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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-B-101.

8. RELEASE STAMP

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Revision 0

Tank 241-B-101
Tank Characterization Plan

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LIST OF ABBREVIATIONS

B	B-Plant high-level waste
B-101	Tank 241-B-101
BL	B-Plant low-level waste
CW	cladding waste
DOE	U.S. Department of Energy
DNFSB	Defense Nuclear Facilities Safety Board
DQO	data quality objective
DST	double-shell tank
EB	evaporator bottoms
FIC	Food Instrument Corporation
HEPA	High-Efficiency Particulate Air Filter
MW	metal waste
REDOX	reduction-oxidation
RCRA	*Resource Conservation and Recovery Act of 1976*
SAP	Sampling and Analysis Plan
SST	single-shell tank
TCP	Tank Characterization Plan
TOC	total organic carbon
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 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 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-B-101 (B-101) sampling activities.

2.0 DATA QUALITY OBJECTIVES APPLICABLE TO TANK 241-B-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 31, 1995, tank B-101 was classified as a non-Watch List tank. The finalized DQOs that apply to tank B-101 are discussed in the following section.

2.1 SAFETY SCREENING DATA QUALITY OBJECTIVE

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 into one of three categories (SAFE, CONDITIONALLY SAFE, or UNSAFE). The safety screening DQO identifies the guidelines to determine to which category a tank belongs based on analyses that indicate if certain measurements are within established parameters. If a specified parameter is exceeded, further analysis of a second set of properties and a possible Watch List classification would be warranted. A tank can be removed from a Watch List if it is classified as SAFE.

The safety screening 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 primary analytical requirements for the safety screening of a tank are energetics, total alpha activity, moisture content, and flammable gas concentration. These analyses shall be applied to all core samples, DST Resource Conservation and Recovery Act (RCRA) samples, and all auger samples, except those taken exclusively to assess the flammable gas crust burn issue.

3.0 TANK B-101 HISTORICAL INFORMATION

This section summarizes the available historical information on tank B-101. Included are the age of the tank, process history, and a discussion of any historical sampling events for the tank. The fill history information is available in *A History of the 200 Area Tank Farms* (Anderson 1990) and *Historical Tank Content Estimate for the Northeast Quadrant of the Hanford 200 East Area* (Brevick et al. 1994).

3.1 TANK CONFIGURATION

Single-shell tank B-101 was constructed between 1943 and 1944 and is located in the 200 East Area. Tank B-101 is 23 meters (75 feet) in diameter and has a capacity of 2,006,000 liters (530,000 gallons). The tank is first in a cascade flow series consisting of tanks 241-B-101, 241-B-102 and 241-B-103. A cascade flow 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.

The tank B-101 surface level is monitored with a Food Instrument Corporation (FIC) gauge through riser #8. Liquid waste volume is determined by a photographic evaluation and the solid waste volume is determined by a FIC gauge. The gauge is set in the intrusion mode for a 2.5 centimeter (1 inch) increase. If the FIC gauge fails, manual field measurements will be conducted quarterly. The maximum allowable increase from the 93.2 centimeter (36.7 inch) baseline is 5 centimeters (2 inches). There is no criterion for a decrease.

