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RELEASE AUTHORIZATION

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SUPPORTING DOCUMENT

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7. Abstract

This document is a plan which serves as the contractual agreement between the Characterization Program, Sampling Operations, WHC 222-S Laboratory, and PNL 325 Analytical Chemistry Laboratory. The scope of this plan is to provide guidance for the sampling and analysis of samples from tank 241-C-101.

8. RELEASE STAMP

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Tank 241-C-101
Tank Characterization Plan

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

by

Los Alamos Technical Associates
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LIST OF ABBREVIATIONS

C-101	Tank 241-C-101
CW	Coating Waste
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DQO	Data Quality Objective
DST	Double Shell Tank
MW	Metal Waste
NCPLX	Noncomplexed Waste
P	Purex Waste
SST	Single-Shell Tank
TBP	Tributyl Phosphate
TCP	Tank Characterization Plan
WHC	Westinghouse Hanford Company

1.0 INTRODUCTION

The Defense Nuclear Facilities Safety Board has advised the 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 be used to identify the 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) milestone M-44-00 has been made, which states that "A Tank Characterization Plan (TCP) will also 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." This document satisfies that requirement for the tank 241-C-101 (C-101) fiscal year 1995 sampling activity.

2.0 TANK C-101 HISTORICAL INFORMATION

2.1 AGE AND PROCESS HISTORY

Single-shell tank C-101, with a capacity of 2,010,000 liters (530,000 gallons), was constructed in 1944. It is the first, or primary, tank of a cascade comprised of tanks C-101, C-102, and C-103. A cascade is a system in which tanks were connected in series by pipes. Waste added to the first tank overflowed to the secondary tanks after the primary tank became full.

The fill history of tank C-101, presented graphically in Figure 1 and tabulated with a history narrative and waste-type information in Table 1, is taken from *A History of the 200 Area Tank Farms* (Anderson 1990). Tank C-101 began receiving waste in March 1946 and was full by May 1946. It was cascading through the period from 1946 to 1953. During the second quarter of 1952, the metal waste (MW) was sluiced to recover uranium and the tank contained U Plant waste (TBP) until the fourth quarter of 1962. During this period, the overflow outlet to tank 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 (CW) from the fourth quarter of 1960 until the third quarter of 1963 and PUREX waste (P) 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 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).

Tank C-101 currently contains a total volume of 333,000 liters (88,000 gallons) of non-complexed waste (NCPLX) which is equivalent to 69.9 centimeters (27.5 inches) of waste as measured from the baseline of the tank. This waste is comprised of 57,000 liters (15,000 gallons) of unknown waste, 276,000 liters (73,000 gallons) of sludge, with no supernatant or pumpable liquid remaining. The last solids update was obtained November 29, 1983 and the last photo was taken November 17, 1987 (Hanlon 1994). The photograph shows a black and white sludge surface with no visible liquid.

