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Department of Energy
Richland Operations Office
P.O. Box 550
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96-TSD-013

Mr. John T. Conway, Chairman
Defense Nuclear Facilities Safety Board
625 N. Indiana Avenue, N.W., Suite 700
Washington, D.C. 20004

Dear Mr. Conway:

TRANSMITTAL OF DATA INTERPRETATION REPORT FOR TANK 241-BY-108 TO COMPLETE FERROCYANIDE PROGRAM PLAN MILESTONE "SEPTEMBER 30, 1995"

References: (1) DOE/RL-94-110, Rev. 1, "Program Plan for Resolution of the Ferrocyanide Waste Tank Safety Issue at the Hanford Site," U.S. Department of Energy, Richland Operations Office, Washington, dated October 1994.

(2) WHC-EP-0474-19, "Quarterly Report on the Ferrocyanide Safety Program for the Period Ending December 31, 1995," Westinghouse Hanford Company, Richland, Washington, dated January 1996.

This letter transmits "Tank Characterization Report for Single-Shell Tank 241-BY-108," WHC-SD-WM-ER-533, Rev. 0, the fourth and last report of a set of four data interpretation reports. This activity completes the milestone "September 30, 1995" in Reference (1), paragraph 3.4.5.1 and Reference (2), paragraph 3.4.1. The delay in providing this report was due to equipment failure, modification, and staff retraining as indicated in the July 1995, October 1995, and December 1995 (Reference 2) quarterly reports. The U.S. Department of Energy, Richland Operations Office, has approved the enclosed report.

If you have any questions, please contact me or your staff may contact Mr. Jackson Kinzer, Assistant Manager, Tank Waste Remediation System, on (509) 376-7591.

Sincerely,

John D. Wagoner
Manager

TSD:RGH

Enclosure

96/424

WHC-SD-WM-ER-533
Revision 0

Tank Characterization Report for Single-Shell Tank 241-BY-108

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February 1996

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Approved for public release; distribution is unlimited

EXECUTIVE SUMMARY

This tank characterization report summarizes information on the historical uses, current status, and sampling and analysis results of waste stored in single-shell underground tank 241-BY-108. This report supports the requirements of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1994), Milestone M-44-09 and the Ferrocyanide Safety Program, Milestone T22-96-020 (WHC 1995c). As a result of analyses addressed by this report, the tank does not appear to pose safety concerns based on the decision limits of the safety screening and ferrocyanide data quality objectives (DQOs) (Baldwin 1995b).

Tank 241-BY-108 is 1 of 12 single-shell underground waste storage tanks located in the 200 East Area BY Tank Farm on the Hanford Site. It is the second tank in a three-tank cascade series. The tank went into service in March 1951, receiving first-cycle decontamination waste from the bismuth phosphate process through the cascade. This waste type continued to cascade into the tank until the first quarter of 1954. An active process history followed the initial waste receipts. The tank received ferrocyanide-scavenged uranium recovery waste, in-tank solidification waste, evaporator bottoms, cladding waste, organic wash waste, and water. The ferrocyanide-scavenged waste was allowed to settle in the tank prior to discharging the supernatant to various cribs.

A description and the status of tank 241-BY-108 are summarized in Table ES-1 and Figure ES-1. The tank has an operating capacity of 2,870 kL (758 kgal) and presently contains 863 kL (228 kgal) of waste. The total amount is composed of 583 kL (154 kgal) of sludge and 280 kL (74 kgal) of saltcake; no supernatant liquid remains (Hanlon 1996). The sludge contains 34 kL (9 kgal) of drainable interstitial liquid. Tank 241-BY-108 is on the Ferrocyanide Watch List and controls for Organic Watch List Tanks.

Table ES-1. Description and Status of Tank 241-BY-108.

TANK DESCRIPTION	
Type	Single-shell
Constructed	1948-1949
In-service	1951
Diameter	23 m (75 ft)
Maximum operating depth	7 m (23 ft)
Capacity	2,870 kL (758 kgal)
Bottom shape	Dish
Ventilation	Passive
TANK STATUS	
Waste classification	Noncomplexed
Total waste volume	863 kL (228 kgal)
Sludge volume	583 kL (154 kgal)
Drainable interstitial liquid	34 kL (9 kgal)
Saltcake volume	280 kL (74 kgal)
Waste surface level (1992 to 1995)	218 cm (86 in.) to 225 cm (88.5 in.)
Temperature (1974 to present)	10 °C (50 °F) to 68 °C (154 °F)
Integrity	Assumed leaker
Watch List	Ferrocyanide
SAMPLING DATES	
Rotary mode core sample	July 27 to August 16, 1995
SERVICE STATUS	
Partial isolation	December 1982
Interim stabilized	February 1985

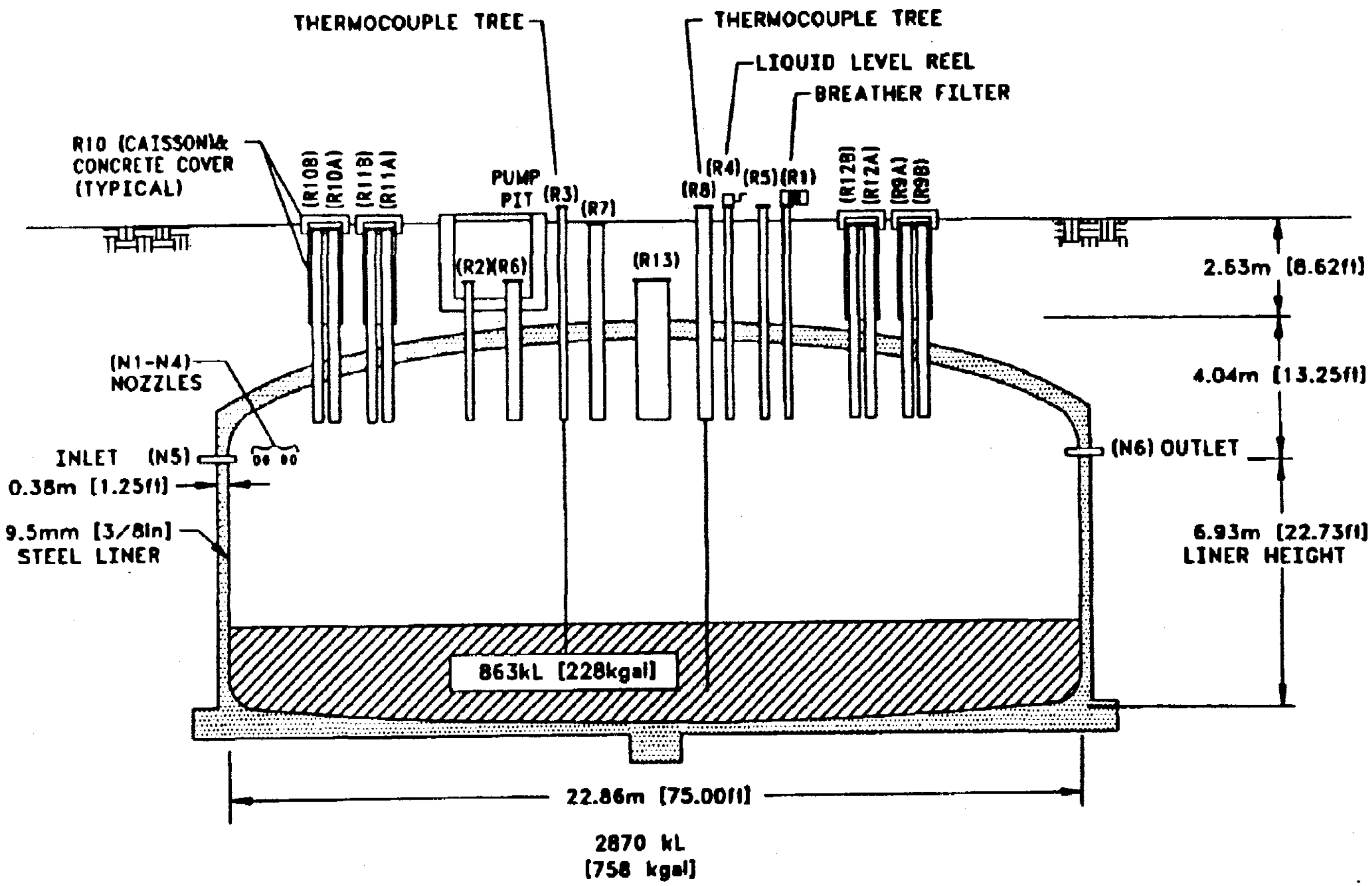

Figure ES-1. Profile of Tank 241-BY-108.

The characterization of tank 241-BY-108 is based on a core sampling event that took place from July 27 through August 16, 1995. Historical sampling data for the top 50.8 cm (20 in.) of waste were obtained from a 1994 auger sampling event. During the 1995 sampling event, cores 98, 99, and 104 were obtained from tank 241-BY-108 using the rotary core sampling method. All three cores were extruded at the Westinghouse Hanford Company 222-S Laboratory. Cores 98 and 104 were analyzed at the 222-S Laboratory in accordance with the *Tank Safety Screening Data Quality Objective* (Babad et al. 1995), the *Interim Data Quality Objectives for Waste Pretreatment and Vitrification* (Kupfer et al. 1994), the *Data Requirements for the Ferrocyanide Safety Issue Developed through the Data Quality Objectives Process* (Meacham et al. 1994), and the *Test Plan for Samples From Hanford Waste Tanks 241-BY-103, BY-104, BY-105, BY-106, BY-108, BY-110, TY-103, U-105, U-107, U-108, and U-109* (Meacham 1995). Although not addressed in the sampling and analysis plan, the analyses required by the *Data Quality Objective to Support Resolution of the Organic Complexant Safety Issue* (Turner et al. 1995) were performed as a consequence of meeting the analytical requirements of the other DQOs and the test plan. Analyses for cores 98 and 104 included determinations for total alpha activity, metals, cyanide, anions, total organic carbon, and an organic screen analysis (Baldwin 1995c). In addition, the energetics and moisture content were determined.

Core 99, obtained from the same riser as core 98, was sent to the Pacific Northwest National Laboratory for analyses in accordance with the safety screening DQO (Babad et al. 1995) and the *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995). These analyses included determination for specific isotopes, metals, cyanide, anions, total organic carbon, density, and thermal analyses (Silvers et al. 1995).

Of the samples from all three cores, two quarter segments from segment 5 of core 104 had mean exothermic reactions (on a dry-weight basis) exceeding the safety screening and ferrocyanide DQOs limit of 481 J/g (dry weight): quarter segment B (573.0 J/g) and quarter segment C (528.3 J/g). The computation of a 95 percent confidence interval (required by the safety screening DQO) indicated the upper limits for these two samples were 702.1 J/g and 657.1 J/g, respectively. Two other samples had one result out of a duplicate pair greater than the threshold: quarter segment 4B of core 98 and a rerun from the same quarter segment. For both samples, the average differential scanning calorimetry (DSC) result was below the limit (473.6 and 445.4 J/g, respectively). However, the upper 95 percent confidence limits for the results of these two samples were 697.7 J/g and 672.0 J/g, respectively; both exceed the 481 J/g DQO limit. Although four samples had DSC values potentially greater than 481 J/g, they also had water contents of at least 35 percent, which reduces the potential for a propagating reaction. In addition, the observed cyanide concentrations were well below the ferrocyanide DQO limit. Analytical nickel concentrations compare favorably with historical estimates (Borsheim and Simpson 1991) and indicate that ferrocyanide has substantially decomposed. One total organic carbon result from quarter segment 4B from core 98 did exceed the ferrocyanide and organic DQOs limit of 30,000 μg/g (dry weight), confirming the high DSC result for this quarter segment. The organic screen revealed that minor amounts of normal paraffin hydrocarbons and tributyl phosphate were present (Baldwin 1995b). All other total organic carbon results were below the limit.

