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Tank Characterization Report for Single-Shell Tank 241-BY-106

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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-106. This report supports the requirements of the Tri-Party Agreement Milestone M-44-09.

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Tank Characterization Report for Single-Shell Tank 241-BY-106

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EXECUTIVE SUMMARY

This tank characterization report summarizes the available information on the historical uses, current status, and sampling and analysis results of wastes stored in single-shell tank 241-BY-106 and the vapors associated with the waste. This report supports the requirements of the *Hanford Federal Facility Agreement and Consent Order* Milestone M-44-09 (Ecology et al. 1996). Analyses of recovered sample material addressed by this report indicate that the tank poses no safety concerns based on the decision criteria of the safety screening and organic data quality objectives (DQOs). However, recovery of the expected sludge was very limited such that tank safety with respect to all relative DQOs, including ferrocyanide, cannot be completely assessed. Core 121 was incomplete because of the inability of the push-mode core sampling technique to penetrate hard waste. Three segments remain unsampled below riser 5.

Tank 241-BY-106 is one of 12 single-shell tanks located in the Hanford Site's 200 East Area BY Tank Farm, and is the third tank in a three-tank cascade series that includes tanks 241-BY-104 and 241-BY-105. The tank went into service during the second quarter of 1953 when it received first-cycle decontamination waste. Most of this waste was sluiced from the tank during 1953. The tank then received ferrocyanide scavenged waste from 1955 to 1957. The scavenged supernatant was routinely discharged to cribs. Much of the ferrocyanide sludge was sent to tanks 241-BY-104 and 241-BY-105 by the end of that time period. Tank 241-BY-106 received Plutonium-Uranium Extraction Plant cladding waste supernatant intermittently from 1961 to 1967. Supernatant was removed from the tank during 1967.

Waste from in-tank solidification operations in the BY Tank Farm was added to and removed from the tank through the mid-1970s. More than 242 kL (64 kgal) of interstitial liquid were pumped from tank 241-BY-106 during interim stabilization efforts in 1995 although interim stabilization has not been completed.

A description of the tank, its contents and sampling activities is presented in Table ES-1. The tank has an operating capacity of 2,870 kL (758 kgal), and presently contains a total of 2,430 kL (642 kgal) of waste (Hanlon 1996). Of this total, 360 kL (95 kgal) is sludge, and 2,070 kL (547 kgal) is saltcake. The tank contains an estimated 757 kL (200 kgal) of drainable interstitial liquid and no supernatant.

This report summarizes the collection and analysis of core samples 64 and 65 acquired between November 1994 and January 1995, core 121 acquired between December 1995 and January 1996, and vapor samples obtained during 1994. Core 121 was incomplete because the bottom three segments were not obtained. The three core samples were obtained to satisfy the requirements of the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995), *Data Quality Objectives for the Waste Compatibility Program* (Carothers 1994), *Data Requirements for the Ferrocyanide Safety Issue Developed through the Data Quality Objective Process* (Meacham et al. 1994 and 1995), *Data Quality Objective to Support Resolution of the Organic Complexant Safety Issue* (Turner et al. 1996), *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995), and *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).

Core samples 64 and 65 were respectively acquired and analyzed in accordance with the tank 241-BY-106 tank characterization plans (Schreiber 1994 and 1995). Core sample 121 was obtained and analyzed in accordance with the tank 241-BY-106 sampling and analysis plan (Bell 1996c). Vapor samples were obtained as stipulated in the *Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution* (Osborne et al. 1994).

Comparisons were made between the analytical results and the decision criteria thresholds defined in the safety screening DQO. A summary of the analytical data and projected inventories is presented in tables ES-2 and ES-3. The saltcake exhibited very different behavior from the sludge. Exothermic reactions were noted in the saltcake, but all exhibited changes in enthalpy less than the DQO notification limit of -480 J/g on a dry-weight basis. Furthermore, all of the results from the one-sided, upper 95 percent confidence interval on the mean are below the -480 J/g limit. The one sludge sample, collected from segment 13 of core 65, exhibited exothermic reactions with changes in enthalpy greater than the DQO notification limit. The highest result was -1,360 J/g (all of the following results for differential scanning calorimetry [DSC] are based on dry weight); however, the sludge contained 37 weight percent water. This water content is above the ferrocyanide DQO requirement of 3.5 weight percent water, based on the highest DSC result for that sample, and above the 17 weight percent requirement of the organic complexant DQO. The flammability of the tank 241-BY-106 headspace was measured at zero percent of the lower flammability limit (LFL) (Bell 1996b). Although hydrostatic head fluid and wash water containing lithium bromide as a tracer were used to facilitate the core sampling, lithium and bromide results indicate no significant contamination from hydrostatic head fluid or wash water.

Moisture content as measured by thermogravimetric analysis (TGA) results were highly varied. The mean results varied from 8.4 to 49 weight percent for the solids, and from 50 to 68 weight percent for the drainable liquids. The saltcake from core 121 contained several samples with a moisture content of less than 17 weight percent. The lower limits of the one-sided 95 percent confidence interval on the mean varied from 0 to 34 weight percent for the solids and from 45 to 49 weight percent for the drainable liquids. The mean TGA results from the saltcake in cores 64 and 65 ranged from 3.8 to 47 weight percent water. The mean sludge weight percent water from core 65 segment 13 was 37.

All of the total organic carbon (TOC) in the saltcake is accounted for by oxalate and formate. Results on a dry weight basis for the saltcake averaged 3,360 μg/g and 32,500 μg/g for the one sludge sample. The sludge results were slightly above the organic DQO limit of 3 weight percent.

The overall mean total alpha activity for the saltcake samples from cores 65 and 121 was 0.0095 μCi/g. Total alpha activity was not measured on core 64. Mean results for core 121 ranged from $<$ 0.002 to 0.032 μCi/g, and the upper limits to the one-sided 95 percent confidence interval on the mean for core 121 ranged from 3.8 to 0.059 μCi/g. The mean total alpha activity for the sludge waste was higher than the saltcake at 0.25 μCi/g. All total alpha results were less than the safety screening DQO limit of 36.0 μCi/g.

Analysis of nickel, cyanide, energetics, and weight percent water, was required by the ferrocyanide DQO to measure the concentration of ferrocyanide in the tank waste and evaluate the hazards it may present. A review of the current data and comparison to historical information showed that the ferrocyanide degraded as much as 99 percent in the nearly four decades since the disodium nickel ferrocyanide was added to the tank.

The historical DQO required analysis for specific analytes of concern that were selected to designate BY saltcake (BYSltCk) and ferrocyanide sludge waste types. All BYSltCk analytes of concern were measured at greater than 10 percent of the expected concentration for saltcake, indicating that the waste type is consistent with the type BYSltCk as described in the historical DQO (Simpson and McCain 1995). The results of five of the six analytes of concern chosen to characterize ferrocyanide waste were taken from the sludge sample (core 65, segment 13). All of the measured analytes of concern for ferrocyanide waste were greater than 10 percent of the expected concentration. Therefore, the sludge is consistent with ferrocyanide waste as expected.

Tables ES-2 and ES-3 present the major analytes and analytes of concern for tank 241-BY-106.

Table ES-1. Description and Status of Tank 241-BY-106.

TANK DESCRIPTION	
Type	Single-shell
Constructed	1948 to 1949
In service	1953
Diameter	23 m (75 ft)
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	2,430 kL (642 kgal)
Saltcake volume	2,070 kL (547 kgal)
Sludge volume	360 kL (95 kgal)
Drainable interstitial liquid volume	757 kL (200 kgal)
Waste surface level (April 21, 1996)	5.41 m (213 in.)
Temperature (June 1995 to June 1996)	24.1 °C (75.4°) to 52.9 °C (127.2 °F)
Watch list	None (Removed from Ferrocyanide 8/96)
Integrity	Assumed leaker (1984)
SAMPLING DATES	
Core 64 and 65	November 17, 1994 to January 24, 1995
Core 121 and tank headspace flammability	December 15, 1995 to January 2, 1996
Vapor samples	July 8, 1994
SERVICE STATUS	
Partial interim isolation	December 1982
Partial interim stabilization	October 1995
Removed from service	August 1977

Table ES-2. Major Analytes and Analytes of Concern in Tank 241-BY-106 Saltcake. (2 sheets)

Analyte	Overall Mean	RSD (Mean)	Projected Inventory
METALS	**µg/g[1]**	**%**	**kg[1]**
Aluminum	20,400 (28,700)	24.9 (18.8)	72,200 (1.02E+05)
Iron	215	22.9	761
Nickel	47.9	10.9	170
Phosphorus	1,032	23.3	3,650
Potassium	2,470	13.6	8,740
Sodium	2.03E+05 (2.11E+05)	3.0 (4.0)	7.19E+05 (7.47E+05)
Sulfur	3,280	14.1	11,600
Uranium	164	13.8	581
ANIONS	**µg/g**	**%**	**kg**
Chloride	2,060	14.2	7,290
Cyanide	20.6	10.1	57.3
Fluoride	5,130	17.6	18,200
Formate	630	11.8	2,230
Nitrate	3.29E+05	11.2	1.16E+06
Nitrite	32,100	14.4	114,000
Oxalate	8,990	15.7	31,800
Phosphate	5,270	18.0	18,700
Sulfate	11,300	13.4	40,000
RADIONUCLIDES	**µCi/g**	**%**	**Ci**
^{137}Cs	106 (89.6)	13.9 (9.9)	3.75E+05 (3.26E+05)
^{90}Sr	(4.26)	(16.6)	14,400
Total alpha	(0.00945)	17.2	33.5
Total beta[2]	(80.2)	(3.7)	2.83E+05

Table ES-2. Major Analytes and Analytes of Concern in Tank 241-BY-106 Saltcake. (2 sheets)

Analyte	Overall Mean	RSD (Mean)	Projected Inventory
CARBON	µg C/g	%	kg
Total organic carbon	2,500	12.1	8,870
Total inorganic carbon	7,359	20.8	26,050
PHYSICAL PROPERTIES		%	kg
Density	1.71 g/mL	2.4	N/A
Percent water	25.5	12.7	9.02E+05

Notes:

RSD = relative standard deviation

[1]Analytical results and projected inventories for analytes in parentheses are from fusion digestion. All other data are from acid or water digestions or from direct analysis.

[2]Result from the core 121 composite.

Table ES-3. Major Analytes and Analytes of Concern in the 241-BY-106 Sludge.

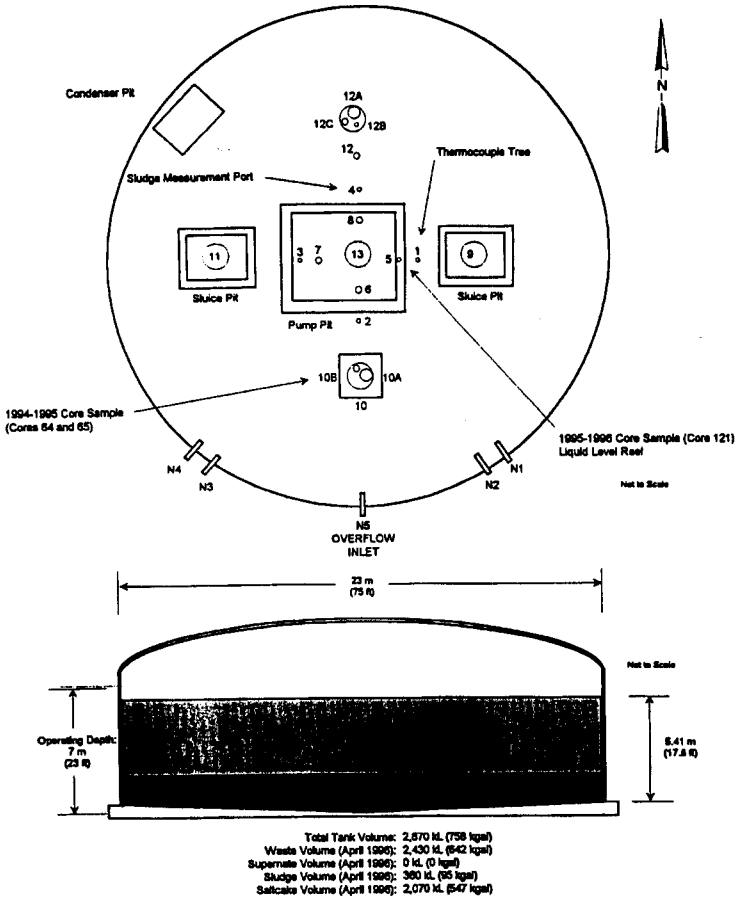
Analyte	Overall Mean	RSD (Mean)	Projected Inventory
METALS	**µg/g**	**%**	**kg**
Aluminum	30,800	2.4	19,000
Calcium	8,150	5.3	5,020
Chromium	1,120	2.8	690
Iron	33,000	1.3	20,300
Nickel	29,500	5.8	18,200
Phosphorus	20,500	5.6	12,600
Sodium	1.30E+05	1.8	80,100
ANIONS	**µg/g**	**%**	**kg**
Cyanide	93.9	5.3	57.8
RADIONUCLIDES	**µCi/g**	**%**	**Ci**
^{137}Cs	508	22.4	3.13E+05
$^{239/240}Pu$	0.0997	5.4	61.4
^{90}Sr	763	2.6	4.70E+05
Total alpha	0.253	14.9	156
CARBON	**µg C/g**	**%**	**kg**
Total organic carbon	20,400	4.2	12,600
Total inorganic carbon	5,580	10.0	3,435
PHYSICAL PROPERTIES		**%**	
Percent water	37.3	1.9	1.34E+05

The heat load was calculated using the data from the 1994-1996 sampling effort (Bell 1996c) to be 6,490 W (22,200 Btu/hr). The historical tank content estimate of heat load was 3,910 W (13,400 Btu/hr), and the estimate by Kummerer (1994) was 2,960 W (10,100 Btu/hr). All of these estimates are well below the 11,700 W (40,000 Btu/hr) threshold differentiating high-heat from low-heat tanks (Bergmann 1991).

None of the analytical data indicate that the tank is unsafe; however, the sampling requirements of the safety screening DQO were not met (two vertical profiles were not obtained from the two risers). The sample recovery for core 64 was very poor and the representativeness of the core 65 sample is questionable. The ferrocyanide sludge in the tank was not fully characterized. Only one small sample of the sludge was acquired. The high TOC and DSC results from the sludge samples suggest that further investigation of the sludge would be prudent.

A profile of tank 241-BY-106 is provided in Figure ES-1.

Figure ES-1. Profile of Tank 241-BY-106



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LIST OF TERMS

μCi/mL	microcuries per milliliter
μCi/L	microcuries per liter
μCi/g	microcuries per gram
μeq/g	microequivalents per gram
μg	microgram
μg/g	micrograms per gram
μg/mL	micrograms per milliliter
μmol	micromole
$\mu g/m^3$	micrograms per cubic meter
μg C/g	micrograms carbon per gram
ANOVA	analysis of variance
Btu/hr	British thermal units per hour
BYSltCk	BY saltcake
c/s	counts per second
cal	calories
Ci	curies
Ci/g	curies per gram
Ci/L	curies per liter
cm	centimeters
DBBP	dibutyl butylphosphonate
DBP	dibutyl phosphate
DL	drainable liquid
DQO	data quality objective
DSC	differential scanning calorimetry
EDTA	ethylenediamine tetraacetic acid
EPA	Environmental Protection Agency
ft	feet
g	grams
g/L	grams per liter
g/mL	grams per milliliter
GEA	gamma energy analysis
HDW	Hanford Defined Waste
HEDTA	hydroxyethylenediamine tetraacetic acid
HHF	hydrostatic head fluid
HTCE	Historical Tank Content Estimate
IC	ion chromatography
ICP/AES	inductively coupled plasma/atomic emission spectroscopy
in.	inches
J	joules
J/g	joules per gram

LIST OF TERMS (Continued)

kg C	kilograms carbon
kg	kilogram
kgal	kilogallon
kL	kiloliter
kW	kilowatt
L	liter
LEL	lower explosive limit
LFL	lower flammability limit
m	meter
M	moles per liter
mbar	millibars
mg/L	milligrams per liter
mg	milligrams
mg/m^3	milligrams per cubic meter
mL	milliliter
mm	millimeter
MS	mass spectroscopy
N/A	not applicable
nCi/g	nanocuries per gram
NFPA	National Fire Prevention Association
NIOSH	National Institute of Occupational Safety and Health
NPH	normal paraffin hydrocarbon
ORNL	Oak Ridge National Laboratory
pCi	picocuries
PFeCN1	ferrocyanide waste, 0.005 M
PFeCN2	ferrocyanide waste, 0.0025 M
PNNL	Pacific Northwest National Laboratory
ppm	parts per million
ppmv	parts per million volume
PUREX	plutonium-uranium extraction
QC	quality control
REL	recommended exposure limit
RPD	relative percent difference
RSD	relative standard deviation
S&ML	Sampling and Mobile Laboratory
SACS	Surveillance Analysis Computer System
SAP	sampling and analysis plan
SNL/OGIST	Sandia National Laboratory/Oregon Graduate Institute of Science
STEL	short-term exposure limit

LIST OF TERMS (Continued)

TBP	tributyl phosphate
TCP	tank characterization plan
TGA	thermogravimetric analysis
TIC	total inorganic carbon
TLM	Tank Layer Model
TNMOC	total nonmethane organic compounds
TOC	total organic carbon
TRU	transuranic
TST	triple sorbent trap
VSS	vapor sampling system
W	watts
WHC	Westinghouse Hanford Company
WSTRS	Waste Status and Transaction Record Summary
wt%	weight percent
°C	degrees Celsius
°F	degrees Fahrenheit

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1.0 INTRODUCTION

This tank characterization report summarizes the information on the historical uses, current status, and sampling and analysis of waste stored in single-shell tank 241-BY-106. The tank was core sampled November 1994 - January 1995 and December 1995 - January 1996 to satisfy the requirements of: *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995), *Data Quality Objectives for the Waste Compatibility Program* (Carothers 1994), *Data Requirements for the Ferrocyanide Safety Issue Developed through the Data Quality Objective Process* (Meacham et al. 1994 and 1995), *Data Quality Objective to Support Resolution of the Organic Complexant Safety Issue* (Turner et al. 1996), *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995), and *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). Vapor samples were obtained and characterized in 1994 as required in *Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution* (Osborne et al. 1994). Tank 241-BY-106, like all other ferrocyanide tanks, is no longer on the Ferrocyanide Watch List (DOE 1996). It has been identified as potentially containing organic complexants (Meacham et al. 1995). This report supports the requirements of *Hanford Federal Facility Agreement and Consent Order* Milestone M-44-09 (Ecology et al. 1996).

Tank 241-BY-106 has been removed from service, partially isolated, and partially interim stabilized. Consequently, it is unlikely that waste removals or additions will occur until pretreatment and retrieval activities commence. The concentration estimates reported in this document are based on the latest sampling data.

1.1 PURPOSE

This report summarizes information about the use and contents of tank 241-BY-106. When possible, this information will be used to assess issues associated with safety, operations, environmental, and process activities. This report also will serve as a reference point for further information concerning tank 241-BY-106.

1.2 SCOPE

Core samples were obtained from the tank between November 1994 and January 1995, and between December 1995 and January 1996. Prior to retrieving the latter samples, tank vapors were sampled and measured using a combustible gas meter to measure the lower flammability limit. In addition, characterization of the tank headspace gases was performed on vapor samples acquired in 1994.

Samples from cores 64 and 65 were analyzed to support the requirements of the safety screening, ferrocyanide, organic, and waste compatibility data quality objectives (DQOs). Samples from core 121 were analyzed to support requirements of the safety screening, ferrocyanide, organic, and historical model DQOs. Vapor samples were obtained and analyzed as required in the generic in-tank health and safety DQO. Objectives of the core sampling events were to determine whether the tank should be placed on the Organics or another Watch List, to evaluate if the ferrocyanide content was sufficiently low to classify the tank as safe (Postma et al. 1994), and to evaluate the historical modeling of the tank waste. The primary analyses included differential scanning calorimetry (DSC) to evaluate fuel level and energetics, thermogravimetric analysis (TGA) to measure moisture content, total alpha activity analysis to evaluate criticality potential, ion chromatography (IC) to measure anion concentrations, inductively coupled plasma (ICP)/atomic emission spectrometry for determination of metal concentrations, and oxidation/coulometry to measure TOC concentration.

2.0 HISTORICAL TANK INFORMATION

This section describes tank 241-BY-106 based on historical information. The first part details the current condition of the tank. The next part contains discussions of the tank's design, transfer history, and process sources that contributed to the tank waste. An estimate of the current contents based on the process history is also provided. Events that may be related to tank safety issues, such as potentially hazardous tank contents or off-normal operating temperatures, are included. The final part summarizes 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

As of February 1996, tank 241-BY-106 contained an estimated 2,430 kL (642 kgal) of waste classified as non-complexed (Hanlon 1996). Solid waste volume is estimated using a manual tape and a photographic evaluation. The solids volume was last updated on April 28, 1982. 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	
	kL	kgal
Total waste	2,430	642
Supernatant liquid	0	0
Sludge	360	95
Saltcake	2,070	547
Drainable interstitial liquid	757	200
Drainable liquid remaining	757	200
Pumpable liquid remaining	617	163

Note:
[1]Hanlon (1996)

Tank 241-BY-106 was removed from service in August 1977. The tank was declared an assumed leaker in 1984 with an estimated leak volume of 30 kL (8 kgal). The tank was partially interim isolated in December 1982 and partial interim stabilization was completed in October 1995. The tank is no longer on any Watch List (Kinzer 1996) and is passively ventilated. All monitoring systems were in compliance with documented standards as of February 29, 1996 (Hanlon 1996).

2.2 TANK DESIGN AND BACKGROUND

The BY Tank Farm was constructed between 1948 and 1949 in the 200 East Area. The 241-BY Tank Farm contains 12 type II 100 series tanks. These tanks have a 2,870-kL (758-kgal) capacity, a 23-m (75-ft) diameter, a 7-m (23-ft) operating depth, and a dished bottom with a 1.2-m (4-ft) radius knuckle. The 241-BY Tank Farm was designed for non-boiling waste with a maximum fluid temperature of 104 °C (220 °F). A 75-mm (3-in.) cascade overflow line connects tank 241-BY-106 as third in a tank cascade series that includes tanks 241-BY-104 and 241-BY-105. The cascade overflow height is approximately 6.91 m (272 in.) from the tank bottom and 600 mm (2 ft) below the top of the steel liner.

Tank 241-BY-106 has 19 risers ranging in size from 102 mm (4 in.) to 1.1 m (42 in.) in diameter. Table 2-2 contains riser numbers, sizes, and descriptions. A plan view that depicts the riser configuration is shown as Figure 2-1. The tank contains three air-lift circulators and an air sweep device in this tank. A tank cross-section showing the approximate waste level, along with a schematic of the tank equipment, is found in Figure 2-2.

Table 2-2. Tank 241-BY-106 Risers.[1,2,3,4] (2 sheets)

Riser Number	Diameter (in.)	Description and Comments
1	4	Thermocouple tree, B-221
2	4	Covered w/concrete, below grade
3	4	Pit drain
4	4	Sludge measurement port (breather filter w/Y offset adapter ECN-189271L 09/06/94)
5	12	Observation port/B-221 (liquid level reel on 4" spool CEO-39572 07/15/87 & ECN-626674 12/21/95)
6	4	Covered w/concrete
7	12	Flange (observation port CEO-39572 07/15/87)
8	12	Covered w/concrete
9	42	Mini cooler
10	42	Cover plate (bench mark CEO-36919 12/11/86)
10A	18	Vent duct (Breather Filter CEO-39572 07/15/87)
10B	4	B-436 LOW (vapor assembly/breather filter offset adapter ECN-189223L 03/10/94) (SPARE ECN-189271L 09/06/94)
10C	14	Air circulator
11	42	Sluice pit, weather covered
12	42	Cover plate (bench mark CE0-36919 12/11/86)
12A	18	Welded plate, below grade
12B	4	Liquid level reel (Blind flange ECN-189269 09/07/94)
12C	14	Airlift circulator, below grade
13	42	Spare
Nozzle Number	**Diameter (in.)**	**Description and Comments**
N1	3	Spare inlet, capped
N2	3	Spare inlet, capped

Table 2-2. Tank 241-BY-106 Risers.[1,2,3,4] (2 sheets)

Nozzle Number	Diameter (in.)	Description and Comments
N3	3	Spare inlet, capped
N4	3	Spare inlet, capped
N5	3	Overflow inlet

Notes:

[1]Alstad (1993)

[2]Tran (1993)

[3]ARHCO (1976)

[4]Vitro Engineering Corporation (1988)

CEO = change engineering order

ECN = engineering change notice

LOW = liquid observation well

2.3 PROCESS KNOWLEDGE

Section 2.3.1 and Table 2-3 present the history of the major waste transfers and receipts that involved tank 241-BY-106. Section 2.3.2 presents an estimate of the tank's contents.

2.3.1 Waste Transfer History

Historical records (Agnew et al. 1996b) indicate that tank 241-BY-106 began receiving first-cycle decontamination waste during the second quarter of 1953. The waste was sluiced from tank 241-BY-106 in the third quarter of 1953 and sent to a crib. The tank received ferrocyanide scavaging waste from U Plant in the first quarter of 1955 through the first quarter of 1957. After settling, the scavenged ferrocyanide supernatant was transferred from tank 241-BY-106 to various cribs from the second quarter of 1955 until the fourth quarter of 1957. The cribs involved in the transfer of ferrocyanide-scavenged supernatant were B-014, B-015, B-018, B-021, B-023, B-024, B-026, B-045 and B-048. Ferrocyanide sludge was transferred from tank 241-BY-106 to tank 241-BY-105 during the first and second quarters of 1956. Supernatant was transferred from tank 241-BY-106 to tanks 241-BY-109 and 241-BX-101 during the second and third quarters of 1956, respectively. Ferrocyanide sludge

Figure 2-1. Riser Configuration for Tank 241-BY-106.

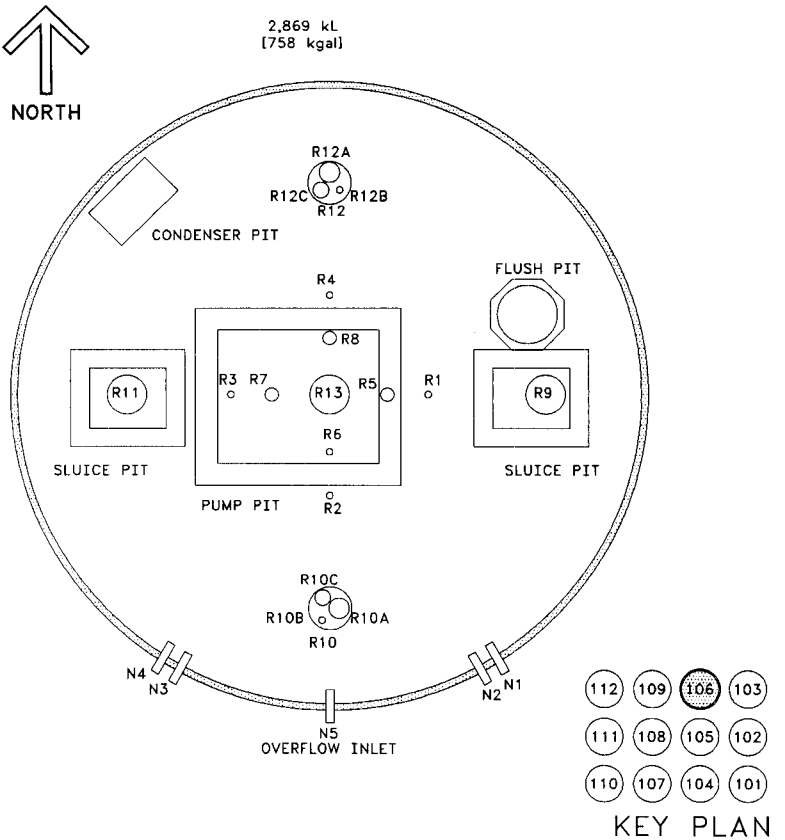


Figure 2-2. Tank 241-BY-106 Configuration.

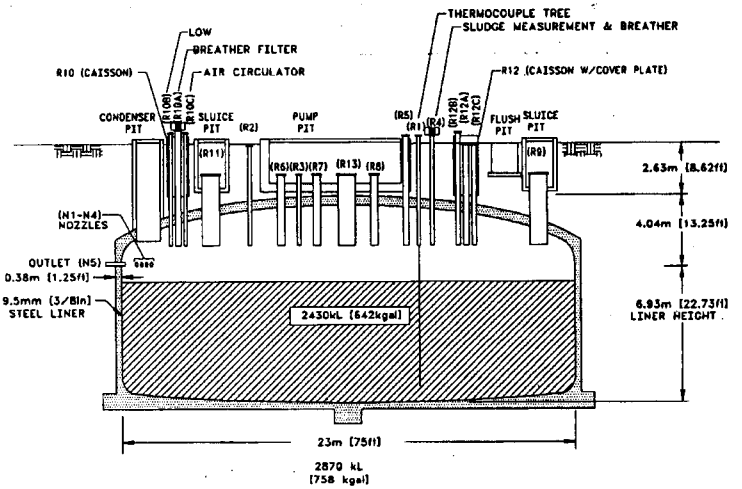


Table 2-3. Summary of Tank 241-BY-106 Waste Input History.[1]

Transfer Source	Waste Type Received	Time Period	Estimated Waste Volume	
			kL	kgal
Unknown	First-cycle decontamination waste	1953	2,870	758
U Plant	Ferrocyanide scavenging waste from uranium recovery operations	1955 - 1957	23,738	6,271
241-C-107	Supernatant transfer of PUREX cladding waste	1961 - 1962	1,416	374
241-C-102	Supernatant transfer of PUREX cladding waste	1966 - 1967	2,892	764
241-BY-105	In-tank solidification waste	1969, 1974	1,931	510
241-BY-109	In-tank solidification waste	1971 - 1973	5,322	1,406
241-BY-112	In-tank solidification waste	1971 - 1976	806	213
241-A-102	Supernatant evaporator feed waste	1977	125	33

Note:
[1]Agnew et al. (1996b)

was pumped again from tank 241-BY-106 to tank 241-BY-104 during the third and fourth quarters of 1956. Also, supernatant was pumped from tank 241-BY-106 to tank 241-BY-112 during the third quarter of 1956. Tank 241-BY-106 received a water addition from an unknown source during the third quarter of 1957.

Tank 241-BY-106 received supernatant waste from tank 241-C-107 during the fourth quarter of 1961 and the second quarter of 1962. These additions were most likely plutonium-uranium extraction (PUREX) cladding waste. Additional PUREX cladding waste from tank 241-C-102 was added during the third quarter of 1966 and the second and third quarters of 1967. Supernatant was pumped from the tank during the first and second quarters of 1967 and the second quarter of 1968 to tank 241-BY-103. Tank 241-BY-106 received supernatant waste consisting of in-tank solidification condensate waste from tank 241-BY-105 during the first quarter of 1969.

Supernatant waste from tank 241-BY-106 was sent to tank 241-BY-112 for in-tank solidification in the third quarter of 1970. Tank 241-BY-106 intermittently sent and received in-tank solidification waste to and from tank 241-BY-112 from the first quarter of 1971 until the first quarter of 1976. Also, tank 241-BY-106 received in-tank solidification bottoms (evaporator bottoms) waste from the first quarter of 1971 until the second quarter of 1973 from tank 241-BY-109. During the third quarter of 1974, the tank received water from an unknown source and supernatant evaporator bottoms from tank 241-BY-105. Supernatant

was pumped from tank 241-BY-106 to tank 241-BY-109 during the third quarter of 1973 and the fourth quarter of 1975. The last receipt involving tank 241-BY-106 occurred during the first and third quarters of 1977 with the transfer and receipt of supernatant evaporator waste from tank 241-A-102. The last transfer involved pumping 242 kL (64 kgal) of interstitial liquid from August to October 1995 as part of the interim stabilization effort. The liquid was sent to tank 241-AN-101 via double-container reciver tank 244-BX.

2.3.2 Historical Estimate of Tank Contents

The following is an estimate of the contents for tank 241-BY-106 based on historical transfer data. The historical data used for the estimate is 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). The WSTRS is a compilation of available waste transfer and volume status data. The HDW provides the assumed typical compositions for 50 separate waste types. The available data are incomplete. This reduces the reliability of the transfer data and the derived modeling results. The TLM, using the WSTRS data, models the waste deposition processes and, using additional data from the HDW, generates an estimate of the tank contents. Several errors are introduced as the model elements are combined to create the tank content estimates. Thus, these model predictions can only be considered estimates that require further evaluation using analytical data.

Based on Agnew et al. (1996a), tank 241-BY-106 contains a 2,059 kL (544 kgal) top layer of in-tank solidification saltcake waste (BYSltCk). The next layer contains 167 kL (44 kgal) of ferrocyanide (PFeCN2) sludge, which used 0.0025 M ferrocyanide to precipitate ^{137}Cs. The bottom layer consisted of 204 kL (54 kgal) of ferrocyanide (PFeCN1) sludge, which used 0.005 M ferrocyanide in the scavenging process. Figure 2-3 represents the estimated waste type and volumes for the tank layers.

The BYSltCk waste layer should contain quantities of sodium, hydroxide, and nitrate in concentrations greater than 5 weight percent. Aluminum, nitrite, and carbonate are expected to be present in the 1 to 5 percent range. Cesium should be found in smaller quantities than in the PFeCN layers. The PFeCN1 and PFeCN2 layers are similar in composition. Both layers should contain sodium and nitrate in concentrations greater than 5 weight percent. Iron, bismuth, uranium, sulfate, and phosphate should be present in concentrations between 1 and 5 percent. The HDW model (Agnew et al. 1996a) is believed to underestimate the cesium content and overestimate the bismuth content of ferrocyanide sludge. Thus, cesium is also expected to be present, and both ferrocyanide layers are expected to have radiological activity. The BYSltCk layer could be further distinguished from the PFeCN layers by noting that the BYSltCk layer does not contain appreciable iron, nickel, or uranium. Table 2-4 shows an estimate of the expected waste constituents and their concentrations.

Figure 2-3. Tank Layer Model for Tank 241-BY-106.

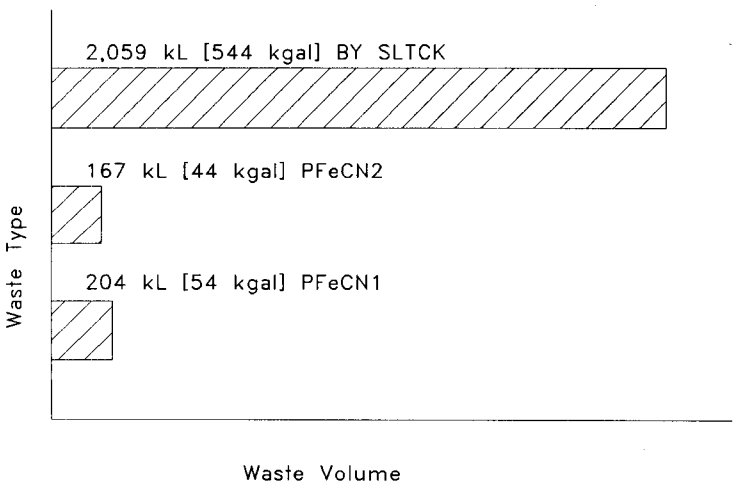


Table 2-4. Tank 241-BY-106 Historical Inventory Estimate.[1] (2 sheets)

Total Inventory Estimate[2]			
Physical Properties			
Total solid waste	3.84E+06 kg (642 kgal)		
Heat load	3,910 W (13,400 Btu/hr)		
Bulk density	1.58 g/mL		
Water wt%	40.3		
Total organic carbon wt% carbon (wet)	0.468		
Chemical Constituents	**M**	**µg/g**	**kg[3]**
Na^{+}	11.1	1.62E+05	6.20E+05
Al^{3+}	1.82	31,000	1.19E+05
Fe^{3+} (total Fe)	0.154	5,450	20,900
Cr^{3+}	0.0434	1,430	5,480
Bi^{3+}	0.0411	5,440	20,900
La^{3+}	2.73E-06	0.240	0.923
Hg^{2+}	3.07E-05	3.90	15.0
Zr (as $ZrO(OH)_2$)	2.51E-04	14.5	55.7
Pb^{2+}	0.00480	630	2,420
Ni^{2+}	0.0318	1,180	4,540
Sr^{2+}	3.04E-06	0.169	0.648
Mn^{2+}	0.00276	95.8	368
Ca^{2+}	0.105	2,670	10,200
K^{+}	0.0345	854	3,280
OH^{-}	8.28	89,100	3.42E+05
NO_3^{-}	5.81	2.28E+05	8.75E+05
NO_2^{-}	1.50	43,700	1.68E+05
CO_3^{2-}	0.468	17,800	68,200
PO_4^{3-}	0.117	7,030	27,000

Table 2-4. Tank 241-BY-106 Historical Inventory Estimate.[1] (2 sheets)

Total Inventory Estimate[2]			
Chemical Constituents	**M**	**μg/g**	**kg[3]**
SO_4^{2-}	0.188	11,400	43,900
Si (as SiO_3^{2-})	0.0760	1,350	5,190
F^-	0.0803	966	3,710
Cl^-	0.120	2,680	10,300
$C_6H_5O_7^{3-}$	0.0203	2,430	9,340
$EDTA^{4-}$	0.00456	832	3,190
$HEDTA^{3-}$	6.16E-04	107	410
glycolate$^-$	0.0143	680	2,610
acetate$^-$	0.0271	1,010	3,890
oxalate^{2-}	2.34E-06	0.130	0.500
DBP	0.0216	3,630	14,000
Butanol	0.0216	1,010	3,890
NH_3	0.00877	94.3	362
$Fe(CN)_6^{4-}$	0.0167	2,860	11,000
Radiological Constituents			
Pu	---	0.0930 (μCi/g)	5.95 (kg)
U	0.0392 (M)	422 (μg/g)	22,700 (kg)
Cs	0.185 (Ci/L)	117 (μCi/g)	4.49E+05 (Ci)
Sr	0.111 (Ci/L)	69.9 (μCi/g)	2.69E+05 (Ci)

Notes:

[1]Agnew et al.(1996a)

[2]The HTCE predictions have not been validated and should be used with caution.

[3]Small differences appear to exist among the inventory above and the inventories calculated from the two sets of historical concentrations. These differences are being evaluated.

2.4 SURVEILLANCE DATA

Tank 241-BY-106 surveillance data 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.

Changes in liquid level measurements may indicate a leak from a tank. Solid surface level measurements provide an indication of physical changes such as interstitial gas formation. Drywells located around the perimeter of the tank may detect increased radioactivity due to a leak to the soil.

2.4.1 Surface Level Readings

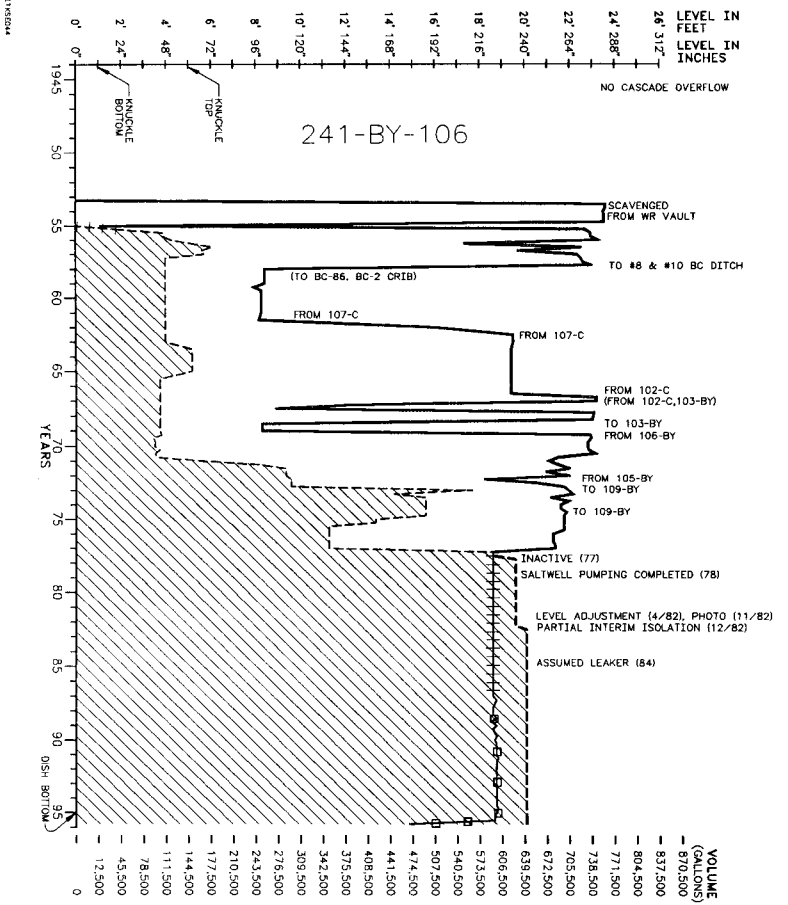
The tank 241-BY-106 waste surface level is monitored quarterly with a manual tape through riser 5. The liquid waste volume is measured by photographic evaluation. The solid waste level is determined by a manual tape surface level gauge and photographic evaluation. Photographs indicate the waste consisted largely of floating solids that may have caused discrepancies in level measurements. Interstitial liquids with a volume of 242 kL (64 kgal) were pumped between August and October 1995. As a consequence, the surface level measurements dropped from 6.21 m (244.5 in.) for the July 1995 reading to 5.41 m (213 in.) for the October 1995 reading.

Tank 241-BY-106 has a liquid observation well located in riser 10B. To measure the interstitial liquid levels, the tank is monitored periodically with a neutron probe and monitored on request with a gamma probe. On April 2, 1996, the waste surface level reading was 5.41 m (17.75 ft). A graphical representation of the tank volume history is presented in Figure 2-4.

2.4.2 Drywell Readings

Tank 241-BY-106 has four drywells. Drywells 22-06-05 (activity was present before 1990; current readings < 200 c/s), 22-06-07 (activity was present before to 1990, current readings < 200 c/s), and 22-06-11 (activity was present before 1990, current readings < 200 c/s) have readings greater than the 50 c/s background radiation. Graphical representations of the data for each active drywell from 1990 to 1993 can be found in the HTCE supporting document for the BY Tank Farm (Brevick et al. 1994).

Figure 2-4. Tank 241-BY-106 Level History.