Figure 1: Fill History for Tank C-101

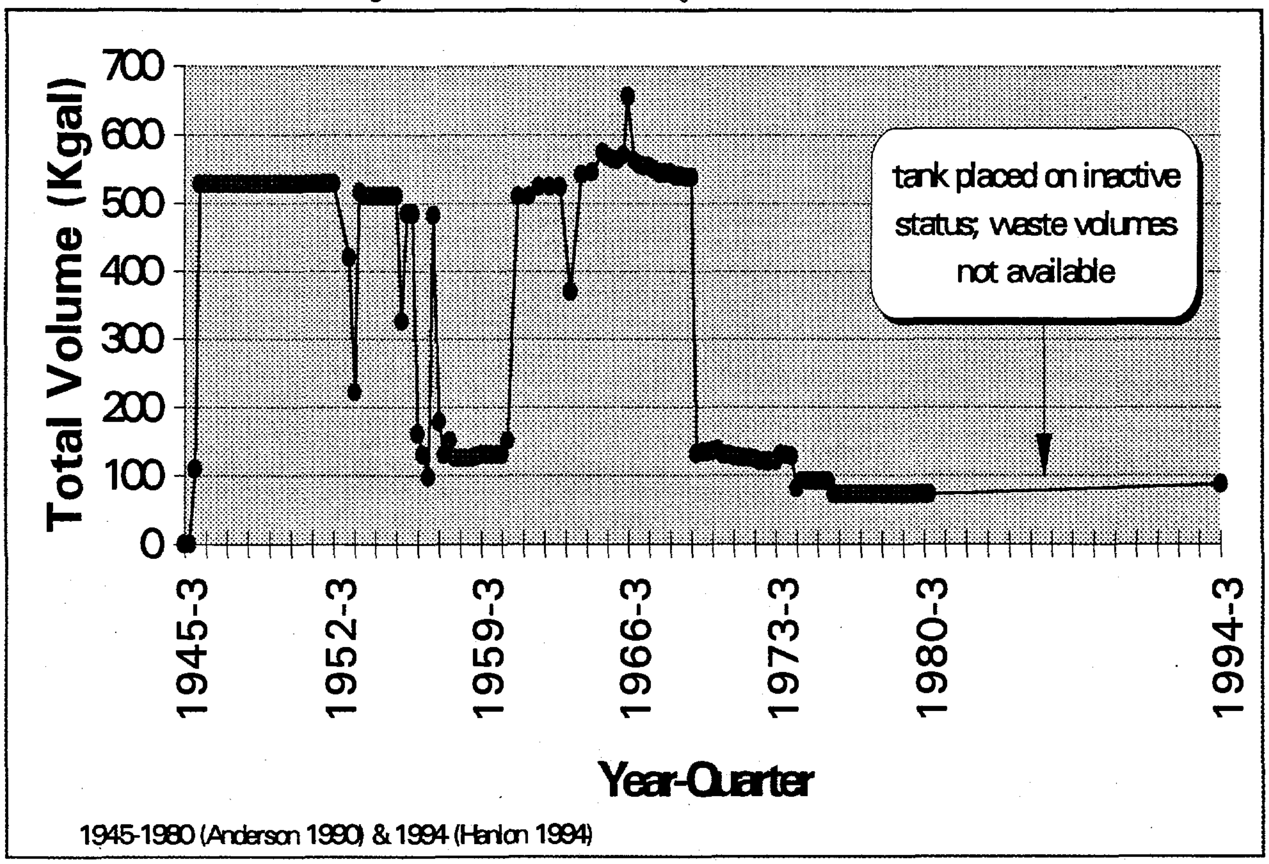

Table 1: Waste Status Summary for Tank C-101

Year-Qtr.	Total Vol. (Kgal)	Type Waste	Waste rec'd from:	Kgal rec'd:	Waste moved to:	Kgal re-moved:	Remarks
1946-1	111	MW					began filling March 1946
1946-2	528	MW					full in May 1946
1952-1	530	MW					
1952-4	—	MW					984 Kgal in Cascade; processing-feed to TBP plant
1953-1	—	MW					
1953-2	422	TBP					MW removal completed; TBP waste started
1953-3	222	TBP			C-103		received TBP waste & pumped to C-103
1953-4	517	TBP					received TBP waste
1954-1	510	TBP					overflow line partially plugged
1955-4	326	TBP					overflow line partially plugged
1956-1	485	TBP					overflow line partially plugged
1956-3	161	TBP			C-112		scavenged & pumped to C-112
1956-4	131	TBP					30 Kgal scavenged in October
1957-1	98	TBP					
1957-2	483	TBP					feed tank for scavenging operation
1957-3	178	EB					feed tank for scavenging operation
1957-4	131	TBP					feed tank for sacvenging operation
1958-1	150	TBP					
1958-2	125	TBP					
1959-3	131	TBP					
1960-4	150	TBP, CW		19			waste received
1961-2	510	CW		423			waste received
1962-2	524	CW		214	BX	699	
1963-4	370	CW, P	A-102	276			waste received
1964-2	542	CW, P	A-103	172			waste received
1964-4	546	CW, P					
1965-2	574	CW, P		28			
1965-3	568	CW, P					
1965-4	565	CW, P					
1966-1	563	CW, P					
1966-2	571	CW, P					
1966-3	656	CW, P					
1966-4	563	CW, P					
1967-1	557	CW, P					
1967-4	549	CW, P					
1968-1	545	CW, P					
1968-4	541	CW, P					
1969-2	538	CW, P					
1969-4	132	P			C-105	404	
1970-1	134	P					four dry wells drilled
1970-3	136	P					possible leaker
1970-4	138	P					
1971-1	131	P					
1971-3	128	P					
1971-4	127	P					
1972-1	125	P					
1972-3	124	P					
1972-4	120	P					
1973-1	121	P					
1973-2	120	P					
1973-4	131	P					suspect leaker
1974-1	129	P					suspect leaker
1974-2	128	P					
1974-3	81	—			C-104	49	suspect leaker
1974-4	92	P					suspect leaker
1976-1	92	P					removed from service
1976-3	73	—					salt well pumped
1978-1	73	—					primary stabilized
1978-2	73	—					questionable integrity
1994-3	88	NPCLX					88 Kgal total waste (sludge)

2.2 EXPECTED TANK CONTENTS

The approximate tank layer volume, derived from the Los Alamos National Laboratories *Waste Status and Transaction Record Summary* (Agnew 1994), indicates that the waste in tank C-101 consists of 56,900 liters (15,000 gallons) of unknown waste in the top-most layer, 72,000 liters (19,000 gallons) of PUREX coating waste in the next layer, 201,000 liters (53,000 gallons) of waste from the uranium recovery process in the third layer, and 3,790 liters (1,000 gallons) of metal waste in the bottom layer. An estimated inventory based on historical sample and analysis data is shown in Table 2 (Brevick 1994).

Table 2: Tank C-101 Solids Composite Inventory Estimate

Physical Properties			
Total solid waste	Mass = 5.39E+05 kg; volume = 333 kL (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**	**$\mu g/g$**	**kg**
Na^+	6.99	9.93E+04	5.35E+04
Al^{3+}	2.24	3.73E+04	2.01E+04
Fe^{3+}	0.36	1.25E+04	6.72E+03
OH^-	7.96	8.36E+04	4.51E+04
NO_3^-	0.60	2.30E+04	1.24E+04
NO_2^-	7.14E-02	2.03E+03	1.09E+03
CO_3^{2-}	0.11	4.06E+03	2.19E+03
PO_4^{3-}	1.00	5.85E+04	3.15E+04
SO_4^{2-}	1.56	9.24E+04	4.99E+04
Cl^-	3.12E-03	68.18	36.77
Radiological Constituents	**Ci/L**	**$\mu Ci/g$**	**Ci**
Pu	1.70E-03	1.05	9.43 (kg)
U	2.82E-02(M)	4.15E+03($\mu g/g$)	2.24E+03 (kg)
Cs	1.05E-03	0.65	3.51E+02
Sr	7.09E-02	43.78	2.36E+04

3.0 REFERENCES

Agnew, S. F., 1994, *Waste Status and Transaction Record Summary for the Northeast Quadrant*, WHC-SD-WM-TI-615, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Anderson, J. D., 1990, *A History of the 200 Area Tank Farms*, WHC-MR-0132, Rev. 0 Westinghouse Hanford Company, Richland, Washington.