The heat load in the tank produced by radioactive decay is estimated at 2.83 kW (1995 radionuclide data). This compares favorably with the 2.7 kW estimated from the headspace temperature (Kummerer 1994). Surveillance data show tank temperatures have varied from 1974 to the present, ranging from 68 °C (154 °F) to 10 °C (50 °F). However, temperatures have remained steady around 39.4 °C (103 °F) for the past three years. The heat load and thermal history indicate that the waste cannot generate radiolytic temperatures high enough to initiate an exothermic reaction.

Before samples were removed from the tank, combustible gas meter readings from inside the risers were taken as required by the safety screening DQO (Babad et al. 1995). The greatest lower flammability limit observed was 5 percent, satisfying the DQO requirement of less than 25 percent of the lower flammability limit. This measurement was confirmed through calculations of a lower flammability limit from results of a 1994 vapor sampling event. A lower flammability limit of 3.0 percent was calculated.

Total alpha activity results for all three cores were well below the safety screening limit of 41 μCi/g; the highest result of the three cores was 0.450 μCi/g indicating the potential for a criticality event is low.

Any remaining material from the sampling event will be set aside for pretreatment studies as identified in the pretreatment DQO.

Waste surface levels have remained constant between 218 cm (86 in.) and 225 cm (88.5 in.) over the past three years.

An historical evaluation was performed on core 99 results as prescribed in the historical DQO (Simpson and McCain 1995). The fingerprint analytes, identified in the DQO for the waste type (ferrocyanide waste) predicted to compose the lower layer of the tank waste, were bismuth, nickel, sodium, ^{137}Cs, ^{90}Sr, and water. Comparisons were made between the analytical results and the DQO-defined concentration levels for these analytes. Results for all fingerprint analytes, except for bismuth, met the criterion of $\geq$ 10 percent of the concentration level predicted in the historical DQO.

Table ES-2 provides concentration and inventory estimates for the most prevalent analytes and analytes of concern based on the 1995 analytical results.

Table ES-2. Major Analytes and Analytes of Concern.[1]

Metals	Overall Mean Concentration µg/g	Relative Standard Deviation[2] (%)	Projected Inventory kg
Aluminum	39,800	29.8	51,700
Chromium	255	34.7	332
Iron	7,190	52.8	9,350
Nickel	2,510	41.8	3,260
Sodium	1.63E+05	14.2	2.12E+05
Uranium	9,470	60.0	12,300
Anions	µg/g	%	kg
Cyanide	362	65.8	471
Fluoride	6,610	26.7	8,590
Nitrate	2.01E+05	18.5	2.61E+05
Nitrite	27,300	13.0	35,500
Oxalate	7,500	11.4	9,750
Phosphate	26,000	24.0	33,800
Sulfate	23,400	27.9	30,400
Radionuclides	µCi/g	%	Ci
^{137}Cs	258	77.9	3.35E+05
^{90}Sr	143	95.5	1.86E+05
Total Alpha	0.0619	43.3	80.5
Carbon	µg C/g	%	kg C
Total Inorganic Carbon	5,340	33.9	6,940
Total Organic Carbon	4,480	20.5	5,820
Physical Properties			
Density	1.51 g/mL	---	
Percent Water	27.2	19.3	

Notes:

[1]Baldwin (1995b) and Silvers et al. (1995)

[2]Overall relative standard deviation of all available results for subsegments and cores as listed in Appendix A.

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LIST OF TERMS

ANOVA	analysis of variance
C	Celsius
Ci	curies
cm	centimeter
cm^3	cubic centimeters
DL	drainable liquid
DQO	data quality objective
DSC	differential scanning calorimetry
F	Fahrenheit
FID/GC	flame ionization detection/gas chromatography
ft	feet
g	gram
HTCE	Historical Tank Content Estimate
IC	ion chromatography
ICP/AES	inductively coupled plasma/atomic emission spectrometry
in.	inches
J	joule
kg	kilogram
kgal	kilogallon
kL	kiloliter
kW	kilowatt
L	liter
m	meter
mg	milligram
mm	millimeter
mL	milliliter
mR/hr	milliroentgens per hour
PFeCN1	type 1 in-plant ferrocyanide
PFeCN2	type 2 in-plant ferrocyanide
PNNL	Pacific Northwest National Laboratory
ppm	parts per million
ppmv	parts per million by volume
QC	quality control
RPD	relative percent difference
RSD	relative standard deviation
RSST	reactive systems screening tool
SAP	sampling and analysis plan
TIC	total inorganic carbon
TGA	thermogravimetric analysis
TLM	Tank Layer Model
TOC	total organic carbon

LIST OF TERMS (Continued)

W	watts
WSTRS	Waste Status and Transaction Record Summary
wt%	weight percent
μ	micro
μCi	microcurie
μg	microgram
μeq	microequivalent

1.0 INTRODUCTION

This tank characterization report summarizes the information on the historical uses, current status, and sampling and analysis results of waste stored in single-shell tank 241-BY-108. The tank was sampled in 1995 to satisfy the requirements of the following: *Tank Safety Screening Data Quality Objective* (Babad et al. 1995), the *Data Requirements for the Ferrocyanide Safety Issue Developed through the Data Quality Objectives Process* (Meacham et al. 1994), the *Test Plan for Samples From Hanford Waste Tanks 241-BY-103, BY-104, BY-105, BY-108, BY-110, TY-103, U-105, U-107, U-108, and U-109* (Meacham 1995), the *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995), and the *Interim Data Quality Objectives for Waste Pretreatment and Vitrification* (Kupfer et al. 1994). In addition, the analytical requirements of the *Data Quality Objective to Support Resolution of the Organic Complexant Safety Issue* (Turner et al. 1995) were met through the analyses required by the other DQOs and the test plan. Auger samples from 1994 were used for historical analytical data. This report supports the requirements of the *Hanford Federal Facility Agreement and Consent Order*, Milestone M-44-09 (Ecology et al. 1994) and the Ferrocyanide Safety Program Milestone, T22-96-020 (WHC 1995c).

Tank 241-BY-108 has been removed from service and 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 reflect the current composition of the waste based on available data. Tank 241-BY-108 is on the Ferrocyanide Watch List. It also has been identified as potentially containing organic complexants (WHC 1995b).

1.1 PURPOSE

This report summarizes information about the use and contents of tank 241-BY-108. When possible, this information will be used to assess issues associated with safety, operations, environmental, and process activities.

1.2 SCOPE

Rotary core samples were taken in July and August of 1995. Prior to retrieving these samples, tank vapors were field tested using a combustible gas meter to determine the lower flammability limit. In addition, a full vapor characterization of the tank headspace gases was performed in 1994. The data from this sampling and analysis event can be found in the *Tank 241-BY-108 Headspace Gas and Vapor Characterization Results for Samples Collected in March 1994 and October 1994* (Huckaby and Bratzel 1995). Cores 98 and 104 were analyzed to comply with the requirements of the safety screening, ferrocyanide, and pretreatment data quality objectives (DQOs) and the safety program test plan. Although the cores were not specifically evaluated to address the organic DQO, the analyses required by the DQO were performed as a consequence of satisfying the analytical requirements of the other DQOs and the test plan. Objectives of the sampling event were to determine whether the ferrocyanide content was sufficiently low to classify the tank as safe (Postma et al. 1994) and to determine whether the organic content was sufficiently high to warrant being classified on the Organic Watch List. Another purpose was to gather additional information and sample for future retrieval and vitrification activities. The primary analyses included differential scanning calorimetry (DSC) to evaluate fuel level and energetics, thermogravimetric analysis (TGA) to determine moisture content, total alpha activity analysis to evaluate criticality potential, ion chromatography (IC) to determine anion concentrations, inductively coupled plasma/atomic emission spectrometry (ICP/AES) to determine metal concentrations, direct persulfate to determine the TOC concentration, and gas chromatography to determine organic concentrations.

Core 99 was taken to test core sampling procedures and was analyzed in an opportunistic venture according to the safety screening and historical DQOs (Kristofzski 1995). The primary methods of analyses included DSC, TGA, alpha proportional counting, density, IC, ICP/AES, and gamma energy analysis.

Two auger samples of the top 50.8 cm (20 in.) of waste were taken in August 1994 to investigate concerns about a possible floating organic layer coming into contact with the saltcake because of saltwell pumping. An organic screen was performed, and TOC and weight percent water contents were measured (Campbell et al. 1995b).

2.0 HISTORICAL TANK INFORMATION

This section describes tank 241-BY-108 based on historical information. The first part details the current condition of the tank. This is followed by discussions of the tank's background, transfer history, and the process sources that contributed to tank waste, including an estimate of the current contents based on process history. 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 October 31, 1995, tank 241-BY-108 contained 863 kL (228 kgal) of noncomplexed waste (Hanlon 1996). The volume of the various waste phases found in the tank are shown in Table 2-1.

Table 2-1. Summary Tank Contents Status.[1]

Waste Form	Volume	
	Kiloliters	Kilogallons
Supernatant liquid	0	0
Drainable interstitial liquid	34	9
Drainable liquid remaining	34	9
Pumpable liquid remaining	0	0
Sludge	583	154
Saltcake	280	74

Note:

[1]Hanlon (1996)

In 1972, tank 241-BY-108 was declared an assumed leaker with a leak volume of less than 19 kL (5 kgal) and was removed from service. Tank 241-BY-108 was partially isolated in December 1982 and interim stabilized in February 1985. This passively ventilated tank is on the Ferrocyanide Watch List. All monitoring systems were in compliance with documented standards as of October 31, 1995 (Hanlon 1996).

2.2 TANK DESIGN AND BACKGROUND

The BY Tank Farm was constructed during 1948 and 1949 in the 200 East Area and contains 12 100-series tanks. These tanks have a 2,870-kL (758-kgal) operating capacity, a 23-m (75-ft) diameter, and a 7 m (23 ft) operating depth. Tank 241-BY-108 began receiving waste in March 1951. Built as one of the second generation tank farms, the BY Tank Farm was designed for nonboiling waste with a maximum fluid temperature of 104 °C (220 °F).

Tank 241-BY-108 is second in the cascade series of three tanks (241-BY-107, -108, and -109). A 7.6 cm (3 in.) cascade overflow line connects the three tanks. The bottom center elevation of tank 241-BY-107 is 183.4 m (601.65 ft) cascading to tank 241-BY-108 with a bottom elevation of 183.1 m (600.65 ft), which cascades to tank 241-BY-109 with a bottom elevation of 182.8 m (599.65 ft). The cascade overflow height is approximately 6.9 m (22.6 ft) from the tank bottom and 61 cm (2 ft) below the top of the steel liner.

These tanks have a dished bottom with a 1.2 m (4 ft) radius knuckle. Similar to all other single-shell tank farms, the tanks in BY Tank Farm are designed with a primary mild steel liner and a concrete dome with various risers. The riser layout was modified from the first generation for better access to the tank. The tanks are set on a reinforced concrete foundation. To simulate tank stress, the tanks were filled with 38 °C (100 °F) water; then a three-ply asphalt waterproofing was applied over the foundation and steel tank. The waterproofing was protected with welded wire reinforced gunite. Two coats of primer were sprayed on all exposed interior tank surfaces. Tank ceiling domes were covered with three applications of magnesium zincfluorosilicate wash. Lead flashing was used to protect the joint where the steel liner met the concrete dome. Asbestos gaskets were used to seal the manholes in the tank dome. Each tank was covered with approximately 2.4 m (8 ft) of overburden.

