SEP 26 1996 **ENGINEERING DATA TRANSMITTAL**

1. EDT 617546

2. To: (Receiving Organization) Distribution	3. From: (Originating Organization) Data Assessment and Interpretation	4. Related EDT No.: N/A
5. Proj./Prog./Dept./Div.: Tank 241-BY-104/Waste Management/DAI/TWRS Technical Basis	6. Design Authority/ Design Agent/Cog. Engr.: Cheryl J. Benar	7. Purchase Order No.: N/A
8. Originator Remarks: This document is being released into the supporting document system for retrievability purposes.		9. Equip./Component No.: N/A
		10. System/Bldg./Facility: 241-BY-104
11. Receiver Remarks: For release.	11A. Design Baseline Document? [] Yes [X] No	12. Major Assm. Dwg. No.: N/A
		13. Permit/Permit Application No.: N/A
		14. Required Response Date: 09/05/96

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Designator	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	WHC-SD-WM-ER-608	N/A	0	Tank Characterization Report for Single-Shell Tank 241-BY-104	N/A	2	1	1

16. KEY

Approval Designator (F)	Reason for Transmittal (G)		Disposition (H) & (I)	
E, S, Q, D or N/A (see WHC-CM-3-5, Sec.12.7)	1. Approval 2. Release 3. Information	4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment	4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION
(See Approval Designator for required signatures)

(G) Reason	(H) Disp.	(J) Name (K) Signature (L) Date (M) MSIN	(G) Reason	(H) Disp.	(J) Name (K) Signature (L) Date (M) MSIN
		Design Authority	1	1	R.J. Cash [signature] 9/24/96 S7-14
		Design Agent			
2	1	Cog.Eng. C.J. Benar [signature] 9/24/96			
2	1	Cog. Mgr. J.G. Kristofzski [signature] 9/24/96			
		QA			
		Safety			
		Env.			

18.	19.	20.	21. DOE APPROVAL (if required)
A.E. Young [signature] 9-5-96 Signature of EDT Originator / Date	N/A Authorized Representative for Receiving Organization / Date	[signature] J.G. Kristofzski 9/24/96 Design Authority/ Cognizant Manager / Date	Ctrl. No. [] Approved [] Approved w/comments [] Disapproved w/comments

BD-7400-172-2 (05/96) GEF097

BD-7400-172-1

Tank Characterization Report for Single-Shell Tank 241-BY-104

Cheryl J. Benar
Westinghouse Hanford Company, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-87RL10930

EDT/ECN: EDT-617546 UC: 2070
Org Code: 79400 Charge Code: N4G4D
B&R Code: EW 3120074 Total Pages: 244

Key Words: Waste Characterization, Single-Shell Tank, SST, Tank 241-BY-104, Tank BY-104, BY-104, BY Farm, Tank Characterization Report, TCR, Waste Inventory, TPA Milestone M-44

Abstract: This document summarizes the information on the historical uses, present status, and the sampling and analysis results of waste stored in Tank 241-BY-104. This report supports the requirements of the Tri-Party Agreement Milestone M-44-09.

Release Approval 9/26/96 Date

DATE: HANFORD RELEASE STA: 4 ID: 2
SEP 26 1996
Release Stamp

Approved for Public Release

WHC-SD-WM-ER-608
Rev. 0

Tank Characterization Report for Single-Shell Tank 241-BY-104

C. J. Benar
J. G. Field
Westinghouse Hanford Company

L. C. Amato
Los Alamos Technical Associate

Date Published
September 1996

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Westinghouse Hanford Company P.O. Box 1970 Richland, Washington

Management and Operations Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

EXECUTIVE SUMMARY

This characterization report summarizes the available information on the historical uses, current status, and the sampling and analysis results of waste contained in underground storage tank 241-BY-104. This report supports the requirements of the *Hanford Federal Facility Agreement and Consent Order*, Milestone M-44-09 (Ecology et al. 1996).

Tank 241-BY-104 is one of 12 single-shell tanks located in the BY-Tank Farm in the 200 East Area of the Hanford Site. Tank 241-BY-104 entered service in the first quarter of 1950 with a transfer of metal waste from an unknown source. Through cascading, the tank was full of metal waste by the second quarter of 1951. The waste was sluiced in the second quarter of 1954. Uranium recovery (tributyl phosphate) waste was sent from tank 241-BY-107 during the second quarter of 1955 and from tank 241-BY-110 during the third quarter of 1955. Most of this waste was sent to a crib during the fourth quarter of 1955. During the third and fourth quarters of 1956 and the second and third quarters of 1957, the tank received waste from the in-plant ferrocyanide scavenging process (PFeCN2) from tanks 241-BY-106, -107, -108, and -110. This waste type is predicted to compose the bottom layer of waste currently in the tank (Agnew et al. 1996a). The tank received PUREX cladding waste (CWP) periodically from 1961 to 1968. Ion-exchange waste from cesium recovery operations was received from tank 241-BX-104 during the second and third quarters of 1968. Tank 241-BY-104 received evaporator bottoms waste from the in-tank solidification process that was conducted in the BY-Tank Farm from tanks 241-BY-109 and 241-BY-112 from 1970 to 1974. The upper portion of tank waste is predicted to be composed of

BY saltcake (Agnew et al. 1996a). Tank 241-BY-104 was declared inactive in 1977. Waste was saltwell pumped from the tank during the third quarter of 1982 and the fourth quarter of 1985.

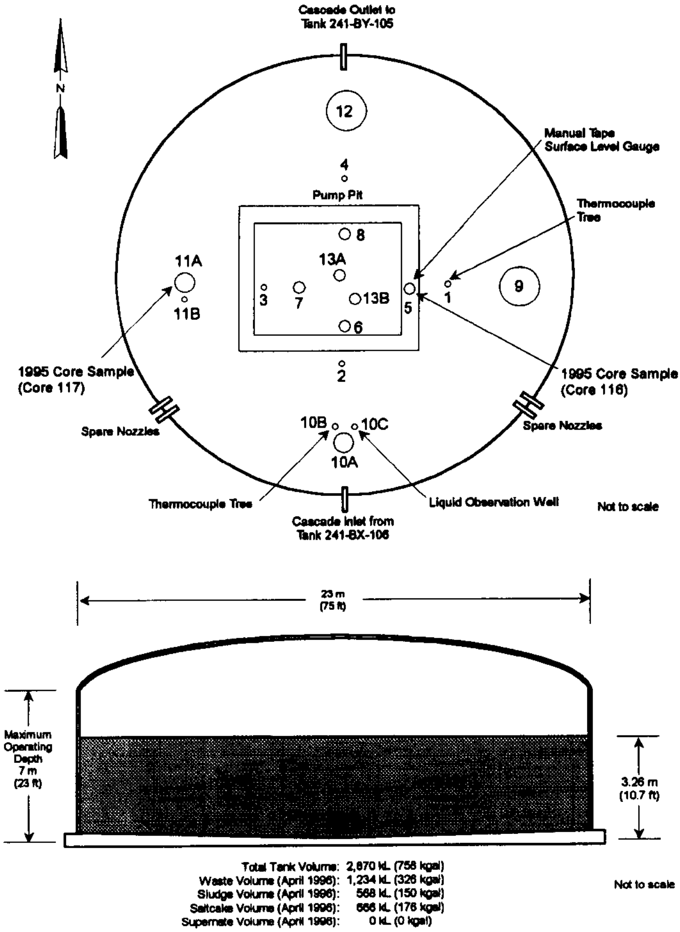
Table ES-1 and Figure ES-1 describe tank 241-BY-104 and its status. The tank has an operating capacity of 2,869 kL (758 kgal) and presently contains an estimated 1,234 kL (326 kgal) of noncomplexed waste. Of this total volume, 568 kL (150 kgal) are estimated to be sludge and 666 kL (176 kgal) are estimated to be saltcake (Agnew 1996). The Hanlon (1996) values are not used because they are inconsistent with waste surface level measurements, and they will not be updated until the tank level stabilizes and the new surface photos are taken (Swaney 1993).

This report summarizes the collection and analysis of two rotary-mode core samples obtained in October and November 1995 and reported in the *Final Report for Tank 241-BY-104, Rotary Mode Cores 116 and 117* (Benar 1996b). Cores 116 and 117 were obtained from risers 5 and 11A, respectively. The sampling event was performed to satisfy the requirements listed in the following documents: *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995), *Data Requirements for the Ferrocyanide Safety Issue Developed through the Data Quality Objective Process* (Meacham et al. 1995), *Data Quality Objective to Support Resolution of the Organic Fuel Rich Tank Safety Issue* (Buckley and Baide 1995), *Test Plan for Samples from Hanford Waste Tanks 241-BY-103, BY-104, BY-105, BY-106, BY-108, BY-110, TY-103, U-105, U-107, U-108, and U-109* (Meacham 1995), *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995),

Table ES-1. Description and Status of Tank 241-BY-104.

TANK DESCRIPTION	
Type	Single-shell
Constructed	1948 and 1949
In service	1950
Diameter	23 m (75 ft)
Maximum operating depth	7 m (23 ft)
Capacity	2,870 kL (758 kgal)
Bottom shape	Dish
Ventilation	Passive
TANK STATUS	
Waste classification	Noncomplexed
Total waste volume	1,234 kL (326 kgal)
Sludge volume	568 kL (150 kgal)
Saltcake volume	666 kL (176 kgal)
Waste surface level (October 1, 1995)	3.26 m (10.7 ft)
Temperature (1993 to 1996)	43.4 °C (110.1 °F) to 54 °C (129 °F)
Integrity	Sound
SAMPLING DATES	
Vapor sampling	June 1994
Sludge samples	February 1976
Auger samples	1992
Rotary-mode core samples and tank headspace flammability	October and November 1995
SERVICE STATUS	
Declared inactive	1977
Interim stabilized	January 1985
Intrusion prevention	September 1990

Figure ES-1. Description and Status of Tank 241-BY-104.



and *Strategy for Sampling Hanford Site Tank Wastes for Development of Disposal Technology* (Kupfer et al. 1995). The sampling and analysis was performed in accordance with the *Tank 241-BY-104 Rotary Core Sampling and Analysis Plan* (Benar 1995).

The purpose of the safety screening data quality objective (DQO) is to identify any unknown safety issues and to evaluate the tank for placement on or removal from a Watch List. To accomplish this, the safety screening DQO requires measurements of the total fuel content of the waste, weight percent water, bulk density measurements, total alpha activity, and a visual examination of waste samples for the presence of an organic layer (liquids only). The safety screening DQO also requires a determination of the flammability of tank headspace gases. To satisfy this requirement, monitoring was performed in the tank headspace using a combustible gas meter before sampling, and the flammability was measured as a percent of the lower flammability limit (LFL). The organic and ferrocyanide DQOs also require measurements of fuel content and weight percent water. In addition, the ferrocyanide DQO requires analyses of cyanide and nickel and the organic DQO requires analysis of total organic carbon (TOC). Finally, the historical model evaluation DQO requires analyses for several chemical species: sodium, aluminum, bismuth, chromium, nickel, nitrate, sulfate, ^{137}Cs, ^{90}Sr, and weight percent water.

To determine fuel content, differential scanning calorimetry was performed on the waste samples. Although exothermic reactions were noted in several samples, all but three were within the DQO threshold of -480 J/g (dry weight), and a fourth had an upper limit to a one-sided 95 percent confidence interval on the mean in excess of the threshold. Only the latter sample had a water content below 17 weight percent (16.4 weight percent), as determined by TGA. Gravimetric analysis on this sample, conducted to verify TGA results, yielded a weight percent water mean of 17.6 weight percent. Seven sample means were lower than the organic DQO decision threshold of 17 weight percent water. The lower limit to one-sided 95 percent confidence intervals on the mean exceeded the decision threshold for 11 samples. Analysis for moisture content using gravimetry verified that six samples still had water contents below 17 weight percent. However, none of the six samples with low water contents contained exothermic reactions with changes in enthalpy exceeding -480 J/g.

The organic DQO establishes the decision threshold for TOC at 30,000 μg C/g (dry weight), whereas the decision threshold for the organic test plan was 45,000 μg C/g (dry weight). Only one sample exceeded the 30,000 μg C/g dry weight limit (33,612 μg C/g). The upper limit to a one-sided 95 percent confidence interval on the mean for a second sample, also exceeded the limit.

The potential for criticality can be assessed from the total alpha activity data. The safety screening DQO decision threshold of 1 g/L was converted to 35.1 μCi/g using the tank density of 1.75 g/mL. The overall tank total alpha activity mean was 0.179 μCi/g, and the highest upper limit to a one-sided 95 percent confidence interval on the mean was 1.19 μCi/g. Therefore, all analytical and confidence interval results were well below the safety screening decision criteria threshold. Finally, the flammability of the gases in the tank headspace was measured at 0 percent of the LFL.

The remaining analytes required by the ferrocyanide DQO, cyanide and nickel, were needed to determine the current cyanide inventory and to provide an estimate of the original cyanide inventory. All cyanide results were much lower than the decision criteria threshold of 39,000 μg/g. Nickel, an indicator of ferrocyanide waste, has a decision criteria threshold of 8,000 μg/g. Three subsegments contained nickel concentrations greater than this limit. Two came from the bottom of core 116 where ferrocyanide waste was expected. The third came from the upper half of segment 1, core 117, an unexpected location.

Ferrocyanide waste is known to degrade over time because of waste tank conditions. To determine the amount of degradation, estimates of the original ferrocyanide inventory were compared with the recent cyanide analytical results. The ferrocyanide is believed to have existed as the complex $Na_2NiFe(CN)_6$. Of the estimated 52,500 kg (based on the current nickel concentration), 39,300 kg (Borsheim and Simpson 1991) and 14,000 kg (Agnew et al. 1996a) were available for the original $Na_2NiFe(CN)_6$ concentration. These were compared with a $Na_2NiFe(CN)_6$ value of 96.4 kg, converted from a cyanide value of 17.7 μg/g. Only the cyanide data from the bottom three segments of each core were used to derive this value because ferrocyanide waste was expected and was shown to be the bottom layer in tank 241-BY-104 (Agnew et al. 1996a). When these numbers are compared, 99.3 to 99.8 percent of the $Na_2NiFe(CN)_6$ has decomposed. Westinghouse Hanford Company has been authorized by the U. S. Department of Energy to remove tank 241-BY-104 from the Ferrocyanide Watch List (Kinzer 1996).

From radionuclide data, the heat generated by the radioactivity in the tank waste is estimated to be 8,270 W (28,200 Btu/hr), which is within the operating specification limit of 11,700 W (40,000 Btu/hr) (Bergmann 1991). Additional estimates of 2,550 W (8,700 Btu/hr) (Kummerer 1994) and 1,310 W (4,470 Btu/hr) (Agnew et al. 1996a) are comparable and are also below this limit. The most recent tank temperature information indicated that tank temperatures varied between 43.4 °C (110 °F) to 54 °C (129 °F) between March 1993 and June 1996. The gradual decrease in tank temperature since January, 1993 indicates that any heat generated from radioactive sources is adequately dissipated.

The historical DQO attempts to verify the presence of particular waste types by comparing the predicted concentrations of certain analytes with the analytical results. Results for these analytes for BY saltcake showed that this waste type was identified. However, some subsegments for three of the six analytes for ferrocyanide waste did not meet the concentration thresholds required to identify the waste. Inspection of the subsegment data revealed that at least some subsegments definitely contained ferrocyanide waste, because of elevated levels of nickel and iron.

Table ES-2 summarizes the concentration and tank inventories for the major constituents in the tank waste.

Table ES-2. Concentrations and Inventories for Major Analytes in Tank 241-BY-104.[1]

Analyte	Overall Mean	RSD (Mean)	Projected Inventory[2]
METALS	μg/g	%	kg
Aluminum	30,100	16.2	65,000
Chromium	4,580	22.9	9,880
Iron	4,090	55.5	8,800
Nickel	1,160	56.4	2,500
Phosphorus	3,560	33.1	7,690
Potassium	3,390	22.4	7,320
Sodium	2.20E+05	4.30	4.75E+05
Strontium	2,330	63.3	5,030
Sulfur	4,420	29.3	9,560
Uranium	3,270	60.0	7,100
ANIONS	μg/g	%	kg
Chloride	2,320	8.89	5,010
Cyanide	< 11.8	N/A	< 25.5
Fluoride	4,630	23.7	10,000
Nitrate	2.61E+05	13.6	5.64E+05
Nitrite	34,900	9.31	75,400
Oxalate	13,100	16.8	28,300
Phosphate	11,200	29.9	24,200
Sulfate	17,300	20.2	37,300
RADIONUCLIDES	μCi/g	%	Ci
^{137}Cs	97.0	8.61	2.10E+05
^{60}Co	< 0.0149	N/A	< 32.2
$^{89/90}Sr$	391	62.5	8.43E+05
Total alpha	0.179	77.0	386
Total beta	837	45.6	1.81E+06
CARBON	μg C/g	%	kg C
Total carbon	25,500	18.5	55,100
Total inorganic carbon	14,800	21.1	32,000
Total organic carbon	6,810	36.8	14,700
PHYSICAL PROPERTIES		%	kg
Density (g/mL)	1.75	1.54	---
Weight percent water	25.6	14.0	5.53E+05

Notes:

[1]Benar (1995) and Appendix A

[2]Calculation based on 1.75 g/mL solids density and 1,234 kL (326 kgal) total solids.

This page intentionally left blank.

CONTENTS

CONTENTS (Continued)

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF TERMS

ANOVA	analysis of variance
Btu/hr	British thermal units per hour
C	carbon
$\overline{C}_{ps}^{react}$	average sample heat capacity
c/s	counts per second
Ci	curies
Ci/g	curies per gram
Ci/L	curies per liter
cm	centimeters
CWP	PUREX cladding waste
DL	drainable liquid
DQO	data quality objective
DSC	differential scanning calorimetry
ECN	Engineering Change Notice
ft	feet
g	grams
g/L	grams per liter
g/mL	grams per milliliter
GEA	gamma energy analysis
HDW	Hanford Defined Waste
HTCE	Historical Tank Content Estimate
IC	ion chromatography
ICP	inductively coupled plasma
in.	inches
J/g	joules per gram
kg	kilograms
kg C	kilograms of carbon
kgal	kilogallons
kL	kiloliters
LEL	lower explosive limit
LFL	lower flammability limit
m	meters
M	moles per liter
mg	milligrams
mL	milliliters
mm	millimeters
mR/hr	milliroentgen per hour
NFPA	National Fire Protection Association
OGIST	Oregon Graduate Institute of Science and Technology
PFeCN2	ferrocyanide waste type
PUREX	plutonium-uranium extraction
$\hat{Q}$	specific exothermic energy

LIST OF TERMS (Continued)

Rev.	revision
RPD	relative percent difference
RSD	relative standard deviation
RSST	reactive systems screening tool
SACS	Surveillance Analysis Computer System
SAP	sampling and analysis plan
TC	total carbon
TIC	total inorganic carbon
TGA	thermogravimetric analysis
TLM	Tank Layer Model
TOC	total organic carbon
W	watts
WHC	Westinghouse Hanford Company
WSTRS	Waste Status and Transaction Record Summary
wt%	weight percent
°C	degrees Celsius
°C/minute	degrees Celsius per minute
°F	degrees Fahrenheit
μCi/g	microcuries per gram
μCi/L	microcuries per liter
μeq/g	microequivalents per gram
μg C/g	micrograms carbon per gram
μg/g	micrograms per gram
μm	micrometers
ΔH	change in enthalpy

1.0 INTRODUCTION

This tank characterization report gives an overview of single-shell tank 241-BY-104 and its waste contents. It provides estimated concentrations and inventories for the waste components based on the latest sampling and analysis activities and background tank information. The characterization of tank 241-BY-104 is based on the results from two rotary-mode core samples taken in October and November 1995. The sampling and analysis event was governed by the following documents: *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995), *Data Requirements for the Ferrocyanide Safety Issue Developed through the Data Quality Objective Process* (Meacham et al. 1995), *Data Quality Objective to Support Resolution of the Organic Fuel Rich Tank Safety Issue* (Buckley and Baide 1995), *Test Plan for Samples From Hanford Waste Tanks 241-BY-103, BY-104, BY-105, BY-106, BY-108, BY-110, TY-103, U-105, U-107, U-108, and U-109* (Meacham 1995), *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995), and *Strategy for Sampling Hanford Site Tank Wastes for Development of Disposal Technology* (the pretreatment DQO) (Kupfer et al. 1995). For information purposes, results from two sampling events (in 1976 and 1992) also have been provided.

Tank 241-BY-104 was declared inactive in 1977; it was interim stabilized in 1985. As a result the composition of the waste should not change appreciably until pretreatment and retrieval activities begin. The concentration and inventory values reported in this document reflect the best estimates based on the most recent analytical data. This report supports the requirements of the *Hanford Federal Facility Agreement and Consent Order*, Milestone M-44-09 (Ecology et al. 1996).

1.1 PURPOSE

The purpose of this report is to summarize the information about the use and contents of tank 241-BY-104. Where possible, this information will be used to assess issues associated with safety, operational, environmental, and process development activities. This report also provides a reference point for more detailed information about tank 241-BY-104.

1.2 SCOPE

This report is based on the October/November 1995 rotary-mode core sampling event. The sampling and analysis plan (SAP), *Tank 241-BY-104 Rotary Core Sampling and Analysis Plan* (Benar 1995), integrated the sampling and analytical requirements of the documents which governed this sampling event. Segments were subsampled on a quarter-segment basis for sludge and half-segment basis for saltcake. A composite of core 116 was also produced.

The analyses required on each subsegment and the composite differed according to the governing document.

No analyses were required by the pretreatment DQO (Kupfer et al. 1995). The safety screening, ferrocyanide, organic, and historical DQOs and the organic test plan required DSC to evaluate the energetics. The four DQOs required TGA to determine the moisture content. Analyses for total alpha activity and density were performed to satisfy requirements of the safety screening DQO. The final safety screening DQO requirement, determining the flammability of the tank headspace vapors, was performed before the core sampling using a combustible gas meter. Cyanide, total carbon (TC), and selected metals (by inductively coupled plasma spectroscopy [ICP]) were analyzed to satisfy the ferrocyanide DQO. Additional analyses performed to meet the organic DQO requirements were persulfate oxidation for TOC, ICP for selected metals, and gravimetry for moisture content. Additional analyses performed on the core samples to satisfy the historical DQO were ion chromatography (IC) for a full suite of anions, gamma energy analysis (GEA) for ^{137}Cs and ^{60}Co, beta proportional counting for ^{90}Sr and total beta, phosphorescence for total uranium, and a full suite of metals by ICP. The organic test plan also required adiabatic calorimetry reactive systems screening tool (RSST) analyses to evaluate the ability of the tank material to support a propagating reaction.

For more detail about the analytical requirements for each subsegment, see Section 3.0.

2.0 HISTORICAL TANK INFORMATION

This section describes tank 241-BY-104 based on historical information. It includes information about the current condition of the tank, tank design, transfer history, and process sources that contributed to the tank waste, including an estimate of the current contents based on the process history. It also includes events that may relate to tank safety issues, such as potentially hazardous tank contents or off-normal operating temperatures,and a summary of available surveillance data for the tank. Solid and liquid level data are used to determine tank integrity (leaks) and to provide clues to internal activity in the solid layers of the tank. Temperature data are provided to evaluate the heat generating characteristics of the waste.

2.1 TANK STATUS

Hanlon (1996) estimates that tank 241-BY-104 contains 1,537 kL (406 kgal) of waste classified as noncomplexed. This estimate is inconsistent with the October 1, 1995 waste level measurement of 326 cm (1260 kL [333 kgal]) and with Agnew (1996) Tank Layering Model estimates of 1234 kL [326 kgal]. The Hanlon document will be updated when the tank level stabilizes (Swaney 1993). The liquid waste volume is based on Hanlon (1996) and estimated using a photographic evaluation. For purposes of this report the total waste, sludge and saltcake estimates will be those estimates in TLM. The amounts of various waste phases existing in the tank are presented in Table 2-1.

Table 2-1. Estimated Tank Contents.[1]

Waste Form	Estimated Volume[1]	
	kL	kgal
Total Waste[1]	1,234	326
Supernatant Liquid	0	0
Sludge	568	150
Saltcake	666	176
Drainable Interstitial Liquid[2]	68	18
Drainable Liquid Remaining	68	18
Pumpable Liquid Remaining	0	0

Notes:

[1]Agnew (1996)

[2]Hanlon (1996)

Tank 241-BY-104 is out of service, as are all single-shell tanks. This tank is categorized as sound with interim stabilization (1985) and intrusion prevention (1990) completed. The tank is passively ventilated. All monitoring systems except the manual tape surface level gauge were in compliance with documented standards as of April 30, 1996 (Hanlon 1996).

2.2 TANK DESIGN AND BACKGROUND

The 241-BY Tank Farm was constructed from 1948 to 1949 in the 200 East Area. The 241-BY Tank Farm contains 12 100-series tanks. These tanks have a capacity of 2,869 kL (758 kgal), a diameter of 23 m (75 ft), and an operating depth of 7 m (23 ft) (Leach and Stahl 1993). Built according to the second generation design, the 241-BY Tank Farm was designed for nonboiling waste with a maximum fluid temperature of 104 °C (220 °F). A cascade overflow line 7.5 cm (3 in.) in diameter connects tank 241-BY-104 as fourth in a cascade series of six tanks beginning with tanks 241-BX-104, -105, and -106 in the BX Tank Farm. Anecdotal evidence indicates that the cascade from tank 241-BX-106 to tank 241-BY-104 did not function well. As a result, the BX-farm and BY-farm cascades often operated separately. Tank 241-BY-104 cascades into tanks 241-BY-105 and -106 in the BY Tank Farm (Hanlon 1996). Each tank in the cascade series is set one foot lower in elevation than the preceding tank. The cascade overflow height is approximately 7 m (23 ft) from the tank bottom and 37 cm (1.2 ft) below the top of the steel liner.

The tank has a dished bottom with a 1.2 m (4 ft) radius knuckle. Tank 241-BY-104 was designed with a primary mild steel liner and a concrete dome with various risers. The tank is set on a reinforced concrete foundation. A three-ply asphalt waterproofing was applied over the foundation and steel tank. Two coats of primer were sprayed on all exposed interior tank surfaces. The tank ceiling dome was covered with three applications of magnesium zinc fluorosilicate wash. Lead flashing was used to protect the joint where the steel liner meets the concrete dome. Asbestos gaskets were used to seal the risers in the tank dome. The tank was waterproofed on the sides and top with tar and welded wire reinforced gunite. This tank was covered with approximately 2.6 m (8.5 ft) of overburden.

According to the drawings and engineering change notices (H-2-73252, H-2-37104, and CEO-39571), tank 241-BY-104 has 20 risers. The risers range in diameter from 10 cm (4 in.) to 1.1 m (3.5 ft). Table 2-2 shows the numbers, diameters, and descriptions of the risers and the inlet, overflow, and spare nozzles. Figure 2-1 shows a plan view of the riser configuration. Riser 4, 10 cm (4 in.) in diameter, is available for use (Lipnicki 1995). Figure 2-2 shows a tank cross section showing the approximate waste level and a schematic of the tank equipment.

Figure 2-1. Riser Configuration for Tank 241-BY-104.

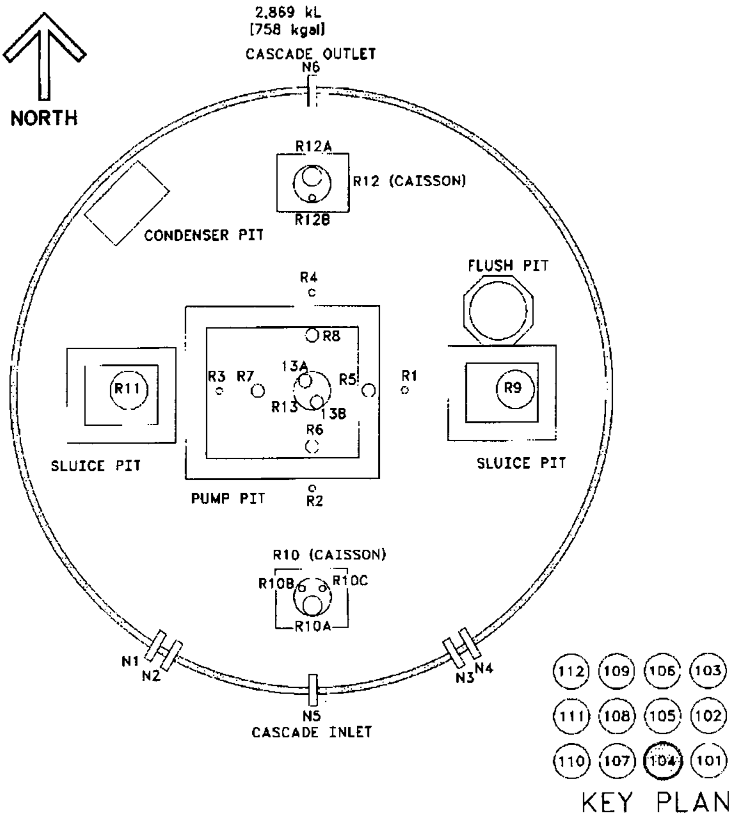


Figure 2-2. Tank 241-BY-104 Cross-Section.

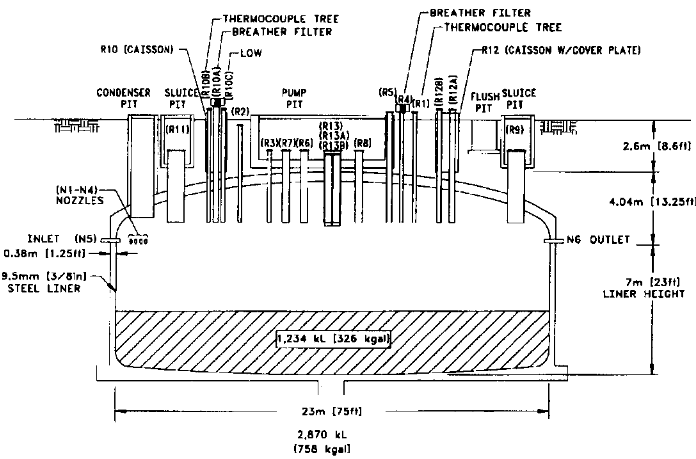


Table 2-2. Tank 241-BY-104 Risers.[1,2,3,4]

Riser Number	Diameter (in.)	Description and Comments
1	4	Thermocouple tree
2	4	Covered with concrete, below grade
3	4	Spare [plugged ECN-132359, December 3, 1990]
4	4	Breather filter, G-1 housing
5	12	Liquid level reel [liquid level reel on 4 in. spool CEO-39571, July 15, 1987] [4 in. diameter ECN-626660, October 23, 1995]
6	12	Covered with concrete
7	12	Saltwell screen and pump
8	12	Covered with concrete
9	42	Cover plate, weather covered
10	42	Adapter plate [bench mark CEO-36921, December 11, 1986], caisson
10A	18	Vent intake [vapor assembly on 18 in. to 4 in. adaptor and split spool ECN-166521L, May 25, 1994 and ECN-189223L, March 10, 1994]
10B	4	Flanged [thermocouple tree ECN-176624, June 1, 1993]
10C	4	B-436 liquid observation well
11	42	Cover plate, weather covered
12	42	Lead shielding, caisson
12A	18	Capped
12B	4	Spare
13	42	Cover plate
13A	14	[Observation port CEO-39571, July 15, 1987]
13B	14	Air lift circulator
Nozzle Number	**Diameter (in.)**	**Description and Comments**
N1	3	Spare, capped
N2	3	Spare
N3	3	Spare
N4	3	Spare, capped
N5	3	Cascade inlet from tank 241-BX-106
N6	3	Cascade outlet to tank 241-BY-105

Notes:

[1]Alstad (1993)
[2]Tran (1993)
[3]Vitro Engineering Corporation (1986)
[4]ARHCO (1976)

2.3 PROCESS KNOWLEDGE

Section 2.3.1 and Table 2-3 provide the history of the major waste transfers involving tank 241-BY-104. Section 2.3.2 provides an estimates the tank contents.

2.3.1 Waste Transfer History

Tank 241-BY-104 received metal waste from an unknown source during the first quarter of 1950. The tank received metal waste through the cascade line from tank 241-BX-106 in the first quarter of 1951. The cascade continued through the second quarter of 1951 and filled the tank, which then cascaded waste to tank 241-BY-105. The cascading stopped in the fourth quarter of 1951. The tank remained full until the second quarter of 1954 when the tank was sluiced and emptied. The waste was transferred to tank 241-BY-109 and the 244-BXR vault (Anderson 1990).

Waste from uranium recovery by the tributyl phosphate process was sent to tank 241-BY-104 from tank 241-BY-107 during the second quarter of 1955 and from tank 241-BY-110 during the third quarter of 1955. Most of this waste was sent to crib B-049 during the fourth quarter of 1955.

During the third and fourth quarters of 1956 and the second and third quarters of 1957, the tank received waste from the in-plant ferrocyanide scavenging process (PFeCN2) from tanks 241-BY-106, -107, -108, and -110.

The tank received PUREX cladding waste (CWP) from tank 241-C-107 during the third quarter of 1961 and the second quarter of 1962. The supernate was sent to tank 241-BY-103 in the second quarter of 1967. During the third and fourth quarters of 1967 and the first quarter of 1968, the tank received cladding waste from tank 241-C-102. Supernate was sent to tank 241-BY-103 in the second quarter of 1968.

Ion-exchange waste from cesium recovery operations was received from tank 241-BX-104 during the second and third quarters of 1968. Supernate was sent to tanks 241-A-103 and 241-C-110 during the first quarter of 1970.

Tank 241-BY-104 received evaporator bottoms waste from the in-tank solidification process, conducted in the BY Tank Farm, from tanks 241-BY-109 and 241-BY-112 during 1970 to 1974. Waste was sent to tank 241-A-102 during the fourth quarter of 1976 and the first quarter of 1977.

Tank 241-BY-104 was declared inactive in 1977. Waste was saltwell pumped to tank 241-AW-102 during the third quarter of 1982 and to tank 241-AN-101 during the fourth quarter of 1985. Currently, the waste in tank 241-BY-104 is classified as noncomplexed.

Table 2-3. Summary of Tank 241-BY-104 Waste Received History.[1,2]

Transfer Source	Waste Type Received	Time	Estimated Waste Volume	
			kL	kgal
Unknown	Metal waste	1950	42	11
241-BX-106	Metal waste supernate	1951	4,906	1,296
241-BY-107, 241-BY-110	Uranium recovery waste (TBP)	1955	2,714	717
241-BY-106, 241-BY-107, 241-BY-108, 241-BY-110	PFeCN2 waste	1956 to 1957	2,055	543
241-C-107	PUREX cladding waste (CWP)	1961 to 1962	575	152
241-C-102	PUREX cladding waste (CWP)	1967 to 1968	1,987	525
241-BX-104	Ion-exchange waste from cesium recovery	1968	1,896	501
241-BY-109, 241-BY-112	Evaporator bottoms waste from in-tank solidification	1970 to 1974	7,790	2,058

Notes:

[1]Waste volumes and types are best estimates based on historical data.
[2]Agnew et al. (1996b)

2.3.2 Historical Estimation of Tank Contents

The following is an estimate of tank 241-BY-104 contents based on historical transfer data. The historical data used for the estimate are from the *Waste Status and Transaction Record Summary for the Northeast Quadrant* (WSTRS) (Agnew et al. 1996b), and the *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 3* (Agnew et al. 1996a). The Hanford Defined Waste (HDW) Model Rev. 3 document contains the HDW list, the Tank Layer Model (TLM), and the historical tank content estimate (HTCE) (Brevick 1994). The WSTRS is a compilation of available waste transfer and volume status data. The HDW provides the assumed typical compositions for 50 waste types. In some cases, the available data are incomplete, thereby reducing the usability of the transfer data and the derived results. The TLM, using the WSTRS data, models the waste deposition processes and, using additional data from the HDW which may introduce more errors, generates an estimate of the tank contents. Thus, these predictions are considered estimates that require further evaluation using analytical data.

Based on the TLM, tank 241-BY-104 contains a top layer of 666 kL (176 kgal) of BY saltcake and a 568 kL (150 kgal) bottom sludge layer of PFeCN2. Figure 2-3 shows a graph of the estimated waste types and volumes for the tank layers. The PFeCN2 (bottom waste layer) should contain greater than 1 percent of nitrate, sodium, iron, bismuth, chromium, hydroxide, carbonate, phosphate, sulfate, ferrocyanide, and uranium; with between 1 and 0.1 percent of nickel, calcium, nitrite, silicate, fluoride, and chloride. This layer is expected to show very small activity because of the low concentration of cesium and strontium. The top waste layer, BYSltCk, is expected to contain greater than 1 percent of sodium, hydroxide, aluminum, nitrate, nitrite, carbonate, and sulfate; with between 1 and 0.1 percent chromium, calcium, phosphate, silicate, chloride, citric acid, acetate, oxolate, DBP, and uranium. The activity of this layer should be moderate, corresponding to the amount of cesium and strontium present. Table 2-4 shows an estimate of the expected waste constituents and their concentrations.

Figure 2-3. Tank Layer Model for Tank 241-BY-104.

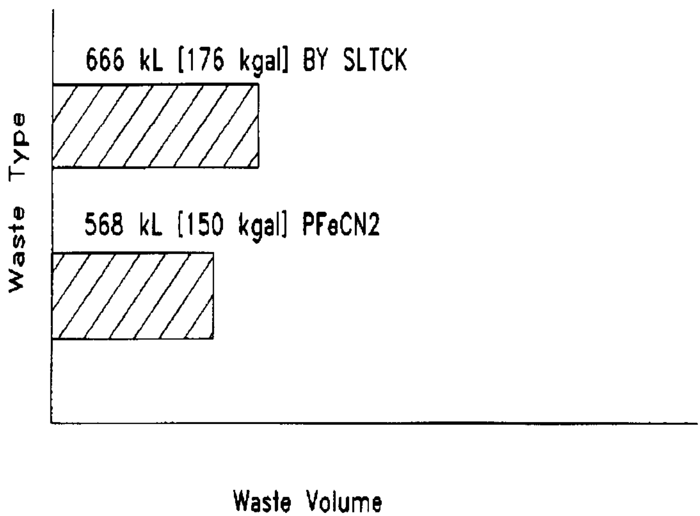


Table 2-4. Tank 241-BY-104 Historical Inventory Estimate.[1,2] (2 sheets)

Total Inventory Estimate			
Physical Properties			
Total solid waste	1.86E+06 kg (326 kgal)		
Heat load	1,310 W (4,470 Btu/hr)		
Bulk density	1.51 (g/mL)		
Water weight percent	46.5		
Total Organic Carbon wt% Carbon (wet)	0.434		
Chemical Constituents	**M**	**μg/g**	**kg**
Na^+	8.45	1.29E+05	2.40E+05
Al^{3+}	1.16	20,800	38,600
Fe^{3+} (total Fe)	0.448	16,600	30,900
Cr^{3+}	0.0287	992	1,840
Bi^{3+}	0.132	18,300	34,000
La^{3+}	1.74E-06	0.161	0.299
Hg^{2+}	1.96E-05	2.61	4.84
Zr (as $ZrO(OH)_2$)	1.60E-04	9.70	18.0
Pb^{2+}	0.00306	421	783
Ni^{2+}	0.0670	2,610	4,860
Sr^{2+}	1.94E-06	0.113	0.210
Mn^{4+}	0.00176	64.1	119
Ca^{2+}	0.179	4,770	8,870
K^+	0.0280	727	1,350
OH^-	6.56	74,100	1.38E+05
NO_3^-	4.57	1.88E+05	3.50E+05
NO_2^-	1.02	31,100	57,700
CO_3^{2-}	0.410	16,400	30,400
PO_4^{3-}	0.224	14,100	26,200
SO_4^{2-}	0.181	11,600	21,500
Si (as SiO_3^{2-})	0.0724	1,350	2,510
F^-	0.122	1,530	2,850
Cl^-	0.104	2,440	4,540
$citrate^{3-}$	0.0130	1,630	3,020

Table 2-4. Tank 241-BY-104 Historical Inventory Estimate.[1,2] (2 sheets)

Total Inventory Estimate			
Chemical Constituents (Cont'd)	**M**	**μg/g**	**kg**
$EDTA^{4-}$	0.00291	556	1,030
$HEDTA^{3-}$	3.92E-04	71.4	133
$glycolate^{-}$	0.00912	454	844
$acetate^{-}$	0.0173	678	1,260
$oxalate^{2-}$	1.49E-06	0.0871	0.162
DBP	0.0138	2,430	4,520
butanol	0.0138	677	1,260
NH_3	0.00573	64.6	120
$Fe(CN)_6^{4-}$	0.0359	6,460	12,000
Radiological Constituents	**Ci/L**	**μCi/g**	**Ci**
Pu		0.0627	1.94 (kg)
U	0.0704 (M)	795 (μg/g)	20,700 (kg)
Cs	0.123	82.0	1.52E+05
Sr	0.0716	47.5	88,300

Notes:

[1]These estimates have not been validated and should be used with caution.

[2]Agnew et al. (1996a)

2.4 SURVEILLANCE DATA

Tank 241-BY-104 surveillance includes surface level measurements (liquid and solid) and temperature monitoring inside the tank (waste and headspace). The data provide the basis for determining tank integrity.

Liquid level measurements may indicate a tank leak. Solid surface level measurements indicate physical changes and consistency of the solid layers of a tank. Drywells located around the perimeter of the tank may detect increased radioactivity caused by a leak to the soil.