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Hanlon, B. M., 1994, *Tank Farm Surveillance and Waste Status Summary Report for July 1994*, WHC-EP-0182-72, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

SAMPLING AND ANALYSIS PLAN

FOR PUSH-MODE CORE SAMPLING OF TANK C-101 IN FISCAL YEAR 1995

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LIST OF ABBREVIATIONS FOR APPENDIX A

ACL Analytical Chemistry Laboratory
C-101 Tank 241-C-101
DOE Department of Energy
DQO Data Quality Objective
DSC Differential Scanning Calorimetry
HHF Hydrostatic Head Fluid
IC Ion Chromatography
ICP Inductively Coupled Plasma (atomic emission spectroscopy)
RCRA *Resource Conservation and Recovery Act of 1976*
RSST Reactive System Screening Tool
SARP Safety and Analysis Report for Packaging
TCP Tank Characterization Plan
TGA Thermogravimetric Analysis
TOC Total Organic Carbon
TWRS Tank Waste Remediation System
WHC Westinghouse Hanford Company

A1.0 SPECIFIC TANK 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).

A1.1 RELEVANT SAFETY ISSUES

There are four Watch-List tank classifications (ferrocyanide, organic salts, hydrogen/flammable gas, and high heat load) which cover the six safety issues related to public and worker health that have been associated with the Hanford Site underground storage tanks. These safety issues are as follows: ferrocyanide, flammable gas, organic, criticality, high heat, and vapor safety issues (Babad 1992). Tank C-101 has been identified as a non-Watch List and low heat load tank (<11.7 kW or <40,000 Btu/hr) (Hanlon 1994).

Since tank C-101 is a non-Watch List tank and no disposal programs have requested analysis of the waste material, the *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994) is the only DQO that applies to tank C-101 at this time. It 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 identify safety conditions related to the ferrocyanide, organic, flammable gas, and criticality safety issues.

A1.1.1 Safety Screening Data Quality Objectives

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 push mode core sampling method. Two core 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 level of a common set of primary analytes and waste characteristics. These analytes are energetics, total alpha, % moisture, and flammable gas concentrations. If acceptance criteria 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 TCP 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 push mode core sampling method.

A2.0 SAMPLING INFORMATION

Tank C-101 is currently scheduled to be sampled by the push mode core sampling method. Samples shall be taken from risers 1 and 8. For detailed information regarding the sampling activities, refer to work procedure WTWP-94-072 for riser 1 and work procedure WTWP-94-073 for riser 8. In addition, refer to work package ES-94-1233. This document contains operating procedures and the chain of custody records for this sampling event.

Current records indicate that there are 333 kL (88 kgal) of non complex waste in tank C-101. The most current waste level is approximately 69.9 cm (27.5 inches). Tank C-101 is considered an assumed leaker with respect to tank integrity.

One push mode core sample from each of risers 1 and 8 of tank C-101 shall be collected. Based on current records, two segments are expected from each core. However, a greater or lesser number of cores may need to be obtained, depending on the accuracy of the available waste level information. The first segment from each core is expected to contain 22.3 cm (8 inches) while the final segment should contain 48.3 cm (19 inches) of waste material.

Hydrostatic head fluid (HHF) with lithium bromide (LiBr) as a tracer shall be used to aid in the collection of core samples. An HHF blank shall be prepared as part of the sampling procedure. The blank shall consist of a container filled with HHF (with LiBr tracer) from the same batch of HHF used during the push mode core sampling. It shall be analyzed for Li (and Br, if the Li notification limit is exceeded) in order to determine the concentration of the tracer at the time the core was taken. Only one HHF blank per tank is required. This blank is required in addition to the field/trip blank (sampler filled with water). For specific information concerning sample handling, custody, and transport, refer to the quality assurance/quality control requirements in Section A4.2.

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 segments 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), core samples from tank C-101 must be vented every 47 days from the time of the cask sealing to allow any retained gas to escape.

Step 1 Receive push mode core samples at the laboratory in accordance with approved procedures.

Step 2 Conduct the following on the material from each extruded segment:

- Perform a visual examination of the segment(s)
- Record observations. This may include a sketch of the extruded core sample in addition to written documentation of pertinent descriptive information such as color, texture, homogeneity, and consistency.
- Take color photographs and/or a videotape to visually document the extruded core segments.

Step 3 Is the segment 100% drainable liquid?

Yes: Proceed to Step 11
No: Proceed to Step 4

Step 4 Separate any drainable liquid from the solids. Measure and record the volume. Retain drainable liquids for further processing.

SOLIDS PATH

Step 5 Divide each extruded core segment into half segments.

Step 6 Homogenize each half-segment 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 for the homogenization test. Additional tests may be performed at the laboratory's discretion.