3.2 AGE AND PROCESS HISTORY

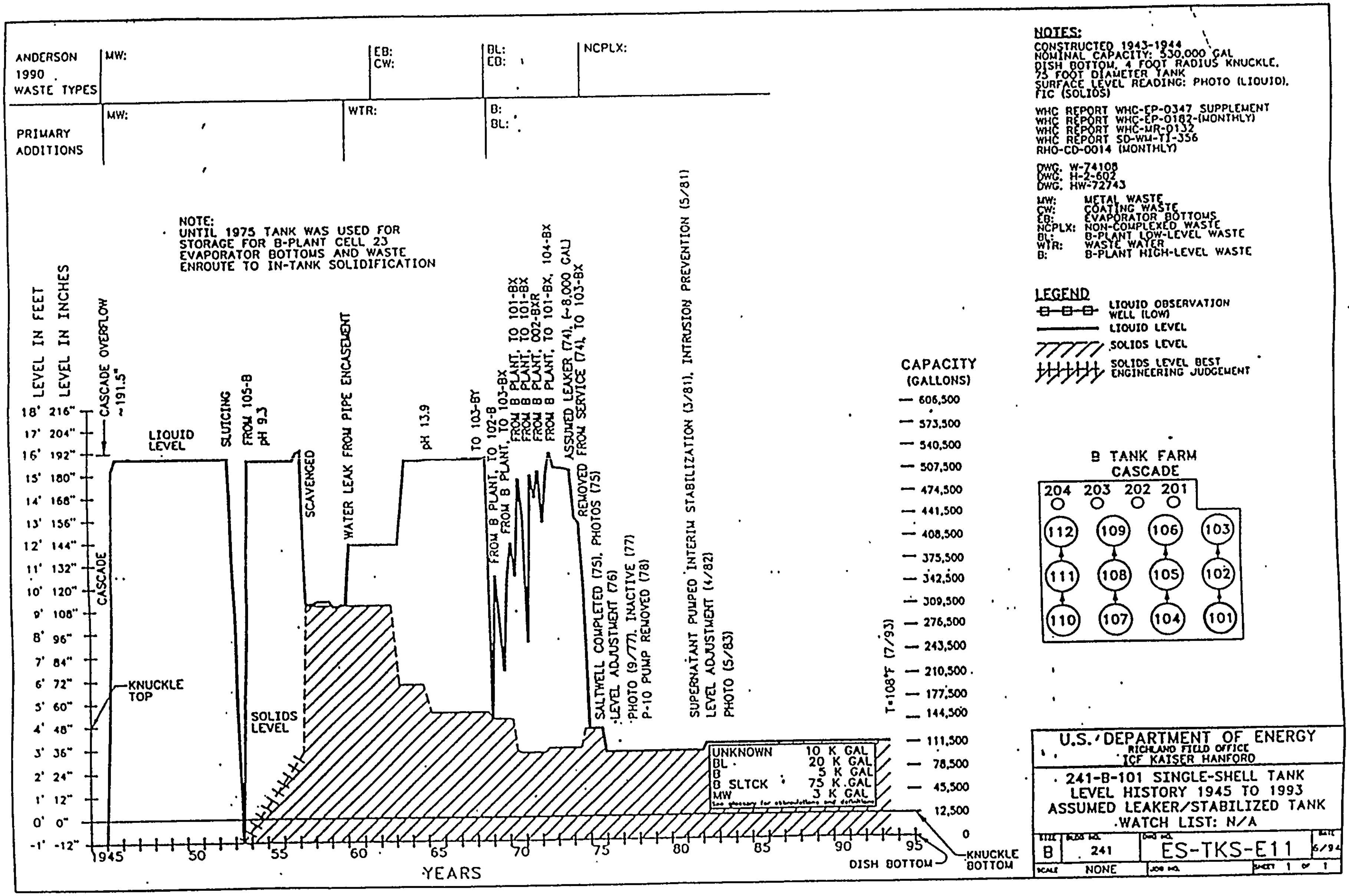
Tank B-101 was filled with metal waste (MW) from May 1945 to October 1945 as part of a cascade system. The tank continued to hold MW waste until the second quarter of 1953. In the first quarter of 1953, the tank was processing feed for U Plant. On December 28, 1953, sluicing for uranium recovery was completed. In the fourth quarter of 1953, tank B-101 received evaporator bottoms (EB) waste from tank 241-B-105. From the fourth quarter of 1953 to the second quarter of 1963, the tank received EB waste. In the third quarter of 1957, in-farm scavenged feed was sent to the CR process vault. In the second quarter of 1960, wastewater leaked into the pipe encasement which drained to tank B-101. In the fourth quarter of 1963, the tank received coating waste (CW). The tank continued to hold the CW and EB waste until the fourth quarter of 1968, when waste was transferred to tank 241-BY-103. From the second quarter of 1969 until the fourth quarter of 1974, the tank received B Plant low-level waste (BL) from B Plant while transferring waste to tanks 241-B-102, 241-BX-103, 241-BX-101, and 241-BX-104.

In 1974, the tank was declared an assumed leaker after leaking approximately 30,000 liters (8,000 gallons) and was removed from service. A saltwell was installed in tank B-101 in 1975, a level adjustment was made in 1976, and the tank was declared inactive in 1977. Interim stabilization was completed after the supernatant pumping was completed (with a flex and float pump) in March 1981. Intrusion prevention was completed in May 1981 and a level adjustment was made in April 1982. Figure 3-1 shows the supernatant and solids waste levels of tank B-101 from 1944 to the present (Anderson 1990). The solids and supernatant levels were taken on a quarterly basis as part of the overall surveillance effort in the tank farms. Zero on the vertical scale is at the knuckle bottom and the dish bottom is 30 centimeters (1 foot) below the knuckle bottom. The solids level in the tank is indicated by the shaded area and the supernatant level is indicated by the thick solid line above the shaded area.

3.3 HISTORICAL SAMPLING EVENTS

One tank sludge sample was received from tank B-101 on January 5, 1976 and analyzed in February 1976. The sludge sample had the consistency of soft mud and was dark brown. Particle size distribution of sample solids showed 90 weight percent between 5 and 50 μm. A heat generation rate, based on $^{89+90}Sr$ and ^{137}Cs was calculated at 2.01E-02 watts/liter of sludge (Brevick et al. 1994). The complete analysis results can be found in *Characterization and Lab Analysis on Tank Samples 101-B and 104-S* (Horton 1976).

Figure 3-1: Fill History of Tank 241-B-101



4.0 CURRENT TANK STATUS

4.1 1995 TANK STATUS

Tank B-101 is identified as a low-heat load non-Watch List tank, and is classified as an assumed leaker. The tank is passively ventilated, interim stabilized, and intrusion prevention measures have been completed. As of January 31, 1995, approximately 428,000 liters (113,000 gallons) of non-complexed waste was contained in the tank. The waste was comprised of 38,000 liters (10,000 gallons) of unknown waste material, 106,000 liters (28,000 gallons) of sludge, and 284,000 liters (75,000 gallons) of saltcake. No liquids capable of pumping remain in the waste. This volume of waste corresponded to a depth of 93 centimeters (36 inches). From May 1974 to the present, the median temperature is 35°C (95°F) with a minimum of 4°C (40°F) and a maximum of 58°C (137°F). Tank B-101 is scheduled to be monitored semi-annually in January and July (Brevick et al. 1994).