2.4.1 Surface Level

The tank 241-BY-104 waste surface level is monitored quarterly with a manual tape through riser 5. The tape is currently out of service (Hanlon 1996). The maximum allowable increase from the 3.33 m (10.9 ft) baseline is 7.5 cm (3 in.). The criterion for a decrease does not apply to this tank. The tank has a liquid observation well located in riser 10C. The tank is monitored weekly with a neutron probe and with a gamma probe (on request) to determine the interstitial liquid level. The surface level on October 1, 1995, was 3.26 m (10.7 ft) (WHC 1996). Figure 2-4 is a graph of the tank volume history.

2.4.2 Drywells

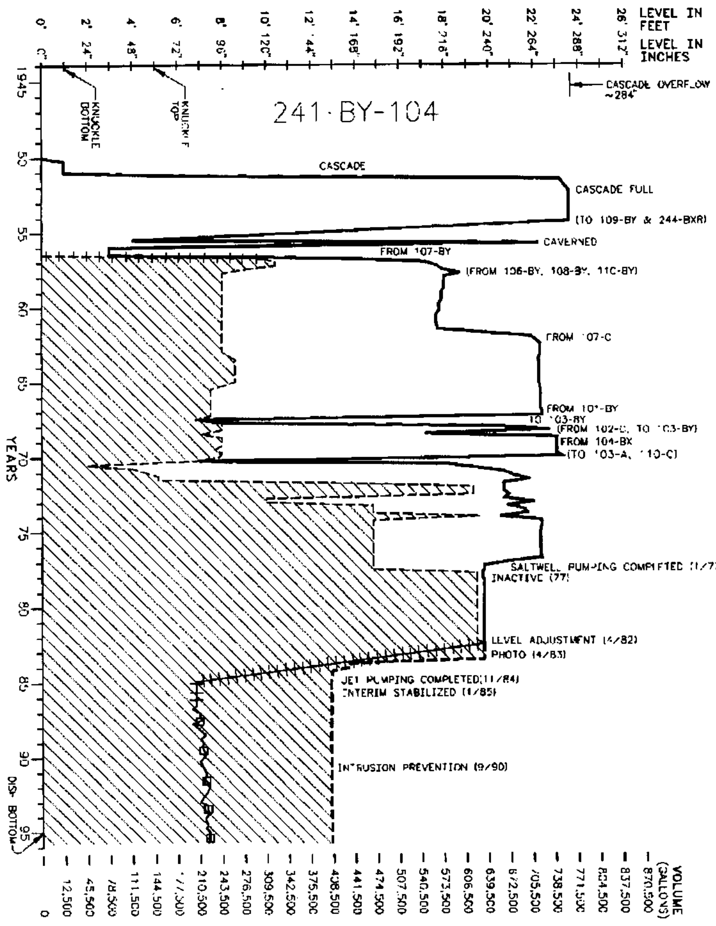
Tank 241-BY-104 has five drywells. Only one drywell, 22-04-09 (active prior to 1990, current reading < 200 counts per second), has a reading greater than 50 counts per second background radiation. This is well below the leak detection criteria of 200 counts per second. Graphical representations of the data for each active drywell from 1990 to 1993 are in the HTCE supporting document for the BY Tank Farm (Brevick et al. 1994).

2.4.3 Internal Tank Temperatures

Tank 241-BY-104 has two thermocouple trees to monitor the waste temperature: tree 1 (riser 1) has 12 thermocouples and tree 2 (riser 10B) has 6 thermocouples. No temperature data exist for thermocouples 7 through 12 on tree 1. Elevations are available for both trees and the thermocouples. Plots of individual thermocouple readings are in the HTCE supporting document for the BY Tank Farm (Brevick et al. 1994).

Temperature data, obtained from the Surveillance Analysis Computer System (SACS) (WHC 1996), were recorded from March 1993 until June 1996. The mean temperature of the SACS data for thermocouple tree 1 was 52 °C (126 °F) with a minimum of 49.9 °C (121.8 °F) and a maximum of 54 °C (129 °F). The mean temperature of the SACS data for thermocouple tree 2 was 45 °C (113 °F) with a minimum of 43.4 °C (110.1 °F) and a

Figure 2-4. Tank 241-BY-104 Level History.

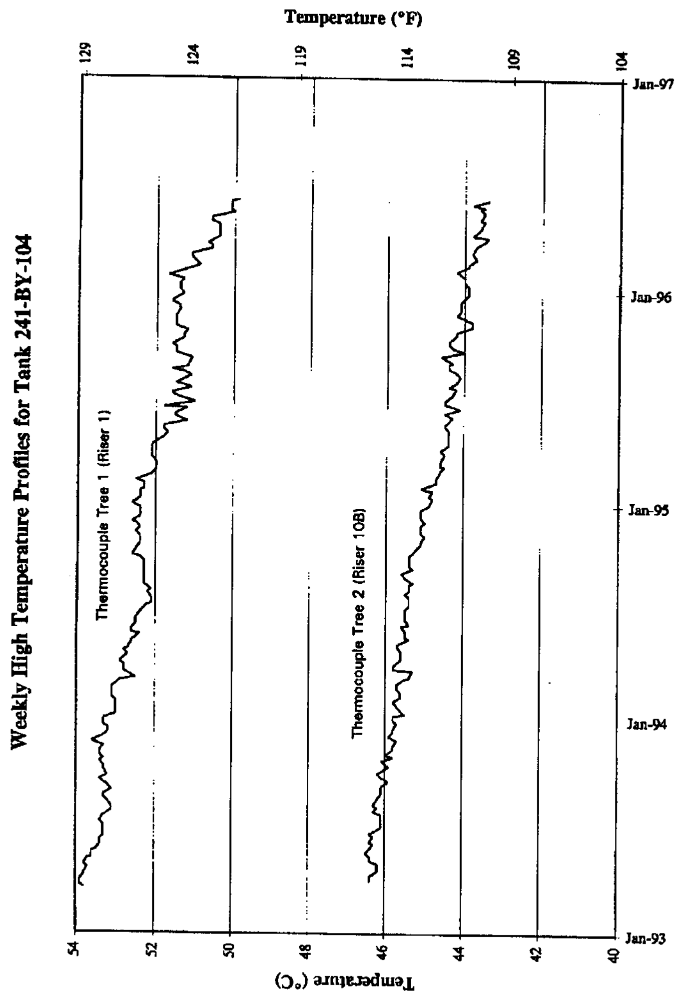


maximum of 46.5 °C (115.7 °F). Tank 241-BY-104 is on the Ferrocyanide Watch List; therefore weekly temperature monitoring is required. Figure 2-5 is a graph of the weekly high temperatures for each thermocouple tree. Both trees are trending towards lower temperatures.

2.4.4 Tank 241-BY-104 Photographs

The April 27, 1983, montage of the tank 241-BY-104 interior shows off-white to yellow solids interspersed with dark yellow veins and brown areas. At the time the photographs were taken, the tank contained approximately 2,400 kL (634 kgal) of waste which equals approximately 6 m (19.8 ft). The tank has since been saltwell pumped, reducing the volume of the waste to its current level (1,234 kL [326 kgal]). Therefore, the montage probably does not accurately represent the current tank waste and is not reproduced in this document.

Figure 2-5. Tank 241-BY-104 Weekly High Temperature Plot.



3.0 TANK SAMPLING OVERVIEW

This section describes the October and November 1995 sampling and analysis event for tank 241-BY-104. Two rotary-mode core samples were taken to satisfy the requirements of the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995), the *Data Requirements for the Ferrocyanide Safety Issue Developed through the Data Quality Objective Process* (Meacham et al. 1995), the *Data Quality Objective to Support Resolution of the Organic Fuel Rich Tank Safety Issue* (Buckley and Baide 1995), the *Test Plan for Samples From Hanford Waste Tanks 241-BY-103, BY-104, BY-105, BY-106, BY-108, BY-110, TY-103, U-105, U-107, U-108, and U-109* (Meacham 1995), the *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995), and the *Strategy for Sampling Hanford Site Tank Wastes for Development of Disposal Technology* (Kupfer et al. 1995). The SAP, *Tank 241-BY-104 Rotary Core Sampling and Analysis Plan* (Benar 1995), integrated the sampling and analytical requirements of these documents. Table 3-1 summarizes the requirements. Descriptions of two historical sampling events have also been included. For further discussions of the sampling and analysis procedures, refer to the *Tank Characterization Reference Guide* (DeLorenzo et al. 1994).

3.1 DESCRIPTION OF SAMPLING EVENT

All core samples were taken using the rotary-mode core sampling method. Core 116 was obtained through riser 5 from October 31, 1995, through November 3. Core 117 was acquired from riser 11A on November 15 and 16. The only sampling anomaly noted on the chain-of-custody forms was that the bottom alarm went off during the taking of segment 5 from core 117 before the sampler had traveled the expected depth (Benar 1996a). Both cores were shipped to the Westinghouse Hanford Company 222-S Laboratory. A deionized water field blank was produced and delivered with core 116.

Prior to core sampling, the flammability of the tank headspace was measured to address the vapor flammability issue of the safety screening DQO. Monitoring of headspace gases with a combustible gas meter was performed within three feet of the waste surface (Benar 1995).

A hydrostatic head fluid was not used in conjunction with the core sampling. However, water was used to wash the drill string during sampling operations. A tracer (lithium bromide) was added to the wash water to gauge contamination of the segments by the wash water.

Table 3-1. Integrated Data Quality Objective Requirements for the October/November 1995 Sampling Event for Tank 241-BY-104.[1]

Applicable DQOs	Sampling Requirements	Primary Analytical Requirements
Safety screening (Dukelow et al. 1995)	Core samples from a minimum of two risers separated radially to the maximum extent possible. Flammability monitoring done in tank headspace.	▸ Energetics ▸ Moisture content ▸ Total alpha activity ▸ Bulk density ▸ Headspace gas flammability ▸ Visual check for presence of organic layer (liquids only)
Ferrocyanide (Meacham et al. 1995)	Core samples from a minimum of two risers separated radially to the maximum extent possible.	▸ Energetics ▸ Moisture content ▸ Cyanide ▸ Nickel
Organic (Buckley and Baide 1995)	Two vertical profiles of the liquid and solid portions of the tank waste.	▸ Energetics ▸ Moisture content ▸ Total organic carbon
Organic test plan (Meacham 1995)	N/A	▸ Energetics (by DSC) ▸ Energetics (by RSST)
Historical (Simpson and McCain 1995)	Isolation of a segment containing only one specified waste type (BY saltcake; ferrocyanide waste [PFeCN2])	▸ Energetics ▸ Moisture content ▸ Anions by IC ▸ ^{137}Cs, ^{60}Co, and ^{90}Sr ▸ Metals by ICP
Pretreatment (Kupfer et al. 1995)	▸ Remove 125 mL of solid composite for process development work. ▸ Archive 100 mL of solid and liquid composite for the Pretreatment Program.	n/a

Note:

[1]Benar (1995)

3.2 SAMPLE HANDLING

All samples were received and extruded at the 222-S Laboratory. No waste was in the sampler for segment 1 of core 116. Segments 1 and 2 of core 117 were the only segments that contained drainable liquid. Table 3-2 presents a description of the core samples and other sampling information. The estimates for percent recovery were derived by dividing the length of sample recovered for each segment by the expected sample length (taken from the chain-of-custody forms in Benar [1996b]).

The segments were subsampled for analysis to meet the ferrocyanide DQO requirements. The ferrocyanide DQO contained the most extensive sample breakdown. This DQO requires analyses on homogenized quarter segments for sludge and homogenized half segments for saltcake (Meacham et al. 1995). When a segment contained both sludge and saltcake, the two waste phases were separated and treated as though they were individual segments. For example, segment 2 of core 116 contained both sludge and saltcake. After separating the waste phases, the sludge was designated quarter segment A (only enough material for one quarter segment), and the saltcake was labeled upper half (only enough material for one half). For core 117, segment 3, the sludge quarter segments C and D were combined because they were both sludges and had similar visual characteristics. Table 3-2 shows the subsampling scheme.

A composite of core 116 was also made to support the requirements of the historical and pretreatment DQOs. Aliquots of the composite were taken for analysis according to the historical DQO. To satisfy the disposal development strategy, 125 mL of the composite were archived for process development work, and another 100 mL were archived for pretreatment studies.

3.3 SAMPLE ANALYSIS

The analyses performed on the subsegments were those required by the safety screening, ferrocyanide, organic, and historical DQOs, along with the organic test plan. The pretreatment DQO also applied to the sampling event; however, no analyses were needed to meet the requirements of the document. Required analyses varied depending on the waste matrix. All five documents required measurements for energetics by DSC and moisture content by TGA (except for the organic test plan which did not require TGA). Additional primary analytical requirements are listed below by document: 1) safety screening DQO - total alpha activity (sludge only), density (sludge only), and a visual check for the presence of an organic layer (liquids only); 2) ferrocyanide DQO - cyanide and nickel; 3) organic DQO - TOC (sludge only); 4) organic test plan - energetics by RSST (sludge only); 5) historical DQO - anions by IC, selected metals by ICP, ^{137}Cs, ^{60}Co, and ^{90}Sr (sludge only). Analyses for lithium and bromide were also required to check for contamination by the water used to wash the drill string.

Table 3-2. Subsampling Scheme and Sample Descriptions.[1] (3 sheets)

Segment	Percent Recovery (%)[2]	Drill String Dose Rate (mR/hr)	Sample Weights Solid (g)	Sample Weights Liquid (g)	Subsample Portion	Sample Description
Core 116 - Riser 5						
1	0	< 0.5	0	0	None	No sample observed.
2	39	440	127.5	0	A	2.5 in.; dry yellowish-green solid, crystalline in texture.
					Upper ½	5 in.; slightly moist brown saltcake/sludge mixture.
3	63	100	192.5	0	Upper ½	First 2 in.; dry yellowish-green solid, crystalline in texture.
					Lower ½	Remaining 10 in.; slightly moist, yellowish/brown saltcake
4	74	1,200	324.3	0	A	5 in.; dry, brown saltcake/sludge mixture.
					B	4.5 in.; moist, brown sludge.
					C	4.5 in.; moist, brown sludge.
5	89	800	402.5	0	A	Extruded approximately 17 in. of waste. Solids did not retain their shape. Material was damp, granular, and brown in color.
					B	
					C	
					D	
6	92	1,300	467.7	0	A	Extruded approximately 17 in. of waste. Solids did not retain their shape. Material was damp, granular, and brown in color.
					B	
					C	
					D	

Table 3-2. Subsampling Scheme and Sample Descriptions.[1] (3 sheets)

Segment	Percent Recovery (%)[2]	Drill String Dose Rate (mR/hr)	Sample Weights		Subsample Portion	Sample Description
			Solid (g)	Liquid (g)		
Core 116 - Riser 5 (Cont'd)						
7	95	1,300	468.4	0	A	Extruded approximately 18 in. of waste. Solids did not retain their shape. Material was damp, granular, and brown in color; appeared to be a mixture of saltcake and sludge.
					B	
					C	
					D	
8	54	1,000	258.3	0	A	The descriptions of both subsegments were identical - wet, dark rust colored solids with a texture resembling sludge. Both subsegments were 5 in. in length. A 9 in. gap separated the two subsegments.
					D	
Core 117 - Riser 11A						
1	93	1,500	15.4	158.4	DL	Opaque, yellowish-green liquid.
					Upper ½	Saltcake; no other description given.
2	42	1,300	216.4	98.5	DL	Opaque, black-brown liquid.
					A	2 in.; solids were a black-brown sludge. Subsegments were separated by a 7.5 in. gap.
					D	6 in.; solids were a black-brown sludge.

Table 3-2. Subsampling Scheme and Sample Descriptions.[1] (3 sheets)

Segment	Percent Recovery (%)[2]	Drill String Dose Rate (mR/hr)	Sample Weights Solid (g)	Sample Weights Liquid (g)	Subsample Portion	Sample Description
Core 117- Riser 11A						
3	63	1,200	251.5	0	C and D	First 6 in. were dark brown chunks of sludge.
					Upper ½	The remaining 6 in. were wet, grainy, dark brown saltcake.
4	32	350	169.3	0	Upper ½	First 13 in. were empty, followed by nearly 6 in. of a dark brown solid with a texture like chunky saltcake.
5	37	50	98.1	0	A C	The descriptions of both subsegments were identical - dark brown solids that resembled soft sludge. Both subsegments were 3.5 in. in length. A 7 in. gap separated the two subsegments.

Notes:

DL = Drainable liquid

[1]Benar (1996a)

[2]The percent recoveries were estimated by dividing the recovered sample lengths by the expected sample lengths taken from the chain-of-custody records in Benar (1996b).

The analyses performed on the core composite were those required by the historical DQO. These included analyses for anions (by IC), selected metals (by ICP), ^{137}Cs, ^{60}Co, ^{90}Sr, and bulk density.

In addition to the core sample analyses, the tank headspace flammability was measured using a combustible gas meter prior to core sampling.

Secondary analyses of the DQOs were performed when results from the primary analyses met certain conditions. Only those secondary analyses which already had not been performed as primary analyses are discussed. Total carbon analyses were run on the sludge samples which contained exothermic reactions with enthalpy changes greater than the -480 J/g limit as required by the ferrocyanide DQO. A full suite of cations were analyzed by ICP on water-leached aliquots of selected samples representing the BY saltcake and the ferrocyanide waste types identified in the historical DQO. Because the presence of these waste types was verified by the primary analyses, total beta and uranium (by phosphorescence) were also measured on the same selected solids samples. Finally, a moisture content analysis by gravimetry was performed on nine solids samples. Eight samples had TGA results below the 17 weight percent organic DQO limit. Although the mean of the ninth sample was above 17 weight percent, gravimetric analysis was run because the lower limit to the 95 percent confidence interval for the TGA results was below 17 percent, and the sample contained exothermic reactions with changes in enthalpy greater than the -480 J/g safety screening limit.

Before performing ICP analyses and analyses for total alpha, total beta, ^{137}Cs, ^{90}Sr, and uranium by phosphorescence on both segments and core composites, the solids were digested using a potassium hydroxide fusion in a zirconium crucible. The majority of the segments were also subjected to an ICP analysis after an acid digestion to confirm the ferrocyanide aging models. As discussed previously, water digestions before an ICP analysis were performed on those segments which represented the waste types targeted by the historical DQO. Preparations for the IC analyses for both segments and core composites were made using water digestions. All analyses performed on the drainable liquid were done so directly.

Where appropriate, laboratory quality control checks included laboratory control standards, matrix spikes, duplicate analyses, and blanks. Section 5.1.2 provides an assessment of the quality control procedures and data.

All reported analyses were performed in accordance with approved laboratory procedures. Table 3-3 shows a list of sample numbers and applicable analyses. Table 3-4 shows the analytical procedures by title and number. No deviations or modifications were noted by the laboratory.

Table 3-3. Summary of Samples and Analyses.[1] (5 sheets)

Segment	Segment Portion	Waste Matrix	Labcore Number[2]	Analyses
Core 116				
1	n/a	Empty	n/a	n/a
2	Upper ½	Saltcake	3529 3531 3536	DSC, TGA, gravimetry, cyanide ICP (fusion), GEA IC
	A	Sludge	3525 3528 3530 3534	Bulk density DSC, TGA, gravimetry, cyanide, TC, TIC, TOC Alpha, GEA, $^{89/90}Sr$ IC
3	Upper ½	Saltcake	3703 3700 3705	DSC, TGA, gravimetry, cyanide ICP (fusion), GEA, alpha IC
	Lower ½	Saltcake	3702 3701 3533 3704	DSC, TGA, gravimetry, cyanide, TIC, TOC ICP (fusion), GEA ICP (acid) IC
4	A	Sludge	3594 3632 3649 3666 3683	Bulk density DSC, TGA, cyanide, TIC, TOC ICP (fusion), GEA, $^{89/90}Sr$, beta, uranium (by phosphorescence) ICP (acid) ICP (water), IC
	B	Sludge	3595 3637 3650 0604[3] 3684	Bulk density DSC, TGA, cyanide, TIC, TOC ICP (fusion), GEA, $^{89/90}Sr$, beta, uranium (by phosphorescence) ICP (acid) ICP (water), IC
	C	Sludge	3596 3641 3651 0605[3] 3685	Bulk density DSC, TGA, cyanide, TIC, TOC ICP (fusion), alpha, GEA, $^{89/90}Sr$, beta, uranium (by phosphorescence) ICP (acid) ICP (water), IC

Table 3-3. Summary of Samples and Analyses.[1] (5 sheets)

Segment	Segment Portion	Waste Matrix	Labcore Number[2]	Analyses
Core 116 (Cont'd)				
5	A	Sludge	3597	Bulk density
			3633	DSC, TGA, cyanide, TIC, TOC
			3652	ICP (fusion), GEA, $^{89/90}Sr$
			0606[3]	ICP (acid)
			3686	IC
	B	Sludge	3598	Bulk density
			3638	DSC, TGA, cyanide, TIC, TOC
			3653	ICP (fusion), GEA, $^{89/90}Sr$
			0607[3]	ICP (acid)
			3687	IC
	C	Sludge	3599	Bulk density
			3642	DSC, TGA, cyanide, TIC, TOC
			3654	ICP (fusion), alpha, GEA, $^{89/90}Sr$
			0608[3]	ICP (acid)
			3688	IC
	D	Sludge	3600	Bulk density
			3645	DSC, TGA, gravimetry, cyanide, TC, TIC, TOC
			3655	ICP (fusion), alpha, GEA, $^{89/90}Sr$
			0609[3]	ICP (acid)
			3689	IC
6	A	Sludge	3601	Bulk density
			3634	DSC, TGA, cyanide, TIC, TOC
			3656	ICP (fusion), GEA, $^{89/90}Sr$
			3673	ICP (acid)
			3690	IC
	B	Sludge	3602	Bulk density
			3639	DSC, TGA, cyanide, TIC, TOC
			3657	ICP (fusion), GEA, $^{89/90}Sr$
			3674	ICP (acid)
			3691	IC
	C	Sludge	3603	Bulk density
			3643	DSC, TGA, gravimetry, cyanide, TIC, TOC
			3658	ICP (fusion), alpha, GEA, $^{89/90}Sr$
			3675	ICP (acid)
			3692	IC

Table 3-3. Summary of Samples and Analyses.[1] (5 sheets)

Segment	Segment Portion	Waste Matrix	Labcore Number[2]	Analyses
Core 116 (Cont'd)				
6 (Cont'd)	D	Sludge	3604 3646 3659 3676 3693	Bulk density DSC, TGA, gravimetry, cyanide, TIC, TOC ICP (fusion), alpha, GEA, $^{89/90}Sr$ ICP (acid) IC
7	A	Sludge	3605 3635 3660 3677 3694	Bulk density DSC, TGA, cyanide, TIC, TOC ICP (fusion), GEA, $^{89/90}Sr$ ICP (acid) IC
	B	Sludge	3606 3640 3661 3678 3695	Bulk density DSC, TGA, cyanide, TIC, TOC ICP (fusion), GEA, $^{89/90}Sr$ ICP (acid) IC
	C	Sludge	3607 3644 3662 3679 3696	Bulk density DSC, TGA, cyanide, TIC, TOC ICP (fusion), alpha, GEA, $^{89/90}Sr$ ICP (acid) IC
	D	Sludge	3647 3663 3680 3697	DSC, TGA, cyanide, TC, TIC, TOC ICP (fusion), alpha, GEA, $^{89/90}Sr$, beta, uranium (by phosphorescence) ICP (acid) ICP (water), IC
8	A	Sludge	3636 3664 3681 3698	DSC, TGA, cyanide, TC, TIC, TOC ICP (fusion), GEA, $^{89/90}Sr$, beta, uranium (by phosphorescence) ICP (acid) ICP (water), IC
	D	Sludge	3648 3665 3682 3699	DSC, TGA, cyanide, TIC, TOC ICP (fusion), alpha, GEA, $^{89/90}Sr$ ICP (acid) IC
Core 116 composite			0374[3] 0373[3]	ICP (fusion), GEA, $^{89/90}Sr$ IC

Table 3-3. Summary of Samples and Analyses.[1] (5 sheets)

Segment	Segment Portion	Waste Matrix	Labcore Number[2]	Analyses
Core 117				
1	Upper ½	Saltcake	3764 3771 3772	DSC, TGA, cyanide ICP (fusion), GEA IC
	DL	Drainable liquid	3761	DSC, TGA, cyanide, TOC, ICP (direct)
2	A	Sludge	3776 3781 3786 3791 3796	Bulk density DSC, TGA, cyanide, TIC, TOC ICP (fusion), alpha, GEA, $^{89/90}Sr$ ICP (acid) IC
	D	Sludge	3777 3782 3787 3792 3797	Bulk density DSC, TGA, cyanide, TIC, TOC ICP (fusion), alpha, GEA, $^{89/90}Sr$ ICP (acid) IC
	DL	Drainable liquid	3775	DSC, TGA, cyanide, TOC, ICP (direct)
3	Upper ½	Saltcake	3809 3811 3813	DSC, TGA, cyanide ICP (fusion), GEA, beta, uranium (by phosphorescence) ICP (water), IC
	C and D	Sludge	3778 3783 3788 3793 3798	Bulk density DSC, TGA, cyanide, TIC, TOC ICP (fusion), alpha, GEA, $^{89/90}Sr$, beta, uranium (by phosphorescence) ICP (acid) ICP (water), IC
4	Upper ½	Saltcake	3810 3812 3814	DSC, TGA, gravimetry, cyanide ICP (fusion), GEA IC

Table 3-3. Summary of Samples and Analyses.[1] (5 sheets)

Segment	Segment Portion	Waste Matrix	Labcore Number[2]	Analyses
Core 117 (Cont'd)				
5	A	Sludge	3779 3784 3789 3794 3799	Bulk density DSC, TGA, cyanide, TIC, TOC ICP (fusion), alpha, GEA, $^{89/90}Sr$ ICP (acid) IC
	C	Sludge	3785 3790 3795 3800	DSC, TGA, gravimetry, cyanide, TIC, TOC ICP (fusion), alpha, GEA, $^{89/90}Sr$ ICP (acid) IC
Vapor tests	Tank headspace		n/a	Combustible gas meter readings for flammable gas concentration

Notes:

n/a = not applicable
TIC = total inorganic carbon

[1]Benar (1996b)
[2]All sample numbers begin with "S95T00" unless otherwise noted.
[3]Sample numbers begin with "S96T000."

Table 3-4. Analytical Procedures.[1] (2 sheets)

Analyte	Method	Preparation Procedure	Analytical Procedure
Energetics	DSC: Mettler[2] Perkin-Elmer[3]	n/a	LA-514-113, Rev. C-1 LA-514-114, Rev. C-1
	Reactive systems screening tool	n/a	WHC-SD-WM-TP-104
Percent water	TGA: Mettler™ Perkin-Elmer™	n/a	LA-560-112, Rev. B-1 LA-514-114, Rev. C-1
	Gravimetry	n/a	LA-564-101, Rev. F-1
Total alpha activity	Alpha proportional counting	Fusion digest on solid samples, LA-549-141, Rev. D-0; Direct on liquid samples	LA-508-101, Rev. D-2
Solid bulk density	n/a	n/a	LO-160-103, Rev. B-0
TC	Persulfate/ coulometry	n/a	LA-342-100, Rev. C-0
TOC			

Table 3-4. Analytical Procedures.[1] (2 sheets)

Analyte	Method	Preparation Procedure	Analytical Procedure
TIC	Acid/coulometry	n/a	LA-342-100, Rev. C-0
Metals	Inductively coupled plasma spectroscopy	Solids: Fusion: LA-549-141, Rev. E-0 acid: LA-505-149, Rev. D-0 water: LA-504-101, Rev. E-0	LA-505-151, Rev. D-3 LA-505-161, Rev. B-0
		Liquids: Acid dilution: LA-505-158, Rev. A-4	
Anions	Ion chromatography	LA-504-101, Rev. E-0	LA-533-105, Rev. D-1
Cyanide	Distillation	n/a	Solids: LA-695-103, Rev. A-0 liquids: LA-695-102, Rev. E-0
Total beta activity	Beta proportional counting	Fusion digest on solids, LA-549-141, Rev. E-0	LA-58-101, Rev. D-2
Uranium	Phosphorescence	Fusion digest on solids, LA-549-141, Rev. E-0	LA-925-009, Rev. A-1
$^{89/90}Sr$	Beta proportional counting	Fusion digest on solids, LA-549-141, Rev. E-0	LA-220-101, Rev. D-1
^{137}Cs and ^{60}Co	Gamma energy analysis	Fusion digest on solids, LA-549-141, Rev. E-0	LA-548-121, Rev. D-1
Flammable gas	Combustible gas meter readings	n/a	WHC-IP-0030 IH 1.4 and IH 2.1

Notes:

Rev. = revision

[1]Benar (1995)

[2]Mettler™ is a registered trademark of Mettler Electronics, Anaheim, California.

[3]Perkin-Elmer™ is a registered trademark of Perkins Research and Manufacturing Company, Inc., Canoga Park, California.

3.4 DESCRIPTION OF HISTORICAL SAMPLING EVENTS

This section discusses two historical sampling and analysis events. The first event occurred in 1976. Because of significant changes in the tank waste volume since 1976, the results from this sampling event are considered not to represent tank contents and are included only for information purposes. The date of the second sampling event is unknown, but it probably occurred in 1992. Two auger samples were taken. The results from these two historical sampling events are in Appendix C.

3.4.1 Description of the 1976 Sampling Event

A sludge sample was received in the 222-S Laboratory on February 6, 1976, and the results were reported on March 16 (Horton 1976). The sample was noted as soft in texture and reddish-brown in color. Information was not available about the technique used to obtain the samples, the riser sampled, or the sample depth.

3.4.1.1 Sample Handling and Analysis (1976). The sample was prepared by fusing a known mass of solids with KOH, dissolving the melt with concentrated HCl, then diluting the sample with a known volume of water. No additional information was available about how the sample was handled once it was received for analysis. The analytical results from this sampling event are in Appendix C (Horton 1976).

3.4.2 Description of the 1992 Sampling Event

Two auger samples of the top 15 cm (6 in.) of saltcake were taken from risers 5 and 10B (The sample from riser 10B was taken before the thermocouple tree was installed.) The waste was sampled to determine whether a ferrocyanide safety issue existed, because tank 241-BY-104 is the tank with the greatest amount of ferrocyanide waste (Beck et al. 1992). The samples had the appearance of brown, damp, granular salt. The sampling dates were June 17 and 18, 1992. Additional information can be found in Neskas and Borsheim (1993).

3.4.2.1 Sample Handling and Analysis (1992). For details about the sample preparation and analytical results, refer to Beck et al. (1992). The subsamples were prepared by KOH fusion, water digestion, and acid digestion. They were analyzed by adiabatic calorimetry, DSC, and TGA to measure the material's tendency to self-heat and its response to heating. Three major features were found: water loss, an unidentified endotherm (called endotherm 2), and an exotherm of uncertain cause.

Inductively coupled plasma spectroscopy was performed to determine the presence of various metals. Separate analyses for cyanide, TOC, and total inorganic carbon (TIC) were also performed. Other analyses included particle size distribution, X-ray diffraction, polarized light microscopy (for insolubles), and ion chromatography (for soluble anions). Radiochemical analyses were performed with the fusion dissolution solution. For analytical results, see Appendix C.

3.4.3 Vapor Sampling

Headspace vapor samples were collected from tank 241-BY-104 using the vapor sampling system on June 24, 1994, by Westinghouse Hanford Company Sampling and Mobile Laboratories (WHC 1995). Sample collection and analysis were performed as directed by the sample and analysis plan (WHC 1995, Appendix A). Air from the tank 241-BY-104 headspace was withdrawn through a heated sampling probe mounted in riser 10A and transferred through heated tubing to the vapor sampling system sampling manifold.

For a general description of vapor sampling and sample analysis methods, see Huckaby et al. (1995). The sampling equipment, sample collection sequence, sorbent trap sample air flow rates and flow times, chain of custody information, and a discussion of the sampling event are in WHC (1995b).

This page intentionally left blank.

4.0 ANALYTICAL RESULTS

This section summarizes the analytical results associated with the October and November 1995 core sampling of tank 241-BY-104. Section 3.0 described the sampling and analysis parameters that governed the event. The Westinghouse Hanford Company 222-S Laboratory analyzed the core samples.

Table 4-1 show the data locations for this tank characterization report. The complete analytical data set is in Appendix A. Appendix B contains the data for lithium and bromide, the analytes evaluated to gauge the amount of contamination by the wash water.

Table 4-1. Analytical Data Presentation Tables.

Data Type	Location
Chemical data summary	Table 4-2
Percent water data for samples containing less than the organic DQO requirement	Table 4-3
Exothermic DSC data summary	Table 4-4
Tank BY-104 inorganic gas and vapor concentrations	Table 4-5
Comprehensive analytical data	Appendix A
Wash water contamination check data	Appendix B
Historical sampling data	Appendix C

4.1 DATA PRESENTATION

The analytical results from the October and November 1995 sampling of tank 241-BY-104 are from the *Final Report for Tank 241-BY-104, Rotary Mode Cores 116 and 117* (Benar 1996b). Sections 4.1.1, 4.1.2, 4.1.3, 4.1.4, and 4.1.5 provide the chemical data, physical data, headspace flammability results, and wash water contamination check results, and vapor sampling results respectively.

4.1.1 Chemical Data Summary

Table 4-2 shows the mean concentration estimates and inventories. All information in the t is from Appendix A tables. Data from the two cores were combined to derive overall means for all analytes except DSC, which does not require calculation of a mean. For 11 metals, the ICP analysis was performed after fusion, acid, and water digestions. For three of these (aluminum, chromium, and sodium),the means based on the fusion data are provided in Table 4-2; means based on other digestion methods are provided in Appendix A. For the other eight metals with ICP data from the three digestions, the means based on the acid digestion data are reported in Table 4-2.

Column 1 of Table 4-2 contains the name of the analyte, and column 2 contains the overall means. The means are based on subsegment level data. The overall weighted means were calculated by averaging the individual primary and duplicate results for each subsegment to obtain a subsegment (or sample) mean. The subsegment means within a given segment were averaged to obtain a segment mean, the segment means within a given core were averaged to obtain a core mean, and finally the two core means were averaged to derive the overall tank mean. Not all steps are necessary for each analyte, digestion method, or subsegment, but the procedure is the same. The overall mean and projected inventories in Table 4-2 were considered detected or nondetected (<) values. When 50 percent or more of the individual primary and duplicate measurements had detected results, the overall mean was reported as a detected value. Conversely, when greater than half of the individual primary and duplicate measurements had nondetected results, the overall mean was reported as a nondetected value. If a nondetected value is used as a quantitative result, the mean concentration as inventory estimates are biased. The magnitude of the bias cannot be estimated.

Drainable liquid was obtained from the first two segments of core 117. Results from the drainable liquid analyses have been averaged together with the solids results from those segments. This averaging was based on "weighing factors." The weighing factors were derived from the recovered masses of solid and liquid from the two segments. For segment 1, the weighing factors were as follows: 1) solid = 8.86 percent, and 2) liquids = 91.1 percent. The weighing factors for segment 2 were as follows: 1) solid = 68.7 percent, and 2) liquids = 31.3 percent. For a complete discussion on the weighing method, see Appendix A.

Column 3 shows the relative standard deviation (RSD) as a percent of the mean, defined as the standard deviation of the mean divided by the mean, multiplied by 100. The RSDs were determined by using standard analysis of variance (ANOVA) statistical techniques (nested models) and were computed only for analytes that had "detected" means. If a nondetected value is used to compute an RSD, the RSD is biased. The magnitude of the bias cannot be estimated.

Column 4 projected inventories obtained by multiplying the overall mean in μg/g, μg C/g, or μCi/g by the total waste volume of 1,234 kL (326 kgal), the overall tank density of 1.75 g/mL, and the appropriate conversion factors.

Table 4-2. Chemical Data Summary for Tank 241-BY-104. (2 sheets)

Analyte	Overall Mean	RSD (Mean)	Projected Inventory
METALS	**µg/g**	**%**	**kg**
Aluminum[1]	30,100	16.2	65,000
Antimony	< 37.5	n/a	< 81.1
Arsenic	< 62.4	n/a	< 135
Barium	< 69.1	n/a	< 149
Beryllium	< 3.16	n/a	< 6.8
Bismuth[2]	< 285	n/a	< 615
Boron	< 45.0	n/a	< 97.2
Cadmium	16.1	30.3	34.8
Calcium[2]	1,240	50.6	2,680
Cerium	< 62.4	n/a	< 135
Chromium[1]	4,580	22.9	9,880
Cobalt	< 15.2	n/a	< 32.8
Copper	< 8.25	n/a	< 17.8
Iron[2]	4,090	55.5	8,830
Lanthanum	< 36.8	n/a	< 79.5
Lead	190	35.3	410
Magnesium	< 165	n/a	< 356
Manganese[2]	77.1	38.6	166
Molybdenum	36.5	10.3	78.8
Neodymium	< 71.2	n/a	< 154
Nickel[2]	1,160	56.4	2,510
Phosphorus[2]	3,560	33.1	7,690
Potassium	3,390	22.4	7,320
Samarium	< 62.4	n/a	< 135
Selenium	< 62.8	n/a	< 136
Silicon[2]	434	36.1	937
METALS (Cont.)		**%**	**kg**
Silver	16.9	7.84	36.5
Sodium[1]	2.20E+05	4.30	4.75E+05
Strontium	2,330	63.3	5,030
Sulfur	4,420	29.3	9,540
Thallium	< 125	n/a	< 270
Titanium	< 12.1	n/a	< 26.1

Table 4-2. Chemical Data Summary for Tank 241-BY-104. (2 sheets)

Analyte	Overall Mean	RSD (Mean)	Projected Inventory
Metals (Cont.)	μg/g	%	kg
Uranium[2]	3,270	60.0	7,060
Vanadium	< 31.2	n/a	< 67.4
Zinc	41.0	31.5	88.5
Zirconium	13.2	20.6	28.5
ANIONS	μg/g	%	kg
Chloride	2,320	8.89	5,010
Cyanide	< 11.8	n/a	< 25.5
Fluoride	4,630	23.7	10,000
Nitrate	2.61E+05	13.6	5.64E+05
Nitrite	34,900	9.31	75,400
Oxalate	13,100	16.8	28,300
Phosphate	11,200	29.9	24,200
Sulfate	17,300	20.2	37,360
RADIONUCLIDES	μCi/g	%	Ci
^{137}Cs	97.0	8.61	2.10E+05
^{60}Co	< 0.0149	n/a	< 32.2
^{90}Sr	391	62.5	8.44E+05
Total alpha	0.179	77.0	386
Total beta	837	45.6	1.81E+06
CARBON	μg C/g	%	kg C
Total carbon	25,500	18.5	55,100
Total inorganic carbon	14,800	21.1	32,000
Total organic carbon	6,810	36.8	14,700
PHYSICAL PROPERTIES		%	kg
Density (g/mL)	1.75	1.54	n/a
Weight percent water (%)	25.6	14.0	6.89E+05

Notes:

[1]Mean based on fusion digested results. All others are based on acid digested results.

[2]Although analyses were performed on fusion digested samples, the means based on the acid digested samples were reported because the fusion digested mean was nondetected.

4.1.2 Physical Data Summary

A DSC analysis was required by the safety screening, ferrocyanide, organic, and historical DQOs and the organic test plan. All these documents, except for the test plan, also required TGA. Density was performed to satisfy the safety screening DQO, and gravimetry was required by the organic DQO when the weight percent water fell below 17 weight percent. An RSST analysis was required by the test plan on the subsegment with the greatest exothermic energy as determined by DSC.

4.1.2.1 Thermogravimetric and Gravimetric Analyses. During a TGA, the mass of a sample is measured while its temperature is increased at a constant rate. Nitrogen is passed over the sample during heating to remove any released gases. Any decrease in the weight of a sample represents a loss of gaseous matter from the sample through evaporation or through a reaction that forms gas phase products. The moisture content is estimated by assuming that all TGA sample weight loss up to a certain temperature (typically 150 to 200 °C) is caused by water evaporation. Thermogravimetric analysis was performed directly on solids and drainable liquid samples.

Table A-55 shows the TGA results for tank 241-BY-104. All samples exhibited a large weight loss between the ambient temperature and approximately 240 °C. This weight loss is associated with the first endothermic transition; it was attributed to the water evaporation. The overall mean percent water for the tank waste was 25.6 weight percent.

The organic DQO requires a gravimetry analysis on the subsegments which contained less than 17 weight percent water as determined by TGA. Gravimetry analyses were performed on nine samples, eight which had TGA results below 17 percent and a ninth which had the lower limit to a one-sided 95 percent confidence interval on the mean below 17 percent and exothermic behavior exceeding the -480 J/g safety screening energetics limit. Table A-56 shows the results of these gravimetry tests.

Table 4-3 shows the samples which had TGA results below the organic DQO limit and the corresponding gravimetric data. Column 5 also includes the lower limits to one-sided 95 percent confidence intervals on the mean for the TGA data.