Tank 241-BY-108 has 16 risers ranging in size from 10.2-cm (4-in.) to 1.1-m (42-in.) diameter. The surface level is monitored through riser 4 with a manual tape. Table 2-2 shows riser numbers, sizes, and descriptions. A plan view of the riser configuration is shown in Figure 2-1. Risers 1 and 2, which are 10.2-cm (4-in.) diameter, and 7 and 12a, which are 30.5-cm (12-in.) diameter, are available for use. A tank cross section showing the approximate waste level and a schematic of the tank equipment are shown in Figure 2-2.

Table 2-2. Tank 241-BY-108 Risers.[1]

Riser Number	Diameter (inches)	Description and Comments
R1	4	Breather filter
R2	4	Flange, weather covered
R3	4	Thermocouple tree[2]
R4	4	Liquid level reel, bench mark
R5	4	Flange
R6	12	Flange, bale, weather covered
R7	12	Blind flange, below grade
R8	12	Thermocouple tree
R9	42	Caisson
R9B	12	Flange and spool
R10	42	Caisson, welded
R10A	12	Exhaust port, bench mark, concrete covered
R10B	18	Blanked, concrete covered
R11	42	Caisson
R11A	12	Airlift circulator (capped), concrete covered
R11B	4	Capped, concrete covered
R12	42	Caisson
R12A	12	Airlift circulator (capped), concrete covered
R12B	18	Observation port, concrete covered
R13	42	Below grade
N1	3	Spare nozzle
N2	3	Spare nozzle
N3	3	Spare nozzle
N4	3	Spare nozzle
N5	3	Cascade inlet nozzle
N6	3	Cascade outlet nozzle

Note:

[1]Alstad (1993) and Brevick et al. (1994)

[2]A thermocouple tree was installed through riser 3 on July 25, 1995. However, temperature plots from this tree are not available because the tree has not been functioning properly.

Figure 2-1. Riser Configuration for Tank 241-BY-108.

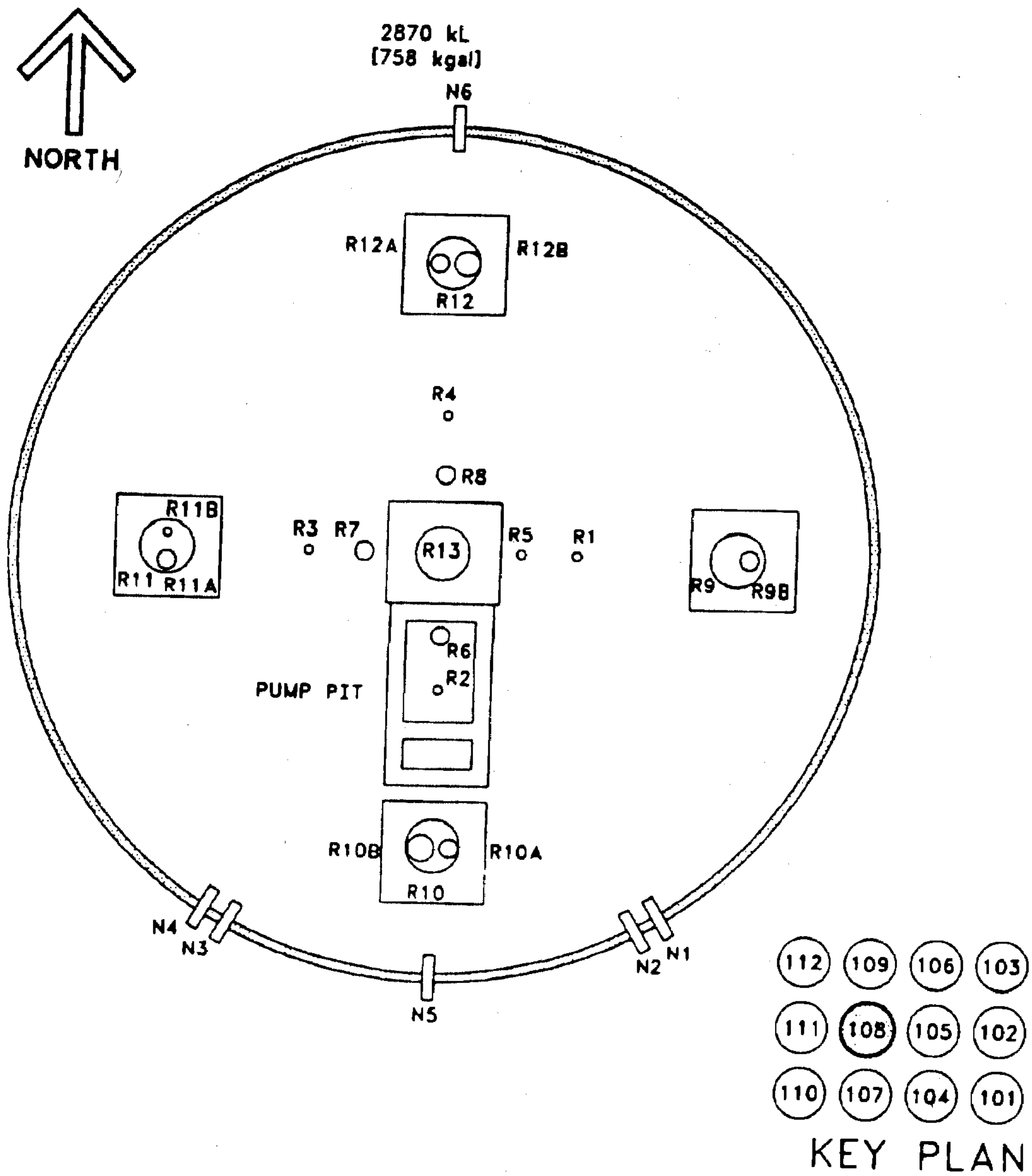
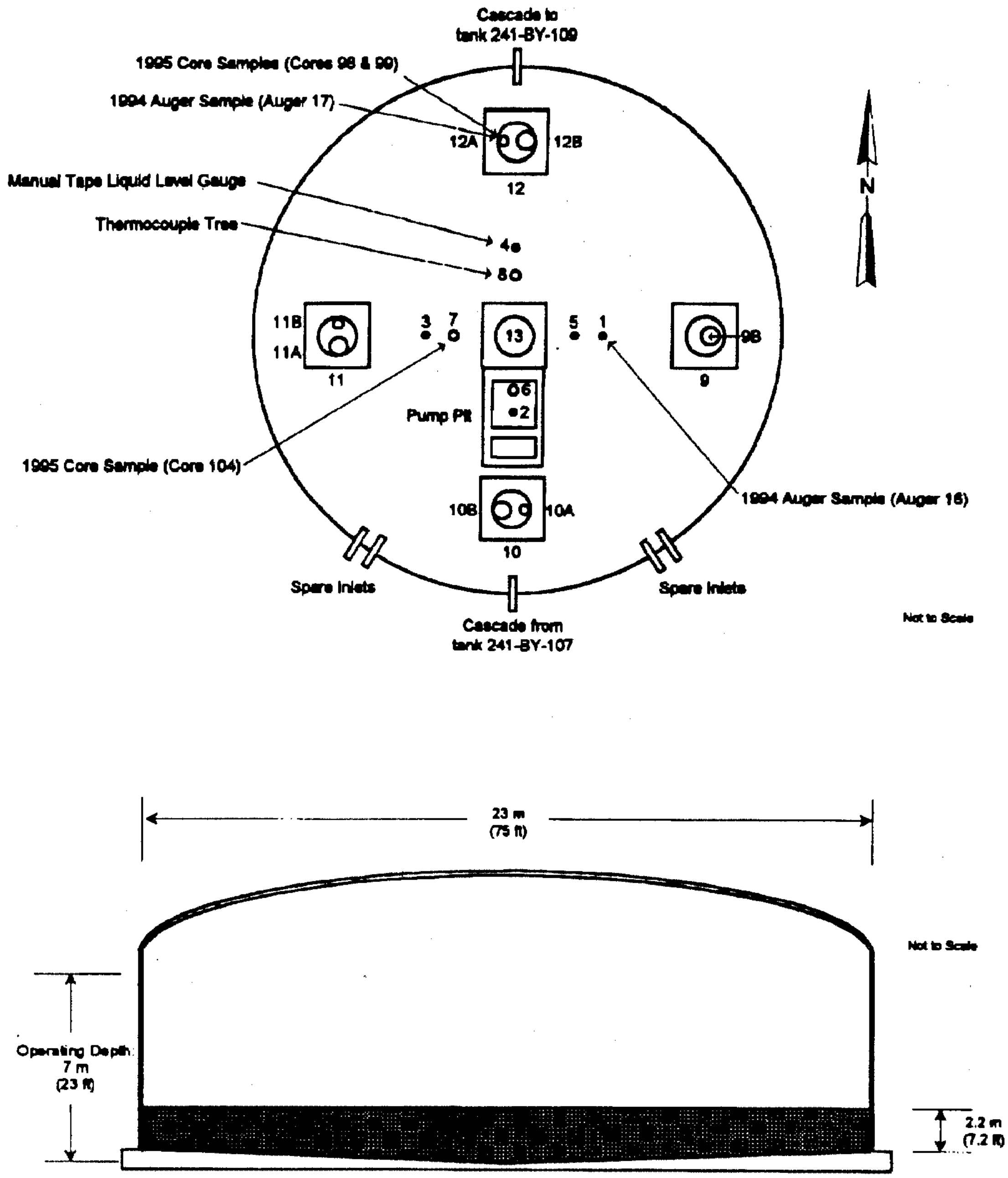


Figure 2-2. Tank 241-BY-108 Configuration.



Total Tank Volume: 2,870 kL (758 kgal)
Waste Volume (October 1995): 863 kL (228 kgal)
Supernate Volume (October 1995): 0 kL (0 kgal)
Sludge Volume (October 1995): 583 kL (154 kgal)
Saltcake Volume (October 1995): 280 kL (74 kgal)

2.3 PROCESS KNOWLEDGE

The subsections below provide information about the transfer history of tank 241-BY-108, describe the process wastes that made up the transfers, and give an estimate of the current tank contents based on transfer history.

2.3.1 Waste Transfer History

Initially, tank 241-BY-108 received first-cycle decontamination waste that cascaded from tank 241-BY-107 during March 1951. This waste originated during the $BiPO_4$ process for processing and recovery of plutonium. This waste type was cascaded until 1954. From 1954 until 1957, tank 241-BY-108 received in-plant ferrocyanide-scavenged uranium recovery waste. (Tank 241-BY-108 was a primary settling tank.) Ferrocyanide was added to the uranium recovery waste to precipitate cesium. After settling, the supernatant liquid (by this time relatively free of cesium) was transferred from tank 241-BY-108 to various cribs. The precipitation of cesium was used to reduce the volume of the stored tank waste. During 1957, tank 241-BY-108 also received in-tank ferrocyanide-scavenged uranium recovery waste (supernatant) from tank 241-C-112 (another primary settling tank). During 1959, tank 241-BY-108 received waste from tank 241-C-105.