2.4.3 Internal Tank Temperatures

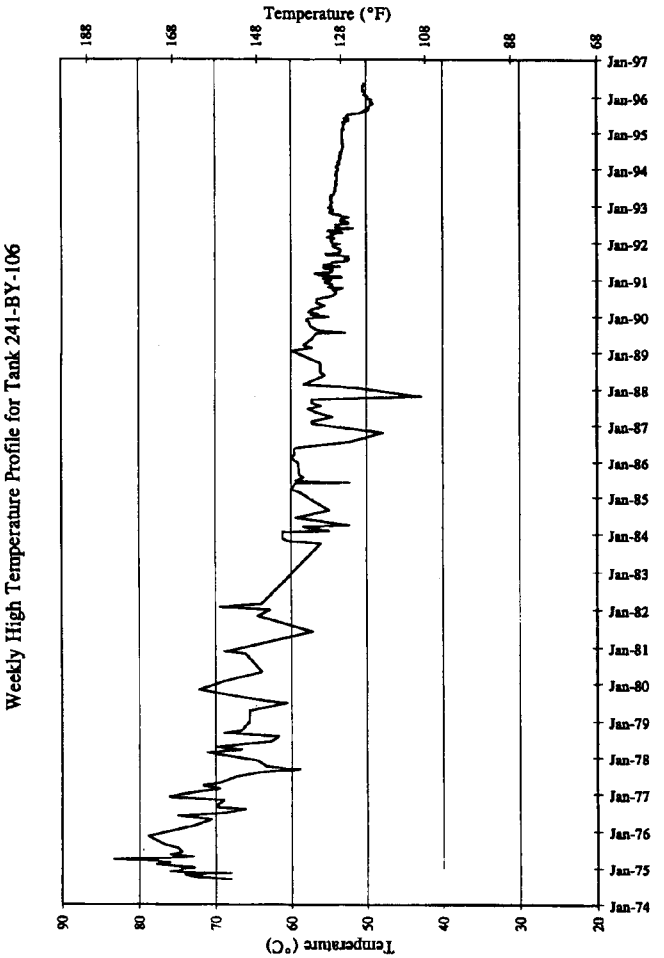
Tank 241-BY-106 has a single thermocouple tree with 12 thermocouples to monitor the waste temperature. Elevations are known for the first six thermocouples. Thermocouple 1 is 213 mm (0.7 ft) from the bottom of the tank. Thermocouples 1 through 5 are evenly spaced 610 mm (2 ft) apart. Thermocouple 6 is 7.53 m (24.7 ft) from the bottom of the tank.

Temperature data, obtained from the Surveillance Analysis Computer System (SACS), were recorded from September 1974 until June 1996. The mean temperature of the SACS data was 56 °C (132.7 °F) with a minimum temperature of 23 °C (73 °F) and a maximum temperature of 83.3 °C (181.9 °F). For the period June 1995 to June 1996 the mean temperature of the SACS data was 43.4 °C (110.1 °F) with a minimum temperature of 24.1 °C (75.4 °F) and a maximum temperature of 52.9 °C (127.2 °F). On 8/28/96, the waste (thermocouple 1) temperature was 49.60 °C (121.28 °F) and the headspace (thermocouple 6) temperature was 27.60 °C (81.68 °F). Plots of the individual thermocouple readings for tank 241-BY-106 can be found in the HTCE supporting documents for the BY Tank Farm (Brevick et al., 1994). There appears to have been a general decrease in temperature over time. A graphical representation of the weekly high temperatures can be found in Figure 2-5.

2.4.4 Tank 241-BY-106 Photographs

Figure 2-6, the 1982 photographic montage of the tank interior, indicates a bright yellow and goldish crust formed on a reddish-brown liquid. Saltcake has formed on some of the equipment within the tank. Equipment visible in the photograph include an airlift circulator, inlet nozzles, a saltwell screen, a temperature probe, and an old level measurement tape. At the time the photographs were taken, the tank contained approximately 2,430 kL (642 kgal) of waste; however, interstitial liquid was pumped from the tank since then. Surface level readings indicate a 710-mm (28-in.) drop that may be due to some local subsidence. Therefore, the photographs might not fairly represent the current appearance of the waste.

Figure 2-5. Tank 241-BY-106 Weekly High Temperature Plot.



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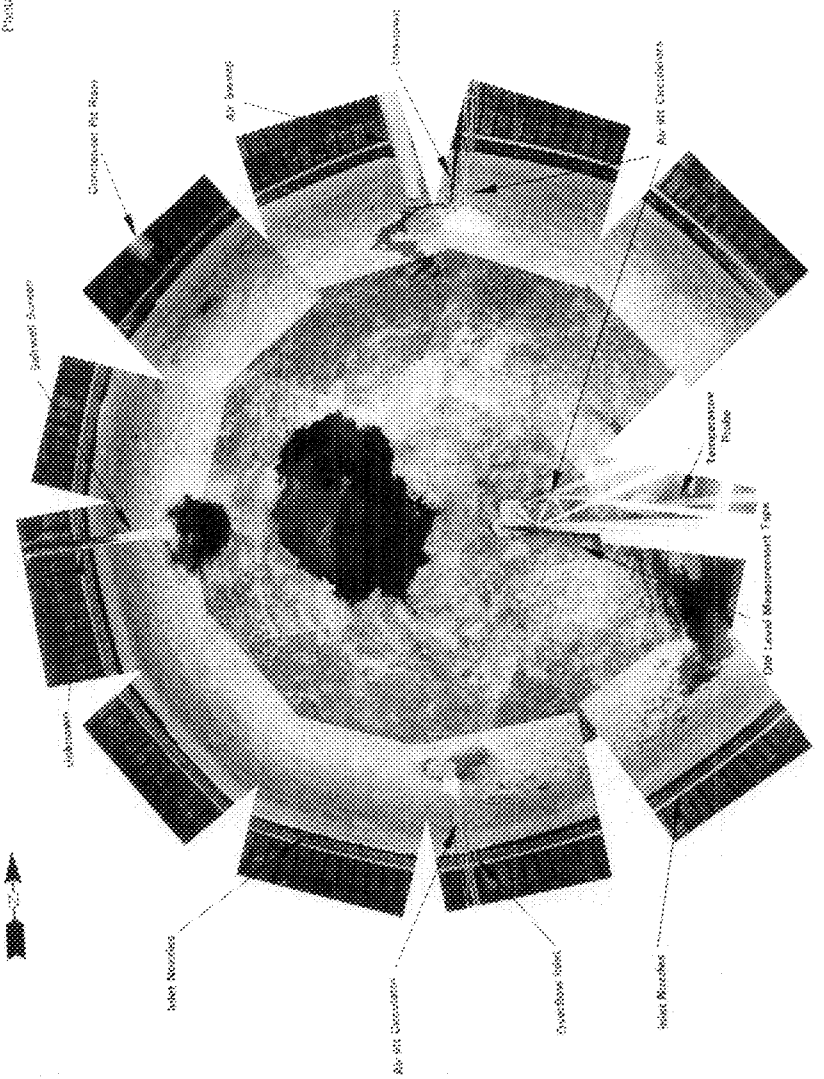
241-BY-106

Photo Date: 11-1-93

Figure 2-6. Photographic Montage of Tank 241-BY-106.



3.0 TANK SAMPLING OVERVIEW

This section focuses on the November 1994 through January 1995 and December 1995 through January 1996 sampling and analysis events for tank 241-BY-106. Three core samples were taken to satisfy the requirements of the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995), *Data Quality Objectives for the Waste Compatibility Program* (Carothers 1994), *Data Requirements for the Ferrocyanide Safety Issue Developed through the Data Quality Objective Process* (Meacham et al. 1994 and 1995) *Data Quality Objective to Support Resolution of the Organic Complexant Safety Issue* (Turner et al. 1996), *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995), and *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 first two core samples (64 and 65) were acquired and analyzed in accordance with the tank characterization plan (TCP) (Schreiber 1994 and Schreiber 1995). The third core sample (121) was obtained and analyzed in accordance with the sampling and analysis plan (SAP) (Bell 1996c). Core 121 was incomplete as the bottom three segments could not be collected. Vapor samples were obtained in 1994 as required in *Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution* (Osborne et al. 1994). Further discussion of the sampling and analysis procedures can be found in the *Tank Characterization Reference Guide* (DeLorenzo et al. 1994).

Analytical results have also been reported for liquid samples probably taken in 1971 and 1990. Because tank 241-BY-106 was actively receiving waste until the third quarter of 1977, sampling events prior to this date no longer represent the current tank contents. Data from sampling and analysis events prior to 1989 may not be acceptable for some regulatory evaluations and decisions. None of the 1971 or 1990 liquid sample results were used to evaluate the present tank contents due to the age of the data and the lack of specifics concerning sample locations. The data are included in this report for historical comparison. Results from historical sampling events are compared with recent analytical results to corroborate data and to identify data trends.

3.1 DESCRIPTION OF 1994-1996 CORE SAMPLING EVENTS

3.1.1 Cores 64 and 65

Core samples 64 and 65, containing 13 segments each, were collected from riser 10B of tank 241-BY-106 between November 17, 1994 and January 24, 1995. A field blank of deionized water was created and delivered to the 222-S Laboratory with the core 64 samples. Because of poor sample recovery and no sludge recovery from core 64, core 65 was taken from the same location in the tank. Core 64 was the first tank sample attempted using the rotary-mode sampling system. Cores 64 and 65 were received, extruded, and analyzed at the 222-S Laboratories to support the requirements of the safety screening (Dukelow et al.

1995), waste compatibility (Carothers 1994), and ferrocyanide (Meacham et al. 1995) DQOs. Sampling and analytical requirements of these DQO documents are summarized in Table 3-1.

Table 3-1. Integrated Data Quality Objective Requirements for Tank 241-BY-106, Cores 64, 65, and 121.[1,2,3]

Sampling Event	Applicable DQOs/Test Plan	Sampling Requirements	Primary Analytical Requirements
Core samples 64, 65, 121	Safety screening	Core samples from a minimum of two risers separated radially to the maximum extent possible	Energetics, moisture content, total alpha, bulk density, flammable gas
Core samples 64, 65, 121	Ferrocyanide	Core samples from two risers	Energetics, moisture content, total cyanide, nickel, total organic carbon
Core sample 121	Organic	One core sample	Energetics, moisture, total organic carbon
Core sample 121	Historical	Two core samples	Energetics, moisture, total beta, anions, metals, uranium, Cs-137, Sr-90, bulk density
Core sample 64	Waste compatibility	Liquid samples from one riser at three depths	Energetics, moisture content, total organic carbon, Cs-137, Sr-90, Al, Fe, Na, hydroxide, anions, carbonate, pH, Pu-239/240, Am-241, density, volume percent solids
Vapor samples	Generic in-tank health and safety	See Table 3-6	Organic vapors, hydrogen, nitrous oxide, carbon dioxide, carbon monoxide, ammonia, nitrogen dioxide, nitric oxide, water vapor
Core samples 64, 65, 121	Organic test plan	Two core samples	Energetics, moisture, TOC

Notes:

[1]Schreiber (1994)
[2]Schreiber (1995)
[3]Bell (1996b)

3.1.2 Core 121

Core sample 121, containing 10 segments, was collected from riser 5 of tank 241-BY-106 between December 15, 1995 and January 2, 1996. All segments were taken in the push mode using the rotary-mode sampling truck. A field blank of deionized water was created and delivered to the 222-S Laboratory with the core 121 samples. Thirteen segments were expected; however, segments 11, 12, and 13 were not collected because the downforce limit for push-mode was exceeded. As a result, no sample was obtained from the sludge layer. Segment 10 was taken in three parts, labeled segment 10, 10A, and 10B. Although not on the Flammable Gas Watch List, there exists an unreviewed safety question with respect to flammable gas in tank 241-BY-106 (Hodgson et al. 1995). As a result, there is no Authorization Basis for rotary-mode sampling in tank 241-BY-106. The rotary-mode sampling system is undergoing upgrades and additional sampling may be performed at a later date if necessary.

Core 121 was received, extruded, and analyzed at the 222-S Laboratories to support the requirements of the safety screening, ferrocyanide, organic complexant, and historical DQOs, and the organic test plan (Meacham 1995). Before taking core 121, the flammability of tank vapors was checked using a flammable gas meter. This was done to meet operational safety requirements and to fulfill the safety screen DQO requirement. To meet these requirements, the vapors in the tank headspace must be less than 25 percent of the lower flammability limit (LFL). The results showed that the flammability of the tank dome space was 0% of the LFL.

3.2 SAMPLE HANDLING (1994 - 1996 CORE SAMPLES)

Pertinent sampling information for the three core samples is provided in Tables 3-2, 3-3, and 3-4. Upon delivery to the 222-S Laboratory, core 64 was extruded and subsampled as prescribed in the *Tank 241-BY-106 Tank Characterization Plan* (Schreiber 1994). Cores 65 and 121 were extruded and subsampled at the 222-S Laboratory as prescribed in Schreiber (1995) and Bell (1996c), respectively. Video recordings and/or color photographs were taken of each segment immediately following extrusion and may be viewed by contacting the 222-S Laboratory.

The sampling and analysis schemes for the solids and liquids recovered from cores 64, 65, and 121 are respectively provided in Schreiber (1994), Schreiber (1995), and Bell (1996c). Solid material from the extruded segments were divided into half segments labeled as upper and lower halves. The upper half is the material in the top half of the sampler; the material collected first by the sampler. Drainable liquids were identified as such. Selected solid samples were homogenized with a mortar and pestle prior to analysis, as indicated in Table 3-2. A core 121 composite was created in accordance with the historical DQO.

Table 3-2. Sample Receipt and Extrusion Information for Tank 241-BY-106, Core 64.[1] (2 sheets)

Seg.	Date Sampled	Date Received	Date Extruded	Liner Liquid (g)	Drainable Liquid Recovered (g)	Solids Recovered (g)	Sample Description
1	11/17/94	11/21/94	11/30/94	0.0	0.0	15.95 (upper half)	Extruded was a light-yellow, creamy slurry followed by off-white saltcake with a slushy texture. Both were collected in a single jar.
2	11/21/94	11/21/94	11/30/94	0.0	0.0	125.06 (upper half)	Extruded was a greenish-grey slurry, then 7.5 cm of off-white, chunky saltcake coated with the colored slurry. Both materials were collected in a single jar.
3	11/21/94	11/28/94	12/1/94	0.0	144.32	37.59 (slurry)	Collected pale olive-colored drainable liquid followed by an even paler colored slurry. The slurry was grainy from the presence of solids.
4	11/23/94	11/28/94	12/2/94	0.0	0.0	128.01 (lower half) 189.31 (upper half)	Collected from the upper and lower halves of the segment was a grayish-brown, wet saltcake with a slushy, grainy texture. Mixed with the upper half saltcake was a darker colored slurry. The sample was partitioned into upper and lower halves.
5	12/2/94	12/5/94	12/6/94	0.0	0.0	2.43 (upper half)	The solids were wet, slush-like, and pale yellow in color. They only appeared at the very end of the extrusion.
6	12/2/94	12/5/94	12/7/94	0.0	17.23	2.83 (upper half)	Olive-green colored drainable liquid was obtained first, followed by no sample until the very end of the extrusion when a small amount of wet, slushy, pale yellow solids was observed.
7	12/5/94	12/6/94	12/8/94	0.0	0.0	0.0	The sampler piston was found lodged in the valve housing, which did not allow sample collection or valve closure.
8	12/5/94	12/6/94	12/8/94	0.0	0.0	114.83 (lower half) 110.82 (upper half) 162.52 (slurry)	The sample was a mixture of wet saltcake and slurry. The grey, slushy saltcake was partitioned into upper and lower halves. The darker colored slurry, containing some lumps of saltcake, was placed into a separate container.

Table 3-2. Sample Receipt and Extrusion Information for Tank 241-BY-106, Core 64.[1] (2 sheets)

Seg.	Date Sampled	Date Received	Date Extruded	Liner Liquid (g)	Drainable Liquid Recovered (g)	Solids Recovered (g)	Sample Description
9	12/5/94	12/9/94	12/9/94	0.0	0.0	73.11 (upper half)	Collected from the upper half of the sampler was pale yellow, grainy, saltcake mixed with some slurry. All material was placed in one jar
10	12/20/94	12/21/94	12/21/94	0.0	244	146 (lower half) 28 (upper half)	Pale green, drainable liquid was recovered first followed by light yellow, wet saltcake from the upper and lower halves of the sampler.
11	12/21/94	12/22/94	12/27/94	0.0	0.0	37.5 (upper half)	Collected from the upper half of the sampler were dry, hard, crystalline solids ranging in color from light gray to white. The entire sample was homogenized with a mortar and pestle.
12	12/21/94	12/22/94	12/27/94	5.0	0.0	96.0 (upper half)	Wet saltcake was collected from the upper and lower halves. It was moist and slush-like, appearing light gray to white in color. All of the sample was homogenized with a mortar and pestle.
13	12/21/94	12/22/94	12/27/94	0.0	0.0	12.8 (upper half)	The off-white solids were dry, crystalline, and hard similar to those in segment 11. All sample was homogenized with a mortar and pestle.
FB	12/21/94	12/21/94	12/27/94	0.0	287	0.0	Collected clear, colorless, drainable liquid in two sample jars.

Note:

[1]Bell (1995a)
FB = field blank
Seg. = Segment

Table 3-3. Sample Receipt and Extrusion Information for Tank 241-BY-106, Core 65.[1] (2 sheets)

Seg.	Date Sampled	Date Received	Date Extruded	Liner Liquid (g)	Drainable Liquid Recovered (g)	Solids Recovered (g)	Sample Description
1	1/18/95	1/20/95	1/27/95	0.0	438.46	11.70 (upper half)	Collected light yellow drainable liquid, which was less turbid than the liquid from segments 4, 5, 6, 7, and 8. Last to extrude from the sampler was slushy, light yellow saltcake.
2	1/19/95	1/20/95	1/27/95	0.0	428.10	22.40 (upper half)	Collected turbid, light yellow-green drainable liquid followed by slushy, light yellow saltcake from the upper half of the sampler.
3	1/19/95	1/20/95	1/30/95	0.0	429.70	21.43 (upper half)	Collected turbid, light yellow-green drainable liquid followed by slushy, light yellow saltcake from the upper half of the sampler.
4	1/20/95	1/20/95	1/25/95	0.0	411.74	42.01 (upper half)	Opaque, yellow drainable liquid was recovered from the sampler before slushy, light yellow saltcake was collected from the upper half of the sampler.
5	1/20/95	1/20/95	1/26/95	0.0	409.48	34.58 (upper half)	Turbid, yellow-green drainable liquid was recovered first. Slushy, light yellow saltcake was recovered next from the upper half.
5A	1/20/95	1/20/95	1/30/95	0.0	0.0	0.30 (upper half)	No material was extruded from the sampler. A small amount of white, crusty solids were recovered from the sampler piston.
6	1/20/95	1/23/95	1/26/95	0.0	423.08	29.38 (upper half)	The last material to extrude from the sampler was slushy, light yellow saltcake. Collected first was light yellow, drainable liquid.
7	1/20/95	1/23/95	1/27/95	0.0	422.54	26.74 (upper half)	The last material to extrude from the sampler was slushy, light yellow saltcake. Collected first was light yellow, drainable liquid.
8	1/20/95	1/23/95	1/26/95	0.0	394.25	44.15 (upper half)	The last material to extrude from the sampler was slushy, light yellow saltcake. Collected first was light yellow, drainable liquid.

Table 3-3. Sample Receipt and Extrusion Information for Tank 241-BY-106, Core 65.[1] (2 sheets)

Seg.	Date Sampled	Date Received	Date Extruded	Liner Liquid (g)	Drainable Liquid Recovered (g)	Solids Recovered (g)	Sample Description
9	1/23/95	1/25/95	2/7/95	0.0	0.0	9.36 (upper half)	Recovered from the upper half of the segment was light yellow-green saltcake and no drainable liquid.
10	1/24/95	1/25/95	2/6/95	0.0	363.65	90.32 (upper half)	Collected first was turbid, yellow-green drainable liquid. Solids were observed towards the end of the extrusion. The first solids to appear were hard, crystalline chunks that ranged in color from white to gray. Remaining solids were wet, yellow-green saltcake.
11	1/24/95	1/25/95	2/6/95	0.0	82.73	4.91 (upper half)	Recovered solids were crystalline and light yellow in color. The drainable liquid was yellow-green in color and turbid.
12	1/24/95	1/25/95	2/3/95	0.0	44.25	0.0	The light brown, turbid liquid was different in appearance than the light yellow-green liquid obtained from the previous segments.
13	1/24/95	1/25/95	2/3/95	0.0	< 5 mL (not collected)	57.15 (sludge) 74.49 (saltcake)	Collected approx. 13 cm of solids from the upper half of the sampler. The first 5 cm were a dark brown sludge and the final 8 cm were compacted white saltcake material coated with sludge. The two types of material separated cleanly and were collected in separate jars.

Notes:

[1]Bell (1995a)

Seg. = Segment

Table 3-4. Sample Receipt and Extrusion Information for Tank 241-BY-106, Core 121.[1] (3 sheets)

Seg.	Date Sampled	Date Received	Date Extruded	Liner Liquid (g)	Drainable Liquid Recovered (g)	Solids Recovered (g)	Sample Description
1	12/15/95	12/18/95	12/20/95	0.0	0.0	10.6 (upper half)	Extruded approx. 2.5 cm of dry, crumbly saltcake, which were off white in color.
2	12/15/95	12/18/95	12/20/95	0.0	0.0	101.1 (upper half)	All sample was collected in the last 11-12 cm of the extrusion as damp saltcake with a fine texture, unlike most other saltcake observed. The color was off white except for the upper 2.5 cm, which was grey.
3	12/15/95	12/18/95	12/20/95	0.0	0.0	209.8 (upper half) 88.9 (lower half)	No sample extruded the first 17-18 cm. The remainder of the sampler was full of damp, crumbly saltcake that retained its shape. It was medium grey with 3 bands of white material 1-2 cm wide and 6-8 cm apart. The texture was roughly that of fine sand. The last 23 cm extruded were taken as the upper half portion and the remainder was taken as the lower half portion.
4	12/15/95	12/18/95	12/20/95	0.0	0.0	220.2 (upper half) 135.4 (lower half)	No sample extruded in the first 13 cm. The rest of the sampler was full of damp, crumbly saltcake with the texture of fine sand. The first 11-12 cm and the last 2.5 cm were medium grey in color. The remainder of the sample was striated with alternating rings of grey and white saltcake. The last 23 cm extruded were taken as the upper half portion and the balance was taken as the lower half portion.
5	12/16/96	12/18/96	12/20/95	0.0	0.0	234.3 (upper half)	Extruded from the upper 23 cm of the sampler was damp saltcake that retained its shape. It was light to medium grey in color with the texture of fine sand. The upper 5-6 cm of sample were slightly darker than the remaining sample.

Table 3-4. Sample Receipt and Extrusion Information for Tank 241-BY-106, Core 121.[1] (3 sheets)

Seg.	Date Sampled	Date Received	Date Extruded	Liner Liquid (g)	Drainable Liquid Recovered (g)	Solids Recovered (g)	Sample Description
6	12/16/95	12/18/95	12/20/95	0.0	0.0	286.1 (upper half)	No sample was found in the first 20 cm of the extrusion. The remainder of the sampler was full of grey, damp, saltcake that retained its shape in the tray. The sample had the texture of fine sand.
7	12/16/95	12/18/95	12/21/95	0.0	0.0	234.9 (upper half)	The upper 23 cm of the sampler were full of damp, grey, saltcake that retained its shape. The texture was slightly grainier than that from the previous segments. A 1 cm plug of sample found in the volume in front of the valve was discarded.
8	12/18/95	12/18/95	12/21/95	0.0	0.0	261.8 (upper half) 88.4 (lower half)	Extruded first were 5 cm of very wet, off-white saltcake followed by a 2-3 cm gap then 8-9 cm of medium grey, drier saltcake. After another gap of 7-8 cm, there were 27 cm of saltcake similar to that extruded immediately before it, but the texture was grainier and appeared less homogeneous than material in the preceding segments.
9	12/18/95	12/18/95	12/21/95	0.0	0.0	29.5 (upper half)	No sample was observed until the very end of the extrusion when approximately 2.5 cm of damp, dark grey, granular saltcake were extruded.
10	12/18/95	12/22/95	1/5/96	0.0	0.0	158.6 (upper half)	The upper 18 cm of the sampler were filled with damp, medium grey saltcake that retained its shape. The upper 2-3 cm of sample were dark grey. The entire sample had the texture of fine sand.
10A	12/18/95	12/22/95	1/5/96	0.0	0.0	4.1 (upper half)	There was about 1 cm of sample boxed to the sampler piston. It was damp, dark grey, and appeared to be saltcake, although it could have been sludge.

Table 3-4. Sample Receipt and Extrusion Information for Tank 241-BY-106, Core 121.[1] (3 sheets)

Seg.	Date Sampled	Date Received	Date Extruded	Liner Liquid (g)	Drainable Liquid Recovered (g)	Solids Recovered (g)	Sample Description
10B[1]	12/29/95	1/3/96	1/27/96	5.0	0.0	96.0 (upper half)	Wet saltcake was collected from the upper and lower halves. It was moist and slush-like, appearing light gray to white in color. All of the sample was homogenized with a mortar and pestle.
FB	1/2/96	1/3/96	1/27/96	0.0	287	0.0	Collected clear, colorless, drainable liquid in two sample jars.

Note:

[1]Bell (1996a)
FB = field blank
Seg. = segment

3.3 SAMPLE ANALYSIS (1994 - 1996 CORE SAMPLES)

The analyses performed at the segment level on liquid samples and at the half-segment level on solid samples from cores 64 and 65 were limited to those needed to satisfy the safety screening and ferrocyanide DQO requirements. The waste compatibility DQO requirements were performed on the liquid samples from core 64. The results of these analyses have been reported in Bell (1995a, 1995b, 1995c, and 1996b). Per direction of the Ferrocyanide Safety Program (Cash 1995), only segments 11, 12, and 13 of core 65 were analyzed. Those bottom three segments were the only ones believed to possibly represent the tank waste for core 65. Furthermore, historical information (Agnew et al. 1996b) indicates that any ferrocyanide sludge would be in the last 0.91 m (36 in.) of waste.

The analyses performed at the half segment level, on liquid samples, or the core composite from core 121, were not limited to those needed to satisfy the safety screening, ferrocyanide, organic, and historical DQO requirements. Additional analytical results for metals, anions, and radionuclides were obtained on an opportunistic basis (Kristofzski 1995) in the process of meeting the DQO requirements.

Depending on the analysis, saltcake and sludge subsamples were analyzed directly or after a fusion, acid, or water digestion. Drainable liquid subsamples were analyzed directly or after dilution in water or acid. Analysis by TGA and DSC were performed under a nitrogen purge. Initially, only the primary analyses listed in the applicable DQO documents were performed. Because the notification limit for energetics was exceeded on the core 65 sludge, secondary analyses for TOC, ^{137}Cs, ^{60}Co, ^{154}Eu, ^{155}Eu, ^{90}Sr, and $^{239/240}$Pu were performed on the sludge material.

The results of the analyses are presented and discussed in Section 4.0. The results of the quality control (QC) tests and the implications for data quality are discussed in Section 5.1.2. A summary of the cores, segments, segment portions, individual sample numbers, and the analyses performed on each sample are available in Appendix A. Analytical procedure titles, instruments, and preparation methods used in the analysis of the core samples are summarized in Table 3-5.

3.4 DESCRIPTION OF 1994 VAPOR SAMPLING

Tank 241-BY-106 headspace gas and vapor samples were collected and analyzed to help determine the potential risks to tank farm workers due to fugitive emissions from the tank. The drivers and objectives of waste tank headspace sampling and analysis are discussed in *Program Plan for the Resolution of Tank Vapor Issues* (Osborne and Huckaby 1994). Tank 241-BY-106 was vapor sampled in accordance with *Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution* (Osborne et al. 1994).

Table 3-5. Analytical Procedures.[1]

Analysis	Instrument	Preparation Procedure	Procedure Number[2]
Energetics by DSC	Mettler™ instrument	N/A	LA-514-113, Rev. C-1
	Perkin-Elmer™ instrument		LA-514-114, Rev. C-1
Percent moisture by TGA	Mettler™ instrument	N/A	LA-560-112, Rev. B-1. LA-560-112, Rev. A-2
	Perkin-Elmer™ instrument		LA-514-114, Rev. C-1
Specific gravity	N/A	N/A	LA-510-112
Bulk Density	N/A	N/A	LO-160-103, Rev. B-0
Total alpha activity	Alpha proportional counter	LA-549-141, Rev. D-0	LA-508-101, Rev. D-2
Free cyanide	Spectrophotometer	N/A	LA-695-102, Rev. C-0
Total cyanide	Spectrophotometer	N/A	LA-695-103, Rev. A-0
TOC (persulfate oxidation)	Coulometer	N/A	LA-342-100, Rev. A-0 LA-342-100, Rev. C-0
TOC (furnace oxidation)	Coulometer	N/A	LA-344-105, Rev. B-3
Organic layer	N/A	N/A	LA-519-151, Rev. E-2
Total metals	Inductively coupled plasma spectroscopy	LA-505-159, Rev. D-0 LA-549-141, Rev. C-2	LA-505-151, Rev. A-1 LA-505-161, Rev. A-1
Anions	Ion chromatograph	N/A	LA-533-105, Rev. D-1
Flammable gas	Combustible gas meter	N/A	WHC-IP-0030, IH 1.4 and IH 2.1

Notes.

[1]Bell (1995a, 1995b, 1996a, 1996b)

[2]Internal procedures of Westinghouse Hanford Company, Richland, Washington.

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

Headspace gas and vapor samples were collected from tank 241-BY-106 using the vapor sampling system (VSS) on July 8, 1994 by Westinghouse Hanford Company (WHC) Sampling and Mobile Laboratories. Sample collection and analyses were performed as directed by the sample and analysis plan (WHC 1995). Air from the tank 241-BY-106 headspace was withdrawn via a heated sampling probe mounted in riser 10B, and transferred via heated tubing to the VSS sampling manifold. All heated zones of the VSS were maintained at approximately 65 °C (150 °F). Further discussion of the methods used for collection and analysis of the vapor samples can be found in Section 4.0, as well as some analytical results.

3.4.1 Sample Handling and Analysis (1994 Vapor Samples)

Sampling media were prepared and analyzed by WHC, Oak Ridge National Laboratories (ORNL), Pacific Northwest National Laboratories (PNNL), and Oregon Graduate Institute of Science and Technology (OGIST) through a contract with Sandia National Laboratories (SNL). The 46 tank air samples and 2 ambient air control samples collected are listed in Table 3-6 by analytical laboratory. Table 3-6 also lists the 10 trip blanks provided by the laboratories. A general description of vapor sampling and sample analysis methods is given by Huckaby (1994). 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 itself are given in WHC (1995a) and references therein.

3.5 HISTORICAL SAMPLING EVENTS

Historical analytical data are available for sampling events of tank 241-BY-106. Data from waste samples obtained from the tank from 1971 to 1990 were taken from Atlantic Richfield Hanford Company and Westinghouse Hanford Company internal letters and memoranda. The analytical results are presented in Appendix D. Because of the uncertainty in sampling locations and analytical procedures, and the age of some of these data, these historical data were not used to assess the current contents or the status of the tank with respect to safety.

3.5.1 Description of 1971 and 1990 Liquid Sampling Events

Supernatant or liquid samples were removed from tank 241-BY-106 on at least two occasions. The earlier samples were most likely taken in 1971. Additional samples may have been taken in 1972. Analytical results are presented in Buckingham (1971 and 1972). It appears the analyses were performed at the 222-S Laboratory, although the above references are not clear in that regard. Furthermore, no riser number, chain-of-custody, or sampling date information is provided. The purpose of taking some of the samples was to investigate waste layering in the tank. Buckingham (1972) reports that one "dip" sample was removed near the surface of the tank and "the second sample was removed at a depth of 33 feet, 10 inches [10.3 m] from ground level."

Table 3-6. Tank 241-BY-106 Gas and Vapor Sample Type and Number.

Laboratory	Sampling Device	Nominal Sample Volume (L)	Target Analytes	Number of Samples
Oak Ridge National Laboratory	Triple sorbent trap	5.0	Organic vapors	4 tank air samples + 2 trip blanks
Oregon Graduate Institute of Science and Technology	SUMMA™ canister	6.0	Hydrogen, nitrous oxide, carbon dioxide, carbon monoxide	3 tank air samples
Pacific Northwest National Laboratory	Acidified carbon sorbent trap	3.0	Ammonia	5 tank air samples + 2 trip blanks
	Triethanolamine sorbent trap	3.0	Nitrogen dioxide	10 tank air samples + 2 trip blanks
	Oxidation bed + Triethanolamine sorbent trap	3.0	Nitric oxide	10 tank air samples + 2 trip blanks
	Silica gel sorbent trap	3.0	Water vapor	10 tank air samples + 2 trip blanks
	SUMMA™ canister	6.0	Organic vapors	3 tank air samples + 2 ambient air samples
WHC 222-S Laboratory	Silica gel sorbent trap	2.0	Tritium-substituted water vapor	1 tank air sample

Note:

SUMMA™ is a trademark of Molectrics, Inc., Cleveland, Ohio.

At least one set of supernatant samples was removed from tank 241-BY-106 in the 1990 to 1991 time frame. Cooling curve data on tank 241-BY-106 supernatant samples are presented in Edrington (1991a). The data were apparently collected to support a subsequent liquid waste transfer. Analytical results on tank 241-BY-106 supernatant are reported in Edrington (1991b). It is not known whether additional samples were taken for this purpose, or whether the same samples were used for both cooling curve and analytical evaluation. It appears the analyses were performed at the 222-S Laboratory, although the above references are not clear in that regard. Furthermore, no riser number, chain-of-custody, or sampling date information is provided.

3.5.2 Supernatant Sample Analysis (1971 and 1990)

The sample preparation methods used are not clear in Buckingham (1971 and 1972) and Edrington (1991b). It is believed that all analyses were performed directly or after dilution in acid or water. Furthermore, the analytical methods used are not indicated. Most likely, anion concentrations were determined by ion chromatography and cations were determined by inductively coupled plasma spectroscopy. Tables containing the analytical results are presented in Appendix D.

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4.0 ANALYTICAL RESULTS

This section presents the analytical results associated with cores 64 and 65, taken from November 17, 1994 to January 24, 1995 and core 121, taken from December 5, 1995 to January 2, 1996. The results of the vapor samples taken in 1994 will also be presented. The core and vapor samples were taken and analyzed to satisfy the DQO requirements specified in Table 3-2. Sampling and analysis requirements of the tank 241-BY-106 core samples were performed as directed in Schreiber (1994 and 1995) and Bell (1996c). Sampling and analysis requirements of the tank 241-BY-106 vapor samples were performed as directed in Osborne et al. (1994).

Analytical results are presented as shown in Table 4-1. Comprehensive analytical data are found in Appendix A. Overall analyte mean results and projected inventories are reported in this section, along with a discussion of the physical analyses such as DSC and TGA. All reported analyses were performed in accordance with approved laboratory procedures.

Table 4-1. Tank 241-BY-106 Analytical Data Presentation Tables.

Analytical Data	Data Location
Chemical saltcake data summary	Table 4-2
Chemical sludge data summary	Table 4-3
Core sample comprehensive analytical data	Appendix A
Hydrostatic head fluid contamination	Appendix B
Vapor sample analytical data	Appendix C

4.1 DATA PRESENTATION

This section summarizes the analytical results from core samples 64, 65, and 121, and vapor samples taken in 1994 and 1995. The subsections below present chemical data summaries, information concerning physical analyses, and a discussion about vapor analyses. Data from the analysis of cores 64 and 65 were reported in Bell (1995a and 1996b,c). The core 121 saltcake and headspace flammability results were reported in Bell (1996b and 1996c). Vapor results were reported in WHC (1995a).

4.1.1 Chemical Data Summary

All information in Tables 4-2 and 4-3 was taken from Appendix A. Table 4-2 shows overall composition means for all analytes measured in the saltcake; Table 4-3 presents those for the sludge. Because the recovery of sludge was very limited (Section 3.1), the sludge results should be used with caution. The first two columns of the tables contain the analyte name and overall mean. The means reported are simple (non-weighted) means of sample-duplicate pairs from each core. A separate overall mean was calculated for each digestion (acid, water, or fusion) and each waste type (saltcake, sludge, liquid, and core composite). When 50 percent or more of the individual primary/duplicate measurements exhibited detected results, the overall mean was reported as a detected value. Conversely, when results for more than half of the individual primary/duplicate results were nondetected (denoted '<'), the overall mean was reported as a nondetected value.

The third column displays the relative standard deviation (RSD) for the mean of all the results. The RSD is defined as the standard deviation of the mean divided by the mean and multiplied by 100. It is determined using standard analysis of variance (ANOVA) statistical techniques. If nondetected values are used as quantitative results, the mean concentrations, inventory estimates, and RSD values are biased. The magnitude of the bias cannot be estimated. Thus, means and the ANOVA estimates in which nondetected results were used should be interpreted with caution.

The projected inventories listed in the final column were based on a saltcake inventory of 2,070 kL (547 kgal) or on a sludge volume of 360 kL (95 kgal). The densities of the samples from core 64 and 65 were not measured; therefore, the mean density value for the saltcake from core 121 (1.71 g/mL) was used to calculate the projected inventories for all three cores. In the one case for core 121 in which results existed for both solids and drainable liquids, results from the analysis of the drainable liquids were included in the solids results, in order to more fully represent the constituency of the solid waste. The specific gravity value used for the conversion from $\mu g/mL$ to $\mu g/g$ (1.34) was the weighted mean of the three specific gravity samples (two from core 64 and one from core 121). The weighted mean was used because of the difference between the average values from the two cores, although the difference between a simple mean and a weighted mean was small in this case.

Table 4-2. Data Summary for Detected Analytes in Tank 241-BY-106 Saltcake. (2 sheets)

Analyte	Overall Mean	RSD (Mean)	Projected Inventory
METALS[1]	µg/g	%	kg
Aluminum	20,400 (28,700)	24.9 (18.8)	72,200 (1.02E+05)
Boron	113	11.5	400
Cadmium	8.25	15.1	29.2
Calcium	308	24.6	1,090
Chromium	855 (1,272)	10.8 (20.1)	3,030 (4,500)
Iron	215	22.9	761
Lead	64.5	12.7	228
Manganese	9.57	11.2	33.9
Nickel	47.9	10.9	170
Phosphorus	1,032	23.3	3,650
Potassium	2,470	13.6	8,740
Silicon[2]	184	20.2	651
Silver	14.5	3.6	51.3
Sodium	2.03E+05 (2.11E+05)	3.0 (4.0)	7.19E+05 (7.47E+05)
Strontium	44.4	16.5	157
Sulfur	3,280	14.1	11,600
Uranium	164.2	13.8	581
Zinc	18.4	4.9	65.1
Zirconium	6.28 (4,720)[3]	8.4 (8.0)	22.2 (16,700)[3]
ANIONS	µg/g	%	kg
Chloride	2,060	14.2	7,290
Cyanide	20.6	10.1	72.9
Fluoride	5,130	17.6	18,200
Formate	630	11.8	2,230
Nitrate	3.29E+05	11.2	1.16E+06
Nitrite	32,100	14.4	114,000
Oxalate	8,990	15.7	31,800
Phosphate	5,270	18.0	18,700
Sulfate	11,300	13.4	40,000

Table 4-2. Data Summary for Detected Analytes in Tank 241-BY-106 Saltcake. (2 sheets)

Analyte	Overall Mean	RSD (Mean)	Projected Inventory
RADIONUCLIDES	µCi/g	%	Ci
^{137}Cs	106 (89.6)	13.9 (9.9)	3.75E+05 (3.26E+05)
^{90}Sr	(4.26)	(16.6)	15,100
Total alpha	(0.00945)	(17.2)	33.5
Total beta[4]	(80.2)	(3.7)	2.84E+05
CARBON	µg C/g	%	kg C
Total inorganic carbon	7,359	20.8	26,050
Total organic carbon	2,500	12.1	8,870
PHYSICAL PROPERTIES			
Density	1.71 g/mL	2.4	n/a
Percent water	25.5	12.7	9.02E+05

Notes:

n/a = not applicable

[1]Analytical results and projected inventories for analytes in parentheses are from fusion digestion. All other data are from acid or water digestions or from direct analysis.

[2]The silicon data is probably biased high and should be used with caution. Acid digestion of samples containing fluoride will likely leach silicon from the glassware.

[3]The zirconium fusion data is probably biased high and should be used with caution. Fusion digestions were performed in zirconium crucibles.

[4]Data is from the core 121 composite only.

Table 4-3. Data Summary for Detected Analytes in Tank 241-BY-106 Sludge.

Analyte	Overall Mean	RSD (Mean)	Projected Inventory
METALS	µg/g	%	kg
Aluminum	30,800	2.4	19,000
Calcium	8,150	5.3	5,020
Chromium	1,120	2.8	690
Iron	33,000	1.3	20,300
Nickel	29,500	5.8	18,200
Phosphorus	20,500	5.6	12,600
Sodium	1.30E+05	1.8	80,100
Zinc	194	5.5	120
Zirconium[1]	589	0.6	363
RADIONUCLIDES	µCi/g	%	Ci
Total alpha	0.253	14.9	156
^{137}Cs	508	22.4	3.13E+05
$^{239/240}Pu$	0.0997	5.4	61.4
^{90}Sr	763	2.6	4.70E+05
CYANIDE	µg/g	%	kg
Cyanide	93.9	5.3	57.8
TOTAL CARBON	µg C/g	%	kg
Total inorganic carbon	5,580	10.0	3,440
Total organic carbon	20,400	4.2	12,600
PHYSICAL PROPERTIES		%	kg
Weight percent water	37.3	1.9	1.34E+05

Note:

[1]The zirconium fusion data is probably biased high and should be used with caution. Fusion digestions were performed in a zirconium crucible.

4.1.2 Physical Data Summary

4.1.2.1 Thermogravimetric Analysis. 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 the heating to remove any released gases. Any decrease in the mass of a sample represents a loss of gaseous matter from the sample either through evaporation or through a reaction that forms gas phase products. The moisture content is estimated by assuming that all sample mass loss up to a certain temperature (typically 150 °C [302 °F]) is due to water evaporation.

The TGA results for tank 241-BY-106 are presented in Appendix A, Table A-62. All samples exhibited a large weight loss between the ambient temperature and 200 °C. In most of the runs, the weight loss occurred in one transition. The mean weight percent water for the saltcake was 25.5 and 37 for the sludge. Weight percent water results varied widely for the core samples. Drainable liquid means ranged from 50 to 68 weight percent. Saltcake and sludge samples exhibited mean results from 3.8 to 49 weight percent. Waste heterogeneity and small sample sizes led to a large relative percent difference (RPD) between some samples and duplicates results.