Table 4-3. Percent Water Data for Samples Containing Less than the Organic DQO Requirement.[1]

Sample Number	Core: Segment	Subsegment	TGA Mean	Lower Limits to One-sided 95% Confidence Intervals on the Mean	Gravimetric Mean
			% H_2O	% H_2O	% H_2O
S95T003529	116:2	Upper ½	12.5	8.0	15.2
S95T003528		A	16.4	14.4	17.6
S95T003703	116:3	Upper ½	9.9	6.4	12.2
S95T003702		Lower ½	11.2	4.2	8.84
S95T003645	116:5	D	23.1	14.4	21.9
S95T003643	116:6	C	14.5	0.0	23.0
S95T003646		D	12.2	0.0	23.2
S95T003810	117:4	Upper ½	13.6	12.2	15.1
S95T003785	117:5	C	16.4	9.18	16.3

Note:

[1]Benar (1996a and 1996b)

4.1.2.2 Differential Scanning Calorimetry. During a DSC analysis, heat absorbed or emitted by a substance is measured while the temperature of the substance is increased at a constant rate. While the substance is being heated, nitrogen is passed over the waste material to remove any gases being released. The onset temperature for an endothermic (characterized by or causing the absorption of heat) or an exothermic (characterized by or causing the release of heat) event is measured with thermocouples and displayed graphically.

Differential scanning calorimetry was performed on all solid subsegments and the drainable liquid. The DSC results (wet weight basis) are in Table A-57. The peak temperature and maximum enthalpy change are given for each transition. For all samples, the first transition was endothermic and represented the evaporation of free and interstitial water. Most solid samples exhibited a second transition. In many cases, this second transition was exothermic. Several solids samples also exhibited a third transition which was exothermic in about 50 percent of cases. The drainable liquid samples displayed only one transition. Because exothermic reactions are associated with negative enthalpy changes, they are shown in Table A-57 with a negative sign.

The relative percent differences (RPDs) between primary and duplicate runs for nine samples were outside the quality control parameter of $\leq$ 10 percent. Three samples were selected for reruns because of high DSC values. The RPDs did not improve appreciably, which indicates the cause of the high RPDs was probably caused by heterogeneity of the waste material.

Table 4-4 shows the samples which exhibited exothermic reactions. To compare the exothermic enthalpy changes with the safety screening DQO decision criteria threshold of -480 J/g (dry weight basis), all exothermic reactions were converted to a dry weight basis using the respective sample weight percent water. The table also includes the upper limit to one-sided 95 percent confidence intervals on the mean for each sample.

The majority of the exothermic reactions and the upper limit to one-sided 95 percent confidence intervals on the mean were below the decision threshold of -480 J/g. Three samples had DSC results greater than the limit, and a fourth had an upper limit to one-sided 95 percent confidence intervals on the mean above the threshold. The highest individual sample result was -1,294 J/g (dry weight), and the highest upper limit to one-sided 95 percent confidence intervals on the mean was -1,621 J/g (both from subsegment D of segment 5 from core 116). Although the water content of core 116 subsegment 5D was 23.1 percent, it had a lower limit to one-sided 95 percent confidence interval on the mean of 14.2 percent (see Table 4-3).

Table 4-4. DSC Exothermic Results and 95 Percent Confidence Interval Upper Limits. (2 sheets)

Sample Number	Core: Segment	Subsegment	Run	Dry Wt. ΔH J/g	Mean J/g	Upper Limit to One-sided 95% Confidence Intervals on the Mean J/g
S95T003528	116:2	A	1	0	-69.4	-507.2
			2	-138.7		
S95T003529		Upper ½	1	-30.5	-22.1	-76.2
			2	-13.6		
S95T003703	116:3	Upper ½	1	0	-6.2	-46.3
			2	-12.5		

Table 4-4. DSC Exothermic Results and 95 Percent Confidence Interval Upper Limits. (2 sheets)

Sample Number	Core: Segment	Subsegment	Run	Dry Wt. ΔH J/g	Mean J/g	Upper Limit to One-sided 95% Confidence Intervals on the Mean J/g
S95T003638	116:5	B	1	-255.8	-163.1	-435.7
			2	-344.7		
			3[1]	0		
			4	-52.0		
S95T003645		D	1	-284.9	-767.8	-1,621
			2	-724.6		
			3	-1,294		
S95T003634	116:6	A	1	-32.6	-41.3	-96.2
			2	-50.0		
S95T003639		B	1	-104.1	-100	-126.6
			2	-95.8		
S95T003635	116:7	A	1	-140.8	-137.9	-156.8
			2	-134.9		
S95T003640		B	1	-389.6	-220.6	-475.5
			2	-309.8		
			3[1]	-75.0		
			4	-107.8		
S95T003647		D	1	-484.1	-460.4	-612.7
			2	-436.6		
S95T003636	116:8	A	1	-736.4	-806.0	-1,252
			2	-875.7		
S95T003782	117:2	D	1	-29.4	-33.1	-57.1
			2	-36.9		

Note:
[1]The third and fourth runs were reruns performed two months later.

4.1.2.3 Reactive Systems Screening Tool. Because the safety screening action limit for DSC was exceeded, RSST adiabatic calorimetry was performed on the sludge sample with the highest individual energetic result. This sample was quarter segment D of segment 5, core 116, which had a DSC value for the duplicate of -724.6 J/g. Before the RSST test, the sample was dried over low heat (which removed 9.5 percent moisture), then size-reduced (ground up). The dried sample was sealed in the RSST under approximately 6.8 bar nitrogen. The heating rate for the sample was approximately 1 °C per minute.

The sample self-heated weakly from about 170 °C to about 435 °C in the RSST at a peak rate of approximately 30.7 °C per minute (Benar 1996b). Concurrently, it raised the pressure in the containment by 2.3 bar at a peak rate of 0.11 bar per minute. All the pressure rise during self-heating was caused solely by the temperature change and not by the generation of noncondensible gas. Weak, net gas generation occurred during a subsequent hold at high temperature and the final cool down to ambient temperature. Significant excess dried sample was retained for possible future use (Benar 1996b). In summary, the waste could not support an exothermic propagating reaction.

4.1.2.4 Density. Density measurements were performed on all solids subsegments except four. For these four subsegments, the density analysis was not performed because of either insufficient sample recovery or the material was too sticky to maneuver into the centrifuge tube, making it impossible to perform the measurement (Benar 1996a). The density values ranged from 1.63 g/mL to 1.83 g/mL, with an overall mean of 1.75 g/mL. Table A-54 shows the density data.

4.1.3 Headspace Flammability Screening Results

As required by the safety screening DQO (Dukelow et al. 1995) and requested in the SAP (Benar 1995), the tank headspace was sampled and analyzed for the presence of flammable gases before core sampling. The safety screening DQO notification limit for flammable gas concentration is 25 percent of the LFL. Monitoring with a combustible gas meter was performed within three feet of the waste surface. The combustible gas meter reports results as a percent of the lower explosive limit (LEL). Because the National Fire Protection Association (NFPA) defines the terms LFL and LEL identically, the two terms may be used interchangeably (NFPA 1995). The reported LFL of 0 percent was well below the safety screening limit.

4.1.4 Wash Water Contamination Check

Water was used to wash the drill string during the 1995 core sampling event. Lithium bromide was added to the wash water as a tracer, and its presence in core samples would indicate wash water contamination. According to the SAP, the primary analysis for the contamination check was lithium (Benar 1995). Lithium was analyzed by ICP, and no result exceeded the 100 μg/g threshold. The evaluation was performed on the acid digest results. An evaluation could not be performed on the fusion digest results because the detection limits for these samples were greater than the threshold. Because lithium was not found in quantities above the threshold, bromide was not analyzed for contamination check purposes. However, results for bromide were obtained because a full suite of anions by IC were required by the historical DQO. Comparison of the bromide results to the 1,200 μg/g contamination check limit revealed that 10 subsegments had values above the limit. The percent water values from these subsegments were not corrected, however, because the bromide results were only slightly above the limit, and they were similar to the results from adjacent subsegments which displayed no detectable bromide. The analytical results for lithium and bromide were not included in Table 4-2 because they are not inherent constituents of the tank waste. Appendix B tabulates the results.

4.1.5 Vapor Sampling

Tank 241-BY-104 headspace was sampled in April 1994 and June 1994 for gases and vapors to address flammability and industrial hygiene concerns. It was determined that no headspace constituents exceeded the flammability notification limits, but that ammonia, measured to be 248 ppmv, exceeded the 150 ppmv industrial hygiene notification limits specified in *Vapor Sampling and Analysis Plan* (Homi 1995). Table 4-5 contains results from this sampling event.

Table 4-5. Tank 241-BY-104 Inorganic Gas and Vapor Concentrations. (Analyses by Oregon Graduate Institute of Science and Technology and Pacific Northwest National Laboratory)

Compound	CAS[1] number	Sample type	Number of samples	Average[2] (ppmv)
Ammonia, NH_3	7664-41-7	Sorbent trap	5	248
Carbon dioxide, CO_2	124-38-9	SUMMA[1]	3	[10.5]
Carbon monoxide, CO	630-08-0	SUMMA™	3	[1.0]
Hydrogen, H_2	1333-74-0	SUMMA™	3	[295]
Hydrogen cyanide[3], HCN	74-90-8	Sorbent trap	3	$\leq$ 0.007
Nitric oxide, NO	10102-43-9	Sorbent trap	10	0.29
Nitrogen dioxide, NO_2	10102-44-0	Sorbent trap	10	$\leq$ 0.07
Nitrous oxide, N_2O	10024-97-2	SUMMA™	3	[201]
Water vapor, H_2O	7732-18-5	Sorbent trap	10	19,500 (14.1 mg/L)

Notes:

[1]CAS = Chemical Abstract Service

[2]Bracketed values are from OGIST and should be considered secondary results, non-bracketed values are from Pacific Northwest National Laboratory and should be considered primary results.

[3]Results for hydrogen cyanide are from the April 1994 in situ sampling event.

[1]SUMMA is a trademark of Moletrics, Inc., Cleveland, Ohio.

This page intentionally left blank.

5.0 INTERPRETATION OF CHARACTERIZATION RESULTS

This section describes the overall quality and consistency of the current sampling results for tank 241-BY-104, and it assesses and compares these results against historical information and program requirements.

5.1 ASSESSMENT OF SAMPLING AND ANALYTICAL RESULTS

This section evaluates sampling and analysis factors that may impact data interpretation. These factors are used to assess the overall data quality and consistency and to identify any limitations in the data use.

5.1.1 Field Observations

The safety screening DQO (Dukelow et al. 1995) objective, that vertical waste profiles be obtained from at least two widely spaced risers, was fulfilled. The only problem noted during the sampling event (from the chain-of-custody forms) was when the bottom alarm sounded before the sampler had traveled the expected depth during the taking of segment 5, core 117 (Benar 1996b). No sample was recovered from segment 1 of core 116. Recoveries for the remaining segments of core 116 were mainly good. Core 117 segment recovery was fair. No sampling anomaly should impact data usefulness.

5.1.2 Quality Control Assessment

The usual quality control assessment includes an evaluation of the appropriate standard recoveries, matrix spike recoveries, duplicate analyses, and blanks that are performed in conjunction with the chemical analyses. All the pertinent quality control tests were conducted on the 1995 core samples, enabling a full assessment of data accuracy and precision. The SAP (Benar 1995) established the specific criteria for all quality control checks. Quality control results outside these criteria are identified by superscripts in Appendix A tables for all analytes. Quality control results are summarized below.

The standard and matrix spike recovery results provide an estimate of analysis accuracy. If a standard or spike recovery is above or below the given criterion, the analytical results may be biased high or low, respectively. Standard recoveries for all analytes were within the defined criteria with the exception of 11 total alpha activity samples. Total alpha activity also had 11 out of 15 spikes below the quality control limits of 90 to 110 percent recovery. Low total alpha activity spike recoveries are common because of difficulties in preparing the sample mount which can cause self-shielding. For sodium, nearly half the spikes were outside the quality control limits. The poor recoveries were probably caused by high dilutions required to measure the large sodium concentrations. The spike recovery deviations for the remainder of the analytes were very minor and should not impact data quality.

Analytical precision is estimated by the RPD, which is defined as the absolute value of the difference between the primary and duplicate samples, divided by their mean, times 100. Total alpha activity had 6 of 15 RPDs above the criterion probably caused by low activities and possible self-shielding. Thirteen of 35 samples analyzed for percent water had RPDs above the quality control limit, and 11 of 33 DSC samples with exothermic reactions had RPDs above the criterion. This was not unusual given the small sample sizes (13 to 68 mg) and possible sample heterogeneity problems. Many other analytes showed minor RPD deviations probably caused by sample concentrations near the detection limit, which adversely impacted the reproducibility of the results, and sample heterogeneity problems. Finally, the preparation blank results for various analytes were above the detection limits. However, no blank contamination was noted because the blank results were inconsequential when compared with the sample results. Therefore, the low level of contamination did not impact data quality for any analytes.

In summary, the majority of the quality control results were within the boundaries specified in the SAP (Benar 1995). The quality control discrepancies reflect the heterogeneous nature of the sample and indicate more variability in results than is desirable. However, the discrepancies should not impact the data validity.

5.1.3 Data Consistency Checks

Comparisons of different analytical methods can help assess data consistency and quality. A good comparison strengthens the credibility of both results, whereas a poor comparison brings the reliability of the data into question. The quantity of data available made possible the comparisons of total beta to the sum of the individual emitters, the ICP phosphorus result with the IC phosphate number, and the ICP sulfur value with the IC sulfate result. In addition, mass and charge balances were calculated.

5.1.3.1 Comparison of Results from Different Analytical Methods. A comparison was made in Table 5-1 between the total beta activity mean and the sum of the activity means of the individual beta emitters.

The sum of the activities of the individual beta emitters was determined by adding the ^{137}Cs and $^{89/90}$Sr activities. The ^{60}Co activity was not used because the mean was nondetected. Because $^{89/90}$Sr is in equilibrium with its daughter product ^{90}Y, the $^{89/90}$Sr activity must be multiplied by 2 to account for all beta emitters. The total beta activity result was 837 uCi/g, and the sum of the beta emitters was 879 μCi/g. The two values agreed well, as evidenced by the ratio of 1.05.

Table 5-1. Tank 241-BY-104 Comparison of Total Beta Activities with the Sum of the Individual Activities.

Analyte	Overall Mean (μCi/g)
^{137}Cs	97
$^{89/90}Sr$	391 * 2 = 782
Sum of beta emitters	879
Total beta activity	837
Ratio	1.05

Table 5-2 compares ICP phosphorus and sulfur concentration means to phosphate and sulfate concentration means as determined by IC analysis. The ICP phosphorus result, which represents total phosphorus, was 3,560 μg/g. The IC phosphate value of 11,200 μg/g, which is a measurement of the water-soluble phosphorus in the form of phosphate, converted to 3,650 μg/g of phosphorus. These numbers agreed quite well, as evidenced by the ratio of 0.98.

The IC sulfate value of 17,300 μg/g, which represents soluble sulfur in the form of sulfate, was equivalent to 5,770 μg/g of sulfur. The ICP result for sulfur was 4,420 μg/g (ratio of 0.77). These results are contradictory to expected behavior. Because ICP measures total sulfur, its result is usually larger than or equal to the concentration of soluble sulfur calculated from the IC sulfate value. These unexpected results could be caused by some metal sulfates being insoluble in acid and more soluble in basic media.

Table 5-2. Tank 241-BY-104 Comparison of Phosphorus and Sulfur Concentrations with the Equivalent Concentrations of Phosphate and Sulfate. (2 sheets)

Analyte	Overall Mean (μg/g)
Phosphorus	
Measured mean phosphorus concentration by ICP	3,560
Phosphorus concentration from phosphate by IC	3,650
Ratio	0.98
Analyte	**Overall Mean (μg/g)**
Sulfur	
Measured mean sulfur concentration by ICP	4,420
Sulfur concentration from sulfate by IC	5,770
Ratio	0.77

5.1.3.2 Mass and Charge Balances. The principle objective in performing mass and charge balances is to determine whether the measurements were consistent. In calculating the balances, only analytes listed in Table 4-2, which were detected at a concentration of 1,000 μg/g (0.1 weight percent) or greater, were considered.

Except for sodium and potassium, all cations in Table 5-3 were assumed to be in their most common hydroxide or oxide form, and the concentrations of the assumed species were calculated stoichiometrically. Because precipitates are neutral species, all positive charge was attributed to the sodium and potassium cations. The anionic analytes listed in Table 5-4 were assumed to be present as sodium and/or potassium salts and were expected to balance the positive charge exhibited by the cations. Phosphorus and sulfur were assumed to be present primarily as the soluble phosphate and sulfate ions. The acetate and carbonate data were derived from the TOC and TIC analyses, respectively. The concentrations of cationic species in Table 5-3, the sum of the anionic species in Table 5-4, and the percent water estimate were used to calculate the mass balance. The uncertainty estimates (RSDs) associated with each analyte are also in the tables. The uncertainty estimates for the cation and anion totals, and the overall uncertainty in Table 5-5 were computed using propagation of errors techniques (Nuclear Regulatory Commission 1988).

The mass balance was calculated from the formula below. The factor 0.0001 is the conversion factor from μg/g to weight percent.

Mass balance = Percent Water + 0.0001 x [Total Analyte Concentration]

= Percent Water + 0.0001 x [$Al(OH)_3^-$ + $Cr(OH)_3$ + $FeO(OH)$ + Na^+ + K^+ + U_3O_8 + $C_2H_3O_2^-$ + CO_3^{-2} + F^- + NO_3^- + NO_2^- + $C_2O_4^{-2}$ + PO_4^{-3} + SO_4^{-2}]

The total analyte concentrations calculated from the above equation is 763,000 μg/g. The mean weight percent water obtained from thermogravimetric analysis reported in Table 4-2 is 25.6 percent or 256,000 μg/g. The mass balance resulting from adding the percent water to the total analyte concentration is 102 percent (see Table 5-5).

The following equations demonstrate the derivation of total cations and total anions; the charge balance is the ratio of these two values.

Total cations (μeq/g) = $[Na^+]/23.0 + [K^+]/39.1$ = 9,650 μeq/g

Total anions (μeq/g) = $[C_2H_3O_2^-]/59.0 + [CO_3^{-2}]/30.0 + [F^-]/19.0 + [NO_3^-]/62.0 + [NO_2^-]/46.0 + [C_2O_4^{-2}]/44.0 + [PO_4^{-3}]/31.7 + [SO_4^{-2}]/48.1$ = 8,980 μeq/g

The charge balance obtained by dividing the sum of the positive charge by the sum of the negative charge was 1.07.

In summary, the above calculations yield reasonable (close to 1.00 for charge balance and 100 percent for mass balance) mass and charge balance values, indicating that the analytical results are generally consistent.

Table 5-3. Cation Mass and Charge Data.

Analyte	Concentration ($\mu g/g$)	Assumed Species	Concentration of Assumed Species ($\mu g/g$)	RSD (Mean) (%)	Charge ($\mu eq/g$)
Aluminum	30,100	$Al(OH)_3^-$	87,000	16.2	---
Chromium	4,580	$Cr(OH)_3$	9,070	22.9	---
Iron	4,090	FeO(OH)	6,510	46.4	---
Sodium	220,000	Na^+	220,000	4.30	9,560
Potassium	3,390	K^+	3,390	22.4	86.7
Uranium	3,270	U_3O_8	3,860	29.6	---
Total			330,000	5.3	9,650

Table 5-4. Anion Mass and Charge Data.

Analyte	Concentration ($\mu g/g$)	Assumed Species	Concentration of Assumed Species ($\mu g/g$)	RSD (Mean) (%)	Charge ($\mu eq/g$)
TOC	6,810	$C_2H_3O_2^-$	16,700	36.8	283
TIC	14,800	CO_3^{-2}	74,000	21.1	2,470
Fluoride	4,630	F^-	4,630	23.7	244
Nitrate	261,000	NO_3^-	261,000	13.6	4,210
Nitrite	34,900	NO_2^-	34,900	9.31	759
Oxalate	13,100	$C_2O_4^{-2}$	13,100	16.8	298
Phosphate	11,200	PO_4^{-3}	11,200	29.9	353
Sulfate	17,300	SO_4^{-2}	17,300	20.2	360
Total			433,000		8,980

Table 5-5. Mass Balance Totals.

Totals	Concentrations (µg/g)	RSD (Mean) %
Cation Total from Table 5-3	330,000	5.3
Anion Total from Table 5-4	433,000	9.2
Water	256,000	14.0
Grand Total	1,020,000	5.5

5.2 COMPARISON OF HISTORICAL AND ANALYTICAL RESULTS

A sludge sample was taken from tank 241-BY-104 in 1976. Because of significant changes in the tank waste volume since 1976, the results from this sampling event no longer represent the tank contents; therefore, no comparisons are reasonable. Two auger samples were taken from tank 241-BY-104 in 1992; however, comparisons between these results and the results from the latest sampling event were also not reasonable since only the top 6 in. were sampled during the 1992 event. Therefore, no comparisons between historical and current analytical results were made.

5.3 TANK WASTE PROFILE

According to the estimate of Hanlon (1996), tank 241-BY-104 consists of 1,385 kL (366 kgal) of saltcake and 151 kL (40 kgal) of sludge. The saltcake and sludge layers include 68 kL (18 kgal) of drainable interstitial liquid. This differs from the TLM estimate, which divided the waste into 666 kL (176 kgal) of BY saltcake on top of 586 kL (150 kgal) of ferrocyanide sludge (see Figure 2-3).

According to visual descriptions, the texture, color, and water content of the samples varied widely within cores. The texture and water content ranged from dry, crystalline saltcake to wet sludge. Saltcake and sludge mixtures also were noted within subsegments. The color ranged from yellowish-green to brown to a dark rust. The waste descriptions between cores were generally consistent, although drainable liquid was found only in the first two segments of core 117. The amount of drainable liquid in segment 1 of core 117 suggests that there may be an isolated pool of supernate under riser 11A (from which core 117 was taken). Segment 1 contained 91.1 percent liquid (based on recovered masses from the liquid and solids), and segment 2 had 31.3 percent liquid. Unfortunately, a photograph of the surface of the waste reflecting the current situation was not available. Neither Hanlon (1996) nor the TLM predicted supernate to be present. Based on all of the above information, the tank waste appears to be heterogeneous.

Standard statistical ANOVA models were fit to the 1995 subsegment level data. The results from this model can be used to judge the vertical and horizontal variability in analyte concentrations. A random effects nested ANOVA model was fit to the analytical data for a particular analyte provided that 50 percent or more of the individual primary and duplicate measurements were above the detection limit. This was the same detect/nondetect rule applied to the overall mean estimates. If a nondetected value is used as a quantitative result, the mean concentration of inventory estimates are biased. The magnitude of the bias cannot be estimated. Thus, the results of the ANOVA calculations in which nondetected results were used should be interpreted with caution.

The ANOVA model p-value is compared to a standard significance level ($\alpha = 0.05$). If it is less than 0.05, then the analyte means are significantly different. However, if a p-value is greater than 0.05, the analyte means are not significantly different. Because the data set is unbalanced, the p-values are approximate. In the following paragraphs, the p-values are in parentheses. Because three digestion methods were used for some of the ICP analytes, the analyte name is appended with a fusion, acid, or water digestion designation.

Regarding concentration variability between cores, the ANOVA results indicated significant differences for just 1 of 46 analytes tested (including the different digestion methods). This single difference was for sulfate (0.0458). Therefore, the tank contents appear to be horizontally uniform.

The results of the segment level ANOVA tests indicated that 31 of 46 analytes showed significant vertical concentration differences: aluminum fusion (0.016), acid (<0.001), and water (0.005), cadmium acid (< 0.001), chromium fusion (< 0.001) and acid (0.003), molybdenum acid (0.001), phosphorus acid (0.001), potassium acid < 0.001) and water (0.011), silver acid (0.024), sodium fusion (< 0.001), acid (0.002), and water (0.012), strontium acid (0.030), sulfur acid (0.006) and water (0.040), uranium by ICP acid (0.034), chloride (0.014), fluoride (0.002), nitrate (< 0.001), nitrite (< 0.001), oxalate (0.042), phosphate (< 0.001), sulfate (0.037), ^{90}Sr (< 0.001), total alpha activity (0.013), total beta activity (0.002), uranium by phosphorescence (0.005), TOC (< 0.001), and weight percent water (0.002).

The ANOVA analysis showing concentration variability between the subsegments indicated that 36 of the 46 analytes had significant differences: aluminum fusion and acid (< 0.001); cadmium and calcium acid (< 0.001); chromium fusion, acid, and water (< 0.001); iron, lead, manganese, molybdenum, and nickel acid (< 0.001); phosphorus acid and water (< 0.001); potassium acid (0.017); silicon acid and water (< 0.001); silver acid (< 0.001); sodium fusion (0.005); acid (< 0.001), and water (0.015), strontium acid (< 0.001), sulfur acid (< 0.001) and water (0.002), uranium, zinc, and zirconium acid (all < 0.001), ^{90}Sr, ^{137}Cs, total alpha activity, cyanide, TIC, and weight percent water (all < 0.001), total beta activity (0.004), uranium by phosphorescence (0.003), and TOC (< 0.028).

In summary, the Hanlon (1996) estimates, the TLM, the visual descriptions of the samples, and the statistical results indicated a large degree of tank vertical heterogeneity. Two waste phases are present, and the majority of analytes from the segment and subsegment levels showed concentration differences. Results pertaining to the horizontal disposition of the waste were consistent. The visual descriptions of the samples did not vary widely between cores, and the statistical analysis showed only 1 of 46 analytes with a significant concentration difference between the two cores. To conclude, the tank contents appear to be vertically heterogeneous and generally uniform horizontally.

5.4 COMPARISON OF TRANSFER HISTORY WITH ANALYTICAL RESULTS

Table 5-6 compares the Agnew et al. (1996a) estimates of the tank contents to the analytical results from the 1995 core sampling event. The historical estimates generated combine several data sources (see Section 2.3.3). Each data source contains assumptions and/or other factors (such as transfers of an unknown waste type into the tank) that may impact the modeled concentrations. Since the HTCE values have not been validated, these comparisons are made for information only. Column 3 lists overall tank inventories based on the subsegment data , and column 4 contains inventories based on water digested samples as required by the historical DQO. Only subsegments from segment 4, 7, and 8 from core 116 and segment 3 from core 117 were subjected to the water digestion; therefore, the inventory incorporates only these results and is not a true tank inventory. Column 5 provides results from a single composite sample from core 116.

A reasonably good comparison exists between the calculated analytical inventory and historical estimates (see Table 5-6). Except for bismuth and strontium, all historical estimates are within 25 percent of the overall tank inventory. Many analytes are within 50 percent or better. Bismuth appears to be overpredicted by the historical estimates and strontium appears to be underpredicted.

Table 5-6. Comparison of HTCE Predictions with 1995 Analytical Results for Tank 241-BY-104. (2 sheets)

Analyte	HTCE Estimate[1]	Overall Tank Inventories[2]	Water Digest Inventories[2]	Composite Analytical Results[2]
METALS	kg	kg	kg	kg
Aluminum	38,600	65,000	75,200	51,400
Bismuth	34,000	< 615	< 230	< 4,730
Calcium	8,870	2,680	< 230	< 4,730
Chromium	1,840	9,880	3,090	12,500
Iron	30,900	8,830	< 116	4,710
Lanthanum	0.299	< 79.5	< 116	< 2,350
Lead	783	410	< 233	< 4,730
Manganese	119	166	< 23.3	< 473
Nickel	4,860	2,510	< 46.6	< 944
Potassium	1,350	7,320	10,060	---
Silicon	2,510	937	214	< 2,350
Sodium	2.40E+05	4.75E+05	4.06E+05	5.59E+05
Strontium	0.210	5,030	< 23.3	1,050
Uranium	20,700	7,060	< 1,160	< 23,540
Zirconium	18.0	28.5	< 23.3	10,800
ANIONS	kg	kg	kg	kg
Chloride	4,540	5,010	Same results as those used for the overall tank means and inventories.	4,300
Fluoride	2,850	10,000		14,730
Nitrate	3.50E+05	5.64E+05		4.53E+05
Nitrite	57,700	75,400		66,500
Phosphate	26,200	24,200		32,180
Sulfate	21,500	37,360		50,500
RADIONUCLIDES	Ci	Ci	Ci	Ci
^{137}Cs	1.52E+05	2.10E+05	---	2.18E+05
^{90}Sr	88,300	8.44E+05	---	79,040
Total alpha activity	117	386	---	---

Table 5-6. Comparison of HTCE Predictions with 1995 Analytical Results for Tank 241-BY-104. (2 sheets)

Analyte	HTCE Estimate[1]	Overall Tank Inventories[2]	Water Digest Inventories[2]	Composite Analytical Results[2]
CARBON	kg C	kg C	kg	kg
Total inorganic carbon	6,080	32,000	---	---
Total organic carbon	4,340	14,700	---	---
PHYSICAL PROPERTIES				
Weight percent water	46.5 %	25.6 %	---	---
Density	1.51 g/mL	1.75 g/mL	---	---

Notes:

[1]Agnew et al. (1996a)

[2]Benar (1996b)

5.5 EVALUATION OF PROGRAM REQUIREMENTS

The October and November 1995 core sampling event was governed by five DQOs and the organic test plan. One DQO, the pretreatment DQO, is not discussed in this section because it did not require analyses. The safety screening DQO (Dukelow et al. 1995) lists requirements for examining the waste in each Hanford underground waste tank to identify safety problems, to evaluate the tank for placement on a Watch List, or to verify current Watch List status. Tank 241-BY-104 is currently on the Ferrocyanide Watch List. The ferrocyanide DQO specifies the data needed to determine the interim safe storage status of the Ferrocyanide Watch List tanks and to help corroborate the historical data and aging data that will be used to resolve the Ferrocyanide Safety Issue (Meacham et al. 1995). The organic DQO (Buckley and Baide 1995) addresses the possibility of an exothermic reaction between organic complexants and precipitated nitrate or nitrite salts. The organic test plan (Meacham 1995) examines the flammability potential of tanks containing entrained organic solvents. Finally, the historical DQO (Simpson and McCain 1995) attempts to acquire information through selective tank sampling to quantify the errors associated with the predictions for the waste composition. These issues were integrated by the SAP (Benar 1995) into a list of required analytical tests and their respective decision criteria thresholds. Section 5.5 discusses the requirements of each DQO and the test plan and compares the analytical data to their decision criteria thresholds.

5.5.1 Safety Evaluation

The safety screening, ferrocyanide, and organic DQO sampling objective that vertical profiles of the waste be obtained from at least two widely spaced risers was met. Of the five primary analyses required by the safety screening DQO, three have decision criteria thresholds which, if exceeded, could warrant further investigation to ensure tank safety. These three analyses include DSC to evaluate the fuel content, total alpha activity to determine the criticality potential, and a determination of the flammability of the gases in the tank headspace. Differential scanning calorimetry, TGA (to determine the moisture content), cyanide, and nickel analyses were required to examine the safety issues of the ferrocyanide DQO. Accompanying decision criteria thresholds were also listed in the DQO.

The primary analyses required by the organic DQO with safety decision criteria thresholds are DSC, TGA, and a TOC analysis. Finally, the organic test plan required DSC and RSST analyses to estimate the energetics and fuel content. No decision criteria threshold has been established for the RSST analysis. Section 4.1.2.3 shows the results from this analysis. Table 5-7 lists the applicable primary decision variables, DQOs or test plan, decision criteria thresholds, and the analytical results from the 1995 core sampling event.

To investigate the relationship between the DSC results and the TOC and cyanide concentrations, the DSC dry weight results for those subsegments which had exothermic reactions are compared to the corresponding dry weight TOC and cyanide results and their energy equivalents in Table 5-8. The TOC data were converted to their energy equivalents using the following equation.

$$\text{Energy Equivalent} = \text{wt\% TOC (dry weight)}\ \frac{(632\ J/g)}{5}$$

The 632 J/g value represents the energy equivalent of 5 weight percent TOC, based on a sodium acetate average energetics standard. Of the organic species expected to be present, sodium acetate represents the baseline energetic species and provides a reasonably conservative estimate of energetics.

The cyanide fuel content was assumed to exist as the species $Na_2NiFe(CN)_6$ (Meacham et al. 1995). The necessary conversion of the cyanide analytical result (dry weight) to the weight percent of the assumed species was accomplished by the following equation:

$$\text{Na}_2\text{NiFe(CN)}_6\ wt\% = \left[\frac{X\ \mu g\ CN}{g}\right] * \left[\frac{1\ \mu mol\ CN}{26\ \mu g\ CN}\right] * \left[\frac{1\ \mu mol\ Na_2NiFe(CN)_6}{6\ \mu mol\ CN}\right] *$$

$$\left[\frac{316.5\ \mu\text{g}\ \text{Na}_2\text{NiFe(CN)}_6}{1\ \mu\text{mol}\ \text{Na}_2\text{NiFe(CN)}_6}\right] * \left[\frac{1}{1 * 10^6\ \text{Mg}}\right] * 100\ \text{wt\%}\ \text{Na}_2\text{NiFe(CN)}_6$$

Table 5-7. Decision Variables and Criteria for the Safety Screening, Ferrocyanide, and Organic Data Quality Objectives and the Organic Test Plan. (2 sheets)

Primary Decision Variable	Applicable DQO(s) or Test Plan	Decision Criteria Threshold	Analytical Result
Total fuel content (measured by DSC)[1]	Safety screening; Ferrocyanide; Organic	-480 J/g	Three samples exceeded limit; four had an upper limit to a one-sided 95% confidence interval on the mean above limit. Highest value = -1,294 J/g; highest upper limit to a one-sided 95% confidence interval on the mean = -1,620.8 J/g.
	Organic test plan	-1,200 J/g	
Total organic carbon[1]	Organic	30,000 μg C/g	One sample exceeded limit (33,612 μg C/g). Two upper limits to a one-sided 95% confidence interval on the mean exceeded limit, highest value = 45,053 μg C/g.
	Organic test plan	45,000 μg C/g	
Weight percent water (measure by TGA)	Organic; Ferrocyanide	17 wt%	Eight samples below limit; 12 had lower limits to a one-sided 95% confidence interval on the mean below threshold. Lowest lower limit to a one-sided 95% confidence interval on the mean = 0.0 wt%.
	Organic test plan	20 wt%	
Total alpha activity	Safety screening	35.1 μCi/g[2]	No samples exceeded limit. Highest upper limit to a one-sided 95% confidence interval on the mean = 1.19 μCi/g.
Flammable gas	Safety screening	25% of the LFL	0% of the LFL
Cyanide	Ferrocyanide	39,000 μg/g	No samples exceeded limit.

Table 5-7. Decision Variables and Criteria for the Safety Screening, Ferrocyanide, and Organic Data Quality Objectives and the Organic Test Plan. (2 sheets)

Primary Decision Variable	Applicable DQO(s) or Test Plan	Decision Criteria Threshold	Analytical Result
Nickel	Ferrocyanide	8,000 μg/g	Three samples exceeded limit.

Notes:

[1]All decision criteria thresholds and analytical results are given as dry weight values.

[2]Although the actual decision criteria threshold listed in the DQO was 1 g/L, total alpha activity was reported in μCi/g rather than g/L. To convert the notification limit into the same units as those of the laboratory, it was assumed that all alpha decay originated from ^{239}Pu. Using the tank density of 1.75 g/mL and the specific activity of ^{239}Pu (0.0615 Ci/g), the decision criteria threshold was converted to 35.1 μCi/g using the equation below (Benar 1995).

$$\left[\frac{1\ g}{L}\right]\left[\frac{1\ L}{10^3\ mL}\right]\left[\frac{1}{density}\ \frac{mL}{g}\right]\left[\frac{0.0615\ Ci}{1\ g}\right]\left[\frac{10^6\ \mu Ci}{1\ Ci}\right] = \frac{61.5}{density}\ \frac{\mu Ci}{g}$$

Table 5-8. Comparison of DSC Analytical Results with TOC and Cyanide Results.

Segment: Subsegment	Analyte	Mean Analytical Result[1]	Energy Equivalent	Sum	Mean DSC Analytical Result
		μg/g	J/g	J/g	J/g
Core 116					
2:A	TOC	31,500	-398	-398	-69.4 (-507.2)[2]
	CN^-	21.6	-0.263		
5:D	TOC	8,150	-103	-103	-767.8
	CN^-	< 10.6	-0.129		
7:D	TOC	16,800	-212	-213	-460.4 (-484.1)[3]
	CN^-	85.0	-1.03		
8:A	TOC	20,300	-256	-257	-806.0
	CN^-	104	-1.27		

Notes:

[1]Dry weight basis.
[2]The value in parentheses is the 95 percent confidence interval upper limit.
[3]The value in parentheses was the result for the primary run.

The resulting weight percent was then inserted into the energy equivalent ferrocyanide concentration equation given in Meacham et al. (1995), which was manipulated algebraically to give the following energy equivalent in J/g:

$$(\text{weight\% } Na_2NiFe(CN)_6) * \left[\frac{6{,}000 \text{ J/g } Na_2NiFe(CN)_6}{100 \text{ weight\%}}\right] = X \text{ J/g waste}$$

For a given subsegment, the energy equivalent values for cyanide and TOC were added in column 5 of Table 5-8; the mean DSC analytical result is given in column 6. This comparison is only for samples which had exothermic reactions with changes in enthalpy above the -480 J/g limit. The sum of the two energy equivalents generally did not compare well with the DSC results. Assuming that all the TOC is present as sodium acetate may have biased the comparison. The TOC energy equivalent would be higher than the values in Table 5-7 if sodium EDTA (a higher energy form) is used as the energetics standard. However, the DSC results are still much higher. This may be expected given the heterogeneous nature of the tank waste and small sample sizes used for DSC analyses.

The potential for criticality can be assessed from the total alpha activity data. As shown in Table 5-7 all analytical and confidence interval results were well below the safety screening decision criteria thresholds.

Determining the flammability of the tank headspace gases is an additional safety screening DQO requirement. The combustible gas meter results were 0 percent of the LFL.

The concentrations of cyanide and nickel are additional indications of ferrocyanide waste. The cyanide concentration was well below the threshold limit for all samples. Three samples exceeded the threshold limit for nickel. High nickel concentrations were expected in the lower portions of tank 241-BY-104 because this waste is predicted to be composed of ferrocyanide waste (Agnew et al. 1996a). The highest concentrations of nickel were found in segments 7 and 8 of core 116 and the upper half of segment 1 from core 117.

Recent aging studies of ferrocyanide waste show the combined effects of temperature, radiation, and pH during 39 or more years of storage would have destroyed most ferrocyanide originally added to the tanks (Babad et al. 1993; Lilga et al. 1993, 1994, 1995, and 1996). This prediction has been confirmed by the tank samples analyzed to date. To determine the extent of ferrocyanide degradation over time, estimates of the total amount of $Na_2NiFe(CN)_6$ originally present in the tank are needed as well as recent analytical cyanide concentrations. According to Borsheim and Simpson (1991), 39,300 kg of $Na_2NiFe(CN)_6$ were expected to remain in the tank at the end of the ferrocyanide waste transfer activity in 1957. According to Agnew 1996a, a $Na_2NiFe(CN)_6$ inventory of 14,000 kg is obtained based on the historical concentration for $Fe(CN)_6^{4-}$ of 0.0359 moles/L, a density estimate of 1.6 g/mL, and total waste estimate of 1.86E+06 kg. Because ferrocyanide waste has been predicted to comprise approximately the bottom 62 in. of the tank contents comparisons between current analytical data and estimates of $Na_2NiFe(CN)_6$ originally found in the tank should be based only on the mean analytical values from the bottom three segments of each core (Agnew et al. 1996a). Another method of estimating the amount of $Na_2NiFe(CN)_6$ originally present would be to assume that all the nickel currently found in the tank originated from $Na_2NiFe(CN)_6$. The mean nickel concentration based on the bottom three segments of cores 116 and 117 was 3,620 μg/g. If all the nickel originated from $Na_2NiFe(CN)_6$, the observed nickel concentration indicates that 19,500 μg/g of $Na_2NiFe(CN)_6$ (52,500 kg of $Na_2NiFe(CN)_6$) existed in the tank before degradation. Therefore, these three sources of information place the original $Na_2NiFe(CN)_6$ inventory approximately within the 14,000- to 52,500-kg range.

The total cyanide analytical mean based on the bottom three segments of cores 116 and 117 was 17.7 μg/g (47.5 kg of cyanide) which is equivalent to 96.4 kg of $Na_2NiFe(CN)_6$. Consequently, it appears that 99.3 to 99.8 percent (1-96.4/14,000 to 1-96.4/52,500) of the ferrocyanide complex has decomposed.

Eight samples had less than the required 17 weight percent water, 12 after computation of the 95 percent confidence interval lower limits. Analysis for moisture content using gravimetry was performed for the eight original samples and one of the four additional samples which had DSC results above the decision threshold. Gravimetric analysis indicated six samples still had water contents below 17 weight percent.

Another factor in assessing tank safety is the heat generation from radioactive decay and the resultant temperature increase of the waste. The 1995 analytical results provided mean estimates for ^{60}Co, ^{137}Cs, and ^{90}Sr. Table 5-9 predicts the tank heat load to be 8,270 W (28,200 Btu/hr). Agnew 1996a provides an estimate of 1,310 W (4,470 Btu/hr), and Kummerer (1994) estimated 2,550 W (8,700 Btu/hr) based on tank headspace temperatures. All estimates were below the 11,700 W (40,000 Btu/hr) design specification for single-shell tanks (Bergmann 1991). Because tank temperatures have decreased since January 1993, it may be concluded that any heat generated from radioactive sources is adequately dissipated.

Table 5-9. Tank 241-BY-104 Estimated Heat Load.

Radionuclide	μCi/g	Ci	Watts
^{60}Co	< 0.0149	< 40.1	< 0.618
^{137}Cs	97.0	2.61E+05	1,230
^{90}Sr	391	1.05E+06	7,040
Total		1.31E+06	8,270

In summary, all analyses requested by the safety DQOs were performed during the October and November 1995 sampling event. The analytical results indicate the tank cannot be assumed to be safe based on current DQO and threshold values.