Step 8 Conduct the homogenization test by taking 1 to 2 g aliquots 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 in duplicate.

NOTE: If there is an insufficient amount of sample available in any subsample to perform all required analyses on the half segment, 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 (potential organic) layers?

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.

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 segment-level 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 segment-level drainable liquid as the segment level 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.

Figure A-1: Laboratory Flowchart A

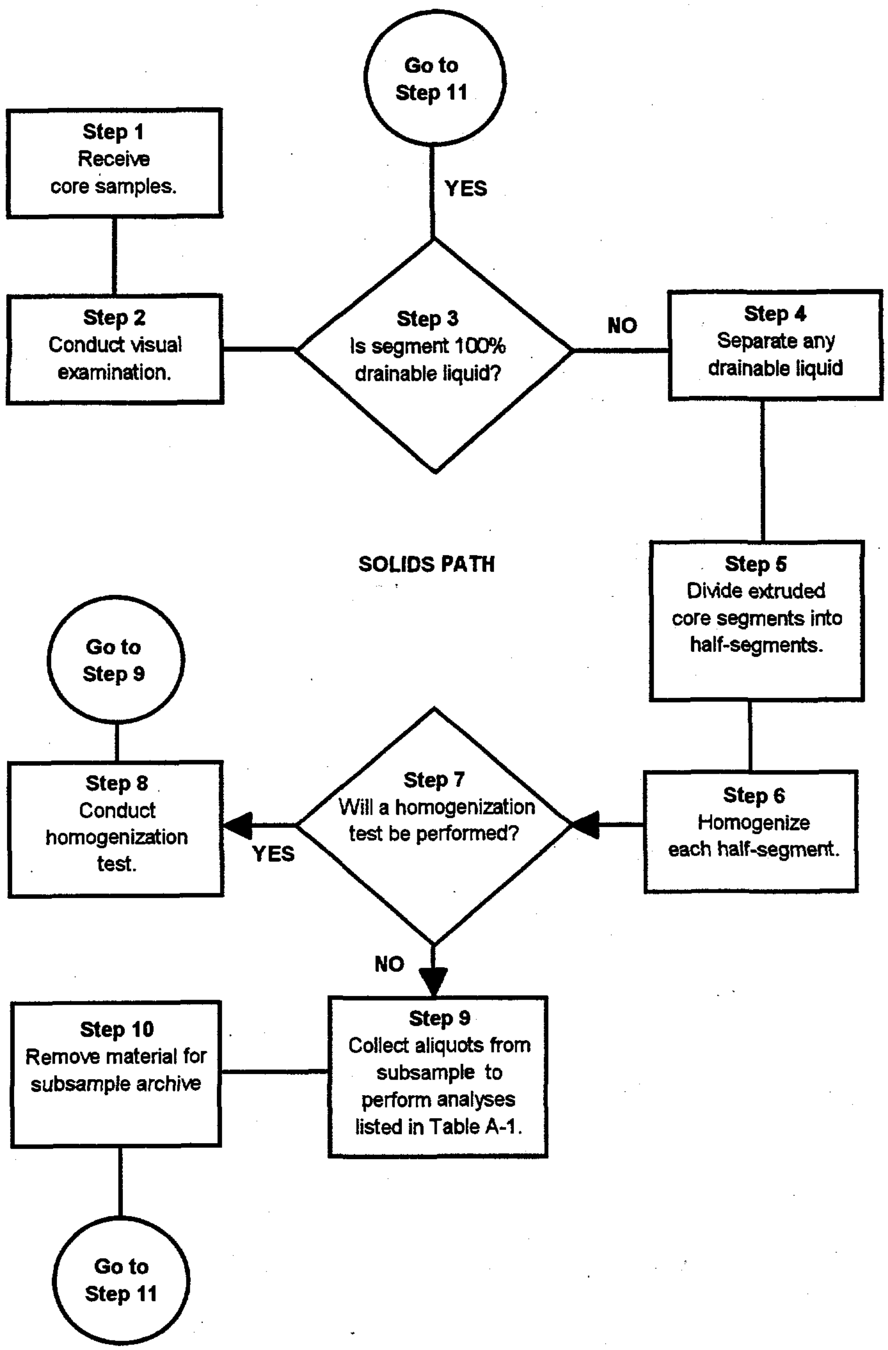


Figure A-2: Laboratory Flowchart B

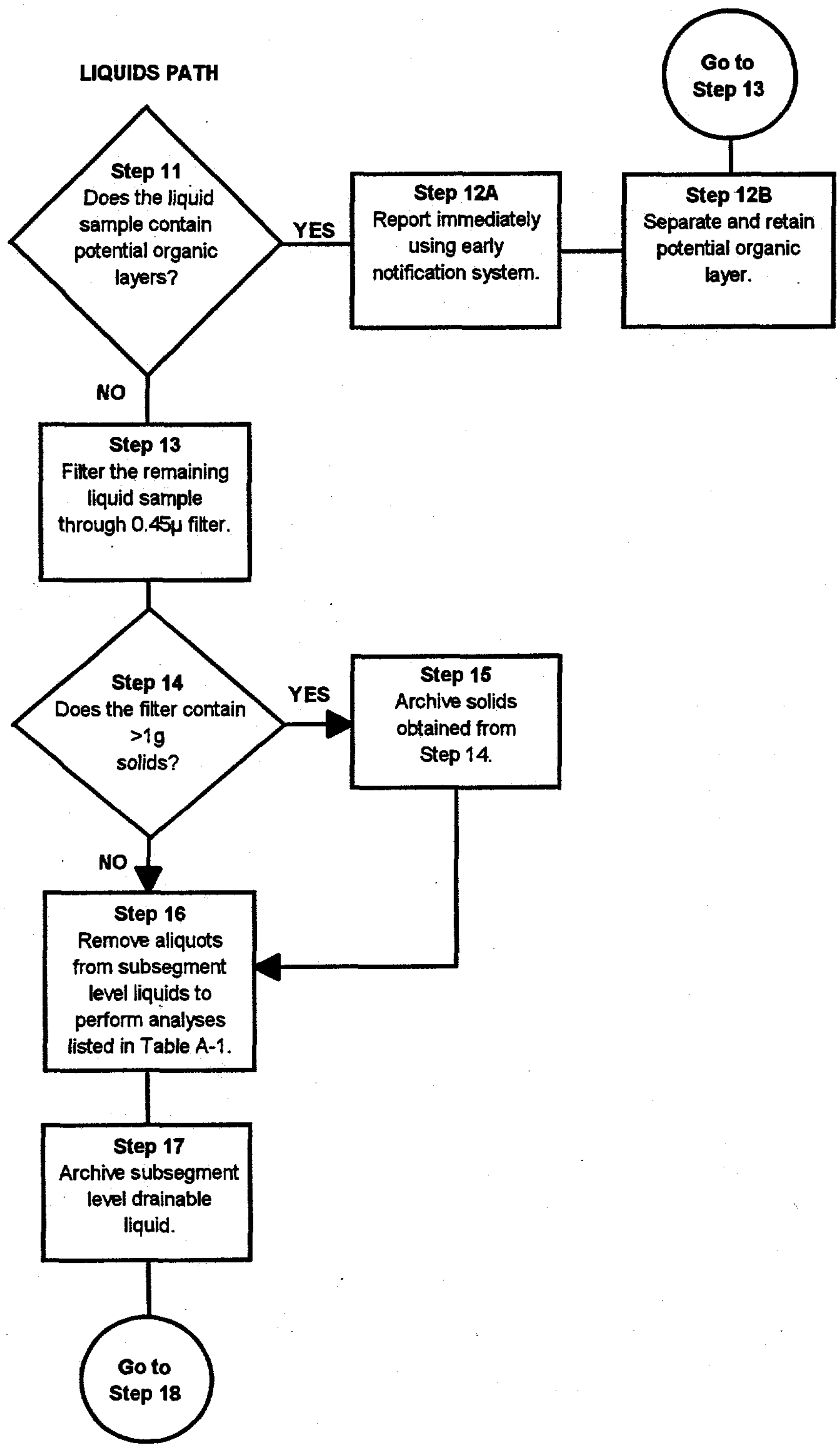
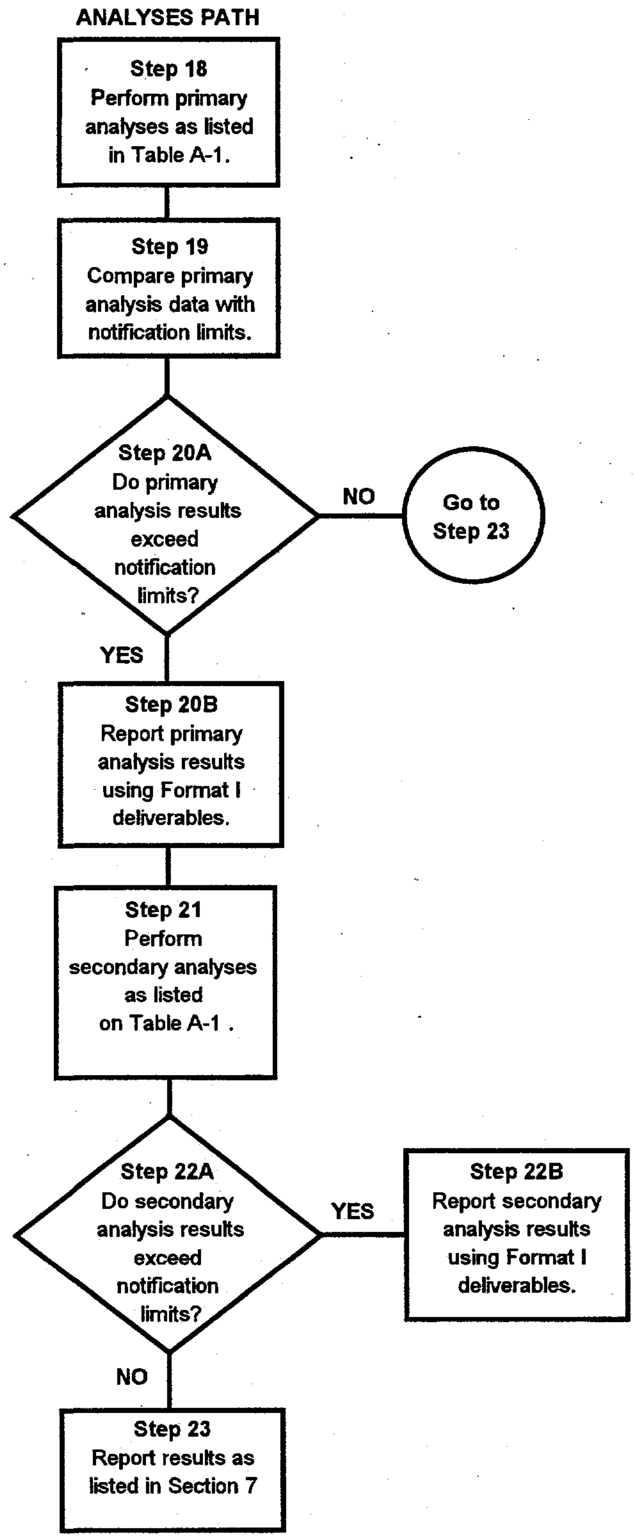