4.2 EXPECTED TANK CONTENTS

Tank B-101 is expected to have two primary layers. A layer of saltcake waste generated from the 242-B evaporator (BSltCk), followed by a top layer of sludge composed of B-Plant high-level (B), B-Plant low-level (BL), and unknown waste. The photographs for tank B-101 taken in 1975 indicate a rough black surface with no visible liquid. The level was adjusted and supernatant was pumped from this tank after these photographs were taken; therefore, the photograph does not represent the current tank contents. An estimated inventory based on the Tank Layering Model (Agnew 1994) is shown in Table 4-1. This estimate is based on the 428,000 liters (113,000 gallons) of solids in the tank.

Table 4-1: Tank 241-B-101 Solids Composite Inventory Estimate

Physical Properties			
Total Solid Waste	Mass = 6.40E+05 kg; Volume = 428 kL (113 kgal)		
Heat Load	1.59E+01 kW (5.43E+04 BTU/hr)		
Bulk Density	1.50 (g/cm^3)		
Void Fraction	0.62		
Water wt%	37.28		
TOC wt% C (wet)	0.08		
Chemical Constituents	**moles/L**	**µg/g**	**kg**
Na^+	8.23E+00	1.27E+05	8.09E+04
Al^{+3}	6.10E01	1.11E+04	7.08E+03
Fe^{+3} (total Fe)	8.10E-01	3.01E+04	1.92E+04
Cr^{+3}	6.58E-05	2.29E+00	1.46E+00
Pb^{+2}	8.85E-06	1.23E+00	7.80E-01
Ni^{+2}	5.41E-02	2.13E+03	1.36E+03
OH^-	4.57E+00	5.19E+04	3.32E+04
NO_3^-	2.46E+00	1.02E+05	6.54E+04
NO_2^-	3.39E-02	1.04E+03	6.67E+02
CO_3^{-2}	5.20E-01	2.10E+04	1.34E+04
PO_4^{-3}	8.10E-01	5.12E+04	3.27E+04
SO_4^{-2}	5.90E-01	3.79E+04	2.43E+04
Si (as SiO_3^{-2})	5.30E-01	9.97E+03	6.38E+03
F^-	4.44E-02	5.65E+02	3.61E+02
Cl^-	8.08E-03	1.91E+02	1.22E+02
$C_6H_5O_7^{-3}$	3.27E-03	4.13E+02	2.64E+02
glycolate$^-$	3.92E-02	1.97E+03	1.26E+03
Radiological Constituents	**Ci/L**	**µCi/g**	**Ci**
Pu		1.25E+00	1.33E+01 (kg)
U	4.66E-02 (M)	7.42E+03 (µg/g)	4.75E+03 (kg)
Cs	1.58E-02	1.06E+01	6.76E+03
Sr	5.51E+00	3.69E+03	2.36E+06

5.0 STRATEGY FOR DATA QUALITY OBJECTIVE RESOLUTION

A review of the historical information for tank B-101 indicates that it is necessary to sample the tank in order to satisfy (Babad and Redus 1994). Although tank B-101 was sampled in 1976, any analytical results obtained prior to 1989 are considered less reliable due to a lack of TPA-assured quality assurance/quality control. In addition, tank B-101 contains solids which have not been characterized since the tank was supernatant pumped and interim stabilized.

Only one sampling event for tank B-101 is currently scheduled: a push core sample (Stanton 1995). The push mode core sampling method was chosen based on surface photographs taken of the waste. Although rotary mode core sampling could be performed, it would be substantially more expensive. Auger sampling is not appropriate due to the depth of the waste (see Section 4.1). Auger sampling would not allow a full vertical profile to be obtained, which would not satisfy the safety screening DQO. The push mode core sampling shall be conducted following the *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994). Sampling and analytical requirements from this DQO are summarized in Table 5-1. Complete lists of sampling and analytical requirements are given, as an appended attachment, in the appropriate Sampling and Analysis Plan (SAP).

Table 5-1: Integrated DQO Requirements

Sampling Event	Applicable DQOs	Sampling Requirements	Analytical Requirements
Push Core Sampling	▸Safety Screening DQO	Core samples from a minimum of 2 risers separated radially to the maximum extent possible	▸Energetics ▸Moisture Content ▸Total Alpha

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APPENDIX A

SAMPLING AND ANALYSIS PLAN FOR TANK 241-B-101 PUSH CORE SAMPLING IN FISCAL YEAR 1995

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LIST OF ABBREVIATIONS FOR APPENDIX A

ACL	Analytical Chemistry Laboratory
B-101	Tank 241-B-101
DOE	Department of Energy
DQO	data quality objective
DSC	differential scanning calorimetry
DST	double-shell tank
GEA	gamma energy analysis
HHF	hydrostatic head fluid
HPGE/MCA	high purity germanium - multi channel analysis
IC	ion chromatography
ICP	inductively coupled plasma
LiBr	lithium bromide
NCPLX	non-complexed waste
PNL	Battelle Pacific Northwest Laboratory
RCRA	*Resource Conservation and Recovery Act of 1976*
RSST	reactive system screening tool - adiabatic calorimetry
SAP	Sampling and Analysis Plan
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 SAMPLING AND ANALYSIS OBJECTIVES

This Sampling and Analysis Plan (SAP) will identify characterization objectives for sample collection, laboratory analytical evaluation, and reporting requirements following the *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994). This data quality objective (DQO) is described in the Tank Characterization Plan (TCP) for tank 241-B-101 (B-101). This SAP will also identify procedures and requirements for collecting and characterizing samples from tank B-101 by the push core sampling method.