4.1.2.2 Differential Scanning Calorimetry. During a DSC run, heat absorbed or emitted by a sample is measured while the sample is exposed to a linear increase in temperature. While the sample is being heated, nitrogen is passed over it 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 graphically.

The DSC results, including peak temperatures and magnitude of enthalpy changes on a wet basis, are presented in Appendix A, Table A-61. All of the samples exhibited an initial endothermic reaction, which represents the evaporation of free and interstitial water. Two of the samples from core 121 exhibited exothermic reactions (segment 2 upper half and segment 9 upper half). Neither result exhibited changes in enthalpy in excess of the decision criteria threshold of -480 J/g on a dry basis. All upper limits to one-sided 95 percent confidence interval limits on the mean were below the decision criteria threshold. Peak temperatures for the exothermic reactions ranged from 243 to 445 °C (470 to 833 °F), and changes in enthalpy ranged from -12 to -50 J/g.

A number of samples from cores 64 and 65 exhibited exothermic reactions. Some samples displayed more than one exothermic reaction, in which case the value of the first exothermic reaction was reported. All drainable liquid samples and the saltcake samples from segments 2, 3, 4, and 8 of core 64 displayed exothermic behavior. The saltcake from core 65 segment 13 exhibited no exothermic behavior, while the sample, duplicate, and triplicate runs of the sludge from the same segment yielded wet-weight enthalpy changes of -418, -855, and -421 J/g, respectively. All of these results exceeded the decision criteria threshold on a dry-weight basis. The exothermic reactions for the core 65 segment 13 samples exhibited peak temperatures ranging from 312 to 318 °C (594 to 604 °F).

A number of samples displayed poor baselines at temperatures greater than 400 °C (752 °F). This was believed to be caused by damage to the DSC sensor from volatilized material. The samples from segments 1 and 2 of core 64 were run to 450 °C (842 °F) rather than the prescribed 500 °C (932 °F) in an effort to minimize the problem.

4.1.2.3 Bulk Density. Bulk density measurements were performed on the solid samples from core 121. Density measurements were not performed on 4 of the subsegments due to insufficient sample. The bulk density results are presented in Appendix A, Table A-64. The mean bulk density for the tank was 1.71 g/mL. Density measurements were not specified for core samples 64 and 65; therefore, the value from core 121 was used in calculations such as the projected inventories in Tables 4-2 and 4-3.

4.1.3 Headspace Flammability Screening Results

As requested in the SAP (Bell 1996a), the tank 241-BY-106 headspace was sampled and analyzed for the presence of flammable gases prior to sampling core 121. The safety screening decision criteria threshold for flammable gas concentration is 25 percent of the LFL (Dukelow et al. 1995). The combustible gas meter used to sample the tank headspace reports results as a percentage of the lower explosive limit (LEL). Because the National Fire Protection Association (NFPA) defines the terms LEL and LFL identically, the two terms may be used interchangeably (NFPA 1995). The reported flammable gas result was 0 percent of the LFL.

4.1.4 Hydrostatic Head Fluid Contamination

Water with a lithium bromide tracer was used as wash water or as hydrostatic head fluid (HHF) in the core sampling operations. The SAP and the TCP requirement for cores 64 and 65 was to analyze segments for Li only if the chain of custody forms indicated that HHF or wash water (for drill string flushing) was used during sampling. If the concentration of Li was found to be greater than 100 $\mu g/g$, then analysis for bromide was required. None of the chain of custody forms for segments from core 64 indicated that HHF or wash water was used. The chain of custody forms for segments 2, 5, 5A, 6, 9, 10, 12, and 13 of core 65 indicated that wash water was used. Only segments 11, 12, and 13 of core 65 were analyzed (Section 3.3) to meet the DQO requirements, and only segments 12 and 13 were analyzed for Li. The SAP for core 121 required analysis of all samples for Li and bromide. All Li and bromide data are presented in Appendix B. There is no evidence of any contamination from HHF or wash water.

4.2 VAPOR RESULTS

Vapor samples were acquired in 1994 in accordance with the requirements of Osborne et al. (1994). Sampling and analytical methods are presented in Table 3-6 and in sections 4.2.1 and 4.2.2. Analytical results are summarized in Appendix C.

4.2.1 Inorganic Gases and Vapors

Analytical results of sorbent trap and SUMMA™ canister tank air samples for selected inorganic gases and vapors are given in Table C-1 in parts per million by volume (ppmv). Inorganic analyte sorbent traps were prepared and analyzed by PNNL, and SUMMA™ canisters were analyzed for inorganic analytes by OGIST. Reports by PNNL (Lucke et al. 1994) and Sandia National Laboratory/Oregon Graduate Institute of Science and Technology (SNL/OGIST) (Rasmussen 1994c and 1994d) describe sample preparation and analyses.

The small relative standard deviations of the results, given in the last column in Table C-2, indicate the precision of reported results is very good. Relative standard deviations range from 1 percent for nitrous oxide results to 28 percent for nitric oxide results. The larger relative standard deviation of the nitric oxide results is due to the fact that it is very near the analytical method's limit of quantitation. The precision reported depends both on sampling parameters (e.g., sample flow rate and flow time for sorbent traps) and analytical parameters (e.g., sample preparation, dilutions, etc.), and the small relative standard deviations suggest a high degree of control was maintained both in the field and in the laboratories.

4.2.1.1 Ammonia, Hydrogen, and Nitrous Oxide. Ammonia, hydrogen and nitrous oxide are commonly detected gases in the waste tanks. Believed to be products of chemical reactions and radiolysis of the waste, they have been found above the 1-ppmv level in virtually all the tank headspaces sampled to date.

The reported ammonia concentration, 74 ppmv, is about three times higher than the National Institute of Occupational Safety and Health (NIOSH) eight-hour recommended exposure limit (REL) of 25 ppmv (NIOSH 1990). Ammonia concentrations at this level are not uncommon in the waste tank headspaces, and are known to be as high as about 1,040 ppmv in tank 241-BY-108 (McVeety et al. 1994).

In general, hydrogen is of concern as a fuel. The measured 45.5 ppmv of hydrogen in tank 241-BY-106, however, represents only about 0.1 percent of the LFL for hydrogen in air, and is not a flammability concern at this level. The nitrous oxide concentration in tank 241-BY-106, 70.6 ppmv, is about three times the NIOSH eight-hour REL of 25 ppmv (NIOSH 1976 and 1977).

The measured concentrations of ammonia (74 ppmv), hydrogen (45.5 ppmv), and nitrous oxide (70.6 ppmv) are consistent with the observation that these three constituents are commonly found in approximately equal concentrations.

4.2.1.2 Carbon Dioxide and Carbon Monoxide. The average measured headspace carbon dioxide concentration, 47.6 ppmv, is markedly lower than normal ambient air concentrations of about 400 ppmv. Little data on waste tank headspace carbon dioxide concentrations are available, but lower than ambient concentrations are expected. Carbon dioxide introduced by air exchange with the atmosphere is readily absorbed by caustic supernatant and interstitial liquids of the waste tanks, and converted to carbonate in solution. It is reasonable to expect the level of carbon dioxide in a tank headspace will therefore depend on the rate of air exchange and the pH and surface area of aqueous waste (i.e., supernatant, interstitial liquid, and condensate) in the tank. For comparison, the carbon dioxide concentrations of the cascaded tanks 241-BY-104, BY-105, and BY-106 are 10.5 ppmv, 94 ppmv, and 47.6 ppmv, respectively (Rasmussen 1994a and 1994b).

Carbon monoxide in the tank 241-BY-106 headspace, at about 0.45 ppmv, is more concentrated than in ambient air, where it typically is about 0.05 to 0.15 ppmv. Carbon monoxide may be a decomposition product of organic waste in the tank. Tanks known to have significantly higher organic vapor concentrations have also been observed to have higher carbon monoxide concentrations, e.g., carbon monoxide concentration in tank 241-C-103 was 26.7 ppmv (Huckaby and Story 1994). With a NIOSH eight-hour REL of 35 ppmv (NIOSH 1990), the 0.45 ppmv in tank 241-BY-106 probably does not represent a worker hazard.

4.2.1.3 Nitric Oxide, Nitrogen Dioxide, Water and Tritium. Nitric oxide and nitrogen dioxide concentrations in the tank 241-BY-106 headspace were measured to be 0.13 ppmv and 0.05 ppmv, respectively. These are both acid gases that would have very low equilibrium concentrations above the high pH interstitial liquid in tank 241-BY-106. The measurable presence of nitric oxide may be due to its formation from oxygen and nitrogen in the radiation field of the headspace. The NIOSH eight-hour REL is 25 ppmv for nitric oxide, and the 15-minute short-term exposure limit (STEL) for nitrogen dioxide is 1 ppmv.

The water vapor concentration of tank 241-BY-106 was measured to be about 14.7 mg/L, at the tank headspace temperature of 27 °C (81 °F) and pressure of 984 mbar (740 torr), (WHC 1995a). This corresponds to water vapor partial pressure of 20.4 mbar (15.3 torr), to a dew point of 17.8 °C (64 °F), and to a relative humidity of 57 percent.

Tritium was tested for using silica gel sorbent traps. It is assumed that tritium produced by the waste combines with hydroxide ions to form tritium-substituted water. Evaporation of the tritium-substituted water would then result in airborne radioactive contamination. Silica gel sorbent traps adsorb virtually all (normal and tritium-substituted) water vapor from the sampled tank air, and are analyzed at the WHC 222-S Laboratory. Analysis of the silica gel, which would have trapped approximately 34 mg of water vapor, indicated the total activity of the sample to be below the method detection limit of 50 pCi (WHC 1995a).

4.2.2 Organic Vapors

Organic vapors in the tank 241-BY-106 headspace were sampled using SUMMA™ canisters, which were analyzed at PNNL, and triple sorbent traps (TSTs), which were analyzed by ORNL. None of the positively or tentatively identified organic analytes were at or above levels of concern. Both laboratories used gas chromatography and mass spectrometry to separate, identify, and quantitate the analytes. Descriptions of sample device cleaning, sample preparations, and analyses are given by Jenkins et al. (1994) and Lucke et al. (1994). A quantitative measurement of the total organic vapor concentration by the U.S. Environmental Protection Agency (EPA) task order 12 (TO-12) method was also performed by OGIST (EPA 1988, Rasmussen 1994c).

4.2.2.1 Positively Identified Organic Analytes. The ORNL positively identified and quantitated 26 of 27 analytes selected by WHC, (one analyte, vinylidene chloride, was below detection limits). These analytes, and their average concentrations from the analysis of four TSTs, are given in Table C-2. The TST target analytes for tank 241-BY-106 were based on the tank 241-C-103 target analytes, which were selected by a PNNL panel of toxicology experts as being of potential toxicological concern (Mahlum et al. 1994).

Also given in Table C-2 are the organic compounds positively identified and quantitated in SUMMA™ canister samples by PNNL. Pacific Northwest National Laboratory performed analyses according to the EPA TO-14 methodology (EPA 1988, Lucke et al. 1994). Only seven of the 40 TO-14 analytes were observed to be above the 0.002-ppmv quantitation limit of the analyses (Lucke et al. [1994]) provides the complete TO-14 analyte list). Averages reported are from analyses of three SUMMA™ canister samples except where noted.

Three analytes in Table C-2 were common to both the ORNL and PNNL analyses: dichloromethane, benzene, and toluene. The ORNL and PNNL results are in excellent agreement for dichloromethane and toluene, but differ by more than a factor of three for benzene. Though the benzene values differ by more than the allowed ±30 percent analytical accuracy, this difference is reasonable given that fundamentally different sampling devices and analytical methods were used. What is important in this case is that both ORNL and PNNL results, 0.0073 ppmv and 0.0022 ppmv respectively, clearly indicate that benzene is well below its NIOSH STEL of 1 ppmv.

The 3 most abundant organic compounds in the tank 241-BY-106 headspace are methane, acetone, and 1-butanol. At 3.6 ppmv, the methane concentration is about two times higher than its normal ambient air concentration. Methane is probably formed during the chemical and radiolytic degradation of organic wastes in the tank. Methane is not a constituent of toxicological concern, and its LFL in air is about 5 percent by volume. This places the 3.6 ppmv of methane in tank 241-BY-106 at about 0.007 percent of its LFL. Acetone, at 0.37 ppmv, and 1-butanol, at 0.34 ppmv, similarly presents virtually no flammable or toxicological risks.

4.2.2.2 Tentatively Identified Organic Analytes. In addition to targeted analytes, both ORNL and PNNL analytical procedures allow the tentative identification of other organic vapors. Table C-3 is a reproduction of the PNNL list of tentatively identified compounds, with estimated concentrations, and Table C-4 is a reproduction of the ORNL list of tentatively identified compounds, and their estimated concentrations in mg/m^3, in dry air at 0 °C (32 °F) and 1.01 bar.

Both ORNL and PNNL tentatively identify analytes by comparing the mass spectroscopy (MS) molecular fragmentation patterns with a library of known MS fragmentation patterns. This method allows an organic analyte to be identified (with reasonable certainty) as an alkane, a ketone, an aldehyde, etc., and also measures its molecular weight (which specifies the number of carbon atoms in the molecule). The method usually does not, however, allow the unambiguous identification of structural isomers, and this ambiguity increases with analyte molecular weight. Entries in Tables C-3 and C-4, particularly near the bottoms of the tables where the analytes have higher molecular weights, illustrate this.

The PNNL and ORNL methods used to tentatively identify and estimate concentrations are described by Jenkins et al. (1994) and Lucke et al. (1994), respectively, and should be reviewed before the data are used for decision making. Results in Tables C-3 and C-4 are presented in terms of observed peaks, and are not adjusted for the occurrence of chromatographic peak doublets and even triplets (e.g., Compound # 2, 3, and 4 in Table C-4). In these instances, the estimated concentration of a compound appearing as a doublet or triplet is simply the sum of the individual peak estimates.

Concentrations given in Tables C-3 and C-4 should be considered rough estimates. The proper quantitation of all observed analytes is outside the scope and budget of these analyses, and the estimation of concentrations involves several important assumptions. The validity of each assumption depends on the analyte, and such factors as the specific configuration of the analytical instrumentation.

4.2.2.3 Total Nonmethane Organic Compounds. The OGIST measured the total nonmethane organic compound concentration in three SUMMA™ canister samples using the EPA TO-12 method (Rasmussen 1994c). The sample mean was 9,900 μg/m^3, with a standard deviation of 350 μg/m^3. Though data on other tanks are very limited, this value is neither high nor low compared to most other waste tanks sampled to date.

4.2.2.4 Discussion of Organic Analytes. The organic analytes observed in the waste tank headspaces are indicative of the types of semivolatile organic waste that have been stored in each tank. Examination of the data provides clues to both the current organic constituents and the chemical reactions that they undergo.

Some of the compounds listed in Tables C-2, C-3, and C-4 were introduced to the tank with process waste streams, and are detected in the headspace because the original inventory has not been completely evaporated or degraded. Examples of these are tributyl phosphate (TBP), which was used as an extractant in several Hanford processes; dibutyl

butylphosphonate, which was a contaminant of TBP; and the semivolatile normal paraffinic hydrocarbons (NPHs), (i.e., n-undecane, n-dodecane, n-tridecane, and n-pentadecane) and branched and cyclic alkanes (e.g., methylated decahydronaphthalenes, cyclopentanes, and cyclohexanes) with similar boiling points that were used as a diluent for TBP. The specific presence of the decahydronaphthalenes and cyclohexanes, which were not observed in tank 241-C-103 samples, is an indication of their different waste histories.

Most of the compounds in Tables C-2, C-3, and C-4, however, are believed to be chemical reaction and radiolytic reaction products of the semivolatile or nonvolatile organic waste stored in the tank. Specifically, 1-butanol is known to be formed by the hydrolysis of TBP, and it has been suggested that the alcohols, aldehydes, ketones, nitriles, alkenes, and short chain alkanes are all degradation products of NPHs.

Examination of the compounds listed in Tables C-2, C-3 and C-4 suggests many of the volatile species (presumed to be degradation products of the NPHs) have functional groups on the molecule's first or second carbon atom. For example, most alkenes listed have their double bond between the first and second carbon atoms, and ketones generally have the double bonded oxygen atom on the second carbon atom.

As observed in other NPH-containing waste tanks, there are many small cyclic compounds, specifically cyclopropanes, cyclopentanes, and furans. The presence of these suggest that organic radicals, formed in the radiation field of the tank, play a role in the degradation of the semivolatile compounds.

5.0 INTERPRETATION OF CHARACTERIZATION RESULTS

The purpose of this chapter is to discuss the overall quality and consistency of the current sampling results for tank 241-BY-106, and to assess and compare 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 interpretation of the data. These factors are used to assess the overall quality and consistency of the data and to identify any limitations in the use of the data. They include comparisons of analytical methods, mass and charge balances, and an assessment of field conditions at the time of sampling.

5.1.1 Field Observations

The safety screening, ferrocyanide, historical, and organic DQO requirements that vertical profiles from at least two widely spaced risers be obtained was not fulfilled. Hard waste was encountered under riser 5 and prevented the acquisition of the bottom three segments of core 121. The sludge component of the waste was not sampled, with the exception of a small portion of segment 13 of core 65. A complete assessment of the ferrocyanide waste in the tank was not possible. The sampling requirements of the waste compatibility and vapor DQOs were met. Water with a lithium bromide tracer was used to acquire several of the segments. There was no evidence of contamination from HHF or wash water. All analyses were performed in accordance with the required procedures.

5.1.2 Quality Control Assessment

The usual QC assessment includes an evaluation of the appropriate standard recoveries, spike recoveries, duplicate analyses, and blanks that are performed in conjunction with the chemical analyses. All the pertinent QC tests were conducted on the 1994-1996 core samples, allowing a full assessment regarding the accuracy and precision of the data. The SAP (Bell 1996c) and the TCPs (Schreiber 1994 and 1995) established the specific criteria for the primary analytes (TGA, DSC, TOC, bulk density, total alpha and total beta activities, $^{239/240}Pu$, $^{90/90}Sr$, ^{137}Cs, total uranium, aluminum, lithium, nickel, sodium, sulfate, nitrate, acetate, formate, oxalate, cyanide, and hydroxide), while the remainder of the analytes were governed by the laboratory criteria (DOE 1995). Sample and duplicate pairs that had one or more QC results outside the specified criteria are identified by superscripts in the Appendix A tables.

The standard and spike recovery results provide an estimate of the accuracy of the analysis. If a standard or spike recovery is above or below the given criterion, the analytical results may be biased high or low, respectively. The precision is estimated by the relative percent difference (RPD), which is defined as the absolute value of the difference between the primary and duplicate samples, divided by their mean, times one hundred.

The TGA analyses exhibited a number of sample-duplicate pairs with high RPD values. The majority of the high RPD values may be attributed to sample heterogeneity as evidenced by the sample descriptions provided in Section 3.2. All standard recoveries for TGA were within specifications. Certain DSC analysis exhibited the same RPD problems as the TGA. All standard recoveries for DSC were within the limits prescribed in the SAP. A number of spike recoveries and RPD values were outside the target level for total alpha activity analyses. This was most likely due to the low sample activities and possible self-shielding caused by a high solid content on the sample mount. The cyanide analysis displayed low spike recoveries in two samples, as well as some high RPD values on samples from three segments of core 64, and the sludge segment from core 65. Two of the samples from core 121 exhibited low spike recoveries, and four samples showed high RPDs. Low spike recoveries may have biased low the TOC results from the sludge portion of segment 13 of core 65. The spike recoveries were most likely due to small sample sizes and sample heterogeneity. The TOC analysis of two of the core 121 samples displayed high RPDs and high spike recoveries. The nickel analyses for core 65 had RPD values slightly higher than the TCP limit. Some aluminum and sodium analyses exhibited high RPD values and poor spike recoveries. Due to the high concentrations of sodium and aluminum, the poor spike recoveries were not evaluated. High RPDs were the sole quality control problem for ^{90}Sr. The IC analyses exhibited high RPDs for nitrate, oxalate, and sulfate, low spike recoveries for nitrate, and high spike recoveries for sulfate. Finally, none of the samples except for the gamma energy analysis exceeded the criterion for preparation blanks. The contamination was very small relative to the sample activity and did not impact the usability or validity of the data.

In summary, most of the QC results for the primary analytes listed above were within the boundaries specified in the SAP. The few discrepancies noted should not impact either the validity or the use of the data.

5.1.3 Data Consistency Checks

Comparing different analytical methods can help in assessing data consistency and quality. Several correlations were possible with the data set provided with the three core samples; these are presented in the following subsections. They include the comparison of phosphorus and sulfur by ICP with phosphate and sulfate as analyzed by IC, mass and charge balances, the comparison of total beta with the sum of the measured beta emitters, and comparison of TOC values with the oxalate and formate data.

Analyte concentrations used for the data consistency checks were a combination of fusion, acid, and water digestion results. When more than one digest result was available, the highest value was used. Typically this was the fusion result. Only water digestion results were available for the anions. The TOC and total inorganic carbon (TIC) analyses do not require a digestion.

5.1.3.1 Comparison of Results from Different Analytical Methods. The following data consistency checks compare results from different analytical methods. Close agreement between the methods strengthens the credibility of both the results, whereas a poor agreement brings the reliability of the data or assumptions regarding the data into question. All analytical mean results were taken from Appendix A.

5.1.3.1.1 Phosphate and Sulfate Results. Phosphate and sulfate were measured on water-digested samples. Phosphate and sulfate data are only available for core 121. The mean phosphate results for the saltcake were 5,270 μg/g (segment average) and 6,230 μg/g for the core composite. These amounts of phosphate respectively convert to 1,714 and 2,027 μg/g of phosphorus. These results compare very well with the water-digested core composite phosphorous result of 2,020 μg/g and indicate that nearly all phosphorus is present as phosphate.

The mean sulfate results for the saltcake were 11,300 μg/g (segment average) and 13,200 μg/g for the core composite. These amounts of sulfate respectively convert to 3,771 and 4,405 μg/g of sulfur. These results compare very well with the water-digested core composite sulfur result of 4,510 μg/g and indicate that nearly all sulfur is present as sulfate.

5.1.3.1.2 Mass and Charge Balances. The principle objective in performing mass and charge balances is to determine if the measurements were self-consistent. In calculating the balances, the metals and anions listed in Table 4-2 that were detected at a level greater than 1,000 μg/g in the saltcake were considered. The sludge results were not subjected to a mass or charge balance because of the small number of analytes and because only one sludge sample was obtained.

All positive charge was attributed to the soluble sodium and potassium cations. The sodium value was obtained from the fusion digest result in Appendix A and the potassium value was obtained from the acid digest result in Appendix A. Half of the aluminum concentration was assumed to be present as the aluminate ion because of the relatively high concentration of aluminum found in the water-digested core 121 core composite. The balance of the aluminum was not water soluble and was assumed to be present as aluminate. All TOC was assumed to be in the form of oxalate (See Section 5.1.3.1.4.), and carbonate data were derived from the TIC data. The other anionic analytes listed in Table 5-2 were assumed to be present as sodium or potassium salts. The concentrations of sodium and potassium in Table 5-1, the anionic and neutral species in Table 5-2, and the percent water were ultimately used to calculate the mass balance. The uncertainty estimates (RSDs) associated with each analyte are also given in the tables. The uncertainty estimates for the cation and

anion totals, as well as the overall uncertainty given in Table 5-3, 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 $\mu g/g$ to weight percent.

$$\text{Mass balance} = \%\ \text{water} + 0.0001 \times \{\text{Total Analyte Concentration}\}$$
$$= \%\ \text{water} + 0.0001 \times \{Al_2O_3 + AlO_{2-} + CrPO_4 + Na^+ + K^+ + C_2O_4^{2-} + Cl^- + F^- + CO_3^{2-} + NO_3^- + NO_2^- + OH^- + PO_4^{3-} + SO_4^{2-}\}$$

The total analyte concentration calculated from the above equation is 742,200 $\mu g/g$. The mean weight percent water obtained from thermogravimetric analysis reported in Table 4-2 is 25.5 percent, or 253,000 $\mu g/g$. The mass balance resulting from adding the percent water to the total analyte concentration is 99.7 percent (Table 5-3).

The following equations demonstrate the derivation of total cations and total anions, and the charge balance is the ratio of these two values. To derive the results as shown in the equations, all concentrations must be expressed in $\mu g/g$.

<u>Total cations</u> ($\mu eq/g$) = $[Na^+]/23.0 + K^+/39.1 = 9{,}241\ \mu eq/g$

<u>Total anions</u> ($\mu eq/g$) = $[AlO_2^-]/59.0 + C_2O_4^{2-}/44.0 + [Cl^-]/35.5 + [F^-]/19.0 + [CO_3^{2-}]/30.0 + [NO_3^-]/62.0 + [NO_2^-]/46.0 + [OH^-]/17 + [PO_4^{3-}]/31.7 + [SO_4^{2-}]/48.1 = 10{,}800\ \mu eq/g$

The charge balance obtained by dividing the sum of the positive charge by the sum of the negative charge was 0.856.

Table 5-1. Cation Mass and Charge Data.

Analyte	Concentration	Assumed Species	Concentration of Assumed Species	RSD (Mean)	Charge
	$\mu g/g$		$\mu g/g$	%	$\mu eq/g$
Sodium	211,000	Na^+	211,000	4.0	9,180
Potassium	2,470	K^+	2,470	13.6	63
Total			213,470	n/a	9,241

Table 5-2. Anion Mass and Charge Data.

Analyte	Concentration	Species or Assumed Species	Concentration of Assumed Species	RSD (Mean)	Charge
	µg/g		µg/g	%	µeq/g
Aluminum	14,350	Al_2O_3	27,100	18.8	---
Aluminum	14,350	AlO_2^-	31,400	18.8	532
TOC	2,500	$C_2O_4^{2-}$	9,180	12.1	208
TIC	7,359	CO_3^{2-}	36,800	20.8	1,230
Chromium	1,272	$CrPO_4$	3,600	20.1	---
Chloride	2,060	Cl^-	2,060	14.2	58
Fluoride	5,130	F^-	5,130	17.6	270
Hydroxide	35,800	OH^-	35,800	6.8	2,100
Nitrate	329,000	NO_3^-	329,000	11.2	5,310
Nitrite	32,100	NO_2^-	32,100	14.4	698
Phosphate	5,270	PO_4^{3-}	5,270	18.0	166
Sulfate	11,300	SO_4^{2-}	11,300	13.4	235
Total			528,740	N/A	10,800

Note:

[1]Hydroxide data taken from Table A-66.

Table 5-3. Mass Balance Totals.

Totals	Concentrations	RSD (Mean)
	µg/g	%
Total from Table 5-1	213,470	N/A
Total from Table 5-2	528,740	N/A
Water %	255,000	12.7
Grand Total	997,200	N/A

5.1.3.1.3 Total Beta Results. The total beta result obtained from the core composite was compared with the measured beta emitters ^{137}Cs and $^{89/90}Sr$. For consistency, all results used originated from analysis of the fusion digest of the core 121 composite. The data are available in Appendix A.

Total beta (calculated) = $[^{137}Cs] + (2)([^{89/90}Sr]) = 81.7\ \mu Ci/g$.

The factor of two arises from the fact that ^{90}Sr is in equilibrium with ^{90}Y, which has a much shorter half life. Thus, for every beta decay from strontium, there is an additional beta decay from the yttrium.

The measured total beta on the core 121 composite was 80.2 μCi/g.

5.1.3.1.4 TOC Results. The TOC results were compared with the concentrations of the organic acids oxalate, formate, and acetate. These acids were only analyzed on core 121 samples. Most acetate results were below the detection limit; therefore, only the oxalate and formate data were used.

The data in Table 5-4 show that all the TOC may be accounted for by the carbon in formate and oxalate.

Table 5-4. Comparison on TOC with Formate and Oxalate.

Species	Percent Carbon	Core 121 Mean (μg/g)	Carbon (μg/g)
Formate	26.7	630	168
Oxalate	27.3	8,990	2,450
TOC	100	2,450	2,450

In summary, all the data consistency results yielded excellent results with the exception of the charge balance. At 0.856 the positive/negative charge ratio was reasonable considering the assumptions made with respect to the assumed specied and that only analytes in concentration greater than 1,000 μg/g were considered. A small relative percent error in the sodium results would significantly affect the charge balance.

5.2 COMPARISON OF HISTORICAL WITH ANALYTICAL RESULTS

As mentioned in Section 3.4, historical data are available for three sampling events for tank 241-BY-106: 1971, 1972, and 1990. However, waste was added to and removed from the tank following the 1971 and 1972 events and the analytical results are no longer likely to

accurately reflect the current tank contents. Furthermore, samples from the three sampling events were described as supernatant. Because the 1994 through 1996 sampling activities produced no supernatant samples, the most recent analytical results are not compared to the historical analytical results. Historical results are presented in Appendix D for information purposes only.

5.3 TANK WASTE PROFILE

An objective of the 1994-1996 sampling events was to obtain a vertical profile of the tank 241-BY-106 waste from two widely spaced risers (Bell 1996c) and (Schreiber 1994 and 1995). This objective was not achieved. The sample recoveries for the 13 segments of cores 64 and 65 were generally not good, though recoveries were better for the 10 segments of core 121 (see Tables 3-2, 3-3, 3-4). However, none of the cores provided a complete vertical profile of the tank waste.

The TLM predicts that the vertical deposition of the tank waste consists of three layers: about 5 m (16 ft) of BYSltCk deposited atop two layers of ferrocyanide sludge less than 1 m (3 ft) in depth. The two sludge layers are expected to be indistinguishable from each other except that the PFeCN1 waste had a greater concentration of ferrocyanide when placed in the tank. The visual description of the extrusion of segments from core 65 suggests that the waste is vertically heterogeneous. The description of the extrusion of the bottom-most segment of core 65 (segment 13) indicates a distinct change from light-colored saltcake-like material to dark sludge (see Table 3-3). This distinct change is also supported by notable differences in analytical results (e.g, iron, nickel, and TOC) between the sludge and saltcake phases of core 65 segment 13.

5.4 COMPARISON OF TRANSFER HISTORY WITH ANALYTICAL RESULTS

The HTCE estimate of the contents of tank 241-BY-106 is shown in Table 5-5 along with the concentration estimates from the most recent analytical results. Because the HTCE document estimates the entire tank contents, a weighted average of the 1994-1996 sludge and saltcake data was calculated based on the sludge and saltcake waste volumes (Section 4.1.1) when sludge and saltcake were both available. This comparison is presented for information purposes only. The HTCE values are generated from a combination of inputs: transfer history, estimated compositions of various Hanford Site waste types, and modeled waste layering (see Agnew et al. 1996a). Each of the three inputs contains assumptions and/or other factors (such as transfers of an unknown waste type into the tank) that may impact HTCE data. Because of uncertainty of waste volumes, poor sample recovery in cores 64 and 65, and the assumption that the sludge density is the same as the saltcake density, the HTCE values have not been validated and should be used with caution.

Table 5-5. Comparison of Historical Tank Content Estimate[1] with 1994 through 1996 Analytical Results for Tank 241-BY-106.[2]

Analyte	Combined Mean (1994-1996 Analytical Result)	HTCE Estimate
METALS	**µg/g**	**µg/g**
Aluminum	29,010	31,000
Bismuth	<1,860[3]	5,440
Calcium	1,470	2,670
Chromium	895	1,430
Iron	1,300	5,450
Nickel	4,410	1,180
Sodium	1.99E+05	1.62E+05
ANIONS	**µg/g**	**µg/g**
Chloride	2,060[3]	2,680
Nitrate	3.29E+05[3]	2.28E+05
Nitrite	32,100[3]	43,700
Phosphate	13,600[3]	7,030
Sulfate	11,300[3]	11,400
TOTAL CARBON	**µg/g**	**µg/g**
Total organic carbon	5,110	4,680
RADIONUCLIDES	**µCi/g**	**µCi/g**
^{137}Cs	166	117
$^{239/240}Pu$	0.0997[4]	0.093
^{90}Sr	116	69.9

Notes:

[1]Agnew et al. (1996a)
[2]Bell (1996b)
[3]Overall mean from Table 4-2 saltcake results only; anions were not measured on sludge samples.
[4]Overall mean from Table 4-3 sludge results only.

Comparing the HTCE with the most recent analytical values produced varied results; yet most analytes compared quite favorably. The largest disparity was found with the Bi and Ni values. BYSltCk is not expected to contain much Bi and it is believed that Agnew et al. (1996a) has overestimated the Bi concentration of ferrocyanide sludge. The measured Ni results may be biased since only one sludge sample was obtained from the three cores taken.

Further comparisons can be made qualitatively between the HTCE predictions and most recent analytical results. The HTCE predicts the ferrocyanide sludge will contain higher concentrations of iron, nickel, and cesium when compared to the BYSltCk layer. The results in Appendix A show sludge concentrations for iron, nickel, and cesium are indeed higher.

5.5 EVALUATION OF PROGRAM REQUIREMENTS

The 1994-1996 core sampling events were governed by five DQOs. All three core samples were governed by the safety screening and ferrocyanide DQOs (Dukelow et al. 1995, Meacham et al. 1994, 1995) and the organic test plan (Meacham 1995). Furthermore, core 64 was governed by the waste compatibility DQO (Carothers 1994) and core 121 was governed by the organic and historical DQOs (Turner et al. 1996, Simpson and McCain 1995).

Each DQO contains requirements pertinent to a primary issue regarding tank waste. The safety screening DQO lists requirements for examining the waste in each Hanford Site underground waste tank to identify safety problems and to evaluate the tank for placement on a Watch List. The waste compatibility DQO identifies potential safety and operational problems that could be encountered when combining waste from two sources. The ferrocyanide DQO addresses the issues of ferrocyanide aging, sampling requirements, and tank classification, and the analyses necessary to characterize specific tanks. The organic complexant DQO lists the tanks which, as determined from historic records, could contain organic complexants, and the safety implications of the organic compounds and moisture content of the waste. The organic test plan examines the flammability potential of tanks containing entrained organic solvents. The historical DQO provides a way to increase the usefulness of historical data by identifying waste types and the analytes that characterize those waste types. The data gathered in accordance with the historical DQO also provide error estimates for the historical data. The generic in-tank health and safety DQO directs the sampling of various vapors that exist or potentially exist in the tank headspace and that could present a flammability or toxicity problem.

The primary issues discussed above were integrated by the TCP or SAP into a list of required analytical tests and their respective limits. Several issues overlap; e.g., the safety screening DQO requirement for the analysis of energetics by DSC is shared by the ferrocyanide and organic complexant DQOs and the organic test plan. Table 5-6 lists the applicable safety issues, decision variables and thresholds, and the mean analytical result from the 1994-1996 core sampling event for the safety screening DQO. The following

paragraphs will discuss each issue as identified in the DQOs, the analyses performed to evaluate those issues, and the analytical results from the 1994-1996 core sampling events.

Table 5-6. Decision Variables and Criteria for the Safety Screening, Organic, and Ferrocyanide Data Quality Objectives, and the Organic Test Plan. (2 sheets)

Primary Decision Variable	Applicable DQO or Test Plan	Decision Criteria Threshold	Analytical Result
Total fuel content	Safety Screening	-480 J/g[1]	1 sample exceeded limit: High value = -1,360 J/g
	Organic Complexant	-480 J/g[1]	
	Organic test plan	-1,200 J/g[1]	
	Ferrocyanide	-480 J/g[1]	
Total Organic Carbon	Organic complexant	30,000 μg C/g[1]	High mean from sludge = 32,500 μg C/g
	Organic test plan	45,000 μg C/g[1]	
Weight percent water	Organic complexant	17 weight percent	25.5 wt% (saltcake) 37.3 wt% (sludge)
	Organic test plan	0.022 [fuel (in J/g) -1,200 J/g] or 20 wt%	
	Ferrocyanide	0.022 [fuel (in J/g) - 1200 J/g][2]	
Total alpha activity	Safety screening	Core 121: 36.0 μCi/g[3] Cores 64/65: 41 μCi/g[4]	0.00945 μCi/g (saltcake) 0.253 μCi/g (sludge)

Table 5-6. Decision Variables and Criteria for the Safety Screening, Organic, and Ferrocyanide Data Quality Objectives, and the Organic Test Plan. (2 sheets)

Primary Decision Variable	Applicable DQO or Test Plan	Decision Criteria Threshold	Analytical Result
$^{239/240}Pu$	Safety screening	41 μCi/g	0.0996 μCi/g
Flammable gas	Safety screening	25% of LFL	0% of LFL

Notes:

[1]Dry-weight basis

[2]Cores 64 and 65 were analyzed under Rev. 1 of the ferrocyanide DQO (Meacham 1994), where the moisture limit was 4/3 (wt% fuel - 8 wt% fuel). Because core 121 was analyzed under Rev. 2 of the ferrocyanide DQO (Meacham et al. 1995), all cores are evaluated under Rev. 2 for the purpose of this tank characterization report.

[3]Although the actual decision criterion listed in the DQO was 1 g/L, total alpha was measured in μCi/g rather than g/L. To convert the notification limit for total alpha into the same units as the laboratory, it was assumed that all alpha decay originated from ^{239}Pu. Using the specific activity of ^{239}Pu (0.0615 Ci/g), and a measured density of 1.71 g/mL, the decision criterion for core 121 may be converted to 36.0 μCi/g as shown:

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

[4]The notification limit of 41 μCi/g for total alpha for core 64 and 65 is listed in Bell (1995a)

5.5.1 Tank 241-BY-106 Heat Load

A factor in assessing tank safety is the heat generation from radioactive decay and the resulting potential temperature increase of the waste. The heat value was calculated using the data from the 1994-1996 sampling effort (Bell 1996c) to be 6,490 W (22,200 Btu/hr). The HTCE estimate of heat load was 3,910 W (13,400 Btu/hr), and the estimate by Kummerer (1994) is 2,960 W (10,100 Btu/hr). All of these estimates are well below the 11,700-W (40,000-Btu/hr) threshold differentiating high-heat from low-heat tanks (Bergmann 1991). The concentrations and projected inventories of the two primary contributors to tank heat load are presented in Table 5-7. Because an upper temperature limit has been exhibited (Section 2.4.3), it may be concluded that any heat generated from radioactive sources throughout the year is dissipated.

Table 5-7. Tank 241-BY-106 Projected Heat Load.

Radionuclide	Specific Activity (μCi/g)	Projected Inventory (Ci)	Heat Load from Radioactive Decay (W)
^{137}Cs	106 (saltcake) 508 (sludge)	6.88E+05 (total)	3,250
$^{89/90}$Sr	4.08 (saltcake) 763 (sludge)	4.84E+05 (total)	3,240
Total			6,490

5.5.2 Safety Screening Evaluation

Data criteria identified in the safety screening DQO were used to assess the safety of the waste in tank 241-BY-106. The requirement that vertical profiles of the waste be obtained from at least two widely spaced risers was not met (Section 5.1.1). The three primary safety analyses required by the safety screening DQO include DSC to evaluate the fuel content, total alpha activity to measure criticality, and determination of the lower flammability limit of the gases in the tank headspace. For each of the required analyses, a notification threshold was established by the DQO which, if exceeded, may warrant further investigation to assure the safety of the tank.

The safety screening DQO has established a notification limit of -480 J/g (dry weight basis) as determined by DSC. Several exothermic reactions were noted; none exceeded the -480-J/g limit except the sludge sample from segment 13 of core 65. All drainable liquid samples exhibited exothermic properties. The saltcake samples from segments 2, 3, 4, and 8 of core 64 displayed exothermic behavior. The saltcake from segment 13 of core 65 showed no exothermic reactions. The sample, duplicate, and triplicate results from the core 65 sludge exceeded the safety screening notification limit, exhibiting dry weight enthalpy changes of -667, -1,360, and -672.1 J/g. Total organic carbon was analyzed as a secondary analyte as a consequence of the high DSC results on the sludge. The mean TOC result for the sludge, on a dry weight basis, was 32,500 μg C/g, which is slightly above the DQO limit of 30,000 μg C/g. The moisture content of the sludge was measured by TGA, exhibiting 37.3 weight percent water.

The potential for criticality can be assessed from the total alpha activity data. The safety screening notification limit is 1 g/L (Dukelow et al. 1995). Because total alpha activity is measured in μCi/g, the 1 g/L threshold is equivalent to 36.0 μCi/g for the solids (Bell 1996a) based on a measured core 121 density of 1.71 g/mL. The total alpha activity mean for the saltcake was 0.00945 μCi/g, and 0.253 μCi/g for the sludge. Both results were well below the SAP and the TCP limits.

For tank headspace flammability, the requirement is that any flammable gas present must be ≤ 25 percent of the LFL. The analytical result was 0 percent of the LFL (see Section 4.1.3).

In conclusion, no analytical results indicate that tank 241-BY-106 is unsafe. There is adequate moisture in the one (sludge) sample that exceeded the safety screening DQO energetics notification limit to mediate a propagating reaction. However, the poor sample recovery in segments 12 and 13 of core 64 and 65, and the incomplete sampling of core 121, preclude the tank from being declared safe.

5.5.3 Organic Complexant Evaluation

Regarding the organic complexant DQO, the optimum number of waste profiles required is based on information such as historical sampling or prior sampling activities. If specific information is not available, two vertical profiles will be obtained from widely spaced risers. Tank 241-BY-106 was evaluated in accordance with this DQO because the tank was identified as possibly containing > 3 weight percent TOC by a review of waste transfer records (Turner et al. 1996). The primary analyses required by this DQO are DSC, TGA, and a TOC analysis to estimate the contribution of TOC to the total fuel content. The one sludge sample obtained did contain TOC at a level greater than 3%.

The organic test plan supplements the safety screening and organic DQO, although the notification limits are less stringent. It attempts to confirm tank fuel content models through resolution of three safety issues: organic solvent fires, organic complexant condensed phase propagating reactions, and ferrocyanide propagating reactions. Required analyses include DSC, TGA, and TOC analysis.

5.5.4 Waste Compatibility Evaluation

In accordance with the waste compatibility DQO (Carothers 1994), core 64 from tank 241-BY-106 was analyzed to assess the safety and operational implications of commingling the wastes in the tank and the double-shell tank systems. Safety considerations include criticality, flammable gas generation and accumulation, energetics, corrosion and leakage. Operational considerations include plugged pipelines and equipment, TRU segregation, complexant waste segregation, and heat load limits of the receiving tank. Not all of the safety and operational considerations were within the scope of this report, notably the potential chemical reactivity of the waste in a variety of different situations, and the tendency of the waste to plug piping and equipment. Table 5-8 presents the analyses used to evaluate the waste in terms of the safety and operational considerations that are within the scope of this report. The primary decision variable, the notification limit, and the analytical results from the 1994/1995 core sampling event are listed for each safety or operational issue. All listed analyses and evaluations were well within the notification limits imposed by the waste compatibility DQO.

Table 5-8. Decision Variables and Criteria for the Waste Compatibility Data Quality Objective.