5.5.2 Historical Model Evaluation

The primary objective of the historical model evaluation DQO was to acquire adequate information through selective tank sampling to quantify the errors associated with predicting tank waste composition based on waste transaction history and waste type compositions (Simpson and McCain 1995). The requirement of a minimum of two widely spaced cores with thick layered segments was met. The DQO identifies key waste components for certain waste types including BY saltcake and ferrocyanide waste. Tank 241-BY-104 was selected for historical evaluation because it was expected to contain layers thick enough to provide entire segments composed of these two waste types (Agnew et al. 1996a). The first step in the evaluation is to compare the analytical results with DQO-defined concentration levels for waste components. If the analytical results are $\geq$ 10 percent of the DQO levels (ratio of 0.1 or more), the waste type and layer identification are considered acceptable and further analyses are requested (Simpson and McCain 1995).

According to the TLM (see Figure 2-3), it is likely the top three segments were BY saltcake, and the bottom three segments consisted of ferrocyanide waste. The analytical results were compared in Table 5-10 to the historical model evaluation DQO predicted concentrations for the BY saltcake and ferrocyanide waste types. The waste components for BY saltcake were sodium, aluminum, nitrate, sulfate, and percent water, and those for ferrocyanide waste were sodium, bismuth, nickel, ^{137}Cs, ^{90}Sr, and percent water. As samples were collected to meet historical DQOs in Simpson and McCain (1995), adequate analyses also were completed to fulfill requirements for Simpson and McCain (1996). The 1996 revision of the historical DQOs adds uranium as a waste component for BY saltcake waste and iron and phosphate for PFeCN waste.

When possible, the fusion digested results for the metals were used rather than the acid digested results because the fusion results more closely represent total concentrations. Only the saltcake results (subsegments upper or lower half in the Appendix A tables) were compared to the BY saltcake levels, and only the sludge results (subsegments A, B, C, or D in the Appendix A tables) were used for the ferrocyanide waste levels. Subsegment breakdowns did not strictly follow the TLM predictions: sludge subsegments were formed from material from the top three subsegments, and a saltcake subsegment was formed from segment 4 of core 117. The comparisons were made at the subsegment mean level for both cores.

All analytical results for the BY saltcake waste components exceeded the 10 percent criterion specified in the DQO with the exception of sulfate in some subsegments. For the ferrocyanide waste comparison, some subsegments from four out of eight analytes (iron, bismuth, nickel, and percent water) did not meet the criterion. The TLM seems to overpredict these analytes for other BY-tanks also. A closer inspection of the data reveals that several adjacent subsegments met the criteria, but comparing the results for all sludge subsegments causes the ratios to be below the DQO levels. Results from the bottom three subsegments from core 116 and the bottom subsegment from segment 2 through segment 4 for core 117 revealed that these subsegments obviously contained ferrocyanide waste. Consequently, it appears that the ferrocyanide waste may not be as thick as predicted.

Table 5-10. Comparison of Waste Components with Analytical Results.

Waste Type	Fingerprint Analyte	Analytical Result Range[1]	Historical DQO Concentration[2]	Ratio
BY saltcake	Sodium	218,000 - 281,000 μg/g	165,000 μg/g	1.3 - 1.7
	Aluminum	4,170 - 58,800 μg/g	18,600 μg/g	0.22 - 3.2
	Uranium	9,470 - 25,200 μg/g	4,700 μg/g	0.89 - 5.4
	Nitrate	181,000 - 475,000 μg/g	266,000 μg/g	0.68 - 1.8
	Sulfate	1,660 - 25,700 μg/g	33,732 μg/g	0.49 - 0.76
	Percent water	8.99 - 37.06 %	35.9 %	0.25 - 1.0
Ferrocyanide	Sodium	136,000 - 254,000 μg/g	60,000 - 150,000 μg/g	2.3 - 4.2
	Iron	< 890 - 49,000 μg/g	36,000 μg/g	0.02 - 1.36
	Bismuth[3]	< 37.1 to 2,670 μg/g	25,000 μg/g	0.0015 to 0.11
	Nickel	< 355 - 13,500 μg/g	4,000 μg/g	0.089 - 3.38
	^{137}Cs	24.2 - 147 μCi/g	8 μCi/g	3.0 - 18
	^{90}Sr	15.4 - 1,760 μCi/g	4 μCi/g	3.85 - 440
	Percent water	0.875 - 34.4 %	28 - 81 %	0.031 - 1.2

Notes:

[1]Benar (1996b)

[2]Simpson and McCain (1995)

This page intentionally left blank.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The waste in tank 241-BY-104 was core sampled in October and November 1995 and analyzed in accordance with the safety screening, ferrocyanide, organic, historical, and pretreatment DQOs and the organic safety test plan. The analytes were evaluated to address safety issues including energetics to determine the fuel content, TOC and cyanide to determine their contribution to the total fuel content, nickel to estimate the original tank ferrocyanide waste inventory, weight percent water, total alpha activity to assess criticality, and flammable gas concentration. The analytes required by the historical DQO, to quantify the errors involved in predicting tank waste composition, were full sets of metals and anions, and selected radionuclides. All samples were analyzed at the Westinghouse Hanford Company 222-S Analytical Chemistry Laboratory.

Regarding the safety evaluation, comparisons were made between the analytical results and the decision criteria thresholds listed in the safety screening, ferrocyanide, and organic DQOs and the organic test plan. All the following DSC values are given on a dry weight basis. Three samples contained exothermic reactions with changes in enthalpy greater than the decision threshold of -480 J/g. All three samples had moisture contents greater than 17 weight percent, the minimum required to prevent a propagating reaction (Buckley and Baide 1995). A fourth sample had the upper limit to a one-sided 95 percent confidence interval on the mean above -480 J/g. The water content of this sample was slightly below 17 weight percent (16.4 weight percent). A secondary gravimetric analysis was performed on this sample; the gravimetric results were 17.6 weight percent water. Although seven other samples had percent water results below the 17 weight percent organic DQO limit, none contained exothermic reactions with changes in enthalpy greater than the -480 J/g limit. The organic DQO decision threshold for TOC concentration is 30,000 μg C/g. The overall mean TOC result was 6,810 μg C/g. One sample had a dry weight mean of 33,612 μg C/g and a correspondingly high DSC value. A second sample had a mean below the threshold for TOC, but the 95 percent confidence interval upper limit was 31,973 μg C/g. The DSC analyses for this sample showed no exotherms were present.

The remaining requirements of the safety screening DQO were satisfied. The total alpha activity mean was 0.179 μCi/g, and the highest upper limit to a one-sided 95 percent confidence interval on the mean was 1.19 μCi/g, far below the decision threshold of 35.1 μCi/g. The decision threshold for tank headspace flammability is 25 percent of the LFL. Combustible gas meter readings registered 0 percent of the LFL.

Two additional analytes, cyanide and nickel, were required to address safety issues by the ferrocyanide DQO. All cyanide results were much lower than the decision criteria threshold of 39,000 μg/g. Nickel, an indicator of ferrocyanide waste, had a decision criteria threshold of 8,000 μg/g. Two subsegments from core 116 and one from core 117 exceeded the limit. Unexpectedly, the subsegment from core 117, which exceeded the limit, was found in the upper half of segment 1 and not in the lower regions of the waste.

An investigation of ferrocyanide waste degradation was performed on tank 241-BY-104. This was done by comparing several estimates of the original tank inventory of cyanide (as the species disodium nickel ferrocyanide [$Na_2NiFe[CN]_6$) with the recent analytically determined concentration. Estimates of 52,500 kg (based on the current nickel concentration), 39,300 kg (from Borsheim and Simpson [1991]), and 14,000 kg (from Agnew 1996a) were available for the original $Na_2NiFe(CN)_6$ concentration. These were compared with a $Na_2NiFe(CN)_6$ value of 96.4 kg, converted from a cyanide value of 17.7 μg/g. Because the ferrocyanide waste is expected to exist as the bottom layer in tank 241-BY-104 only the cyanide data from the bottom three segments of each core were used to derive this value (Agnew et al. 1996a). Comparing these numbers, it appears that 99.3 to 99.8 percent of the $Na_2NiFe(CN)_6$ has decomposed.

Based on analytical results, the estimated tank heat load was 8,270 W (28,200 Btu/hr). The HTCE estimate of the tank heat load was 1,310 W (4,470 Btu/hr), and the estimate based on the headspace temperature was 2,550 W (8,700 Btu/hr). All three estimates were below the 11,700 W (40,000 Btu/hr) high-heat threshold (Bergmann 1991). The continuous, gradual decrease in the tank temperature since January 1993 indicates that any heat generated from radioactive sources throughout the year is dissipated.

The historical DQO attempts to verify the presence of particular waste types by comparing the predicted concentrations of certain analytes with the analytical results. The results of these comparisons indicated that the tank does contain BY saltcake as expected. Although it is known from process history records that tank 241-BY-104 contains ferrocyanide waste, only three of the six waste components for ferrocyanide waste were present. Analyses indicate that the ferrocyanide waste layer may not be as thick as predicted.

In summary, all safety DQOs were met by the October and November 1995 sampling event, and the analyses indicate that the tank can be assumed to be safe based on current DQOs and threshold values.

7.0 REFERENCES

Agnew, S. F., J. Boyer, R. A. Corbin, T. B. Duran, J. R. Fitzpatrick, K. A. Jurgensen, T. P. Ortiz, and B. L. Young, 1996a, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 3*, LA-UR-96-858, Rev. 0, Los Alamos National Laboratory, Los Alamos, New Mexico.

Agnew, S. F., P. Baca, R. A. Corbin, T. B. Duran and K. A. Jurgensen, 1996b, *Waste Status and Transaction Record Summary for the Northeast Quadrant*, WHC-SD-WM-TI-615, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

Alstad, A. T., 1993, *Riser Configuration Document for Single-Shell Tanks*, WHC-SD-RE-TI-053, Rev. 9, Westinghouse Hanford Company, Richland, Washington.

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

ARHCO, 1976, *104-BY Tank Arrangement "As-Built"*, Drawing H-2-37104, Rev. 0, Atlantic Richfield Hanford Company, Richland, Washington.

Babad, H., R. J. Cash, J. E. Meacham, and B. C. Simpson, 1993, *The Role of Aging in Resolving the Ferrocyanide Safety Issue*, WHC-EP-0599, Westinghouse Hanford Company, Richland, Washington.

Bechtold, D. B., 1991, *Laboratory Test Plan for Adiabatic Calorimetry of Single-Shell and Double Shell Tank Wastes*, WHC-SD-WM-TP-104, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Beck, M. A., D. B. Bechtold, and B. E. Hay, 1992, *Analysis Report for 241-BY-104 Auger Samples*, WHC-SD-WM-TI-540, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Benar, C. J., 1996a, *45-Day Safety Screening Results for Tank 241-BY-104, Rotary Mode Cores 116 and 117*, WHC-SD-WM-DP-164, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Benar, C. J., 1996b, *Final Report for Tank 241-BY-104, Rotary Mode Cores 116 and 117*, WHC-SD-WM-DP-164, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Benar, C. J., 1995, *Tank 241-BY-104 Rotary Core Sampling and Analysis Plan*, WHC-SD-WM-TSAP-040, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Bergmann, L. M., 1991, *Single-Shell Tank Isolation Safety Analysis Report*, WHC-SD-WM-SAR-006, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

Borsheim, G. L. and B. C. Simpson, 1991, *An Assessment of the Inventories of the Ferrocyanide Watch List Tanks*, WHC-SD-WM-ER-133, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Brevick, C. H., L. A. Gaddis, and A. C. Walsh, 1994, *Supporting Document for the Historical Tank Content Estimate for BY Tank Farm*, WHC-SD-WM-ER-312, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Buckley, L. L., and D. G. Baide, 1995, *Data Quality Objective to Support Resolution of the Organic Fuel Rich Tank Safety Issue*, WHC-SD-WM-DQO-006, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Burnum, S. T., 1995, *Qualification of Reported WHC Vapor Program Data*, (letter 95-CHD-065 to President, Westinghouse Hanford Company, August 18), U. S. Department of Energy, Richland, Washington.

DeLorenzo, D. S., A. T. DiCenso, D. B. Hiller, K. W. Johnson, J. H. Rutherford, D. J. Smith, and B. C. Simpson, 1994, *Tank Characterization Reference Guide*, WHC-SD-WM-TI-648, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

DOE, 1995, *Hanford Analytical Services Quality Assurance Plan*, DOE/RL-94-95, Rev. 2, U.S. Department of Energy, Richland, Washington.

Dukelow, G. T., J. W. Hunt, H. Babad, and J. E. Meacham, 1995, *Tank Safety Screening Data Quality Objective*, WHC-SD-WM-SP-004, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

Ecology, EPA, and DOE, 1996, *Hanford Federal Facility Agreement and Consent Order*, as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

Homi, L. S., 1995, *Vapor Sampling and Analysis Plan*, WHC-SD-WM-TP-335, Rev. 0G, Westinghouse Hanford Company, Richland, Washington.

Hanlon, B. M., 1996, *Waste Tank Summary Report for Month Ending April 30, 1996*, WHC-EP-0182-97, Westinghouse Hanford Company, Richland, Washington.

Horton, J. E., 1976, *Characterization and Analysis of 104-BY Tank Sludge*, (internal letter to W. R. Christensen, March 16), Atlantic Richfield Hanford Company, Richland, Washington.

Huckaby, J. L., H. Babad, and D. R. Bratzel, 1995 *Headspace Gas and Vapor Characterization Summary for the 43 Vapor Program Suspect Tanks*, WHC-SD-WM-ER-514 Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Kinzer, J., 1996, *Authorization to Remove the Remaining 14 Ferrocyanide Tanks, 241-BY-103, 241-BY-104, 241-BY-105, 241-BY-106, 241-BY-107, 241-BY-108, 241-BY-110, 241-BY-111, 241-BY-112, 241-T-107, 241-TX-118, 241-TY-101, 241-TY-103, and 241-TY-104, from the "Watch List,"* (letter 96-WSD-195 to President, Westinghouse Hanford Company, September 4), U. S. Department of Energy, Richland, Washington.

Kummerer, M., 1994, *Topical Report on Heat Removal Characteristics of Waste Storage Tanks*, WHC-SD-WM-SARR-010, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Kupfer, M. J., W. W. Schulz, and J. T. Slankas, 1995, *Strategy for Sampling Hanford Site Tank Wastes for Development of Disposal Technology*, WHC-SD-WM-TA-154, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Leach, C. E. and S. M. Stahl, 1993, *Hanford Site Tank Farm Facilities Interim Safety Basis Volume I and II*, WHC-SD-WM-ISB-001, Westinghouse Hanford Company, Richland, Washington.

Lilga, M. A., M. R. Lumetta, and G. F. Schiefelbein, 1993, *Ferrocyanide Safety Project, Task 3 Ferrocyanide Aging Studies FY 1993 Annual Report,* PNL-8888, Pacific Northwest National Laboratory, Richland, Washington.

Lilga, M. A., E. V. Alderson, D. J. Kowalski, M. R. Lumetta, and G. F. Schiefelbein, 1994, *Ferrocyanide Safety Project Task 3 Ferrocyanide Aging Studies FY 1994 Annual Report,* PNL-10126, Pacific Northwest National Laboratory, Richland, Washington.

Lilga, M. A., E. V. Alderson, R. T. Hallen, M. O. Hogan, T. L. Hubler, G. L. Jones, D. J. Kowalski, M. R. Lumetta, G. F. Schiefelbein, and M. R. Telander, 1995, *Ferrocyanide Safety Project: Ferrocyanide Aging Studies - FY 1995 Annual Report,* PNL-10713, Pacific Norhtwest National Laboratory, Richland, Washington.

Lilga, M. A., R. T. Hallen, E. V. Alderson, M. O. Hogan, T. L. Hubler, G. L. Jones, D. J. Kowalski, M. R. Lumetta, W. F. Riemath, R. A. Romine, G. F. Schiefelbein, and M. R. Telander, 1996, *Ferrocyanide Safety Project: Ferrocyanide Aging Studies - Final Report*, PNNL-11211, Pacific Northwest National Laboratory, Richland, Washington.

Lipnicki, J., 1995, *Waste Tank Risers Available for Sampling*, WHC-SD-WM-TI-710, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

Meacham, J. E., 1995, *Test Plan for Samples From Hanford Waste Tanks 241-BY-103, BY-104, BY-105, BY-106, BY-108, BY-110, TY-103, U-105, U-107, U-108, and U-109*, WHC-SD-WM-TP-378, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Meacham, J. E., R. J. Cash, B. A. Pulsipher, and G. Chen, 1995, *Data Requirements for the Ferrocyanide Safety Issue Developed through the Data Quality Objectives Process* WHC-SD-WM-DQO-007, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

Neskas, J. W., and G. L. Borsheim, 1993, *Data Interpretation Report on Tank 241-BY-104 Auger Samples*, WHC-SD-WM-RPT-068, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

NFPA, 1995, *National Fire Codes*, Vol. 10, Section 115, "Laser Fire Protection," National Fire Protection Association, Quincy, Massachusettes.

Nuclear Regulatory Commission, 1988, *Statistical Methods for Nuclear Materials Management*, NUREG-CR-4604, PNL-5849, (C. A. Bennett and W. M. Bowen eds.), U.S. Government Printing Office, Washington, D.C.

Simpson, B. C., and D. J. McCain, 1995, *Historical Model Evaluation Data Requirements*, WHC-SD-WM-DQO-018, Rev. 0A, Westinghouse Hanford Company, Richland, Washington.

Swaney, 1993, *Waste Level Discrepancies between Manual Level Readings and Current Waste Inventory for Single-shell Tanks*, (internal memorandum 7C242-93-038 to G. T. Frater, December 10), Westinghouse Hanford Company, Richland, Washington.

Tran, T. T., 1993, *Thermocouple Status Single Shell & Double Shell Waste Tanks*, WHC-SD-WM-TI-553, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Vitro Engineering Corporation, 1986, *Piping Waste Tank Isolation 241-BY-104*, drawing H-2-73252, Rev. 2, Vitro Engineering Corporation, Richland, Washington.

WHC 1995b, *Sampling Report for the Vapor and Gas Sampling of Tank 241-BY-104 Using the Vapor Sampling System*, WHC-SD-WM-RPT-100 Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC, 1996, *Surveillance Analysis Computer System Database, June 10*, Tank Farm Surveillance Engineering, Westinghouse Hanford Company, Richland, Washington.

Zimmerman, R. O., 1995, *Safety Department Administrative Manual*, WHC-IP-0030, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

This page intentionally left blank.

APPENDIX A

ANALYTICAL RESULTS FROM 1995 CORE SAMPLING OF SINGLE-SHELL TANK 241-BY-104

This page intentionally left blank.

A.0 ANALYTICAL RESULTS FROM THE 1995 CORE SAMPLING OF SINGLE-SHELL TANK 241-BY-104

A.1 INTRODUCTION

Appendix A reports the chemical, radiochemical, and physical characteristics of tank 241-BY-104 in table form and in terms of the specific concentrations of metals, ions, radionuclides, and physical properties.

Each data table lists the following: laboratory sample identification, sample origin (core/segment/subsegment, or composite), an original and duplicate result for each sample, a sample mean, a mean result for the tank in which both cores are weighted equally, an RSD (mean), and a projected tank inventory for the particular analyte using the overall mean, the waste density, and the appropriate conversion factors. Projected tank inventory is not applicable to the DSC or density data. The data are listed in standard notation for values greater than 0.001 and less than 100,000. Values outside these limits are listed in scientific notation.

The tables are numbered A-1 through A-57. A description of the units and symbols used in the analyte tables and the references used in compiling the analytical data are in the List of Terms and Section 7.0, respectively. For a description of the sampling event and information on sampling rationale and locations, see Section 3.0.

A.2 ANALYTE TABLE DESCRIPTION

Column 1 lists the laboratory sample for which the analyte was measured.

Column 2 specifies the core and segment from which each sample was derived.

Column 3 specifies the subsegment for which the analyte was measured. As required by the ferrocyanide DQO, sludge material was split into quarter segments, and saltcake material was divided into halves. The drainable liquid from the first two segments of core 117 were designated DL.

Columns 4 and 5, Result and Duplicate, are self-explanatory. Column 6, Sample Mean, lists the average of the result and duplicate values. If result and duplicate values were both detected, or one of the two values is detected and the other is nondetected, then the mean is expressed as a detected value. If result and duplicate values were both nondetected, then the mean is expressed as a nondetected result. The result and duplicate values and the result and duplicate means are reported in the tables exactly as found in the Tank Characterization Database. The means may appear to have been rounded up in some cases and rounded down in others. This is because the analytical results given in the tables may have fewer significant figures than originally reported not because the means were incorrectly calculated.

Column 7 lists the overall means for the waste in tank 241-BY-104, and they are calculated as follows:

To obtain the overall weighted mean for the tank waste, the individual sample primary and duplicate pairs within a given subsegment were averaged to obtain a sample mean. The subsegment means within a given segment were averaged to obtain a segment mean, the segment means within a given core were averaged to obtain a core mean, and finally the two core means were averaged to obtain the overall mean. Not all steps were necessary for each analyte or for each subsegment, but the procedure is the same. For the first two segments of core 117, drainable liquid was recovered. Results from analyses on the drainable liquid samples have been combined with the solids results from those segments. The combining was done on a weighted basis according to the masses of the recovered solids and drainable liquid. The weighting factors used in calculating the means for these segments are as follows:

Segment 1 of core 117	Segment 2 of core 117
Solids = 8.86%	Solids = 68.7%
Liquids = 91.1%	Liquids = 31.3%

After multiplying the solids and drainable liquid analytical values by these weighting factors, the resulting numbers were summed. For segment 2 of core 117, solids subsegments A and D were averaged before being subjected to this weighting method. The drainable liquid was averaged into all analytical data sets regardless of digestion method.

All values, including those below the detection level (indicated by the less-than symbol, <), were used in calculating the overall means. If 50 percent or more of all individual primary and duplicate results were detected, then the overall mean was expressed as a detected value. If less than 50 percent of all the individual results were detected, then the overall mean was expressed as a nondetected value. The incorporation of nondetected results provides the most conservative concentration estimates. Because the use of nondetected data in the mean and inventory estimates causes a high bias in those estimates, those particular results should be used with caution.

Separate overall means were calculated based on the fusion digestion, acid digestion, and water digestion results. All means were calculated in the manner just described. Because only one primary/duplicate pair was analyzed on the core composite material, the sample mean is also the overall mean.

The RSD (mean), given in column eight, was computed for applicable analytes using standard ANOVA statistical techniques (nested models). If the overall mean for a given analyte was detected, then an RSD (mean) was also calculated for that analyte using all available data because using nondetected results in the mean calculation also requires their use in the RSD (mean) calculations. Whereas using nondetected results in mean calculations produces a known high bias, using these values in statistical calculations creates an unknown bias. Therefore, the RSD (mean) estimates and the ANOVA results for analytes with nondetected values should be used with caution.

The projected inventory in column 9 is the product of the overall mean, the volume of tank waste (1,234 kL [326 kgal]), the density (1.75 g/mL), and the appropriate conversion factors.

The four quality control parameters assessed on the tank 241-BY-104 samples were standard recoveries, spike recoveries, duplicate analyses (RPDs), and blanks (see Section 5.1.2). More specific information is provided in the appendix tables. Sample and duplicate pairs, in which any quality control parameters were outside their specified limits, are superscripted in the Sample Mean column as follows:

a -- indicates that the standard recovery was below the quality control range.
b -- indicates that the standard recovery was above the quality control range.
c -- indicates that the spike recovery was below the quality control range.
d -- indicates that the spike recovery was above the quality control range.
e -- indicates that the RPD was greater than the quality control limit range.
f -- indicates blank contamination.

Table A-1. Tank 241-BY-104 Analytical Results: Aluminum. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			μg/g	μg/g	μg/g	μg/g	%	kg
S95T003531	116: 2	Upper ½	4,730	3,600	4,165	30,100	16.2	65,000
S95T003530		A	51,900	54,500	53,200			
S95T003700	116: 3	Upper ½	5,420	5,870	5,645			
S95T003701		Lower ½	5,640	7,110	6,375			
S95T003649	116: 4	A	20,700	19,700	20,200			
S95T003650		B	22,900	21,100	22,000			
S95T003651		C	19,500	20,700	20,100			
S95T003652	116: 5	A	21,600	22,600	22,100			
S95T003653		B	22,000	19,300	20,650			
S95T003654		C	22,500	24,700	23,600			
S95T003655		D	23,900	21,900	22,900			
S95T003656	116: 6	A	23,400	23,500	23,450			
S95T003657		B	26,100	26,400	26,250			
S95T003658		C	22,400	19,300	20,850			
S95T003659		D	22,600	19,100	20,850			
S95T003660	116: 7	A	24,400	25,600	25,000			
S95T003661		B	23,300	23,100	23,200			
S95T003662		C	24,500	26,000	25,250			
S95T003663		D	37,200	36,200	36,700			

Table A-1. Tank 241-BY-104 Analytical Results: Aluminum. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003664	116: 8	A	39,200	32,600	35,900	Cont.	Cont.	Cont.
S95T003665		D	1.150E+05	1.010E+05	1.080E+05[QC:e]			
S95T003771	117: 1	Upper ½	62,000	55,500	58,750			
S95T003761		DL	49,000	50,142.9	49,571.4			
S95T003775	117: 2	DL	53,428.6	53,214.3	53,321.4			
S95T003786		A	36,100	33,900	35,000			
S95T003787		D	38,200	36,900	37,550			
S95T003811	117: 3	Upper ½	31,800	30,800	31,300			
S95T003788		C	28,900	27,400	28,150			
S95T003812	117: 4	Upper ½	14,700	15,300	15,000			
S95T003789	117: 5	A	18,700	19,500	19,100			
S95T003790		C	23,700	22,800	23,250			
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	6,310	5,420	5,865[QC:d]	26,400	25.6	57,000
S95T003533	116: 3	Lower ½	7,330	6,990	7,160			
S95T003666	116: 4	A	21,000	19,500	20,250			
S96T000604		B	20,700	17,500	19,100			
S96T000605		C	19,100	20,100	19,600			

Table A-1. Tank 241-BY-104 Analytical Results: Aluminum. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000606	116: 5	A	22,400	17,700	20,050	Cont.	Cont.	Cont.
S96T000607		B	19,500	15,100	17,300			
S96T000608		C	21,800	20,900	21,350			
S96T000609		D	17,700	20,500	19,100			
S95T003673	116: 6	A	22,800	22,900	22,850			
S95T003674		B	22,800	24,300	23,550			
S95T003675		C	18,700	20,300	19,500			
S95T003676		D	21,500	19,100	20,300			
S95T003677	116: 7	A	21,600	21,100	21,350			
S95T003678		B	21,900	21,400	21,650			
S95T003679		C	25,800	25,800	25,800			
S95T003680		D	32,900	32,700	32,800			
S95T003681	116: 8	A	34,200	33,400	33,800			
S95T003682		D	43,800	41,100	42,450			
S95T003761	117: 1	DL	49,000	50,142.9	49,571.4			
S95T003775	117: 2	DL	53,428.6	53,214.3	53,321.4			
S95T003791		A	29,600	28,800	29,200			
S95T003792		D	32,200	32,300	32,250			
S95T003793	117: 3	C	23,300	27,100	25,200			
S95T003794	117: 5	A	17,600	18,800	18,200			
S95T003795		C	21,400	21,700	21,550			

Table A-1. Tank 241-BY-104 Analytical Results: Aluminum. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	21,500	22,600	22,050	34,800	27.5	75,200
S95T003684		B	28,100	22,600	25,350			
S95T003685		C	22,700	23,800	23,250			
S95T003697	116: 7	D	24,400	31,100	27,750			
S95T003698	116: 8	A	18,900	29,800	24,350			
S95T003761	117: 1	DL	49,000	50,142.9	49,571.4			
S95T003775	117: 2	DL	53,428.6	53,214.3	53,321.4			
S95T003813	117: 3	Upper ½	30,600	28,400	29,500			
S95T003798		C	32,700	30,100	31,400			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	24,300	23,300	23,800	23,800	2.10	51,400

Table A-2. Tank 241-BY-104 Analytical Results: Antimony. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	< 51.5	< 54.4	< 52.95	< 37.5	n/a	< 81
S95T003533	116: 3	Lower ½	< 57.5	< 57.8	< 57.65			
S95T003666	116: 4	A	< 57.0	< 53.6	< 55.3			
S96T000604		B	< 33.6	< 29.9	< 31.75[QC:a,c]			
S96T000605		C	< 35.5	< 37.5	< 36.5[QC:a]			
S96T000606	116: 5	A	< 26.9	< 27.4	< 27.15[QC:a]			
S96T000607		B	< 25.9	< 22.3	< 24.1[QC:a]			
S96T000608		C	< 24.4	< 26.4	< 25.4[QC:a]			
S96T000609		D	< 30.1	< 29.0	< 29.55[QC:a]			
S95T003673	116: 6	A	< 29.2	< 28.8	< 29.0			
S95T003674		B	< 26.5	< 27.0	< 26.75			
S95T003675		C	< 30.0	< 30.2	< 30.1			
S95T003676		D	< 29.5	< 28.2	< 28.85			
S95T003677	116: 7	A	< 26.2	< 25.5	< 25.85			
S95T003678		B	< 30.1	< 29.3	< 29.7			
S95T003679		C	< 53.7	< 52.5	< 53.1			
S95T003680		D	< 30.8	< 30.9	< 30.85			

Table A-2. Tank 241-BY-104 Analytical Results: Antimony. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003681	116: 8	A	< 26.7	< 27.6	< 27.15	Cont.	Cont.	Cont.
S95T003682		D	< 19.2	< 17.9	< 18.55			
S95T003761	117: 1	DL	< 51.5	< 51.5	< 51.5			
S95T003775	117: 2	DL	< 51.5	< 51.5	< 51.5			
S95T003791		A	< 37.0	< 36.8	< 36.9			
S95T003792		D	< 33.2	< 33.6	< 33.4			
S95T003793	117: 3	C	< 27.6	< 28.0	< 27.8			
S95T003794	117: 5	A	< 29.6	< 28.2	< 28.9			
S95T003795		C	< 28.2	< 29.2	< 28.7			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 56.8	< 57.2	< 57.0	< 64.7	n/a	< 140
S95T003684		B	< 52.3	< 52.6	< 52.45			
S95T003685		C	< 53.2	< 53.3	< 53.25			
S95T003697	116: 7	D	< 53.6	< 53.6	< 53.6			
S95T003698	116: 8	A	< 118	< 122	< 120			
S95T003761	117: 1	DL	< 51.5	< 51.5	< 51.5			
S95T003775	117: 2	DL	< 51.5	< 51.5	< 51.5			
S95T003813	117: 3	Upper ½	< 57.9	< 57.7	< 57.8			
S95T003798		C	< 57.0	< 57.7	< 57.35			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 1,360	< 1,260	< 1,310	< 1,310	n/a	< 2,800

Table A-3. Tank 241-BY-104 Analytical Results: Arsenic. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	< 85.9	< 90.6	< 88.25	< 62.4	n/a	< 135
S95T003533	116: 3	Lower ½	< 95.9	< 96.3	< 96.1			
S95T003666	116: 4	A	< 95.0	< 89.4	< 92.2			
S96T000604		B	< 56.0	< 49.9	< 52.95			
S96T000605		C	< 59.2	< 62.5	< 60.85			
S96T000606	116: 5	A	< 44.8	< 45.6	< 45.2			
S96T000607		B	< 43.2	< 37.1	< 40.15			
S96T000608		C	< 40.6	< 44.0	< 42.3			
S96T000609		D	< 50.2	< 48.3	< 49.25			
S95T003673	116: 6	A	< 48.6	< 48.0	< 48.3			
S95T003674		B	< 44.2	< 45.0	< 44.6			
S95T003675		C	< 50.0	< 50.3	< 50.15			
S95T003676		D	< 49.1	< 47.0	< 48.05			
S95T003677	116: 7	A	< 43.4	< 42.5	< 42.95			
S95T003678		B	< 50.2	< 48.9	< 49.55			
S95T003679		C	< 89.5	< 87.5	< 88.5			
S95T003680		D	< 51.3	< 51.4	< 51.35			

Table A-3. Tank 241-BY-104 Analytical Results: Arsenic. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003681	116: 8	A	< 44.5	< 46.0	< 45.25	Cont.	Cont.	Cont.
S95T003682		D	< 32.0	< 29.8	< 30.9			
S95T003761	117: 1	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003791		A	< 61.7	< 61.3	< 61.5			
S95T003792		D	< 55.3	< 56.1	< 55.7			
S95T003793	117: 3	C	< 46.0	< 46.6	< 46.3			
S95T003794	117: 5	A	< 49.3	< 48.3	< 48.8			
S95T003795		C	< 47.1	< 48.6	< 47.85			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 94.6	< 95.4	< 95.0	< 108	n/a	< 230
S95T003684		B	< 87.2	< 87.7	< 87.45			
S95T003685		C	< 88.6	< 88.9	< 88.75			
S95T003697	116: 7	D	< 89.3	< 89.3	< 89.3			
S95T003698	116: 8	A	< 196	< 204	< 200			
S95T003761	117: 1	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003813	117: 3	Upper ½	< 96.5	< 96.1	< 96.3			
S95T003798		C	< 95.0	< 96.2	< 95.6			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 2,260	< 2,110	< 2,190	< 2,190	n/a	< 4,700

Table A-4. Tank 241-BY-104 Analytical Results: Barium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	< 42.9	< 45.3	< 44.1	< 69.1	n/a	< 149
S95T003533	116: 3	Lower ½	< 47.1	< 48.2	< 47.65			
S95T003666	116: 4	A	< 47.5	< 44.7	< 46.1			
S96T000604		B	< 28.0	< 24.1	< 26.05			
S96T000605		C	< 29.6	< 31.2	< 30.4			
S96T000606	116: 5	A	< 22.4	< 22.8	< 22.6			
S96T000607		B	< 21.6	< 18.6	< 20.1			
S96T000608		C	< 20.3	< 22.0	< 21.15			
S96T000609		D	< 25.1	< 24.2	< 24.65			
S95T003673	116: 6	A	< 24.3	< 24.0	< 24.15			
S95T003674		B	< 22.1	< 22.5	< 22.3			
S95T003675		C	< 25.0	< 25.1	< 25.05			
S95T003676		D	< 24.7	< 23.5	< 24.1			
S95T003677	116: 7	A	< 21.7	< 21.4	< 21.55			
S95T003678		B	< 25.1	< 24.4	< 24.75			
S95T003679		C	< 44.8	< 43.9	< 44.35			
S95T003680		D	326	318	322			

Table A-4. Tank 241-BY-104 Analytical Results: Barium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S95T003681	116: 8	A	535	508	521.5	Cont.	Cont.	Cont.
S95T003682		D	180	168	174			
S95T003761	117: 1	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003775	117: 2	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003791		A	< 30.8	< 30.6	< 30.7			
S95T003792		D	< 27.6	< 28.0	< 27.8			
S95T003793	117: 3	C	87.0	106	96.5			
S95T003794	117: 5	A	< 24.6	< 24.1	< 24.35			
S95T003795		C	< 23.5	< 24.3	< 23.9			
Solids: water digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S95T003683	116: 4	A	< 47.3	< 47.7	< 47.5	< 53.9	n/a	< 116
S95T003684		B	< 43.6	< 43.9	< 43.75			
S95T003685		C	< 44.3	< 44.4	< 44.35			
S95T003697	116: 7	D	< 44.6	< 44.7	< 44.65			
S95T003698	116: 8	A	< 98.0	< 102	< 100			
S95T003761	117: 1	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003775	117: 2	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003813	117: 3	Upper ½	< 48.3	< 48.0	< 48.15			
S95T003798		C	< 47.5	< 48.1	< 47.8			
Core composite: fusion digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S96T000374	116	n/a	< 1,130	< 1,050	< 1,090	< 1,090	n/a	< 2,400

Table A-5. Tank 241-BY-104 Analytical Results: Beryllium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	< 4.29	< 4.53	< 4.41	< 3.16	n/a	< 6.8
S95T003533	116: 3	Lower ½	< 4.71	< 4.82	< 4.765			
S95T003666	116: 4	A	< 4.75	< 4.47	< 4.61			
S96T000604		B	< 2.80	< 2.41	< 2.605			
S96T000605		C	< 2.96	< 3.12	< 3.04			
S96T000606	116: 5	A	< 2.24	< 2.28	< 2.26			
S96T000607		B	< 2.16	< 1.86	< 2.01			
S96T000608		C	6.59	< 2.20	4.395[QC:e]			
S96T000609		D	< 2.51	< 2.42	< 2.465			
S95T003673	116: 6	A	< 2.43	< 2.40	< 2.415			
S95T003674		B	< 2.21	< 2.25	< 2.23			
S95T003675		C	< 2.50	< 2.51	< 2.505			
S95T003676		D	< 2.47	< 2.35	< 2.41			
S95T003677	116: 7	A	< 2.17	< 2.14	< 2.155			
S95T003678		B	< 2.51	< 2.44	< 2.475			
S95T003679		C	< 4.48	< 4.39	< 4.435			
S95T003680		D	< 2.57	< 2.57	< 2.57			

Table A-5. Tank 241-BY-104 Analytical Results: Beryllium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			μg/g	μg/g	μg/g	μg/g	%	kg
S95T003681	116: 8	A	< 2.22	< 2.30	< 2.26	Cont.	Cont.	Cont.
S95T003682		D	< 1.60	< 1.49	< 1.545			
S95T003761	117: 1	DL	< 4.28571	< 4.28571	< 4.28571			
S95T003775	117: 2	DL	< 4.28571	< 4.28571	< 4.28571			
S95T003791		A	< 3.08	< 3.06	< 3.07			
S95T003792		D	< 2.76	< 2.80	< 2.78			
S95T003793	117: 3	C	< 2.30	< 2.33	< 2.315			
S95T003794	117: 5	A	< 2.46	< 2.41	< 2.435			
S95T003795		C	< 2.35	< 2.43	< 2.39			
Solids: water digest			μg/g	μg/g	μg/g	μg/g	%	kg
S95T003683	116: 4	A	< 4.73	< 4.77	< 4.75	< 5.39	n/a	< 11.7
S95T003684		B	< 4.36	< 4.39	< 4.375			
S95T003685		C	< 4.43	< 4.44	< 4.435			
S95T003697	116: 7	D	< 4.46	< 4.47	< 4.465			
S95T003698	116: 8	A	< 9.80	< 10.2	< 10.0			
S95T003761	117: 1	DL	< 4.28571	< 4.28571	< 4.28571			
S95T003775	117: 2	DL	< 4.28571	< 4.28571	< 4.28571			
S95T003813	117: 3	Upper ½	< 4.83	< 4.80	< 4.815			
S95T003798		C	< 4.75	< 4.81	< 4.78			
Core composite: fusion digest			μg/g	μg/g	μg/g	μg/g	%	kg
S96T000374	116	n/a	< 113	< 105	< 109	< 109	n/a	< 235

Table A-6. Tank 241-BY-104 Analytical Results: Bismuth. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003531	116: 2	Upper ½	< 4,660	< 4,150	< 4,405	< 2,070	n/a	< 4,470
S95T003530		A	< 2,020	< 1,770	< 1,895			
S95T003700	116: 3	Upper ½	< 4,470	< 3,720	< 4,095			
S95T003701		Lower ½	< 4,590	< 3,470	< 4,030			
S95T003649	116: 4	A	< 1,750	< 1,840	< 1,795			
S95T003650		B	< 1,870	< 1,890	< 1,880			
S95T003651		C	< 1,840	< 1,830	< 1,835			
S95T003652	116: 5	A	< 1,900	< 1,880	< 1,890			
S95T003653		B	< 1,870	< 1,930	< 1,900			
S95T003654		C	< 1,970	< 2,020	< 1,995			
S95T003655		D	< 1,920	< 1,960	< 1,940			
S95T003656	116: 6	A	< 1,750	< 1,790	< 1,770			
S95T003657		B	< 1,820	< 1,780	< 1,800			
S95T003658		C	< 1,900	< 1,920	< 1,910			
S95T003659		D	< 2,040	< 1,990	< 2,015			
S95T003660	116: 7	A	< 2,050	< 2,040	< 2,045			
S95T003661		B	< 1,960	< 1,970	< 1,965			
S95T003662		C	< 1,730	< 1,850	< 1,790			
S95T003663		D	2,630	2,400	2,515			

Table A-6. Tank 241-BY-104 Analytical Results: Bismuth. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003664	116: 8	A	< 4,240	< 4,420	< 4,330	Cont.	Cont.	Cont.
S95T003665		D	< 2,020	< 1,830	< 1,925			
S95T003771	117: 1	Upper ½	< 5,020	< 5,070	< 5,045			
S95T003761		DL	< 85.7143	< 85.7143	< 85.7143			
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003786		A	< 2,010	< 1,960	< 1,985			
S95T003787		D	< 1,960	< 1,960	< 1,960			
S95T003811	117: 3	Upper ½	< 1,830	< 1,840	< 1,835			
S95T003788		C	< 1,980	< 1,980	< 1,980			
S95T003812	117: 4	Upper ½	< 1,980	< 2,020	< 2,000			
S95T003789	117: 5	A	< 2,030	< 2,030	< 2,030			
S95T003790		C	< 1,910	< 1,910	< 1,910			
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	327	< 90.6	208.8[QC:c,e]	< 285	n/a	< 615
S95T003533	116: 3	Lower ½	< 95.9	< 96.3	< 96.1			
S95T003666	116: 4	A	< 95.0	< 89.4	< 92.2			
S96T000604		B	< 56.0	< 49.9	< 52.95[QC:e]			
S96T000605		C	< 59.2	< 62.5	< 60.85			