In 1968, tank 241-BY-108 received in-tank solidification waste from tank 241-BY-111. From 1969 until 1974, tank 241-BY-108 received evaporator bottoms waste (from the in-tank solidification process), cladding waste, and organic wash waste from tank 241-BY-109. In 1970 and 1971, tank 241-BY-108 also received in-tank solidification waste. Finally, 27 kL (7 kgal), 61 kL (16 kgal) and 8 kL (2 kgal) of water were intermittently added to tank 241-BY-108 from 1972 until 1975. It should be noted that BY saltcake waste, as indicated by the *Waste Status and Transaction Record Summary for the Northeast Quadrant* (WSTRS) (Agnew et al. 1995b), was added to tank 241-BY-108 in 1976. This transaction can be viewed as a redesignation of a part of tank 241-BY-108's waste volume to BY saltcake waste. Approximately 863 kL (228 kgal) of waste was left in tank 241-BY-108 after the final transfer out of the tank in 1982. Table 2-3 summarizes tank 241-BY-108 waste receipt history. It does not include water additions.

Table 2-3. Summary of Tank 241-BY-108 Waste Receipt History.[1, 2] (2 sheets)

Transfer Source	Waste Type Received	Time Period	Waste Volume	
			Kiloliters	Kilogallons
241-BY-107	First-cycle decontamination waste	1951 - 1954	5,485	1,449
U Plant	In-plant ferrocyanide-scavenged uranium recovery waste	1954 - 1957	33,105	8,745
241-C-112	In-tank ferrocyanide-scavenged uranium recovery waste	1957	1,878	496

Table 2-3. Summary of Tank 241-BY-108 Waste Receipt History.[1,2] (2 sheets)

Transfer Source	Waste Type Received	Time Period	Waste Volume Kiloliters	Kilogallons
241-C-105	Uranium recovery waste/cladding waste/PUREX cladding waste/	1959	1,863	492
241-BY-111	In-tank solidification waste	1968	1,435	379
241-BY-109	Evaporator bottoms waste (from in-tank solidification process)/cladding waste/organic wash waste/	1969 - 1974	3,309	874
241-BY-112	In-tank solidification waste	1970 - 1971	2,271	600
Unknown	BY saltcake waste	1976	734	194

Notes:

[1]Agnew et al. (1995b)

[2]This table shows historical data that have not been validated.

2.3.2 Historical Estimate of Tank Contents

An estimate of the current contents of tank 241-BY-108 based on historical transfer data is available from the *Historical Tank Content Estimate for the Northeast Quadrant of the Hanford 200 East Area* (HTCE) (Brevick et al. 1994a). The historical data used for the estimate is the *Waste Status and Transaction Record Summary for the Northeast Quadrant (WSTRS)* (Agnew et al. 1995b), the *Hanford Defined Waste: Chemical and Radionuclide Compositions* (Agnew 1995), and the *Tank Layer Model for the Northeast, Southwest, and Northwest Quadrants* (TLM) (Agnew et al. 1995a). The WSTRS is a compilation of available waste transfer and volume status data. The Hanford Defined Wastes provides the assumed typical compositions for Hanford waste types. In some cases, the available data are incomplete, reducing the usability of the transfer data and the modeling results derived from it. The TLM takes the WSTRS data, models the waste deposition processes, and using additional data from the Hanford Defined Wastes generates an estimate of the tank contents. Thus, these model predictions can only be considered an estimate that requires further evaluation using analytical data.

The HTCE states that tank 241-BY-108 contains, from the bottom to the top, the following waste layers: 424 kL (112 kgal) of type 1 in-plant ferrocyanide (PFeCN1) waste, 201 kL (53 kgal) of type 2 in-plant ferrocyanide (PFeCN2) waste, and 238 kL (63 kgal) of BY saltcake waste. The difference between PFeCN1 waste and PFeCN2 waste is that 0.005 M ferrocyanide was used to precipitate ^{137}Cs producing PFeCN1 while 0.0025 M ferrocyanide produced PFeCN2. The first cycle decontamination waste (received from the bismuth phosphate process in 1951 to 1954) should not contribute to the sludge currently in the tank. The reason for this is that the waste was received through the cascade, and a majority of the solids would have settled out in the first cascade tank (241-BY-107). Figure 2-3 shows a graph representing the estimated waste type and volumes for the tank layers.

The PFeCN1 waste and the PFeCN2 waste are predicted to be similar in composition. Both layers should contain large amounts of sodium and sulfate and relatively large quantities of iron, bismuth, uranium, nitrate, phosphate, and ferrocyanide (Agnew 1995). Additionally, a significant quantity of nickel should be present along with a trace of plutonium. Because quantities of cesium should be present, both layers will show activity.

The BY saltcake waste layer should contain large quantities of sodium and nitrate and relatively large quantities of aluminum, nitrite, and sulfate. Moderate to small quantities of potassium, iron, chromium, zirconium, lead, and bismuth will be present also. Cesium should be found in modest quantities; therefore, this layer will have a moderate activity (smaller than the PFeCN layers) (Agnew 1995). The BY saltcake layer can be distinguished further from the PFeCN layers because the BY saltcake layer contains aluminum (not found in the PFeCN layers) and does not contain nickel (found in the PFeCN layers).

Table 2-4 shows the HTCE values for tank 241-BY-108. These values are concentration and inventory estimates for the waste as a whole. In determining HTCE values, the individual waste type predictions have been combined to generate a single concentration and inventory estimate for the overall tank waste.

2.4 SURVEILLANCE DATA

Tank 241-BY-108 surveillance consists of surface level measurements (liquid and solid), temperature monitoring inside the tank (waste and vapor space), and leak detection well (drywell) monitoring for radioactivity outside the tank. The data are significant because they provide the basis for determining tank integrity.

Liquid level measurements can indicate if there is a major leak from a tank. Solid surface level measurements provide an indication of physical changes and consistency of the solid layers of a tank. Drywells located around the tank perimeter may show increased radioactivity from leaks in the vicinity of a drywell.

2.4.1 Surface Level Readings

Tank 241-BY-108 is categorized as an assumed leaker. The surface level of the waste is monitored quarterly with a manual tape through riser 4. The surface level graph shows the readings for the past three years remained steady between 225 cm (88.5 in.) and 218 cm (86 in.). An occurrence report was issued in January 1980 because of a 9,800 L (2,600 gal) liquid intrusion caused by snow rapidly melting into the tank through the pits. As of October 1, 1995, the surface level was at 220 cm (87 in.). A level history graph of the volume measurements is shown in Figure 2-4.

Figure 2-3. Tank Layer Model for Tank 241-BY-108.

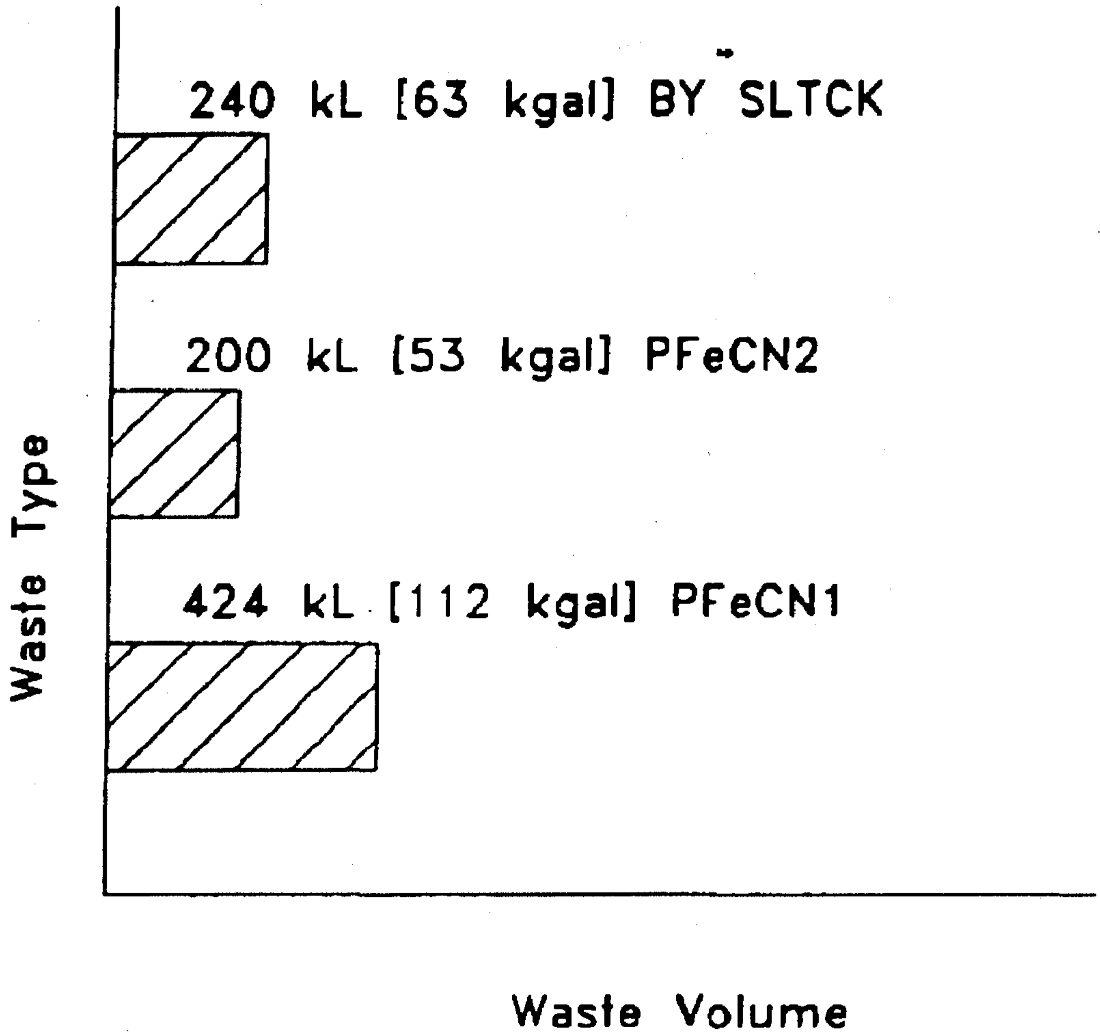


Table 2-4. Tank 241-BY-108 Inventory Estimate (2 sheets).[1,2]

Solids Composite Inventory Estimate			
Physical Properties			
Total solid waste	1.38E+06 kg; 863 kL (228 kgal)		
Heat load	0.750 kW (2,560 BTU/hr)		
Bulk density	1.60 (g/cm^3)		
Void fraction	0.529		
Water wt%	45.8		
Total Organic Carbon wt% Carbon (wet)	0.418		
Chemical Constituents	**moles/L**	**ppm**	**kg**
Na^+	8.60	1.24E+05	1.71E+05
Al^{3+}	0.276	4,670	6,430
Fe^{3+} (total Fe)	1.16	40,600	55,900
Cr^{3+}	0.0243	790	1,090
Bi^{3+}	0.238	31,100	42,800
La^{3+}	0	0	0
Ce^{3+}	0	0	0
Zr (as $ZrO(OH)_2$)	6.76E-04	38.6	53.2
Pb^{2+}	4.47E-05	5.80	7.99
Ni^{2+}	0.0953	3,510	4,830
Sr^{2+}	0	0	0
Mn^{4+}	0	0	0
Ca^{2+}	0.142	3,510	4,920
K^{1+}	0.00951	233	321
OH^-	5.00	53,200	73,400
NO_3^-	3.25	1.26E+05	1.74E+05
NO_2^-	0.327	9,430	13,000
CO_3^{2-}	0.182	6,860	9,450
PO_4^{3-}	0.317	18,800	26,000
SO_4^{2-}	1.54	92,500	1.27E+05
Si (as SiO_3^{2-})	0.353	6,210	8,560
F^-	0.385	4,580	6,310
Cl^-	0.0550	1,220	1,680
$C_6H_5O_7^{3-}$	6.91E-04	81.8	113
$EDTA^{4-}$	0.00138	249	343
$HEDTA^{3-}$	0	0	0