Safety Issue	Primary Decision Variable	Decision Criteria Threshold	Mean Analytical Result
Criticality	[$^{239/240}$Pu]	$^{239/240}$Pu + 1.077E-10 * (U-gross) > 0.013 g/L (> 0.7995 μCi/mL)[1]	Less than detection limit
Flammable gas	Specific gravity	> 1.30	1.34
Ferrocyanide/organics	Total fuel content	Exothermic reactions < 177 °C (350 °F), absolute value of exotherm/endotherm ≥ 1 (No notification required)	Absolute value of exotherm/endotherm < 1
Corrosion and leakage	[NO_3^-] [OH^-] [NO_2^-]	> 341,000 μg/mL < 171 or > 135,000 μg/mL < 506 or > 252,000 μg/mL	1.10E+05 μg/mL 35,800 μg/mL 78,100 μg/mL
Operations Issue			
TRU segregation	TRU elements	[$^{239/240}$Pu], [^{238}Pu], [^{241}Am], [U total], [$^{243/244}$Cm], [^{237}Np] total concentration > 0.1 μCi/g	Less than detection limit
Complexant segregation	Measured by selected analyte concentration, or by performing a boildown test in the laboratory.		
Operations Issue			
Heat load	Heat generation rate from radioactive decay	≤ 20,000 W (70,000 Btu/hr)	6,490 W (22,200 Btu/hr)

Note:

[1]Although the actual decision criterion listed in the waste compatibility DQO (Carothers 1994) was 0.013 g/L, total alpha was measured in μCi/g rather than g/L. To convert the notification limit for total alpha into the same units as the laboratory used, it was assumed that all alpha activity originated from ^{239}Pu. Using the specific activity of ^{239}Pu (0.0615 Ci/g), the decision criterion may be converted to 0.7995 μCi/ml as shown:

$$\left(\frac{0.013\ \text{g}}{\text{L}}\right)\left(\frac{1\ \text{L}}{10^3\ \text{mL}}\right)\left(\frac{0.0615\ \text{Ci}}{1\ \text{g}}\right)\left(\frac{10^6\ \mu\text{Ci}}{1\ \text{Ci}}\right) = 0.7995\ \frac{\mu\text{Ci}}{\text{mL}}.$$

The < 0.013 g/L notification limit for criticality is based on the mean concentration of $^{239/240}Pu$ plus 1.077E-10 times the mean gross uranium result. Because the analytical results for the 1994-1995 core sampling event were reported in units of μCi/mL, the limit was converted to those units by using the method described in Note 1 of Table 5-8. The analytical mean for $^{239/240}Pu$ was well below the notification limit. Flammable gases may accumulate in wastes with high specific gravity (>1.30). The mean specific gravity for the 1994-1995 core samples was 1.34. Transfers may be allowed with a specific gravity of the source > 1.3, provided that the specific gravity of the commingled wastes is ≤ 1.41. The limit for energetics is an exotherm/endotherm ratio < 1 for all reactions below 168 °C (335 °F). Note that this is not a notification limit. The limits for corrosion protection as stated in the waste compatibility DQO are based on the receiving tank temperature and the concentrations of the corrosion-inhibiting chemicals which are added to the waste. The limits as stated in Table 5-8 apply to tanks with operating temperatures of < 75 °C (167 °F).

Operations issues are based on the policy of segregating TRU and complexant wastes, avoiding excess heat in the tanks, and ensuring pumpability of the source waste to the receiving tank. The total concentration of TRU elements can be calculated by converting the values to a per-weight basis from the per-volume basis by dividing the analytical result for each radionuclide by the mean drainable liquid specific gravity, and summing the per-weight results. The total can then be compared to the 0.1 μCi/g [100 nCi/g] standard for segregating TRU waste from non-TRU. In the case of tank 241-BY-106, all applicable results were less than the detection limit. The waste is non-TRU. The heat load was calculated as shown in Table 5-7.

5.5.5 Ferrocyanide Evaluation

Tank 241-BY-106 received ferrocyanide scavenging waste from 221-U Plant from the first quarter of 1955 through the first quarter of 1957. As a primary receiver of ferrocyanide waste, the tank was subject to the requirements of revision 1 of the ferrocyanide DQO (Meacham et al. 1994). Although the sampling of core 65 (the only one to contain sludge) was governed by revision 1 of the ferrocyanide DQO (Meacham et al. 1994), revision 2 has been used to perform the ferrocyanide evaluation (Meacham et al. 1995). The primary analyses required by the ferrocyanide DQO include DSC, TGA, and measurements of the cyanide, nickel, and total organic carbon concentrations. All tanks have been removed from the Ferrocyanide Watch List principally because analysis of all ferrocyanide tanks sampled to date show that the ferrocyanide fuel has degraded to a safe level.

The following discussion will provide the evidence of ferrocyanide aging and will support the removal of tank 241-BY-106 (and all other ferrocyanide tanks) from the Ferrocyanide Watch List. The ferrocyanide evaluation was performed only on the sludge results.

5.5.5.1 Nickel and Cyanide Results. The concentrations of nickel and cyanide are considerations of the ferrocyanide DQO. The nickel results from the sludge were well above the 8,000-μg/g DQO limit. Nickel results above this limit are indicative of ferrocyanide

waste; the analytical results confirmed expectations that the sludge contained ferrocyanide waste. However, the cyanide result (150 μg/g dry) was much lower than the 39,000 μg/g DQO limit (Meacham et al. 1995). The evidence shows that the waste was ferrocyanide sludge, but the cyanide has degraded to a small fraction of its original content.

5.5.5.2 Sludge Energetics. As shown below, the high energetics observed in the sludge sample may be accounted for by the TOC content rather than by cyanide. Results from the DSC analysis that exceeded the safety screening notification limit of -480 J/g (from the sludge sample from core 65 segment 13) were compared to the energy equivalents of the cyanide and TOC analytical results for that segment. The cyanide and TOC values were converted to a dry weight basis by dividing the wet weight results by the solid fraction of segment 13, core 65 (1 - 0.373). The cyanide fuel content was assumed to exist as disodium nickel ferrocyanide ($Na_2NiFe(CN)_6$). The cyanide analytical result (dry weight) was converted to the weight percent of the assumed species by the following equation:

$$Na_2NiFe(CN)_6\ wt\% = \left(\frac{150\ \mu g\ CN}{g}\right) x \left(\frac{1\ \mu mol\ CN}{26\ \mu g\ CN}\right) x \left(\frac{1\ \mu mol\ Na_2NiFe(CN)_6}{6\ \mu mol\ CN}\right) x \left(\frac{316.5\ \mu g\ Na_2NiFe(CN)_6}{1\ \mu mol\ Na_2NiFe(CN)_6}\right) x \frac{1\ g}{1\ x\ 10^6\ \mu g}\ x\ 100\ wt\% = 0.0304$$

The calculated weight percent ferrocyanide was converted to the energy equivalent ferrocyanide (in J/g) using the following equation.

$$0.0304\%\ Na_2NiFe(CN)_6 * \left(\frac{-6{,}000\ J/g\ Na_2NiFe(CN)_6}{100\ weight\%}\right) = -1.83\ J/g.$$

The energy equivalent conversion for TOC (based on a sodium acetate average energetics standard) is calculated by converting the analytical results from μg/g to weight percent (dividing by 10,000). The equation (Meacham et al. 1995) is:

$$\left(\frac{-1{,}200\ J/g}{4.5\%\ TOC}\right) * 3.25\%\ TOC = -867\ J/g.$$

The energetics contribution from cyanide is negligible compared to the contribution from TOC. The sum of the energy equivalent values for cyanide (-1.83 J/g) and TOC (-867 J/g) is approximately equal to the average of the exotherms observed in the sludge (-901 J/g). Thus, virtually all the energetics are accounted for by the TOC.

5.5.5.3 Moisture Content. The TGA notification limit listed in the ferrocyanide DQO is as follows:

weight percent water > 0.022 [fuel (-J/g) - 1200 J/g].

Using this equation and the highest exotherm observed (-1,360 J/g), the minimum water content required in the sample with DSC results above the notification limit was 3.5 percent. The 37.3 percent result was well above that limit.

5.5.5.4 Ferrocyanide Degradation. Recent aging studies of ferrocyanide waste show that the combined effects of temperature, radiation, and pH during 38 years or more of storage would have destroyed most of the 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.

In order to measure the extent of ferrocyanide degradation over time, estimates of the total amount of $Na_2NiFe(CN)_6$ originally present in the tank and recent analytical cyanide concentrations are needed. According to Borsheim and Simpson (1991), 14,000 kg of $Na_2NiFe(CN)_6$ was expected to remain in the tank at the end of the ferrocyanide waste transfer activity in 1957. This number is reasonably close to the $Na_2NiFe(CN)_6$ inventory of 12,800 kg calculated based on the HTCE concentration for $Fe(CN)_6^{4-}$ of 0.0167 M, the HTCE density value of 1.58 g/mL, and the HTCE total mass for the waste of 3.84E+06 kg. It should be noted that any comparison between current analytical data to estimates of $Na_2NiFe(CN)_6$ originally found in the tank should be based only on the mean analytical values from segment 13 of core 65 because that was the only sample of ferrocyanide waste acquired in the 1994-1996 sampling effort.

Another method of estimating the amount of $Na_2NiFe(CN)_6$ originally present in the tank 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 segment 13 of core 65 was 29,500 μg/g. If all the nickel originated from $Na_2NiFe(CN)_6$, then the observed nickel concentration indicates that 159,000 μg/g of $Na_2NiFe(CN)_6$ [89,870 kg of $Na_2NiFe(CN)_6$ based on the HTCE density value of 1.58 g/mL and sludge volume from Hanlon (1996)] existed in the tank before degradation. This number is vastly different from the ones from the HTCE and Borsheim and Simpson (1991). It suggests that the sludge sample obtained may not be representative of the ferrocyanide sludge, at least with respect to nickel. Another possibility is that the nickel results were biased high when the fusion dissolution was performed in a nickel crucible. Dissolution in a zirconium crucible had been requested.

Estimation of the amount of degradation of $Na_2NiFe(CN)_6$ based on the current concentration of cyanide uses the range of values from the Borsheim and Simpson model and the HTCE (12,800 kg-14,000 kg). The recent total cyanide analytical mean from segment 13 of core 65 is 93.9 μg/g (57.8 kg of cyanide) which is equivalent to 117 kg of $Na_2NiFe(CN)_6$. Thus, it appears that over 99 percent [(117 kg/12,800 kg)*100] of the ferrocyanide complex has decomposed.

In conclusion, further sampling of tank 241-BY-106 to evaluate the ferrocyanide issue is not necessary because: 1) the tank has been removed from the Ferrocyanide Watch List (Kinzer 1996); 2) the cyanide data clearly show that the ferrocyanide originally present has nearly completely degraded; 3) the energetics observed in the sludge are attributable to the TOC content and not ferrocyanide; and 4) adequate moisture is available to mediate an exothermic reaction between any remaining ferrocyanide and oxidant.

5.5.6 Historical Evaluation

In addition to the safety screening DQO, core 121 was analyzed in accordance with the historical DQO (Simpson and McCain 1995). This DQO strives to quantify the errors associated with the tank waste composition predictions based on waste transaction history and waste type compositions. The DQO identifies key components for certain waste types.

Tank 241-BY-106 was not selected as a priority tank for historical evaluation, but it is an acceptable alternate tank for tanks 241-BY-104, BY-105, and BY-110 (Simpson and McCain 1995). The first step in the evaluation is to compare the analytical results with DQO-defined concentration levels for a selected number of analytes. This comparison ensures the predicted waste type is in the tank and at the predicted location within the waste matrix. If the analytical results are $\geq$ 10 percent of the DQO levels (ratio of 0.1), the waste type and layer identification are considered acceptable (Simpson and McCain 1995).

Because ferrocyanide sludge is predicted to comprise approximately the bottom 1 m (36 in.) of waste in the tank (Agnew et al. 1995a), most of segment 12 and all of segment 13 of core 121 should be completely composed of this waste type. However, these segments were not obtained during the 1995-1996 sampling event because of hard waste, as discussed in Section 3.1.2. All segments of core 121 were composed of saltcake, with some drainable liquids. Segment 13 of core 65 contained some sludge waste. The six sludge analytes of concern came from segment 13 of core 65. Tables 5-9 and 5-10 compare the concentration levels for ferrocyanide and saltcake to the historical DQO.

Table 5-9. Tank 241-BY-106 Historical Model Evaluation for BY Saltcake.[1]

Analyte of Concern	Expected Concentration[2] (μg/g)	Core Composite Concentration (μg/g)	Were all analyzed saltcake samples > 10% of expected concentration?
Sodium	165,000	257,000 (fusion) 218,000 (acid)	yes
Aluminum	18,600	14,800 (fusion) 12,600 (acid)	yes
Moisture	35.9%	17.09 wt%	yes
Nitrate	266,000	425,000	yes
Sulfate	33,732	13,100	yes

Note:

[1]Bell (1996b)
[2]Simpson and McCain (1995)

Table 5-10. Tank 241-BY-106 Historical Model Evaluation for Ferrocyanide Waste.[1]

Waste Type	Analyte of Concern	Expected Concentration or Range[2] (μg/g)	Core 121 Composite (Saltcake) Core 65 (Sludge) (μg/g)	Were all analyzed samples > 10% of expected concentration?[3]
Saltcake	Sodium	60,000 - 150,000	257,000 (fusion) 218,000 (acid)	yes
	Bismuth	> 25,000	< 1,930 (fusion) < 47.70 (acid)	no
	Nickel	> 4,000	< 386.0 (fusion) 37.55 (acid)	no
	Moisture	28-81 wt%	17.09 wt%	yes
	^{137}Cs	> 8 μCi/g	69.10 μCi/g	yes
	^{90}Sr	> 4 μCi/g	6.29 μCi/g	no
Sludge	Sodium	60,000 - 150,000	130,000 (fusion)[3]	yes
	Bismuth	> 25,000	not available	---
	Nickel	> 4,000	29,500 (fusion)[3]	yes
	Moisture	28 - 81 wt%	37.31 wt%	yes
	^{137}Cs	> 8 μCi/g	507.5 μCi/g[3]	yes
	^{90}Sr	> 4 μCi/g	763.0 μCi/g[3]	yes

Notes:

[1]Bell (1996b)

[2]Simpson and McCain (1995)

[3]Sludge was only recovered from the lower half of segment 13 of core 65.

[4]Results from sludge collected from segment 13 of core 65.

Data in Tables 5-9 and 5-10 show that the saltcake in tank 241-BY-106 is consistent with the waste type BYSltCk per the historical modeling DQO. As expected, the saltcake is not consistent with the ferrocyanide waste type because it does not contain adequate amounts of Bi, Ni, or Sr-90. Sludge was only recovered from the lower half of segment 13 from core 65; however, the analyses of concern are consistent with the ferrocyanide waste type.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Tank 241-BY-106 was core sampled November 1994 through January 1995 and December 1995 through January 1996. Three core samples were taken to satisfy the requirements of the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995), *Data Quality Objectives for the Waste Compatibility Program* (Carothers 1994), *Data Requirements for the Ferrocyanide Safety Issue Developed through the Data Quality Objective Process* (Meacham et al. 1994 and 1995), *Data Quality Objective to Support Resolution of the Organic Complexant Safety Issue* (Turner et al. 1996), *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995), and *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 first two core samples (64 and 65) were acquired and analyzed in accordance with the *Tank 241-BY-106 Tank Characterization Plan* (Schreiber 1994 and Schreiber 1995). The third core sample (121) was obtained and analyzed in accordance with *Tank 241-BY-106 Rotary Core Sampling and Analysis Plan* (Bell 1996c). Vapor samples were obtained in 1994 as required in *Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution* (Osborne et al. 1994).

Tank 241-BY-106 entered service during the second quarter of 1953 when it received first-cycle decontamination waste. Most of this waste was sluiced from the tank during 1953. The tank then received ferrocyanide scavenged waste from 1955 to 1957 and PUREX cladding waste supernatant intermittently from 1961 to 1967. The addition of the ferrocyanide waste led to placement on the Ferrocyanide Watch List. The tank has an operating capacity of 2,870 kL (758 kgal), and presently contains a total of 2,430 kL (642 kgal) of waste (Hanlon 1996). Of this total, 360 kL (95 kgal) are sludge, and 2,070 kL (547 kgal) are saltcake.

6.1 SAFETY SCREENING EVALUATION

The requirement that vertical profiles of the waste be obtained from at least two widely spaced risers was not met (Section 5.1.1). Of the three primary safety screening analyses, none exceeded the safety screening DQO limit except the DSC results from the core 65 sludge sample. Total organic carbon was analyzed as a secondary analyte as a consequence of the high DSC results on the sludge. The mean TOC result for the sludge, on a dry weight basis, was 32,500 μg C/g, which is slightly above the DQO limit of 30,000 μg C/g. The moisture content of the sludge was measured by TGA, exhibiting 37.3 weight percent water.

In conclusion, no analytical results indicate that tank 241-BY-106 is unsafe. There is adequate moisture in the one (sludge) sample that exceeded the safety screening DQO energetics notification limit to mediate a propagating reaction. However, the poor sample recovery in segments 12 and 13 of core 64 and 65, and the incomplete sampling of core 121, preclude the tank from being declared safe.

6.2 ORGANIC COMPLEXANT EVALUATION

Tank 241-BY-106 was evaluated in accordance with this DQO because the tank was identified as possibly containing greater than 3 weight percent TOC by a review of waste transfer records (Turner et al. 1996). The primary analyses required by this DQO are DSC, TGA, and a TOC analysis to estimate the contribution of TOC to the total fuel content. The one sludge sample obtained did contain TOC at a level greater than 3 percent. However, as indicated above with the safety screening DQO, there appears to be adequate moisture in the sludge to mediate a propagating reaction.

6.3 FERROCYANIDE EVALUATION

All tanks have been removed from the Ferrocyanide Watch List (Kinzer 1996 and Cowan 1996) principally because analysis of all ferrocyanide tanks sampled to date shows that the ferrocyanide fuel has degraded to a safe level. The data collected from tank 241-BY-106 support this conclusion.

The concentrations of nickel and cyanide are considerations of the ferrocyanide DQO. The nickel results from the sludge were well above the 8,000-μg/g DQO limit. Nickel results above this limit are indicative of ferrocyanide waste; the analytical results confirmed expectations that the sludge contained ferrocyanide waste. However, the cyanide result (150 μg/g dry) was much lower than the 39,000-μg/g DQO limit (Meacham et al. 1995). The evidence shows that the waste was ferrocyanide sludge, but the cyanide has degraded to a small fraction of its original content. Furthermore, the high energetics observed in the sludge sample may be accounted for by the TOC content rather than by cyanide (Section 5.5.5.2). The energetics not accounted for by TOC may be due to organic compounds present, but not oxidized and quantified in the TOC analytical method.

The TGA notification limit for moisture was calculated to be 3.53 percent. The 37.3 percent result was well above that limit.

Estimation of the amount of degradation of $Na_2NiFe(CN)_6$ based on the current concentration of cyanide uses the range of values from Borsheim and Simpson (1991) and the HTCE (12,800 kg-14,000 kg). The recent total cyanide analytical mean from segment 13 of core 65 is 93.9 μg/g (57.8 kg of cyanide) which is equivalent to 117 kg of $Na_2NiFe(CN)_6$. Thus, it appears that over 99 percent [(117 kg/12,800 kg)*100] of the ferrocyanide complex has decomposed.

6.4 WASTE COMPATIBILITY EVALUATION

Core 64 from tank 241-BY-106 was analyzed to assess the safety and operational implications of commingling the wastes in the tank and the double-shell tank systems. All listed analyses and evaluations were well within the notification limits imposed by the waste compatibility DQO even though the specific gravity was in excess of 1.3. The compatibility DQO allows for a waste transfer if calculations show that the comingled waste would have a specific gravity less than 1.3.

6.5 HISTORICAL EVALUATION

Core 121 was analyzed in accordance with the historical DQO (Simpson and McCain 1995). The data show that the saltcake in tank 241-BY-106 is consistent with the waste type BYSltCk per the historical modeling DQO. As expected, the saltcake is not consistent with the ferrocyanide waste type because it does not contain adequate amounts of Bi, Ni, or Sr-90. Sludge was only recovered from the lower half of segment 13 from core 65; however, the analyses are consistent with the ferrocyanide waste type.

6.6 CONCLUSION

The analytical results do not indicate that the tank is unsafe. However, the sampling requirements of the safety screening DQO were not met because two complete vertical profiles were not acquired. Additional sampling may be necessary to satisfy the safety screening DQO. This decision is currently under review by the Data Review Committee.

Further sampling of tank 241-BY-106 to evaluate the ferrocyanide issue is not necessary because: 1) the tank has been removed from the Ferrocyanide Watch List; 2) the cyanide data clearly show that the ferrocyanide originally present has nearly completely degraded; 3) the energetics observed in the sludge are attributable to the TOC content and not ferrocyanide; and 4) adequate moisture is available to mediate an exothermic reaction between any remaining ferrocyanide and oxidant.

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APPENDIX A

ANALYTICAL RESULTS
SINGLE-SHELL TANK 241-BY-106

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APPENDIX A

ANALYTICAL RESULTS SINGLE-SHELL TANK 241-BY-106

A.1 INTRODUCTION

Appendix A shows the chemical and radiological characteristics of tank 241-BY-106 in table form and in terms of the specific concentrations of metals, ions, radionuclides, total carbon, physical properties, and organic compounds.

The data table for each analyte lists the following: laboratory sample identification, sample origin (core/segment/subsegment), an original and duplicate result for each sample, a sample mean, a simple mean for the tank in which all cores and segments are weighted equally, a relative standard deviation, and a projected tank inventory for the particular analyte using the mean and the appropriate conversion factors. 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-67. A description of the units and symbols used in the analyte tables and the references used in compiling the analytical data are found in the List of Terms and Section 7.0.

A.2 ANALYTE TABLE DESCRIPTION

The Sample Number column lists the laboratory sample from which the analyte was measured. For information on sampling rationale, locations, and descriptions of sampling events, see Section 3.0.

Column two describes the core and segment from which each sample was derived. The first number listed is the core number. It is followed by a colon and segment number.

Column three contains the name of the segment portion from which the sample was taken: half segment, drainable liquid (DL), or composite.

The Result and Duplicate columns are self-explanatory. The Sample Mean column is the average of the result and duplicate values. All values, including those below the detection level (indicated by the less than symbol, <), were averaged. If both sample values were nondetected, the mean is expressed as a nondetected value.

The result and duplicate values were originally reported to higher significant figures than shown in the tables. The means were calculated by the laboratory, in a consistent manner, using the original data. The means may appear to have been rounded up in some cases and rounded down in others. However, this is because the analytical results are shown in the tables to only three significant figures, not because the means were incorrectly calculated.

Analytical values for drainable liquids, reported by the laboratory in μg/mL, were converted to units of μg/g for calculating the overall means for those analytes for which results for both solid and liquid phases were reported. A specific gravity of 1.34 was used for the conversion.

The tank (or analyte concentration) means for the waste in tank 241-BY-106 were calculated as follows:

The overall tank (or analyte concentration) mean was calculated by generating a simple average of all segments of the three cores. This is referred to as the overall mean in Appendix A.

The relative standard deviation (RSD) of the mean (in percent) is 100 times the standard deviation of the mean divided by the tank mean. This is referred to as RSD (mean) in the Appendix A tables. Relative standard deviations of the mean were not computed for analytes that had at least 50 percent nondetected values. The standard deviation of the mean was estimated using a hierarchical statistical model fit to the data (Jensen and Liebetrau 1988), and used all data available for a given analyte.

The projected inventory is the product of the tank (or analyte concentration) mean, the volume of tank waste (2,070 kL of saltcake and 360 kL of sludge), the density of the waste, and the appropriate conversion factors.

The four quality control (QC) parameters assessed on the tank 241-BY-106 samples were standards, spikes, duplicates, and blanks. The QC results for cores 64, 65, and 121 were summarized in Section 5.1.2. More specific information is provided with each of the following appendix tables. Sample and duplicate pairs in which any of the QC parameters were outside their specified limits are footnoted in column 6 with a 1, 2, 3, 4, 5, or 6 as follows:

"a" indicates the standard recovery was below the QC limit.
"b" indicates the standard recovery was above the QC limit.
"c" indicates the spike recovery was below the QC limit.
"d" indicates the spike recovery was above the QC limit.
"e" indicates the RPD was outside the QC limits.
"f" indicates there was some blank contamination.

The primary analyte results, and secondary analyte results required by the primary analyte results, were evaluated in accordance with the sampling and analysis plan (Bell 1996a). All other analytes were evaluated in accordance with the *Hanford Analytical Services Quality Assurance Plan* (DOE 1995).

Table A-1. Tank 241-BY-106 Analytical Results: Aluminum. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004179	121: 1	Upper ½	44,200	45,300	44,750	28,700	18.8	1.02E+05
S95T004180	121: 2	Upper ½	98,000	13,300	55,650[QC:e]			
S96T001415		Upper ½	1.160E+05	1.180E+05	1.170E+05			
S95T004181	121: 3	Upper ½	13,800	13,900	13,850			
S95T004182		Lower ½	15,900	15,600	15,750			
S95T004183	121: 4	Upper ½	13,700	14,500	14,100			
S95T004184		Lower ½	10,200	12,200	11,200[QC:e]			
S95T004185	121: 5	Upper ½	16,300	17,300	16,800			
S95T004186	121: 6	Upper ½	11,600	11,700	11,650			
S95T004187	121: 7	Upper ½	6,640	13,200	9,920[QC:e]			
S96T001378		Upper ½	14,800	99,000	56,900[QC:e]			
S95T004188	121: 8	Upper ½	21,300	23,400	22,350			
S95T004189		Lower ½	22,900	22,500	22,700			
S95T004190	121: 9	Upper ½	70,200	67,700	68,950			
S96T000106	121: 10	Upper ½	9,010	9,560	9,285			
S96T000107	121: 10A	Upper ½	16,100	15,700	15,900			
S96T000250	121: 10B	Upper ½	25,500	24,300	24,900			
S96T000251		Lower ½	14,800	13,400	14,100			
S96T000258		DL	61,000 µg/mL	61,800 µg/mL	61,400 µg/mL (45,800 µg/g)			
S95T000085	65: 11	Upper ½	20,000	18,500	19,250			

Table A-1. Tank 241-BY-106 Analytical Results: Aluminum. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T000100	65: 13	Upper ½	8,592.16	8,916.76	8,754.46	Cont'd	Cont'd	Cont'd
S95T000322		Upper ½	12,183.5	11,887.6	12,035.5			
Solids/Sludge			µg/g	µg/g	µg/g	µg/g	%	kg
S95T000101	65:13	Upper ½	31,549.8	30,066	30,800	30,800	2.4	19,000
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	80,100	86,900	83,500[QC:d]	20,400	24.9	72,200
S95T004192	121: 3	Upper ½	11,500	11,500	11,500			
S95T004193		Lower ½	13,800	13,900	13,850			
S95T004194	121: 4	Upper ½	8,980	9,050	9,015			
S95T004195		Lower ½	10,800	10,800	10,800			
S95T004196	121: 5	Upper ½	14,500	15,200	14,850			
S95T004197	121: 6	Upper ½	10,500	10,100	10,300			
S95T004198	121: 7	Upper ½	13,100	11,700	12,400[QC:e]			
S95T004199	121: 8	Upper ½	21,700	20,800	21,250			
S95T004200		Lower ½	20,300	17,700	19,000[QC:e]			
S95T004201	121: 9	Upper ½	13,700	14,600	14,150			
S96T000108	121: 10	Upper ½	7,890	8,020	7,955			
S96T000252	121: 10B	Upper ½	18,900	18,400	18,650			
S96T000253		Lower ½	13,000	13,100	13,050			
S96T000258		DL	61,000 µg/mL	61,800 µg/mL	61,400 µg/mL (45,800 µg/g)			

Table A-1. Tank 241-BY-106 Analytical Results: Aluminum. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Liquids			µg/mL	µg/mL	µg/mL	µg/mL	%	kg
S95T000004	64: 3	DL	33,000	33,700	33,350	34,400	4.0	N/A
S95T000228		DL	31,100	30,900	31,000			
S94T000355	64: 6	DL	35,000	38,500	36,750			
S94T000371	64: 10	DL	36,500	36,600	36,550			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	14,600	17,800	16,200[QC:e]	16,200	9.8	57,300
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	12,500	12,600	12,550	12,600	0.4	44,600
Composite: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000379	1-10B	Composite	15,400	14,300	14,850	14,900	3.7	52,700

Table A-2. Tank 241-BY-106 Analytical Results: Antimony.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	< 22.1	< 23	< 22.55	< 29.5	N/A	< 104
S95T004192	121: 3	Upper ½	< 27.7	< 28.5	< 28.1			
S95T004193		Lower ½	< 24.4	< 22.6	< 23.5			
S95T004194	121: 4	Upper ½	< 26.7	< 31	< 28.85			
S95T004195		Lower ½	< 30.4	< 26.5	< 28.45			
S95T004196	121: 5	Upper ½	< 31.7	< 28.1	< 29.9			
S95T004197	121: 6	Upper ½	< 30.1	< 31.1	< 30.6			
S95T004198	121: 7	Upper ½	< 28.5	< 27.3	< 27.9			
S95T004199	121: 8	Upper ½	< 29	< 27.9	< 28.45			
S95T004200		Lower ½	< 25.6	< 24.5	< 25.05			
S95T004201	121: 9	Upper ½	< 28.5	< 27.7	< 28.1			
S96T000108	121: 10	Upper ½	< 27.2	< 28.1	< 27.65			
S96T000252	121: 10B	Upper ½	< 25.9	< 26.5	< 26.2			
S96T000253		Lower ½	< 24.9	< 23.9	< 24.4			
S96T000258		DL	< 84.1 µg/mL	< 84.1 µg/mL	< 84.1 µg/mL (< 62.8 µg/g)			
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	< 28.6	< 28.3	< 28.45	< 28.5	N/A	< 101
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	< 34.2	< 34.9	< 34.55	< 34.6	N/A	< 122

Table A-3. Tank 241-BY-106 Analytical Results: Arsenic.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	< 36.9	< 38.3	< 37.6	< 49.2	N/A	< 174
S95T004192	121: 3	Upper ½	< 46.2	< 47.5	< 46.85			
S95T004193		Lower ½	< 40.7	< 37.6	< 39.15			
S95T004194	121: 4	Upper ½	< 44.4	< 51.7	< 48.05			
S95T004195		Lower ½	< 50.6	< 44.2	< 47.4			
S95T004196	121: 5	Upper ½	< 52.8	< 46.9	< 49.85			
S95T004197	121: 6	Upper ½	< 50.1	< 51.9	< 51			
S95T004198	121: 7	Upper ½	< 47.6	< 45.6	< 46.6			
S95T004199	121: 8	Upper ½	< 48.3	< 46.6	< 47.45			
S95T004200		Lower ½	< 42.4	< 40.8	< 41.6			
S95T004201	121: 9	Upper ½	< 47.5	< 46.2	< 46.85			
S96T000108	121: 10	Upper ½	< 45.3	< 46.8	< 46.05			
S96T000252	121: 10B	Upper ½	< 43.2	< 44.2	< 43.7			
S96T000253		Lower ½	< 41.5	< 40	< 40.75			
S96T000258		DL	< 140 µg/mL	< 140 µg/mL	< 140 µg/mL (< 104 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	< 57	< 58.1	< 57.55	< 57.6	N/A	< 204
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	< 47.7	< 46.9	< 47.3	< 47.3	N/A	< 167

Table A-4. Tank 241-BY-106 Analytical Results: Barium. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004179	121: 1	Upper ½	< 1,040	< 1,050	< 1,045	< 931	N/A	< 3,300
S95T004180	121: 2	Upper ½	< 924	< 1,010	< 967			
S96T001415		Upper ½	< 733	< 722	< 727.5			
S95T004181	121: 3	Upper ½	< 983	< 977	< 980			
S95T004182		Lower ½	< 1,070	< 1,060	< 1,065			
S95T004183	121: 4	Upper ½	< 935	< 985	< 960			
S95T004184		Lower ½	< 975	< 940	< 957.5			
S95T004185	121: 5	Upper ½	< 882	< 929	< 905.5			
S95T004186	121: 6	Upper ½	< 1,030	< 1,050	< 1,040			
S95T004187	121: 7	Upper ½	< 967	< 969	< 968			
S96T001378		Upper ½	< 675	< 617	< 646			
S95T004188	121: 8	Upper ½	< 871	< 948	< 909.5			
S95T004189		Lower ½	< 1,050	< 1,130	< 1,090			
S95T004190	121: 9	Upper ½	< 1,130	< 1,070	< 1,100			
S96T000106	121: 10	Upper ½	< 1,070	< 1,170	< 1,120			
S96T000107	121: 10A	Upper ½	< 1,090	< 1,070	< 1,080			
S96T000250	121: 10B	Upper ½	< 908	< 863	< 885.5			
S96T000251		Lower ½	< 1,170	< 1,200	< 1,185			
S96T000258		DL	< 70 µg/mL	< 70 µg/mL	< 70 µg/mL (< 52.2 µg/g)			

Table A-4. Tank 241-BY-106 Analytical Results: Barium. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	< 18.5	< 19.2	< 18.85	< 24.6	N/A	< 87.1
S95T004192	121: 3	Upper ½	< 23.1	< 23.7	< 23.4			
S95T004193		Lower ½	< 20.3	< 18.8	< 19.55			
S95T004194	121: 4	Upper ½	< 22.2	< 26	< 24.1			
S95T004195		Lower ½	< 25.3	< 22.1	< 23.7			
S95T004196	121: 5	Upper ½	< 26.4	< 23.4	< 24.9			
S95T004197	121: 6	Upper ½	< 25.1	< 25.9	< 25.5			
S95T004198	121: 7	Upper ½	< 23.8	< 22.7	< 23.25			
S95T004199	121: 8	Upper ½	< 24.1	< 23.3	< 23.7			
S95T004200		Lower ½	< 21.2	< 20.4	< 20.8			
S95T004201	121: 9	Upper ½	< 23.7	< 23.1	< 23.4			
S96T000108	121: 10	Upper ½	< 22.7	< 23.4	< 23.05			
S96T000252	121: 10B	Upper ½	< 21.6	< 22.1	< 21.85			
S96T000253		Lower ½	< 20.8	< 19.9	< 20.35			
S96T000258		DL	< 70 µg/mL	< 70 µg/mL	< 70 µg/mL (< 52.2 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	< 28.5	< 29.1	< 28.8	< 28.8	N/A	< 102

Table A-4. Tank 241-BY-106 Analytical Results: Barium. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Composite: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000379	1-10B	Composite	< 897	< 965	< 931	< 931	N/A	< 3,300
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	< 23.9	< 23.5	< 23.7	< 23.7	N/A	< 83.9

Table A-5. Tank 241-BY-106 Analytical Results: Beryllium.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	< 1.85	< 1.92	< 1.885	< 2.46	N/A	< 8.71
S95T004192	121: 3	Upper ½	< 2.31	< 2.37	< 2.34			
S95T004193		Lower ½	< 2.03	< 1.88	< 1.955			
S95T004194	121: 4	Upper ½	< 2.22	< 2.6	< 2.41			
S95T004195		Lower ½	< 2.53	< 2.21	< 2.37			
S95T004196	121: 5	Upper ½	< 2.64	< 2.34	< 2.49			
S95T004197	121: 6	Upper ½	< 2.51	< 2.59	< 2.55			
S95T004198	121: 7	Upper ½	< 2.38	< 2.27	< 2.325			
S95T004199	121: 8	Upper ½	< 2.41	< 2.33	< 2.37			
S95T004200		Lower ½	< 2.12	< 2.04	< 2.08			
S95T004201	121: 9	Upper ½	< 2.37	< 2.31	< 2.34			
S96T000108	121: 10	Upper ½	< 2.27	< 2.34	< 2.305			
S96T000252	121: 10B	Upper ½	< 2.16	< 2.21	< 2.185			
S96T000253		Lower ½	< 2.08	< 1.99	< 2.035			
S96T000258		DL	< 7 µg/mL	< 7 µg/mL	< 7 µg/mL (< 5.22 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	< 2.85	< 2.91	< 2.88	< 2.88	N/A	< 10.2
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	< 2.39	< 2.35	< 2.37	< 2.37	N/A	< 8.39

Table A-6. Tank 241-BY-106 Analytical Results: Bismuth. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004179	121: 1	Upper ½	< 2,080	< 2,110	< 2,095	< 1,860	N/A	< 6,580
S95T004180	121: 2	Upper ½	< 1,850	< 2,030	< 1,940			
S96T001415		Upper ½	< 1,470	< 1,440	< 1,455			
S95T004181	121: 3	Upper ½	< 1,970	< 1,950	< 1,960			
S95T004182		Lower ½	< 2,140	< 2,130	< 2,135			
S95T004183	121: 4	Upper ½	< 1,870	< 1,970	< 1,920			
S95T004184		Lower ½	< 1,950	< 1,880	< 1,915			
S95T004185	121: 5	Upper ½	< 1,760	< 1,860	< 1,810			
S95T004186	121: 6	Upper ½	< 2,050	< 2,100	< 2,075			
S95T004187	121: 7	Upper ½	< 1,930	< 1,940	< 1,935			
S96T001378		Upper ½	< 1,350	< 1,230	< 1,290			
S95T004188	121: 8	Upper ½	< 1,740	< 1,810	< 1,775			
S95T004189		Lower ½	< 2,100	< 2,250	< 2,175			
S95T004190	121: 9	Upper ½	< 2,260	< 2,150	< 2,205			
S96T000106	121: 10	Upper ½	< 2,140	< 2,340	< 2,240			
S96T000107	121: 10A	Upper ½	< 2,200	< 2,130	< 2,165			
S96T000250	121: 10B	Upper ½	< 1,820	< 1,730	< 1,775			
S96T000251		Lower ½	< 2,330	< 2,320	< 2,325			
S96T000258		DL	< 140 µg/mL	< 140 µg/mL	< 140 µg/mL (< 104 µg/g)			

Table A-6. Tank 241-BY-106 Analytical Results: Bismuth. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	< 36.9	< 38.3	< 37.6	< 49.2	N/A	< 174
S95T004192	121: 3	Upper ½	< 46.2	< 47.5	< 46.85			
S95T004193		Lower ½	< 40.7	< 37.6	< 39.15			
S95T004194	121: 4	Upper ½	< 44.4	< 51.7	< 48.05			
S95T004195		Lower ½	< 50.6	< 44.2	< 47.4			
S95T004196	121: 5	Upper ½	< 52.8	< 46.9	< 49.85			
S95T004197	121: 6	Upper ½	< 50.1	< 51.9	< 51			
S95T004198	121: 7	Upper ½	< 47.6	< 45.6	< 46.6			
S95T004199	121: 8	Upper ½	< 48.3	< 46.6	< 47.45			
S95T004200		Lower ½	< 42.4	< 40.8	< 41.6			
S95T004201	121: 9	Upper ½	< 47.5	< 46.2	< 46.85			
S96T000108	121: 10	Upper ½	< 45.3	< 46.8	< 46.05			
S96T000252	121: 10B	Upper ½	< 43.2	< 44.2	< 43.7			
S96T000253		Lower ½	< 41.5	< 40	< 40.75			
S96T000258		DL	< 140 µg/mL	< 140 µg/mL	< 140 µg/mL (< 104 µg/g)			

Table A-6. Tank 241-BY-106 Analytical Results: Bismuth. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	< 57	< 58.1	< 57.55	< 57.6	N/A	< 204
Composite: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000379	1-10B	Composite	< 1,790	< 1,930	< 1,860	< 1,860	N/A	< 6,580
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	< 47.7	< 46.9	< 47.3	< 47.3	N/A	< 167

Table A-7. Tank 241-BY-106 Analytical Results: Boron. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004179	121: 1	Upper ½	< 1,040	< 1,050	< 1,045	< 931	N/A	< 3,300
S95T004180	121: 2	Upper ½	< 924	1,010	967			
S96T001415		Upper ½	< 733	< 722	< 727.5			
S95T004181	121: 3	Upper ½	< 983	< 977	< 980			
S95T004182		Lower ½	< 1,070	< 1,060	< 1,065			
S95T004183	121: 4	Upper ½	< 935	< 985	< 960			
S95T004184		Lower ½	< 975	< 940	< 957.5			
S95T004185	121: 5	Upper ½	< 882	< 929	< 905.5			
S95T004186	121: 6	Upper ½	< 1,030	< 1,050	< 1,040			
S95T004187	121: 7	Upper ½	< 967	< 969	< 968			
S96T001378		Upper ½	< 675	< 617	< 646			
S95T004188	121: 8	Upper ½	< 871	< 948	< 909.5			
S95T004189		Lower ½	< 1,050	< 1,130	< 1,090			
S95T004190	121: 9	Upper ½	< 1,130	< 1,070	< 1,100			
S96T000106	121: 10	Upper ½	< 1,070	< 1,170	< 1,120			
S96T000107	121: 10A	Upper ½	< 1,090	< 1,070	< 1,080			
S96T000250	121: 10B	Upper ½	< 908	< 863	< 885.5			
S96T000251		Lower ½	< 1,170	< 1,200	< 1,185			
S96T000258		DL	< 70 µg/mL	< 70 µg/mL	< 70 µg/mL (< 52.2 µg/g)			

Table A-7. Tank 241-BY-106 Analytical Results: Boron. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	410	82.6	246.3[QC:e]	113	11.5	400
S95T004192	121: 3	Upper ½	103	134	118.5[QC:e]			
S95T004193		Lower ½	129	36.7	82.85[QC:e]			
S95T004194	121: 4	Upper ½	106	141	123.5[QC:e]			
S95T004195		Lower ½	125	117	121			
S95T004196	121: 5	Upper ½	167	152	159.5			
S95T004197	121: 6	Upper ½	109	150	129.5[QC:e]			
S95T004198	121: 7	Upper ½	98.4	123	110.7[QC:e]			
S95T004199	121: 8	Upper ½	146	124	135			
S95T004200		Lower ½	121	87.8	104.4 [QC:e]			
S95T004201	121: 9	Upper ½	125	88.7	106.85 [QC:e]			
S96T000108	121: 10	Upper ½	114	125	119.5			
S96T000252	121: 10B	Upper ½	< 21.6	< 22.1	< 21.85			
S96T000253		Lower ½	117	22.5	69.75[QC:e]			
S96T000258		DL	< 70 µg/mL	< 70 µg/mL	< 70 µg/mL (< 52.2 µg/g)			

Table A-7. Tank 241-BY-106 Analytical Results: Boron. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	< 28.5	< 29.1	< 28.8	< 28.8	N/A	< 102
Composite: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000379	1-10B	Composite	< 897	< 965	< 931	< 931	N/A	< 3,300
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	130	120	125	125	4.0	443