A2.0 SAMPLING EVENT REQUIREMENTS

A2.1 SAMPLING PREPARATION

Before push core sampling can be performed on tank B-101, available risers must be identified for use in this sampling event. The selected risers must be inspected and prepared to confirm their ability to be used in sampling. Safety hazards must be identified for which special precautions must be made.

A2.2 SAMPLING REQUIREMENTS

As of January 31, 1995, tank B-101 contained approximately 428,000 liters (113,000 gallons) of non-complexed waste. The waste was comprised of 38,000 liters (10,000 gallons) of unknown waste material, 106,000 liters (28,000 gallons) of sludge, and 284,000 liters (75,000 gallons) of saltcake. No liquids capable of pumping remain in the waste (Brevick et al. 1994). This volume of waste corresponded to a depth of 93 centimeters (36 inches).

Tank B-101 is currently scheduled to be core sampled. Two core samples shall be collected from risers 2 and 7. If a different riser is necessary to meet sampling and analysis requirements, this change 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.

Based on the current waste volume information, each of the core samples is expected to consist of two segments. Both segments should be 48 centimeters (19 inches). It should be noted that the sampling objective is to obtain a vertical profile of the waste; therefore, more or less segments may need to be taken depending on the accuracy of the current waste volume records. For detailed information regarding the sampling activities, refer to work package ES-95-00212. This document contains the operating procedures and the chain-of-custody records for this sampling event.

One field blank for this tank shall be obtained by filling a sampler with deionized water. This field blank is to accompany the samples to the laboratory hot cell. All collected samples and the field blank shall be shipped to the laboratory following the *Load/Transport Sample Cask(s)* procedure (TO-080-090). Core samples shall be transported to the laboratory within three calendar days of each segment's removal from the tank.

Occasionally, hydrostatic head fluid (HHF), with lithium bromide (LiBr) as a tracer, may be used to aid in the collection of the core samples. If HHF is used, Sampling Operations must state this in the chain-of-custody form that accompanies the sample to the laboratory, and must provide a HHF blank for the laboratory. The HHF blank shall consist of a container filled with HHF (with LiBr tracer) from the same batch of HHF used during the sampling. This blank shall be analyzed for lithium, and bromide if the lithium 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. The HHF blank is required in addition to the field/trip blank.

A3.0 LABORATORY ANALYSIS REQUIREMENTS

A3.1 ANALYSIS SCHEME

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. The 45-day reporting format, Format III, is explained in Section A7.3.

As a precautionary measure, the Safety and Analysis Report for Packaging (SARP) in the *Load/Transport Sample Cask(s)* procedure (TO-080-090) has been reviewed for any safety issues involved with transportation of tank B-101 push core samples. **For core samples from tank B-101, the shipping containers <u>must</u> be vented every 47 days to release any accumulated gas.**

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

Step 1 Receive 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 segment in addition to written documentation of pertinent descriptive information such as color, texture, homogeneity, and consistency.
- Report the sample recovery results to the Characterization Program within one working day of sample breakdown.
- Take color photographs or a color videotape to visually document the composition of the extruded segment.

Step 3 Does the segment 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 segment 100% drainable liquid?

Yes: Proceed to Step 11
No: Proceed to Step 5

SOLIDS PATH

Step 5 Divide each extruded 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 half-segment per core, at a minimum, should be used if a homogenization test is to be performed. Additional tests may be performed at the laboratory's discretion.

Step 8 Conduct the homogenization test by taking a 1 to 2 gram aliquot from widely separated locations of the homogenized subsegment. Conduct the homogenization test in accordance with Bell (1993).

Step 9 Collect sufficient aliquots from each homogenized subsegment 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 subsegment 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 A3.4.

Step 10 Remove at least 20 ml and up to 40 ml of each homogenized subsegment 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?

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 requirements as listed in Section A7.2.

SECONDARY ANALYSIS PATH

Step 21 Perform secondary analyses following 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 requirements as listed in Section A7.2.