Table 2-4. Tank 241-BY-108 Inventory Estimate (2 sheets).[1, 2]

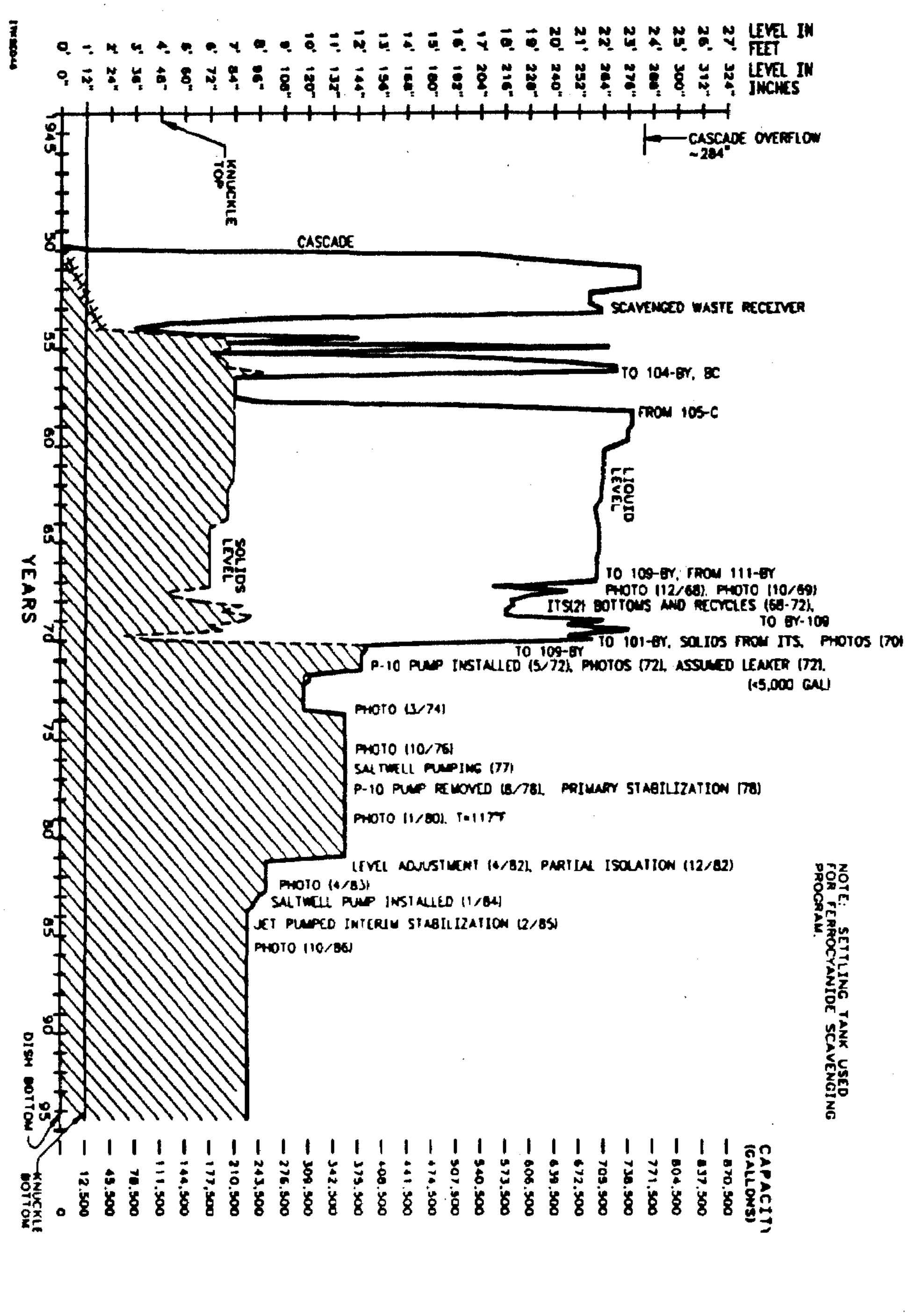
Solids Composite Inventory Estimate			
Chemical Constituents (Continued)	**moles/L**	**ppm**	**kg**
NTA^{3-}	0	0	0
glycolate^{-}	0	0	0
acetate^{-}	0.00881	325	448
oxalate^{2-}	0	0	0
DBP	0.00105	176	242
NPH	0	0	0
CCl_4	0	0	0
hexone	0	0	0
$Fe(CN)_6^{4-}$	0.0845	11,200	15,400
Radiological Constituents	**Ci/L**	**μCi/g**	**Ci**
Pu		0.0425	0.977 (kg)
U	0.0905 (moles/L)	963 (μg/g)	18,600 (kg)
Cs	0.171	107	1.48E+05
Sr	0.0101	6.32	8,710

Notes:

[1]Brevick et al. (1994a)

[2]This table shows data that have not been validated.

Figure 2-4. Tank 241-BY-108 Level History.



2.4.2 Internal Tank Temperatures

Two thermocouple trees are installed in tank 241-BY-108 through risers 3 and 8. The tree in riser 3 was added on July 25, 1955. Because this tree has not been functioning properly, temperature data from it are not reliable. Consequently, the temperature data for tank 241-BY-108 were taken solely from the thermocouple tree in riser 8. This tree has 13 thermocouples. Elevations are known for the first 10 thermocouples. Thermocouple 1 is 152 mm (0.5 ft) from the bottom of the tank. Thermocouples 2 through 10 are evenly spaced at 610 mm (2 ft) intervals above thermocouple 1. Review of the tank 214-BY-108 level history indicates that from September 1974 to October 1982 thermocouples 7 through 13 were in the vapor space. After October 1982, thermocouples 1 through 4 were in or near the solids level, and the remainder of the thermocouples were in the vapor space.

Thermocouples 1 through 10 have similar temperature readings that span from 1974 to the present. Limited data are available for thermocouples 11 through 13. There is a gap in the temperature readings from October 1983 until November 1989 probably caused by equipment malfunctions. The median temperature is 29 °C (84 °F), the minimum temperature is 10 °C (50 °F), and the maximum temperature is 68 °C (154 °F). The temperature reading for thermocouple 1 was 42 °C (107 °F) on December 10, 1995. Plots of the thermocouple readings for tank 241-BY-108 can be found in the supporting documents for the HTCE (Brevick et al. 1994b). A graph of the weekly high temperature is shown in Figure 2-5.

2.4.3 Drywells

Tank 241-BY-108 has seven drywells in the surrounding soil to monitor leaks. Although significant drywell activity was observed in the past (as expected from an assumed leaker), readings are currently below 200 counts per second. Tank 241-BY-108 does not have a liquid observation well.

2.4.4 Tank 241-BY-108 Photographs

The 1986 photographs of the tank 241-BY-108 interior show a white to light rose solid waste surface. Equipment, visible in the photographs, includes an air lift circulator, a thermocouple tree, a manual tape, an air breather riser, and a saltwell screen. There have been no waste transfers or surface level changes since the photographs were taken; therefore the photographs should accurately show the current tank contents. A photographic montage of tank 241-BY-108 is shown in Figure 2-6.

Figure 2-5. Tank 241-BY-108 Weekly High Temperature Plot.

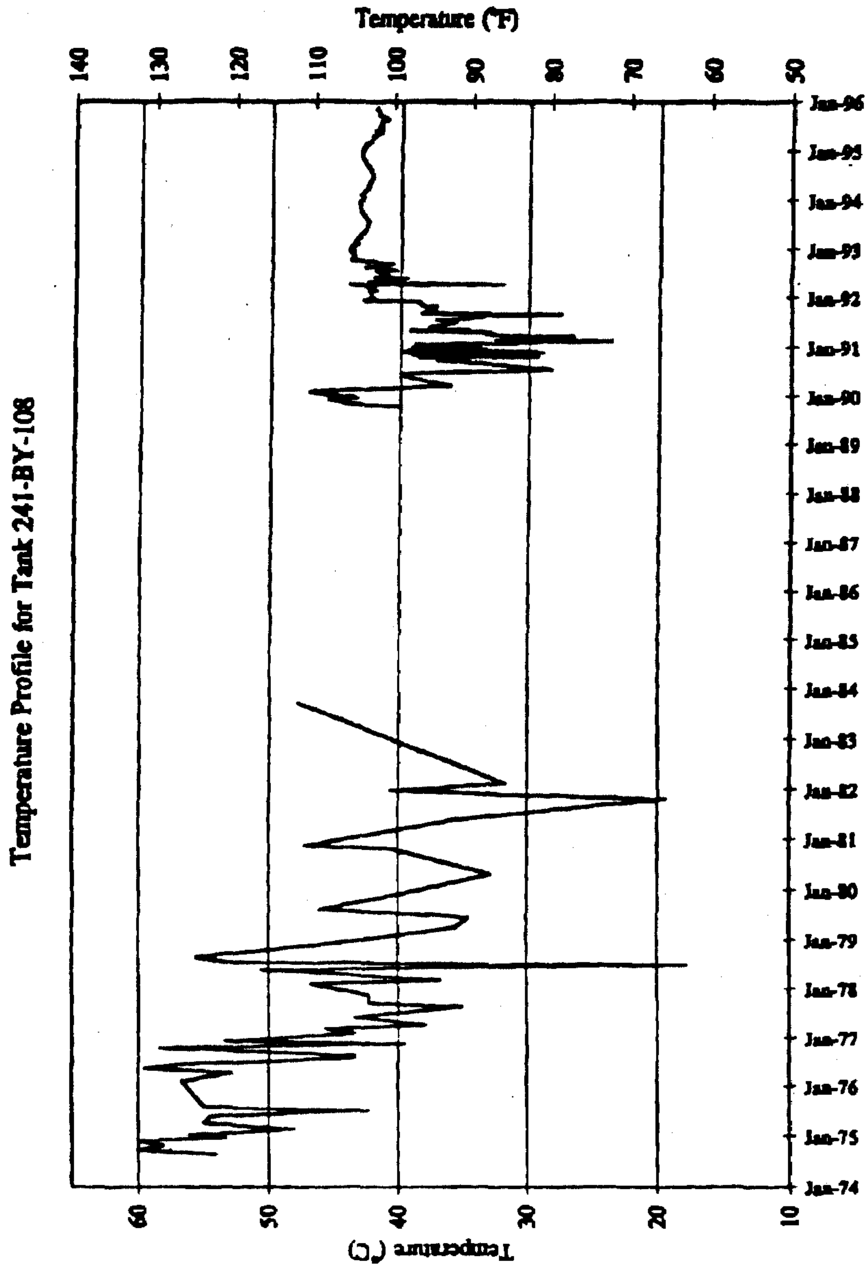
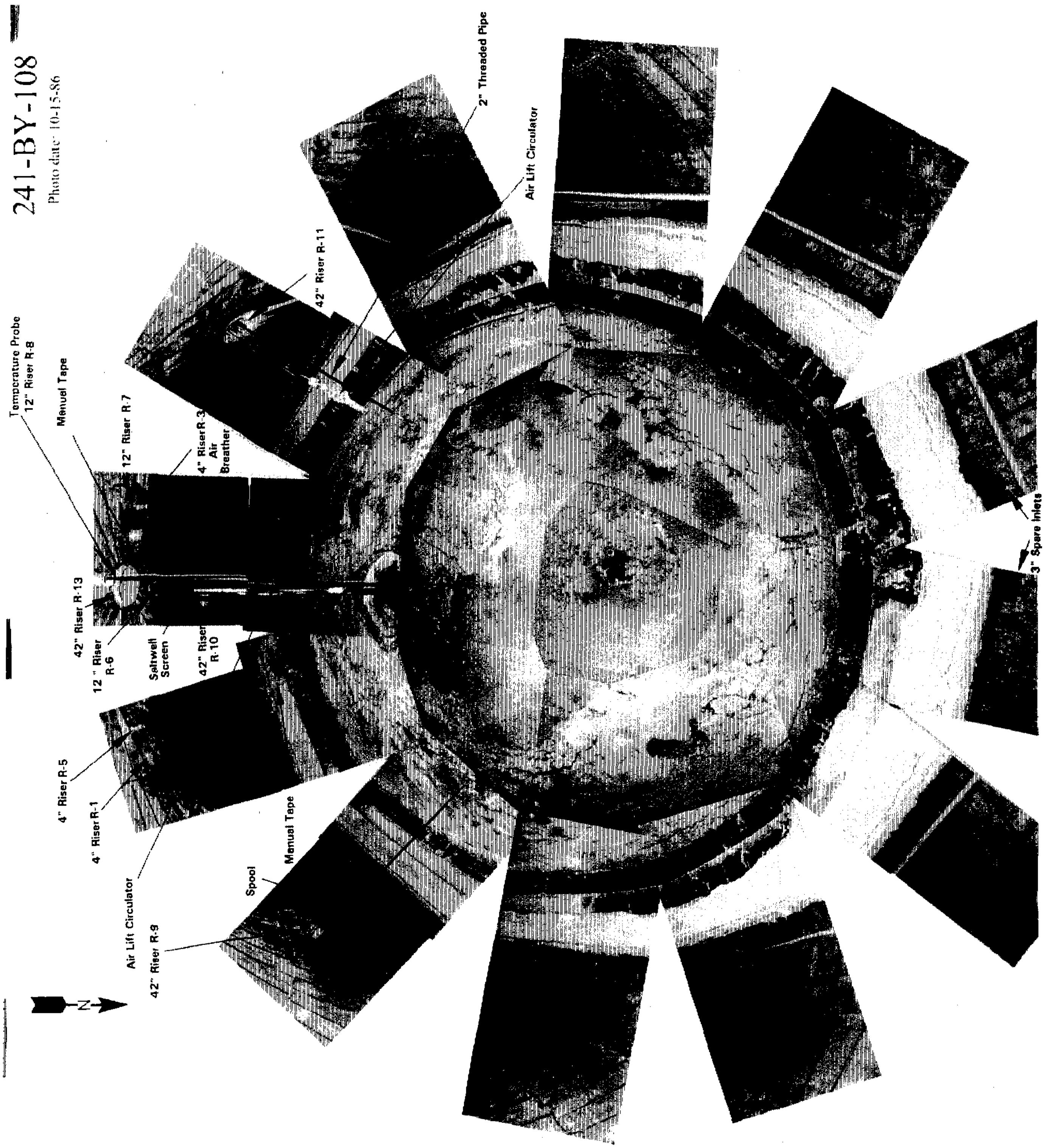