Table A-8. Tank 241-BY-106 Analytical Results: Cadmium.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	13.2	13.1	13.15	8.25	15.1	29.2
S95T004192	121: 3	Upper ½	7.61	7.65	7.63			
S95T004193		Lower ½	7.47	8.03	7.75			
S95T004194	121: 4	Upper ½	9.67	9.46	9.565			
S95T004195		Lower ½	17.2	16.6	16.9			
S95T004196	121: 5	Upper ½	20.8	17.9	19.35			
S95T004197	121: 6	Upper ½	5.73	4.58	5.155[QC:e]			
S95T004198	121: 7	Upper ½	5.02	4.64	4.83			
S95T004199	121: 8	Upper ½	6.71	6.46	6.585			
S95T004200		Lower ½	8.79	9.03	8.91			
S95T004201	121: 9	Upper ½	7.94	8.07	8.005			
S96T000108	121: 10	Upper ½	4.43	3.72	4.075			
S96T000252	121: 10B	Upper ½	< 2.16	< 2.21	< 2.185			
S96T000253		Lower ½	3.64	5.09	4.365[QC:e]			
S96T000258		DL	< 7 µg/mL	< 7 µg/mL	< 7 µg/mL (< 5.22 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	4.02	5.87	4.945[QC:e]	4.95	18.7	17.5
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	7.6	8.68	8.14	8.14	6.6	28.8

Table A-9. Tank 241-BY-106 Analytical Results: Calcium. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004179	121: 1	Upper ½	< 2,080	< 2,110	< 2,095	< 1,960	N/A	< 6,940
S95T004180	121: 2	Upper ½	< 1,850	< 2,030	< 1,940			
S96T001415		Upper ½	< 1,470	< 1,440	< 1,455			
S95T004181	121: 3	Upper ½	< 1,970	< 1,950	< 1,960			
S95T004182		Lower ½	< 2,140	< 2,130	< 2,135			
S95T004183	121: 4	Upper ½	< 1,870	< 1,970	< 1,920			
S95T004184		Lower ½	< 1,950	< 1,880	< 1,915			
S95T004185	121: 5	Upper ½	< 1,760	< 1,860	< 1,810			
S95T004186	121: 6	Upper ½	< 2,050	< 2,100	< 2,075			
S95T004187	121: 7	Upper ½	< 1,930	< 1,940	< 1,935			
S96T001378		Upper ½	< 1,350	< 1,230	< 1,290			
S95T004188	121: 8	Upper ½	< 1,740	< 1,810	< 1,775			
S95T004189		Lower ½	< 2,100	< 2,250	< 2,175			
S95T004190	121: 9	Upper ½	< 2,260	< 2,150	< 2,205			
S96T000106	121: 10	Upper ½	< 2,140	< 2,340	< 2,240			
S96T000107	121: 10A	Upper ½	< 2,200	< 2,130	< 2,165			
S96T000250	121: 10B	Upper ½	< 1,820	< 1,730	< 1,775			
S96T000251		Lower ½	< 2,330	< 2,320	< 2,325			

Table A-9. Tank 241-BY-106 Analytical Results: Calcium. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000258		DL	< 140 µg/mL	< 140 µg/mL	< 140 µg/mL (< 104 µg/g)	Cont'd	Cont'd	Cont'd
S95T000085	65: 11	Upper ½	< 1,080	< 1,080	< 1,080			
S95T000100	65: 13	Upper ½	< 509.061	< 513.347	< 511.204			
S95T000322		Upper ½	6,341.08	6,215.01	6,278.05			
Solids/Sludge			µg/g	µg/g	µg/g	µg/g	%	kg
S95T000101	65:13	Upper ½	8,587.22	7,716.72	8,151.97	8,150	5.3	5,020
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	2,350	273	1,311.5[QC:e]	308	24.6	1,090
S95T004192	121: 3	Upper ½	151	175	163[QC:e]			
S95T004193		Lower ½	161	196	178.5[QC:e]			
S95T004194	121: 4	Upper ½	142	878	510[QC:e]			
S95T004195		Lower ½	264	225	244.5[QC:e]			
S95T004196	121: 5	Upper ½	219	295	257[QC:e]			
S95T004197	121: 6	Upper ½	435	245	340[QC:e]			
S95T004198	121: 7	Upper ½	190	184	187			
S95T004199	121: 8	Upper ½	267	215	241[QC:e]			
S95T004200		Lower ½	227	173	200[QC:e]			
S95T004201	121: 9	Upper ½	251	411	331[QC:e]			
S96T000108	121: 10	Upper ½	168	239	203.5[QC:e]			

Table A-9. Tank 241-BY-106 Analytical Results: Calcium. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000252	121: 10B	Upper ½	224	139	181.5[QC:e]	Cont'd	Cont'd	Cont'd
S96T000253		Lower ½	160	184	172[QC:e]			
S96T000258		DL	< 140 µg/mL	< 140 µg/mL	< 140 µg/mL (< 104 µg/g)			
Liquids			µg/mL	µg/mL	µg/mL	µg/mL	%	kg
S95T000004	64: 3	DL	< 40	< 40	< 40	< 65.0	N/A	N/A
S95T000355	64: 6	DL	< 40	< 40	< 40			
S95T000371	64: 10	DL	< 40	< 40	< 40			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	109	112	110.5	111	1.4	393
Composite: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000379	1-10B	Composite	< 1,790	< 1,930	< 1,860	< 1,860	N/A	< 6,580
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	260	272	266	266	2.3	942

Table A-10. Tank 241-BY-106 Analytical Results: Cerium.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	< 36.9	< 38.3	< 37.6	< 49.2	N/A	< 174
S95T004192	121: 3	Upper ½	< 46.2	< 47.5	< 46.85			
S95T004193		Lower ½	< 40.7	< 37.6	< 39.15			
S95T004194	121: 4	Upper ½	< 44.4	< 51.7	< 48.05			
S95T004195		Lower ½	< 50.6	< 44.2	< 47.4			
S95T004196	121: 5	Upper ½	< 52.8	< 46.9	< 49.85			
S95T004197	121: 6	Upper ½	< 50.1	< 51.9	< 51			
S95T004198	121: 7	Upper ½	< 47.6	< 45.6	< 46.6			
S95T004199	121: 8	Upper ½	< 48.3	< 46.6	< 47.45			
S95T004200		Lower ½	< 42.4	< 40.8	< 41.6			
S95T004201	121: 9	Upper ½	< 47.5	< 46.2	< 46.85			
S96T000108	121: 10	Upper ½	< 45.3	< 46.8	< 46.05			
S96T000252	121: 10B	Upper ½	< 43.2	< 44.2	< 43.7			
S96T000253		Lower ½	< 41.5	< 40	< 40.75			
S96T000258		DL	< 140 µg/mL	< 140 µg/mL	< 140 µg/mL (< 104 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	< 57	< 58.1	< 57.55	< 57.6	N/A	< 204
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	< 47.7	< 46.9	< 47.3	< 47.3	N/A	< 167

Table A-11. Tank 241-BY-106 Analytical Results: Chromium. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004179	121: 1	Upper ½	< 208	212	< 210	1,272	20.1	4,500
S95T004180	121: 2	Upper ½	1,740	1,440	1,590[QC:e]			
S96T001415		Upper ½	2,070	1,930	2,000			
S95T004181	121: 3	Upper ½	1,090	1,200	1,145			
S95T004182		Lower ½	1,040	1,110	1,075			
S95T004183	121: 4	Upper ½	1,070	1,180	1,125			
S95T004184		Lower ½	1,100	1,280	1,190[QC:e]			
S95T004185	121: 5	Upper ½	1,440	1,490	1,465			
S95T004186	121: 6	Upper ½	708	785	746.5			
S95T004187	121: 7	Upper ½	654	886	770[QC:e]			
S96T001378		Upper ½	841	1,580	1,210.5[QC:e]			
S95T004188	121: 8	Upper ½	1,320	1,440	1,380			
S95T004189		Lower ½	1,800	1,630	1,715			
S95T004190	121: 9	Upper ½	1,820	1,750	1,785			
S96T000106	121: 10	Upper ½	806	988	897[QC:e]			
S96T000107	121: 10A	Upper ½	5,590	5,550	5,570			
S96T000250	121: 10B	Upper ½	416	371	393.5[QC:e]			
S96T000251		Lower ½	693	658	675.5			

Table A-11. Tank 241-BY-106 Analytical Results: Chromium. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000258		DL	354 µg/mL	353 µg/mL	353.5 µg/mL (264 µg/g)	Cont'd	Cont'd	Cont'd
S95T000085	65:11	Upper ½	236	235	235.5			
Solids/Sludge			µg/g	µg/g	µg/g	µg/g	%	kg
S95T000101	65:13	Upper ½	1,149.41	1,087.49	1,118.45	1,120	2.8	690
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	1,280	1,330	1,305	855	10.8	3,030
S95T004192	121: 3	Upper ½	1,260	1,240	1,250			
S95T004193		Lower ½	903	908	905.5			
S95T004194	121: 4	Upper ½	644	607	625.5			
S95T004195		Lower ½	997	904	950.5			
S95T004196	121: 5	Upper ½	1,350	1,060	1,205[QC:e]			
S95T004197	121: 6	Upper ½	594	507	550.5[QC:e]			
S95T004198	121: 7	Upper ½	771	681	726[QC:e]			
S95T004199	121: 8	Upper ½	1,200	1,110	1,155			
S95T004200		Lower ½	1,350	1,260	1,305			
S95T004201	121: 9	Upper ½	1,040	1,120	1,080			
S96T000108	121: 10	Upper ½	698	610	654[QC:e]			
S96T000252	121: 10B	Upper ½	271	263	267			

Table A-11. Tank 241-BY-106 Analytical Results: Chromium. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000253		Lower ½	472	699	585.5[QC:e]	Cont'd	Cont'd	Cont'd
S96T000258		DL	354 µg/mL	353 µg/mL	353.5 µg/mL (264 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	393	525	459[QC:e]	459	14.4	1,620
Composite: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000379	1-10B	Composite	1,260	1,050	1,155[QC:e]	1,160	9.1	4,110
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	793	746	769.5	770	3.1	2,730

Table A-12. Tank 241-BY-106 Analytical Results: Cobalt.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S95T004191	121: 2	Upper ½	< 7.38	< 7.66	< 7.52	< 9.83	N/A	< 34.8
S95T004192	121: 3	Upper ½	< 9.24	< 9.49	< 9.365			
S95T004193		Lower ½	< 8.13	< 7.53	< 7.83			
S95T004194	121: 4	Upper ½	< 8.89	< 10.3	< 9.595			
S95T004195		Lower ½	< 10.1	< 8.85	< 9.475			
S95T004196	121: 5	Upper ½	< 10.6	< 9.38	< 9.99			
S95T004197	121: 6	Upper ½	< 10	< 10.4	< 10.2			
S95T004198	121: 7	Upper ½	< 9.52	< 9.09	< 9.305			
S95T004199	121: 8	Upper ½	< 9.66	< 9.31	< 9.485			
S95T004200		Lower ½	< 8.49	< 8.15	< 8.32			
S95T004201	121: 9	Upper ½	< 9.5	< 9.24	< 9.37			
S96T000108	121: 10	Upper ½	< 9.06	< 9.36	< 9.21			
S96T000252	121: 10B	Upper ½	< 8.64	< 8.85	< 8.745			
S96T000253		Lower ½	< 8.31	< 7.97	< 8.14			
S96T000258		DL	< 28 µg/mL	< 28 µg/mL	< 28 µg/mL (< 20.9 µg/g)			
Composite: water digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S96T000381	1-10B	Composite	< 11.4	< 11.6	< 11.5	< 11.5	N/A	< 40.7
Composite: acid digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S96T000380	1-10B	Composite	< 9.55	< 9.38	< 9.465	< 9.47	N/A	< 33.5

Table A-13. Tank 241-BY-106 Analytical Results: Copper. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	11.9	12.7	12.3	< 5.49	N/A	< 19.4
S95T004192	121: 3	Upper ½	< 4.62	< 4.75	< 4.685			
S95T004193		Lower ½	< 4.07	< 3.76	< 3.915			
S95T004194	121: 4	Upper ½	< 4.44	< 5.17	< 4.805			
S95T004195		Lower ½	< 5.06	< 4.42	< 4.74			
S95T004196	121: 5	Upper ½	< 5.28	< 4.69	< 4.985			
S95T004197	121: 6	Upper ½	< 5.01	< 5.19	< 5.1			
S95T004198	121: 7	Upper ½	< 4.76	< 4.56	< 4.66			
S95T004199	121: 8	Upper ½	< 4.83	< 4.66	< 4.745			
S95T004200		Lower ½	< 4.24	< 4.08	< 4.16			
S95T004201	121: 9	Upper ½	< 4.75	< 4.62	< 4.685			
S96T000108	121: 10	Upper ½	< 4.53	< 4.68	< 4.605			
S96T000252	121: 10B	Upper ½	< 4.32	< 4.42	< 4.37			
S96T000253		Lower ½	< 4.15	< 4	< 4.075			
S96T000258		DL	< 14 µg/mL	< 14 µg/mL	< 14 µg/mL (< 10.4 µg/g)			

Table A-13. Tank 241-BY-106 Analytical Results: Copper. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	< 5.7	< 5.81	< 5.755	< 5.76	N/A	< 20.4
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	< 4.77	< 4.69	< 4.73	< 4.73	N/A	< 16.7

Table A-14. Tank 241-BY-106 Analytical Results: Iron. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004179	121: 1	Upper ½	< 1,040	< 1,050	< 1,045	< 1,810	N/A	< 6,410
S95T004180	121: 2	Upper ½	< 924	< 1,010	< 967			
S96T001415		Upper ½	1,260	833	1,046.5[QC:e]			
S95T004181	121: 3	Upper ½	< 983	< 977	< 980			
S95T004182		Lower ½	< 1,070	< 1,060	< 1,065			
S95T004183	121: 4	Upper ½	< 935	< 985	< 960			
S95T004184		Lower ½	< 975	< 940	< 957.5			
S95T004185	121: 5	Upper ½	< 882	< 929	< 905.5			
S95T004186	121: 6	Upper ½	< 1,030	< 1,050	< 1,040			
S95T004187	121: 7	Upper ½	< 967	< 969	< 968			
S96T001378		Upper ½	< 675	679	677			
S95T004188	121: 8	Upper ½	< 871	< 948	< 909.5			
S95T004189		Lower ½	< 1,050	< 1,130	< 1,090			
S95T004190	121: 9	Upper ½	< 1,130	< 1,070	< 1,100			
S96T000106	121:10	Upper ½	< 1,070	< 1,170	< 1,120			
S96T000107	121:10A	Upper ½	< 1,090	< 1,070	< 1,080			
S96T000250	121:10B	Upper ½	< 908	< 863	< 885.5			
S96T000251		Lower ½	< 1,170	< 1,200	< 1,185			

Table A-14. Tank 241-BY-106 Analytical Results: Iron. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000258		DL	< 70 µg/mL	< 70 µg/mL	< 70 µg/mL (< 52.2 µg/g)	Cont'd	Cont'd	Cont'd
S95T000085	65:11	Upper ½	< 540	< 540	< 540			
S95T000322	65:13	Upper ½	19,486.2	19,325.8	19,406			
Solids/Sludge			µg/g	µg/g	µg/g	µg/g	%	kg
S95T000101	65:13	Upper ½	33,440.6	32,562.9	33,001.7	33,000	1.3	20,300
Solids: acid digest		µg/g	µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	990	692	841[QC:e]	215	22.9	761
S95T004192	121: 3	Upper ½	153	149	151			
S95T004193		Lower ½	113	112	112.5			
S95T004194	121: 4	Upper ½	103	136	119.5[QC:e]			
S95T004195		Lower ½	298	285	291.5			
S95T004196	121: 5	Upper ½	268	214	241[QC:e]			
S95T004197	121: 6	Upper ½	201	167	184[QC:e]			
S95T004198	121: 7	Upper ½	169	159	164			
S95T004199	121: 8	Upper ½	226	219	222.5			
S95T004200		Lower ½	290	287	288.5			
S95T004201	121: 9	Upper ½	262	303	282.5[QC:e]			
S96T000108	121:10	Upper ½	115	93.1	104.05[QC:e]			

Table A-14. Tank 241-BY-106 Analytical Results: Iron. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest		**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S96T000252	121:10B	Upper ½	45.9	43.5	44.7	Cont'd	Cont'd	Cont'd
S96T000253		Lower ½	103	154	128.5[QC:e]			
S96T000258		DL	< 70 µg/mL	< 70 µg/mL	< 70 µg/mL (<52.2 µg/g)			
Liquids			**µg/mL**	**µg/mL**	**µg/mL**	**µg/mL**	**%**	**kg**
S95T000004	64: 3	DL	20.1	20.4	20.25	< 19.7	N/A	N/A
S95T000228		DL	18.4	18.3	18.35			
S95T000355	64:6	DL	< 20	< 20	< 20			
S95T000371	64:10	DL	< 20	< 20	< 20			
Composite: water digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S96T000381	1-10B	Composite	52	82.5	67.25[QC:e]	67.3	22.7	238
Composite: fusion			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S96T000379	1-10B	Composite	< 897	< 965	< 931	< 931	N/A	< 3,300
Composite: acid digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S96T000380	1-10B	Composite	165	155	160	160	3.1	560

Table A-15. Tank 241-BY-106 Analytical Results: Lanthanum.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	< 18.5	< 19.2	< 18.85	< 24.6	N/A	< 87.1
S95T004192	121: 3	Upper ½	< 23.1	< 23.7	< 23.4			
S95T004193		Lower ½	< 20.3	< 18.8	< 19.55			
S95T004194	121: 4	Upper ½	< 22.2	< 26	< 24.1			
S95T004195		Lower ½	< 25.3	< 22.1	< 23.7			
S95T004196	121: 5	Upper ½	< 26.4	< 23.4	< 24.9			
S95T004197	121: 6	Upper ½	< 25.1	< 25.9	< 25.5			
S95T004198	121: 7	Upper ½	< 23.8	< 22.7	< 23.25			
S95T004199	121: 8	Upper ½	< 24.1	< 23.3	< 23.7			
S95T004200		Lower ½	< 21.2	< 20.4	< 20.8			
S95T004201	121: 9	Upper ½	< 23.7	< 23.1	< 23.4			
S96T000108	121:10	Upper ½	< 22.7	< 23.4	< 23.05			
S96T000252	121:10B	Upper ½	< 21.6	< 22.1	< 21.85			
S96T000253		Lower ½	< 20.8	< 19.9	< 20.35			
S96T000258		DL	< 70 µg/mL	< 70 µg/mL	< 70 µg/mL (< 52.2 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	< 28.5	< 29.1	< 28.8	< 28.8	N/A	< 102
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	< 23.9	< 23.5	< 23.7	< 23.7	N/A	< 83.9

Table A-16. Tank 241-BY-106 Analytical Results: Lead.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S95T004191	121: 2	Upper ½	78.8	180	129.4[QC:c]	64.5	12.7	228
S95T004192	121: 3	Upper ½	55.4	52.7	54.05			
S95T004193		Lower ½	< 40.7	39.2	39.95			
S95T004194	121: 4	Upper ½	< 44.4	< 51.7	< 48.05			
S95T004195		Lower ½	< 50.6	46.9	< 48.75			
S95T004196	121: 5	Upper ½	< 52.8	< 46.9	< 49.85			
S95T004197	121: 6	Upper ½	221	< 51.9	136.45			
S95T004198	121: 7	Upper ½	56.4	< 45.6	51			
S95T004199	121: 8	Upper ½	60.4	55.3	57.85			
S95T004200		Lower ½	58.3	60.8	59.55			
S95T004201	121: 9	Upper ½	56.1	49.7	52.9			
S96T000108	121:10	Upper ½	< 45.3	< 46.8	< 46.05			
S96T000252	121:10B	Upper ½	< 43.2	< 44.2	< 43.7			
S96T000253		Lower ½	< 41.5	47.9	44.7			
S96T000258		DL	< 140 µg/mL	< 140 µg/mL	< 140 µg/gmL (< 104 µg/g)			
Composite: water digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S96T000381	1-10B	Composite	< 57	< 58.1	< 57.55	< 57.6	N/A	< 204
Composite: acid digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S96T000380	1-10B	Composite	< 47.7	< 46.9	< 47.3	< 47.3	N/A	< 167

Table A-17. Tank 241-BY-106 Analytical Results: Magnesium.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	50.8	< 38.3	44.55	< 50.4	N/A	< 178
S95T004192	121: 3	Upper ½	< 46.2	< 47.5	< 46.85			
S95T004193		Lower ½	< 40.7	< 37.6	< 39.15			
S95T004194	121: 4	Upper ½	< 44.4	< 51.7	< 48.05			
S95T004195		Lower ½	< 50.6	< 44.2	< 47.4			
S95T004196	121: 5	Upper ½	< 52.8	< 46.9	< 49.85			
S95T004197	121: 6	Upper ½	< 50.1	< 51.9	< 51			
S95T004198	121: 7	Upper ½	< 47.6	< 45.6	< 46.6			
S95T004199	121: 8	Upper ½	< 48.3	< 46.6	< 47.45			
S95T004200		Lower ½	< 42.4	< 40.8	< 41.6			
S95T004201	121: 9	Upper ½	< 47.5	70.1	58.8			
S96T000108	121:10	Upper ½	< 45.3	< 46.8	< 46.05			
S96T000252	121:10B	Upper ½	< 43.2	< 44.2	< 43.7			
S96T000253		Lower ½	< 41.5	< 40	< 40.75			
S96T000258		DL	< 140 µg/mL	< 140 µg/mL	< 140 µg/mL (< 104 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	< 57	< 58.1	< 57.55	< 57.6	N/A	< 204
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	< 47.7	< 46.9	< 47.3	< 47.3	N/A	< 167

Table A-18. Tank 241-BY-106 Analytical Results: Manganese. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004179	121: 1	Upper ½	< 208	< 211	< 209.5	< 186	N/A	< 658
S95T004180	121: 2	Upper ½	< 185	< 203	< 194			
S96T001415		Upper ½	< 147	< 144	< 145.5			
S95T004181	121: 3	Upper ½	< 197	< 195	< 196			
S95T004182		Lower ½	< 214	< 213	< 213.5			
S95T004183	121: 4	Upper ½	< 187	< 197	< 192			
S95T004184		Lower ½	< 195	< 188	< 191.5			
S95T004185	121: 5	Upper ½	< 176	< 186	< 181			
S95T004186	121: 6	Upper ½	< 205	< 210	< 207.5			
S95T004187	121: 7	Upper ½	< 193	< 194	< 193.5			
S96T001378		Upper ½	< 135	< 123	< 129			
S95T004188	121: 8	Upper ½	< 174	< 181	< 177.5			
S95T004189		Lower ½	< 210	< 225	< 217.5			
S95T004190	121: 9	Upper ½	< 226	< 215	< 220.5			
S96T000106	121:10	Upper ½	< 214	< 234	< 224			
S96T000107	121:10A	Upper ½	< 220	< 213	< 216.5			
S96T000250	121:10B	Upper ½	< 182	< 173	< 177.5			
S96T000251		Lower ½	< 233	< 232	< 232.5			
S96T000258		DL	< 14 µg/mL	< 14 µg/mL	< 14 µg/mL (< 10.4 µg/g)			

Table A-18. Tank 241-BY-106 Analytical Results: Manganese. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	14.1	11.2	12.65[QC:e]	9.57	11.2	33.9
S95T004192	121: 3	Upper ½	4.96	< 4.75	< 4.855			
S95T004193		Lower ½	5.44	5.66	5.55			
S95T004194	121: 4	Upper ½	4.89	5.55	5.22			
S95T004195		Lower ½	14.8	13.7	14.25			
S95T004196	121: 5	Upper ½	14.1	10.7	12.4[QC:e]			
S95T004197	121: 6	Upper ½	7.9	6.28	7.09[QC:e]			
S95T004198	121: 7	Upper ½	7.24	6.68	6.96			
S95T004199	121: 8	Upper ½	12.3	11.5	11.9			
S95T004200		Lower ½	15	14.5	14.75			
S95T004201	121: 9	Upper ½	16.5	18.8	17.65[QC:e]			
S96T000108	121:10	Upper ½	9.22	7.03	8.125[QC:e]			
S96T000252	121:10B	Upper ½	< 4.32	< 4.42	< 4.37			
S96T000253		Lower ½	6.78	7.84	7.31			
S96T000258		DL	< 14 µg/mL	< 14 µg/mL	< 14 µg/mL (< 10.4 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	< 5.7	< 5.81	< 5.755	< 5.76	N/A	< 20.4

Table A-18. Tank 241-BY-106 Analytical Results: Manganese. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Composite: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000379	1-10B	Composite	< 179	< 193	< 186	< 186	N/A	< 658
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	7.83	7.64	7.735	7.74	1.2	27.4

Table A-19. Tank 241-BY-106 Analytical Results: Molybdenum.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	< 18.5	< 19.2	< 18.85	< 27.2	N/A	< 96.3
S95T004192	121: 3	Upper ½	< 23.1	< 23.7	< 23.4			
S95T004193		Lower ½	21.5	20.7	21.1			
S95T004194	121: 4	Upper ½	< 22.2	< 26	< 24.1			
S95T004195		Lower ½	27.9	26.9	27.4			
S95T004196	121: 5	Upper ½	33.4	31.1	32.25			
S95T004197	121: 6	Upper ½	< 25.1	< 25.9	< 25.5			
S95T004198	121: 7	Upper ½	< 23.8	< 22.7	< 23.25			
S95T004199	121: 8	Upper ½	30.4	29.8	30.1			
S95T004200		Lower ½	31.1	27.4	29.25			
S95T004201	121: 9	Upper ½	< 23.7	< 23.1	< 23.4			
S96T000108	121:10	Upper ½	< 22.7	< 23.4	< 23.05			
S96T000252	121:10B	Upper ½	26.6	26.8	26.7			
S96T000253		Lower ½	< 20.8	< 19.9	< 20.35			
S96T000258		DL	81.1 µg/mL	77.6 µg/mL	79.35 µg/mL (59.2 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	DL	< 28.5	31	< 29.75	< 29.8	N/A	< 105.5
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	< 23.9	< 23.5	< 23.7	< 23.7	N/A	83.9

Table A-20. Tank 241-BY-106 Analytical Results: Neodymium.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	< 36.9	< 38.3	< 37.6	< 49.2	N/A	< 174
S95T004192	121: 3	Upper ½	< 46.2	< 47.5	< 46.85			
S95T004193		Lower ½	< 40.7	< 37.6	< 39.15			
S95T004194	121: 4	Upper ½	< 44.4	< 51.7	< 48.05			
S95T004195		Lower ½	< 50.6	< 44.2	< 47.4			
S95T004196	121: 5	Upper ½	< 52.8	< 46.9	< 49.85			
S95T004197	121: 6	Upper ½	< 50.1	< 51.9	< 51			
S95T004198	121: 7	Upper ½	< 47.6	< 45.6	< 46.6			
S95T004199	121: 8	Upper ½	< 48.3	< 46.6	< 47.45			
S95T004200		Lower ½	< 42.4	< 40.8	< 41.6			
S95T004201	121: 9	Upper ½	< 47.5	< 46.2	< 46.85			
S96T000108	121:10	Upper ½	< 45.3	< 46.8	< 46.05			
S96T000252	121:10B	Upper ½	< 43.2	< 44.2	< 43.7			
S96T000253		Lower ½	< 41.5	< 40	< 40.75			
S96T000258		DL	< 140 µg/mL	< 140 µg/mL	< 140 µg/mL (< 104 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	< 57	< 58.1	< 57.55	< 57.6	N/A	< 204
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	< 47.7	< 46.9	< 47.3	< 47.3	N/A	< 167

Table A-21. Tank 241-BY-106 Analytical Results: Nickel. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004179	121: 1	Upper ½	< 416	< 421	< 418.5	< 685	N/A	< 2,420
S95T004180	121: 2	Upper ½	< 361	< 406	< 383.5			
S96T001415		Upper ½	< 293	< 289	< 291			
S95T004181	121: 3	Upper ½	< 393	< 391	< 392			
S95T004182		Lower ½	< 429	< 423	< 426			
S95T004183	121: 4	Upper ½	< 374	< 394	< 384			
S95T004184		Lower ½	< 390	< 376	< 383			
S95T004185	121: 5	Upper ½	< 353	< 372	< 362.5			
S95T004186	121: 6	Upper ½	< 411	< 419	< 415			
S95T004187	121: 7	Upper ½	< 387	< 388	< 387.5			
S96T001378		Upper ½	< 270	< 247	< 258.5			
S95T004188	121: 8	Upper ½	< 348	< 379	< 363.5			
S95T004189		Lower ½	< 420	< 451	< 435.5			
S95T004190	121: 9	Upper ½	< 452	< 427	< 439.5			
S96T000106	121:10	Upper ½	< 429	< 467	< 448			
S96T000107	121:10A	Upper ½	578	564	571			
S96T000250	121:10B	Upper ½	< 363	< 345	< 354			
S96T000251		Lower ½	< 466	< 479	< 472.5			
S96T000258		DL	< 28 µg/mL	< 28 µg/mL	< 28 µg/mL (< 20.9 µg/g)			

Table A-21. Tank 241-BY-106 Analytical Results: Nickel. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T000085	65:11	Upper ½	< 215	< 216	< 215.5	Cont'd	Cont'd	Cont'd
S95T000100	65:13	Upper ½	6,510.31	7,407.4	6,958.85[QC:e]			
Solids/Sludge			µg/g	µg/g	µg/g	µg/g	%	kg
S95T000101	65:13	Upper ½	31,216.8	27,809.6	29,513.2[QC:e]	29,500	5.8	18,200
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	68.1	73	70.55	47.9	10.9	170
S95T004192	121: 3	Upper ½	38.1	38.9	38.5			
S95T004193		Lower ½	19.7	16.1	17.9[QC:e]			
S95T004194	121: 4	Upper ½	25.3	27.5	26.4			
S95T004195		Lower ½	67.2	69.2	68.2			
S95T004196	121: 5	Upper ½	63.2	54.9	59.05[QC:e]			
S95T004197	121: 6	Upper ½	55.4	48.8	52.1[QC:e]			
S95T004198	121: 7	Upper ½	52.1	46.4	49.25[QC:e]			
S95T004199	121: 8	Upper ½	50	50	50			
S95T004200		Lower ½	68.2	72.2	70.2			
S95T004201	121: 9	Upper ½	71.9	79.6	75.75			
S96T000108	121:10	Upper ½	64.7	59.4	62.05			
S96T000252	121:10B	Upper ½	16.2	17.5	16.85			
S96T000253		Lower ½	40.5	40.5	40.5			

Table A-21. Tank 241-BY-106 Analytical Results: Nickel. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S96T000258		DL	< 28 µg/mL	< 28 µg/mL	< 28 µg/mL (< 20.9 µg/g)	Cont'd	Cont'd	Cont'd
Composite: water digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S96T000381	1-10B	Composite	15	24.4	19.7[QC:c]	19.7	23.4	69.7
Composite: fusion			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S96T000379	1-10B	Composite	< 359	< 386	< 372.5	< 373	N/A	< 1,320
Composite: acid digest			**µg/g**	**µg/g**	**µg/g**	**µg/g**	**%**	**kg**
S96T000380	1-10B	Composite	37.5	37.6	37.55[QC:a]	37.6	0.10	133

Table A-22. Tank 241-BY-106 Analytical Results: Phosphorus. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004179	121: 1	Upper ½	< 4,160	< 4,210	< 4,185	< 4,440	N/A	< 15,700
S95T004180	121: 2	Upper ½	< 3,610	4,120	3,865			
S96T001415		Upper ½	5,170	5,270	5,220			
S95T004181	121: 3	Upper ½	< 3,930	< 3,910	< 3,920			
S95T004182		Lower ½	< 4,290	< 4,230	< 4,260			
S95T004183	121: 4	Upper ½	< 3,740	< 3,940	< 3,840			
S95T004184		Lower ½	< 3,900	< 3,760	< 3,830			
S95T004185	121: 5	Upper ½	< 3,530	< 3,720	< 3,625			
S95T004186	121: 6	Upper ½	< 4,110	< 4,190	< 4,150			
S95T004187	121: 7	Upper ½	< 3,870	< 3,880	< 3,875			
S96T001378		Upper ½	< 2,700	4,080	3,390			
S95T004188	121: 8	Upper ½	< 3,480	< 3,790	< 3,635			
S95T004189		Lower ½	< 4,200	< 4,510	< 4,355			
S95T004190	121: 9	Upper ½	< 4,520	< 4,270	< 4,395			
S96T000106	121:10	Upper ½	< 4,290	< 4,670	< 4,480			
S96T000107	121:10A	Upper ½	< 4,370	< 4,270	< 4,320			
S96T000250	121:10B	Upper ½	< 3,630	< 3,450	< 3,540			
S96T000251		Lower ½	< 4,660	< 4,790	< 4,725			
S96T000258		DL	423 µg/mL	423 µg/mL	423 µg/mL (316 µg/g)			

Table A-22. Tank 241-BY-106 Analytical Results: Phosphorus. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T000322	65:13	Upper ½	15,004.6	14,837.7	14,921.2	Cont'd	Cont'd	Cont'd
Solids/Sludge			µg/g	µg/g	µg/g	µg/g	%	kg
S95T000101	65:13	Upper ½	19,300	21,600	20,450	20,500	5.6	12,600
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	3,560	3,610	3,585	1,032	23.3	3,650
S95T004192	121: 3	Upper ½	1,080	1,860	1,470[QC:e]			
S95T004193		Lower ½	2,410	1,430	1,920[QC:e]			
S95T004194	121: 4	Upper ½	1,720	297	1,008.5[QC:e]			
S95T004195		Lower ½	468	489	478.5[QC:a]			
S95T004196	121: 5	Upper ½	2,020	2,050	2,035			
S95T004197	121: 6	Upper ½	384	338	361[QC:e]			
S95T004198	121: 7	Upper ½	337	301	319[QC:e]			
S95T004199	121: 8	Upper ½	479	497	488			
S95T004200		Lower ½	474	774	624[QC:e]			
S95T004201	121: 9	Upper ½	1,150	395	772.5[QC:e]			
S96T000108	121:10	Upper ½	229	196	212.5[QC:e]			
S96T000252	121:10B	Upper ½	1,540	1,450	1,495			
S96T000253		Lower ½	311	479	395[QC:e]			
S96T000258		DL	423 µg/mL	423 µg/mL	423 µg/mL (316 µg/g)			

Table A-22. Tank 241-BY-106 Analytical Results: Phosphorus. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Liquids			µg/mL	µg/mL	µg/mL	µg/mL	%	kg
S95T000004	64: 3	DL	280	280	280	299	3.4	N/A
S94T000355	64: 6	DL	287	318	302.5			
S94T000371	64:10	DL	311	318	314.5			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	971	3,060	2,015.5[QC:e]	2,020	51.8	7,150
Composite: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000379	1-10B	Composite	< 3,590	< 3,860	< 3,725	< 3,730	N/A	< 13,204
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	911	2,760	1,835.5[QC:e]	1,840	50.4	6,510

Table A-23. Tank 241-BY-106 Analytical Results: Potassium.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	1,780	1,790	1,785	2,470	13.6	8,740
S95T004192	121: 3	Upper ½	1,750	1,770	1,760			
S95T004193		Lower ½	2,200	2,230	2,215			
S95T004194	121: 4	Upper ½	1,550	1,640	1,595			
S95T004195		Lower ½	1,750	1,770	1,760			
S95T004196	121: 5	Upper ½	1,980	2,140	2,060			
S95T004197	121: 6	Upper ½	1,740	1,630	1,685			
S95T004198	121: 7	Upper ½	2,190	1,940	2,065			
S95T004199	121: 8	Upper ½	3,360	3,120	3,240			
S95T004200		Lower ½	3,200	2,940	3,070			
S95T004201	121: 9	Upper ½	2,340	2,300	2,320			
S96T000108	121:10	Upper ½	1,350	1,410	1,380			
S96T000252	121:10B	Upper ½	3,280	3,300	3,290			
S96T000253		Lower ½	2,120	2,130	2,125			
S96T000258		DL	8,910 µg/mL	8,940 µg/mL	8,925 µg/mL (6,660 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	2,310	2,810	2,560[QC:c]	2,560	9.8	9,060
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	1,930	1,940	1,935	1,940	0.3	6,870

Table A-24. Tank 241-BY-106 Analytical Results: Samarium.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	< 36.9	< 38.3	< 37.6	< 49.2	N/A	< 174
S95T004192	121: 3	Upper ½	< 46.2	< 47.5	< 46.85			
S95T004193		Lower ½	< 40.7	< 37.6	< 39.15			
S95T004194	121: 4	Upper ½	< 44.4	< 51.7	< 48.05			
S95T004195		Lower ½	< 50.6	< 44.2	< 47.4			
S95T004196	121: 5	Upper ½	< 52.8	< 46.9	< 49.85			
S95T004197	121: 6	Upper ½	< 50.1	< 51.9	< 51			
S95T004198	121: 7	Upper ½	< 47.6	< 45.6	< 46.6			
S95T004199	121: 8	Upper ½	< 48.3	< 46.6	< 47.45			
S95T004200		Lower ½	< 42.4	< 40.8	< 41.6			
S95T004201	121: 9	Upper ½	< 47.5	< 46.2	< 46.85			
S96T000108	121:10	Upper ½	< 45.3	< 46.8	< 46.05			
S96T000252	121:10B	Upper ½	< 43.2	< 44.2	< 43.7			
S96T000253		Lower ½	< 41.5	< 40	< 40.75			
S96T000258		DL	< 140 µg/mL	< 140 µg/mL	< 140 µg/mL (< 104 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	< 57	< 58.1	< 57.55	< 57.6	N/A	< 204
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	< 47.7	< 46.9	< 47.3	< 47.3	N/A	< 167

Table A-25. Tank 241-BY-106 Analytical Results: Selenium.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	< 36.9	< 38.3	< 37.6	< 49.2	N/A	< 174
S95T004192	121: 3	Upper ½	< 46.2	< 47.5	< 46.85			
S95T004193		Lower ½	< 40.7	< 37.6	< 39.15			
S95T004194	121: 4	Upper ½	< 44.4	< 51.7	< 48.05			
S95T004195		Lower ½	< 50.6	< 44.2	< 47.4			
S95T004196	121: 5	Upper ½	< 52.8	< 46.9	< 49.85			
S95T004197	121: 6	Upper ½	< 50.1	< 51.9	< 51			
S95T004198	121: 7	Upper ½	< 47.6	< 45.6	< 46.6			
S95T004199	121: 8	Upper ½	< 48.3	< 46.6	< 47.45			
S95T004200		Lower ½	< 42.4	< 40.8	< 41.6			
S95T004201	121: 9	Upper ½	< 47.5	< 46.2	< 46.85			
S96T000108	121:10	Upper ½	< 45.3	< 46.8	< 46.05			
S96T000252	121:10B	Upper ½	< 43.2	< 44.2	< 43.7			
S96T000253		Lower ½	< 41.5	< 40	< 40.75			
S96T000258		DL	< 140 µg/mL	< 140 µg/mL	< 140 µg/mL (< 104 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	< 57	< 58.1	< 57.55	< 57.6	N/A	< 204
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	< 47.7	< 46.9	< 47.3	< 47.3	N/A	< 167

Table A-26. Tank 241-BY-106 Analytical Results: Silicon[1]. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004179	121: 1	Upper ½	< 1,040	< 1,050	< 1,045	< 954	N/A	< 3,380
S95T004180	121: 2	Upper ½	< 924	< 1,010	< 967			
S96T001415		Upper ½	948	1,020	984			
S95T004181	121: 3	Upper ½	< 983	< 977	< 980			
S95T004182		Lower ½	< 1,070	< 1,060	< 1,065			
S95T004183	121: 4	Upper ½	< 935	< 985	< 960			
S95T004184		Lower ½	< 975	< 940	< 957.5			
S95T004185	121: 5	Upper ½	< 882	< 929	< 905.5			
S95T004186	121: 6	Upper ½	< 1,030	< 1,050	< 1,040			
S95T004187	121: 7	Upper ½	< 967	< 969	< 968			
S96T001378		Upper ½	< 675	800	737.5			
S95T004188	121: 8	Upper ½	< 871	< 948	< 909.5			
S95T004189		Lower ½	< 1,050	< 1,130	< 1,090			
S95T004190	121: 9	Upper ½	< 1,130	< 1,070	< 1,100			
S96T000106	121:10	Upper ½	< 1,070	< 1,170	< 1,120			
S96T000107	121:10A	Upper ½	< 1,090	< 1,070	< 1,080			
S96T000250	121:10B	Upper ½	< 908	< 863	< 885.5			
S96T000251		Lower ½	< 1,170	< 1,200	< 1,185			
S96T000258		DL	184 µg/mL	190 µg/mL	187 µg/mL (140 µg/g)			

Table A-26. Tank 241-BY-106 Analytical Results: Silicon[1]. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	1,120	136	628[QC:b,e]	184	20.2	651
S95T004192	121: 3	Upper ½	146	42.8	94.4[QC:b,e]			
S95T004193		Lower ½	233	203	218[QC:b,e]			
S95T004194	121: 4	Upper ½	36.4	412	224.2[QC:b,e]			
S95T004195		Lower ½	166	468	317[QC:b,e]			
S95T004196	121: 5	Upper ½	197	53.2	125.1[QC:b,e]			
S95T004197	121: 6	Upper ½	120	89.2	104.6[QC:b,e]			
S95T004198	121: 7	Upper ½	32.3	122	77.15[QC:b,e]			
S95T004199	121: 8	Upper ½	188	153	170.5[QC:b,e]			
S95T004200		Lower ½	188	205	196.5[QC:b]			
S95T004201	121: 9	Upper ½	212	266	239[QC:b,e]			
S96T000108	121:10	Upper ½	93.5	94.2	93.85[QC:b]			
S96T000252	121:10B	Upper ½	38.5	37.1	37.8[QC:b]			
S96T000253		Lower ½	78.1	110	94.05[QC:b,e]			
S96T000258		DL	184 µg/mL	190 µg/mL	187 µg/mL (140 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	152	196	174[QC:e]	174	12.6	616
Composite: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000379	1-10B	Composite	< 897	< 965	< 931	< 931	N/A	3,300

Table A-26. Tank 241-BY-106 Analytical Results: Silicon[1]. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	405	445	425[QC:b]	425	4.7	1,500

Note:

[1]Silicon results are probably biased high and should be used with caution. Acid in the presence of fluoride generates hydrogen fluoride that leaches Si from the laboratory glassware.