Table A-6. Tank 241-BY-104 Analytical Results: Bismuth. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
S96T000606	116: 5	A	< 44.8	< 45.6	< 45.2	Cont.	Cont.	Cont.
S96T000607		B	43.3	< 37.1	40.2[QC:e]			
S96T000608		C	41.4	< 44	42.7			
S96T000609		D	< 50.2	< 48.3	< 49.25			
S95T003673	116: 6	A	< 48.6	< 48	< 48.3			
S95T003674		B	< 44.2	< 45	< 44.6			
S95T003675		C	< 50	< 50.3	< 50.15			
S95T003676		D	51.6	< 47.0	< 49.3			
S95T003677	116: 7	A	72.1	76.6	74.35			
S95T003678		B	64.9	58.7	61.8			
S95T003679		C	< 89.5	89.3	< 89.4			
S95T003680		D	1,900	1,850	1,875			
S95T003681	116: 8	A	2,670	2,510	2,590			
S95T003682		D	1,010	952	981			
S95T003761	117: 1	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003791		A	< 61.7	< 61.3	< 61.5			
S95T003792		D	92.4	98.7	95.55			
S95T003793	117: 3	C	423	514	468.5[QC:e]			
S95T003794	117: 5	A	< 49.3	< 48.3	< 48.8			
S95T003795		C	71.0	63.1	67.05[QC:e]			

Table A-6. Tank 241-BY-104 Analytical Results: Bismuth. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			μg/g	μg/g	μg/g	μg/g	%	kg
S95T003683	116: 4	A	< 94.6	< 95.4	< 95.0	< 108	n/a	< 230
S95T003684		B	< 87.2	< 87.7	< 87.45			
S95T003685		C	< 88.6	< 88.9	< 88.75			
S95T003697	116: 7	D	< 89.3	< 89.3	< 89.3			
S95T003698	116: 8	A	< 196	< 204	< 200			
S95T003761	117: 1	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003813	117: 3	Upper ½	< 96.5	< 96.1	< 96.3			
S95T003798		C	< 95.0	< 96.2	< 95.6			
Core composite: fusion digest			μg/g	μg/g	μg/g	μg/g	%	kg
S96T000374	116	n/a	< 2,260	< 2,110	< 2,190	< 2,190	n/a	< 4,730

Table A-7. Tank 241-BY-104 Analytical Results: Boron. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	55.1	129	92.05[QC:e]	< 45.0	n/a	< 97.2
S95T003533	116: 3	Lower ½	< 47.1	< 48.2	< 47.65			
S95T003666	116: 4	A	62.5	66.1	64.3			
S96T000604		B	< 28.0	< 24.1	< 26.05			
S96T000605		C	106	106	106			
S96T000606	116: 5	A	59.6	< 22.8	41.2[QC:e]			
S96T000607		B	< 21.6	< 18.6	< 20.1			
S96T000608		C	26.2	24.4	25.3			
S96T000609		D	< 25.1	30.6	27.85			
S95T003673	116: 6	A	< 24.3	< 24	< 24.15			
S95T003674		B	< 22.1	< 22.5	< 22.3			
S95T003675		C	< 25	< 25.1	< 25.05			
S95T003676		D	< 24.7	< 23.5	< 24.1			
S95T003677	116: 7	A	< 21.7	23.7	22.7			
S95T003678		B	< 25.1	< 24.4	< 24.75			
S95T003679		C	54.8	< 43.9	49.35[QC:e]			
S95T003680		D	29.4	26.6	28.0			

Table A-7. Tank 241-BY-104 Analytical Results: Boron. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S95T003681	116: 8	A	34.4	< 23	28.7[QC:e]	Cont.	Cont.	Cont.
S95T003682		D	< 16.0	< 14.9	< 15.45			
S95T003761	117: 1	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003775	117: 2	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003791		A	< 30.8	< 30.6	< 30.7			
S95T003792		D	99.1	126	112.55[QC:e]			
S95T003793	117: 3	C	24.4	39.6	32[QC:e]			
S95T003794	117: 5	A	39.3	< 24.1	31.7[QC:e]			
S95T003795		C	90.8	< 24.3	57.55[QC:e]			
Solids: water digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S95T003683	116: 4	A	< 47.3	< 47.7	< 47.5	< 53.9	n/a	< 116
S95T003684		B	< 43.6	< 43.9	< 43.75			
S95T003685		C	< 44.3	< 44.4	< 44.35			
S95T003697	116: 7	D	< 44.6	< 44.7	< 44.65			
S95T003698	116: 8	A	< 98.0	< 102	< 100			
S95T003761	117: 1	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003775	117: 2	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003813	117: 3	Upper ½	< 48.3	< 48.0	< 48.15			
S95T003798		C	< 47.5	< 48.1	< 47.8			
Core composite: fusion digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S96T000374	116	n/a	< 1,130	< 1,050	< 1,090	< 1,090	n/a	< 2,350

Table A-8. Tank 241-BY-104 Analytical Results: Cadmium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	71.3	55.8	63.55[QC:e]	16.1	30.3	34.8
S95T003533	116: 3	Lower ½	13.3	13.6	13.45			
S95T003666	116: 4	A	14.4	14.7	14.55			
S96T000604		B	11.0	9.45	10.225			
S96T000605		C	11.1	12.6	11.85			
S96T000606	116: 5	A	9.01	7.97	8.49			
S96T000607		B	11.4	8.08	9.74[QC:e]			
S96T000608		C	13.7	8.91	11.305[QC:e]			
S96T000609		D	7.94	9.79	8.865			
S95T003673	116: 6	A	11.0	10.5	10.75			
S95T003674		B	8.63	8.73	8.68			
S95T003675		C	8.71	10.5	9.605			
S95T003676		D	13.8	10.2	12.0[QC:e]			
S95T003677	116: 7	A	13.1	13.0	13.05			
S95T003678		B	9.91	9.32	9.615			
S95T003679		C	8.91	9.43	9.17			
S95T003680		D	15.2	15.1	15.15			

Table A-8. Tank 241-BY-104 Analytical Results: Cadmium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			μg/g	μg/g	μg/g	μg/g	%	kg
S95T003681	116: 8	A	7.26	5.88	6.57[QC:e]	Cont.	Cont.	Cont.
S95T003682		D	2.92	2.68	2.80			
S95T003761	117: 1	DL	< 4.28571	< 4.28571	< 4.28571			
S95T003775	117: 2	DL	< 4.28571	< 4.28571	< 4.28571			
S95T003791		A	14.0	13.7	13.85			
S95T003792		D	67.4	68.3	67.85			
S95T003793	117: 3	C	17.1	21.5	19.3[QC:e]			
S95T003794	117: 5	A	3.19	3.10	3.145			
S95T003795		C	4.61	3.99	4.30			
Solids: water digest			μg/g	μg/g	μg/g	μg/g	%	kg
S95T003683	116: 4	A	< 4.73	< 4.77	< 4.75	< 5.39	n/a	< 11.6
S95T003684		B	< 4.36	< 4.39	< 4.375			
S95T003685		C	< 4.43	< 4.44	< 4.435			
S95T003697	116: 7	D	< 4.46	< 4.47	< 4.465			
S95T003698	116: 8	A	< 9.80	< 10.2	< 10.0			
S95T003761	117: 1	DL	< 4.28571	< 4.28571	< 4.28571			
S95T003775	117: 2	DL	< 4.28571	< 4.28571	< 4.28571			
S95T003813	117: 3	Upper ½	< 4.83	< 4.80	< 4.815			
S95T003798		C	< 4.75	< 4.81	< 4.78			
Core composite: fusion digest			μg/g	μg/g	μg/g	μg/g	%	kg
S96T000374	116	n/a	< 113	< 105	< 109	< 109	n/a	< 236

Table A-9. Tank 241-BY-104 Analytical Results: Calcium. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			μg/g	μg/g	μg/g	μg/g	%	kg
S95T003531	116: 2	Upper ½	< 4,660	< 4,150	< 4,405	< 2,660	n/a	< 5,700
S95T003530		A	< 2,020	< 1,770	< 1,895			
S95T003700	116: 3	Upper ½	< 4,470	< 3,720	< 4,095			
S95T003701		Lower ½	< 4,590	< 3,470	< 4,030			
S95T003649	116: 4	A	< 1,750	< 1,840	< 1,795			
S95T003650		B	< 1,870	< 1,890	< 1,880			
S95T003651		C	< 1,840	< 1,830	< 1,835			
S95T003652	116: 5	A	< 1,900	< 1,880	< 1,890			
S95T003653		B	< 1,870	< 1,930	< 1,900			
S95T003654		C	< 1,970	< 2,020	< 1,995			
S95T003655		D	< 1,920	< 1,960	< 1,940			
S95T003656	116: 6	A	< 1,750	< 1,790	< 1,770			
S95T003657		B	< 1,820	< 1,780	< 1,800			
S95T003658		C	< 1,900	< 1,920	< 1,910			
S95T003659		D	< 2,040	< 1,990	< 2,015			
S95T003660	116: 7	A	< 2,050	< 2,040	< 2,045			
S95T003661		B	< 1,960	< 1,970	< 1,965			
S95T003662		C	< 1,730	< 1,850	< 1,790			
S95T003663		D	9,200	8,550	8,875			
S95T003664	116: 8	A	14,700	14,400	14,550			
S95T003665		D	4,310	4,550	4,430			

Table A-9. Tank 241-BY-104 Analytical Results: Calcium. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003771	117: 1	Upper ½	< 5,020	< 5,070	< 5,045	Cont.	Cont.	Cont.
S95T003761		DL	< 85.7143	< 85.7143	< 85.7143			
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003786		A	< 2,010	< 1,960	< 1,985			
S95T003787		D	< 1,960	< 1,960	< 1,960			
S95T003811	117: 3	Upper ½	< 1,830	< 1,840	< 1,835			
S95T003788		C	2,610	2,390	2,500			
S95T003812	117: 4	Upper ½	< 1,980	< 2,020	< 2,000			
S95T003789	117: 5	A	< 2,030	< 2,030	< 2,030			
S95T003790		C	< 1,910	< 1,910	< 1,910			
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	269	165	217[QC:c,e]	1,240	50.6	2,680
S95T003533	116: 3	Lower ½	306	214	260[QC:e]			
S95T003666	116: 4	A	331	296	313.5[QC:e]			
S96T000604		B	504	460	482[QC:c]			
S96T000605		C	575	611	593			
S96T000606	116: 5	A	368	363	365.5			
S96T000607		B	454	364	409[QC:e]			
S96T000608		C	367	377	372			
S96T000609		D	466	406	436[QC:e]			

Table A-9. Tank 241-BY-104 Analytical Results: Calcium. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003673	116: 6	A	475	358	416.5[QC:c,e]	Cont.	Cont.	Cont.
S95T003674		B	216	222	219			
S95T003675		C	482	429	455.5[QC:e]			
S95T003676		D	471	333	402[QC:e]			
S95T003677	116: 7	A	540	408	474[QC:e]			
S95T003678		B	442	334	388[QC:e]			
S95T003679		C	286	254	270[QC:e]			
S95T003680		D	7,660	7,660	7,660			
S95T003681	116: 8	A	12,000	11,500	11,750			
S95T003682		D	3,920	3,690	3,805			
S95T003761	117: 1	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003791		A	262	264	263			
S95T003792		D	659	664	661.5			
S95T003793	117: 3	C	2,300	2,720	2,510			
S95T003794	117: 5	A	246	248	247			
S95T003795		C	357	301	329[QC:e]			

Table A-9. Tank 241-BY-104 Analytical Results: Calcium. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 94.6	< 95.4	< 95.0	< 108	n/a	< 230
S95T003684		B	< 87.2	< 87.7	< 87.45			
S95T003685		C	< 88.6	< 88.9	< 88.75			
S95T003697	116: 7	D	< 89.3	< 89.3	< 89.3			
S95T003698	116: 8	A	< 196	< 204	< 200			
S95T003761	117: 1	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003813	117: 3	Upper ½	< 96.5	< 96.1	< 96.3			
S95T003798		C	< 95.0	< 96.2	< 95.6			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 2,260	< 2,110	< 2,185	< 2,190	n/a	< 4,730

Table A-10. Tank 241-BY-104 Analytical Results: Cerium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			μg/g	μg/g	μg/g	μg/g	%	kg
S95T003532	116: 2	A	< 85.9	< 90.6	< 88.25	< 62.4	n/a	< 135
S95T003533	116: 3	Lower ½	< 95.9	< 96.3	< 96.1			
S95T003666	116: 4	A	< 95.0	< 89.4	< 92.2			
S96T000604		B	< 56.0	< 49.9	< 52.95			
S96T000605		C	< 59.2	< 62.5	< 60.85			
S96T000606	116: 5	A	< 44.8	< 45.6	< 45.2			
S96T000607		B	< 43.2	< 37.1	< 40.15			
S96T000608		C	< 40.6	< 44.0	< 42.3			
S96T000609		D	< 50.2	< 48.3	< 49.25			
S95T003673	116: 6	A	< 48.6	< 48.0	< 48.3			
S95T003674		B	< 44.2	< 45.0	< 44.6			
S95T003675		C	< 50.0	< 50.3	< 50.15			
S95T003676		D	< 49.1	< 47.0	< 48.05			
S95T003677	116: 7	A	< 43.4	< 42.5	< 42.95			
S95T003678		B	< 50.2	< 48.9	< 49.55			
S95T003679		C	< 89.5	< 87.5	< 88.5			
S95T003680		D	< 51.3	< 51.4	< 51.35			
S95T003681	116: 8	A	< 44.5	< 46.0	< 45.25			
S95T003682		D	< 32.0	< 29.8	< 30.9			
S95T003761	117: 1	DL	< 85.7143	< 85.7143	< 85.7143			

Table A-10. Tank 241-BY-104 Analytical Results: Cerium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143	Cont.	Cont.	Cont.
S95T003791		A	< 61.7	< 61.3	< 61.5			
S95T003792		D	< 55.3	< 56.1	< 55.7			
S95T003793	117: 3	C	< 46.0	< 46.6	< 46.3			
S95T003794	117: 5	A	< 49.3	< 48.3	< 48.8			
S95T003795		C	< 47.1	< 48.6	< 47.85			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 94.6	< 95.4	< 95	< 108	n/a	< 230
S95T003684		B	< 87.2	< 87.7	< 87.45			
S95T003685		C	< 88.6	< 88.9	< 88.75			
S95T003697	116: 7	D	< 89.3	< 89.3	< 89.3			
S95T003698	116: 8	A	< 196	< 204	< 200			
S95T003761	117: 1	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003813	117: 3	Upper ½	< 96.5	< 96.1	< 96.3			
S95T003798		C	< 95.0	< 96.2	< 95.6			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 2,260	< 2,110	< 2,185	< 2,190	n/a	< 4,730

Table A-11. Tank 241-BY-104 Analytical Results: Chromium. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003531	116: 2	Upper ½	12,100	9,350	10,725	4,580	22.9	9,880
S95T003530		A	18,400	19,000	18,700			
S95T003700	116: 3	Upper ½	11,800	11,800	11,800			
S95T003701		Lower ½	4,290	4,280	4,285			
S95T003649	116: 4	A	2,960	2,850	2,905			
S95T003650		B	1,880	1,840	1,860			
S95T003651		C	1,590	1,620	1,605			
S95T003652	116: 5	A	2,190	2,310	2,250			
S95T003653		B	4,050	3,470	3,760			
S95T003654		C	4,340	3,370	3,855			
S95T003655		D	4,730	5,160	4,945			
S95T003656	116: 6	A	5,180	4,820	5,000			
S95T003657		B	4,770	4,760	4,765			
S95T003658		C	4,460	4,670	4,565			
S95T003659		D	4,480	4,070	4,275			
S95T003660	116: 7	A	4,770	5,390	5,080			
S95T003661		B	4,160	4,010	4,085			
S95T003662		C	3,420	3,740	3,580			
S95T003663		D	6,470	6,190	6,330			
S95T003664	116: 8	A	1,180	994	1,087			
S95T003665		D	966	1,310	1,138			

Table A-11. Tank 241-BY-104 Analytical Results: Chromium. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003771	117: 1	Upper ½	1,860	1,770	1,815	Cont.	Cont.	Cont.
S95T003761		DL	3,150	3,192.86	3,171.43			
S95T003775	117: 2	DL	2,757.14	2,728.57	2,742.86			
S95T003786		A	3,940	3,700	3,820			
S95T003787		D	17,000	16,200	16,600			
S95T003811	117: 3	Upper ½	2,280	2,270	2,275			
S95T003788		C	4,510	4,340	4,425			
S95T003812	117: 4	Upper ½	2,010	2,020	2,015			
S95T003789	117: 5	A	1,360	1,470	1,415			
S95T003790		C	1,690	1,800	1,745			
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	11,500	8,840	10,170[QC:d]	3,550	20.5	7,670
S95T003533	116: 3	Lower ½	4,300	4,070	4,185			
S95T003666	116: 4	A	3,000	2,800	2,900			
S96T000604		B	1,740	1,470	1,605			
S96T000605		C	1,320	1,400	1,360			
S96T000606	116: 5	A	1,770	1,580	1,675			
S96T000607		B	2,510	2,110	2,310			
S96T000608		C	2,850	3,030	2,940			
S96T000609		D	2,800	3,530	3,165			

Table A-11. Tank 241-BY-104 Analytical Results: Chromium. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003673	116: 6	A	4,140	4,180	4,160	Cont.	Cont.	Cont.
S95T003674		B	3,170	3,570	3,370			
S95T003675		C	3,120	3,500	3,310			
S95T003676		D	3,780	3,210	3,495			
S95T003677	116: 7	A	3,380	3,400	3,390			
S95T003678		B	2,570	2,980	2,775			
S95T003679		C	2,540	2,720	2,630			
S95T003680		D	5,160	5,060	5,110			
S95T003681	116: 8	A	1,070	1,090	1,080			
S95T003682		D	647	610	628.5			
S95T003761	117: 1	DL	3,150	3,192.86	3,171.43			
S95T003775	117: 2	DL	2,757.14	2,728.57	2,742.86			
S95T003791		A	2,620	2,440	2,530			
S95T003792		D	11,500	11,100	11,300			
S95T003793	117: 3	C	3,120	3,560	3,340			
S95T003794	117: 5	A	885	824	854.5			
S95T003795		C	1,210	956	1,083			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	2,900	3,090	2,995	1,430	38.0	3,090
S95T003684		B	2,100	1,690	1,895			
S95T003685		C	936	970	953			

Table A-11. Tank 241-BY-104 Analytical Results: Chromium. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			μg/g	μg/g	μg/g	μg/g	%	kg
S95T003697	116: 7	D	487	611	549[QC:e]	Cont.	Cont.	Cont.
S95T003698	116: 8	A	41.0	31.9	36.45[QC:e]			
S95T003813	117: 3	Upper ½	252	238	245			
S95T003798		C	79.1	78.8	78.95			
Core composite: fusion digest			μg/g	μg/g	μg/g	μg/g	%	kg
S96T000374	116	n/a	5,830	5,780	5,805	5,810	0.43	12,500

Table A-12. Tank 241-BY-104 Analytical Results: Cobalt. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	< 17.2	< 18.1	< 17.65	< 15.2	n/a	< 32.8
S95T003533	116: 3	Lower ½	< 19.2	< 19.3	< 19.25			
S95T003666	116: 4	A	< 19.0	< 17.9	< 18.45			
S96T000604		B	< 11.2	< 9.98	< 10.59			
S96T000605		C	< 11.8	< 12.5	< 12.15			
S96T000606	116: 5	A	< 8.96	< 9.13	< 9.045			
S96T000607		B	< 8.64	< 7.43	< 8.035			
S96T000608		C	10.7	< 8.81	9.755			
S96T000609		D	< 10.0	< 9.67	< 9.835			
S95T003673	116: 6	A	< 9.72	< 9.6	< 9.66			
S95T003674		B	< 8.85	< 8.99	< 8.92			
S95T003675		C	< 10.0	< 10.2	< 10.1			
S95T003676		D	11.0	< 9.4	10.2			
S95T003677	116: 7	A	11.3	12.0	11.65			
S95T003678		B	10.5	10.6	10.55			
S95T003679		C	< 17.9	< 17.5	< 17.7			
S95T003680		D	25.1	23.9	24.5			
S95T003681	116: 8	A	34.8	34.4	34.6			
S95T003682		D	10.4	9.75	10.075			

Table A-12. Tank 241-BY-104 Analytical Results: Cobalt. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003761	117: 1	DL	< 17.1	< 17.1	< 17.1	Cont.	Cont.	Cont.
S95T003775	117: 2	DL	< 17.1	< 17.1	< 17.1			
S95T003791		A	< 12.3	< 12.4	< 12.35			
S95T003792		D	26.6	27.0	26.8			
S95T003793	117: 3	C	12.5	15.3	13.9			
S95T003794	117: 5	A	< 9.86	< 9.65	< 9.755			
S95T003795		C	10.8	< 9.72	< 10.26			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 18.9	< 19.1	< 19.0	< 21.6	n/a	< 46.6
S95T003684		B	< 17.4	< 17.5	< 17.45			
S95T003685		C	< 17.7	< 17.8	< 17.75			
S95T003697	116: 7	D	< 17.9	< 17.9	< 17.9			
S95T003698	116: 8	A	< 39.2	< 40.7	< 39.95			
S95T003761	117: 1	DL	< 17.1	< 17.1	< 17.1			
S95T003775	117: 2	DL	< 17.1	< 17.1	< 17.1			
S95T003813	117: 3	Upper ½	< 19.3	< 19.2	< 19.25			
S95T003798		C	< 19.0	< 19.2	< 19.1			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 452	< 422	< 437	< 437	n/a	< 944

Table A-13. Tank 241-BY-104 Analytical Results: Copper. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	< 8.59	< 9.06	< 8.825	< 8.25	n/a	< 17.8
S95T003533	116: 3	Lower ½	< 9.59	< 9.63	< 9.61			
S95T003666	116: 4	A	< 9.50	< 8.94	< 9.22			
S96T000604		B	< 5.60	< 4.99	< 5.295			
S96T000605		C	< 5.92	< 6.25	< 6.085			
S96T000606	116: 5	A	8.77	8.24	8.505			
S96T000607		B	< 4.32	< 3.71	< 4.015			
S96T000608		C	8.89	< 4.40	6.645[QC:e]			
S96T000609		D	< 5.02	< 4.83	< 4.925			
S95T003673	116: 6	A	< 4.86	< 4.80	< 4.83			
S95T003674		B	< 4.42	< 4.50	< 4.46			
S95T003675		C	< 5.00	5.03	< 5.015			
S95T003676		D	< 4.91	< 4.70	< 4.805			
S95T003677	116: 7	A	< 4.34	< 4.25	< 4.295			
S95T003678		B	< 5.02	4.92	4.97			
S95T003679		C	< 8.95	< 8.75	< 8.85			
S95T003680		D	17.6	10.8	14.2[QC:e]			
S95T003681	116: 8	A	12.9	15.0	13.95			
S95T003682		D	33.7	31.5	32.6			
S95T003761	117: 1	DL	< 8.57143	< 8.57143	< 8.57143			

Table A-13. Tank 241-BY-104 Analytical Results: Copper. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003775	117: 2	DL	< 8.57143	< 8.57143	< 8.57143	Cont.	Cont.	Cont.
S95T003791		A	< 6.17	< 6.13	< 6.15			
S95T003792		D	9.97	13.6	11.785[QC:e]			
S95T003793	117: 3	C	5.35	< 4.66	5.005			
S95T003794	117: 5	A	< 4.93	< 4.83	< 4.88			
S95T003795		C	5.58	< 4.86	5.22			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 9.46	< 9.54	< 9.50	< 10.8	n/a	< 23.3
S95T003684		B	< 8.72	< 8.77	< 8.745			
S95T003685		C	< 8.86	< 8.89	< 8.875			
S95T003697	116: 7	D	< 8.93	< 8.93	< 8.93			
S95T003698	116: 8	A	< 19.6	< 20.4	< 20.0			
S95T003761	117: 1	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003775	117: 2	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003813	117: 3	Upper ½	< 9.65	< 9.61	< 9.63			
S95T003798		C	< 9.50	< 9.62	< 9.56			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 226	< 211	< 218.5	< 219	n/a	< 473

Table A-14. Tank 241-BY-104 Analytical Results: Iron. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			μg/g	μg/g	μg/g	μg/g	%	kg
S95T003531	116: 2	Upper ½	< 2,330	< 2,080	< 2,205	< 4,790	n/a	< 10,340
S95T003530		A	8,230	9,690	8,960			
S95T003700	116: 3	Upper ½	< 2,230	< 1,860	< 2,045			
S95T003701		Lower ½	< 2,290	< 1,750	< 2,020			
S95T003649	116: 4	A	993	1,060	1,026.5			
S95T003650		B	< 936	< 945	< 940.5			
S95T003651		C	< 922	< 915	< 918.5			
S95T003652	116: 5	A	< 951	< 940	< 945.5			
S95T003653		B	936	< 965	950.5			
S95T003654		C	< 986	< 1,010	< 998			
S95T003655		D	< 962	< 980	< 971			
S95T003656	116: 6	A	< 877	< 895	< 886			
S95T003657		B	< 910	< 889	< 899.5			
S95T003658		C	< 950	< 958	< 954			
S95T003659		D	< 1,020	< 994	< 1,007			
S95T003660	116: 7	A	1,130	1,130	1,130			
S95T003661		B	< 979	< 985	< 982			
S95T003662		C	< 866	< 923	< 894.5			
S95T003663		D	43,700	41,100	42,400			

Table A-14. Tank 241-BY-104 Analytical Results: Iron. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003664	116: 8	A	54,500	43,500	49,000	Cont.	Cont.	Cont.
S95T003665		D	15,300	12,400	13,850			
S95T003771	117: 1	Upper ½	< 2,510	< 2,530	< 2,520			
S95T003761		DL	< 42.8571	< 42.8571	< 42.8571			
S95T003775	117: 2	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003786		A	< 1,000	< 979	< 989.5			
S95T003787		D	2,390	2,300	2,345			
S95T003811	117: 3	Upper ½	937	933	935			
S95T003788		C	9,670	9,230	9,450			
S95T003812	117: 4	Upper ½	2,170	2,130	2,150			
S95T003789	117: 5	A	< 1,020	< 1,020	< 1,020			
S95T003790		C	1,190	1,120	1,155			
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	312	204	258[QC:c,e]	4,090	55.5	8,830
S95T003533	116: 3	Lower ½	798	704	751[QC:e]			
S95T003666	116: 4	A	882	822	852			
S96T000604		B	724	643	683.5[QC:c,e]			
S96T000605		C	765	809	787			

Table A-14. Tank 241-BY-104 Analytical Results: Iron. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000606	116: 5	A	501	474	487.5	Cont.	Cont.	Cont.
S96T000607		B	732	534	633[QC:e]			
S96T000608		C	539	588	563.5			
S96T000609		D	510	640	575[QC:e]			
S95T003673	116: 6	A	620	611	615.5[QC:c]			
S95T003674		B	416	456	436			
S95T003675		C	548	601	574.5			
S95T003676		D	839	690	764.5[QC:e]			
S95T003677	116: 7	A	973	978	975.5			
S95T003678		B	669	727	698			
S95T003679		C	706	745	725.5			
S95T003680		D	32,800	32,000	32,400			
S95T003681	116: 8	A	43,900	41,400	42,650			
S95T003682		D	12,700	11,900	12,300			
S95T003761	117: 1	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003775	117: 2	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003791		A	710	722	716[QC:d]			
S95T003792		D	1,980	1,830	1,905			
S95T003793	117: 3	C	7,700	9,250	8,475			
S95T003794	117: 5	A	708	752	730			
S95T003795		C	1,120	1,000	1,060			

Table A-14. Tank 241-BY-104 Analytical Results: Iron. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 47.3	< 47.7	< 47.5	< 53.9	n/a	< 116
S95T003684		B	< 43.6	< 43.9	< 43.75			
S95T003685		C	< 44.3	< 44.4	< 44.35			
S95T003697	116: 7	D	< 44.6	< 44.7	< 44.65			
S95T003698	116: 8	A	< 98.0	< 102	< 100			
S95T003761	117: 1	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003775	117: 2	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003813	117: 3	Upper ½	< 48.3	< 48.0	< 48.15			
S95T003798		C	< 47.5	< 48.1	< 47.8			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	1,640	2,720	2,180	2,180	24.8	4,710

Table A-15. Tank 241-BY-104 Analytical Results: Lanthanum. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	60.3	< 45.3	52.8[QC:e]	< 36.8	n/a	< 79.5
S95T003533	116: 3	Lower ½	< 47.1	< 48.2	< 47.65			
S95T003666	116: 4	A	< 47.5	< 44.7	< 46.1			
S96T000604		B	< 28.0	< 24.1	< 26.05			
S96T000605		C	< 29.6	< 31.2	< 30.4			
S96T000606	116: 5	A	< 22.4	< 22.8	< 22.6			
S96T000607		B	< 21.6	< 18.6	< 20.1			
S96T000608		C	< 20.3	< 22.0	< 21.15			
S96T000609		D	< 25.1	< 24.2	< 24.65			
S95T003673	116: 6	A	< 24.3	< 24.0	< 24.15			
S95T003674		B	< 22.1	< 22.5	< 22.3			
S95T003675		C	< 25.0	< 25.1	< 25.05			
S95T003676		D	< 24.7	< 23.5	< 24.1			
S95T003677	116: 7	A	< 21.7	< 21.4	< 21.55			
S95T003678		B	< 25.1	< 24.4	< 24.75			
S95T003679		C	< 44.8	< 43.9	< 44.35			
S95T003680		D	82.3	81.0	81.65			

Table A-15. Tank 241-BY-104 Analytical Results: Lanthanum. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003681	116: 8	A	106	103	104.5	Cont.	Cont.	Cont.
S95T003682		D	41.2	38.3	39.75			
S95T003761	117: 1	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003775	117: 2	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003791		A	< 30.8	< 30.6	< 30.7			
S95T003792		D	< 27.6	< 28.0	< 27.8			
S95T003793	117: 3	C	< 23.0	25.9	< 24.45			
S95T003794	117: 5	A	< 24.6	< 24.1	< 24.35			
S95T003795		C	< 23.5	< 24.3	< 23.9			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 47.3	< 47.7	< 47.5	< 53.9	n/a	< 116
S95T003684		B	< 43.6	< 43.9	< 43.75			
S95T003685		C	< 44.3	< 44.4	< 44.35			
S95T003697	116: 7	D	< 44.6	< 44.7	< 44.65			
S95T003698	116: 8	A	< 98.0	< 102	< 100			
S95T003761	117: 1	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003775	117: 2	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003813	117: 3	Upper ½	< 48.3	< 48.0	< 48.15			
S95T003798		C	< 47.5	< 48.1	< 47.8			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 1,130	< 1,050	< 1,090	< 1,090	n/a	< 2,350

Table A-16. Tank 241-BY-104 Analytical Results: Lead. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	< 85.9	< 90.6	< 88.25	190	35.3	410
S95T003533	116: 3	Lower ½	< 95.9	< 96.3	< 96.1			
S95T003666	116: 4	A	< 95.0	92.6	< 93.8			
S96T000604		B	71.8	70.5	71.15			
S96T000605		C	85.9	85.1	85.5			
S96T000606	116: 5	A	72.9	55.7	64.3[QC:e]			
S96T000607		B	77.2	51.3	64.25[QC:e]			
S96T000608		C	78.2	66.6	72.4			
S96T000609		D	56.3	62.7	59.5			
S95T003673	116: 6	A	84.1	79.7	81.9			
S95T003674		B	71.8	75.4	73.6			
S95T003675		C	62.0	67.1	64.55			
S95T003676		D	104	77.6	90.8[QC:e]			
S95T003677	116: 7	A	82.1	82.9	82.5			
S95T003678		B	75.7	71.4	73.55			
S95T003679		C	< 89.5	< 87.5	< 88.5			
S95T003680		D	1,090	1,070	1,080			

Table A-16. Tank 241-BY-104 Analytical Results: Lead. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003681	116: 8	A	1,130	1,080	1,105	Cont.	Cont.	Cont.
S95T003682		D	503	477	490			
S95T003761	117: 1	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003791		A	82.8	92.1	87.45			
S95T003792		D	219	215	217			
S95T003793	117: 3	C	321	383	352			
S95T003794	117: 5	A	57.5	55.6	56.55			
S95T003795		C	79.6	77.1	78.35			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 94.6	< 95.4	< 95.0	< 108	n/a	< 233
S95T003684		B	< 87.2	< 87.7	< 87.45			
S95T003685		C	< 88.6	< 88.9	< 88.75			
S95T003697	116: 7	D	< 89.3	< 89.3	< 89.3			
S95T003698	116: 8	A	< 196	< 204	< 200			
S95T003761	117: 1	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003813	117: 3	Upper ½	< 96.5	< 96.1	< 96.3			
S95T003798		C	< 95.0	< 96.2	< 95.6			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 2,260	< 2,110	< 2,185	< 2,190	n/a	< 4,730

Table A-17. Tank 241-BY-104 Analytical Results: Magnesium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	< 85.9	< 90.6	< 88.25	< 165	n/a	< 356
S95T003533	116: 3	Lower ½	< 95.9	< 96.3	< 96.1			
S95T003666	116: 4	A	< 95.0	< 89.4	< 92.2			
S96T000604		B	< 56.0	< 49.9	< 52.95			
S96T000605		C	< 59.2	< 62.5	< 60.85			
S96T000606	116: 5	A	< 44.8	< 45.6	< 45.2			
S96T000607		B	< 43.2	< 37.1	< 40.15			
S96T000608		C	< 40.6	< 44.0	< 42.3			
S96T000609		D	< 50.2	< 48.3	< 49.25			
S95T003673	116: 6	A	< 48.6	< 48.0	< 48.3			
S95T003674		B	< 44.2	< 45.0	< 44.6			
S95T003675		C	< 50.0	< 50.3	< 50.15			
S95T003676		D	< 49.1	< 47.0	< 48.05			
S95T003677	116: 7	A	< 43.4	< 42.5	< 42.95			
S95T003678		B	< 50.2	< 48.9	< 49.55			
S95T003679		C	< 89.5	< 87.5	< 88.5			
S95T003680		D	969	953	961			

Table A-17. Tank 241-BY-104 Analytical Results: Magnesium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003681	116: 8	A	1,340	1,260	1,300	Cont.	Cont.	Cont.
S95T003682		D	389	366	377.5			
S95T003761	117: 1	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003791		A	< 61.7	< 61.3	< 61.5			
S95T003792		D	< 55.3	57.6	56.45			
S95T003793	117: 3	C	254	304	279			
S95T003794	117: 5	A	< 49.3	< 48.3	< 48.8			
S95T003795		C	< 47.1	< 48.6	< 47.85			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 94.6	< 95.4	< 95.0	< 108	n/a	< 233
S95T003684		B	< 87.2	< 87.7	< 87.45			
S95T003685		C	< 88.6	< 88.9	< 88.75			
S95T003697	116: 7	D	< 89.3	< 89.3	< 89.3			
S95T003698	116: 8	A	< 196	< 204	< 200			
S95T003761	117: 1	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003813	117: 3	Upper ½	< 96.5	< 96.1	< 96.3			
S95T003798		C	< 95.0	< 96.2	< 95.6			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 2,260	< 2,110	< 2,185	< 2,190	n/a	< 4,730

Table A-18. Tank 241-BY-104 Analytical Results: Manganese. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003531	116: 2	Upper ½	< 466	< 415	< 440.5[QC:e]	< 223	n/a	< 482
S95T003530		A	345	499	422[QC:e]			
S95T003700	116: 3	Upper ½	< 447	< 372	< 409.5[QC:e]			
S95T003701		Lower ½	< 459	< 347	< 403[QC:e]			
S95T003649	116: 4	A	< 175	< 184	< 179.5			
S95T003650		B	< 187	< 189	< 188			
S95T003651		C	< 184	< 183	< 183.5			
S95T003652	116: 5	A	< 190	< 188	< 189			
S95T003653		B	< 187	< 193	< 190			
S95T003654		C	< 197	< 202	< 199.5			
S95T003655		D	< 192	< 196	< 194			
S95T003656	116: 6	A	< 175	< 179	< 177			
S95T003657		B	< 182	< 178	< 180			
S95T003658		C	< 190	< 192	< 191			
S95T003659		D	< 204	< 199	< 201.5			
S95T003660	116: 7	A	< 205	< 204	< 204.5			
S95T003661		B	< 196	< 197	< 196.5			
S95T003662		C	< 173	< 185	< 179			
S95T003663		D	667	626	646.5			
S95T003664	116: 8	A	769	643	706[QC:e]			
S95T003665		D	235	195	215[QC:e]			

Table A-18. Tank 241-BY-104 Analytical Results: Manganese. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003771	117: 1	Upper ½	< 502	< 507	< 504.5	Cont.	Cont.	Cont.
S95T003761		DL	< 8.57143	< 8.57143	< 8.57143			
S95T003775	117: 2	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003786		A	< 201	< 196	< 198.5			
S95T003787		D	< 196	< 196	< 196			
S95T003811	117: 3	Upper ½	< 183	< 184	< 183.5			
S95T003788		C	< 198	< 198	< 198			
S95T003812	117: 4	Upper ½	< 198	< 202	< 200			
S95T003789	117: 5	A	< 203	< 203	< 203			
S95T003790		C	< 191	< 191	< 191			
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	81.2	9.62	45.41[QC:c,e]	77.1	38.6	166
S95T003533	116: 3	Lower ½	35.8	33.4	34.60			
S95T003666	116: 4	A	46.2	43.2	44.7			
S96T000604		B	38.3	33.4	35.85[QC:c,e]			
S96T000605		C	33.8	36.0	34.9			
S96T000606	116: 5	A	22.6	21.1	21.85			
S96T000607		B	27.9	22.7	25.3[QC:e]			
S96T000608		C	27.9	25.5	26.7			
S96T000609		D	26.0	33.2	29.6[QC:e]			

Table A-18. Tank 241-BY-104 Analytical Results: Manganese. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003673	116: 6	A	31.6	31.4	31.5[QC:c]	Cont.	Cont.	Cont.
S95T003674		B	20.0	22.7	21.35[QC:e]			
S95T003675		C	26.0	29.4	27.7[QC:e]			
S95T003676		D	35.8	29.8	32.8[QC:e]			
S95T003677	116: 7	A	38.4	38.6	38.5			
S95T003678		B	28.4	32.8	30.6[QC:e]			
S95T003679		C	30.7	33.9	32.3			
S95T003680		D	506	499	502.5			
S95T003681	116: 8	A	597	575	586			
S95T003682		D	170	151	160.5[QC:e]			
S95T003761		DL	< 8.57143	< 8.57143	< 8.57143			
S95T003775	117: 2	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003791		A	22.6	22.1	22.35[QC:c]			
S95T003792		D	72.6	67.1	69.85			
S95T003793	117: 3	C	114	137	125.5[QC:e]			
S95T003794	117: 5	A	42.5	44.0	43.25			
S95T003795		C	60.3	52.2	56.25[QC:e]			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 9.46	< 9.54	< 9.50	< 10.8	n/a	< 23.3
S95T003684		B	< 8.72	< 8.77	< 8.745			
S95T003685		C	< 8.86	< 8.89	< 8.875			

Table A-18. Tank 241-BY-104 Analytical Results: Manganese. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S95T003697	116: 7	D	< 8.93	< 8.93	< 8.93	Cont.	Cont.	Cont.
S95T003698	116: 8	A	< 19.6	< 20.4	< 20.0			
S95T003813	117: 3	Upper ½	< 9.65	< 9.61	< 9.63			
S95T003798		C	< 9.50	< 9.62	< 9.56			
Core composite: fusion digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S96T000374	116	n/a	< 226	< 211	< 218.5	< 219	n/a	< 473

Table A-19. Tank 241-BY-104 Analytical Results: Molybdenum. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	< 42.9	< 45.3	< 44.1	36.5	10.3	78.8
S95T003533	116: 3	Lower ½	< 47.1	< 48.2	< 47.65			
S95T003666	116: 4	A	< 47.5	< 44.7	< 46.1			
S96T000604		B	29.4	25.1	27.25			
S96T000605		C	< 29.6	< 31.2	< 30.4			
S96T000606	116: 5	A	30.5	24.3	27.4[QC:e]			
S96T000607		B	26.5	20.7	23.6[QC:e]			
S96T000608		C	34.4	28.4	31.4			
S96T000609		D	< 25.1	26.6	25.85			
S95T003673	116: 6	A	34.3	34.0	34.15			
S95T003674		B	34.5	35.5	35.0			
S95T003675		C	29.5	30.7	30.1			
S95T003676		D	31.5	29.7	30.6			
S95T003677	116: 7	A	28.3	28.3	28.3			
S95T003678		B	30.6	29.0	29.8			
S95T003679		C	< 44.8	< 43.9	< 44.35			
S95T003680		D	< 25.7	< 25.7	< 25.7			
S95T003681	116: 8	A	< 22.2	< 23.0	< 22.6			
S95T003682		D	18.6	18.0	18.3			

