J. G. Kristofzski, "Point of Contact/Distribution List", 7E720-94-141, dated October 11, 1994.
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