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

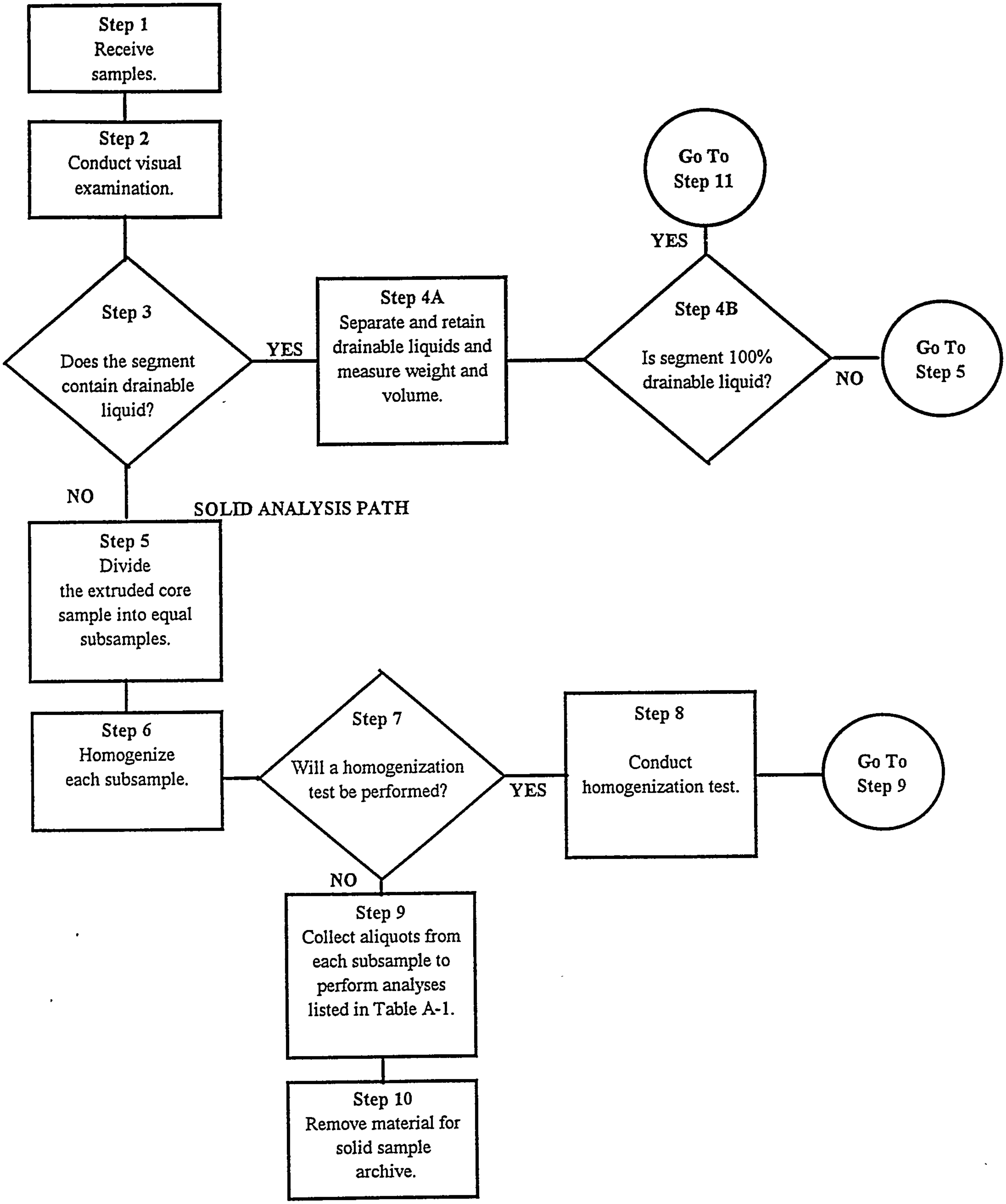

Figure A-1: Solid Analysis Flow Chart

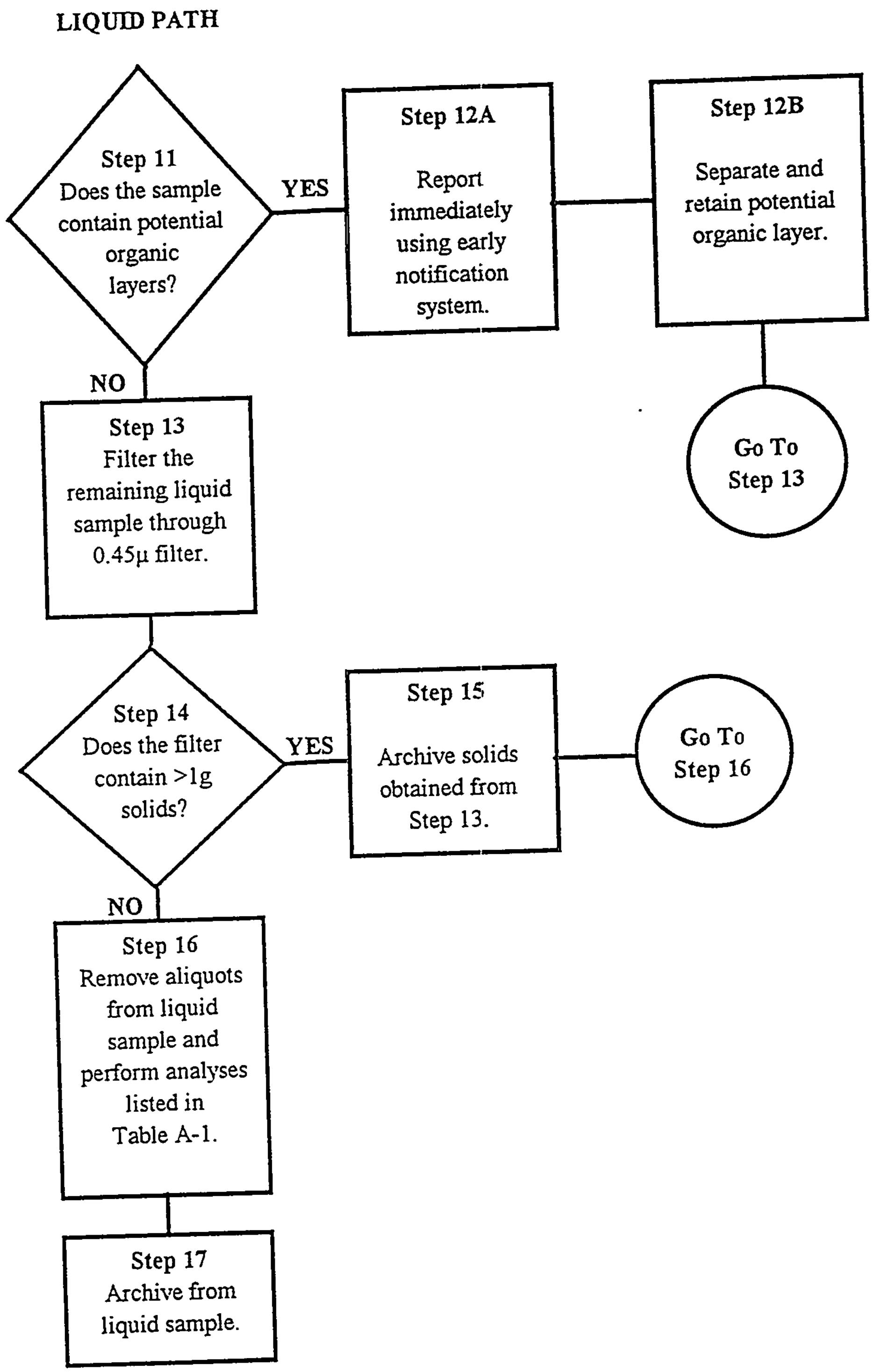

Figure A-2: Liquid Analysis Flow Chart

ANALYSIS AND REPORTING PATH

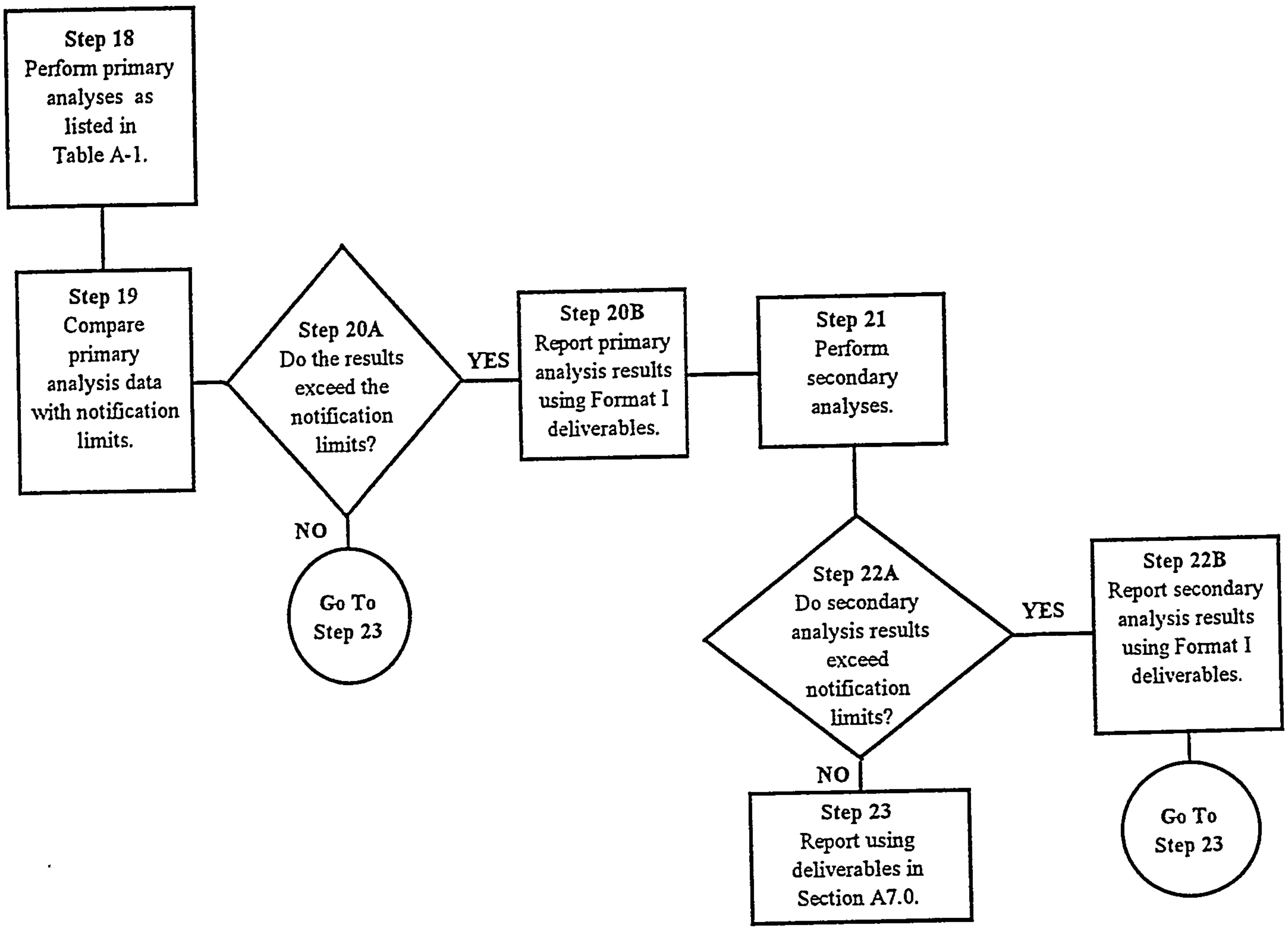

Figure A-3: Sample Analysis and Reporting Flow Chart

A3.2 SPECIFIC METHODS AND ANALYSES

The analyses in Table A-1, to be performed on the tank B-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 the table.

A3.3 INSUFFICIENT SEGMENT RECOVERY

If the amount of material recovered from the core samples taken from tank B-101 is insufficient to perform the analyses requested and permit a minimum 20 mL archive per segment, the laboratory shall notify the Tank Cognizant Engineer within one working day (See Table A-2). A ranking of the analyses requested in this document is given in Section A3.4. Any analyses prescribed by this document, but not performed, shall be identified in the appropriate data report with justification for non-performance.

A3.4 PRIORITIES OF REQUESTED ANALYSES

Confirmation of the priority levels, or revision of sample breakdown procedures may be provided to the laboratory by the Characterization Program 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 prioritization will be determined by the program on a DQO basis.