Table A-27. Tank 241-BY-106 Analytical Results: Silver.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	11.3	10.4	10.85	14.5	3.6	51.3
S95T004192	121: 3	Upper ½	15	15.6	15.3			
S95T004193		Lower ½	15.6	16.1	15.85			
S95T004194	121: 4	Upper ½	15.1	15.5	15.3			
S95T004195		Lower ½	15.7	16.9	16.3			
S95T004196	121: 5	Upper ½	15.1	15.9	15.5			
S95T004197	121: 6	Upper ½	16.4	15.4	15.9			
S95T004198	121: 7	Upper ½	15.8	16	15.9			
S95T004199	121: 8	Upper ½	14.8	14.1	14.45			
S95T004200		Lower ½	15.3	14.6	14.95			
S95T004201	121: 9	Upper ½	17	16.7	16.85			
S96T000108	121:10	Upper ½	15.6	15.1	15.35			
S96T000252	121:10B	Upper ½	12.8	12	12.4			
S96T000253		Lower ½	14.3	10.5	12.4[QC:e]			
S96T000258		DL	< 14 µg/mL	< 14 µg/mL	< 14 µg/mL (< 10.4 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	18.2	21.2	19.7	19.7	7.6	69.7
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	16.8	16	16.4	16.4	2.4	58.1

Table A-28. Tank 241-BY-106 Analytical Results: Sodium. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004179	121: 1	Upper ½	2.240E+05	2.270E+05	2.255E+05	2.11E+05	4.0	7.47E+05
S95T004180	121: 2	Upper ½	1.560E+05	2.560E+05	2.060E+05[QC:e]			
S96T001415		Upper ½	1.740E+05	1.720E+05	1.730E+05			
S95T004181	121: 3	Upper ½	2.370E+05	2.330E+05	2.350E+05			
S95T004182		Lower ½	2.440E+05	2.350E+05	2.395E+05			
S95T004183	121: 4	Upper ½	2.440E+05	2.540E+05	2.490E+05			
S95T004184		Lower ½	2.390E+05	2.500E+05	2.445E+05			
S95T004185	121: 5	Upper ½	2.200E+05	2.370E+05	2.285E+05			
S95T004186	121: 6	Upper ½	2.250E+05	2.360E+05	2.305E+05			
S95T004187	121: 7	Upper ½	2.010E+05	2.380E+05	2.195E+05[QC:e]			
S96T001378		Upper ½	2.460E+05	1.450E+05	1.955E+05[QC:e]			
S95T004188	121: 8	Upper ½	2.120E+05	2.330E+05	2.225E+05			
S95T004189		Lower ½	2.210E+05	2.230E+05	2.220E+05			
S95T004190	121: 9	Upper ½	2.010E+05	1.890E+05	1.950E+05			
S96T000106	121:10	Upper ½	2.150E+05	2.340E+05	2.245E+05			
S96T000107	121:10A	Upper ½	2.180E+05	2.110E+05	2.145E+05			

Table A-28. Tank 241-BY-106 Analytical Results: Sodium. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000250	121:10B	Upper ½	1.950E+05	1.860E+05	1.905E+05	Cont'd	Cont'd	Cont'd
S96T000251		Lower ½	2.260E+05	2.100E+05	2.180E+05			
S96T000258		DL	2.530E+05 µg/mL	2.600E+05 µg/mL	2.565E+05 µg/mL (1.914 E+05 µg/g)			
S95T000085	65:11	Upper ½	2.150E+05	2.180E+05	2.165E+05			
S95T000100	65:13	Upper ½	2.110E+05	2.116E+05	2.113E+05			
S95T000101		Upper ½	1.274E+05	1.321E+05	1.297E+05			
S95T000322		Upper ½	71,832.2	71,800.2	71,816.2			
Solids/Sludge			µg/g	µg/g	µg/g	µg/g	%	kg
S95T000101	65:13	Upper ½	1.274E+05	1.321E+05	1.297E+05	1.30E+05	1.8	80,100
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	1.520E+05	1.410E+05	1.465E+05	2.03E+05	3.0	7.19E+05
S95T004192	121: 3	Upper ½	2.120E+05	2.200E+05	2.160E+05			
S95T004193		Lower ½	2.160E+05	2.180E+05	2.170E+05			
S95T004194	121: 4	Upper ½	2.110E+05	2.170E+05	2.140E+05			
S95T004195		Lower ½	2.270E+05	2.250E+05	2.260E+05			
S95T004196	121: 5	Upper ½	2.320E+05	2.210E+05	2.265E+05[QC:b,d]			
S95T004197	121: 6	Upper ½	2.260E+05	2.170E+05	2.215E+05[QC:b]			
S95T004198	121: 7	Upper ½	2.240E+05	2.150E+05	2.195E+05[QC:b]			

Table A-28. Tank 241-BY-106 Analytical Results: Sodium. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004199	121: 8	Upper ½	1.990E+05	2.010E+05	2.000E+05[QC:b]	Cont'd	Cont'd	Cont'd
S95T004200		Lower ½	2.100E+05	1.920E+05	2.010E+05[QC:b]			
S95T004201	121: 9	Upper ½	2.080E+05	2.110E+05	2.095E+05[QC:b]			
S96T000108	121:10	Upper ½	2.100E+05	2.170E+05	2.135E+05			
S96T000252	121:10B	Upper ½	1.830E+05	1.720E+05	1.775E+05			
S96T000253		Lower ½	2.000E+05	1.330E+05	1.665E+05[QC:e]			
S96T000258	121:10B	DL	2.530E+05 µg/mL	2.600E+05 µg/mL	2.565E+05 µg/mL (1.914 E+05 µg/g)			
Liquids			µg/mL	µg/mL	µg/mL	µg/mL	%	kg
S95T000004	64: 3	DL	1.410E+05	1.420E+05	1.415E+05	1.42E+05	3.1	N/A
S95T000228		DL	1.300E+05	1.290E+05	1.295E+05			
S94T000355	64: 6	DL	1.400E+05	1.540E+05	1.470E+05			
S94T000371	64:10	DL	1.490E+05	1.500E+05	1.495E+05			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	2.580E+05	3.050E+05	2.815E+05[QC:e]	2.82E+05	8.3	9.98E+05
Composite: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000379	1-10B	Composite	2.580E+05	2.560E+05	2.570E+05	2.57E+05	0.4	9.10E+05
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	2.240E+05	2.110E+05	2.175E+05[QC:b]	2.18E+05	3.0	7.71E+05

Table A-29. Tank 241-BY-106 Analytical Results: Strontium.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	52.3	47.3	49.8	44.4	16.5	157
S95T004192	121: 3	Upper ½	33	32.1	32.55			
S95T004193		Lower ½	25.4	25.5	25.45			
S95T004194	121: 4	Upper ½	17.2	18.5	17.85			
S95T004195		Lower ½	103	97.5	100.25			
S95T004196	121: 5	Upper ½	77.7	64.6	71.15[QC:e]			
S95T004197	121: 6	Upper ½	58.5	51.9	55.2[QC:e]			
S95T004198	121: 7	Upper ½	49.4	47.3	48.35			
S95T004199	121: 8	Upper ½	64.2	65.4	64.8			
S95T004200		Lower ½	76.9	78.1	77.5			
S95T004201	121: 9	Upper ½	62.7	72.9	67.8[QC:e]			
S96T000108	121:10	Upper ½	16.4	10.1	13.25[QC:e]			
S96T000252	121:10B	Upper ½	< 4.32	< 4.42	< 4.37			
S96T000253		Lower ½	12.6	40.8	26.7[QC:e]			
S96T000258		DL	< 14 µg/mL	< 14 µg/mL	< 14 µg/mL (< 10.4 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	15.6	24.4	20[QC:e]	20	22.0	70.8
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	42.9	42.4	42.65	42.7	0.6	151

Table A-30. Tank 241-BY-106 Analytical Results: Sulfur.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	4,700	4,410	4,555	3,280	14.1	11,600
S95T004192	121: 3	Upper ½	3,750	3,780	3,765			
S95T004193		Lower ½	3,800	3,820	3,810			
S95T004194	121: 4	Upper ½	1,460	1,480	1,470			
S95T004195		Lower ½	3,720	3,550	3,635			
S95T004196	121: 5	Upper ½	4,210	3,830	4,020			
S95T004197	121: 6	Upper ½	3,080	2,880	2,980			
S95T004198	121: 7	Upper ½	4,500	4,140	4,320			
S95T004199	121: 8	Upper ½	5,420	5,680	5,550			
S95T004200		Lower ½	6,050	5,490	5,770			
S95T004201	121: 9	Upper ½	4,780	5,430	5,105[QC:e]			
S96T000108	121:10	Upper ½	1,620	1,100	1,360[QC:e]			
S96T000252	121:10B	Upper ½	322	309	315.5[QC:a]			
S96T000253		Lower ½	1,050	3,530	2,290[QC:e]			
S96T000258		DL	325 µg/mL	342 µg/mL	333.5 µg/mL (249 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	4,250	4,770	4,510[QC:e]	4,510	5.8	16,000
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	3,370	3,050	3,210	3,210	5.0	11,400

Table A-31. Tank 241-BY-106 Analytical Results: Thallium.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	< 73.8	< 76.6	< 75.2	< 98.3	N/A	< 348
S95T004192	121: 3	Upper ½	< 92.4	< 94.9	< 93.65			
S95T004193		Lower ½	< 81.3	< 75.3	< 78.3			
S95T004194	121: 4	Upper ½	< 88.9	< 103	< 95.95			
S95T004195		Lower ½	< 101	< 88.5	< 94.75			
S95T004196	121: 5	Upper ½	< 106	< 93.8	< 99.9			
S95T004197	121: 6	Upper ½	< 100	< 104	< 102			
S95T004198	121: 7	Upper ½	< 95.2	< 90.9	< 93.05			
S95T004199	121: 8	Upper ½	< 96.6	< 93.1	< 94.85			
S95T004200		Lower ½	< 84.9	< 81.5	< 83.2			
S95T004201	121: 9	Upper ½	< 95	< 92.4	< 93.7			
S96T000108	121:10	Upper ½	< 90.6	< 93.6	< 92.1			
S96T000252	121:10B	Upper ½	< 86.4	< 88.5	< 87.45			
S96T000253		Lower ½	< 83.1	< 79.7	< 81.4			
S96T000258		DL	< 280 µg/mL	< 280 µg/mL	< 280 µg/mL (< 209 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	< 114	< 116	< 115	< 115	N/A	< 407
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	< 95.5	< 93.8	< 94.65	< 94.7	N/A	< 335

Table A-32. Tank 241-BY-106 Analytical Results: Titanium.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	9.27	< 3.83	< 6.55	< 5.10	N/A	< 18.1
S95T004192	121: 3	Upper ½	< 4.62	< 4.75	< 4.685			
S95T004193		Lower ½	< 4.07	< 3.76	< 3.915			
S95T004194	121: 4	Upper ½	< 4.44	< 5.17	< 4.805			
S95T004195		Lower ½	< 5.06	< 4.42	< 4.74			
S95T004196	121: 5	Upper ½	< 5.28	< 4.69	< 4.985			
S95T004197	121: 6	Upper ½	< 5.01	< 5.19	< 5.1			
S95T004198	121: 7	Upper ½	< 4.76	< 4.56	< 4.66			
S95T004199	121: 8	Upper ½	< 4.83	< 4.66	< 4.745			
S95T004200		Lower ½	< 4.24	< 4.08	< 4.16			
S95T004201	121: 9	Upper ½	< 4.75	< 4.62	< 4.685			
S96T000108	121:10	Upper ½	< 4.53	< 4.68	< 4.605			
S96T000252	121:10B	Upper ½	< 4.32	< 4.42	< 4.37			
S96T000253		Lower ½	< 4.15	< 4	< 4.075			
S96T000258		DL	< 14 µg/mL	< 14 µg/mL	< 14 µg/mL (< 10.4 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	< 5.7	< 5.81	< 5.755	< 5.76	N/A	< 20.4
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	< 4.77	< 4.69	< 4.73	< 4.73	N/A	< 16.7

Table A-33. Tank 241-BY-106 Analytical Results: Total Uranium (Phosphoresence).

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004179	121: 1	Upper ½	12.7	11.9	12.3	164.2	13.8	581
S95T004180	121: 2	Upper ½	132	110	121			
S96T001415		Upper ½	185	189	187			
S95T004181	121: 3	Upper ½	142	138	140			
S95T004182		Lower ½	113	125	119			
S95T004183	121: 4	Upper ½	168	169	168.5			
S95T004184		Lower ½	303	316	309.5			
S95T004185	121: 5	Upper ½	271	339	305[QC:e]			
S95T004186	121: 6	Upper ½	179	206	192.5			
S95T004187	121: 7	Upper ½	44.2	173	108.6[QC:e]			
S96T001378		Upper ½	218	196	207			
S95T004188	121: 8	Upper ½	238	253	245.5			
S95T004189		Lower ½	340	327	333.5			
S95T004190	121: 9	Upper ½	234	235	234.5			
S96T000106	121:10	Upper ½	64.8	71.8	68.3			
S96T000107	121:10A	Upper ½	127	114	120.5			
S96T000250	121:10B	Upper ½	20.1	19.1	19.6			
S96T000251		Lower ½	66.6	60.8	63.7			
Composite: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000379	1-10B	Composite	167	183	175	175	4.6	620

Table A-34. Tank 241-BY-106 Analytical Results: Total Uranium (ICP). (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004179	121: 1	Upper ½	< 10,400	< 10,500	< 10,450	< 9,720	N/A	< 34,400
S95T004180	121: 2	Upper ½	< 9,240	< 10,100	< 9,670			
S96T001415		Upper ½	< 7,330	< 7,220	< 7,275			
S95T004181	121: 3	Upper ½	< 9,830	< 9,770	< 9,800			
S95T004182		Lower ½	< 10,700	< 10,600	< 10,650			
S95T004183	121: 4	Upper ½	< 9,350	< 9,850	< 9,600			
S95T004184		Lower ½	< 9,750	< 9,400	< 9,575			
S95T004185	121: 5	Upper ½	< 8,820	< 9,290	< 9,055			
S95T004186	121: 6	Upper ½	< 10,300	< 10,500	< 10,400			
S95T004187	121: 7	Upper ½	< 9,670	< 9,690	< 9,680			
S96T001378		Upper ½	< 6,750	< 6,170	< 6,460			
S95T004188	121: 8	Upper ½	< 8,710	< 9,480	< 9,095			
S95T004189		Lower ½	< 10,500	< 11,300	< 10,900			
S95T004190	121: 9	Upper ½	< 11,300	< 10,700	< 11,000			
S96T000106	121:10	Upper ½	< 10,700	< 11,700	< 11,200			
S96T000107	121:10A	Upper ½	< 10,900	< 10,700	< 10,800			
S96T000250	121:10B	Upper ½	< 9,080	< 8,630	< 8,855			
S96T000251		Lower ½	< 11,700	< 12,000	< 11,850			
S96T000258	121:10B	DL	< 700 µg/mL	< 700 µg/mL	< 700 µg/mL (< 522 µg/g)			
S95T000322	65:13	Upper ½	< 17,600	< 17,567.6	< 17,583.8			

Table A-34. Tank 241-BY-106 Analytical Results: Total Uranium (ICP). (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	< 185	< 192	< 188.5	< 254	N/A	< 899
S95T004192	121: 3	Upper ½	< 231	< 237	< 234			
S95T004193		Lower ½	< 203	< 188	< 195.5			
S95T004194	121: 4	Upper ½	< 222	< 260	< 241			
S95T004195		Lower ½	275	267	271			
S95T004196	121: 5	Upper ½	< 264	< 234	< 249			
S95T004197	121: 6	Upper ½	< 251	< 259	< 255			
S95T004198	121: 7	Upper ½	< 238	< 227	< 232.5			
S95T004199	121: 8	Upper ½	< 241	< 233	< 237			
S95T004200		Lower ½	258	274	266			
S95T004201	121: 9	Upper ½	264	268	266			
S96T000108	121:10	Upper ½	< 227	< 234	< 230.5			
S96T000252	121:10B	Upper ½	< 216	< 221	< 218.5			
S96T000253		Lower ½	< 208	< 199	< 203.5			
S96T000258		DL	< 700 µg/mL	< 700 µg/mL	< 700 µg/mL (< 522 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	< 285	< 291	< 288	< 288	N/A	< 1,020
Composite: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000379	1-10B	Composite	< 8,970	< 9,650	< 9,310	< 9,310	N/A	< 33,000

Table A-34. Tank 241-BY-106 Analytical Results: Total Uranium (ICP). (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	< 239	< 235	< 237	< 237	N/A	< 839

Table A-35. Tank 241-BY-106 Analytical Results: Vanadium.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	< 18.5	< 19.2	< 18.85	< 24.6	N/A	< 87.1
S95T004192	121: 3	Upper ½	< 23.1	< 23.7	< 23.4			
S95T004193		Lower ½	< 20.3	< 18.8	< 19.55			
S95T004194	121: 4	Upper ½	< 22.2	< 26	< 24.1			
S95T004195		Lower ½	< 25.3	< 22.1	< 23.7			
S95T004196	121: 5	Upper ½	< 26.4	< 23.4	< 24.9			
S95T004197	121: 6	Upper ½	< 25.1	< 25.9	< 25.5			
S95T004198	121: 7	Upper ½	< 23.8	< 22.7	< 23.25			
S95T004199	121: 8	Upper ½	< 24.1	< 23.3	< 23.7			
S95T004200		Lower ½	< 21.2	< 20.4	< 20.8			
S95T004201	121: 9	Upper ½	< 23.7	< 23.1	< 23.4			
S96T000108	121:10	Upper ½	< 22.7	< 23.4	< 23.05			
S96T000252	121:10B	Upper ½	< 21.6	< 22.1	< 21.85			
S96T000253		Lower ½	< 20.8	< 19.9	< 20.35			
S96T000258		DL	< 70 µg/mL	< 70 µg/mL	< 70 µg/mL (< 52.2 µg/g)			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	< 28.5	< 29.1	< 28.8	< 28.8	N/A	< 102
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	< 23.9	< 23.5	< 23.7	< 23.7	N/A	< 83.9

Table A-36. Tank 241-BY-106 Analytical Results: Zinc. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004179	121: 1	Upper ½	< 208	< 211	< 209.5	< 446	N/A	< 1,580
S95T004180	121: 2	Upper ½	< 185	< 203	< 194			
S96T001415		Upper ½	< 147	< 144	< 145.5			
S95T004181	121: 3	Upper ½	< 197	< 195	< 196			
S95T004182		Lower ½	< 214	< 213	< 213.5			
S95T004183	121: 4	Upper ½	< 187	< 197	< 192			
S95T004184		Lower ½	< 195	< 188	< 191.5			
S95T004185	121: 5	Upper ½	< 176	< 186	< 181			
S95T004186	121: 6	Upper ½	< 205	< 210	< 207.5			
S95T004187	121: 7	Upper ½	< 193	< 194	< 193.5			
S96T001378		Upper ½	< 135	< 123	< 129			
S95T004188	121: 8	Upper ½	< 174	< 181	< 177.5			
S95T004189		Lower ½	< 210	< 225	< 217.5			
S95T004190	121: 9	Upper ½	< 226	< 215	< 220.5			
S96T000106	121:10	Upper ½	10,400	1,250	5,825[QC:e]			
S96T000107	121:10A	Upper ½	< 220	< 213	< 216.5			
S96T000250	121:10B	Upper ½	< 182	< 173	< 177.5			
S96T000251		Lower ½	< 233	< 232	< 232.5			
S96T000258	121:10B	DL	< 14 µg/mL	< 14 µg/mL	< 14 µg/mL (< 10.4 µg/g)			

Table A-36. Tank 241-BY-106 Analytical Results: Zinc. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T000085	65:11	Upper ½	< 108	< 208	< 158	Cont'd	Cont'd	Cont'd
S95T000100	65:13	Upper ½	< 50.9061	87.4227	< 69.1644			
Solids/Sludge			µg/g	µg/g	µg/g	µg/g	%	kg
S95T000101	65:13	Upper ½	205.182	183.804	194.493	194	5.5	120
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	25.3	24.3	24.8	18.4	4.9	65.1
S95T004192	121: 3	Upper ½	22.3	22.4	22.35			
S95T004193		Lower ½	20.5	18.4	19.45			
S95T004194	121: 4	Upper ½	16.2	17	16.6			
S95T004195		Lower ½	17.7	17.6	17.65			
S95T004196	121: 5	Upper ½	18.3	17.7	18			
S95T004197	121: 6	Upper ½	16.6	15.8	16.2			
S95T004198	121: 7	Upper ½	17.4	17.1	17.25			
S95T004199	121: 8	Upper ½	18.2	17.1	17.65			
S95T004200		Lower ½	23.7	21.3	22.5			
S95T004201	121: 9	Upper ½	22.8	21.9	22.35			
S96T000108	121:10	Upper ½	16.7	18.1	17.4			
S96T000252	121:10B	Upper ½	16.8	16.9	16.85			
S96T000253		Lower ½	17.6	16.3	16.95			
S96T000258		DL	< 14 µg/mL	< 14 µg/mL	< 14 µg/mL (< 10.4 µg/g)			

Table A-36. Tank 241-BY-106 Analytical Results: Zinc. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	12.2	17.1	14.65[QC:c]	14.7	16.7	52
Composite: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000379	1-10B	Composite	< 179	< 193	< 186	< 186	N/A	< 658
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	22	17.4	19.7[QC:c]	19.7	11.7	69.7

Table A-37. Tank 241-BY-106 Analytical Results: Zirconium.[1] (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004179	121: 1	Upper ½	6,160	6,170	6,165	4,720	8.0	16,700
S95T004180	121: 2	Upper ½	4,420	3,040	3,730[QC:e]			
S96T001415		Upper ½	6,470	5,840	6,155			
S95T004181	121: 3	Upper ½	5,610	5,590	5,600			
S95T004182		Lower ½	5,380	5,290	5,335			
S95T004183	121: 4	Upper ½	5,200	5,480	5,340			
S95T004184		Lower ½	2,490	4,990	3,740[QC:e]			
S95T004185	121: 5	Upper ½	5,830	6,150	5,990			
S95T004186	121: 6	Upper ½	4,840	6,010	5,425[QC:e]			
S95T004187	121: 7	Upper ½	4,600	6,130	5,365[QC:e]			
S96T001378		Upper ½	5,370	4,860	5,115			
S95T004188	121: 8	Upper ½	4,810	5,250	5,030			
S95T004189		Lower ½	5,900	6,370	6,135			
S95T004190	121: 9	Upper ½	5,420	5,100	5,260			
S96T000106	121:10	Upper ½	5,430	6,320	5,875[QC:e]			
S96T000107	121:10A	Upper ½	5,710	5,550	5,630			
S96T000250	121:10B	Upper ½	3,700	3,580	3,640			
S96T000251		Lower ½	6,590	3,970	5,280[QC:e]			
S96T000258D		DL	< 14 µg/mL	< 14 µg/mL	< 14 µg/mL (< 10.4 µg/g)			

Table A-37. Tank 241-BY-106 Analytical Results: Zirconium.[1] (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S95T000085	65:11	Upper ½	4,000	4,300	4,150	Cont'd	Cont'd	Cont'd
S95T000100	65:13	Upper ½	120.832	127.823	124.328			
Solids/Sludge			µg/g	µg/g	µg/g	µg/g	%	kg
S95T000101	65:13	Upper ½	592.804	585.634	589.219	589	0.6	363
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004191	121: 2	Upper ½	8.05	5.33	6.69[QC:e]	6.28	8.4	22.2
S95T004192	121: 3	Upper ½	< 4.62	< 4.75	< 4.685			
S95T004193		Lower ½	< 4.07	< 3.76	< 3.915			
S95T004194	121: 4	Upper ½	< 4.44	< 5.17	< 4.805[QC:e]			
S95T004195		Lower ½	8.78	7.95	8.365			
S95T004196	121: 5	Upper ½	11.2	8.25	9.725[QC:e]			
S95T004197	121: 6	Upper ½	< 5.01	< 5.19	< 5.1			
S95T004198	121: 7	Upper ½	5.32	5.14	5.23			
S95T004199	121: 8	Upper ½	6.28	6.84	6.56			
S95T004200		Lower ½	7.6	7.05	7.325			
S95T004201	121: 9	Upper ½	7.76	7.36	7.56			
S96T000108	121:10	Upper ½	< 4.53	< 4.68	< 4.605			
S96T000252	121:10B	Upper ½	< 4.32	< 4.42	< 4.37			
S96T000253		Lower ½	4.31	5.39	4.85[QC:e]			
S96T000258		DL	< 14 µg/mL	< 14 µg/mL	< 14 µg/mL (< 10.4 µg/g)			

Table A-37. Tank 241-BY-106 Analytical Results: Zirconium.[1] (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	< 5.7	< 5.81	< 5.755	< 5.76	N/A	< 20.4
Composite: fusion			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000379	1-10B	Composite	3,790	2,450	3,120	3,120	21.5	11,000
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000380	1-10B	Composite	4.86	< 4.69	< 4.775[QC:a]	< 4,78	N/A	< 16.9

Note:

[1]Fusion preparations were performed in zirconium crucibles. The fusion results are biased high and should be used with extreme caution.

Table A-38. Tank 241-BY-106 Analytical Results: Chloride. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004202	121: 1	Upper ½	695.4	929	812.2[QC:e]	2,060	14.2	7,290
S95T004203	121: 2	Upper ½	1,479	1,580	1,529.5			
S95T004204	121: 3	Upper ½	1,388	1,310	1,349			
S95T004205		Lower ½	1,734	1,740	1,737			
S95T004206	121: 4	Upper ½	1,426	1,090	1,258[QC:e]			
S95T004207		Lower ½	1,337	531	934[QC:e]			
S95T004208	121: 5	Upper ½	1,814	1,620	1,717			
S95T004209	121: 6	Upper ½	1,601	1,390	1,495.5			
S95T004210	121: 7	Upper ½	1,642	1,720	1,681			
S95T004211	121: 8	Upper ½	1,896	2,130	2,013			
S95T004212		Lower ½	2,959	3,620	3,289.5[QC:e]			
S95T004213	121: 9	Upper ½	4,472	1,960	3,216[QC:e]			
S96T000109	121:10	Upper ½	1,136	1,200	1,168			
S96T000254	121:10B	Upper ½	3,660	2,850	3,255[QC:e]			
S96T000255		Lower ½	2,156	2,140	2,148			
S96T000258	121:10B	DL	7,207 µg/mL	6,990 µg/mL	7,098.5 µg/mL (5,297.4 µg/g)			

Table A-38. Tank 241-BY-106 Analytical Results: Chloride. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Liquids			µg/mL	µg/mL	µg/mL	µg/mL	%	kg
S95T000004	64: 3	DL	3,790	3,880	3,835	4,040	5.1	N/A
S95T000228		DL	3,610	3,510	3,560			
S94T000355	64: 6	DL	4,420	4,280	4,350			
S94T000371	64:10	DL	4,360	4,470	4,415			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	1,959	2,460	2,209.5[QC:e]	2,210	11.3	7,820

Table A-39. Tank 241-BY-106 Analytical Results: Fluoride. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004202	121: 1	Upper ½	912.2	1,090	1,001.1[QC:e]	5,130	17.6	18,200
S95T004203	121: 2	Upper ½	7,448	7,810	7,629			
S95T004204	121: 3	Upper ½	5,065	5,160	5,112.5			
S95T004205		Lower ½	6,320	6,580	6,450			
S95T004206	121: 4	Upper ½	6,010	5,490	5,750			
S95T004207		Lower ½	12,220	5,610	8,915[QC:e]			
S95T004208	121: 5	Upper ½	13,020	15,300	14,160[QC:e]			
S95T004209	121: 6	Upper ½	4,813	4,240	4,526.5			
S95T004210	121: 7	Upper ½	4,228	4,260	4,244			
S95T004211	121: 8	Upper ½	5,823	6,210	6,016.5			
S95T004212		Lower ½	7,343	7,170	7,256.5			
S95T004213	121: 9	Upper ½	6,677	6,470	6,573.5			
S96T000109	121:10	Upper ½	1,523	1,930	1,726.5[QC:e]			
S96T000254	121:10B	Upper ½	956.9	1,160	1,058.45[QC:e]			
S96T000255		Lower ½	1,501	833	1,167[QC:e]			
S96T000258		DL	567.6 µg/mL	541 µg/mL	554.3 µg/mL (414 µg/g)			

Table A-39. Tank 241-BY-106 Analytical Results: Fluoride. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Liquids			µg/mL	µg/mL	µg/mL	µg/mL	%	kg
S95T000004	64: 3	DL	223	213	218	228	2.5	N/A
S95T000228		DL	222	227	224.5			
S94T000355	64: 6	DL	246	242	244			
S94T000371	64:10	DL	231	216	223.5			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	6,375	9,230	7,802.5[QC:e]	7,800	18.3	27,600

Table A-40. Tank 241-BY-106 Analytical Results: Nitrate. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004202	121: 1	Upper ½	2.267E+05	2.840E+05	2.554E+05[QC:e]	3.29E+05	11.2	1.16E+06
S95T004203	121: 2	Upper ½	49,670	50,900	50,285			
S95T004204	121: 3	Upper ½	4.001E+05	4.010E+05	4.006E+05			
S95T004205		Lower ½	3.499E+05	3.270E+05	3.385E+05			
S95T004206	121: 4	Upper ½	5.698E+05	5.370E+05	5.534E+05			
S95T004207		Lower ½	4.629E+05	2.460E+05	3.545E+05[QC:e]			
S95T004208	121: 5	Upper ½	3.549E+05	3.100E+05	3.325E+05			
S95T004209	121: 6	Upper ½	5.182E+05	4.540E+05	4.861E+05			
S95T004210	121: 7	Upper ½	4.566E+05	4.410E+05	4.488E+05			
S95T004211	121: 8	Upper ½	1.948E+05	2.380E+05	2.164E+05[QC:e]			
S95T004212		Lower ½	1.370E+05	1.600E+05	1.485E+05			
S95T004213	121: 9	Upper ½	2.822E+05	2.720E+05	2.771E+05			
S96T000109	121: 10	Upper ½	5.691E+05	5.230E+05	5.461E+05			
S96T000254	121: 10B	Upper ½	2.302E+05	3.750E+05	3.026E+05[QC:e]			
S96T000255		Lower ½	4.511E+05	3.970E+05	4.241E+05			
S96T000258	121: 10B	DL	1.656E+05 µg/mL	1.650E+05 µg/mL	1.653E+05µg/mL (1.234E+05 µg/g)			

Table A-40. Tank 241-BY-106 Analytical Results: Nitrate. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Liquids			µg/mL	µg/mL	µg/mL	µg/mL	%	kg
S95T000004	64: 3	DL	99,300	99,600	99,450	96,500	7.5	N/A
S95T000228		DL	1.150E+05	1.130E+05	1.140E+05			
S94T000355	64: 6	DL	79,200	79,300	79,250			
S94T000371	64: 10	DL	93,100	93,500	93,300			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	3.819E+05	4.680E+05	4.250E+05[QC:e]	4.25E+05	10.1	1.50E+06

Table A-41. Tank 241-BY-106 Analytical Results: Nitrite. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004202	121: 1	Upper ½	12,670	15,900	14,285[QC:e]	32,100	14.4	114,000
S95T004203	121: 2	Upper ½	21,410	21,800	21,605			
S95T004204	121: 3	Upper ½	19,560	18,900	19,230			
S95T004205		Lower ½	26,020	27,300	26,660			
S95T004206	121: 4	Upper ½	22,790	23,000	22,895			
S95T004207		Lower ½	25,800	26,100	25,950			
S95T004208	121: 5	Upper ½	27,430	24,800	26,115			
S95T004209	121: 6	Upper ½	23,890	21,000	22,445			
S95T004210	121: 7	Upper ½	25,890	27,000	26,445			
S95T004211	121: 8	Upper ½	38,920	43,100	41,010			
S95T004212		Lower ½	46,490	45,100	45,795			
S95T004213	121: 9	Upper ½	30,530	29,100	29,815			
S96T000109	121: 10	Upper ½	17,250	18,800	18,025			
S96T000254	121: 10B	Upper ½	60,690	45,300	52,995[QC:e]			
S96T000255		Lower ½	32,640	30,100	31,370			
S96T000258		DL	1.193E+05 µg/mL	1.210E+05 µg/mL	1.202E+05 µg/mL (8.97E+04 µg/g)			

Table A-41. Tank 241-BY-106 Analytical Results: Nitrite. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Liquids			µg/mL	µg/mL	µg/mL	µg/mL	%	kg
S95T000004	64: 3	DL	65,000	64,100	64,550	67,600	4.4	N/A
S95T000228		DL	61,500	60,200	60,850			
S94T000355	64: 6	DL	71,000	71,700	71,350			
S94T000371	64: 10	DL	73,800	73,700	73,750			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	23,350	31,000	27,175[QC:e]	27,200	14.1	96,300

Table A-42. Tank 241-BY-106 Analytical Results: Phosphate. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004202	121: 1	Upper ½	4,376	5,020	4,698	5,270	18.0	18,700
S95T004203	121: 2	Upper ½	12,580	15,500	14,040[QC:e]			
S95T004204	121: 3	Upper ½	4,932	8,890	6,911[QC:e]			
S95T004205		Lower ½	5,548	4,240	4,894[QC:e]			
S95T004206	121: 4	Upper ½	3,320	2,470	2,895[QC:e]			
S95T004207		Lower ½	3,118	2,400	2,759[QC:e]			
S95T004208	121: 5	Upper ½	14,710	12,500	13,605[QC:e]			
S95T004209	121: 6	Upper ½	6,506	6,650	6,578			
S95T004210	121: 7	Upper ½	4,825	5,330	5,077.5			
S95T004211	121: 8	Upper ½	2,526	2,410	2,468			
S95T004212		Lower ½	2,393	2,360	2,376.5			
S95T004213	121: 9	Upper ½	2,305	2,420	2,362.5			
S96T000109	121: 10	Upper ½	3,852	< 920	2,386			
S96T000254	121: 10B	Upper ½	6,967	8,500	7,733.5[QC:e]			
S96T000255		Lower ½	3,957	3,740	3,848.5			
S96T000258		DL	2,299 µg/mL	2,320 µg/mL	2,309.5 µg/mL (1,723.5 µg/g)			

Table A-42. Tank 241-BY-106 Analytical Results: Phosphate. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Liquids			µg/mL	µg/mL	µg/mL	µg/mL	%	kg
S95T000004	64: 3	DL	< 2,120	< 2,120	< 2,120	< 1,910	N/A	N/A
S95T000228		DL	< 1,270	< 1,270	< 1,270			
S94T000355	64: 6	DL	< 2,120	< 2,120	< 2,120			
S94T000371	64: 10	DL	< 2,120	< 2,120	< 2,120			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	3,172	9,280	6,226	6,230	49.1	22,100

Table A-43. Tank 241-BY-106 Analytical Results: Sulfate. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004202	121: 1	Upper ½	3,707	4,360	4,033.5[QC:e]	11,300	13.4	40,000
S95T004203	121: 2	Upper ½	15,420	16,400	15,910			
S95T004204	121: 3	Upper ½	13,900	12,400	13,150			
S95T004205		Lower ½	12,680	13,000	12,840			
S95T004206	121: 4	Upper ½	5,326	5,390	5,358			
S95T004207		Lower ½	12,570	6,520	9,545[QC:e]			
S95T004208	121: 5	Upper ½	18,000	15,300	16,650[QC:e]			
S95T004209	121: 6	Upper ½	14,830	13,000	13,915			
S95T004210	121: 7	Upper ½	16,440	16,400	16,420			
S95T004211	121: 8	Upper ½	14,800	15,800	15,300			
S95T004212		Lower ½	21,840	19,900	20,870			
S95T004213	121: 9	Upper ½	19,700	18,500	19,100			
S96T000109	121: 10	Upper ½	6,529	8,010	7,269.5[QC:e]			
S96T000254	121: 10B	Upper ½	3,482	4,060	3,771			
S96T000255		Lower ½	6,044	5,030	5,537[QC:e]			
S96T000258		DL	1,940 µg/mL	2,170 µg/mL	2,055 µg/mL (1,533 µg/g)			
Liquids			µg/mL	µg/mL	µg/mL	µg/mL	%	kg
S95T000004	64: 3	DL	< 2,120	< 2,120	< 2,120	< 2,020	N/A	N/A
S95T000228		DL	< 1,700	< 1,700	< 1,700			

Table A-43. Tank 241-BY-106 Analytical Results: Sulfate. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Liquids			µg/mL	µg/mL	µg/mL	µg/mL	%	kg
S94T000355	64: 6	DL	< 2,120	< 2,120	< 2,120	Cont'd	Cont'd	Cont'd
S94T000371	64: 10	DL	< 2,120	< 2,120	< 2,120			
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	12,030	14,200	13,115[QC:e]	13,100	8.3	46,400

Table A-44. Tank 241-BY-106 Analytical Results: Americium-241.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			**µCi/g**	**µCi/g**	**µCi/g**	**µCi/g**	**%**	**Ci**
S95T004179	121: 1	Upper ½	< 0.4934	< 0.498	< 0.4957	< 0.377	N/A	< 1,330
S95T004180	121: 2	Upper ½	< 0.4811	< 0.501	< 0.49105			
S96T001415		Upper ½	< 0.08349	< 0.0852	< 0.084345			
S95T004181	121: 3	Upper ½	< 0.5165	< 0.509	< 0.51275			
S95T004182		Lower ½	< 0.5994	< 0.588	< 0.5937			
S96T001378	121: 7	Upper ½	< 0.08417	< 0.0811	< 0.082635			
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**	**µCi/mL**	**%**	**Ci**
S95T000004	64: 3	DL	< 4.660E-05	< 4.870E-05	< 4.765E-05	< 4.67E-05	N/A	N/A
S94T000355	64: 6	DL	< 4.870E-05	< 4.510E-05	< 4.690E-05			
S94T000371	64: 10	DL	< 4.380E-05	< 4.750E-05	< 4.565E-05			

Table A-45. Tank 241-BY-106 Analytical Results: Cesium-137. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: acid digest			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S94T000307	64: 1	Upper ½	136	136	136	106	13.9	3.75E+05
S94T000317	64: 2	Upper ½	163	160	161.5			
S94T000318	64: 3	Upper ½	161	154	157.5			
S94T00004		DL	186 µCi/mL	184 µCi/mL	185 µCi/mL (138 µCi/g)			
S94T000319	64: 4	Upper ½	108	129	118.5			
S94T000320		Lower ½	59.5	68.1	63.8			
S94T000351	64: 8	Upper ½	66.2	95.8	81[QC:e]			
S94T000352		Lower ½	76.3	64.8	70.55			
S94T000353		Lower ½	224	232	228			
S94T000354	64: 9	Upper ½	60	58.3	59.15			
S94T000376	64: 10	Upper ½	90.2	89.3	89.75			
S94T000377		Lower ½	60.7	47	53.85[QC:e]			
S94T000371		DL	210 µCi/mL	212 µCi/mL	211 µCi/mL (157 µCi/g)			
S94T000395	64: 11	Upper ½	21.6	18.9	20.25			
S94T000396	64: 12	Upper ½	145	142	143.5			
S94T000397	64: 13	Upper ½	12.9	13.4	13.15			

Table A-45. Tank 241-BY-106 Analytical Results: Cesium-137. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S95T004179	121: 1	Upper ½	56.88	57.5	57.19	89.6	9.9	3.17E+05
S95T004180	121: 2	Upper ½	59.94	60.4	60.17			
S96T001415	121: 2	Upper ½	65.94	67.2	66.57			
S95T004181	121: 3	Upper ½	64.74	65.3	65.02			
S95T004182		Lower ½	83.42	82	82.71			
S95T004183	121: 4	Upper ½	62.92	64.8	63.86			
S95T004184		Lower ½	52.79	60.5	56.645			
S95T004185	121: 5	Upper ½	77.48	81.1	79.29			
S95T004186	121: 6	Upper ½	56.12	59.8	57.96			
S96T001378	121: 7	Upper ½	79.42	75	77.21			
S95T004188	121: 8	Upper ½	114.3	125	119.65			
S95T004189		Lower ½	127.5	124	125.75			
S95T004190	121: 9	Upper ½	82.67	77.1	79.885			
S96T000106	121: 10	Upper ½	45.59	50	47.795			
S96T000107	121: 10A	Upper ½	80.49	79.1	79.795			
S96T000250	121: 10B	Upper ½	135.1	130	132.55			
S96T000251		Lower ½	78.5	68.4	73.45			
S94T000306	64: 1	Upper ½	125	130	127.5			
S94T000312	64: 2	Upper ½	170	174	172			
S94T000314	64: 3	Upper ½	218	215	216.5			

Table A-45. Tank 241-BY-106 Analytical Results: Cesium-137. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			**µCi/g**	**µCi/g**	**µCi/g**	**µCi/g**	**%**	**Ci**
S94T000315	64: 4	Upper ½	133	134	133.5	Cont'd	Cont'd	Cont'd
S94T000316		Lower ½	63	62.7	62.85			
S94T000347	64: 8	Upper ½	73.5	89	81.25			
S94T000349		Lower ½	222	219	220.5			
S94T000350	64: 9	Upper ½	61.2	56.2	58.7			
S94T000374	64: 10	Upper ½	97.7	102	99.85			
S94T000375		Lower ½	62.3	61.2	61.75			
S94T000392	64: 11	Upper ½	20.1	19.5	19.8			
S94T000393	64: 12	Upper ½	85.7	107	96.35[QC:e]			
S94T000394	64: 13	Upper ½	13.1	13.3	13.2			
Solids/Sludge			**µCi/g**	**µCi/g**	**µCi/g**	**µCi/g**	**%**	**Ci**
S95T000101	65: 13	Upper ½	394	621	507.5[QC:e]	508	22.4	3.13E+05
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**	**µCi/mL**	**%**	**Ci**
S95T000004	64:3	DL	186 µCi/mL	184 µCi/mL	185 µCi/mL (138 µCi/g)	207	5.7	N/A
S94T000355	64: 6	DL	226	225	225.5 (168 µCi/g)			
S94T000371	64: 10	DL	210 µCi/mL	212 µCi/mL	211 µCi/mL (157 µCi/g)			
Composite: fusion			**µCi/g**	**µCi/g**	**µCi/g**	**µCi/g**	**%**	**Ci**
S96T000379	1-10B	Composite	70.9	67.3	69.1	69.1	2.6	2.44E+05