Figure A-3: Laboratory Flowchart C



A3.2 INSUFFICIENT SEGMENT RECOVERY

If the amount of material recovered from core samples taken from tank C-101 is insufficient to perform the analyses requested and to permit a minimum 10 mL archive per segment, the laboratory shall notify the Tank Cognizant Engineer and the manager of Analytical Services, Program Management and Integration, listed in Table A-2, within one working day. 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

The analyses to be performed for the tank safety screening have been prioritized below. Confirmation of prioritization levels or revision of sample breakdown procedures may be provided based upon the sample recovery, readily observable physical property distinctions within the sample, and the requested sample breakdown procedures provided in section A3.1.

PRIORITY LEVEL 1

DSC, TGA, Total Alpha (when necessary) and Li analyses shall be performed.

PRIORITY LEVEL 2

Secondaries for Safety Screening (TOC, cyanide, RSST, bromide, Pu-239/240, Fe, Mn, and U) shall be performed.

A4.0 SPECIFIC ANALYTE, QUALITY CONTROL, AND DATA CRITERIA

A4.1 SPECIFIC METHODS AND ANALYSES

The analyses in Table A-1 to be performed on the tank C-101 core samples are based on the Safety Screening DQO referenced in Section A1.0. 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 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/quality control of analyzing the waste tank core samples at the 222-S Laboratory. If the analyses are performed at the 325 Analytical Chemistry Laboratory (ACL), the analysis shall be guided by the 325 Quality Assurance Plan (Kuhl-Klinger 1994). Additionally, the *Hanford Analytical Services Quality Assurance Plan* (DOE 1994), when implemented, shall be used as 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 core samples each are to be taken from tank C-101 and shipped to the performing laboratory by Sampling Operations in accordance with work package ES-94-1233. That work package shall also initiate the chain-of-custody for the samples. Approved work procedures WTWP-94-072 and WTWP-94-073, and procedure TO-080-090 ("Load/Transport Sample Cask(s)") are 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 segment collected to the performing laboratory within 1 working day of removing the segment from the tank, but must transport each segment within 3 calendar days. The field blank and HHF blank shall each count as a segment. Sampling Operations is responsible for verbally notifying the laboratory (373-2435 for 222-S Laboratory; 376-2639 for 325 ACL) at least 24 hours in advance of an expected shipment. If samples are going to be delivered to 325 ACL the laboratory shall be notified at least 72 hours in advance of actual sample shipment so that proper shift operations can be planned.

A4.2.3 Sample Custody

The chain-of-custody form is initiated by the sampling team as described in work package ES-94-1233. Core 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. Receipt and control of samples in the 325 ACL are described in procedure PNL-ALO-051.

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

SOLID ANALYSES							
Project Name	C-101 Push Mode Core Sample		COMMENTS			REPORTING LEVELS	
Plan Number	WHC-SD-WM-TP-285, REV. 0		Homogenization Test - Not Required			FORMAT I	Early Notify
			Field Blank - Required			FORMAT II	Process Control
PROGRAM	PROGRAM CONTACTS		Hot Cell Blank - Not Required			FORMAT III	Safety Screening
A. Safety Screening	Safety Screening	H. Babad	HHF Blank - Required			FORMAT IV	Waste Management
	TWRS	R. D. Schreiber	TANK	#CORES	RISER#	FORMAT V	RCRA Compliance
	222-S Laboratory	J. G. Kristofzski	C-101	2	1 and 8	FORMAT VI	Special
	325 Laboratory	S. G. McKinley					