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

SOLID ANALYSES

Project Name	B-101 Push Mode Core Sample		COMMENTS		REPORTING LEVELS	
Plan Number	WHC-SD-WM-TP-350, REV. 0		Homogenization Test - Per Laboratory Discretion		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	E. J. Lipke	HHF Blank - Required [11]		FORMAT IV	Waste Management
	TWRS	R. D. Schreiber	TANK	#CORES	FORMAT V	RCRA Compliance
			B-101	2	FORMAT VI	Special

PROGRAM	PRIMARY ANALYSES			SAMPLE[1]	PREP[2]	QUALITY CONTROL[3]						CRITERIA			FORMAT
	METHOD	ANAL.	WHC 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	X	d	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	X	d	ea smpl	N/A	N/A	ea AB	±10	90-110	wt%	< 17	37	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
A	ICP[11]	Li	LA-505-151	X[11]	f or a	ea smpl	see 7	ea PB	ea AB	±10	90-110	µg/g	> 100	unknown	I, III
PROGRAM	SECONDARY ANALYSES			SAMPLE[1]	PREP[2]	QUALITY CONTROL[3]						CRITERIA			FORMAT
	METHOD	ANAL.	WHC PROCEDURE	½ SEG SLDG		DUP	SPK/MSD	BLK	CALIB STD	PR	AC	UNITS	NOTIFICATION LIMIT[4]	EXPECTED RANGE[4]	
A	Distillation[8]	CN	LA-695-102	X	d	ea smpl	1/mtrx	ea AB	ea AB	±10	90-110	µg/g	> 39,000	unknown	I, III