Table A-46. Tank 241-BY-106 Analytical Results: Cobalt-60.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S95T004179	121: 1	Upper ½	< 0.01394	< 0.0167	< 0.01532	< 0.0181	N/A	< 64.1
S95T004180	121: 2	Upper ½	< 0.01319	< 0.0203	< 0.016745			
S96T001415		Upper ½	< 0.03368	< 0.0346	< 0.03414			
S95T004181	121: 3	Upper ½	< 0.01819	< 0.0193	< 0.018745			
S95T004182		Lower ½	< 0.02241	< 0.0157	< 0.019055			
S95T004183	121: 4	Upper ½	< 0.01479	< 0.0135	< 0.014145			
S95T004184		Lower ½	< 0.01792	< 0.0186	< 0.01826			
S95T004185	121: 5	Upper ½	< 0.01347	< 0.0144	< 0.013935			
S95T004186	121: 6	Upper ½	< 0.01392	< 0.0154	< 0.01466			
S95T004187	121: 7	Upper ½	< 0.01072	< 0.0136	< 0.01216			
S96T001378		Upper ½	< 0.0313	< 0.029	< 0.03015			
S95T004188	121: 8	Upper ½	< 0.01383	< 0.0176	< 0.015715			
S95T004189		Lower ½	< 0.0195	< 0.0183	< 0.0189			
S95T004190	121: 9	Upper ½	< 0.0195	< 0.0175	< 0.0185			
S96T000106	121: 10	Upper ½	< 0.01636	< 0.0111	< 0.01373			
S96T000107	121: 10A	Upper ½	< 0.01988	< 0.0264	< 0.02314			
S96T000250	121: 10B	Upper ½	< 0.01322	< 0.0122	< 0.01271			
S96T000251		Lower ½	< 0.01549	< 0.0153	< 0.015395			
Solids Sludge: fusion			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S95T000101	65: 13	Upper ½	< 0.0129	< 0.0182	< 0.01555	< 0.0156	N/A	< 9.61
Composite: fusion			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S96T000379	1-10B	Composite	< 0.01472	< 0.0127	< 0.01371	< 0.0137	N/A	< 48.5

Table A-47. Tank 241-BY-106 Analytical Results: Europium-154.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S95T004179	121: 1	Upper ½	< 0.04074	< 0.053	< 0.04687	< 0.0491	N/A	< 174
S95T004180	121: 2	Upper ½	< 0.04825	< 0.0506	< 0.049425			
S96T001415		Upper ½	< 0.07551	< 0.0875	< 0.081505			
S95T004181	121: 3	Upper ½	< 0.03332	< 0.0428	< 0.03806			
S95T004182		Lower ½	< 0.06273	< 0.0553	< 0.059015			
S95T004183	121: 4	Upper ½	< 0.04937	< 0.0355	< 0.042435			
S95T004184		Lower ½	< 0.04897	< 0.041	< 0.044985			
S95T004185	121: 5	Upper ½	< 0.04039	< 0.0424	< 0.041395			
S95T004186	121: 6	Upper ½	< 0.03342	< 0.0478	< 0.04061			
S95T004187	121: 7	Upper ½	< 0.02621	< 0.0422	< 0.034205			
S96T001378		Upper ½	< 0.0742	< 0.0657	< 0.06995			
S95T004188	121: 8	Upper ½	< 0.04276	< 0.0435	< 0.04313			
S95T004189		Lower ½	< 0.04971	< 0.0606	< 0.055155			
S95T004190	121: 9	Upper ½	< 0.05534	< 0.0481	< 0.05172			
S96T000106	121: 10	Upper ½	< 0.03954	< 0.0468	< 0.04317			
S96T000107	121: 10A	Upper ½	< 0.05092	< 0.0572	< 0.05406			
S96T000250	121: 10B	Upper ½	< 0.0375	< 0.0376	< 0.03755			
S96T000251		Lower ½	< 0.04854	< 0.0504	< 0.04947			
Solids/Sludge			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S95T000101	65: 13	Upper ½	< 0.0634	< 0.103	< 0.0832	< 0.0832	N/A	< 51.3
Composite: fusion			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S96T000379	1-10B	Composite	< 0.04298	< 0.0448	< 0.04389	< 0.0439	N/A	< 155

Table A-48. Tank 241-BY-106 Analytical Results: Europium-155.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			**µCi/g**	**µCi/g**	**µCi/g**	**µCi/g**	**%**	**Ci**
S95T004179	121: 1	Upper ½	< 0.2331	< 0.233	< 0.23305	< 0.217	N/A	< 768
S95T004180	121: 2	Upper ½	< 0.2283	< 0.239	< 0.23365			
S96T001415		Upper ½	< 0.1554	< 0.158	< 0.1567			
S95T004181	121: 3	Upper ½	< 0.2454	< 0.24	< 0.2427			
S95T004182		Lower ½	< 0.2865	< 0.283	< 0.28475			
S96T001378	121: 7	Upper ½	< 0.1591	< 0.146	< 0.15255			
Solids/Sludge			**µCi/g**	**µCi/g**	**µCi/g**	**µCi/g**	**%**	**Ci**
S95T000101	65: 13	Upper ½	< 0.22	< 0.355	< 0.2875	< 0.288	N/A	< 177

Table A-49. Tank 241-BY-106 Analytical Results: Neptunium-237.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			**µCi/g**	**µCi/g**	**µCi/g**	**µCi/g**	**%**	**Ci**
S95T004183	121: 4	Upper ½	< 0.4021	< 0.429	< 0.41555	< 0.470	N/A	< 1,660
S95T004184		Lower ½	< 0.3844	< 0.41	< 0.3972			
S95T004185	121: 5	Upper ½	< 0.436	< 0.452	< 0.444			
S95T004186	121: 6	Upper ½	< 0.4087	< 0.416	< 0.41235			
S95T004187	121: 7	Upper ½	< 0.3296	< 0.428	< 0.3788			
S95T004188	121: 8	Upper ½	< 0.5215	< 0.575	< 0.54825			
S95T004189		Lower ½	< 0.6033	< 0.619	< 0.61115			
S95T004190	121: 9	Upper ½	< 0.4996	< 0.486	< 0.4928			
S96T000106	121:10	Upper ½	< 0.3749	< 0.404	< 0.38945			
S96T000107	121:10A	Upper ½	< 0.4951	< 0.494	< 0.49455			
S96T000250	121:10B	Upper ½	< 0.5811	< 0.55	< 0.56555			
S96T000251		Lower ½	< 0.5088	< 0.475	< 0.4919			
Composite: fusion			**µCi/g**	**µCi/g**	**µCi/g**	**µCi/g**	**%**	**Ci**
S96T000379	1-10B	Composite	< 0.5496	< 0.563	< 0.5563	< 0.556	N/A	< 1970

Table A-50. Tank 241-BY-106 Analytical Results: Plutonium-239/40.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**	**µCi/mL**	**%**	**Ci**
S95T000004	64: 3	DL	< 7.000E-06	< 9.970E-06	< 8.485E-06	< 8.05E-06	N/A	N/A
S94T000355	64: 6	DL	< 9.620E-06	< 8.070E-06	< 8.845E-06			
S94T000371	64: 10	DL	< 6.720E-06	< 6.900E-06	< 6.810E-06			
Solids/Sludge: fusion			**µCi/g**	**µCi/g**	**µCi/g**	**µCi/g**	**%**	**Ci**
S95T000101	65: 13	Upper ½	0.105	0.0943	0.09965	0.0997	5.4	61.4

Table A-51. Tank 241-BY-106 Analytical Results: Strontium-89/90. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S95T004179	121: 1	Upper ½	0.941	0.981	0.961	4.26	16.6	15,100
S96T001415		Upper ½	9.31	8.8	9.055			
S95T004181	121: 3	Upper ½	6.02	5.91	5.965			
S95T004182		Lower ½	7.52	7.39	7.455			
S95T004183	121: 4	Upper ½	6.49	6.91	6.7			
S95T004184		Lower ½	8.82	10.2	9.51[QC:e]			
S95T004185	121: 5	Upper ½	9.13	9.53	9.33			
S95T004186	121: 6	Upper ½	6.5	5.67	6.085[QC:e]			
S96T001378		Upper ½	5.12	5.74	5.43[QC:e]			
S95T004188	121: 8	Upper ½	8.95	9.75	9.35			
S95T004189		Lower ½	9.91	9.32	9.615			
S95T004190	121: 9	Upper ½	9.46	8.68	9.07			
S96T000106	121:10	Upper ½	2.61	3.04	2.825[QC:e]			
S96T000107	121:10A	Upper ½	13	12.3	12.65			
S96T000250	121:10B	Upper ½	0.667	0.673	0.67			
S96T000251		Lower ½	2.22	2.35	2.285			
S94T000306	64: 1	Upper ½	2.78	2.76	2.77			
S94T000312	64: 2	Upper ½	3.94	3.38	3.66[QC:e]			

Table A-51. Tank 241-BY-106 Analytical Results: Strontium-89/90. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			**µCi/g**	**µCi/g**	**µCi/g**	**µCi/g**	**%**	**Ci**
S94T000314	64: 3	Upper ½	0.957	0.771	0.864[QC:f]	Cont'd	Cont'd	Cont'd
S94T000315	64: 4	Upper ½	7	7.13	7.065[QC:a]			
S94T000316		Lower ½	1.49	1.41	1.45			
S94T000347	64: 8	Upper ½	0.392	0.499	0.4455[QC:e]			
S94T000348		Lower ½	0.731	0.786	0.7585			
S94T000349		Lower ½	0.913	0.635	0.774[QC:e]			
S94T000350	64: 9	Upper ½	0.509	0.446	0.4775[QC:e]			
S94T000374	64:10	Upper ½	0.692	0.672	0.682			
S94T000375		Lower ½	0.188	0.262	0.225[QC:e]			
S94T000392	64:11	Upper ½	0.303	0.291	0.297			
S94T000393	64:12	Upper ½	0.949	1.06	1.0045[QC:e]			
S94T000394	64:13	Upper ½	0.182	0.188	0.185			
Solids/Sludge			**µCi/g**	**µCi/g**	**µCi/g**	**µCi/g**	**%**	**Ci**
S95T000101	65:13	Upper ½	783	743	763[QC:a]	763	2.6	4.70E+05
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**	**µCi/mL**	**%**	**Ci**
S95T000004		DL	0.061 µCi/mL	0.0507 µCi/mL	0.05585 µCi/mL (0.04168 µCi/g)	0.0377	28.3	N/A
S94T000355	64: 6	DL	0.0207	0.0172	0.01895 (0.0141 µCi/mL)			
S94T000371		DL	0.0395 µCi/mL	0.037 µCi/mL	0.03825 µCi/mL (0.02854 µCi/g			
Composite: fusion			**µCi/g**	**µCi/g**	**µCi/g**	**µCi/g**	**%**	**Ci**
S96T000379	1-10B	Composite	6.42	6.16	6.29	6.29	2.1	22,300

Table A-52. Tank 241-BY-106 Analytical Results: Total Alpha. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: fusion			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S95T004179	121: 1	Upper ½	< 0.00173	< 0.00229	< 0.00201[QC:a]	0.00945	17.2	33.5
S95T004180	121: 2	Upper ½	0.00509	0.00559	0.00534[QC:a]			
S95T004181	121: 3	Upper ½	0.00874	0.00628	0.00751[QC:a,e]			
S95T004182		Lower ½	0.00786	0.00745	0.007655[QC:a]			
S95T004183	121: 4	Upper ½	0.0128	0.012	0.0124			
S95T004184		Lower ½	0.0178	0.0119	0.01485[QC:f]			
S95T004185	121: 5	Upper ½	0.0146	0.017	0.0158[QC:e]			
S95T004186	121: 6	Upper ½	0.00962	0.012	0.01081[QC:f]			
S95T004187	121: 7	Upper ½	< 0.0034	0.00565	< 0.004525			
S95T004188	121: 8	Upper ½	0.0105	0.00934	0.00992[QC:e]			
S95T004189		Lower ½	0.0114	0.0149	0.01315[QC:e]			
S95T004190	121: 9	Upper ½	0.01	0.00674	0.00837[QC:e]			
S96T000106	121:10	Upper ½	0.00285	0.00474	0.003795[QC:e]			
S96T000107	121:10A	Upper ½	0.0316	0.0319	0.03175			
S96T000250	121:10B	Upper ½	< 0.00162	< 0.00335	< 0.002485[QC:e]			
S96T000251		Lower ½	0.00493	0.00549	0.00521			
S96T000258		DL	< 0.00486 µCi/mL	< 0.0197 µCi/mL	< 0.01228 µCi/mL (< 0.00916 µCi/g)			
S95T000100	65:13	Upper ½	< 0.00482	0.00599	< 0.005405[QC:e]			

Table A-52. Tank 241-BY-106 Analytical Results: Total Alpha. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids/Sludge			**µCi/g**	**µCi/g**	**µCi/g**	**µCi/g**	**%**	**Ci**
S95T000101	65:13	Upper ½	0.29	0.215	0.2525[QC:e]	0.253	14.9	156
Composite: fusion			**µCi/g**	**µCi/g**	**µCi/g**	**µCi/g**	**%**	**Ci**
S96T000379	1-10B	Composite	0.0086	0.0118	0.0102[QC:e]	0.0102	15.7	36.1

Table A-53. Tank 241-BY-106 Analytical Results: Total Beta.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Composite: fusion			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
S96T000379	1-10B	Composite	83.2	77.2	80.2	80.2	3.7	2.84E+05

Table A-54. Tank 241-BY-106 Analytical Results: Total inorganic carbon. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004167	121: 1	Upper ½	32,600	36,500	34,550	7,359	20.8	26,050
S95T004168	121: 2	Upper ½	23,000	24,700	23,850			
S95T004169	121: 3	Upper ½	7,400	12,100	9,750[QC:e]			
S95T004170		Lower ½	20,100	18,600	19,350			
S95T004171	121: 4	Upper ½	4,330	4,160	4,245			
S95T004172		Lower ½	7,060	6,350	6,705			
S95T004173	121: 5	Upper ½	11,900	9,970	10,935			
S95T004174	121: 6	Upper ½	7,160	8,090	7,625			
S95T004175	121: 7	Upper ½	12,300	12,400	12,350			
S95T004176	121: 8	Upper ½	14,400	18,200	16,300[QC:e]			
S95T004177		Lower ½	17,800	6,800	12,300[QC:e]			
S95T004178	121: 9	Upper ½	29,000	31,500	30,250			
S96T000104	121: 10	Upper ½	1,680	3,190	2,435[QC:e]			
S96T000105	121: 10A	Upper ½	3,850	4,330	4,090			
S96T000248	121: 10B	Upper ½	6,840	5,690	6,265			
S96T000249		Lower ½	935	1,120	1,027.5			
S96T000258		DL	1,890	1,840	1,865			
S94T000305	64: 1	Upper ½	4,910	3,720	4,315[QC:e]			
S94T000308	64: 2	Upper ½	5,410	5,540	5,475			
S94T000309	64: 3	Upper ½	2,710	2,480	2,595			

Table A-54. Tank 241-BY-106 Analytical Results: Total inorganic carbon. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids			µg/g	µg/g	µg/g	µg/g	%	kg
S94T000310	64: 4	Upper ½	13,900	10,700	12,300[QC:e]	Cont'd	Cont'd	Cont'd
S94T000311		Lower ½	1,410	1,430	1,420			
S94T000326	64: 5	Upper ½	1,150	2,140	1,645[QC:e]			
S94T000342	64: 6	Upper ½	939	1,090	1,014.5			
S94T000343	64: 8	Upper ½	1,110	962	1,036			
S94T000344		Lower ½	637	639	638			
S94T000345		Lower ½	1,870	2,010	1,940			
S94T000346	64: 9	Upper ½	647	815	731[QC:e]			
S94T000372	64: 10	Upper ½	1,560	775	1,167.5[QC:e]			
S94T000373		Lower ½	1,890	1,500	1,695[QC:e]			
S94T000381	64: 11	Upper ½	1,070	866	968[QC:e]			
S94T000381	64: 12	Upper ½	1,560	1,820	1,690			
S94T000391	64: 13	Upper ½	318	358	338			
Solids/Sludge			µg/g	µg/g	µg/g	µg/g	%	kg
S95T000099	65: 13	Upper ½	4,770	5,280	5,025	5,580	10.0	3,440
S95T000734		Upper ½	6,560	5,720	6,140			
Liquids			µg/mL	µg/mL	µg/mL	µg/mL	%	kg
S95T000004	64: 3	DL	1,510 µg/mL	1,440 µg/mL	1,475 µg/mL (1,101 µg/g)	1,140	14.8	N/A
S94T000355	64:6	DL	980 µg/mL	1,000 µg/mL	990 µg/mL (739 µg/g)			
S94T000371	64: 10	DL	947 µg/mL	952 µg/mL	949.5 µg/mL (708.6 µg/g)			

Table A-55. Tank 241-BY-106 Analytical Results: Total organic carbon. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004167	121: 1	Upper ½	812	752	782	2,505	12.1	8,870
S95T004168	121: 2	Upper ½	4,240	4,770	4,505			
S95T004169	121: 3	Upper ½	2,450	3,090	2,770[QC:e]			
S95T004170		Lower ½	3,890	3,390	3,640			
S95T004171	121: 4	Upper ½	2,020	2,020	2,020			
S95T004172		Lower ½	2,770	4,170	3,470[QC:e]			
S95T004173	121: 5	Upper ½	4,950	5,000	4,975			
S95T004174	121: 6	Upper ½	3,380	3,660	3,520			
S95T004175	121: 7	Upper ½	4,190	4,170	4,180			
S95T004176	121: 8	Upper ½	5,400	5,420	5,410			
S95T004177		Lower ½	5,840	5,890	5,865			
S95T004178	121: 9	Upper ½	5,920	5,930	5,925			
S96T000104	121: 10	Upper ½	1,030	1,210	1,120			
S96T000105	121: 10A	Upper ½	4,900	5,130	5,015			
S96T000248	121: 10B	Upper ½	1,190	1,440	1,315			
S96T000249		Lower ½	1,060	1,120	1,090			
S96T000258		DL	2,620	2,310	2,470			
S94T000305	64: 1	Upper ½	2,570	2,410	2,490			
S94T000308	64: 2	Upper ½	2,850	2,270	2,560[QC:e]			
S94T000309	64: 3	Upper ½	2,310	2,250	2,280			

Table A-55. Tank 241-BY-106 Analytical Results: Total organic carbon. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids			µg/g	µg/g	µg/g	µg/g	%	kg
S94T000310	64: 4	Upper ½	4,180	4,410	4,295	Cont'd	Cont'd	Cont'd
S94T000311		Lower ½	1,310	1,230	1,270			
S94T000326	64: 5	Upper ½	733	994	863.5[QC:e]			
S94T000342	64: 6	Upper ½	948	898	923			
S94T000343	64: 8	Upper ½	1,050	1,050	1,050			
S94T000344		Lower ½	940	823	881.5			
S94T000345		Lower ½	2,860	3,020	2,940			
S94T000346	64: 9	Upper ½	403	464	433.5			
S94T000372	64:10	Upper ½	1,700	1,200	1,450[QC:e]			
S94T000373		Lower ½	1,340	674	1,007[QC:e]			
S94T000381	64:11	Upper ½	596	400	498[QC:f]			
S94T000390	64:12	upper ½	1,860	1,220	1,540[QC: e]			
S94T000391	64:13	Upper ½	111	123	117			
Solids/Sludge			µg/g	µg/g	µg/g	µg/g	%	kg
S95T000099	65:13	Upper ½	20,800	21,700	21,250	20,400	4.2	12,600
S95T000734		Upper ½	19,900	19,200	19,550			

Table A-55. Tank 241-BY-106 Analytical Results: Total organic carbon. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Liquids			µg/g	µg/g	µg/g	µg/mL	%	kg
S95T000004	64: 3	DL	2,300 µg/mL	2,320 µg/mL	2,310 µg/mL (1,723 µg/g)	2,670	18.3	N/A
S95T000228	64:3	DL	1,860 µg/mL	1,960 µg/mL	1,910 µg/mL (1,425 µg/g)			
S94T000355	64: 6	DL	4,160 µg/mL	4,060 µg/mL	4,110 µg/mL (3,067 µg/g)			
S94T000371	64:10	DL	2,290 µg/mL	2,420 µg/mL	2,355 µg/mL (1,757 µg/g)			

Table A-57. Tank 241-BY-106 Analytical Results: Acetate.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004202	121: 1	Upper ½	357.2	488	422.6[QC:e]	< 538	N/A	< 1,900
S95T004203	121: 2	Upper ½	807.3	1,110	958.65[QC:e]			
S95T004204	121: 3	Upper ½	< 256.3	< 269	< 262.65			
S95T004205		Lower ½	< 220.4	< 210	< 215.2			
S95T004206	121: 4	Upper ½	< 217.9	< 238	< 227.95			
S95T004207		Lower ½	< 230.8	< 240	< 235.4			
S95T004208	121: 5	Upper ½	< 236.9	< 236	< 236.45			
S95T004209	121: 6	Upper ½	< 214.3	< 224	< 219.15			
S95T004210	121: 7	Upper ½	< 234.7	< 239	< 236.85			
S95T004211	121: 8	Upper ½	912.4	1,210	1,061.2[QC:e]			
S95T004212		Lower ½	1,224	1,210	1,217			
S95T004213	121: 9	Upper ½	< 205.3	< 210	< 207.65			
S96T000109	121:10	Upper ½	482.3	620	551.15[QC:e]			
S96T000254	121:10B	Upper ½	1,362	1,090	1,226[QC:e]			
S96T000255		Lower ½	802	797	799.5			

Table A-58. Tank 241-BY-106 Analytical Results: Formate.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004202	121: 1	Upper ½	365.1	363	364.05	630	11.8	2,230
S95T004203	121: 2	Upper ½	464.8	459	461.9			
S95T004204	121: 3	Upper ½	509.7	484	496.85			
S95T004205		Lower ½	603.1	616	609.55			
S95T004206	121: 4	Upper ½	405.4	405	405.2			
S95T004207		Lower ½	492.7	480	486.35			
S95T004208	121: 5	Upper ½	556.2	572	564.1			
S95T004209	121: 6	Upper ½	448.7	432	440.35			
S95T004210	121: 7	Upper ½	537	507	522			
S95T004211	121: 8	Upper ½	801.7	768	784.85			
S95T004212		Lower ½	876.5	835	855.75			
S95T004213	121: 9	Upper ½	639.7	588	613.85			
S96T000109	121:10	Upper ½	364.7	403	383.85			
S96T000254	121:10B	Upper ½	1,010	809	909.5[QC:e]			
S96T000255		Lower ½	615.9	601	608.45			
S96T000258		DL	2,062 µg/mL	2,140 µg/mL	2,101 µg/mL (1,568 µg/g)			

Table A-59. Tank 241-BY-106 Analytical Results: Oxalate. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004202	121: 1	Upper ½	1,328	1,390	1,359	8,990	15.7	31,800
S95T004203	121: 2	Upper ½	12,260	12,700	12,480			
S95T004204	121: 3	Upper ½	9,469	8,330	8,899.5			
S95T004205		Lower ½	10,590	11,000	10,795			
S95T004206	121: 4	Upper ½	5,200	5,410	5,305			
S95T004207		Lower ½	14,140	6,540	10,340[QC:e]			
S95T004208	121: 5	Upper ½	16,100	14,900	15,500			
S95T004209	121: 6	Upper ½	12,220	10,700	11,460			
S95T004210	121: 7	Upper ½	12,770	12,700	12,735			
S95T004211	121: 8	Upper ½	12,740	13,600	13,170			
S95T004212		Lower ½	18,240	16,700	17,470			
S95T004213	121: 9	Upper ½	15,970	15,200	15,585			
S96T000109	121:10	Upper ½	3,625	4,700	4,162.5[QC:e]			
S96T000254	121:10B	Upper ½	1,281	1,660	1,470.5[QC:e]			
S96T000255		Lower ½	3,293	2,330	2,811.5[QC:e]			
S96T000258		DL	< 434.8 µg/mL	< 435 µg/mL	< 434.9 µg/mL (< 324.5 µg/g)			
Composite: water			µg/g	µg/g	µg/g	µg/g	%	kg
S96T000381	1-10B	Composite	10,950	13,300	12,125[QC:e]	12,125	9.7	42,900

Table A-59. Tank 241-BY-106 Analytical Results: Oxalate. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Liquids			µg/mL	µg/mL	µg/mL	µg/mL	%	kg
S95T000228	64: 3	DL	< 1,060	< 1,060	< 1,060	< 1,060	N/A	N/A

Table A-60. Tank 241-BY-106 Analytical Results: Cyanide (2 Sheets).

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids			µg/g	µg/g	µg/g	µg/g	%	kg
S95T004167	121: 1	Upper ½	17	18.5	17.75	20.6	10.1	72.9
S95T004168	121: 2	Upper ½	18	17.3	17.65			
S95T004169	121: 3	Upper ½	15.6	16.7	16.15			
S95T004170		Lower ½	27.7	30.9	29.3			
S95T004171	121: 4	Upper ½	10.9	12	11.45			
S95T004172		Lower ½	20.3	17	18.65[QC:e]			
S95T004173	121: 5	Upper ½	12.9	13.6	13.25			
S95T004174	121: 6	Upper ½	6.13	6.28	6.205			
S95T004175	121: 7	Upper ½	5.47	6.61	6.04[QC:e]			
S95T004176	121: 8	Upper ½	13.2	13.8	13.5			
S95T004177		Lower ½	18.7	20.6	19.65			
S95T004178	121: 9	Upper ½	15.6	14.4	15			
S96T000104	121:10	Upper ½	10.8	11.8	11.3			
S96T000105	121:10A	Upper ½	19.9	21.2	20.55			
S96T000248	121:10B	Upper ½	30.7	24.3	27.5[QC:e]			
S96T000249		Lower ½	15.7	14.7	15.2			
S96T000258		DL	42.5	44.4	43.4			

Table A-60. Tank 241-BY-106 Analytical Results: Cyanide. (2 Sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids			µg/g	µg/g	µg/g	µg/g	%	kg
S94T000305	64: 1	Upper ½	30.5	29.9	30.2	Cont'd	Cont'd	Cont'd
S94T000308	64: 2	Upper ½	34.5	36.8	35.65			
S94T000309	64: 3	Upper ½	44.5	45.1	44.8			
S94T000310	64: 4	Upper ½	55.2	53.3	54.25			
S94T000311		Lower ½	23.2	24.3	23.75			
S94T000326	64: 5	Upper ½	30.7	31.2	30.95			
S94T000342	64: 6	Upper ½	22.1	18.7	20.4[QC:f]			
S94T000343	64: 8	Upper ½	11.7	10.6	11.15			
S94T000344		Lower ½	9.02	9.49	9.255			
S94T000345		Lower ½	21.6	25	23.3[QC:e]			
S94T000346	64: 9	Upper ½	28.1	29.7	28.9			
S94T000372	64:10	Upper ½	13.8	13	13.4			
S94T000373		Lower ½	24.2	24	24.1			
S94T000381	64:11	Upper ½	3	3.7	3.35[QC:e]			
S94T000390	64:12	upper ½	21.40	21.90	21.65			
S94T000391	64:13	Upper ½	2.27	2.42	2.345			
Solids/Sludge			µg/g	µg/g	µg/g	µg/g	%	kg
S95T000099	65:13	Upper ½	98.9	88.9	93.9	93.9	5.3	57.8

Table A-61. Tank 241-BY-106 Analytical Results: Energetics by DSC. (6 sheets)

Sample Number	Sample Location		Run	Sample Weight	Transition 1		Transition 2		Transition 3	
	Seg.	Subseg.		mg	Peak Temp. (°C)	ΔH (J/g)	Peak Temp. (°C)	ΔH (J/g)	Peak Temp. (°C)	ΔH (J/g)
Core 64										
S94T000305	1	Upper ½	1[1]	18.821	128.1	1074.5	266.5	45.3	---	---
			2[1]	19.628	129.8	1089.2	264.7	48.5	---	---
			3[1]	12.813	118.6	1043.2	253.1	63.5	---	---
S94T000308	2	Upper ½	1[1]	18.545	133.6	976.5	335.5	-237.0	---	---
			2[1]	15.261	130.6	1124.0	248.8	-116.4	423.7	- 8.0
			3[1]	11.552	128.3	1114.8	313.8	-175.7	---	---
S94T000309	3	Upper ½	1[1]	6.390	121.4	809.2	264.5	-123.4	431.4	- 88.7
			2[1]	28.720	128.5	784.5	246.3	-74.5	---	---
			3[1]	18.722	136.8	851.0	246.2	-108.4	---	---
S94T000004	3	DL	1[1]	12.961	120.0	1259.7	253.5	-31.0	---	---
			2[1]	12.856	118.6	1227.5	183.4	11.6	253.7	- 30.9
S94T000310	4	Upper ½	1[1]	22.712	139.3	674.7	242.2	-21.1	321.3	- 53.9
			2[1]	39.416	141.2	614.8	251.3	-14.2	325.0	- 29.6
S94T000311	4	Lower ½	1[1]	17.919	116.1	377.4	278.4	72.8	475.3	- 358.7
			2[1]	11.803	117.0	352.4	290.1	82.1	433.6	-123.4
			3[1]	19.993	125.7	255.9	294.6	113.8	---	---
S94T000326	5	Upper ½	1[1]	19.055	122.4	276.2	305.4	143.8	---	---
			2[1]	10.223	108.2	344.5	297.8	82.3	---	---
S94T000342	6	Upper ½	1[1]	16.186	156.7	558.0	---	---	---	---
			2[1]	15.528	113.1	421.7	---	---	---	---

Table A-61. Tank 241-BY-106 Analytical Results: Energetics by DSC. (6 sheets)

Sample Number	Sample Location		Run	Sample Weight	Transition 1		Transition 2		Transition 3	
	Seg.	Subseg.		mg	Peak Temp. (°C)	ΔH (J/g)	Peak Temp. (°C)	ΔH (J/g)	Peak Temp. (°C)	ΔH (J/g)
Core 64										
S94T000355	6	DL	1[1]	13.465	Illegible	Illegible	252.4	-35.4	---	---
			2[1]	13.385	Illegible	Illegible	251.5	-87.2	---	---
			3[1]	12.995	Illegible	1247.8	251.8	-68.8	---	---
S94T000343	8	Upper ½	1[1]	17.193	111.0	266.7	---	---	---	---
			2[1]	17.612	115.1	284.2	---	---	---	---
S94T000344	8	Lower ½	1[1]	12.541	121.6	410.4	---	---	---	---
			2[1]	14.801	Illegible	Illegible	---	---	---	---
S94T000345	8	slurry	1[1]	17.853	134.9	870.5	Illegible	Illegible	---	---
			2[1]	14.181	130.2	838.8	223.7	-5.8	250.5	- 52.4
S94T000346	9	Upper ½	1[1]	18.795	147.4	206.0	283.4	96.7	---	---
			2[1]	17.877	152.8	245.1	281.6	167.7	---	---
S94T000372	10	Upper ½	1[1]	30.362	127.8	587.7	---	---	---	---
			2[1]	35.008	145.5	580.6	---	---	---	---
S94T000373	10	Lower ½	1[1]	32.481	148.5	565.6	---	---	---	---
			2[1]	30.502	122.8	401.7	---	---	---	---
S94T000371	10	DL	1[1]	13.784	122.5	1185.0	251.5	-44.5	---	---
			2[1]	13.494	120.9	1055.1	251.6	-44.0	---	---
S94T000381	11	Upper ½	1[1]	14.023	103.3	61.4	147.5	5.0	300.6	159.7
			2[1]	17.103	97.3	48.4	147.3	5.6	300.2	177.3

Table A-61. Tank 241-BY-106 Analytical Results: Energetics by DSC. (6 sheets)

Sample Number	Sample Location		Run	Sample Weight	Transition 1		Transition 2		Transition 3	
	Seg.	Subseg.		mg	Peak Temp. (°C)	ΔH (J/g)	Peak Temp. (°C)	ΔH (J/g)	Peak Temp. (°C)	ΔH (J/g)
Core 64										
S94T000390	12	Upper ½	1[1]	19.197	128.1	597.8	255.6	6.2	---	---
			2[1]	15.001	130.3	597.2	255.5	16.6	---	---
S94T000391	13	Upper ½	1[1]	12.548	99.9	299.8	209.5	14.6	299.9	144.2
			2[1]	12.470	101.8	283.7	206.0	10.0	301.8	151.6
Core 65										
S94T000084	11	Upper ½	1[1]	32.314	147.2	633.1	---	---	---	---
			2[1]	38.550	132.8	747.0	---	---	---	---
S94T000229	11	DL	1[1]	24.982	131.6	1091.3	249.6	-19.9	---	---
			2[1]	17.974	130.6	1120.0	249.5	-20.1	---	---
S94T000109	12	DL	1[1]	11.207	121.6	1104.9	251.3	-54.1	---	---
			2[1]	12.112	119.3	1159.0	249.3	-59.4	---	---
S94T000098	13	saltcake	1[1]	10.130	101.5	957.7	213.1	31.9	265.3	24.5
			2[1]	12.892	103.0	882.2	212.9	39.5	275.2	45.9
S94T000099	13	sludge	1[1]	10.081	116.6	853.5	317.9	-417.9	---	---
			2[1]	10.572	129.9	1135.3	318.0	-855.4	---	---
			3[1]	20.014	134.1	746.3	312.1	-421.4	---	---
Core 121										
S95T004167	1	Upper ½	1[1]	32.998	136.0	354.4	296.0	74.0	---	---
			2[1]	48.159	139.5	348.9	306.4	130.4	---	---
S95T004168	2	Upper ½	1[1]	24.731	129.5	823.8	264.1	69.6	---	---
			2[1]	45.640	139.8	807.8	255.8	28.3	444.7	-12.0

Table A-61. Tank 241-BY-106 Analytical Results: Energetics by DSC. (6 sheets)

Sample Number	Sample Location		Run	Sample Weight	Transition 1		Transition 2		Transition 3	
	Seg.	Subseg.		mg	Peak Temp. (°C)	ΔH (J/g)	Peak Temp. (°C)	ΔH (J/g)	Peak Temp. (°C)	ΔH (J/g)
Core 121										
S95T004169	3	Upper ½	1[2]	38.320	109.873	721.909	---	---	---	---
			2[2]	40.870	144.74	482.9	281.3	29.76	---	---
			3[2]	30.640	114.468	603.097	---	---	---	---
S95T004170		Lower ½	1[2]	31.050	141.43	449.95	261.29	67.2	---	---
			2[2]	19.240	133.86	869.33	275.35	13.1	---	---
			3[2]	28.040	124.415	623.751	---	---	---	---
S95T004171	4	Upper ½	1[2]	19.940	124.55	315.68	274.79	135.33	---	---
			2[2]	14.680	108.26	217.86	272.22	136.95	---	---
S95T004172		Lower ½	1[2]	24.740	107.67	366.94	275.64	112.57	---	---
			2[2]	21.190	105.407	490.358	---	---	---	---
S95T004173	5	Upper ½	1[2]	27.900	106.53	519.72	271.47	50.51	---	---
			2[2]	25.300	106.81	333.57	296.24	118.47	418.44	19.12
			1[2]	48.990	109.07	66.04	150.9	279.99	---	---
			2[2]	39.640	149.7	210.8	203.8	20.33	---	---
S95T004174	6	Upper ½	1[2]	92.210	149.58	344.01	281.21	80.78	---	---
			2[2]	74.150	147.89	169.31	306.08	156.57	---	---
			1[2]	36.230	107.0	360.54	272.19	116.61	---	---
			2[2]	12.080	103.15	276.81	272.78	114.93	---	---
S95T004175	7	Upper ½	1[2]	29.160	132.46	485.94	270.82	82.06	---	---
			2[2]	69.220	149.45	392.91	273.02	65.18	---	---

Table A-61. Tank 241-BY-106 Analytical Results: Energetics by DSC. (6 sheets)

Sample Number	Sample Location		Run	Sample Weight	Transition 1		Transition 2		Transition 3	
	Seg.	Subseg.		mg	Peak Temp. (°C)	ΔH (J/g)	Peak Temp. (°C)	ΔH (J/g)	Peak Temp. (°C)	ΔH (J/g)
Core 121										
S95T004176	8	Upper ½	1[2]	38.540	140.578	570.658	---	---	---	---
			2[2]	14.060	115.796	969.490	---	---	---	---
S95T004177		Lower ½	1[2]	13.800	120.86	1263.36	365.43	49.87	---	---
			2[2]	10.100	121.947	1475.131	---	---	---	---
S95T004178	9	Upper ½	1[2]	9.800	101.09	819.54	281.89	48.53	350.52	350.52
			2[2]	9.900	121.28	692.88	279.56	41.59	357.89	51.02
			1[1]	24.886	108.9	746.3	319.0	75.4	---	---
			2[1]	21.305	109.1	789.1	242.8	-18.1	319.0	-50.2
S96T000104	10	Upper ½	1[2]	27.470	111.11	296.69	279.43	119.69	---	---
			2[2]	31.270	110.18	266.01	285.3	134.88	---	---
S96T000105	10A	Upper ½	1[2]	48.110	155.26	523.05	271.06	67.51	---	---
			2[2]	33.430	133.3	663.28	265.39	55.01	---	---
S96T000248	10B	Upper ½	Q1[2]	17.210	135.53	1558.23	241.68	79.57	---	---
			2[2]	14.310	128.58	1380.0	251.91	NR	---	---
S96T000249		Lower ½	1[2]	23.670	153.692	965.681	---	---	---	---
			2[2]	45.040	149.970	766.581	---	---	---	---

Table A-61. Tank 241-BY-106 Analytical Results: Energetics by DSC. (6 sheets)

Sample Number	Sample Location		Run	Sample Weight	Transition 1		Transition 2		Transition 3	
	Seg.	Subseg.		mg	Peak Temp. (°C)	ΔH (J/g)	Peak Temp. (°C)	ΔH (J/g)	Peak Temp. (°C)	ΔH (J/g)
S96T000258		DL	1[1]	41.763	121.3	1331.8	241.8	41.0	308.4	2.4
			2[1]	42.893	127.3	831.0	306.6	1.2	---	---

Notes:

[1]DSC analysis performed on a Mettler™ instrument.
[2]DSC analysis performed on a Perkin-Elmer instrument.

ΔH = change in enthalpy (negative sign denotes exothermic reaction)

Table A-62. Tank 241-BY-106 Analytical Results: Percent Water.[1] (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory[1]
Solids			%	%	%	%	%	kg
S95T004167	121: 1	Upper ½	17.45	15.06	16.255[QC:e]	25.5	12.7	9.02E5
S95T004168	121: 2	Upper ½	30.84	30.5	30.67			
S95T004169	121: 3	Upper ½	21.57	17.91	19.74[QC:e]			
S95T004170		Lower ½	27.47	19.02	23.245[QC:e]			
S95T004171	121: 4	Upper ½	12.7	12.05	12.375			
S95T004172		Lower ½	15.58	12.74	14.16[QC:e]			
S95T004173	121: 5	Upper ½	19.45	20.58	20.015			
S95T004174	121: 6	Upper ½	14.91	14.6	14.755			
S95T004175	121: 7	Upper ½	17.37	16.08	16.725			
S95T004176	121: 8	Upper ½	26.58	30.19	28.385[QC:e]			
S95T004177		Lower ½	36.63	37	36.815			
S95T004178	121: 9	Upper ½	29.53	21.02	25.275[QC:e]			
S96T000104	121: 10	Upper ½	10.49	6.31	8.4[QC:e]			
S96T000105	121: 10A	Upper ½	18.47	18.35	18.41			
S96T000248	121:10B	Upper ½	48.82	48.86	48.84			
S96T000249		Lower ½	48.24	48.93	48.585			
S96T000258		DL	49.56	51.38	50.47			
S94T000305	64: 1	Upper ½	47.17	46.24	46.705	N/A	N/A	N/A
S94T000308	64: 2	Upper ½	46.65	47.26	46.955			
S94T000309	64: 3	Upper ½	38.31	32.2	35.255[QC:e]			

Table A-62. Tank 241-BY-106 Analytical Results: Percent Water.[1] (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory[1]
S94T000310	64: 4	Upper ½	21.07	25.62	23.345[QC:e]	N/A	N/A	N/A
S94T000311		Lower ½	9.7	9.78	9.74			
S94T000326	64: 5	Upper ½	14.37	14.24	14.305			
S94T000342	64: 6	Upper ½	18.01	15.64	16.825[QC:e]			
S94T000343	64: 8	Upper ½	8.26	11.57	9.915[QC:e]			
S94T000344		Lower ½	17.65	20.47	19.06[QC:e]			
S94T000345		Lower ½	43.17	43.45	43.31			
S94T000346	64: 9	Upper ½	18.38	14.94	16.66[QC:e]			
S94T000372	64:10	Upper ½	25.39	14.24	19.815[QC:e]			
S94T000373		Lower ½	20.1	17.41	18.755[QC:e]			
S94T000381	64:11	Upper ½	3.51	4.05	3.78[QC:e]			
S94T000390	64:12	Upper ½	26.83	27.76	27.30			
S94T000391	64:13	Upper ½	12.26	10.15	11.205[QC:e]			
S95T000084	65:11	Upper ½	25.28	20.63	22.955[QC:e]			
S95T000098	65:13	Upper ½	27.38	28.93	28.155			
Solids/Sludge			%	%	%	%	%	kg
S95T000099	65:13	Upper ½	38.01	36.62	37.315	37.3	1.9	1.34E5
Liquids			%	%	%	%	%	kg
S95T000004	64: 3	DL	68.57	67.93	68.25	62.4	6.3	N/A
S94T000355	64: 6	DL	55.22	54.57	54.895			
S94T000371	64:10	DL	63.85	64.07	63.96			

Table A-62. Tank 241-BY-106 Analytical Results: Percent Water.[1] (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory[1]
Composite			%	%	%	%	%	kg
S96T000378	1-10B	Composite	17.02	17.16	17.09	17.1	0.4	Cont'd

Note:

[1] The overall mean, RSD, and projected inventory calculation were performed using only the core 121 data. Tank 241-BY-106 was partially interim stabilized (pumped) after cores 64 and 65 were taken; therefore, the percent moisture values from those cores are no longer credible.

Table A-63. Tank 241-BY-106 Analytical Results: Bulk Density.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Solids			g/mL	g/mL	g/mL	g/mL	%	N/A
S95T004145	121:2	Upper ½	1.800	---	---	1.71	2.4	
S95T004146	121:3	Upper ½	1.870	---	---			
S95T004147		Lower ½	1.680	---	---			
S95T004148	121:4	Upper ½	1.790	---	---			
S95T004149		Lower ½	1.760	---	---			
S95T004150	121:5	Upper ½	1.640	---	---			
S95T004151	121:6	Upper ½	1.700	---	---			
S95T004152	121:7	Upper ½	1.810	---	---			
S95T004153	121:8	Upper ½	1.470	---	---			
S95T004154		Lower ½	1.430	---	---			
S96T000101	121:10	Upper ½	1.660	---	---			
S96T000245	121:10B	Upper ½	1.890	---	---			

Table A-64. Tank 241-BY-106 Analytical Results: Specific gravity.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Liquids			unitless	unitless	unitless	unitless	%	N/A
S96T000258	121:10B	DL	1.42	1.404	1.412	1.34[1]	5.6	
S94T000371	64:10	DL	1.28	1.28	1.28			
S95T000004	64: 3	DL	1.24	1.25	1.245			

Note:

[1]Overall mean is a weighted average. For a discussion, see Section 4.1.