PROGRAM	PRIMARY ANALYSES				SAMPLE[1]	PREP[2]	QUALITY CONTROL[3]						CRITERIA			FOR-MAT
	METHOD	ANAL.	WHC PROCEDURE	PNL PROCEDURE	½ SEG SLDG		DUP	SPK/ MSD	BLK	CALIB STD	PR	AC	UNITS	NOTIFICATION LIMIT[4]	EXPECTED RANGE[4]	
A	DSC	Energy	LA-514-113	PNL-ALO-508	X	d[6]	ea smpl	N/A	N/A	ea AB	±10	90-110	J/g[5]	>= 481	unknown	I, III
A	TGA	% H_2O	LA-560-112	PNL-ALO-508	X	d[6]	ea smpl	N/A	N/A	ea AB	±10	90-110	wt%	<=17	unknown	I, III
A	Alpha	Total Alpha	LA-508-101	PNL-ALO-421 PNL-ALO-420	X	f	ea smpl	1/mtrx	ea PB	ea AB	±10	90-110	µCi/g	> 41	unknown	I, III
A	ICP	Li	LA-505-151	PNL-ALO-211	X	f,w	ea smpl	see 8	ea PB	ea AB	±10	90-110	µg/g	>100	unknown	I, III
PROGRAM	SECONDARY ANALYSES				SAMPLE[1]	PREP[2]	QUALITY CONTROL[3]						CRITERIA			FOR-MAT
	METHOD	ANAL.	WHC PROCEDURE	PNL PROCEDURE	½ SEG SLDG		DUP	SPK/ MSD	BLK	CALIB STD	PR	AC	UNITS	NOTIFICATION LIMIT[4]	EXPECTED RANGE[4]	
A	Distillation[9]	CN	LA-695-102	PNL-ALO-285	X	d[6]	ea smpl	1/mtrx	ea PB	ea PB	±10	90-110	µg/g	> 39,000	unklnown	I, III
A	Sep. & α counting[10]	Pu-239/240	LA-503-156	PNL-ALO-423 PNL-ALO-422	X	f	ea smpl	1/mtrx[7]	ea PB	ea AB	±10	90-110	µCi/g	> 41	unknown	I, III
A	ICP[10]	Fe	LA-505-151	PNL-ALO-211	X	a	ea smpl	see 8	ea PB	ea AB	±10	90-110	µg/g	none	unknown	III
A	ICP[10]	Mn	LA-505-151	PNL-ALO-211	X	a	ea smpl	see 8	ea PB	ea AB	±10	90-110	µg/g	none	unknown	III
A	ICP[10]	U	LA-505-151	PNL-ALO-211	X	a	ea smpl	see 8	ea PB	ea AB	±10	90-110	µg/g	none	unknown	III
A	IC[11]	Br	LA-533-105	PNL-ALO-212	X	w	ea smpl	1/mtrx	ea PB	ea AB	±10	90-110	µg/g	>1200	unknown	I, III
A	RSST[9]	Energy	see 10 below	N/A	X	d[6]	N/A	N/A	N/A	ea AB	±10	90-110	J/g[5]	>= 481	unknown	I, III
A	Hot Persulfate[9]	TOC	LA-342-100	PNL-ALO-381	X	d[6]	ea smpl	1/mtrx	ea AB	ea AB	±10	90-110	µg C/g	> 30,000	unknown	I, III

[1]½ SEG SLDG-½ segment, sludge

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

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

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

[5]Dry weight basis.

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

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

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

[9]These analyses required if DSC exceeds notification limits. The RSST method, yet to be proceduralized, may be found in WHC-SD-WM-TP-104.

[10]Performed only if total alpha exceeds notification limit.

[11]Performed only if Li exceeds notification limit.

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

LIQUID ANALYSES

Project Name	C-101 Push Mode Core Sample		COMMENTS			REPORTING LEVELS	
Plan Number	WHC-SD-WM-TP-285, REV. 0		Homogenization Test -Not Required			FORMAT I	Early Notify
			Field Blank - Required			FORMAT II	Process Control
PROGRAM	PROGRAM CONTACTS		Hot Cell Blank - Not Required			FORMAT III	Safety Screening
A. Safety Screening	Safety Screening	H. Babad	HHF Blank - Required			FORMAT IV	Waste Management
	TWRS	R. D. Schreiber	TANK	#CORES	RISER#	FORMAT V	RCRA Compliance
	222-S Laboratory	J. G. Kristofzski	C-101	2	1 and 8	FORMAT VI	Special
	325 Laboratory	S. G. McKinley					

PROGRAM	PRIMARY ANALYSES				SAMPLE[1]	PREP[2]	QUALITY CONTROL[3]						CRITERIA			FORMAT
	METHOD	ANAL.	WHC PROCEDURE	PNL PROCEDURE	FB & S-LEV LIQ		DUP	SPK/ MSD	BLK	CALIB STD	PR	AC	UNITS	NOTIFICATION LIMIT[4]	EXPECTED RANGE[4]	
A	DSC	Energy	LA-514-113	PNL-ALO-508	X	d[6]	ea smpl	N/A	N/A	ea AB	±10	90-110	J/g[5]	>= 481	unknown	I, III
A	TGA	% H_2O	LA-560-112	PNL-ALO-508	X	d[6]	ea smpl	N/A	N/A	ea AB	±10	90-110	wt%	<=17	unknown	I, III
A	ICP	Li	LA-505-151	PNL-ALO-211	X	d[6]	ea smpl	see 7	ea PB	ea AB	±10	90-110	µg/mL	>100	unknown	I, III
A	Visual	Organic Layer	LA-519-151	PNL-ALO-501	X	d[6]	N/A	N/A	N/A	N/A	N/A	N/A		presence	unknown	I,III
PROGRAM	SECONDARY ANALYSES				SAMPLE[1]	PREP[2]	QUALITY CONTROL[3]						CRITERIA			FORMAT
	METHOD	ANAL.	WHC PROCEDURE	PNL PROCEDURE	FB & S-LEV LIQ		DUP	SPK/ MSD	BLK	CALIB STD	PR	AC	UNITS	NOTIFICATION LIMIT[4]	EXPECTED RANGE[4]	
A	Distillation[8]	CN	LA-695-102	PNL-ALO-285	X	d[6]	ea smpl	1/mtrx	ea PB	ea PB	±10	90-110	µg/mL	> 58,000[10]	unklnown	I, III
A	IC[9]	Br	LA-533-105	PNL-ALO-212	X	d[6]	ea smpl	1/mtrx	ea PB	ea AB	±10	90-110	µg/mL	>1,200	unknown	I, III
A	RSST[8]	Energy	see 8 below	N/A	X	d[6]	N/A	N/A	N/A	ea AB	±10	90-110	J/g[5]	> 481	unknown	I, III
A	Hot Persulfate[8]	TOC	LA-342-100	PNL-ALO-381	X	d[6]	ea smpl	1/mtrx	ea AB	ea AB	±10	90-110	µg C/mL	> 45,000[10]	unknown	I, III