A	Sep. & α counting[9]	Pu-239/240	LA-503-156	X	f	ea smpl	1/mtrx[6]	ea PB	ea AB	±10	90-110	µCi/g	> 41	unknown	I, III
A	ICP[9]	Fe	LA-505-151	X	f or a	ea smpl	see 7	ea PB	ea AB	±10	90-110	µg/g	none	30,000	III
A	ICP[9]	Mn	LA-505-151	X	f or a	ea smpl	see 7	ea PB	ea AB	±10	90-110	µg/g	none	unknown	III
A	ICP[9]	U	LA-505-151	X	f or a	ea smpl	see 7	ea PB	ea AB	±10	90-110	µg/g	none	7,420	III
A	IC[10]	Br	LA-533-105	X	w	ea smpl	1/mtrx	ea PB	ea AB	±10	90-110	µg/g	> 1200	unknown	I, III
A	RSST[8]	Energy.	see 8 below	X	d	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	X	d	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 and matrix spike duplicate, AB-analytical batch, PB-preparation blank, 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] Tracer or carrier may be used in place of a spike and results corrected for recovery.

[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 finalized, may be found in WHC-SD-WM-TP-104.

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

[10] Performed only if Li exceeds notification limit.

[11] If the chain of custody form indicates that HHF fluid with LiBr tracer was used to obtain the segment, Li analysis is to be performed on that segment and an HHF blank shall be provided by Sampling Operations.