Table A-65. Tank 241-BY-106 Analytical Results: pH Measurement.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Liquids			unitless	unitless	unitless	unitless	%	N/A
S95T000004	64: 3	DL	13.3	13.76	13.53	13.6	1.0	
S94T000355	64: 6	DL	13.17	13.82	13.495			
S94T000371	64:10	DL	13.32	14.02	13.67			

Table A-66. Tank 241-BY-106 Analytical Results: Hydroxide.

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)	Projected Inventory
Liquids			µg/mL	µg/mL	µg/mL	µg/mL	%	kg
S95T000004	64: 3	DL	33,500	31,300	32,400	35,800	6.8	N/A
S95T000228		DL	31,200	30,600	30,900			
S94T000355	64: 6	DL	41,600	40,500	41,050			
S94T000371	64:10	DL	38,400	38,900	38,650			

APPENDIX B

SINGLE-SHELL TANK 241-BY-106
HYDROSTATIC HEAD FLUID CONTAMINATION

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Table B-1. Tank 241-BY-106 Hydrostatic Head Fluid Contamination: Lithium. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)
Solids: fusion			µg/g	µg/g	µg/g	µg/g	%
S95T004179	121: 1	Upper ½	< 208	< 211	< 209.5	< 198	N/A
S95T004180	121: 2	Upper ½	< 185	< 203	< 194		
S96T001415		Upper ½	< 147	< 144	< 145.5		
S95T004181	121: 3	Upper ½	< 197	< 195	< 196		
S95T004182		Lower ½	< 214	< 213	< 213.5		
S95T004183	121: 4	Upper ½	< 187	< 197	< 192		
S95T004184		Lower ½	< 195	< 188	< 191.5		
S95T004185	121: 5	Upper ½	< 176	< 186	< 181		
S95T004186	121: 6	Upper ½	< 205	< 210	< 207.5		
S95T004187	121: 7	Upper ½	< 193	< 194	< 193.5		
S96T001378		Upper ½	< 135	< 123	< 129		
S95T004188	121: 8	Upper ½	< 174	< 181	< 177.5		
S95T004189		Lower ½	< 210	< 225	< 217.5		
S95T004190	121: 9	Upper ½	< 226	< 215	< 220.5		
S96T000106	121:10	Upper ½	< 214	< 234	< 224		
S96T000107	121:10A	Upper ½	< 220	< 213	< 216.5		
S96T000250	121:10B	Upper ½	< 182	< 173	< 177.5		
S96T000251		Lower ½	< 233	< 232	< 232.5		
S96T000258		DL	< 14 µg/ml	< 14 µg/ml	< 14 µg/ml (< 10.4 µg/g)		
S95T000322	65:13	Upper ½	< 439.19	< 439.19	< 439.19		

Table B-1. Tank 241-BY-106 Hydrostatic Head Fluid Contamination: Lithium. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)
Solids: acid digest			µg/g	µg/g	µg/g	µg/g	%
S95T004191	121: 2	Upper ½	< 3.69	< 3.83	< 3.76	< 4.92	N/A
S95T004192	121: 3	Upper ½	< 4.62	< 4.75	< 4.685		
S95T004193		Lower ½	< 4.07	< 3.76	< 3.915		
S95T004194	121: 4	Upper ½	< 4.44	< 5.17	< 4.805[QC:e]		
S95T004195		Lower ½	< 5.06	< 4.42	< 4.74[QC:e]		
S95T004196	121: 5	Upper ½	< 5.28	< 4.69	< 4.985[QC:e]		
S95T004197	121: 6	Upper ½	< 5.01	< 5.19	< 5.1		
S95T004198	121: 7	Upper ½	< 4.76	< 4.56	< 4.66		
S95T004199	121: 8	Upper ½	< 4.83	< 4.66	< 4.745		
S95T004200		Lower ½	< 4.24	< 4.08	< 4.16		
S95T004201	121: 9	Upper ½	< 4.75	< 4.62	< 4.685		
S96T000108	121:10	Upper ½	< 4.53	< 4.68	< 4.605		
S96T000252	121:10B	Upper ½	< 4.32	< 4.42	< 4.37		
S96T000253		Lower ½	< 4.15	< 4	< 4.075		
S96T000258		DL	< 14 µg/ml	< 14 µg/ml	< 14 µg/ml (< 10.4 µg/g)		
Liquids			µg/mL	µg/mL	µg/mL	µg/mL	%
S95T000109	65:12	DL	< 5.01	< 5.01	< 5.01	< 5.01	N/A
Composite: water digest			µg/g	µg/g	µg/g	µg/g	%
S96T000381	S1-10B	Composite	< 5.7	< 5.81	< 5.755	< 5.75	N/A

Table B-1. Tank 241-BY-106 Hydrostatic Head Fluid Contamination: Lithium. (3 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)
Composite: fusion			µg/g	µg/g	µg/g	µg/g	%
S96T000379	1-10B	Composite	< 179	< 193	< 186	< 186	N/A
Composite: acid digest			µg/g	µg/g	µg/g	µg/g	%
S96T000380	1-10B	Composite	< 4.77	< 4.69	< 4.73	< 4.73	N/A

Table B-2. Tank 241-BY-106 Hydrostatic Head Fluid Contamination: Bromide. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)
Solids: water digest			µg/g	µg/g	µg/g	µg/g	%
S95T004202	121: 1	Upper ½	< 957	1,070	1,013.5	1,024	11.4
S95T004203	121: 2	Upper ½	< 933.2	1,060	< 996.6		
S95T004204	121: 3	Upper ½	1,104	1,160	1,132		
S95T004205		Lower ½	< 949.3	< 905	< 927.15		
S95T004206	121: 4	Upper ½	1,167	1,270	1,218.5		
S95T004207		Lower ½	1,237	1,290	1,263.5		
S95T004208	121: 5	Upper ½	1,020	1,020	1,020		
S95T004209	121: 6	Upper ½	1,524	1,590	1,557		
S95T004210	121: 7	Upper ½	1,166	1,280	1,223		
S95T004211	121: 8	Upper ½	< 492.1	< 441	< 466.55		
S95T004212		Lower ½	1,173	1,070	1,121.5		
S95T004213	121: 9	Upper ½	< 884.3	< 905	< 894.65		
S96T000109	121:10	Upper ½	< 930.5	< 975	< 952.75		
S96T000254	121:10B	Upper ½	1,017	1,130	1,073.5		
S96T000255		Lower ½	1,190	1,090	1,140		
S96T000258		DL	< 521.8 µg/mL	< 522 µg.mL	< 521.9 µg/mL (< 389 µg/g)		

Table B-2. Tank 241-BY-106 Hydrostatic Head Fluid Contamination: Bromide. (2 sheets)

Sample Number	Sample Location	Segment Portion	Result	Duplicate	Sample Mean	Overall Mean	RSD (Mean)
Liquids			**µg/mL**	**µg/mL**	**µg/mL**	**µg/mL**	**%**
S95T000004	64: 3	DL	< 2,120	< 2,120	< 2,120	< 2,015	N/A
S95T000228		DL	< 1,700	< 1,700	< 1,700		
S94T000355	64: 6	DL	< 2,120	< 2,120	< 2,120		
S94T000371	64:10	DL	< 2,120	< 2,120	< 2,120		
Composite: water digest			**µg/g**	**µg/g**	**µg/g**		
S96T000381	S1-10B	TOTAL	< 981.5	1,000	< 990.75	< 991	N/A

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APPENDIX C

SINGLE-SHELL TANK 241-BY-106
1994 VAPOR SAMPLING RESULTS

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Table C-1. Inorganic Gas and Vapor Concentrations.

Analyte	CAS #	Sample Type	Number of samples	Average (ppmv)	Standard Deviation (ppmv)	RSD (%)
Ammonia, NH_3	7664-41-7	Sorbent Trap	5	74	2	3
Carbon Dioxide, CO_2	124-38-9	SUMMA™	3	47.6	1.4	3
Carbon Monoxide, CO	630-08-0	SUMMA™	3	0.45	.03	7
Hydrogen, H_2	1333-74-0	SUMMA™,[1]	3	45.5[1]	2.5	5
Nitric Oxide, NO	10102-43-9	Sorbent Trap	10	0.13	0.04	28
Nitrogen Dioxide, NO_2	10102-44-0	Sorbent Trap	5	0.05[2]	0.006	13
Nitrous Oxide, N_2O	10024-97-2	SUMMA™	3	70.6	0.6	1
Water Vapor, H_2O	7732-18-5	Sorbent Trap	10	20,700 (14.7 mg/L)	1,200 (0.8 mg/L)	6

Notes:

CAS = Chemical Abstract Service

[1]Hydrogen analysis of 7/8/94 samples problematic, average given is for 3 SUMMA™ canister samples collected 5/4/94 (Rasmussen 1994b).
[2]Only 5 of the 10 samples were statistically above blank nitrite levels.

Table C-2. Organic Target Compound Average Concentrations. (3 sheets)

Compound	CAS #	Sample Type	Average (ppmv)	Standard Deviation (ppmv)	RSD %
Methane	74-82-8	SUMMA™	3.6[1]	<0.1	4
Dichlorodifluoromethane	75-71-8	SUMMA™	0.011	0.002	18
Chloromethane (Methyl chloride)	74-87-3	SUMMA™	0.0028	0.0006	20
Trichlorofluoromethane	75-69-4	SUMMA™	0.19	0.02	9
Dichloromethane (Methylene chloride)	75-09-2	TST SUMMA™	0.00047[2] <0.002	0.00017 --	36 --
Ethanenitrile (Acetonitrile)	75-05-8	TST	0.12	0.02	16
Propanone (Acetone)	67-64-1	TST	0.37	0.08	23
Propanenitrile	107-12-0	TST	0.0043	0.0002	5
Butanal	123-72-8	TST	0.061	0.013	21
n-Hexane	110-54-3	TST	0.085	0.011	13
Benzene	71-43-2	TST SUMMA™	0.0073 0.0022	0.0008 0.0004	11 19
1-Butanol	71-36-3	TST	0.34	0.03	8
Butanenitrile	109-74-0	TST	0.0015	0.00009	6
2-Pentanone	107-87-9	TST	0.011	0.0009	9
n-Heptane	142-82-5	TST	0.031	0.002	6

Table C-2. Organic Target Compound Average Concentrations. (3 sheets)

Compound	CAS #	Sample Type	Average (ppmv)	Standard Deviation (ppmv)	RSD %
Toluene	108-88-3	TST SUMMA™	0.0083 0.0071	0.0011 0.0003	13 5
Tetrachloroethene	127-18-4	SUMMA™	0.003	0.001	34
Ethylbenzene	100-41-4	SUMMA™	0.0013[3]	--	--
1,3-Dimethylbenzene (m-xylene) + 1,4-Dimethylbenzene (p-xylene)	108-38-3 106-42-3	SUMMA™	0.0031	0.0004	13
Pentanenitrile	110-59-8	TST	0.0010	0.0001	11
2-Hexanone	591-78-6	TST	0.0042	0.0005	13
n-Octane	111-65-9	TST	0.012	0.001	11
Hexanenitrile	628-73-9	TST	0.00072	0.00011	15
2-Heptanone	110-43-0	TST	0.0032	0.0007	23
n-Nonane	111-84-2	TST	0.0046	0.0006	14
Heptanenitrile	629-08-3	TST	0.00034	0.00003	9
2-Octanone	111-13-7	TST	0.00094	0.00029	31
Octanenitrile	124-12-9	TST	0.00018	0.00002	9
Nonanenitrile	2243-27-8	TST	0.00019	0.00003	15
n-Dodecane	112-70-3	TST	0.0065	0.0014	22
n-Tridecane	629-50-5	TST	0.0069	0.0019	28

Table C-2. Organic Target Compound Average Concentrations. (3 sheets)

Compound	CAS #	Sample Type	Average (ppmv)	Standard Deviation (ppmv)	RSD %
Tributyl phosphate (TBP)	126-73-8	TST	0.000044	0.000009	20
Dibutyl butylphosphonate (DBBP)	75-46-4	TST	0.0000064	0.0000030	47

Notes:

CAS = Chemical Abstract Service
TST = treated sorbent tube

[1]All SUMMA™ canister results are based on analyses of three samples. SUMMA™ analysis of methane was performed by OGIST, other SUMMA™ analyses in this table were performed by PNNL.

[2]Except where noted, all TST results are based on 4 samples.

[3]Result of single sample, other samples < 0.002 ppmv.

Table C-3. Tentatively Identified Organic Compounds Reported by PNNL. (2 sheets)

Compound Number	Compound	CAS #	Average mg/m³	Standard Deviation mg/m³
1	Propene	115-07-1	1.04	0.18
2	Propane	74-98-6	0.68	0.14
3	Propane	74-98-6	0.06	0.01
4	Cyclopropane	75-19-4	0.17	0.04
5	2-Methylpropane	75-28-5	0.56	0.24
6	2-Methylpropene	115-11-7	0.73	0.27
7	n-Butane	106-97-8	0.86	0.35
8	2-Butene	107-01-7	0.16	0.07
9	Ethanol	64-17-5	0.11	--
10	C4 Alkene	N/A	0.09	0.04
11	Acetone	67-64-1	0.88	0.46
12	C5 Alkane	N/A	0.40	0.24
13	1-Pentene	109-67-1	0.25	0.11
14	n-Pentane	109-66-0	0.75	0.44
15	C5 Alkene[1]	N/A	0.06	--
16	C6 Alkene[1]	N/A	0.08	--
17	1-Pentanol[1]	71-41-0	0.07	--
18	2-Methylpentane	107-83-5	0.71	0.06
19	Butanal	123-72-8	0.17	0.04
20	2-Butanone (MEK)	78-93-3	0.17	0.03
21	3-Methylpentane	96-14-0	0.14	0.01
22	1-Hexene	592-41-6	0.15	0.02
23	n-Hexane	110-54-3	0.54	0.08
24	Tetrahydrofuran	109-99-9	0.17	0.02
25	2-Methyl-1-pentene	763-29-1	0.07	0.01
26	1-Butanol	71-36-3	0.99	0.13
27	2-Pentanone	107-87-9	0.13	0.02
28	C7 Alkane	N/A	0.24	0.05
29	1-Heptene	592-76-7	0.06	0.01

Table C-3. Tentatively Identified Organic Compounds Reported by PNNL. (2 sheets)

Compound Number	Compound	CAS #	Average mg/m³	Standard Deviation mg/m³
30	n-Heptane	142-82-5	0.33	0.04
31	C7 Alkene	N/A	0.06	0.01
32	C8 Alkane	N/A	0.12	0.02
33	Hexanal[1]	66-25-1	0.07	--
34	n-Octane	111-65-9	0.11	0.02
35	2-Butoxyethanol[1]	111-76-2	0.06	--
36	C10 Alkane	N/A	0.06	0.01
37	C10 Alkane[1]	N/A	0.05	--
38	Phenol[1]	108-95-2	0.05	--
39	C11 Alkane[1]	N/A	0.05	--
40	n-Undecane	1120-21-4	0.06	0.00
41	n-Dodecane	112-70-3	0.09	0.01
42	C12 Alkane	N/A	0.07	0.01
43	Benzothiazole[1] (impurity)	95-16-9	0.06	--
44	C7 Cyclohexane[1]	N/A	0.06	--
45	C13 Alkane	N/A	0.06	0.01
46	n-Tridecane	629-50-5	0.09	0.01
47	C13 Alkane	N/A	0.06	0.01
48	C13 Alkane	N/A	0.06	0.01

Notes:

CAS = Chemical Abstract Service
N/A = not applicable

[1]Detected in only one sample.

Table C-4. Tentatively Identified Organic Compounds Reported by ORNL. (12 sheets)

Compound Number	Compound	CAS #	Average[1] (mg/m³)
1	2-Butene, (Z)-	107-01-7	0.527
2	1-Propene, 2-methyl-	115-11-7	0.040
3	1-Propene, 2-methyl-	115-11-7	0.125
4	1Propene, 2-methyl-	115-11-7	0.035
5	1-Butene, 3-methyl-	563-45-1	0.053
6	Methyl ether	115-10-6	0.133
7	Butane, 2-methyl-	78-78-4	0.298
8	Methane, trichlorofluoro-	75-69-4	0.265
9	1-Pentene	109-67-1	0.297
10	1-Butyne and others	107-00-6	0.004
11	Propane, 2-methyl-	75-28-5	1.685
12	Furan	110-00-9	0.028
13	1,3-Pentadiene, (E)- and C5-Alkene	2004-70-8	0.017
14	2-Propanol	67-63-0	0.276
15	2-Pentene, (Z)-	627-20-3	0.016
16	Cyclopentane	287-92-3	0.076
17	Cyclopropane, 1,1-dimethyl-	1630-94-0	0.026
18	1-Pentyne and C4-alkene	627-19-0	0.018
19	1,3-Pentadiene, (Z)-	504-60-9	0.027
20	Butane, 2,2-dimethyl-	75-83-2	0.005
21	2-Propenenitrile and others	107-13-1	0.007
22	1-Pentene, 4-methyl-	691-37-2	0.109
23	Cyclopentane	287-92-3	0.048
24	Pentane, 2-methyl-	107-83-5	0.699
25	C3-cyclopropane	N/A	0.045
26	2,3-Dihydrofuran	N/A	0.035
27	Cyclopropane, propyl-	2415-72-7	0.004
28	1-Butene	106-98-9	0.005

Table C-4. Tentatively Identified Organic Compounds Reported by ORNL. (12 sheets)

Compound Number	Compound	CAS #	Average[1] (mg/m³)
29	Pentane, 3-methyl-	96-14-0	0.152
30	Propanenitrile	107-12-0	0.006
31	1-Pentene, 2-methyl-	763-29-1	0.068
32	C6-alkene	N/A	0.169
33	3-Buten-2-one	78-94-4	0.036
34	2-Butanone	78-93-3	0.212
35	2-Hexene, (Z)-	7688-21-3	0.023
36	2-Pentene, 4-methyl-, (E)-	674-76-0	0.029
37	Alkanol	N/A	0.032
38	Cyclopropane, propyl-	2415-72-7	0.116
39	C6-alkene	N/A	0.025
40	Cyclopentane, methyl-	96-37-7	0.096
41	Alkenol	N/A	0.158
42	Furan, tetrahydro-	109-99-9	0.302
43	1,3-Butadiene, 2,3-dimethyl-	513-81-5	0.048
44	1,4-Hexadiene	592-45-0	0.033
45	1H-Pyrrole and others	109-97-7	0.008
46	Mixture	N/A	0.007
47	1-Hexene, 5-methyl-	3524-73-0	0.028
48	2-Butenal	4170-30-3	0.015
49	Furan, 2,5-dihydro-	1708-29-8	0.029
50	3-Butenenitrile	109-75-1	0.016
51	Hexane, 2-methyl-	591-76-4	0.044
52	1-Hexene, 3,4-dimethyl-	16745-94-1	0.003
53	Pentane, 2,3-dimethyl-	565-59-3	0.001
54	Furan, 2-propyl-	4229-91-8	0.340
55	Cyclopentane, 1,3-dimethyl-, cis-	2532-58-3	0.002
56	C3-Cyclopentane	N/A	0.002

Table C-4. Tentatively Identified Organic Compounds Reported by ORNL. (12 sheets)

Compound Number	Compound	CAS #	Average[1] (mg/m³)
57	C6-alkenone	N/A	0.008
58	Cyclopentane, 1,2-dimethyl-	2452-99-5	0.010
59	C2-cyclopentane	N/A	0.066
60	2-Pentanol	6032-29-7	0.009
61	2-Heptene, (E)-	14686-13-6	0.005
62	2-Pentanone, 4-methyl-	108-10-1	0.010
63	2-Heptene	592778	0.001
64	Cyclohexane, methyl-	108-87-2	0.041
65	1-Hexene, 2-methyl-	6094-02-6	0.001
66	Hexane, 2,4-dimethyl-	589-43-5	0.001
67	C7-alkene	N/A	0.010
68	2-Pentanol, 2-methyl-	590-36-3	0.013
69	C6-Alkenone	N/A	0.001
70	C8-Alkene	N/A	0.002
71	2-Pentanone, 4-methyl-	108-10-1	0.010
72	Alkane	N/A	0.006
73	Mixture	N/A	0.001
74	Mixture	N/A	0.005
75	Cyclopropane, 1-heptyl-2methyl-	74663-91-5	0.015
76	C8-Alkene	N/A	0.001
77	Pentane, 3-ethyl-2-methyl-	609-26-7	0.024
78	Heptane, 3-methyl-	589-81-1	0.055
79	1-Octen-3-one	4312-99-6	0.017
80	Cyclohexane, 1,3-dimethyl-, cis-	638-04-0	0.007
81	C2-cyclohexane	N/A	0.001
82	1,4-Hexadiene, 4-methyl- and others	1116-90-1	0.001

Table C-4. Tentatively Identified Organic Compounds Reported by ORNL. (12 sheets)

Compound Number	Compound	CAS #	Average[1] (mg/m³)
83	3-Hexanone	589-38-8	0.016
84	1-Hexene, 4,5-dimethyl-	16106-59-5	0.001
85	Hexanal	66-25-1	0.010
86	Formamide, N-(2-methylpropyl)-	6281-96-5	0.007
87	Alkanol	N/A	0.003
88	1-Pentanol, 5-methoxy-	4799-62-6	0.003
89	Cyclopentane, 1,1,3-trimethyl-	4516-69-2	0.005
90	Hexanal	66-25-1	0.003
91	Ethene, tetrachloro-	127-18-4	0.023
92	Acetic acid, butyl ester	123-86-4	0.007
93	Hexamethylcyclotrisiloxane	541-05-9	0.006
94	Pyridine, 4-methyl-	108-89-4	0.007
95	Nitric acid, butyl ester	928-45-0	0.000
96	Heptane, 2,6-dimethyl-	1072-05-5	0.022
97	2-Pentanol, 2,3-dimethyl-	4911-70-0	0.005
98	4-Heptenal, (Z)-	6728-31-0	0.002
99	Cyclohexane, ethyl-	1678-91-7	0.011
100	Cyclohexane, 1,1,3-trimethyl-	3073-66-3	0.019
101	Hexane, 3-methoxy-	54658-01-4	0.009
102	7-Octen-2-one	3664-60-6	0.007
103	Cyclobutanone, 2,3,3-trimethyl-	28290-01-9	0.011
104	Cyclohexane, 1,3,5-trimethyl-	1839-63-0	0.006
105	Heptane, 2,3-dimethyl-	3074-71-3	0.012
106	Octane, 2-methyl-	3221-61-2	0.020
107	Nirto-Compound	N/A	0.001

Table C-4. Tentatively Identified Organic Compounds Reported by ORNL. (12 sheets)

Compound Number	Compound	CAS #	Average[1] (mg/m³)
108	Octane, 3-methyl-	2216-33-3	0.024
109	Benzene, 1,3-dimethyl-	108-38-3	0.020
110	4-Octen-3-one	14129-48-7	0.001
111	Cyclohexane, 1,2,3-trimethyl-	1678-97-3	0.001
112	Alkane	N/A	0.015
113	C3-cyclohexane and others	N/A	0.004
114	Acetamide, N,N-dimethyl- and others	127-19-5	0.001
115	3-Heptanone	106-35-4	0.028
116	Styrene	100-42-5	0.005
117	Benzene, 1,4-dimethyl-	106-42-3	0.008
118	Heptanal	111-71-7	0.007
119	Cyclohexane, 1,1,3,5-tetramethyl-, trans-	50876-31-8	0.001
20	C3-Cyclohexane	N/A	0.001
121	Cyclohexane, 1-ethyl-4-methyl-, cis	4926-78-7	0.004
122	C7-alkanone	N/A	0.005
123	Mixture	N/A	0.002
124	Cyclopropene, 1-butyle-2-ethyl-	50915-91-8	0.016
125	Cyclohexanol, 3-methyl- and others	591-23-1	0.001
126	2-Heptanol, 2-methyl-	625-25-2	0.003
127	Octane, 2,6-dimethyl-	2051-30-1	0.022
128	Cyclohexane, (1-methylethyl)-	696-29-7	0.002
129	Pyridine, 3,5-dimethyl- and others	591-22-0	0.004
130	Furan and others	110-00-9	0.001

Table C-4. Tentatively Identified Organic Compounds Reported by ORNL. (12 sheets)

Compound Number	Compound	CAS #	Average[1] (mg/m³)
131	Heptane, 3-ethyl-2-methyl-	14676-29-0	0.006
132	Mixture	N/A	0.003
133	2-Heptanone, 6-methyl-	928-68-7	0.031
134	Benzene, propyl-	103-65-1	0.003
135	Nonane, 4-methyl-	17301-94-9	0.012
136	1,1,2,3-tetramethyl-cyclohexane A	N/A	0.024
137	Alkenol	N/A	0.034
138	Alkene	N/A	0.010
139	C3-cyclohexene	N/A	0.003
140	3-Pentene-2-ol and others	1569-50-2	0.002
141	4-Octanone and others	589-63-9	0.002
142	Cyclopentane, 1-methyl-3-(2-methylpropyl)-	29053-04-1	0.006
143	C3-Cyclohexene	N/A	0.001
144	Cyclohexane, 1-methyl-4-(-methylethyl)-, cis-	6069-98-3	0.006
145	Phenol	108-95-2	0.010
146	Cyclotetrasiloxane, octamethyl-	556-67-2	0.024
147	Butanoic acid, butyl ester	109-21-7	0.005
148	Decane	124-18-5	0.049
149	4-Nonene, 5-methyl-	15918-07-7	0.001
150	(Z)-2,3,4,5-tetramethyl-3-hexene	N/A	0.005
151	C5-cyclopentane	N/A	0.002
152	C4-Cyclohexane	N/A	0.001
153	Cyclopentane, 1-methyl-3-(2-methylpropyl)-	29053-04-1	0.004

Table C-4. Tentatively Identified Organic Compounds Reported by ORNL. (12 sheets)

Compound Number	Compound	CAS #	Average[1] (mg/m³)
154	Heptane, 2,3,6-trimethyl-	4032-93-3	0.004
155	3-Hexane, 2,2,5,5-tetramethyl-, (A)- and others	692-47-7	0.006
156	Nonane, 2,6-dimethyl-	17302-28-2	0.034
157	Cyclohexanol, 4-(1,1,3,3-tetramethylbutyl)	4631-98-5	0.004
158	1-Hexanol, 2-ethyl	104-76-7	0.001
159	Undecane	1120-21-4	0.005
160	Cyclohexane, (1-methylpropyl)-	7058-01-7	0.014
161	Cyclopentane, 1-hexyl-3-methyl-	61142-68-5	0.001
162	1,1,2,3-Tetramethyl-cyclohexane A	N/A	0.001
163	C5-cyclohexane	N/A	0.004
164	C4-cyclohexane	N/A	0.008
165	1-Undecene	821-95-4	0.001
166	Mixture	N/A	0.001
167	Cyclohexanone, 2,6-diethyl-	16519-68-9	0.001
168	1,1-dimethyl-2-propylcyclo-hexane	N/A	0.017
169	Decane, 4-methyl-	2847-72-5	0.006
170	Decane, 2,6,7-trimethyl-	62108-25-2	0.016
171	Naphthalene, decahydro-, trans-	493-02-7	0.024
172	Mixture	N/A	0.001
173	Ethanone, 1-phenyl-	98-86-2	0.010

Table C-4. Tentatively Identified Organic Compounds Reported by ORNL. (12 sheets)

Compound Number	Compound	CAS #	Average[1] (mg/m³)
174	1-Naphthalenol, decahydro-4a-methyl-8-methylene-2-(1-met) and others	30951-17-8	0.007
175	C5-cyclohexane	N/A	0.007
176	Cyclohexane, 1,2-diethyl-1-methyl-Zinc, bis[2-(1,1-dimethylethyl)-3, 3-dimethylcyclopro	61141-79-5	0.005
177	C5-cyclohexane	N/A	0.016
178	2-Nonanone	821-55-6	0.004
179	C6-cyclohexane	N/A	0.005
180	Undecane	1120-21-4	0.071
181	5-Undecene	4941-53-1	0.005
182	C11-alkene	N/A	0.006
183	Cyclopropane, octyl-	1472-09-9	0.004
184	Undecane, 5-methyl-	1632-70-8	0.012
185	Cyclohexene, 1-pentyl-	15232-85-6	0.006
186	Naphthalene, decahydro-2-methyl-	2958-76-1	0.030
187	C6-Alkenyl-cyclopentane	N/A	0.001
188	5-Dodecene, (Z)-	7206-28-2	0.006
189	Benzoic acid, 2-[(trimethylsilyl)oxyl-, trimethylsilyl ester	3789-85-3	0.004
190	Cyclohexane, pentyl-	4292-92-6	0.014
191	Naphthalene, decahydro-2-methyl-	2958-76-1	0.025
192	Decane, 2,4-dimethyl-	2801-84-5	0.003
193	6-Methylundecane	17302-33-9	0.023
194	Undecane, 4-methyl-	2980-69-0	0.012
195	Undecane, 2-methyl-	7045-71-8	0.019

Table C-4. Tentatively Identified Organic Compounds Reported by ORNL. (12 sheets)

Compound Number	Compound	CAS #	Average[1] (mg/m³)
196	C6-cyclohexane	N/A	0.006
197	Undecane, 3-,methyl-	1002-43-3	0.009
198	2-Cyclohexen-1-one, 4-ethyl-3,4-dimethyl-	17622-46-7	0.003
199	2-Propyl-1,1,3-trimethyl-cyclohexane	N/A	0.005
200	Naphthalene, decahydro-2,3-dimethyl-	1008-80-6	0.007
201	Decane, 2,3,6-drimethyl-	62238-12-4	0.007
202	Mixture	N/A	0.001
203	Cyclohexane, 1,-methyl-3-pentyl-	54411-02-8	0.002
204	Cyclopentane, 2-isopropyl-1,3-dimethyl-	32281-85-9	0.006
205	Naphthalene, decahydro-1,6-dimethyl-	1750-51-2	0.001
206	Cyclohexane, 1-ethyl-2-methyl-, cis-	4923-77-7	0.016
207	Undecane, 2,6-dimethyl-	17301-23-4	0.027
208	C2-Decahydronaphthalene	N/A	0.005
209	Undecane, 4,8-dimethyl-	17301-33-6	0.006
210	C2-Decahydronaphthalene	N/A	0.003
211	Naphthalene, decahydro-1,5-dimethyl-	66552-62-3	0.010
212	4-Nonene, 5-butyl-	7367-38-6	0.019
213	(E,E)(3S,8S),3,8-dimethyl-deca-4,6-diene	N/A	0.015
214	C7-Cyclohexane	N/A	0.002
215	Naphthalene, decahydro-1,6-dimethyl-	1750-51-2	0.001
216	C7-Cyclohexane	N/A	0.009
217	Undecane, 2,10-dimethyl-	17301-27-8	0.019

Table C-4. Tentatively Identified Organic Compounds Reported by ORNL. (12 sheets)

Compound Number	Compound	CAS #	Average[1] (mg/m³)
218	Tridecane, 7-methyl-	26730-14-3	0.049
219	Cyclohexane, 1,2-diethyl-3-methyl-	61141-80-8	0.007
220	2(3H)-Benzofuranone, 3a,4,5,6-tetrahydro-3a,6,6-trimethyl-	16778-26-0	0.010
221	6-Tridecane, 7-methyl-	24949-42-6	0.022
222	Phenol, 4-(1,1-dimethylethyl)- and others	98-54-4	0.004
223	Cyclohexane, (2-ethyl-1-methyl-1-butenyl) -2-Decyne	74810-42-7	0.002
224	Undecane, 6-ethyl-	17312-60-6	0.001
225	Dodecane, 2,5-dimethyl-	56292-65-0	0.010
226	C8-Cyclohexane	N/A	0.004
227	C8-Cyclohexane	N/A	0.006
228	7-Tetradecene	10374-74-0	0.004
229	2-Octylfuran	N/A	0.006
230	Cyclohexane, octyl-	1795-15-9	0.012
231	Tridecane, 4-methyl-	26730-12-1	0.005
232	Tridecane, 2-methyl-	1560-969	0.006
233	C1-acridine and others	N/A	0.021
234	Dodecane, 2,6,10-trimethyl-	3891-98-3	0.061
235	Tetradecane	629-59-4	0.045
236	Tridecane, 4,8-dimethyl-	55030-62-1	0.012
237	1,1,2,3-tetramethyl cyclohexane A	N/A	0.019
238	Cyclopentane, (1-methylbutyl)- Cylotetracosane	4737-43-3	0.007

Table C-4. Tentatively Identified Organic Compounds Reported by ORNL. (12 sheets)

Compound Number	Compound	CAS #	Average[1] (mg/m³)
239	Cyclohexane, 1,1,3,5-tetramethyl-, cis-	50876-32-9	0.001
240	1-Pentadecene	13360-61-7	0.001
241	Alkane	N/A	0.001
242	C16-Alkane	N/A	0.006
243	Dodecane, 2-methyl-8-propyl-	55045-07-3	0.012
244	Dodecane, 2-methyl-8-propyl-decane, 5-propyl-	55045-07-3	0.045
245	Pentadecane, 2-methyl-	1560-93-6	0.003
246	Alkane	N/A	0.004
247	3-tert-butyl-4-methoxphenol	88-32-4	0.000
248	Phenol, (1,1-dimethylethyl)-4-methoxy-	25013-16-5	0.001
249	7-Hexadecene, (Z)-	35507-09-6	0.010
250	Pentadecane	629-62-9	0.043
251	3,4-Undecadiene-2, 10-dione, 6,6-dimethyl-	52588-78-0	0.000
252	C9-Cyclohexane	N/A	0.000
253	Tridecane, 2-methyl-	1560-96-9	0.005
254	Alkane	N/A	0.004
255	Alkane	N/A	0.005
256	Alkane	N/A	0.000
257	Hexadecane, 3-methyl-	6418-43-5	0.001
258	5-Undecanone, 2-methyl-	50639-02-6	0.001
259	Hexadecane	544-76-3	0.015
260	1,2-Benzenedicarboxylic acid, diethyl ester	84-66-2	0.038
261	Pentadecane, 2,6,10-dimethyl-	N/A	0.006

Table C-4. Tentatively Identified Organic Compounds Reported by ORNL. (12 sheets)

Compound Number	Compound	CAS #	Average[1] (mg/m³)
262	1-Hexadecanol	36653-82-4	0.003
263	Heptadecane	629-78-7	0.003
264	Pentadecane, 2,6,10,14-tetramethyl-	1921-70-6	0.004
265	Alkane	N/A	0.004
266	1,1'-Biphenyl, 2,2'-diethyl-	13049-35-9	0.000
267	Tetradecanoic acid	544-63-8	0.008
268	Benzenesulfonamide, N-butyl-	3622-84-2	0.034
269	Pentadecanoic acid	1002-84-2	0.002
270	1-Hexadecanol	36653-82-4	0.003
271	Alkene and others	N/A	0.004
272	Hexadecanoic acid	57-10-3	0.013
273	Phthalate	N/A	0.001
274	Hexadecanoic acid	57-10-3	0.003

Notes:

CAS = Chemical Abstract Service
N/A = not applicable

[1]Average includes samples with zero concentration.

APPENDIX D

SINGLE-SHELL TANK 241-BY-106
HISTORICAL SAMPLING

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APPENDIX D

SINGLE-SHELL TANK 241-BY-106 HISTORICAL SAMPLING

D.0 HISTORICAL SAMPLING

Historically, waste samples have been analyzed in an effort to characterize the composition of the waste within tank 241-BY-106. Data have been compiled for samples obtained from three sampling events from the 1970s and 1990. The data were obtained from internal letters and memoranda from Westinghouse Hanford Company and Atlantic Richfield Hanford Company.

D.1 Description of the 1971 Sampling Event

A sample analysis report dated October 14, 1971 (Buckingham 1972) provided no description of the technique or procedure used to obtain the sample. Also, no data were provided on the riser used or the sampling depth. The sample was a liquid and was most likely a dip sample.

D.1.1 Sample Handling and Analysis

The sample was heated to a temperature of 80 to 90 °C (176 to 194 °F) to dissolve any solids. Approximately 30 mL of the solution were transferred to a jacketed centrifuge cone. The temperature of the solution was adjusted by means of a thermostated circulating water bath. The solution was agitated with a mechanical stirrer as it came to the desired temperatures for analysis. After allowing the solids to settle, a 1-mL sample was withdrawn and immediately diluted in 10 mL of water. The analyses were run on the diluted sample with the results multiplied by 11. Results are presented in Table D-1.

Table D-1. Analysis of 1971 Supernatant Liquid.[1]

Waste Tank 241-BY-106					
Analyses of Waste Samples from Tank 241-BY-106					
October 14, 1971					
Component	30°C	40°C	50°C	60°C	Unit
Physical Data					
Vol. % Solid	19.6	13.2	5.2	0.0	---
SpG	1.453	1.484	1.484	1.478	---
Chemical Analysis					
Na	12.2	11.7	12.4	12.1	M
Al	2.00	2.00	2.22	1.79	M
NO_2^-	1.00	1.08	1.00	1.00	M
NO_3^-	2.79	2.86	3.73	4.17	M
CO_3^{2-}	0.97	0.9	0.55	0.65	M
SO_4^{2-}	0.016	0.005	0.013	0.013	M
Radiological Analysis					
^{137}Cs	3.30E+05	3.30E+05	3.20E+05	3.23E+05	μCi/L
^{134}Cs	3.44E+03	3.50E+03	3.26E+03	3.28E+03	μCi/L

Notes:

[1]Buckingham (1972)

M = molarity
SpG = specific gravitiy

D.2 Description of the 1972 Sampling Event

Two dip samples were taken from tank 241-BY-106 to determine if the waste was forming any layers (Buckingham 1972). One sample was taken near the waste surface (#7395), and the other taken from a depth of 10.3 m (33 ft 10 in.) from ground level (#7394). A description of the technique or procedure used to obtain the samples and the riser from which the samples were taken were not available.

D.2.1 Sample Handling and Analysis

Procedures were not available on the analysis of the two samples. The sample results indicated there were no layers within the waste since both samples were nearly identical in composition. Results are presented in Table D-2.

Table D-2. Analyses of 1972 Tank 241-BY-106 Samples.[1]

Waste Tank 241-BY-106					
Analyses of Waste Samples from Tank 241-BY-106					
April 13, 1972					
Component	No.7395, Surface		No. 7394, 33 ft 10 in.		Lab Unit
	Lab Value	Weight %	Lab Value	Weight %	
Physical Data					
Density	1.415	---	1.414	---	g/mL
Chemical Analyses					
H_2O	---	53.20%	---	53.20	---
Na	9.85	16%	10.32	16.80	M
Al	2.58	4.90%	2.37	4.50	M
NO_2^-	1.11	3.60%	1.13	3.70	M
NO_3^-	2.89	12.70%	2.62	12	M
OH^-	3.95	4.70%	3.81	4.60	M
Total	---	95.1%	---	94.80	---
Radiochemical Analyses					
^{137}Cs	3.37E+05	---	3.37E+05	---	μCi/L
^{134}Cs	3.30E+03	---	3.17E+03	---	μCi/L

Note:

[1]Buckingham (1972)

M = molarity

D.3 Description of the 1990 Sampling Event

Ten supernatant samples were taken from the BY and C Tank Farms in 1990; one of samples was obtained from tank 241-BY-106 and referenced by the shipping number R 8042 and lab number R 8083 (Edrington 1991a). The methods and riser used to obtain the sample and sampling depth were not available.

D.3.1 Sample Handling and Analysis

No procedures were available for the analysis of the liquid sample. Analytical results are presented in Table D-3.

Table D-3. 1990 Supernate Sample Analyses.[1] (3 sheets)

Waste Tank 241-BY-106			
Analyses of Waste Samples from Tank 241-BY-106			
June 3, 1991			
First Reported : November 20, 1990			
Component	Lab Value (R8083)	Lab Value (R8093)	Lab Unit
Physical Data			
pH	13.5	13.5	---
SpG	1.46	1.47	---
H_2O	49	50	%
Chemical Analysis			
Na	210,000	210,000	ppm
Al	43,000	43,000	ppm
K	8,400	7,900	ppm
Ce	1,200	980	ppm
Pb	**	**	ppm
Cr	590	560	ppm
Bi	460	400	ppm
Si	420	360	ppm
Mg	230	30	ppm
Ta	200	---	ppm
Zr	160	130	ppm

Table D-3. 1990 Supernate Sample Analyses.[1] (3 sheets)

Waste Tank 241-BY-106			
Analyses of Waste Samples from Tank 241-BY-106			
June 3, 1991			
First Reported : November 20, 1990			
Sn	140	---	ppm
Mo	120	110	ppm
Ag	80	**	ppm
Fe	78	82	ppm
Ni	73	---	ppm
Cu	73	58	ppm
Ti	49	---	ppm
Ba	32	25	ppm
Cd	**	**	ppm
Ca	20	22	ppm
Sr	15	12	ppm
Li	---	36	ppm
As	2.0	0.02	mg/L
Se	0.35	0.40	mg/L
Hg	**	**	ppm
NO_2	97,000	92,000	ppm
NO_3	173,000	181,000	ppm
OH	0.29	0.28	ppm
SO_4	48,000	45,000	ppm
PO_4	<201	**	ppm
F	*	*	ppm
Cl	*	*	ppm
OH	2.9	2.9	M
TOC	3.16	3.04	g/L Carbon

Table D-3. 1990 Supernate Sample Analyses.[1] (3 sheets)

Waste Tank 241-BY-106			
Analyses of Waste Samples from Tank 241-BY-106			
June 3, 1991			
First Reported : November 20, 1990			
Radiological Analysis			
Total Alpha	1.6	1.8	μCi/L
Total Beta	0.47	3.9	Ci/L
GEA: ^{137}Cs	311,000	310,000	μCi/L
$^{239/240}Pu$	**	**	μCi/L
^{241}Am	**	**	μCi/L
^{90}Sr	110	130	μCi/L
^{99}Tc	60	110	μCi/L

Notes:

[1]Edrington (1991a)
*Samples were filtered. This invalidated F and Cl data.
**Less than detection limits

GEA = gamma energy analysis
M = molarity
ppm = parts per million
SpG = specific gravity

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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			
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