[1]S-LEV LIQ-liquid taken from the segment level, FB-field blank

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

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

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

[5]Dry weight basis.

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

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

[8]These analyses required if DSC exceeds notification limits. The RSST method, yet to be proceduralized, may be found in WHC-SD-WM-TP-104.

[9]Performed only if Li exceeds notification limit.

[10]Converted from µg/g limit assuming a density of 1.5 g/mL.

A5.0 ORGANIZATION

The organization and responsibility of key personnel involved with this tank C-101 characterization project are listed in Table A-2. Procedures for both the WHC 222-S Laboratory and the PNL 325 Analytical Chemistry Laboratory are given in Table A-2 since it is as yet undecided which laboratory shall receive the samples from tank C-101. Analytical Services shall make the laboratory selection two weeks prior to the sampling event. The laboratory selection will be based on the ability of the laboratory to receive the samples as well as its ability to provide the required analytical data in the requested time. Once the performing laboratory is selected, Analytical Services shall send written notification to inform Sampling Operations of the laboratory to which the samples are to be sent.

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
S. G. McKinley	325 Analytical Chemistry Laboratory	Project Manager for Single-Shell Tank (Core Sampling) Projects
R. D. Schreiber	TWRS Characterization Support	Tank C-101 Tank Characterization Plan Cognizant Engineer
H. Babad	Characterization Program	Safety Screening Point of Contact
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)

A6.0 EXCEPTIONS, CLARIFICATIONS, AND ASSUMPTIONS

A6.1 EXCEPTIONS TO DQO REQUIREMENTS

In the Safety Screening DQO, it is specified 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. However, both the soon to be released, revision of the Safety Screening DQO and the Ferrocyanide DQO (Meacham et al. 1994) have 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 (dry weight basis). Therefore, although this Tank Characterization Plan uses the current Safety Screening DQO, it specifies that cyanide is to be run on a half-segment basis and that notification shall be made if the DSC value exceeds 481 J/g (dry weight basis).

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 determined by DSC must be reported on a dry weight basis as shown in equation (1) using the weight percent water determined from thermogravimetric analysis.

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

NOTE: If there is greater than 90 percent water in a sample, converting to a dry weight basis may lead to a large error in the DSC value. However, the conversion is still required.

- The safety screening DQO (Babad and Redus 1994) requires that additional analyses be performed if total alpha activity measures greater than 1 g/L. Total alpha is measured in μCi/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):

$$\left(\frac{1\ g}{L}\right)\left(\frac{1\ L}{10^3\ mL}\right)\left(\frac{1}{density}\ \frac{mL}{g}\right)\left(\frac{0.0615\ Ci}{1\ g}\right)\left(\frac{10^6\ \mu Ci}{1\ Ci}\right) = \frac{61.5}{density}\ \frac{\mu Ci}{g} \qquad (2)$$

NOTE: If a density of 1.5 is assumed for solid material, the notification limit becomes 41 μCi/g.

- The safety screening DQO, upon which the analyses in Table A-1 are based, does not sufficiently address the analyses of any drainable liquid present. In order to characterize the tank waste adequately, all analyses performed on the solids for the safety screening DQO shall also be performed on any drainable liquids (with the exception of total alpha) and on the field blank.

A7.0 DELIVERABLES

All analyses of tank C-101 waste material shall be reported as Formats I 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 core sampling project shall provide monthly status reports to the Characterization Program. This report shall contain 1) a summary of the activities on the analysis of tank C-101, 2) preliminary results to the program, and 3) schedule and cost information on a DQO basis.

Monthly and accumulative costs will be compared to the base as part of the Progress report. Monthly variances greater than 10% and $10,000, and accumulative variances greater than $50,000 from the estimated 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 exceeding their notification limits shall be reported by calling the East Tank Farm Operations Shift Manager at 373-2689 and the Characterization Program (Schreiber 1994b). This verbal notification must be followed within 1 working day by written communication, documenting the observations, to Analytical Services, Characterization Support, Characterization Program Office, Safety Screening Representative, and Waste Tanks Process Engineering. Additional analyses for verification purposes may be contracted between the performing laboratory and the contacts above by a revision to this document, by a letter of instruction, or by a memorandum of understanding.

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, Characterization Program Office, Tank Characterization Resource Center, and Waste Tanks Process Engineering within 45 days of receipt of the last segment of the last core sample at the laboratory loading dock. Although normally raw data would not be attached to this type of report, the DSC and TGA scans have been requested due to the interpretive nature of the analysis. If analyses for the safety screening secondary analytes are required, these results shall be provided within 90 days of receipt of the last segment of the last core 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 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 analysis of 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.

A9.0 REFERENCES

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