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

LIQUID ANALYSES

		COMMENTS	REPORTING LEVELS	
Project Name	B-101 Push Mode Core Sample	Homogenization Test - Per Laboratory Discretion	FORMAT I	Early Notify
Plan Number	WHC-SD-WM-TP-350, REV. 0	Field Blank - Required	FORMAT II	Process Control
		Hot Cell Blank - Not Required	FORMAT III	Safety Screening
PROGRAM	PROGRAM CONTACTS	HHF Blank - Required [11]	FORMAT IV	Waste Management
A. Safety Screening	Safety Screening E. J. Lipke	TANK: B-101	FORMAT V	RCRA Compliance
	TWRS R. D. Schreiber	#CORES: 2	FORMAT VI	Special

PROGRAM	PRIMARY ANALYSES: METHOD	ANAL.	WHC PROCEDURE	SAMPLE[1] FB & S-LEV LIQ	PREP[2]	QUALITY CONTROL[3]: DUP	SPK/MSD	BLK	CALIB STD	PR	AC	CRITERIA: UNITS	NOTIFICATION LIMIT[4]	EXPECTED RANGE[4]	FORMAT
A	DSC	Energy	LA-514-113	X	d	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	X	d	ea smpl	N/A	N/A	ea AB	±10	90-110	wt%	< 17	unknown	I, III
A	ICP[11]	Li	LA-505-151	X[11]	d[6]	ea smpl	see 7	ea AB	ea AB	±10	90-110	µg/mL	> 100[10]	unknown	I, III
A	Visual	Organic Layer	LA-519-151	X	d	N/A	N/A	N/A	N/A	N/A	N/A		presence	unknown	I, III

PROGRAM	SECONDARY ANALYSES: METHOD	ANAL.	WHC PROCEDURE	SAMPLE[1] FB & S-LEV LIQ	PREP[2]	QUALITY CONTROL[3]: DUP	SPK/MSD	BLK	CALIB STD	PR	AC	CRITERIA: UNITS	NOTIFICATION LIMIT[4]	EXPECTED RANGE[4]	FORMAT
A	Distillation[8]	CN	LA-695-102	X	d[6]	ea smpl	1/mtrx	ea AB	ea AB	±10	90-110	µg/mL	> 39,000[10]	unknown	I, III
A	IC[9]	Br	LA-533-105	X	d[6]	ea smpl	1/mtrx	ea AB	ea AB	±10	90-110	µg/mL	> 1,200[10]	unknown	I, III
A	RSST[8]	Energy	see 8 below	X	d	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	X	d[6]	ea smpl	1/mtrx	ea AB	ea AB	±10	90-110	µg C/mL	> 30,000[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 and matrix spike duplicate, AB-analytical batch, PB-preparation blank, 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 finalized, 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 liquid density of 1.0 g/mL.

[11]If the chain of custody form indicates that HHF fluid with LiBr tracer was used to obtain the segment, Li analysis is to be performed on that segment and an HHF blank shall be provided by Sampling Operations.

A4.0 QUALITY ASSURANCE

A4.1 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 core samples at the WHC 222-S Laboratory. Additionally, the *Hanford Analytical Services Quality Assurance Plan* (DOE 1994), when implemented (currently scheduled for August 31, 1995), shall be used as quality assurance requirements.

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 SAMPLE COLLECTION

Two core samples are to be taken from tank B-101 and shipped to the performing laboratory by Sampling Operations following work package ES-95-00212. That work package shall also initiate the chain-of-custody for the samples. Approved procedure TO-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. As part of this sampling event a field blank and occasionally a HHF blank are required (Section A2.2).

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 WHC 222-S Laboratory (373-2435) at least 24 hours in advance of an expected shipment.

A4.3 SAMPLE CUSTODY

The chain-of-custody form is initiated by the sampling team as described in the work package. 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.

A5.0 ORGANIZATION

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

Table A-2: Tank B-101 Project Key Personnel List

Individual	Organization	Responsibility
R. D. Schreiber	TWRS Characterization Plans and Reports	Tank B-101 Tank Characterization Plan Cognizant Engineer
E.J. Lipke	WHC Safety 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

In the safety screening DQO (Babad and Redus 1994), 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 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 115 cal/g (dry weight basis). The next revision to the safety screening DQO will incorporate this change. 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 exothermic reaction (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.

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

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 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):

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

NOTE: If a density of 1.5 g/mL 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 analysis of the field blank or any drainable liquid present in the sample. In order to characterize the tank waste adequately, 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. To adequately determine if any contamination of the sample material has occurred, the field blank shall be analyzed for those analyses performed on the solids.

A7.0 DELIVERABLES

All analyses of tank B-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 "Revised Interim Tank Characterization Plan Guidance" (Schreiber 1994a).

A7.1 PROGRESS REPORTS

Each laboratory performing analyses on tank B-101 waste material from this sampling project shall provide a monthly status report 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 accumulative costs will be compared to the budgeted costs as part of the status report. Monthly variances greater than 10% or $10,000, and accumulative variances greater than $50,000 from the budgeted costs 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 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 1 working day by written communication, documenting the observations, to Characterization Plans and Reports, the Characterization Program Office, the Safety Screening Representative, and Process Control. Points of contact within each project/program are defined by Schreiber (1995). 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, containing the results of the primary safety screen analyses shall be issued to the Safety Screening Representative, Characterization Plans and Reports, Process Control, the Characterization Program Office, Los Alamos Technical Associates, the Tank Characterization Resource Center, and the Tank Characterization Database representative (Schreiber 1995) within 45 days of receipt of the last segment of the last core sample at the laboratory loading dock. 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 notebooks. All significant changes (such as changes in scope) shall be documented by Characterization Plans and Reports via an Engineering Change Notice to this 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 plan.

A9.0 REFERENCES

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