Figure 2-6. Photographic Montage of Tank 241-BY-108.



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3.0 TANK SAMPLING OVERVIEW

This section describes the July and August 1995 sampling and analysis events for tank 241-BY-108. Rotary core samples were taken to satisfy the requirements of the *Tank Safety Screening Data Quality Objective* (Babad et al. 1995), the *Interim Data Quality Objectives for Waste Pretreatment and Vitrification* (Kupfer et al. 1994), the *Data Requirements for the Ferrocyanide Safety Issue Developed through the Data Quality Objectives Process* (Meacham et al. 1994), the *Test Plan for Samples from Hanford Waste Tanks 241-BY-103, BY-104, BY-105, BY-106, BY-108, BY-110, TY-103, U-105, U-107, U-108, and U-109* (Meacham 1995), and the *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995). The sampling and analyses were performed in accordance with the *Tank 241-BY-108 Rotary Mode Core Sampling and Analysis Plan* (Baldwin 1995c). Although not addressed in the sampling and analysis plan, the analyses required by *Data Quality Objective to Support Resolution of the Organic Complexant Safety Issue* (Turner et al. 1995) were performed as a consequence of meeting the analytical requirements of the other DQOs and the test plan. Further discussions of the sampling and analysis procedures can be found in the *Tank Characterization Reference Guide* (DeLorenzo et al. 1994).

3.1 DESCRIPTION OF SAMPLING EVENT

Three rotary mode core samples were collected from tank 241-BY-108 between July 27 and August 16, 1995. Cores 98 and 99 were collected from riser 12A; core 104 from riser 7. Cores 98 and 104 were sent to the Westinghouse Hanford Company 222-S Laboratory for analysis. Core 99 was sent to the Pacific Northwest National Laboratory (PNNL) (325 Analytical Chemistry Laboratory and 325 High Level Radiochemistry Laboratory) for analysis.

Nitrogen gas was used to maintain hydrostatic head pressure during sampler changeout. Water was used to wash the drill string between core sampling operations. A tracer (lithium bromide) was added to the wash water to gauge contamination of the segments by the wash water. A field blank obtained during the sampling operation and a lithium bromide blank were sent to the 222-S Laboratory for analysis.

Table 3-1 summarizes the applicable DQOs and their respective sampling and analysis requirements. Table 3-2 summarizes sample numbering and dose rate information for the 1995 core sampling event.

Table 3-1. Integrated Requirements for Tank 241-BY-108.[1]

Sampling Event	Sampling Requirements	Applicable References and Analytical Requirements
Cores 98 and 104		
Rotary Core Sampling	Core samples from a minimum of two risers separated radially to the maximum extent possible.	*Safety Screening Data Quality Objective*: Moisture content, total alpha activity, energetics, total organic carbon. *Data Requirements for the Ferrocyanide Safety Issue Developed through the Data Quality Objective Process*: Moisture content, energetics, total organic carbon, cyanide, nickel. *Interim Data Quality Objectives for Waste Pretreatment and Vitrification*: Collection of sample for future process development work. *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*: Energetics, total organic carbon. *Tank 241-BY-108 Rotary Mode Core Sampling and Analysis Plan*: Lithium.
Core 99		
Rotary Core Sampling	Core samples from a minimum of two risers separated radially to the maximum extent possible.	*Safety Screening Data Quality Objective*: Moisture content, total alpha activity, energetics, total organic carbon. *Historical Model Evaluation Requirements*: ICP, IC, ^{90}Sr, ^{137}Cs.

Note:

[1]Baldwin (1995c)

Table 3-2. Rotary Cores 98, 99, and 104 Sample Information.

Core/Riser/Segment	Sample Number	Labcore Number	Dose Rate through Drill String (mR/hr)[1]
98/12A/1	95-129	S95T001357	600
98/12A/2	95-130	S95T001358	600
98/12A/3	95-131	S95T001359	800
98/12A/4	95-132	S95T001360	5,000 (at 3 in.)
99/12A/1	95-133	S95T001361	80
99/12A/2	95-134	S95T001362	640
99/12A/3	95-135	S95T001363	400
99/12A/4	95-136	S95T001383	15,000
104/7/1	95-166	S95T001335	40
104/7/2	95-167	S95T001536	800
104/7/3	95-168	S95T001537	1,500
104/7/4	95-169	S95T001538	1,200
104/7/5	95-170	S95T001539	2,500

Note:
[1]mR/hr = milliroentgens per hour

3.2 SAMPLE HANDLING

3.2.1 Cores 98 and 104

Cores 98 and 104 were received by the Westinghouse Hanford Company 222-S Laboratory between July 28 and August 21, 1995; they were extruded between August 1 and August 24, 1995. All core samples were homogenized with a spatula by the 222-S Laboratory prior to analysis.

The core samples were subsampled at the quarter-segment level. Sample recovery was generally good ($\geq$ 90 percent with the exception of segment 1 of core 104 which had a 41 percent recovery). Upon extrusion, some segments exhibited missing quarter segments. The missing quarter segments were assumed to have been occupied by drainable liquid. Quarter segments were identified by letter only if they contained solids. Drainable liquids were identified as such. Quarter segment identifiers A, B, C, and D denote the position of the quarter segment in the core sampler; A was at the top of the sampler, and D was at the bottom.

3.2.2 Core 99

Core 99 was extruded into segments and quarter segments at the 222-S Laboratory. All extruded material from segments 1 through 3 was sent to PNNL. Segment 4 was further subsampled at the 222-S Laboratory; approximately 30 grams of material from each quarter segment were sent to PNNL. The final core 99 shipment was received by PNNL on August 25, 1995.

Segment 1 and quarter-segment 4B were homogenized and subsampled from the top and bottom for use in a homogenization test. All core 99 samples were homogenized by PNNL prior to analysis. The sample mass of the subsampled solids was small. These samples were homogenized with a micro spatula. The drainable liquid samples were homogenized with a magnetic stir bar and plate. No composite analyses, as normally required by the historical DQO (Simpson and McCain 1995), were requested (Baldwin 1995c).

Table 3-3 describes cores 98, 99, and 104 including riser number, recovered segments, color, texture, and mass. The nomenclature of core 99 quarter segments is the same as that for cores 98 and 104.

3.3 SAMPLE ANALYSIS

The analytical data provided by the analysis of cores 98, 99, and 104 were not limited to those required by the safety program test plan and safety screening and ferrocyanide DQOs. Additional analytical results for metals, anions, and radionuclides were obtained in the process of meeting these DQOs to provide optimal information (Kristofzski 1995).

The analyses of the waste in tank 241-BY-108 were performed on the quarter-segment level, as discussed above. Exceptions are the analyses of the first segments of each core, which were performed on any drainable liquids and on all solid material (combined as a "whole segment") from that segment. Cores 98 and 104 were analyzed at the Westinghouse Hanford Company 222-S Laboratory; core 99 was analyzed at the Pacific Northwest National Laboratory (the 325 Analytical Chemistry Laboratory and High Level Radiochemistry Laboratory). Not all analyses or procedures were common to both laboratories. A brief discussion of the analyses follows; a more detailed discussion is in Appendix B.

All analyses were performed by both laboratories on homogenized samples. Weight percent water was determined by TGA. The fuel content of the waste was determined by DSC. Metals were measured using ICP; the 222-S Laboratory prepared the samples by a fusion process, and the 325 Laboratory used an acid digestion. Anions were measured on water-leached samples using IC. Total carbon was measured using hot persulfate and coulometry. The samples were prepared for cyanide analysis by both laboratories using microdistillation. The 222-S Laboratory used a coulometric method for cyanide measurement; the 325 Laboratory used argentometric titration and colorimetry. Total alpha activity was the only

Table 3-3. Cores 98, 99, and 104 Rotary Sample Description.[1,2] (3 sheets)

Segment Number	Sample Total Weight (g)	Recovery[3] %	Segment Description
Core 98 - Riser 12A			
Segment 1 (W)	366.8	168.9	Extruded approximately 5-6 in. of sample. Sample was wet. Texture of sample was crystalline and tended to "melt" on the sample tray. Sample was light brown to dirty white in color. Collected 170 mL of drainable liquid. Color of liquid was yellow and opaque.
Segment 2 (A), (C), (D)	416.0	100	Collected 100 mL of drainable liquid, which was yellow brown in color and opaque. Extruded approximately 12 in. of sample. Sample was divided into quarter segments. Sample texture ranged from a brown sludge to a material resembling a mixture of brown, beige, and dirty white saltcake.
Segment 3 (A), (C), (D)	406.5	100	Collected 60 mL of drainable liquid, which was light brown in color and opaque. Extruded approximately 16.5 in. of sample. Sample was divided into quarter segments. Sample texture ranged from a brown sludge to a material resembling a mixture of brown, beige, and dirty white saltcake.
Segment 4 (A), (B), (C), (D)	490.0	100	No drainable liquid observed or collected. Extruded approximately 19.0 in. of sample. Sample retained its shape. Sample texture ranged from a brown sludge to a material resembling a mixture of brown sludge with white saltcake.