Table A-19. Tank 241-BY-104 Analytical Results: Molybdenum. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003761	117: 1	DL	64.4286	62.7857	63.6071	Cont.	Cont.	Cont.
S95T003775	117: 2	DL	68.8571	67.5714	68.2143			
S95T003791		A	< 30.8	< 30.6	< 30.7			
S95T003792		D	33.5	31.4	32.45			
S95T003793	117: 3	C	23.4	27.1	25.25			
S95T003794	117: 5	A	< 24.6	< 24.1	< 24.35			
S95T003795		C	< 23.5	< 24.3	< 23.9			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 47.3	< 47.7	< 47.5	< 61.6	n/a	< 133
S95T003684		B	< 43.6	< 43.9	< 43.75			
S95T003685		C	< 44.3	< 44.4	< 44.35			
S95T003697	116: 7	D	< 44.6	< 44.7	< 44.65			
S95T003698	116: 8	A	< 98.0	< 102	< 100			
S95T003761	117: 1	DL	64.4286	62.7857	63.6071			
S95T003775	117: 2	DL	68.8571	67.5714	68.2143			
S95T003813	117: 3	Upper ½	< 48.3	< 48.0	< 48.15			
S95T003798		C	< 47.5	< 48.1	< 47.8			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 1,130	< 1,050	< 1,090	< 1,090	n/a	< 2,350

Table A-20. Tank 241-BY-104 Analytical Results: Neodymium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	< 85.9	< 90.6	< 88.25	< 71.2	n/a	< 154
S95T003533	116: 3	Lower ½	< 95.9	< 96.3	< 96.1			
S95T003666	116: 4	A	< 95.0	< 89.4	< 92.2			
S96T000604		B	< 56.0	< 49.9	< 52.95			
S96T000605		C	< 59.2	< 62.5	< 60.85			
S96T000606	116: 5	A	< 44.8	< 45.6	< 45.2			
S96T000607		B	< 43.2	< 37.1	< 40.15			
S96T000608		C	< 40.6	< 44.0	< 42.3			
S96T000609		D	< 50.2	< 48.3	< 49.25			
S95T003673	116: 6	A	< 48.6	< 48.0	< 48.3			
S95T003674		B	< 44.2	< 45.0	< 44.6			
S95T003675		C	< 50.0	< 50.3	< 50.15			
S95T003676		D	< 49.1	< 47.0	< 48.05			
S95T003677	116: 7	A	< 43.4	< 42.5	< 42.95			
S95T003678		B	< 50.2	< 48.9	< 49.55			
S95T003679		C	< 89.5	< 87.5	< 88.5			
S95T003680		D	157	157	157			
S95T003681	116: 8	A	201	196	198.5			
S95T003682		D	71.8	66.6	69.2			

Table A-20. Tank 241-BY-104 Analytical Results: Neodymium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003761	117: 1	DL	< 85.7143	< 85.7143	< 85.7143	Cont.	Cont.	Cont.
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003791		A	< 61.7	< 61.3	< 61.5			
S95T003792		D	< 55.3	< 56.1	< 55.7			
S95T003793	117: 3	C	< 46.0	< 46.6	< 46.3			
S95T003794	117: 5	A	< 49.3	< 48.3	< 48.8			
S95T003795		C	< 47.1	< 48.6	< 47.85			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 94.6	< 95.4	< 95.0	< 108	n/a	< 233
S95T003684		B	< 87.2	< 87.7	< 87.45			
S95T003685		C	< 88.6	< 88.9	< 88.75			
S95T003697	116: 7	D	< 89.3	< 89.3	< 89.3			
S95T003698	116: 8	A	< 196	< 204	< 200			
S95T003761	117: 1	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003813	117: 3	Upper ½	< 96.5	< 96.1	< 96.3			
S95T003798		C	< 95.0	< 96.2	< 95.6			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 2,260	< 2,110	< 2,185	< 2,190	n/a	< 4,730

Table A-21. Tank 241-BY-104 Analytical Results: Nickel. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003531	116: 2	Upper ½	< 931	< 831	< 881[QC:e]	< 2,180	n/a	< 4,710
S95T003530		A	1,420	1,640	1,530			
S95T003700	116: 3	Upper ½	< 893	< 744	< 818.5[QC:e]			
S95T003701		Lower ½	< 915	< 694	< 804.5[QC:e]			
S95T003649	116: 4	A	< 350	< 367	< 358.5			
S95T003650		B	< 374	< 378	< 376			
S95T003651		C	< 369	< 366	< 367.5			
S95T003652	116: 5	A	< 380	< 376	< 378			
S95T003653		B	< 374	< 385	< 379.5			
S95T003654		C	< 394	< 405	< 399.5			
S95T003655		D	< 385	< 392	< 388.5			
S95T003656	116: 6	A	< 351	< 358	< 354.5			
S95T003657		B	< 364	< 356	< 360			
S95T003658		C	< 380	< 383	< 381.5			
S95T003659		D	< 409	< 398	< 403.5			
S95T003660	116: 7	A	411	452	431.5			
S95T003661		B	< 391	< 394	< 392.5			
S95T003662		C	< 346	< 369	< 357.5			
S95T003663		D	12,000	11,400	11,700			

Table A-21. Tank 241-BY-104 Analytical Results: Nickel. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003664	116: 8	A	14,500	12,500	13,500	Cont.	Cont.	Cont.
S95T003665		D	5,730	5,560	5,645			
S95T003771	117: 1	Upper ½	18,800	13,700	16,250			
S95T003761		DL	< 17.1	< 17.1	< 17.1			
S95T003775	117: 2	DL	< 17.1	< 17.1	< 17.1			
S95T003786		A	< 402	< 392	< 397			
S95T003787		D	767	766	766.5			
S95T003811	117: 3	Upper ½	3,970	5,260	4,615			
S95T003788		C	2,690	2,500	2,595			
S95T003812	117: 4	Upper ½	4,010	5,100	4,555			
S95T003789	117: 5	A	< 407	< 407	< 407			
S95T003790		C	< 382	< 382	< 382			
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	87.1	62.7	74.9[QC:e]	1,160	56.4	2,510
S95T003533	116: 3	Lower ½	225	199	212[QC:e]			
S95T003666	116: 4	A	253	243	248			
S96T000604		B	209	182	195.5[QC:c,e]			
S96T000605		C	220	234	227			

Table A-21. Tank 241-BY-104 Analytical Results: Nickel. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000606	116: 5	A	133	126	129.5	Cont.	Cont.	Cont.
S96T000607		B	216	149	182.5[QC:e]			
S96T000608		C	156	164	160			
S96T000609		D	143	171	157[QC:e]			
S95T003673	116: 6	A	179	176	177.5[QC:e]			
S95T003674		B	126	132	129			
S95T003675		C	158	170	164			
S95T003676		D	240	196	218[QC:e]			
S95T003677	116: 7	A	269	262	265.5			
S95T003678		B	193	191	192			
S95T003679		C	206	213	209.5			
S95T003680		D	9,540	9,480	9,510			
S95T003681	116: 8	A	11,400	11,000	11,200			
S95T003682		D	5,000	4,680	4,840			
S95T003761	117: 1	DL	< 17.1	< 17.1	< 17.1			
S95T003775	117: 2	DL	< 17.1	< 17.1	< 17.1			
S95T003791		A	141	143	142			
S95T003792		D	534	538	536			
S95T003793	117: 3	C	2,050	2,460	2,255			
S95T003794	117: 5	A	184	207	195.5[QC:e]			
S95T003795		C	303	270	286.5[QC:e]			

Table A-21. Tank 241-BY-104 Analytical Results: Nickel. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 18.9	< 19.1	< 19.0	< 21.6	n/a	< 46.6
S95T003684		B	< 17.4	< 17.5	< 17.45			
S95T003685		C	< 17.7	< 17.8	< 17.75			
S95T003697	116: 7	D	< 17.9	< 17.9	< 17.9			
S95T003698	116: 8	A	< 39.2	< 40.7	< 39.95			
S95T003813	117: 3	Upper ½	< 19.3	< 19.2	< 19.25			
S95T003798		C	< 19.0	< 19.2	< 19.1			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 452	< 422	< 437	< 437	n/a	< 944

Table A-22. Tank 241-BY-104 Analytical Results: Phosphorus. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003531	116: 2	Upper ½	20,000	18,600	19,300	< 4,980	n/a	< 10,750
S95T003530		A	9,810	4,110	6,960			
S95T003700	116: 3	Upper ½	< 8,930	< 7,440	< 8,185			
S95T003701		Lower ½	< 9,150	< 6,940	< 8,045			
S95T003649	116: 4	A	< 3,500	< 3,670	< 3,585			
S95T003650		B	< 3,740	< 3,780	< 3,760			
S95T003651		C	< 3,690	< 3,660	< 3,675			
S95T003652	116: 5	A	< 3,800	< 3,760	< 3,780			
S95T003653		B	< 3,740	< 3,850	< 3,795			
S95T003654		C	< 3,940	< 4,050	< 3,995			
S95T003655		D	< 3,850	< 3,920	< 3,885			
S95T003656	116: 6	A	< 3,510	< 3,580	< 3,545			
S95T003657		B	< 3,640	< 3,560	< 3,600			
S95T003658		C	< 3,800	< 3,830	< 3,815			
S95T003659		D	< 4,090	< 3,980	< 4,035			
S95T003660	116: 7	A	< 4,090	< 4,090	< 4,090			
S95T003661		B	< 3,910	< 3,940	< 3,925			
S95T003662		C	< 3,460	< 3,690	< 3,575			
S95T003663		D	8,330	8,030	8,180			
S95T003664	116: 8	A	11,900	< 8,850	10,375			
S95T003665		D	4,110	4,660	4,385			

Table A-22. Tank 241-BY-104 Analytical Results: Phosphorus. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003771	117: 1	Upper ½	< 10,000	< 10,100	< 10,050	Cont.	Cont.	Cont.
S95T003761		DL	273.571	274.286	273.929			
S95T003775	117: 2	DL	319.286	325.714	322.5			
S95T003786		A	4,620	< 3,920	4,270			
S95T003787		D	7,650	10,100	8,875			
S95T003811	117: 3	Upper ½	4,580	< 3,690	4,135			
S95T003788		C	< 3,970	< 3,970	< 3,970			
S95T003812	117: 4	Upper ½	< 3,960	< 4,030	< 3,995			
S95T003789	117: 5	A	< 4,070	< 4,070	< 4,070			
S95T003790		C	< 3,820	< 3,820	< 3,820			
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	10,600	19,200	14,900	3,560	33.1	7,690
S95T003533	116: 3	Lower ½	2,810	3,100	2,955			
S95T003666	116: 4	A	1,970	3,900	2,935			
S96T000604		B	2,170	1,340	1,755			
S96T000605		C	905	951	928[QC:a]			
S96T000606	116: 5	A	794	713	753.5[QC:a]			
S96T000607		B	883	699	791[QC:a,e]			
S96T000608		C	808	781	794.5[QC:a]			
S96T000609		D	742	849	795.5[QC:a,e]			

Table A-22. Tank 241-BY-104 Analytical Results: Phosphorus. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003673	116: 6	A	1,030	981	1,005.5	Cont.	Cont.	Cont.
S95T003674		B	892	925	908.5			
S95T003675		C	870	947	908.5			
S95T003676		D	1,040	900	970[QC:e]			
S95T003677	116: 7	A	1,090	1,050	1,070			
S95T003678		B	1,850	1,990	1,920			
S95T003679		C	1,270	1,340	1,305			
S95T003680		D	9,220	8,140	8,680			
S95T003681	116: 8	A	12,700	12,500	12,600			
S95T003682		D	6,060	5,800	5,930			
S95T003761	117: 1	DL	273.571	274.286	273.929			
S95T003775	117: 2	DL	319.286	325.714	322.5			
S95T003791		A	3,800	3,930	3,865			
S95T003792		D	8,710	6,470	7,590			
S95T003793	117: 3	C	3,620	3,650	3,635			
S95T003794	117: 5	A	1,420	1,690	1,555			
S95T003795		C	705	609	657[QC:e]			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	1,970	1,960	1,965	1,360	27.3	2,940
S95T003684		B	2,420	2,660	2,540			
S95T003685		C	1,260	984	1,122			

Table A-22. Tank 241-BY-104 Analytical Results: Phosphorus. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003697	116: 7	D	1,440	2,070	1,755	Cont.	Cont.	Cont.
S95T003698	116: 8	A	< 392	1,670	1,031			
S95T003761	117: 1	DL	273.571	274.286	273.929			
S95T003775	117: 2	DL	319.286	325.714	322.5			
S95T003813	117: 3	Upper ½	3,930	3,990	3,960			
S95T003798		C	1,520	2,090	1,805			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 452	< 422	< 437	< 437	n/a	< 944

Table A-23. Tank 241-BY-104 Analytical Results: Potassium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	1,400	1,160	1,280	3,390	22.4	7,320
S95T003533	116: 3	Lower ½	1,250	1,290	1,270			
S95T003666	116: 4	A	3,290	3,090	3,190			
S96T000604		B	3,620	2,950	3,285			
S96T000605		C	3,060	3,210	3,135			
S96T000606	116: 5	A	3,490	2,720	3,105			
S96T000607		B	3,160	2,430	2,795			
S96T000608		C	3,510	3,440	3,475			
S96T000609		D	2,820	3,300	3,060			
S95T003673	116: 6	A	3,720	3,840	3,780			
S95T003674		B	3,710	3,990	3,850			
S95T003675		C	3,060	3,330	3,195			
S95T003676		D	3,480	3,060	3,270			
S95T003677	116: 7	A	3,410	3,250	3,330			
S95T003678		B	3,400	3,270	3,335			
S95T003679		C	3,560	3,720	3,640			
S95T003680		D	3,180	3,230	3,205			
S95T003681	116: 8	A	2,660	2,620	2,640			
S95T003682		D	2,840	2,580	2,710			

Table A-23. Tank 241-BY-104 Analytical Results: Potassium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003761	117: 1	DL	6,800	7,007.14	6,903.57	Cont.	Cont.	Cont.
S95T003775	117: 2	DL	7,500	7,357.14	7,428.57			
S95T003791		A	2,710	2,500	2,605			
S95T003792		D	3,630	3,600	3,615			
S95T003793	117: 3	C	2,840	3,270	3,055			
S95T003794	117: 5	A	1,970	2,020	1,995			
S95T003795		C	2,290	2,350	2,320			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	3,210	3,500	3,355	4,660	29.5	10,060
S95T003684		B	4,580	3,670	4,125			
S95T003685		C	3,570	3,700	3,635			
S95T003697	116: 7	D	2,780	3,480	3,130			
S95T003698	116: 8	A	3,010	2,960	2,985			
S95T003761	117: 1	DL	6,800	7,007.14	6,903.57			
S95T003775	117: 2	DL	7,500	7,357.14	7,428.57			
S95T003813	117: 3	Upper ½	4,030	3,770	3,900			
S95T003798		C	3,820	3,550	3,685			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	7.310E+06	---	7.310E+06[1]	n/a	n/a	n/a

Note:

[1]Because potassium is used in the digestion procedure (KOH fusion), this number is not valid and is being thrown out.

Table A-24. Tank 241-BY-104 Analytical Results: Samarium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	< 85.9	< 90.6	< 88.25	< 62.4	n/a	< 135
S95T003533	116: 3	Lower ½	< 95.9	< 96.3	< 96.1			
S95T003666	116: 4	A	< 95.0	< 89.4	< 92.2			
S96T000604		B	< 56.0	< 49.9	< 52.95			
S96T000605		C	< 59.2	< 62.5	< 60.85			
S96T000606	116: 5	A	< 44.8	< 45.6	< 45.2			
S96T000607		B	< 43.2	< 37.1	< 40.15			
S96T000608		C	< 40.6	< 44	< 42.3			
S96T000609		D	< 50.2	< 48.3	< 49.25			
S95T003673	116: 6	A	< 48.6	< 48.0	< 48.3			
S95T003674		B	< 44.2	< 45.0	< 44.6			
S95T003675		C	< 50.0	< 50.3	< 50.15			
S95T003676		D	< 49.1	< 47.0	< 48.05			
S95T003677	116: 7	A	< 43.4	< 42.5	< 42.95			
S95T003678		B	< 50.2	< 48.9	< 49.55			
S95T003679		C	< 89.5	< 87.5	< 88.5			
S95T003680		D	< 51.3	< 51.4	< 51.35			

Table A-24. Tank 241-BY-104 Analytical Results: Samarium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003681	116: 8	A	< 44.5	< 46.0	< 45.25	Cont.	Cont.	Cont.
S95T003682		D	< 32.0	< 29.8	< 30.9			
S95T003761	117: 1	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003791		A	< 61.7	< 61.3	< 61.5			
S95T003792		D	< 55.3	< 56.1	< 55.7			
S95T003793	117: 3	C	< 46.0	< 46.6	< 46.3			
S95T003794	117: 5	A	< 49.3	< 48.3	< 48.8			
S95T003795		C	< 47.1	< 48.6	< 47.85			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 94.6	< 95.4	< 95.0	< 108	n/a	< 233
S95T003684		B	< 87.2	< 87.7	< 87.45			
S95T003685		C	< 88.6	< 88.9	< 88.75			
S95T003697	116: 7	D	< 89.3	< 89.3	< 89.3			
S95T003698	116: 8	A	< 196	< 204	< 200			
S95T003761	117: 1	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003813	117: 3	Upper ½	< 96.5	< 96.1	< 96.3			
S95T003798		C	< 95.0	< 96.2	< 95.6			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 2,260	< 2,110	< 2,185	< 2,190	n/a	< 4,730

Table A-25. Tank 241-BY-104 Analytical Results: Selenium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	< 85.9	< 90.6	< 88.25	< 62.8	n/a	< 136
S95T003533	116: 3	Lower ½	101	99.3	100.15			
S95T003666	116: 4	A	95.6	94.3	94.95			
S96T000604		B	< 56.0	< 49.9	< 52.95			
S96T000605		C	< 59.2	< 62.5	< 60.85			
S96T000606	116: 5	A	< 44.8	< 45.6	< 45.2			
S96T000607		B	< 43.2	< 37.1	< 40.15			
S96T000608		C	< 40.6	< 44.0	< 42.3			
S96T000609		D	< 50.2	< 48.3	< 49.25			
S95T003673	116: 6	A	< 48.6	< 48.0	< 48.3			
S95T003674		B	< 44.2	< 45.0	< 44.6			
S95T003675		C	< 50.0	< 50.3	< 50.15			
S95T003676		D	< 49.1	< 47.0	< 48.05			
S95T003677	116: 7	A	< 43.4	< 42.5	< 42.95			
S95T003678		B	< 50.2	< 48.9	< 49.55			
S95T003679		C	91.4	89.7	90.55			
S95T003680		D	52.6	< 51.4	52			

Table A-25. Tank 241-BY-104 Analytical Results: Selenium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003681	116: 8	A	< 44.5	< 46	< 45.25	Cont.	Cont.	Cont.
S95T003682		D	< 32.0	< 29.8	< 30.9			
S95T003761	117: 1	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003791		A	< 61.7	< 61.3	< 61.5			
S95T003792		D	< 55.3	< 56.1	< 55.7			
S95T003793	117: 3	C	< 46.0	< 46.6	< 46.3			
S95T003794	117: 5	A	< 49.3	< 48.3	< 48.8			
S95T003795		C	< 47.1	< 48.6	< 47.85			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 94.6	< 95.4	< 95.0	< 108	n/a	< 233
S95T003684		B	< 87.2	< 87.7	< 87.45			
S95T003685		C	< 88.6	< 88.9	< 88.75			
S95T003697	116: 7	D	< 89.3	< 89.3	< 89.3			
S95T003698	116: 8	A	< 196	< 204	< 200			
S95T003761	117: 1	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003775	117: 2	DL	< 85.7143	< 85.7143	< 85.7143			
S95T003813	117: 3	Upper ½	< 96.5	< 96.1	< 96.3			
S95T003798		C	< 95.0	< 96.2	< 95.6			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 2,260	< 2,110	< 2,185	< 2,190	n/a	< 4,730

Table A-26. Tank 241-BY-104 Analytical Results: Silicon. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003531	116: 2	Upper ½	< 2,330	< 2,080	< 2,205	< 1,220	n/a	< 2,630
S95T003530		A	1,480	1,570	1,525			
S95T003700	116: 3	Upper ½	< 2,230	< 1,860	< 2,045			
S95T003701		Lower ½	< 2,290	< 1,750	< 2,020			
S95T003649	116: 4	A	< 875	< 919	< 897			
S95T003650		B	< 936	< 945	< 940.5			
S95T003651		C	< 922	< 915	< 918.5			
S95T003652	116: 5	A	< 951	< 940	< 945.5			
S95T003653		B	< 934	< 965	< 949.5			
S95T003654		C	< 986	< 1,010	< 998			
S95T003655		D	< 962	< 980	< 971			
S95T003656	116: 6	A	< 877	< 895	< 886			
S95T003657		B	< 910	< 889	< 899.5			
S95T003658		C	< 950	< 958	< 954			
S95T003659		D	< 1,020	< 994	< 1,007			
S95T003660	116: 7	A	< 1,020	< 1,020	< 1,020			
S95T003661		B	< 979	< 985	< 982			
S95T003662		C	1,740	< 923	1,331.5			
S95T003663		D	3,270	3,230	3,250			

Table A-26. Tank 241-BY-104 Analytical Results: Silicon. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003664	116: 8	A	3,780	3,440	3,610	Cont.	Cont.	Cont.
S95T003665		D	2,600	2,780	2,690			
S95T003771	117: 1	Upper ½	< 2,510	< 2,530	< 2,520			
S95T003761		DL	69.4286	64.2143	66.8214			
S95T003775	117: 2	DL	73.5714	79.2857	76.4286			
S95T003786		A	< 1,000	< 979	< 989.5			
S95T003787		D	< 979	< 979	< 979			
S95T003811	117: 3	Upper ½	996	< 919	957.5			
S95T003788		C	< 992	1,100	1,046			
S95T003812	117: 4	Upper ½	< 989	< 1,010	< 999.5			
S95T003789	117: 5	A	< 1,020	< 1,020	< 1,020			
S95T003790		C	< 956	< 956	< 956			
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	525	1,180	852.5[QC:b,d,e]	434	36.1	937
S95T003533	116: 3	Lower ½	324	394	359[QC:b,e]			
S95T003666	116: 4	A	273	343	308[QC:b,e]			
S96T000604		B	297	267	282[QC:c]			
S96T000605		C	569	606	587.5			

Table A-26. Tank 241-BY-104 Analytical Results: Silicon. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000606	116: 5	A	288	190	239[QC:e]	Cont.	Cont.	Cont.
S96T000607		B	208	171	189.5[QC:e]			
S96T000608		C	219	266	242.5[QC:e]			
S96T000609		D	262	350	306[QC:e]			
S95T003673	116: 6	A	161	161	161[QC:b,c]			
S95T003674		B	114	130	122[QC:b,e]			
S95T003675		C	157	167	162[QC:b]			
S95T003676		D	236	183	209.5[QC:b,e]			
S95T003677	116: 7	A	203	210	206.5[QC:b]			
S95T003678		B	142	174	158[QC:b,e]			
S95T003679		C	215	148	181.5[QC:b,e]			
S95T003680		D	1,810	2,120	1,965			
S95T003681	116: 8	A	2,320	1,970	2,145			
S95T003682		D	1,310	1,220	1,265			
S95T003761	117: 1	DL	69.4286	64.2143	66.8214			
S95T003775	117: 2	DL	73.5714	79.2857	76.4286			
S95T003791		A	127	126	126.5[QC:b,c]			
S95T003792		D	258	356	307[QC:b,e]			
S95T003793	117: 3	C	507	598	552.5[QC:b,e]			
S95T003794	117: 5	A	171	196	183.5[QC:b,e]			
S95T003795		C	207	216	211.5[QC:b]			

Table A-26. Tank 241-BY-104 Analytical Results: Silicon. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	132	150	141[QC:e]	99.3	22.8	214
S95T003684		B	68.3	58.4	63.35[QC:e]			
S95T003685		C	189	190	189.5			
S95T003697	116: 7	D	112	158	135[QC:e]			
S95T003698	116: 8	A	< 98.0	< 102	< 100			
S95T003813	117: 3	Upper ½	96.8	89.5	93.15			
S95T003798		C	110	< 48.1	< 79.05[QC:e]			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 1,130	< 1,050	< 1,090	< 1,090	n/a	< 2,350

Table A-27. Tank 241-BY-104 Analytical Results: Silver. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			μg/g	μg/g	μg/g	μg/g	%	kg
S95T003532	116: 2	A	19.5	19.7	19.6	16.9	7.84	36.5
S95T003533	116: 3	Lower ½	22.4	23.5	22.95			
S95T003666	116: 4	A	21.0	21.7	21.35			
S96T000604		B	19.6	17.4	18.5			
S96T000605		C	17.9	17.8	17.85			
S96T000606	116: 5	A	17.7	17.3	17.5			
S96T000607		B	19.7	19.4	19.55			
S96T000608		C	19.5	18.4	18.95			
S96T000609		D	17.3	19.0	18.15			
S95T003673	116: 6	A	19.3	18.7	19.0			
S95T003674		B	18.3	18.1	18.2			
S95T003675		C	16.2	18.1	17.15			
S95T003676		D	19.6	17.0	18.3			
S95T003677	116: 7	A	19.8	19.2	19.5			
S95T003678		B	19.3	18.1	18.7			
S95T003679		C	22.7	23.4	23.05			
S95T003680		D	12.1	11.8	11.95			

Table A-27. Tank 241-BY-104 Analytical Results: Silver. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003681	116: 8	A	13.2	11.0	12.1	Cont.	Cont.	Cont.
S95T003682		D	13.9	13.2	13.55			
S95T003761	117: 1	DL	< 8.57143	< 8.57143	< 8.57143QC:c			
S95T003775	117: 2	DL	< 8.57143	< 8.57143	< 8.57143QC:c			
S95T003791		A	19.4	19.0	19.2			
S95T003792		D	21.2	21.5	21.35			
S95T003793	117: 3	C	16.2	16.3	16.25			
S95T003794	117: 5	A	18.8	18.6	18.7			
S95T003795		C	20.9	19.0	19.95			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 9.46	< 9.54	< 9.50QC:c	< 10.8	n/a	< 23.3
S95T003684		B	< 8.72	< 8.77	< 8.745QC:c			
S95T003685		C	< 8.86	< 8.89	< 8.875			
S95T003697	116: 7	D	< 8.93	< 8.93	< 8.93			
S95T003698	116: 8	A	< 19.6	< 20.4	< 20.0			
S95T003761	117: 1	DL	< 8.57143	< 8.57143	< 8.57143QC:c			
S95T003775	117: 2	DL	< 8.57143	< 8.57143	< 8.57143QC:c			
S95T003813	117: 3	Upper ½	< 9.65	< 9.61	< 9.63QC:c			
S95T003798		C	< 9.50	< 9.62	< 9.56QC:c			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 226	< 211	< 218.5	< 219	n/a	< 473

Table A-28. Tank 241-BY-104 Analytical Results: Sodium. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003531	116: 2	Upper ½	2.830E+05	2.290E+05	2.560E+05[QC:d,e]	2.20E+05	4.30	4.75E+05
S95T003530		A	1.980E+05	1.980E+05	1.980E+05			
S95T003700	116: 3	Upper ½	2.730E+05	2.710E+05	2.720E+05[QC:d]			
S95T003701		Lower ½	2.870E+05	2.750E+05	2.810E+05			
S95T003649	116: 4	A	2.570E+05	2.500E+05	2.535E+05[QC:c]			
S95T003650		B	2.290E+05	2.310E+05	2.300E+05			
S95T003651		C	2.200E+05	2.380E+05	2.290E+05[QC:d]			
S95T003652	116: 5	A	2.370E+05	2.360E+05	2.365E+05[QC:d]			
S95T003653		B	2.430E+05	2.510E+05	2.470E+05			
S95T003654		C	2.450E+05	2.480E+05	2.465E+05[QC:d]			
S95T003655		D	2.440E+05	2.420E+05	2.430E+05[QC:c]			
S95T003656	116: 6	A	2.360E+05	2.350E+05	2.355E+05[QC:c]			
S95T003657		B	2.330E+05	2.340E+05	2.335E+05[QC:c]			
S95T003658		C	2.400E+05	2.400E+05	2.400E+05[QC:c]			
S95T003659		D	2.280E+05	2.310E+05	2.295E+05[QC:d]			
S95T003660	116: 7	A	2.390E+05	2.410E+05	2.400E+05[QC:d]			
S95T003661		B	2.300E+05	2.380E+05	2.340E+05[QC:d]			
S95T003662		C	2.150E+05	2.370E+05	2.260E+05[QC:d]			
S95T003663		D	1.610E+05	1.680E+05	1.645E+05			

Table A-28. Tank 241-BY-104 Analytical Results: Sodium. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003664	116: 8	A	1.490E+05	1.750E+05	1.620E+05[QC:e]	Cont.	Cont.	Cont.
S95T003665		D	1.310E+05	1.410E+05	1.360E+05			
S95T003771	117: 1	Upper ½	2.410E+05	2.290E+05	2.350E+05[QC:c]			
S95T003761		DL	1.700E+05	1.764E+05	1.732E+05[QC:d]			
S95T003775	117: 2	DL	1.814E+05	1.807E+05	1.811E+05			
S95T003786		A	2.150E+05	2.110E+05	2.130E+05[QC:c]			
S95T003787		D	1.950E+05	2.050E+05	2.000E+05[QC:d]			
S95T003811	117: 3	Upper ½	2.190E+05	2.170E+05	2.180E+05[QC:c]			
S95T003788		C	2.080E+05	2.060E+05	2.070E+05			
S95T003812	117: 4	Upper ½	2.560E+05	2.490E+05	2.525E+05[QC:c]			
S95T003789	117: 5	A	2.320E+05	2.300E+05	2.310E+05			
S95T003790		C	2.300E+05	2.250E+05	2.275E+05			
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	2.500E+05	2.530E+05	2.515E+05[QC:b,d]	2.00E+05	5.69	4.32E+05
S95T003533	116: 3	Lower ½	2.520E+05	2.650E+05	2.585E+05[QC:b]			
S95T003666	116: 4	A	2.440E+05	2.530E+05	2.485E+05[QC:b]			
S96T000604		B	2.240E+05	2.190E+05	2.215E+05			
S96T000605		C	2.060E+05	2.170E+05	2.115E+05			

Table A-28. Tank 241-BY-104 Analytical Results: Sodium. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000606	116: 5	A	2.140E+05	2.120E+05	2.130E+05	Cont.	Cont.	Cont.
S96T000607		B	2.230E+05	2.360E+05	2.295E+05			
S96T000608		C	2.180E+05	2.140E+05	2.160E+05			
S96T000609		D	2.180E+05	2.170E+05	2.175E+05			
S95T003673	116: 6	A	2.210E+05	2.160E+05	2.185E+05[QC:b]			
S95T003674		B	2.150E+05	2.110E+05	2.130E+05[QC:b]			
S95T003675		C	1.910E+05	2.230E+05	2.070E+05[QC:b,e]			
S95T003676		D	2.110E+05	1.900E+05	2.005E+05[QC:b]			
S95T003677	116: 7	A	2.090E+05	2.030E+05	2.060E+05[QC:b]			
S95T003678		B	2.120E+05	2.030E+05	2.075E+05[QC:b]			
S95T003679		C	2.360E+05	2.460E+05	2.410E+05[QC:b]			
S95T003680		D	1.520E+05	1.490E+05	1.505E+05[QC:b]			
S95T003681	116: 8	A	1.340E+05	1.270E+05	1.305E+05[QC:b]			
S95T003682		D	1.290E+05	1.200E+05	1.245E+05[QC:b]			
S95T003761	117: 1	DL	1.700E+05	1.764E+05	1.732E+05[QC:d]			
S95T003775	117: 2	DL	1.814E+05	1.807E+05	1.811E+05			
S95T003791		A	2.100E+05	2.010E+05	2.055E+05[QC:d]			
S95T003792		D	1.780E+05	1.710E+05	1.745E+05			
S95T003793	117: 3	C	1.910E+05	1.800E+05	1.855E+05			

Table A-28. Tank 241-BY-104 Analytical Results: Sodium. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			μg/g	μg/g	μg/g	μg/g	%	kg
S95T003794	117: 5	A	2.070E+05	1.920E+05	1.995E+05	1.88E+05	8.83	4.06E+05
S95T003795		C	2.130E+05	2.000E+05	2.065E+05			
S95T003683	116: 4	A	2.730E+05	2.620E+05	2.675E+05			
S95T003684		B	2.440E+05	2.410E+05	2.425E+05[QC:d]			
S95T003685		C	2.480E+05	2.470E+05	2.475E+05[QC:d]			
S95T003697	116: 7	D	1.810E+05	1.570E+05	1.690E+05[QC:d,e]			
S95T003698	116: 8	A	1.350E+05	1.400E+05	1.375E+05[QC:d]			
S95T003761	117: 1	DL	1.700E+05	1.764E+05	1.732E+05[QC:d]			
S95T003775	117: 2	DL	1.814E+05	1.807E+05	1.811E+05			
S95T003813	117: 3	Upper ½	2.180E+05	2.240E+05	2.210E+05[QC:d]			
S95T003798		C	2.110E+05	2.080E+05	2.095E+05[QC:c]			
Core composite: fusion digest			μg/g	μg/g	μg/g	μg/g	%	kg
S96T000374	116	n/a	2.620E+05	2.550E+05	2.585E+05[QC:d]	2.59E+05	1.35	5.59E+05

Table A-29. Tank 241-BY-104 Analytical Results: Strontium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	115	81.9	98.45[QC:e]	2,330	63.3	5,030
S95T003533	116: 3	Lower ½	327	269	298			
S95T003666	116: 4	A	338	310	324			
S96T000604		B	254	229	241.5			
S96T000605		C	298	315	306.5			
S96T000606	116: 5	A	171	159	165			
S96T000607		B	325	224	274.5[QC:e]			
S96T000608		C	228	240	234			
S96T000609		D	185	223	204			
S95T003673	116: 6	A	220	215	217.5			
S95T003674		B	167	169	168			
S95T003675		C	206	229	217.5			
S95T003676		D	332	268	300[QC:e]			
S95T003677	116: 7	A	384	397	390.5			
S95T003678		B	285	300	292.5			
S95T003679		C	323	318	320.5			
S95T003680		D	14,500	14,100	14,300			

Table A-29. Tank 241-BY-104 Analytical Results: Strontium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003681	116: 8	A	26,800	26,300	26,550	Cont.	Cont.	Cont.
S95T003682		D	9,870	9,230	9,550			
S95T003761	117: 1	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003775	117: 2	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003791		A	202	212	207			
S95T003792		D	789	828	808.5			
S95T003793	117: 3	C	4,280	5,210	4,745			
S95T003794	117: 5	A	288	317	302.5			
S95T003795		C	488	461	474.5			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 9.46	< 9.54	< 9.50	< 10.8	n/a	< 23.3
S95T003684		B	< 8.72	< 8.77	< 8.745			
S95T003685		C	< 8.86	< 8.89	< 8.875			
S95T003697	116: 7	D	< 8.93	< 8.93	< 8.93			
S95T003698	116: 8	A	< 19.6	< 20.4	< 20.0			
S95T003761	117: 1	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003775	117: 2	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003813	117: 3	Upper ½	< 9.65	< 9.61	< 9.63			
S95T003798		C	< 9.50	< 9.62	< 9.56			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	465	510	487.5	488	4.61	1,050

Table A-30. Tank 241-BY-104 Analytical Results: Sulfur. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	4,120	3,320	3,720	4,420	29.3	9,540
S95T003533	116: 3	Lower ½	7,310	6,770	7,040			
S95T003666	116: 4	A	9,150	8,460	8,805			
S96T000604		B	7,390	6,460	6,925			
S96T000605		C	6,940	7,270	7,105			
S96T000606	116: 5	A	6,270	5,890	6,080			
S96T000607		B	6,960	5,370	6,165			
S96T000608		C	5,320	5,350	5,335			
S96T000609		D	5,580	6,850	6,215			
S95T003673	116: 6	A	6,190	5,830	6,010			
S95T003674		B	5,520	5,700	5,610			
S95T003675		C	5,600	6,460	6,030			
S95T003676		D	7,010	6,460	6,735			
S95T003677	116: 7	A	7,690	7,530	7,610			
S95T003678		B	7,890	8,270	8,080			
S95T003679		C	9,480	9,800	9,640			
S95T003680		D	6,100	6,380	6,240			

Table A-30. Tank 241-BY-104 Analytical Results: Sulfur. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003681	116: 8	A	3,990	3,320	3,655	Cont.	Cont.	Cont.
S95T003682		D	404	386	395			
S95T003761	117: 1	DL	214.286	220	217.143			
S95T003775	117: 2	DL	238.571	241.429	240			
S95T003791		A	3,150	2,800	2,975			
S95T003792		D	9,680	9,640	9,660			
S95T003793	117: 3	C	4,790	4,830	4,810			
S95T003794	117: 5	A	2,520	2,480	2,500			
S95T003795		C	3,470	3,130	3,300			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	9,380	9,250	9,315	4,140	56.7	8,940
S95T003684		B	8,370	7,690	8,030			
S95T003685		C	8,480	7,990	8,235			
S95T003697	116: 7	D	6,300	6,820	6,560			
S95T003698	116: 8	A	3,910	5,070	4,490			
S95T003761	117: 1	DL	214.286	220	217.143			
S95T003775	117: 2	DL	238.571	241.429	240			
S95T003813	117: 3	Upper ½	3,920	3,990	3,955			
S95T003798		C	5,730	5,540	5,635			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	9,360	9,020	9,190	9,190	1.85	19,850

Table A-31. Tank 241-BY-104 Analytical Results: Thallium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	< 172	< 181	< 176.5	< 125	n/a	< 270
S95T003533	116: 3	Lower ½	< 192	< 193	< 192.5			
S95T003666	116: 4	A	< 190	< 179	< 184.5			
S96T000604		B	< 112	< 99.8	< 105.9			
S96T000605		C	< 118	< 125	< 121.5			
S96T000606	116: 5	A	< 89.6	< 91.3	< 90.45			
S96T000607		B	< 86.4	< 74.3	< 80.35			
S96T000608		C	< 81.2	< 88.1	< 84.65			
S96T000609		D	< 100	< 96.7	< 98.35			
S95T003673	116: 6	A	< 97.2	< 96.0	< 96.6			
S95T003674		B	< 88.5	< 89.9	< 89.2			
S95T003675		C	< 100	< 102	< 101			
S95T003676		D	< 98.2	< 94.0	< 96.1			
S95T003677	116: 7	A	< 86.8	< 85.0	< 85.9			
S95T003678		B	< 100	< 97.5	< 98.75			
S95T003679		C	< 179	< 175	< 177			
S95T003680		D	< 103	< 103	< 103			

Table A-31. Tank 241-BY-104 Analytical Results: Thallium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003681	116: 8	A	< 89.0	< 92.0	< 90.5	Cont.	Cont.	Cont.
S95T003682		D	< 64.0	< 59.7	< 61.85			
S95T003761	117: 1	DL	< 171.429	< 171.429	< 171.429			
S95T003775	117: 2	DL	< 171.429	< 171.429	< 171.429			
S95T003791		A	< 123	< 124	< 123.5			
S95T003792		D	< 111	< 112	< 111.5			
S95T003793	117: 3	C	< 92.0	< 93.2	< 92.6			
S95T003794	117: 5	A	< 98.6	< 96.5	< 97.55			
S95T003795		C	< 94.1	< 97.2	< 95.65			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 189	< 191	< 190	< 216	n/a	< 466
S95T003684		B	< 174	< 175	< 174.5			
S95T003685		C	< 177	< 178	< 177.5			
S95T003697	116: 7	D	< 179	< 179	< 179			
S95T003698	116: 8	A	< 392	< 407	< 399.5			
S95T003761	117: 1	DL	< 171.429	< 171.429	< 171.429			
S95T003775	117: 2	DL	< 171.429	< 171.429	< 171.429			
S95T003813	117: 3	Upper ½	< 193	< 192	< 192.5			
S95T003798		C	< 190	< 192	< 191			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 4,520	< 4,220	< 4,370	< 4,730	n/a	< 10,210

Table A-32. Tank 241-BY-104 Analytical Results: Titanium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	< 8.59	< 9.06	< 8.825	< 12.1	n/a	< 26.1
S95T003533	116: 3	Lower ½	< 9.59	< 9.63	< 9.61			
S95T003666	116: 4	A	< 9.50	< 8.94	< 9.22			
S96T000604		B	< 5.60	< 4.99	< 5.295[QC:a,c]			
S96T000605		C	< 5.92	< 6.25	< 6.085[QC:a]			
S96T000606	116: 5	A	< 4.48	< 4.56	< 4.52[QC:a]			
S96T000607		B	< 4.32	< 3.71	< 4.015[QC:a]			
S96T000608		C	5.56	< 4.40	4.98[QC:a,e]			
S96T000609		D	< 5.02	< 4.83	< 4.925[QC:a]			
S95T003673	116: 6	A	< 4.86	< 4.80	< 4.83			
S95T003674		B	< 4.42	< 4.50	< 4.46			
S95T003675		C	< 5.00	< 5.03	< 5.015			
S95T003676		D	< 4.91	< 4.70	< 4.805			
S95T003677	116: 7	A	< 4.34	< 4.25	< 4.295			
S95T003678		B	< 5.02	< 4.89	< 4.955			
S95T003679		C	< 8.95	< 8.75	< 8.85			
S95T003680		D	52.2	51.8	52.0			

Table A-32. Tank 241-BY-104 Analytical Results: Titanium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S95T003681	116: 8	A	84.5	78.1	81.3	Cont.	Cont.	Cont.
S95T003682		D	24.5	23.2	23.85			
S95T003761	117: 1	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003775	117: 2	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003791	117: 2	A	< 6.17	< 6.13	< 6.15			
S95T003792		D	7.51	7.63	7.57			
S95T003793	117: 3	C	15.0	18.0	16.5			
S95T003794	117: 5	A	< 4.93	< 4.83	< 4.88			
S95T003795		C	< 4.71	< 4.86	< 4.785			
Solids: water digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S95T003683	116: 4	A	< 9.46	< 9.54	< 9.5	< 10.8	n/a	< 23.3
S95T003684		B	< 8.72	< 8.77	< 8.745			
S95T003685		C	< 8.86	< 8.89	< 8.875			
S95T003697	116: 7	D	< 8.93	< 8.93	< 8.93			
S95T003698	116: 8	A	< 19.6	< 20.4	< 20			
S95T003761	117: 1	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003775	117: 2	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003813	117: 3	Upper ½	< 9.65	< 9.61	< 9.63			
S95T003798		C	< 9.50	< 9.62	< 9.56			
Core composite: fusion digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S96T000374	116	n/a	< 226	< 211	< 218.5	< 219	n/a	< 473

Table A-33. Tank 241-BY-104 Analytical Results: Total Uranium (Phosphorescence).