Table 3-3. Cores 98, 99, and 104 Rotary Sample Description.[1,2] (3 sheets)

Segment Number	Sample Total Weight (g)	Recovery[3] %	Segment Description
Core 104 - Riser 7			
Segment 1 (W)	131.3	41.2	Extruded approximately 6-7 in. of sample. Sample was tan in color; dry, crystalline and granular in shape. No drainable liquids.
Segment 2 (A), (B), (C)	383.5	100	No drainable liquid. Extruded approximately 19 in. of sample. Upper half retained its shape, lower half crumbled during extrusion. Upper quarter segment ranged from crumbly saltcake to sludge. Sample was divided into three quarter segments. Sample texture ranged from a brown sludge to a material resembling a mixture of brown sludge with saltcake.
Segment 3 (A), (C), (D)	288.8	89.5	No drainable liquid. Extruded approximately 17 in. of sample. Sample was wet, granular, and did not retain its shape. Sample was divided into three quarter segments. Sample texture resembled a brown saltcake.
Segment 4 (A), (C, (D)	318.3	94.7	No drainable liquid. Extruded approximately 18 in. of sample. Sample was wet, granular, crumbly, and ranged from a yellow to brown saltcake. Sample was divided into three quarter segments.
Segment 5 (A), (B), (C), (D)	422.7	94.7	No drainable liquid. Extruded approximately 18 in. of sample. Lower half retained its shape and was medium to dark brown. The upper half was dark brown and partially retained its shape. Texture of material resembled a sludge. Sample was divided into four quarter segments.

Table 3-3. Cores 98, 99, and 104 Rotary Sample Description.[1,2] (3 sheets)

Segment Number	Sample Total Weight (g)	Recovery[3] %	Segment Description
Core 99 - Riser 12A			
Segment 1	56.4	20.0	Extruded approximately 2 in. of sample. Sample was dirty white saltcake. Texture of sample was crumbly. The sample retained its shape. Collected no drainable liquid.
Segment 2 (A), (D)	335	100	Collected 230 mL of drainable liquid, which was a yellow green color and opaque. Extruded approximately 2 in. of sample. Sample was divided into quarter segments. Quarter segment A was 1 in. in length and resembled a dirty white saltcake which retained its shape. Quarter segment D was 1 in. in length and resembled a cream colored sludge.
Segment 3 (A)	89.0	15.2	Collected 25 mL of drainable liquid, which was tan in color and opaque. Extruded approximately 1 in. of sample. Sample texture resembled a grainy cream-colored saltcake.
Segment 4 (A), (B), (C), (D)	475.9	100	No drainable liquid observed or collected. Extruded approximately 19 in. of sample. Sample retained its shape. Sample was divided into quarter segments. Sample resembled a mixture of brown sludge with embedded saltcake.

Notes:

W = whole segment
A = upper quarter segment
B = second quarter segment from top of core
C = third quarter from top of core
D = bottom quarter segment of core

[1]Baldwin (1995a)

[2]Silvers et al. (1995)

[3]Recovery is calculated by dividing the actual recovered length of sample, including solids and drainable liquids, by the length of the sampler (48.3 cm) or, in the case of the first segment, by the expected segment length. The lengths of the recovered drainable liquids were calculated by converting drainable liquid volumes to the equivalent sampler length (48.3 cm sampler length/250 mL sampler volume = 0.193 cm/mL).

radiochemical test performed by the 222-S Laboratory. The 325 Laboratory performed gamma energy analysis, total beta activity measurement, and analyses for plutonium, strontium, and uranium. Organic compounds, specifically normal paraffin hydrocarbons and tributyl phosphate, were measured by the 222-S Laboratory using flame ionization, gas chromatography, and mass spectrometry. Density was measured by the 325 Laboratory using a mineral oil displacement method. Reactive systems screening tool analysis will be performed on segments with high DSC results. These results will be reported in a revision of this document.

The results of the analyses are presented and discussed in Section 4.0. The results of the quality control tests and the implications for data quality are discussed in Section 5.1.2. A summary of the cores, segments, segment portions, and individual sample numbers, and the analyses performed on each sample is presented in Appendix B, Table B-1. Tables B-2 and B-3 list the procedure titles and numbers for each analysis.

3.4 AUGUST 1994 HISTORICAL AUGER SAMPLING EVENT

Tank 241-BY-108 was auger sampled in August 1994, according to Campbell et al. (1995b). The results are reported in Appendix D and in Campbell et al. (1995a). Note that results in Campbell et al. (1995a) and in Appendix D are labeled as originating from risers 16 and 17. These are the sample numbers. The samples came from risers 1 and 12A. The samples were taken to answer concerns about a possible floating organic layer coming in contact with the top of the solid portion of the waste as a consequence of saltwell pumping associated with interim stabilization. The waste in tank 241-BY-108 is composed of approximately one-third saltcake, which is thought to be more porous than some waste types. Twenty-inch augers were used to sample the top portion of the waste to determine the extent to which the organic layer had occupied the saltcake pores. Auger sample 16 from riser 1 was limited and was analyzed on a whole segment basis. Auger sample 17 from riser 12A was divided into upper and lower segment halves.

Analytes measured on the auger samples consisted of organic compounds, total organic carbon, and weight percent water. The organic compounds were analyzed by a method developed by the Advanced Organic Analytical Methods Group and PNNL (Pool and Bean 1994). After extraction by methylene chloride, the samples were analyzed by gas chromatograph/mass spectrometry and quantified by a gas chromatograph/flame ionization detector. Total organic carbon was analyzed by hot persulfate oxidation, and weight percent water was determined by TGA. Procedure titles and numbers are listed in Appendix B, Table B-4.

4.0 ANALYTICAL RESULTS

This section presents the analytical results associated with the July and August 1995 sampling of tank 241-BY-108. The sampling and analysis were performed as directed in the *Tank 241-BY-108 Rotary Mode Core Sampling and Analysis Plan* (SAP) (Baldwin 1995c). This plan integrated all documents related to sampling and analytical requirements, including applicable DQOs. The SAP sampling and analytical requirements for cores 98 and 104 were taken from the safety screening DQO (Babad et al. 1995), the ferrocyanide DQO (Meacham et al. 1994), and the safety program test plan (Meacham 1995). Through the analyses required by these DQOs, the analytical requirements of the organic DQO were met also. Analysis of the two cores was performed at the Westinghouse Hanford Company 222-S Laboratory. A third core (99) was extruded at the 222-S Laboratory and shipped to the Pacific Northwest National Laboratory (325 Analytical Chemistry Laboratory) for analysis. The analysis of this core also was governed by Baldwin (1995c); the applicable DQOs included safety screening and the historical model evaluation data requirements (Simpson and McCain 1995).

Analytical results are tabulated in Table 4-1. As noted, comprehensive analytical data are found in Appendix A. Except for the physical data, only analyte overall means are reported in Section 4.0. Appendix C contains data for the analytes (lithium and bromide) evaluated to gauge the amount of contamination by the drill string wash water.

Table 4-1. Analytical Data Presentation Tables.

Data Type	Tabulated Location
Chemical data summary	Table 4-2
Thermogravimetric analysis results	Table 4-3
Differential scanning calorimetry results	Table 4-4
Density results	Table 4-5
1995 comprehensive analytical data	Appendix A
Drill string wash water contamination check data	Appendix C

4.1 DATA PRESENTATION

This section summarizes the analytical results from the 1995 sampling of tank 241-BY-108. The subsections below provide information about chemical data, physical data, wash water contamination check results, and the vapor data summary. Data from the analysis of cores 98 and 104 were reported in *Revision 1 Report for Tank 241-BY-108 Rotary Samples, Core 98 and 104* (Baldwin 1995b). The core 99 results were reported in *Single-Shell Tank Waste Characterization: Core 99 Tank BY-108* (Silvers et al. 1995).

4.1.1 Chemical Data Summary

Data from the three cores were combined to derive an overall concentration mean for each analyte. The means reported are weighted means. A weighted overall mean was calculated by taking a simple mean of all subsegment values for a particular segment, then the segment means for an individual core were averaged to derive a core mean. Because cores 98 and 99 were taken from the same riser, their core analytical means were averaged together before averaging with the core 104 analytical values. The final result was the overall mean concentration. The same procedure was followed for analytes which had data from only one or two cores. When more than half of the subsegments had detected results, the overall mean was reported as a detected value. Conversely, when results for 50 percent or more subsegments were nondetected, the overall mean was reported as a less-than (<) value. Table 4-2 shows these overall means. The original subsegment analytical data are listed in Appendix A.

The drainable liquid results were averaged together with the sludge results because the waste consists of both solid and liquid.

The first two columns of Table 4-2 contain the analyte and overall mean from Appendix A. The third column displays the relative standard deviation (RSD) of the mean. The RSD is defined as the standard deviation divided by the mean, multiplied by 100. The RSDs also were obtained from Appendix A. The methodology for calculating the RSDs can be found in Jensen and Liebetrau (1988). The projected inventories listed in the final column were derived by multiplying the overall mean in μg/g or μCi/g by the sludge density (1.51 g/mL) and the waste volume of 863,000 L (228,000 gals).

Table 4-2. Chemical Data Summary for Tank 241-BY-108 (4 sheets).

Analyte	Overall Mean Concentration	Relative Standard Deviation	Projected Inventory
METALS	**μg/g**	**%**	**kg**
Aluminum	39,800	29.8	51,700
Antimony[1]	< 186	n/a	< 242
Arsenic[1]	< 116	n/a	< 151
Barium	124	38.4	161
Beryllium	< 6.73	n/a	< 8.75
Bismuth	< 495	n/a	< 644

Table 4-2. Chemical Data Summary for Tank 241-BY-108 (4 sheets).

Analyte	Overall Mean Concentration	Relative Standard Deviation	Projected Inventory
METALS (Cont'd)	µg/g	%	kg
Boron	250	70.2	325
Cadmium	<16.3	n/a	< 21.2
Calcium	3,370	42.6	4,380
Cerium	< 123	n/a	< 160
Chromium	255	34.7	332
Cobalt	34.2	22.7	44.5
Copper	< 45.9	n/a	< 59.7
Dysprosium	< 69.4	n/a	< 90.2
Europium	< 139	n/a	< 181
Iron	7,190	52.8	9,350
Lanthanum	< 67.4	n/a	< 87.6
Lead	439	43.3	571
Magnesium	447	31.7	581
Manganese	209	61.5	272
Molybdenum	< 54.1	n/a	< 70.3
Neodymium	< 119	n/a	< 155
Nickel	2,510	41.8	3,260
Palladium	< 413	n/a	< 537
Phosphorus	10,100	31.4	13,100
Potassium	2,650	54.2	3,450
Rhodium	< 417	n/a	< 542
Samarium	< 131	n/a	< 170
Selenium[1]	< 135	n/a	< 176
Silicon	1,530	51.4	1,990
Silver	< 49.9	n/a	< 64.9
Sodium	1.63E+05	14.2	2.12E+05
Strontium	3,190	66.2	4,150
Sulfur	6,960	30.2	9,050
Tellurium[1]	< 694	n/a	< 902
Thallium[1]	< 479	n/a	< 623

Table 4-2. Chemical Data Summary for Tank 241-BY-108 (4 sheets).