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003649	116: 4	A	1,010	863	936.5	13,800	48.0	29,800
S95T003650		B	644	599	621.5[QC:d]			
S95T003651		C	670	714	692			
S95T003663	116: 7	D	25,700	23,500	24,600			
S95T003664	116: 8	A	24,000	27,100	25,550			
S95T003811	117: 3	Upper ½	990	1,030	1,010			
S95T003788		C	7,550	7,520	7,535			

Table A-34. Tank 241-BY-104 Analytical Results: Total Uranium (ICP). (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			μg/g	μg/g	μg/g	μg/g	%	kg
S95T003531	116: 2	Upper ½	< 23,300	< 20,800	< 22,050	< 11,700	29.6	< 25,270
S95T003530		A	< 10,100	< 8,830	< 9,465			
S95T003700	116: 3	Upper ½	< 22,300	< 18,600	< 20,450			
S95T003701		Lower ½	< 22,900	< 17,500	< 20,200			
S95T003649	116: 4	A	< 8,750	< 9,190	< 8,970			
S95T003650		B	< 9,360	< 9,450	< 9,405			
S95T003651		C	< 9,220	< 9,150	< 9,185			
S95T003652	116: 5	A	< 9,510	< 9,400	< 9,455			
S95T003653		B	< 9,340	< 9,650	< 9,495			
S95T003654		C	< 9,860	< 10,100	< 9,980			
S95T003655		D	< 9,620	< 9,800	< 9,710			
S95T003656	116: 6	A	< 8,770	< 8,950	< 8,860			
S95T003657		B	< 9,100	< 8,890	< 8,995			
S95T003658		C	< 9,500	< 9,580	< 9,540			
S95T003659		D	< 10,200	< 9,940	< 10,070			
S95T003660	116: 7	A	< 10,200	< 10,200	< 10,200			
S95T003661		B	< 9,790	< 9,850	< 9,820			
S95T003662		C	< 8,660	< 9,230	< 8,945			
S95T003663		D	25,600	26,500	26,050			
S95T003664	116: 8	A	45,300	42,800	44,050			
S95T003665		D	22,300	14,000	18,150			

Table A-34. Tank 241-BY-104 Analytical Results: Total Uranium (ICP). (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			μg/g	μg/g	μg/g	μg/g	%	kg
S95T003771	117: 1	Upper ½	< 25,100	< 25,300	< 25,200	Cont.	Cont.	Cont.
S95T003761		DL	< 429	< 429	< 429[QC:c]			
S95T003775	117: 2	DL	< 429	< 429	< 429			
S95T003786		A	< 10,000	< 9,790	< 9,895			
S95T003787		D	< 9,790	< 9,790	< 9,790			
S95T003811	117: 3	Upper ½	< 9,140	< 9,190	< 9,165			
S95T003788		C	< 9,920	< 9,920	< 9,920			
S95T003812	117: 4	Upper ½	< 9,890	< 10,100	< 9,995			
S95T003789	117: 5	A	< 10,200	< 10,200	< 10,200			
S95T003790		C	< 9,560	< 9,560	< 9,560			
Solids: acid digest			μg/g	μg/g	μg/g	μg/g	%	kg
S95T003532	116: 2	A	< 429	< 453	< 441[QC:d]	3,270	60.0	7,060
S95T003533	116: 3	Lower ½	< 471	< 482	< 476.5			
S95T003666	116: 4	A	585	556	570.5			
S96T000604		B	521	440	480.5[QC:c,e]			
S96T000605		C	510	554	532			
S96T000606	116: 5	A	369	336	352.5			
S96T000607		B	607	440	523.5[QC:e]			
S96T000608		C	397	459	428[QC:e]			
S96T000609		D	361	540	450.5[QC:e]			

Table A-34. Tank 241-BY-104 Analytical Results: Total Uranium (ICP). (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003673	116: 6	A	481	461	471[QC:c]	Cont.	Cont.	Cont.
S95T003674		B	392	392	392			
S95T003675		C	398	466	432[QC:e]			
S95T003676		D	719	555	637[QC:e]			
S95T003677	116: 7	A	763	757	760			
S95T003678		B	549	549	549			
S95T003679		C	483	496	489.5			
S95T003680		D	21,100	20,900	21,000			
S95T003681	116: 8	A	35,600	34,000	34,800			
S95T003682		D	14,200	13,200	13,700			
S95T003761	117: 1	DL	< 428.571	< 428.571	< 428.571[QC:c]			
S95T003775	117: 2	DL	< 428.571	< 428.571	< 428.571			
S95T003791		A	405	435	420			
S95T003792		D	1,620	1,630	1,625			
S95T003793	117: 3	C	5,300	6,460	5,880			
S95T003794	117: 5	A	416	452	434			
S95T003795		C	655	600	627.5			

Table A-34. Tank 241-BY-104 Analytical Results: Total Uranium (ICP). (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 473	< 477	< 475	< 539	n/a	< 1,160
S95T003684		B	< 436	< 439	< 437.5			
S95T003685		C	< 443	< 444	< 443.5			
S95T003697	116: 7	D	< 446	< 447	< 446.5			
S95T003698	116: 8	A	< 980	< 1,020	< 1,000			
S95T003761	117: 1	DL	< 429	< 429	< 429[QC:c]			
S95T003775	117: 2	DL	< 429	< 429	< 429			
S95T003813	117: 3	Upper ½	< 483	< 480	< 481.5			
S95T003798		C	< 475	< 481	< 478			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 11,300	< 10,500	< 10,900	< 10,900	n/a	< 23,540

Table A-35. Tank 241-BY-104 Analytical Results: Vanadium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	< 42.9	< 45.3	< 44.1	< 31.2	n/a	< 67.4
S95T003533	116: 3	Lower ½	< 47.1	< 48.2	< 47.65			
S95T003666	116: 4	A	< 47.5	< 44.7	< 46.1			
S96T000604		B	< 28.0	< 24.1	< 26.05			
S96T000605		C	< 29.6	< 31.2	< 30.4			
S96T000606	116: 5	A	< 22.4	< 22.8	< 22.6			
S96T000607		B	< 21.6	< 18.6	< 20.1			
S96T000608		C	< 20.3	< 22.0	< 21.15			
S96T000609		D	< 25.1	< 24.2	< 24.65			
S95T003673	116: 6	A	< 24.3	< 24.0	< 24.15			
S95T003674		B	< 22.1	< 22.5	< 22.3			
S95T003675		C	< 25.0	< 25.1	< 25.05			
S95T003676		D	< 24.7	< 23.5	< 24.1			
S95T003677	116: 7	A	< 21.7	< 21.4	< 21.55			
S95T003678		B	< 25.1	< 24.4	< 24.75			
S95T003679		C	< 44.8	< 43.9	< 44.35			
S95T003680		D	< 25.7	< 25.7	< 25.7			

Table A-35. Tank 241-BY-104 Analytical Results: Vanadium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003681	116: 8	A	< 22.2	< 23.0	< 22.6	Cont.	Cont.	Cont.
S95T003682		D	< 16.0	< 14.9	< 15.45			
S95T003761	117: 1	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003775	117: 2	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003791		A	< 30.8	< 30.6	< 30.7			
S95T003792		D	< 27.6	< 28.0	< 27.8			
S95T003793	117: 3	C	< 23.0	< 23.3	< 23.15			
S95T003794	117: 5	A	< 24.6	< 24.1	< 24.35			
S95T003795		C	< 23.5	< 24.3	< 23.9			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 47.3	< 47.7	< 47.5	< 53.9	n/a	< 116
S95T003684		B	< 43.6	< 43.9	< 43.75			
S95T003685		C	< 44.3	< 44.4	< 44.35			
S95T003697	116: 7	D	< 44.6	< 44.7	< 44.65			
S95T003698	116: 8	A	< 98.0	< 102	< 100			
S95T003761	117: 1	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003775	117: 2	DL	< 42.8571	< 42.8571	< 42.8571			
S95T003813	117: 3	Upper ½	< 48.3	< 48.0	< 48.15			
S95T003798		C	< 47.5	< 48.1	< 47.8			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 1,130	< 1,050	< 1,090	< 1,090	n/a	< 2,350

Table A-36. Tank 241-BY-104 Analytical Results: Zinc. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	52.4	40.6	46.5[QC:e]	41.0	31.5	88.5
S95T003533	116: 3	Lower ½	17.4	16.7	17.05			
S95T003666	116: 4	A	19.5	22.5	21.0			
S96T000604		B	22.0	18.7	20.35			
S96T000605		C	20.6	22.0	21.3			
S96T000606	116: 5	A	18.1	18.4	18.25			
S96T000607		B	21.6	18.7	20.15			
S96T000608		C	26.6	19.1	22.85[QC:e]			
S96T000609		D	24.8	22.8	23.8			
S95T003673	116: 6	A	24.7	21.1	22.9			
S95T003674		B	18.5	17.5	18.0			
S95T003675		C	20.9	22.3	21.6			
S95T003676		D	24.9	17.7	21.3[QC:e]			
S95T003677	116: 7	A	21.0	19.9	20.45			
S95T003678		B	18.9	18.6	18.75			
S95T003679		C	17.9	17.1	17.5			
S95T003680		D	238	236	237			

Table A-36. Tank 241-BY-104 Analytical Results: Zinc. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003681	116: 8	A	209	200	204.5	Cont.	Cont.	Cont.
S95T003682		D	133	125	129			
S95T003761	117: 1	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003775	117: 2	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003791		A	22.2	21.5	21.85			
S95T003792		D	55.0	58.1	56.55			
S95T003793	117: 3	C	55.4	64.4	59.9			
S95T003794	117: 5	A	21.1	16.1	18.6[QC:e]			
S95T003795		C	22.0	21.1	21.55			
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003683	116: 4	A	< 9.46	< 9.54	< 9.50	< 10.8	n/a	< 23.3
S95T003684		B	< 8.72	< 8.77	< 8.745			
S95T003685		C	< 8.86	< 8.89	< 8.875			
S95T003697	116: 7	D	< 8.93	< 8.93	< 8.93			
S95T003698	116: 8	A	< 19.6	< 20.4	< 20.0			
S95T003761	117: 1	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003775	117: 2	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003813	117: 3	Upper ½	< 9.65	< 9.61	< 9.63			
S95T003798		C	< 9.50	< 9.62	< 9.56			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000374	116	n/a	< 226	< 211	< 218.5	< 219	n/a	< 473

Table A-37. Tank 241-BY-104 Analytical Results: Zirconium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003532	116: 2	A	< 8.59	< 9.06	< 8.825	13.2	20.6	28.5
S95T003533	116: 3	Lower ½	< 9.59	< 9.63	< 9.61			
S95T003666	116: 4	A	< 9.50	< 8.94	< 9.22			
S96T000604		B	8.90	7.12	8.01[QC:a,c,e]			
S96T000605		C	6.89	8.18	7.535[QC:a]			
S96T000606	116: 5	A	6.39	5.83	6.11[QC:a]			
S96T000607		B	11.5	6.63	9.065[QC:a,e]			
S96T000608		C	9.21	7.20	8.205[QC:a,e]			
S96T000609		D	5.71	7.95	6.83[QC:a,e]			
S95T003673	116: 6	A	8.51	8.11	8.31			
S95T003674		B	7.55	7.58	7.565			
S95T003675		C	6.64	8.16	7.40			
S95T003676		D	13.0	11.0	12.0			
S95T003677	116: 7	A	10.4	10.1	10.25			
S95T003678		B	6.52	7.10	6.81			
S95T003679		C	< 8.95	< 8.75	< 8.85			
S95T003680		D	39.4	32.3	35.85			

Table A-37. Tank 241-BY-104 Analytical Results: Zirconium. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S95T003681	116: 8	A	52.0	47.2	49.6	Cont.	Cont.	Cont.
S95T003682		D	22.3	20.6	21.45			
S95T003761	117: 1	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003775	117: 2	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003791		A	8.45	9.48	8.965			
S95T003792		D	33.2	33.1	33.15			
S95T003793	117: 3	C	19.4	22.5	20.95			
S95T003794	117: 5	A	< 4.93	< 4.83	< 4.88			
S95T003795		C	< 4.71	< 4.86	< 4.785			
Solids: water digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S95T003683	116: 4	A	< 9.46	< 9.54	< 9.50	< 10.8	n/a	< 23.3
S95T003684		B	< 8.72	< 8.77	< 8.745			
S95T003685		C	< 8.86	< 8.89	< 8.875			
S95T003697	116: 7	D	< 8.93	< 8.93	< 8.93			
S95T003698	116: 8	A	< 19.6	< 20.4	< 20.0			
S95T003761	117: 1	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003775	117: 2	DL	< 8.57143	< 8.57143	< 8.57143			
S95T003813	117: 3	Upper ½	< 9.65	< 9.61	< 9.63			
S95T003798		C	< 9.50	< 9.62	< 9.56			
Core composite: fusion digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S96T000374	116	n/a	4,920	5,070	4,995	5,000	1.50	10,800

Table A-38. Tank 241-BY-104 Analytical Results: Chloride. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003536	116: 2	Upper ½	441.7	475	458.35	2,320	8.89	5,010
S95T003534		A	2,247	1,830	2,038.5			
S95T003705	116: 3	Upper ½	660.9	581	620.95[QC:e]			
S95T003704		Lower ½	597.7	1,040	818.85[QC:e]			
S95T003683	116: 4	A	2,009	2,410	2,209.5			
S95T003684		B	2,792	2,440	2,616			
S95T003685		C	2,436	2,600	2,518			
S95T003686	116: 5	A	2,770	2,570	2,670			
S95T003687		B	2,001	2,160	2,080.5			
S95T003688		C	2,459	1,900	2,179.5			
S95T003689		D	2,523	2,290	2,406.5			
S95T003690	116: 6	A	3,059	2,890	2,974.5			
S95T003691		B	2,230	2,720	2,475			
S95T003692		C	3,869	2,600	3,234.5			
S95T003693		D	2,478	2,700	2,589			
S95T003694	116: 7	A	2,700	2,730	2,715			
S95T003695		B	2,634	2,760	2,697			
S95T003696		C	3,041	2,980	3,010.5			
S95T003697		D	2,368	2,990	2,679			

Table A-38. Tank 241-BY-104 Analytical Results: Chloride. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003698	116: 8	A	2,145	2,780	2,462.5	Cont.	Cont.	Cont.
S95T003699		D	2,763	3,960	3,361.5			
S95T003772	117: 1	Upper ½	2,054	2,480	2,267			
S95T003796	117: 2	A	2,124	2,380	2,252			
S95T003797		D	2,923	3,100	3,011.5			
S95T003813	117: 3	Upper ½	2,842	2,620	2,731			
S95T003798		C	2,759	2,600	2,679.5			
S95T003814	117: 4	Upper ½	1,998	1,140	1,569			
S95T003799	117: 5	A	1,682	1,830	1,756			
S95T003800		C	6,660	2,180	4,420			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000373	116	n/a	1,907	2,080	1,993.5	1,990	4.35	4,300

Table A-39. Tank 241-BY-104 Analytical Results: Cyanide. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: direct			μg/g	μg/g	μg/g	μg/g	%	kg
S95T003529	116: 2	Upper ½	< 6.71	< 6.59	< 6.65[QC:c]	< 11.8	n/a	< 25.5
S95T003528		A	18.6	17.5	18.05			
S95T003703	116: 3	Upper ½	3.24	3.09	3.165[QC:c]			
S95T003702		Lower ½	3.45	3.17	3.31[QC:a,c]			
S95T003632	116: 4	A	< 7.50	< 7.83	< 7.665			
S95T003637		B	< 8.10	< 8.10	< 8.10			
S95T003641		C	< 6.75	< 6.49	< 6.62			
S95T003633	116: 5	A	< 7.39	< 6.97	< 7.18			
S95T003638		B	< 8.59	< 8.79	< 8.69			
S95T003642		C	< 5.33	< 5.13	< 5.23			
S95T003645		D	< 8.36	< 7.92	< 8.14			
S95T003634	116: 6	A	< 6.62	52.7	29.66[QC:c,e]			
S95T003639		B	< 6.79	< 6.22	< 6.505[QC:c]			
S95T003643		C	< 7.43	< 7.18	< 7.305			
S95T003646		D	< 8.36	< 8.22	< 8.29			

Table A-39. Tank 241-BY-104 Analytical Results: Cyanide. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: direct			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003635	116: 7	A	< 6.79	< 6.74	< 6.765	Cont.	Cont.	Cont.
S95T003640		B	< 5.45	< 5.38	< 5.415			
S95T003644		C	< 5.30	< 5.04	< 5.17			
S95T003647		D	68.6	57.9	63.25[QC:e]			
S95T003636	116: 8	A	67.7	84.9	76.3[QC:d,e]			
S95T003648		D	19.2	1.88	10.54[QC:a,c,e]			
S95T003764	117: 1	Upper ½	2.20	2.38	2.29			
S95T003761		DL	6.00	5.77143	5.88571			
S95T003775	117: 2	DL	4.95714	5.79286	5.375[QC:e]			
S95T003781		A	< 6.62	< 6.55	< 6.585			
S95T003782		D	< 8.43	< 8.51	< 8.47			
S95T003809	117: 3	Upper ½	< 7.13	< 7.21	< 7.17			
S95T003783		C	19.7	23.4	21.55[QC:d,e]			
S95T003810	117: 4	Upper ½	< 7.82	8.39	8.105			
S95T003784	117: 5	A	< 8.39	< 7.93	< 8.16			
S95T003785		C	< 6.16	< 5.87	< 6.015			

Table A-40. Tank 241-BY-104 Analytical Results: Fluoride. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003536	116: 2	Upper ½	5,812	6,710	6,261	4,630	23.7	10,000
S95T003534		A	14,840	13,400	14,120			
S95T003705	116: 3	Upper ½	7,709	6,530	7,119.5			
S95T003704		Lower ½	7,929	7,520	7,724.5			
S95T003683	116: 4	A	6,040	6,050	6,045			
S95T003684		B	5,590	5,130	5,360			
S95T003685		C	5,332	4,940	5,136			
S95T003686	116: 5	A	5,412	4,950	5,181			
S95T003687		B	5,238	5,590	5,414			
S95T003688		C	4,076	3,680	3,878			
S95T003689		D	5,358	4,840	5,099			
S95T003690	116: 6	A	5,420	5,240	5,330			
S95T003691		B	4,187	4,730	4,458.5			
S95T003692		C	5,499	5,340	5,419.5			
S95T003693		D	5,876	5,760	5,818			
S95T003694	116: 7	A	6,497	6,310	6,403.5			
S95T003695		B	7,530	6,990	7,260			
S95T003696		C	7,372	7,620	7,496			
S95T003697		D	3,942	4,520	4,231			

Table A-40. Tank 241-BY-104 Analytical Results: Fluoride. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003698	116: 8	A	2,083	2,250	2,166.5	Cont.	Cont.	Cont.
S95T003699		D	921.3	1,070	995.65[QC:e]			
S95T003772	117: 1	Upper ½	293.8	446	369.9[QC:e]			
S95T003796	117: 2	A	3,788	3,320	3,554			
S95T003797		D	10,010	11,000	10,505			
S95T003813	117: 3	Upper ½	3,799	3,850	3,824.5			
S95T003798		C	3,766	3,800	3,783			
S95T003814	117: 4	Upper ½	3,556	2,970	3,263			
S95T003799	117: 5	A	2,277	2,500	2,388.5			
S95T003800		C	2,687	2,200	2,443.5			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000373	116	n/a	5,667	7,970	6,818.5	6,820	16.9	14,730

Table A-41 Tank 241-BY-104 Analytical Results: Nitrate. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003536	116: 2	Upper ½	3.871E+05	4.320E+05	4.096E+05	2.61E+05	13.6	5.64E+05
S95T003534		A	77,870	55,300	66,585			
S95T003705	116: 3	Upper ½	3.534E+05	3.870E+05	3.702E+05			
S95T003704		Lower ½	4.092E+05	4.040E+05	4.066E+05			
S95T003683	116: 4	A	2.140E+05	2.370E+05	2.255E+05			
S95T003684		B	1.933E+05	2.570E+05	2.252E+05[QC:e]			
S95T003685		C	2.204E+05	2.260E+05	2.232E+05			
S95T003686	116: 5	A	1.868E+05	1.840E+05	1.854E+05			
S95T003687		B	2.272E+05	2.310E+05	2.291E+05[QC:d]			
S95T003688		C	2.316E+05	3.100E+05	2.708E+05[QC:e]			
S95T003689		D	2.615E+05	2.310E+05	2.463E+05[QC:e]			
S95T003690	116: 6	A	2.407E+05	2.310E+05	2.359E+05[QC:c]			
S95T003691		B	2.024E+05	1.950E+05	1.987E+05			
S95T003692		C	2.198E+05	2.280E+05	2.239E+05			
S95T003693		D	2.258E+05	1.940E+05	2.099E+05[QC:e]			
S95T003694	116: 7	A	1.947E+05	2.100E+05	2.024E+05[QC:d]			
S95T003695		B	1.889E+05	1.730E+05	1.810E+05			
S95T003696		C	1.310E+05	1.440E+05	1.375E+05			
S95T003697		D	2.457E+05	1.100E+05	1.779E+05[QC:e]			
S95T003698	116: 8	A	92,650	89,400	91,025			
S95T003699		D	1.167E+05	1.070E+05	1.119E+05			

Table A-41 Tank 241-BY-104 Analytical Results: Nitrate. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003772	117: 1	Upper ½	1.583E+05	2.030E+05	1.807E+05[QC:e]	Cont.	Cont.	Cont.
S95T003796	117: 2	A	1.602E+05	1.620E+05	1.611E+05			
S95T003797		D	81,540	1.030E+05	92,270			
S95T003813	117: 3	Upper ½	2.466E+05	2.840E+05	2.653E+05[QC:e]			
S95T003798		C	2.265E+05	2.330E+05	2.298E+05			
S95T003814	117: 4	Upper ½	4.816E+05	4.680E+05	4.748E+05[QC:e]			
S95T003799	117: 5	A	4.831E+05	4.830E+05	4.831E+05			
S95T003800		C	4.333E+05	4.100E+05	4.217E+05			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000373	116	n/a	2.311E+05	1.890E+05	2.101E+05[QC:e]	2.10E+05	10.0	4.53E+05

Table A-42. Tank 241-BY-104 Analytical Results: Nitrite. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003536	116: 2	Upper ½	5,767	5,930	5,848.5	34,900	9.31	75,400
S95T003534		A	34,120	27,300	30,710			
S95T003705	116: 3	Upper ½	14,410	13,900	14,155			
S95T003704		Lower ½	15,110	15,000	15,055			
S95T003683	116: 4	A	32,770	39,100	35,935			
S95T003684		B	49,220	40,300	44,760			
S95T003685		C	38,700	40,900	39,800			
S95T003686	116: 5	A	42,740	38,900	40,820			
S95T003687		B	37,350	38,700	38,025			
S95T003688		C	42,920	33,600	38,260			
S95T003689		D	38,660	43,000	40,830			
S95T003690	116: 6	A	49,280	48,200	48,740			
S95T003691		B	38,160	45,100	41,630			
S95T003692		C	44,220	42,800	43,510			
S95T003693		D	42,140	43,800	42,970			
S95T003694	116: 7	A	45,570	44,800	45,185			
S95T003695		B	43,930	47,100	45,515			
S95T003696		C	48,440	47,300	47,870			
S95T003697		D	36,420	45,200	40,810			

Table A-42. Tank 241-BY-104 Analytical Results: Nitrite. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003698	116: 8	A	36,800	41,300	39,050	Cont.	Cont.	Cont.
S95T003699		D	50,110	45,900	48,005			
S95T003772	117: 1	Upper ½	35,800	44,600	40,200			
S95T003796	117: 2	A	33,240	33,100	33,170			
S95T003797		D	44,900	47,800	46,350			
S95T003813	117: 3	Upper ½	48,530	45,500	47,015			
S95T003798		C	47,180	44,500	45,840			
S95T003814	117: 4	Upper ½	22,130	19,700	20,915			
S95T003799	117: 5	A	25,290	27,500	26,395			
S95T003800		C	28,230	27,100	27,665			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000373	116	n/a	29,560	32,000	30,780	30,800	3.96	66,500

Table A-43. Tank 241-BY-104 Analytical Results: Oxalate. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			μg/g	μg/g	μg/g	μg/g	%	kg
S95T003536	116: 2	Upper ½	4,277	4,330	4,303.5	13,100	16.8	28,300
S95T003534		A	60,950	50,100	55,525			
S95T003705	116: 3	Upper ½	11,130	10,400	10,765			
S95T003704		Lower ½	16,750	17,200	16,975			
S95T003683	116: 4	A	17,780	20,100	18,940			
S95T003684		B	17,460	16,000	16,730			
S95T003685		C	16,600	< 765	8,682.5			
S95T003686	116: 5	A	16,940	16,300	16,620			
S95T003687		B	16,180	18,100	17,140			
S95T003688		C	13,600	12,700	13,150			
S95T003689		D	15,610	16,100	15,855			
S95T003690	116: 6	A	15,090	17,900	16,495			
S95T003691		B	12,610	13,800	13,205			
S95T003692		C	15,290	15,000	15,145			
S95T003693		D	18,490	18,800	18,645			
S95T003694	116: 7	A	21,280	21,700	21,490			
S95T003695		B	22,160	21,900	22,030			
S95T003696		C	24,950	26,900	25,925			
S95T003697		D	3,975	4,620	4,297.5			
S95T003698	116: 8	A	2,705	4,410	3,557.5			
S95T003699		D	2,767	4,700	3,733.5			

Table A-43. Tank 241-BY-104 Analytical Results: Oxalate. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S95T003772	117: 1	Upper ½	2,307	2,180	2,243.5	Cont.	Cont.	Cont.
S95T003796	117: 2	A	10,710	9,660	10,185			
S95T003797		D	27,730	29,200	28,465			
S95T003813	117: 3	Upper ½	7,815	7,690	7,752.5			
S95T003798		C	12,210	12,200	12,205			
S95T003814	117: 4	Upper ½	10,740	11,400	11,070			
S95T003799	117: 5	A	7,790	8,080	7,935			
S95T003800		C	9,051	8,170	8,610.5			
Core composite: fusion digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S96T000373	116	n/a	18,440	20,200	19,320	19,300	4.56	41,680

Table A-44. Tank 241-BY-104 Analytical Results: Phosphate. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003536	116: 2	Upper ½	48,800	57,200	53,000	11,200	29.9	24,200
S95T003534		A	17,280	29,500	23,390			
S95T003705	116: 3	Upper ½	41,310	33,000	37,155			
S95T003704		Lower ½	20,910	14,600	17,755			
S95T003683	116: 4	A	5,532	6,330	5,931			
S95T003684		B	6,733	7,850	7,291.5			
S95T003685		C	3,130	2,440	2,785			
S95T003686	116: 5	A	2,452	1,540	1,996			
S95T003687		B	2,243	1,620	1,931.5			
S95T003688		C	4,344	2,700	3,522			
S95T003689		D	2,518	2,430	2,474			
S95T003690	116: 6	A	6,039	6,040	6,039.5			
S95T003691		B	3,155	3,110	3,132.5			
S95T003692		C	3,618	3,580	3,599			
S95T003693		D	3,496	3,440	3,468			
S95T003694	116: 7	A	3,499	3,720	3,609.5			
S95T003695		B	8,150	5,710	6,930			
S95T003696		C	5,252	5,580	5,416			
S95T003697		D	5,189	7,770	6,479.5			
S95T003698	116: 8	A	4,902	6,600	5,751			
S95T003699		D	10,450	11,700	11,075			

Table A-44. Tank 241-BY-104 Analytical Results: Phosphate. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T003772	117: 1	Upper ½	1,643	1,900	1,771.5	Cont.	Cont.	Cont.
S95T003796	117: 2	A	15,280	12,000	13,640			
S95T003797		D	37,330	37,000	37,165			
S95T003813	117: 3	Upper ½	12,070	12,000	12,035			
S95T003798		C	4,748	6,310	5,529			
S95T003814	117: 4	Upper ½	6,537	2,800	4,668.5			
S95T003799	117: 5	A	6,411	6,270	6,340.5			
S95T003800		C	6,344	3,100	4,722			
Core composite: fusion digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000373	116	n/a	7,631	22,100	14,865.5	14,900	48.6	32,180

Table A-45. Tank 241-BY-104 Analytical Results: Sulfate. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			μg/g	μg/g	μg/g	μg/g	%	kg
S95T003536	116: 2	Upper ½	4,700	4,610	4,655	17,300	20.2	37,360
S95T003534		A	54,620	39,600	47,110			
S95T003705	116: 3	Upper ½	15,230	13,700	14,465			
S95T003704		Lower ½	25,460	25,900	25,680			
S95T003683	116: 4	A	24,590	27,800	26,195			
S95T003684		B	23,280	21,500	22,390			
S95T003685		C	23,090	21,900	22,495			
S95T003686	116: 5	A	22,300	19,500	20,900			
S95T003687		B	21,970	22,400	22,185			
S95T003688		C	18,130	17,100	17,615			
S95T003689		D	20,820	21,900	21,360			
S95T003690	116: 6	A	23,320	22,000	22,660			
S95T003691		B	17,650	19,700	18,675			
S95T003692		C	22,380	23,900	23,140			
S95T003693		D	24,570	24,400	24,485			
S95T003694	116: 7	A	27,040	27,300	27,170			
S95T003695		B	28,880	28,700	28,790			
S95T003696		C	29,900	31,500	30,700			
S95T003697		D	20,360	21,700	21,030			
S95T003698	116: 8	A	11,900	16,600	14,250			
S95T003699		D	3,034	9,440	6,237			

Table A-45. Tank 241-BY-104 Analytical Results: Sulfate. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S95T003772	117: 1	Upper ½	1,740	1,580	1,660	Cont.	Cont.	Cont.
S95T003796	117: 2	A	13,060	11,800	12,430			
S95T003797		D	32,070	34,100	33,085			
S95T003813	117: 3	Upper ½	12,230	12,200	12,215			
S95T003798		C	16,620	16,100	16,360			
S95T003814	117: 4	Upper ½	14,980	14,900	14,940			
S95T003799	117: 5	A	11,770	11,900	11,835			
S95T003800		C	13,830	12,400	13,115			
Core composite: fusion digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S96T000373	116	n/a	22,420	24,400	23,410	23,400	4.23	50,500

Table A-46. Tank 241-BY-104 Analytical Results: Cesium-137. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S95T003531	116: 2	Upper ½	16.7	14.5	15.6[QC:e]	97.0	8.61	2.10E+05
S95T003530		A	94.03	99.9	96.965			
S95T003700	116: 3	Upper ½	32.9	32.4	32.65			
S95T003701		Lower ½	33.59	34.8	34.195			
S95T003649	116: 4	A	106.7	99.9	103.3			
S95T003650		B	149.7	136	142.85			
S95T003651		C	120.5	132	126.25			
S95T003652	116: 5	A	134	137	135.5			
S95T003653		B	132.6	124	128.3			
S95T003654		C	114.9	125	119.95			
S95T003655		D	124.3	115	119.65			
S95T003656	116: 6	A	119	120	119.5			
S95T003657		B	134.5	134	134.25			
S95T003658		C	115.4	100	107.7[QC:e]			
S95T003659		D	133.1	116	124.55[QC:e]			
S95T003660	116: 7	A	139.8	154	146.9			
S95T003661		B	136.5	135	135.75			
S95T003662		C	119.7	131	125.35			
S95T003663		D	24.96	23.5	24.23			
S95T003664	116: 8	A	48.66	41.0	44.83[QC:e]			
S95T003665		D	130.2	137	133.6			

Table A-46. Tank 241-BY-104 Analytical Results: Cesium-137. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S95T003771	117: 1	Upper ½	98.16	108	103.08	Cont.	Cont.	Cont.
S95T003786	117: 2	A	45.49	44.9	45.195			
S95T003787		D	235	245	240			
S95T003811	117: 3	Upper ½	128.5	123	125.75			
S95T003788		C	121.4	115	118.2			
S95T003812	117: 4	Upper ½	52.11	56.1	54.105			
S95T003789	117: 5	A	68.48	72.5	70.49			
S95T003790		C	86.24	85.1	85.67			
Core composite: fusion digest			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S96T000374	116	n/a	102.5	100	101.25	101	1.24	2.18E+05

Table A-47. Tank 241-BY-104 Analytical Results: Cobalt-60. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S95T003531	116: 2	Upper ½	< 0.01272	< 0.00978	< 0.01125[QC:e]	< 0.0149	n/a	< 32.2
S95T003530		A	0.05317	0.053	0.053085			
S95T003700	116: 3	Upper ½	0.007625	< 0.00753	0.0075775			
S95T003701		Lower ½	< 0.008641	< 0.00753	< 0.0080855[QC:e]			
S95T003649	116: 4	A	< 0.01883	< 0.0189	< 0.018865			
S95T003650		B	< 0.01739	< 0.0157	< 0.016545			
S95T003651		C	< 0.01417	< 0.0137	< 0.013935			
S95T003652	116: 5	A	< 0.01401	< 0.016	< 0.015005[QC:e]			
S95T003653		B	< 0.01631	< 0.0144	< 0.015355[QC:e]			
S95T003654		C	< 0.01067	< 0.00888	< 0.009775[QC:e]			
S95T003655		D	< 0.01121	< 0.0112	< 0.011205			
S95T003656	116: 6	A	< 0.008988	< 0.00921	< 0.009099			
S95T003657		B	< 0.006968	< 0.00828	< 0.007624[QC:e]			
S95T003658		C	< 0.01029	< 0.0094	< 0.009845			
S95T003659		D	< 0.01705	< 0.0155	< 0.016275			
S95T003660	116: 7	A	< 0.01662	< 0.0168	< 0.01671			
S95T003661		B	< 0.01709	< 0.0174	< 0.017245			
S95T003662		C	< 0.008449	< 0.00946	< 0.0089545[QC:e]			
S95T003663		D	< 0.0158	< 0.0124	< 0.0141[QC:e]			

Table A-47. Tank 241-BY-104 Analytical Results: Cobalt-60. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S95T003664	116: 8	A	< 0.02975	< 0.0342	< 0.031975[QC:e]	Cont.	Cont.	Cont.
S95T003665		D	< 0.02155	< 0.0229	< 0.022225			
S95T003771	117: 1	Upper ½	< 0.008958	< 0.00765	< 0.008304[QC:e]			
S95T003786	117: 2	A	< 0.007843	< 0.00801	< 0.0079265			
S95T003787		D	0.05151	< 0.0338	0.042655[QC:e]			
S95T003811	117: 3	Upper ½	< 0.005932	< 0.00629	< 0.006111			
S95T003788		C	< 0.02267	< 0.0205	< 0.021585			
S95T003812	117: 4	Upper ½	< 0.005115	< 0.00556	< 0.0053375			
S95T003789	117: 5	A	< 0.00918	< 0.0108	< 0.00999[QC:e]			
S95T003790		C	< 0.009463	< 0.0103	< 0.0098815			
Core composite: fusion digest			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S96T000374	116	n/a	< 0.01683	< 0.0243	< 0.020565[QC:e]	< 0.0206	n/a	< 44.5

Table A-48. Tank 241-BY-104 Analytical Results: Strontium-89/90. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S95T003530	116:2	A	130	143	136.5	391	62.5	8.44E+05
S95T003649	116:4	A	25.5	24.3	24.9			
S95T003650		B	19.1	17.8	18.45			
S95T003651		C	19.3	22.6	20.95			
S95T003652	116:5	A	16.7	17.3	17.0			
S95T003653		B	24.3	25.4	24.85			
S95T003654		C	19.2	19.4	19.3			
S95T003655		D	19.5	18.2	18.85			
S95T003656	116:6	A	17.9	17.7	17.8			
S95T003657		B	14.5	16.3	15.4			
S95T003658		C	19.1	19.2	19.15			
S95T003659		D	21.6	20.1	20.85			
S95T003660	116:7	A	29.5	30.3	29.9			
S95T003661		B	24.0	23.4	23.7			
S95T003662		C	23.7	26.0	24.85			
S95T003663		D	857	802	829.5			
S95T003664	116:8	A	944	904	924			
S95T003665		D	314	261	287.5			
S95T003786	117:2	A	21.3	20.8	21.05			
S95T003787		D	72.2	67.6	69.9			

Table A-48. Tank 241-BY-104 Analytical Results: Strontium-89/90. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S95T003788	117:3	C	1,770	1,750	1,760	Cont.	Cont.	Cont.
S95T003789	117:5	A	18.3	19.3	18.8			
S95T003790		C	27.1	29.9	28.5			
Core composite: fusion digest			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S95T000374	116	n/a	34.7	38.6	36.65	36.6	5.33	79,040

Table A-49. Tank 241-BY-104 Analytical Results: Total Alpha.

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion digest			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S95T003530	116: 2	A	0.0168	0.0137	0.01525[QC:c,e]	0.179	77.0	386
S95T003700	116: 3	Upper ½	0.00659	0.00614	0.006365[QC:b,c]			
S95T003651	116: 4	C	0.0204	0.0197	0.02005[QC:a,c]			
S95T003654	116: 5	C	0.033	0.0349	0.03395			
S95T003655		D	0.0279	0.0259	0.0269			
S95T003658	116: 6	C	0.0228	0.0206	0.0217[QC:a]			
S95T003659		D	0.0314	0.025	0.0282[QC:a,c,e]			
S95T003662	116: 7	C	0.0325	0.0361	0.0343[QC:a]			
S95T003663		D	0.305	0.211	0.258[QC:a,c,e]			
S95T003665	116: 8	D	0.0974	0.128	0.1127[QC:a,c,e]			
S95T003786	117: 2	A	< 0.0647	< 0.0649	< 0.0648[QC:a,c]			
S95T003787		D	< 0.126	< 0.153	< 0.1395[QC:a,c,]			
S95T003788	117: 3	C	0.714	0.845	0.7795[QC:a,c,e]			
S95T003789	117: 5	A	0.0157	0.0135	0.0146[QC:a,c,e]			
S95T003790		C	< 0.0616	< 0.0776	< 0.0696[QC:a,c,]			

Table A-50. Tank 241-BY-104 Analytical Results: Total Beta.

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S95T003649	116:4	A	156	142	149	837	45.6	1.81E+06
S95T003650		B	160	146	153			
S95T003651		C	136	152	144[QC:e]			
S95T003663	116:7	D	1,950	1,820	1,885			
S95T003664	116:8	A	2,090	1,940	2,015			
S95T003811	117:3	Upper 1/2	167	165	166			
S95T003788		C	505	464	484.5			

Table A-51. Tank 241-BY-104 Analytical Results: Total Carbon.

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: direct			µg C/g	µg C/g	µg C/g	µg C/g	%	kg
S95T003528	116: 2	A	37,300	39,300	38,300	25,500	18.5	55,100
S95T003645	116: 5	D	24,000	24,100	24,050			
S95T003647	116: 7	D	15,700	15,600	15,650			
S95T003636	116: 8	A	22,800	24,900	23,850			

Table A-52. Tank 241-BY-104 Analytical Results: Total Inorganic Carbon. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: direct			µg C/g	µg C/g	µg C/g	µg C/g	%	kg C
S95T003528	116:2	A	20,600	19,300	19,950	14,800	21.1	32,000
S95T003702	116:3	Lower ½	24,100	18,200	21,150			
S95T003632	116:4	A	25,200	23,600	24,400			
S95T003637		B	34,500	36,000	35,250			
S95T003641		C	21,400	22,300	21,850			
S95T003633	116:5	A	22,700	23,400	23,050			
S95T003638		B	20,700	23,400	22,050			
S95T003642		C	19,100	20,300	19,700			
S95T003645		D	19,900	20,200	20,050			
S95T003634	116:6	A	16,900	18,800	17,850			
S95T003639		B	14,400	14,600	14,500			
S95T003643		C	20,800	19,700	20,250			
S95T003646		D	20,600	22,500	21,550			
S95T003635	116:7	A	16,600	19,200	17,900			
S95T003640		B	21,600	19,500	20,550			
S95T003644		C	23,000	22,800	22,900			
S95T003647		D	6,490	11,900	9,195			
S95T003636	116:8	A	2,570	2,970	2,770			
S95T003648		D	3,040	3,110	3,075			
S95T003781	117:2	A	30,500	30,600	30,550			
S95T003782		D	6,450	4,300	5,375			

Table A-52. Tank 241-BY-104 Analytical Results: Total Inorganic Carbon. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: direct			μg C/g	μg C/g	μg C/g	μg C/g	%	kg C
S95T003783	117:3	C	10,800	12,300	11,550	Cont.	Cont.	Cont.
S95T003784	117:5	A	3,920	3,880	3,900			
S95T003785		C	5,520	5,060	5,290			

Table A-53. Tank 241-BY-104 Analytical Results: Total Organic Carbon. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: direct			μg C/g	μg C/g	μg C/g	μg C/g	%	kg
S95T003528	116: 2	A	28,100	24,500	26,300	6,810	36.8	14,700
S95T003702	116: 3	Lower ½	4,000	4,190	4,095			
S95T003632	116: 4	A	5,420	6,060	5,740			
S95T003637		B	5,270	6,090	5,680			
S95T003641		C	5,710	5,810	5,760			
S95T003633	116: 5	A	6,410	6,170	6,290			
S95T003638		B	6,020	6,570	6,295			
S95T003642		C	5,040	6,050	5,545			
S95T003645		D	6,260	6,280	6,270			

Table A-53. Tank 241-BY-104 Analytical Results: Total Organic Carbon. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: direct			µg C/g	µg C/g	µg C/g	µg C/g	%	kg C
S95T003634	116: 6	A	4,850	4,960	4,905	Cont.	Cont.	Cont.
S95T003639		B	4,050	3,930	3,990			
S95T003643		C	5,390	5,160	5,275			
S95T003646		D	6,100	6,000	6,050			
S95T003635	116: 7	A	6,310	7,310	6,810			
S95T003640		B	7,590	6,680	7,135			
S95T003644		C	8,500	8,430	8,465			
S95T003647		D	12,800	12,200	12,500			
S95T003636	116: 8	A	13,500	16,200	14,850			
S95T003648		D	6,750	7,070	6,910			
S95T003761	117: 1	DL	1,571	1,721	1,646.43			
S95T003775	117: 2	DL	1,729	1,757	1,742.86			
S95T003781		A	3,220	3,560	3,390			
S95T003782		D	10,100	10,600	10,350			
S95T003783	117: 3	C	6,490	6,020	6,255			
S95T003784	117: 5	A	3,060	2,950	3,005			
S95T003785		C	3,180	3,300	3,240			

Table A-54. Tank 241-BY-104 Analytical Results: Bulk Density.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)
Solids: direct			g/mL	g/mL	g/mL	g/mL	%
S95T003525	116:2	A	1.630	n/a	1.63	1.75	1.54
S95T003594	116:4	A	1.810	n/a	1.81		
S95T003595		B	1.790	n/a	1.79		
S95T003596		C	1.820	n/a	1.82		
S95T003597	116:5	A	1.790	n/a	1.79		
S95T003598		B	1.740	n/a	1.74		
S95T003599		C	1.720	n/a	1.72		
S95T003600		D	1.730	n/a	1.73		
S95T003601	116:6	A	1.76	n/a	1.76		
S95T003602		B	1.75	n/a	1.75		
S95T003603		C	1.75	n/a	1.75		
S95T003604		D	1.75	n/a	1.75		
S95T003605	116:7	A	1.690	n/a	1.69		
S95T003606		B	1.680	n/a	1.68		
S95T003607		C	1.640	n/a	1.64		
S95T003776	117:2	A	1.740	n/a	1.74		
S95T003777		D	1.830	n/a	1.83		
S95T003778	117:3	C	1.780	n/a	1.78		
S95T003779	117:5	A	1.800	n/a	1.80		

Table A-55. Tank 241-BY-104 Analytical Results: Weight Percent Water (TGA). (3 sheets)

Sample Number	Core: Segment	Segment Portion	Result		Duplicate		Sample Mean	Overall Mean	RSD (Mean)
Solids: direct			% H_2O	Temperature Range (°C)	% H_2O	Temperature Range (°C)	% H_2O	% H_2O	%
S95T003528[1]	116:2	A	16.08	35-150	16.71	35-150	16.395	25.6	14.0
S95T003529[1]		Upper ½	7.290	35-130	13.40	25-120	10.35[QC:e]		
S95T003529[2]			16.52	40-110	12.96	40-110	14.74[QC:e]		
S95T003703[2]	116:3	Upper ½	12.61	40-120	8.980	40-120	10.795[QC:e]		
			11.86	40-110	6.130	40-100	8.995[QC:e]		
S95T003702[2]		Lower ½	12.32	40-100	10.10	40-120	11.21[QC:e]		
S95T003632[1]	116:4	A	19.00	23-210	22.41	40-210	20.70[QC:e]		
S95T003637[2]		B	18.71	40-210	24.20	40-200	21.455[QC:e]		
			31.67	40-220	25.16	40-220	28.415[QC:e]		
S95T003641[2]		C	33.92	40-250	33.91	40-220	33.915		
S95T003633[2]	116:5	A	24.42	40-200	24.11	40-200	24.27		
S95T003638[2]		B	20.34	40-190	21.08	40-200	20.71		
S95T003642[2]		C	23.36	40-200	32.83	40-210	28.095[QC:e]		
S95T003645[2]		D	21.70	40-200	24.45	40-220	23.075[QC:e]		

Table A-55. Tank 241-BY-104 Analytical Results: Weight Percent Water (TGA). (3 sheets)

Sample Number	Core: Segment	Segment Portion	Result		Duplicate		Sample Mean	Overall Mean	RSD (Mean)
Solids: direct			% H_2O	Temperature Range (°C)	% H_2O	Temperature Range (°C)	% H_2O	% H_2O	%
S95T003634[2]	116:6	A	28.77	40-210	26.33	40-220	27.55	Cont.	Cont.
S95T003639[2]		B	30.64	40-240	33.01	40-220	31.825		
S95T003643[1]		C	0.894	35-120	28.00	35-230	11.76[QC:e]		
			triplicate		6.40	35-240			
S95T003646[1] (December 1995)		D	0.752	25-200	0.997	21-250	0.875[QC:e]		
S95T003646[2] (February 1996)			22.97	40-180	24.24	40-200	23.605		
S95T003635[2]	116:7	A	25.73	40-210	25.85	40-190	25.79		
S95T003640[2]		B	28.21	40-190	26.65	40-190	27.43		
S95T003644[2]		C	29.20	40-180	27.83	40-190	28.52		
S95T003647[2]		D	26.81	40-210	24.36	40-200	25.59		
S95T003636[2]	116:8	A	26.96	40-200	26.76	40-210	26.86		
S95T003648[2]		D	35.26	40-180	33.59	40-200	34.42		
S95T003764[2]	117:1	Upper ½	37.49	40-230	36.64	40-220	37.06		
S95T003761[2]		DL	49.05	40-240	48.93	40-220	48.99		
S95T003775[2]	117:2	DL	48.80	40-240	48.95	40-240	48.88		
S95T003781[2]		A	30.24	40-210	28.11	40-210	29.175		
S95T003782[2]		D	34.40	40-210	37.81	40-190	36.11		

Table A-55. Tank 241-BY-104 Analytical Results: Weight Percent Water (TGA). (3 sheets)

Sample Number	Core: Segment	Segment Portion	Result		Duplicate		Sample Mean	Overall Mean	RSD (Mean)
Solids: direct			% H_2O	Temperature Range (°C)	% H_2O	Temperature Range (°C)	% H_2O	% H_2O	%
S95T003809[1]	117:3	Upper ½	37.06	22-230	35.97	24-240	36.52	Cont.	Cont.
S95T003783[1]		C	26.37	21.9-230	28.19	24-230	27.28		
S95T003810[2]	117:4	Upper ½	13.86	40-200	13.40	40-200	13.63		
S95T003784[2]	117:5	A	16.61	40-180	18.13	40-200	17.34		
S95T003785[2]		C	15.26	40-210	17.55	40-210	16.41[QC:e]		

Notes:

[1] Analyzed with a Perkin-Elmer™ instrument

[2] Analyzed with a Mettler™ instrument

Table A-56. Tank 241-BY-104 Analytical Results: Weight Percent Water (Gravimetry).

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)
Solids: direct			% H_2O	% H_2O	% H_2O	% H_2O	%
S95T003529	116: 2	Upper ½	14.66	15.74	15.2	n/a	n/a
S95T003528		A	16.9	18.34	17.62		
S95T003703	116: 3	Upper ½	12.53	12.8	12.165		
S95T003702		Lower ½	8.45	9.22	8.835		
S95T003645	116: 5	D	22.52	21.29	21.905		
S95T003643	116: 6	C	22.9	23.0	22.95		
S95T003646		D	23.2	23.1	23.15		
S95T003810	117: 4	Upper ½	15.6	14.6	15.1		
S95T003785	117: 5	C	16.14	16.4	16.27		

Table A-57. Tank 241-BY-104 Analytical Results: Energetics. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Run	Sample Weight	Transition 1		Transition 2		Transition 3	
Solids: direct				mg	Peak Temp. (°C)	Δ H (J/g)	Peak Temp. (°C)	Δ H (J/g)	Peak Temp. (°C)	Δ H (J/g)
S95T003528[1]	116:2	A	1	27.25	123.8	360.5	262.5	129.6	---	---
			2	43.26	139.4	535.7	255.7	60.9	422.1	-116.0[QC:e]
S95T003529[2]		Upper ½	1	28.44	128.6	494.0	299.4	91.0	401.6	-26.0[QC:e]
			2	43.03	132.2	325.6	302.2	122.2	408.7	-11.6[QC:e]
S95T003703[1]	116:3	Upper ½	1	23.75	132.3	331.5	302.6	120.3	---	---
			2	39.04	115.6	227.3	304.3	119.2	402.6	-11.1[QC:e]
S95T003702[1]		Lower ½	1	22.87	104.4	190.6	295.9	110.2	---	---
			2	23.35	107.2	282.4	293.8	110.6	---	---
S95T003632[1]	116:4	A	1	26.74	104.1	581.3	277.4	76.8	---	---
			2	16.51	106.0	661.2	305.4	54.2	---	---
S95T003637[1]		B	1	35.99	150.4	881.0	374.7	7.3	---	---
			2	44.10	150.1	600.5	296.8	35.8	---	---
S95T003641[1]		C	1	53.79	146.8	425.9	---	---	---	---
			2	46.70	157.9	267.0	---	---	---	---

Table A-57. Tank 241-BY-104 Analytical Results: Energetics. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Run	Sample Weight	Transition 1		Transition 2		Transition 3	
Solids: direct				mg	Peak Temp. (°C)	ΔH (J/g)	Peak Temp. (°C)	ΔH (J/g)	Peak Temp. (°C)	ΔH (J/g)
S95T003633[1]	116:5	A	1	31.31	103.2	661.9	291.9	66.1	422.1	132.9
			2	19.67	102.4	554.9	280.5	68.5	414.1	67.7
S95T003638[2] (December 1995)		B	1	35.70	151.4	702.9	324.6	-202.8[QC:e]	---	---
			2	21.56	146.0	668.9	320.9	-273.3[QC:e]	---	---
S95T003638[2] (February 1996)			1	19.93	106.8	427.8	290.5	70.1	466.9	124.8
			2	55.69	152.0	826.9	349.3	-41.2[QC:e]	---	---
S95T003642[2]		C	1	56.78	155.9	815.5	442.9	110.1	---	---
			2	32.76	133.4	709.3	---	---	---	---
S95T003645[2]		D	1	50.51	149.6	331.2	320.4	-219.2[QC:e]	---	---
			2	18.22	121.8	501.7	315.3	-557.4[QC:e]	---	---
			3	19.59	102.7	446.5	318.9	-995.7	---	---
S95T003634[2]	116:6	A	1	44.11	149.5	941.0	339.1	-23.6[QC:e]	---	---
			2	14.37	143.7	670.8	323.5	-36.2[QC:e]	---	---
S95T003639[2]		B	1	56.94	154.3	629.4	324.5	-71.0	---	---
			2	38.00	155.4	674.2	322.9	-65.3	---	---
S95T003643[1]		C	1	47.63	153.0	532.1	296.3	34.7	---	---
			2	37.71	153.7	534.7	292.4	34.42	---	---
S95T003646[1]		D	1	34.00	159.2	450.4	278.5	32.9	---	---
			2	33.75	143.4	747.1	287.1	31.3	---	---

Table A-57. Tank 241-BY-104 Analytical Results: Energetics. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Run	Sample Weight	Transition 1		Transition 2		Transition 3	
Solids: direct				mg	Peak Temp. (°C)	Δ H (J/g)	Peak Temp. (°C)	Δ H (J/g)	Peak Temp. (°C)	Δ H (J/g)
S95T003635[1]	116:7	A	1	36.00	148.2	1,005	338.8	-104.5	---	---
			2	21.30	136.2	793.6	328.6	-100.1	---	---
S95T003640[2] (December 1995)		B	1	45.72	152.8	546.7	330.2	-282.7[QC:e]	---	---
			2	40.17	148.0	541.1	330.5	-224.8[QC:e]	---	---
S95T003640[2] (February 1996)			1	68.46	163.8	905.2	345.3	-54.4[QC:e]	---	---
			2	22.01	148.6	745.0	329.7	-78.2[QC:e]	---	---
S95T003644[1]		C	1	36.21	146.7	773.6	384.7	72.2	---	---
			2	26.16	145.5	616.4	290.7	47.7	373.0	50.3
S95T003647[2]		D	1	20.15	120.2	973.0	321.3	-360.2	---	---
			2	13.73	124.1	1,373.4	370.5	-324.9	---	---
S95T003636[1]	116:8	A	1	45.50	143.0	655.6	368.6	-538.5[QC:e]	---	---
			2	39.15	150.0	588.0	373.3	-640.5[QC:e]	---	---
S95T003648[2]		D	1	22.05	151.2	639.1	434.4	83.4	---	---
			2	20.35	141.6	709.6	354.1	6.3	431.0	45.5
S95T003764[2]	117:1	Upper ½	1	46.00	144.6	857.3	358.6	1,342	---	---
			2	59.13	135.8	1,017	358.9	845.6	---	---
S95T003781[2]	117:2	A	1	36.65	144.8	747.0	360.8	2,014	---	---
			2	28.91	137.3	838.2	360.3	2,480	---	---
S95T003782[2]		D	1	33.33	143.9	930.4	211.3	50.2	323.0	-18.8[QC:e]
			2	32.90	132.1	967.4	214.2	14.3	327.1	-23.6[QC:e]

Table A-57. Tank 241-BY-104 Analytical Results: Energetics. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Run	Sample Weight	Transition 1		Transition 2		Transition 3	
Solids: direct				mg	Peak Temp. (°C)	Δ H (J/g)	Peak Temp. (°C)	Δ H (J/g)	Peak Temp. (°C)	Δ H (J/g)
S95T003809[1]	117:3	A	1	48.53	142.5	725.5	---	---	---	---
			2	19.58	121.5	858.4	---	---	---	---
S95T003783[1]		C	1	26.69	150.2	955.4	---	---	---	---
			2	18.22	144.8	1,082	---	---	---	---
S95T003810[1]	117:4	Upper ½	1	32.44	154.5	447.7	---	---	---	---
			2	25.25	120.8	299.3	279.8	116.2	---	---
S95T003784[1]	117:5	A	1	43.68	161.1	404.1	---	---	---	---
			2	35.31	146.2	425.1	---	---	---	---
S95T003785[1]		C	1	37.05	150.5	314.3	286.6	77.8	---	---
			2	19.46	104.4	102.6	278.6	102.6	---	---
Drainable Liquid										
S95T003761[2]	117:1	DL	1	30.19	144.1	909.7	---	---	---	---
			2	29.78	141.9	1,358	---	---	---	---
S95T003775[2]	117:2	DL	1	48.25	165.8	1,259	---	---	---	---
			2	32.11	145.8	1401	---	---	---	---

Notes:

[1] Perkin-Elmer™

[2] Mettler™

APPENDIX B

RESULTS OF WASH WATER CONTAMINATION CHECK FOR SINGLE-SHELL TANK 241-BY-104

This page intentionally left blank.

B.0 RESULTS OF WASH WATER CONTAMINATION CHECK FOR SINGLE-SHELL TANK 241-BY-104

B.1 INTRODUCTION AND ANALYTE TABLE DESCRIPTION

Appendix B reports the results of the wash water contamination check for the 1995 rotary-mode core sampling event. Lithium and bromide were measured to detect any contamination of waste samples by wash water.

The data table for each of the two analytes lists the laboratory sample identification number in column 1. For a description of the sampling event and information on sampling rationale and locations, see Section 3.0. A more detailed description of the wash water contamination check results is provided in Section 4.1.4.

Column 2 specifies the core and segment from which each sample was derived.

Column 3 specifies the subsegment for which the analyte was measured. As required by the ferrocyanide DQO, sludge material was split into quarter segments, and saltcake material was divided into halves. The drainable liquid from the first two segments of core 117 were designated DL.

Columns 3 and 4, Result and Duplicate, are self-explanatory. Column 6, Sample Mean, lists the average of the result and duplicate values. If the result and duplicate values were both detected, or one of the two values is detected and the other is nondetected, the mean is expressed as a detected value. If the result and duplicate values were both nondetected, the mean is expressed as a nondetected result. The result and duplicate values and the result and duplicate means, are reported in the tables exactly as found in the Tank Characterization Database. The means may appear to have been rounded up in some cases and rounded down in others. This is because the analytical results given in the tables may have fewer significant figures than originally reported not because the means were incorrectly calculated.

Overall means, RSDs (mean), and projected inventories were not calculated for these two analytes because they are not inherent constituents of the tank waste.

The four quality control parameters assessed on the wash water contamination check analytes were standard recoveries, spike recoveries, duplicate analyses (RPDs), and blanks. Only lithium had any quality control results outside the parameters specified in the SAP (Benar 1995). Five samples had low spike recoveries; they are identified in Column 6 with a superscripted QC:c. The QC:e superscript designates the seven samples which had RPDs outside of the SAP criterion.

Table B-1. Tank 241-BY-104 Analytical Results: Lithium. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean
Solids: fusion digest			μg/g	μg/g	μg/g
S95T003531	116: 2	Upper ½	< 466	< 415	< 440.5[QC:e]
S95T003530		A	< 202	< 177	< 189.5[QC:e]
S95T003700	116: 3	Upper ½	< 447	< 372	< 409.5[QC:e]
S95T003701		Lower ½	< 459	< 347	< 403[QC:e]
S95T003649	116: 4	A	< 175	< 184	< 179.5[QC:c]
S95T003650		B	< 187	< 189	< 188
S95T003651		C	< 184	< 183	< 183.5
S95T003652	116: 5	A	< 190	< 188	< 189
S95T003653		B	< 187	< 193	< 190
S95T003654		C	< 197	< 202	< 199.5
S95T003655		D	< 192	< 196	< 194[QC:c]
S95T003656	116: 6	A	< 175	< 179	< 177
S95T003657		B	< 182	< 178	< 180[QC:c]
S95T003658		C	< 190	< 192	< 191
S95T003659		D	< 204	< 199	< 201.5
S95T003660	116: 7	A	< 205	< 204	< 204.5
S95T003661		B	< 196	< 197	< 196.5
S95T003662		C	< 173	< 185	< 179
S95T003663		D	< 189	< 185	< 187
S95T003664	116: 8	A	< 424	< 442	< 433
S95T003665		D	< 202	< 183	< 192.5

Table B-1. Tank 241-BY-104 Analytical Results: Lithium. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean
Solids: fusion digest			μg/g	μg/g	μg/g
S95T003771	117: 1	Upper ½	< 502	< 507	< 504.5
S95T003761		DL	< 8.57143	< 8.57143	< 8.57143
S95T003775	117: 2	DL	< 8.57143	< 8.57143	< 8.57143
S95T003786		A	< 201	< 196	< 198.5[QC:c]
S95T003787		D	< 196	< 196	< 196
S95T003811	117: 3	Upper ½	< 183	< 184	< 183.5
S95T003788		C	< 198	< 198	< 198
S95T003812	117: 4	Upper ½	< 198	< 202	< 200
S95T003789	117: 5	A	< 203	< 203	< 203
S95T003790		C	< 191	< 191	< 191
Solids: acid digest			μg/g	μg/g	μg/g
S95T003532	116: 2	A	< 8.59	< 9.06	< 8.825
S95T003533	116: 3	Lower ½	< 9.59	< 9.63	< 9.61
S95T003666	116: 4	A	< 9.5	< 8.94	< 9.22
S96T000604		B	< 5.6	< 4.99	< 5.295[QC:e]
S96T000605		C	< 5.92	< 6.25	< 6.085
S96T000606	116: 5	A	< 4.48	< 4.56	< 4.52
S96T000607		B	< 4.32	< 3.71	4.015[QC:e]
S96T000608		C	5.43	< 4.40	4.915[QC:e]
S96T000609		D	< 5.02	< 4.83	< 4.925

Table B-1. Tank 241-BY-104 Analytical Results: Lithium. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean
Solids: acid digest			µg/g	µg/g	µg/g
S95T003673	116: 6	A	< 4.86	< 4.80	< 4.83[QC:c]
S95T003674		B	< 4.42	< 4.50	< 4.46
S95T003675		C	< 5.00	< 5.03	< 5.015
S95T003676		D	< 4.91	< 4.70	< 4.805
S95T003677	116: 7	A	< 4.34	< 4.25	< 4.295
S95T003678		B	< 5.02	< 4.89	< 4.955
S95T003679		C	< 8.95	< 8.75	< 8.85
S95T003680		D	< 5.13	< 5.14	< 5.135
S95T003681	116: 8	A	< 4.45	< 4.60	< 4.525
S95T003682		D	< 3.20	< 2.98	< 3.09
S95T003791	117: 2	A	< 6.17	< 6.13	< 6.15
S95T003792		D	< 5.53	< 5.61	< 5.57
S95T003793	117: 3	C	< 4.60	< 4.66	< 4.63
S95T003794	117: 5	A	< 4.93	< 4.83	< 4.88
S95T003795		C	< 4.71	< 4.86	< 4.785
Solids: water digest			µg/g	µg/g	µg/g
S95T003683	116: 4	A	< 9.46	< 9.54	< 9.50
S95T003684		B	< 8.72	< 8.77	< 8.745
S95T003685		C	< 8.86	< 8.89	< 8.875
S95T003697	116: 7	D	< 8.93	< 8.93	< 8.93

Table B-1. Tank 241-BY-104 Analytical Results: Lithium. (4 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean
Solids: water digest			**μg/g**	**μg/g**	**μg/g**
S95T003698	116: 8	A	< 19.6	< 20.4	< 20.0
S95T003813	117: 3	Upper ½	< 9.65	< 9.61	< 9.63
S95T003798		C	< 9.50	< 9.62	< 9.56
Core composite: fusion digest			**μg/g**	**μg/g**	**μg/g**
S96T000374	116	n/a	< 226	< 211	< 218.5

Table B-2. Tank 241-BY-104 Analytical Results: Bromide. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean
Solids: water digest			µg/g	µg/g	µg/g
S95T003536	116: 2	Upper ½	< 959.9	< 993	< 976.45
S95T003534		A	< 914.3	< 877	< 895.65
S95T003705	116: 3	Upper ½	< 1,092	< 1,080	< 1,086
S95T003704		Lower ½	< 1,217	< 1,240	< 1,228.5
S95T003683	116: 4	A	< 977.3	< 987	< 982.15
S95T003684		B	< 901.4	< 906	< 903.7
S95T003685		C	< 915.3	< 918	< 916.65
S95T003686	116: 5	A	< 991.7	< 1,020	< 1,005.85
S95T003687		B	< 910.5	< 914	< 912.25
S95T003688		C	< 1,001	< 993	< 997
S95T003689		D	< 991.9	< 994	< 992.95
S95T003690	116: 6	A	< 968.5	< 987	< 977.75
S95T003691		B	< 984.4	< 921	< 952.7
S95T003692		C	< 1,213	< 1,210	< 1,211.5
S95T003693		D	< 1,242	< 1,250	< 1,246
S95T003694	116: 7	A	< 1,014	< 1,020	< 1,017
S95T003695		B	< 1,001	< 1,010	< 1,005.5
S95T003696		C	< 2,185	< 2,300	< 2,242.5
S95T003697		D	< 2,272	< 2,270	< 2,271

Table B-2. Tank 241-BY-104 Analytical Results: Bromide. (2 sheets)

Sample Number	Core: Segment	Segment Portion	Result	Duplicate	Sample Mean
Solids: water digest			μg/g	μg/g	μg/g
S95T003698	116: 8	A	< 2,025	< 2,100	< 2,062.5
S95T003699		D	< 903.8	< 888	< 895.9
S95T003772	117: 1	Upper ½	< 598.9	< 597	< 597.95
S95T003796	117: 2	A	< 2,233	< 2,240	< 2,236.5
S95T003797		D	< 2,519	< 2,520	< 2,519.5
S95T003813	117: 3	Upper ½	< 997.1	< 993	< 995.05
S95T003798		C	< 981.6	< 993	< 987.3
S95T003814	117: 4	Upper ½	< 1,005	< 1,000	< 1,002.5
S95T003799	117: 5	A	< 2,475	< 2,460	< 2,467.5
S95T003800		C	< 2,195	< 2,220	< 2,207.5
Core composite: fusion digest			μg/g	μg/g	μg/g
S96T000373	116	n/a	< 1,020	< 916	< 968

This page intentionally left blank.

APPENDIX C

HISTORICAL ANALYTICAL RESULTS

This page intentionally left blank.

C.0 INTRODUCTION

Appendix C contains analytical results from two historical sampling events: a sludge sampling event in 1976 and an auger sampling of the top saltcake layer in 1992. Section C.1 discusses the sludge sample, and Section C.2 shows the results from analyses of the 1992 auger sample. Neither event was used for comparison purposes. Significant waste transfers occurred after the 1976 sampling. The 1992 event obtained waste from only the top six inches of waste.

C.1 1976 ANALYTICAL RESULTS

A sludge sample was received in the laboratory on February 6, 1976, and the results were reported on March 16. The sample was noted as being soft in texture and reddish-brown in color. A description of the technique or procedure used to obtain the samples was not available, and no information about the riser or sample depth was available. The sample was prepared by fusing a known volume of solids with KOH, dissolving the melt with concentrated HCl, and then diluting the sample with a known volume of water. For further discussion of this sampling event, see Section 3.4. Table C-1 show the analytical results.

Table C-1. Sludge Sample from Tank 241-BY-104.[1] (2 sheets)

Waste Tank 241-BY-104		
Received: February 6, 1976		
Component	Lab Value	Lab Unit
Chemical Analysis of 104-BY Tank Sludge		
Bulk density	1.61	g/mL
Particle density	2.09	g/mL
H_2O	28.3	%
Al	2.3	M
Fe	0.1	M
NO_3	24.1	M
Ca	0.06	M
Ba	<0.004	M
Mg	0.04	M
Mn	0.03	M
Ni	0.5	M
PO_4	0.1	M
Si	<0.3	M

Table C-1. Sludge Sample from Tank 241-BY-104.[1] (2 sheets)

Radiological Analysis of 104-BY Tank Sludge			
Pu	0.00113	g/L	
$^{89+90}Sr$	1.13E+05	μCi/L	
^{137}Cs	4.40E+05	μCi/L	
Chemical Analysis of 104-BY Tank Supernate			
Density	1.45	g/mL	
H_2O	48	%	
Al	2.48	M	
Fe	0.00107	M	
NO_2	2.46	M	
NO_3	0.11	M	
OH	3.74	M	
CO_3	0.43	M	
Si	<0.00325	M	
PO_4	0.00979	M	
Total Wt. % Recovery	98.3	%	
Radiological Analysis of 104-BY Tank Supernate			
$^{89+90}Sr$	201	μCi/L	
^{137}Cs	5.30E+05	μCi/L	
Particle Size Distribution of 104-BY Tank Solids			
Particle Size (μm)	**Average Diameter (μm)**	**Weight %**	**Cumulative Weight %**
5 to 10	8.25	4.0	99.4
10 to 20	16.5	68.3	95.4
20 to 30	25.9	19.2	27.1
30 to 40	35.7	3.1	7.9
40 to 50	45.5	1.0	4.8
50 to 60	55.4	1.3	3.8
60 to 70	65.4	0.8	2.5
70 to 80	75.3	0.8	1.7
80 to 90	85.3	0.4	0.9
90 to 100	95.3	0.5	0.5

Note:

[1]Horton (1976)

C.2 1992 ANALYTICAL RESULTS

Two auger samples were taken from the top 15 cm (6 in.) of saltcake from risers 5 and 10B. The waste was sampled to determine whether a ferrocyanide safety issue existed. The samples had the appearance of brown, damp, granular salt. The dates of sampling were June 17 and 18, 1992 (Beck et al. 1992). For more information about this sampling event, see Section 3.4. Analytical results from the event are in Tables C-2 and C-3.

Table C-2. Thermal Analytical Results from the 1992 Saltcake Sample.[1] (2 sheets)

Thermogravimetric Analysis and Differential Scanning Calorimetry for Water Loss						
Analysis Event Assignment	**Riser 5 Top of Auger**	**Riser 10 Top of Auger**	**Riser 5 Bottom of Auger**	**Riser 10 Bottom of Auger**	**Riser 5 Homogenized Composite**	**Riser 10 Homogenized Composite**
TGA--Water Loss						
Temperature range (°C)	Ambient to 190	35 to 141	Ambient to 160	35 to 134	Ambient to 150	Ambient to 145
% Weight loss $\pm \sigma$	20.4 $\pm$ 0.9	20.2 $\pm$ 0.1	17.7 $\pm$ 0.5	22 $\pm$ 3	15.4 $\pm$ 1.5	20 $\pm$ 3
DSC--Water Loss						
Temperature range (°C)	45 to 174	65 to 165	44 to 193	70 to 150	52 to 179	46 to 164
Heat added (endotherm) or lost (exotherm) (-) (J/g $\pm \sigma$)	482 $\pm$ 6	Large but not integrated	440 $\pm$ 60	Large but not integrated	412 $\pm$ 57	580 $\pm$ 180
Thermogravimetric Analysis and Differential Scanning Calorimetry for Endotherm 2						
Analysis Event Assignment	**Riser 5 Top of Auger**	**Riser 10 Top of Auger**	**Riser 5 Bottom of Auger**	**Riser 10 Bottom of Auger**	**Riser 5 Homogenized Composite**	**Riser 10 Homogenized Composite**
TGA--Endotherm 2						
Temperature range (°C)	n/a	115 to 292	160 to 440	127 to 301	150 to 435	125 to 301
% Weight loss $\pm \sigma$	Very slight, not measurable	3.6 $\pm$ 1	23.2 $\pm$ 0.2	2.48 $\pm$ 0.03	19 $\pm$ 2	1.96 $\pm$ 0.03

Table C-2. Thermal Analytical Results from the 1992 Saltcake Sample.[1] (2 sheets)

DSC--Endotherm 2						
Temperature range (°C)	240 to 290	230 to 280	214 to 305	n/a	219 to 311	229 to 287
Heat gained (endotherm) or lost (exotherm) (-) (J/g ± σ)	Not integrated, estimated ~50	Not integrated, estimated ~30	320 ± 150	Not integrated or estimable	310 ± 32	23 ± 13
Thermal Gravimetric Analysis and Differential Scanning Calorimetry for Exotherm						
Analysis Event Assignment	**Riser 5 Top of Auger**	**Riser 10 Top of Auger**	**Riser 5 Bottom of Auger**	**Riser 10 Bottom of Auger**	**Riser 5 Homogenized Composite**	**Riser 10 Homogenized Composite**
TGA--Exothermic Reaction						
Temperature range (°C)	380 to 440	292 to 429	n/a	301 to 430	n/a	294 to 433
% Weight loss ± σ	2 ± 0.7	2.80 ± 0.09	No apparent weight loss	1.93 ± 0.01	Weight loss included with lower temperature endotherm	2 ± 0.5
DSC--Exothermic Reaction						
Temperature range (°C)	311 to 443	357 to 443	303 to 405	358 to 441	390 to 454	375 to 435
Heat gained (endotherm) or lost (exotherm) (-) (J/g ± σ)	-103 ± 3	-40 ± 5	-171 ± 70	-31 ± 10	-22 ± 4	-18 ± 12

Note:

[1]Beck et al. (1992)

Table C-3. Chemical Anlaytical Results from the 1992 Saltcake Sample.[1] (3 sheets)

Cyanide Analysis						
	Riser 5			Riser 10B		
Method	μg/g wet solids	1 σ	Spike recovery %	μg/g wet solids	1 σ	Spike recovery %
Normal method	37	9	114	71	13	Not run
Normal method: rerun for dissolution check	42.9	0.3	103	86	6	73.3
Combined data, normal method: four runs	39	6	n/a	78	12	n/a
Modified method (5% EDTA/5% ethylene diamine)	69	7	69	75.1	0.3	Not run

Total Organic and Inorganic Carbon		
Analyte	Riser 5	Riser 10B
TOC-soluble (μg/g)	6000 ± 180	10,750 ± 14
TOC-direct sample (μg/g)	9100 ± 300	11,000 ± 300
TIC-water soluble (μg/g)	20,000 ± 1600	48,000 ± 1300
TIC-direct sample (μg/g)	19,000 ± 200	38,500 ± 400

Weight Percent Water and pH		
Property	Riser 5	Riser 10B
% Water ± 1σ	17.1 ± 0.1	15.1 ± 0.3
pH ± 1σ	13.155 ± 0.005	11.86 ± 0.01

Table C-3. Chemical Anlaytical Results from the 1992 Saltcake Sample.[1] (3 sheets)

Particle Size Distribution				
	Riser 5		Riser 10B	
Statistics	First run	Duplicate	First run	Duplicate
0.5- to 60-μm count number, length mean	1.34	1.32	1.17	1.14
0.5- to 150-μm count volume, moment mean	40.15	53.67	34.66	23.20

Radiochemical Analysis		
Analysis	Riser 5 μCi/g wet solids ± 1σ	Riser 10B μCi/g wet solids ± 1σ
Total alpha	0.24 ± 0.07	0.14 ± 0.03
Total beta	613 ± 17	288 ± 7
Gamma energy Analysis	^{137}Cs: 115.6 ± 0.8 (4 other nuclides <10^{-1} μCi/g)	^{137}Cs: 76 ± 3 (4 other nuclides <10^{-1} μCi/g)
Uranium	3725 ± 64 μg/g	1640 ± 28 μg/g
$^{239/240}$Pu	0.07 ± 0.02	0.025 ± 0.003
^{90}Sr	143 ± 14	60 ± 2
^{241}Am	0.103 ± 0.004	0.043 ± 0.002

Ion Chromatography Results		
Analyte	Riser 5 μCi/g wet solids ± 1σ	Riser 10B μCi/g wet solids ± 1σ
Fluoride	6735 ± 120	12,100 ± 1400
Chloride	1945 ± 60	1170 ± 100
Nitrite	11,900 ± 1000	15,700 ± 850
Nitrate	49,050 ± 1200	74,500 ± 4400
Phosphate	5785 ± 220	3840 ± 820
Sulfate	26,500 ± 1700	44,600 ± 3800
Total anion	101,900 μg/g	152,000 μg/g

Table C-3. Chemical Anlaytical Results from the 1992 Saltcake Sample.[1] (3 sheets)

Inductively Coupled Plasma Analyses						
	Riser 5			Riser 10B		
Element	Water Digestion (μg/g)	Acid Digestion (μg/g)	Fusion Digestion (μg/g)	Water Digestion (μg/g)	Acid Digestion (μg/g)	Fusion Digestion (μg/g)
Fe	6.25	6000	7080	4.63	2090	2500
Al	1900	80,000	80,700	300	18,000	13,100
Na	152,000	180,000	160,000	272,500	270,000	250,000
P	2300	3000	4100	2800	3000	6390
Sr	n/a	n/a	1700	n/a	n/a	614
Zr	0.5	70	45	1.5	36	36
Si	n/a	n/a	909	n/a	n/a	2080
Co	4.5	50	67	1	23	n/a
Zn	n/a	n/a	100	n/a	n/a	400
Ni	2.1	1300	4000	3	540	5000
Ca	<27	1500	1460	45	710	780
Cr	11,900	14,000	16,800	2300	3900	4240
Ba	n/a	n/a	42	n/a	n/a	20
S	9200	n/a	10,500	18,000	n/a	18,300
Mg	1.2	n/a	150	n/a	n/a	128
Se	n/a	n/a	2000	n/a	n/a	523
Cu	<0.3	20	45	0.9	7	400
Cd	n/a	n/a	98	n/a	n/a	41
Mn	<0.3	300	367	<0.3	110	141
Mo	26.1	n/a	n/a	n/a	n/a	n/a
K	3000	2900	n/a	2100	2400	n/a

Note:

[1]Beck et al. (1992)

This page intentionally left blank.

DISTRIBUTION SHEET

To	From	
Distribution	Data Assessment and Interpretation	Page 1 of 4
		Date 09/05/96
Project Title/Work Order		EDT No. EDT-617546
Tank Characterization Report for Single-Shell Tank 241-BY-104, WHC-SD-WM-ER-608, Rev. 0		ECN No. N/A

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
OFFSITE					
Sandia National Laboratory P.O. Box 5800 MS-0744, Dept. 6404 Albuquerque, NM 87815					
D. Powers		X			
Nuclear Consulting Services Inc. P. O. Box 29151 Columbus, OH 43229-01051					
J. L. Kovach		X			
Chemical Reaction Sub-TAP P.O. Box 271 Lindsborg, KS 67456					
B. C. Hudson		X			
Tank Characterization Panel Senior Technical Consultant Contech 7309 Indian School Road Albuquerque, NM 87110					
J. Arvisu		X			
U. S. Department of Energy - Headquarters Office of Environmental Restoration and Waste Management EM-563 12800 Middlebrook Road Germantown, MD 20874					
J. A. Poppitti		X			
Jacobs Engineering Group	B5-36	X			

DISTRIBUTION SHEET

To	From	Page 2 of 4
Distribution	Data Assessment and Interpretation	Date 09/05/96
Project Title/Work Order		EDT No. EDT-617546
Tank Characterization Report for Single-Shell Tank 241-BY-104, WHC-SD-WM-ER-608, Rev. 0		ECN No. N/A

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
<u>SAIC</u> 20300 Century Boulevard, Suite 200-B Germantown, MD 20874					
H. Sutter		X			
555 Quince Orchard Rd., Suite 500 Gaithersburg, MD 20878					
P. Szerszen		X			
<u>Los Alamos Laboratory</u> CST-14 MS-J586 P. O. Box 1663 Los Alamos, NM 87545					
S. F. Agnew (4)		X			
<u>Los Alamos Technical Associates</u>					
T. T. Tran	B1-44	X			
<u>Ogden Environmental</u> 101 East Wellsian Way Richland, WA 99352					
R. J. Anema		X			
<u>CH2M Hill</u> P. O. Box 91500 Bellevue, WA 98009-2050					
M. McAfee		X			
<u>Tank Advisory Panel</u> 102 Windham Road Oak Ridge, TN 37830					
D. O. Campbell		X			

DISTRIBUTION SHEET

To	From	Page 3 of 4
Distribution	Data Assessment and Interpretation	Date 09/05/96
Project Title/Work Order: Tank Characterization Report for Single-Shell Tank 241-BY-104, WHC-SD-WM-ER-608, Rev. 0		EDT No. EDT-617546
		ECN No. N/A

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
<u>ONSITE</u>					
<u>Boeing Computer Services of Richland</u>					
B. G. Lauzon	R1-08	X			
<u>Department of Energy - Richland Operations</u>					
J. F. Thompson	S7-54	X			
W. S. Liou	S7-54	X			
N. W. Willis	S7-54	X			
<u>ICF-Kaiser Hanford Company</u>					
R. L. Newell	S3-09	X			
<u>Pacific Northwest Laboratory</u>					
N. G. Colton	K3-75	X			
J. R. Gormsen	K7-28	X			
S. A. Hartley	K5-12	X			
J. G. Hill	K7-94	X			
G. J. Lumetta	P7-25	X			
A. F. Noonan	K9-81	X			
<u>Westinghouse Hanford Company</u>					
H. Babad	S7-14	X			
D. A. Barnes	R1-80	X			
C. J. Benar	R2-12	X			
G. R. Bloom	H5-61	X			
W. L. Cowley	A3-37	X			
L. A. Diaz	T6-06	X			
G. L. Dunford	A2-34	X			
E. J. Eberlein	R2-12				X
D. B. Engelman	L6-37	X			
J. S. Garfield	H5-49	X			
J. D. Guberski	R1-51				X
D. L. Herting	T6-09	X			
D. C. Hetzer	S6-31	X			
B. A. Higley	H5-27	X			
G. Jansen	H6-33	X			
G. D. Johnson	S7-15	X			
T. J. Kelley	S7-21	X			

DISTRIBUTION SHEET

To	From	Page 4 of 4
Distribution	Data Assessment and Interpretation	Date 09/05/96
Project Title/Work Order		EDT No. EDT-617546
Tank Characterization Report for Single-Shell Tank 241-BY-104, WHC-SD-WM-ER-608, Rev. 0		ECN No. N/A

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
Westinghouse Hanford Company continued					
N. W. Kirch	R2-11	X			
J. E. Meacham	S7-15	X			
W. C. Miller	R1-56	X			
C. T. Narquis	T6-16	X			
D. E. Place	H5-27	X			
D. A. Reynolds	R2-11	X			
L. M. Sasaki	R2-12	X			
L. W. Shelton, Jr.	H5-49	X			
B. C. Simpson	R2-12	X			
G. L. Troyer	T6-50	X			
L. R. Webb	T6-06	X			
K. A. White	S5-13	X			
Central Files	A3-88	X			
EDMC	H6-08	X			
ERC (Environmental Resource Center)	R1-51	X			
TCRC (10)	R2-12	X			