Analyte	Overall Mean Concentration	Relative Standard Deviation	Projected Inventory
METALS (Cont'd)	**μg/g**	**%**	**kg**
Thorium	< 1,110	n/a	< 1,440
Tin	<1,390	n/a	< 1,810
Titanium	74.9	29.8	97.4
Tungsten	< 744	n/a	< 967
Uranium	9,470	60.0	12,300
Vanadium	< 47.3	n/a	< 61.5
Yttrium	< 14.4	n/a	< 18.7
Zinc	83.5	33.4	109
Zirconium	< 34.7	n/a	< 45.1
ANIONS	**μg/g**	**%**	**kg**
Chloride	1,540	9.66	2,000
Cyanide	362	65.8	471
Fluoride	6,610	26.7	8,590
Nitrate	2.01E+05	18.5	2.61E+05
Nitrite	27,300	13.0	35,500
Oxalate	7,500	11.4	9,750
Phosphate	26,000	24.0	33,800
Sulfate	23,400	27.9	30,400
RADIONUCLIDES	**μCi/g**	**%**	**Ci**
^{241}Am	< 0.187	n/a	< 243
^{134}Cs	< 0.108	n/a	< 140
^{137}Cs	258	77.9	3.35E+05
^{60}Co	< 0.00911	n/a	< 11.8
^{154}Eu	< 0.0455	n/a	< 59.2
^{155}Eu	< 0.389	n/a	< 506
^{238}Pu	0.00659	45.7	8.57
$^{239/240}$Pu	0.0459	91.5	59.7
^{90}Sr	143	95.5	1.86E+05
Total Alpha	0.0619	43.3	80.5
Total Beta	549	88.1	7.14E+05

Table 4-2. Chemical Data Summary for Tank 241-BY-108 (4 sheets).

Analyte	Overall Mean Concentration	Relative Standard Deviation	Projected Inventory
CARBON	μg C/g	%	kg C
Total Carbon	8,970	39.6	11,700
Total Inorganic Carbon	5,340	33.9	6,940
Total Organic Carbon	4,480	20.5	5,820
ORGANICS	μg/g	%	kg
Undecane	23.5	50.8	30.6
Tridecane	71.3	45.2	92.7
Tetradecane	55.1	41.8	71.6
Tri-n-butylphosphate	0.0745	n/a	0.0969
Pentadecane	22.4	43.5	29.1
Nonane	0.988	n/a	1.28
Dodecane	58.8	48.4	76.4
Decane	3.42	n/a	4.45
PHYSICAL PROPERTIES			
Percent Water	27.2	19.3	n/a

Notes:

n/a = not applicable

[1]High < values for certain analytes are because of the lower sensitivity for these analytes by ICP/AES. Also, high uranium concentration can cause interference effects on some trace metals.

4.1.2 Physical Data Summary

Thermal analyses were performed on tank 241-BY-108 core samples to satisfy the requirements of the safety screening DQO (Babad et al. 1995), which dictated that thermal analyses be performed on solid and liquid phases of the waste samples; and the ferrocyanide DQO (Meacham et al. 1994), which required thermal analyses to be performed on the solid phase only. In addition, density determinations were performed on core 99 for the solid and drainable liquid subsegments.

4.1.2.1 Thermogravimetric Analysis. In a TGA, the mass of a sample is measured while its temperature is increased at a constant rate. A gas, such as nitrogen or air, is passed over the sample during the heating to remove any gaseous matter. Any decrease in the weight of a sample represents a loss of gaseous matter from the sample either through evaporation or through a reaction that forms gas phase products.

Weight percent water by TGA was performed by the 222-S Laboratory under a nitrogen purge using procedures LA-560-112 and LA-514-114. Weight percent water by TGA was performed by PNNL, also under a nitrogen purge, using procedure PNL-ALO-508.

Table 4-3 shows the TGA percent water data for tank 241-BY-108. Ten samples exhibited percent water means below the safety screening DQO (Babad et al. 1995) notification limit of 17 weight percent. Two of these samples were from segment 2 of core 98, which also had 100 mL of drainable liquid recovered out of a total 416 grams of sample. The fact that several samples were below 17 weight percent does not in itself constitute an unsafe condition. The energetics values for these samples must also exceed the safety screening notification limits. This is discussed further in Sections 4.3.2 and 5.5. The overall percent water value for the tank calculated by equal weighting of the three cores, the segments, and subsegments, was 27.2 percent.

Table 4-3. Thermogravimetric Analysis Results for Tank 241-BY-108 (3 sheets).[1]

Sample Number	Sample Location		Temp. Range	Result	Duplicate	Mean	Core Mean
	Seg.	Subseg.	(°C)	% H_2O	% H_2O	% H_2O	% H_2O
Core 98							
1373	1	DL	35-260	31.9	34.04	32.97	32.83
1390		Whole	35-270	21.85	19.76	20.80	
1404	2	A	35-275	14.64	14.87	14.75	
1399		C	37-199	43.90	39.74	41.82	
1393		D	39-195	38.92	36.38	37.65	
1396[2]			36-260	40.98	44.12	42.55	
1396[3]			35-260	8.56	9.36	8.96	
1427		DL	35-260	27.11	25.03	26.07	
1431	3	A	38-220	41.31	38.53	39.92	
1432		C	37-196	43.47	44.47	44.12	
1433		D	35-190	34.52	38.56	36.54	
1430		DL	36-220	38.58	39.47	39.02	

Table 4-3. Thermogravimetric Analysis Results for Tank 241-BY-108 (3 sheets).[1]

Sample Number	Sample Location		Temp. Range	Result	Duplicate	Mean	Core Mean
	Seg.	Subseg.	(°C)	% H_2O	% H_2O	% H_2O	% H_2O
Core 98 (Continued)							
1419	4	A	38-190	28.88	36.23	32.55	Cont'd
			30-272	36.64	36.69	36.66	
1420		B	38-180	35.41	35.81	35.61	
1421		C	32-170	38.31	39.82	39.06	
1422		D	34-170	36.49	36.40	36.45	
Core 104							
1925	1	Whole	35-170	24.90	23.78	24.34	22.05
1966	2	A	34-205	20.84	19.25	20.05	
1967		B	n/a	33.54	29.90	31.72	
1968		C	35-240	15.40	9.880	12.64	
1969	3	A	35-250	7.150	7.790	7.470	
1970		C	29-88	11.12	7.680	9.400	
1971		D	38-80	8.070	7.820	7.945	
1972	4	A	34-236	31.01	33.09	32.05	
1973		C	35-230	41.10	41.13	41.12	
1974		D	35-245	9.770	8.800	9.285	
1975	5	A	35-240	9.370	8.980	9.175	
1976		B	35-240	37.69	35.62	36.66	
1977		C	35-220	35.50	35.50	35.50	
1978		D	n/a	32.34	34.59	33.47	
Core 99							
7313	1	Whole	23-157	32.7	26.1	29.4	31.8
7315	2	A	23-136	7.8	6.6	7.2	
7314		D	23-203	17.9	15.5	16.7	
7932		DL	23-236	52.6	46.7	49.7	

Table 4-3. Thermogravimetric Analysis Results for Tank 241-BY-108 (3 sheets).[1]

Sample Number	Sample Location		Temp. Range	Result	Duplicate	Mean	Core Mean
	Seg.	Subseg.	(°C)	% H_2O	% H_2O	% H_2O	% H_2O
Core 99 (Continued)							
7316	3	A	22-212	14.1	35.0	24.6	Cont'd
7935		DL	23-235	52.1	52.6	52.4	
7322	4	A	22-171	25.8	25.1	25.5	
7319		B	22-187	35.3	35.9	35.6	
7318		C	24-173	35.6	36.2	35.9	
7317		D	22-178	40.6	44.0	42.3	
Sample Weight % Loss Mean (% Water) = 27.2%							
Relative Standard Deviation of the Mean = 19.3%							

Notes:

Temp. = temperature
Seg. = segment
Subseg. = subsegment
n/a = not available
DL = drainable liquid
A, B, C, D = top, second, third, or bottom segment portion, respectively.

[1]Baldwin (1995a) and Silvers et al. (1995)

[2]Analysis was performed on Mettler® equipment.

[3]Analysis was performed on Perkin-Elmer® equipment.

4.1.2.2 Differential Scanning Calorimetry. In a DSC analysis, heat absorbed or emitted by a substance is measured while the substance is exposed to a linear increase in temperature. While the substance is being heated, a gas such as nitrogen is passed over the waste material to remove any gases being released. The onset temperature for an endothermic event (characterized by or causing the absorption of heat) or an exothermic event (characterized by or causing the release of heat) is determined graphically.

The DSC analyses were performed by the 222-S Laboratory under a nitrogen atmosphere using procedure LA-514-113 and procedure LA-514-114. The DSC analyses were performed by the Pacific Northwest National Laboratory using procedure PNL-ALO-508, also under a nitrogen purge. Four analyses (three samples and one rerun) exceeded the safety screening notification limit of 481 J/g.

The DSC results are shown in Table 4-4. The temperature range is provided for core 99 data, the onset temperature for the endothermic or exothermic reaction is provided for core 98 and 104 data at maximum enthalpy change, and the magnitude of the enthalpy change is provided for each transition. The first transition represents the endothermic reaction associated with the evaporation of free and interstitial water. The second transition probably represents the energy (heat) required to remove bound water from hydrated compounds such as aluminum hydroxide or to melt salts such as sodium nitrate. The third transition is generally exothermic and is probably caused by the fuel components of the sample reacting with the nitrate salts. The results are reported on a wet weight basis. The safety screening DQO (Babad et al. 1995), however, requires that the exothermic reactions be evaluated on a dry weight basis in order to make a decision concerning tank safety. The dry weight value is obtained from the wet weight value by dividing the reported exothermic value for a subsegment by the solid fraction of the subsegment (that is, 1 minus the fractional percent water value for that subsegment). Two samples (core 104, segment 5, quarter segments B and C) had averages which exceeded the safety screening DQO limit for energetics. Two other samples, the original and rerun from quarter segment B of segment 4 from core 98, had one result of a primary/duplicate pair above the DQO limit but had averages below the threshold. However, the upper 95 percent confidence interval limits (Baldwin 1995a) for both of these samples were above the DQO limit. The implications for these values in terms of tank safety are discussed in Section 5.5.

Table 4-4. Differential Scanning Calorimetry Results for Tank 241-BY-108.[1] (4 sheets)

Sample Number	Sample Location		Run	Sample Weight	Transition 1		Transition 2		Transition 3	
	Seg.	Subseg.		mg	Temp. (°C)[2]	ΔH (J/g)	Temp. (°C)[2]	ΔH (J/g)	Temp. (°C)[2]	ΔH (J/g)
Core 98										
1373	1	DL	1	39.24	141	1,380	---	---	---	---
			2	32.46	135	953	---	---	---	---
1390		W	1	23.67	120	611	187	89.2	276	135
			2	44.26	135	685	198	90.5	301	32.8
1404	2	A	1	42.39	134	823	280	14.5	---	---
			2	34.40	136	915	265	15.4	---	---
1399		C	1	23.80	134	1,270	332	-53.0	---	---
			2	30.90	131	1,220	324	-49.8	---	---
1396		D	1	39.80	147	1,050	---	---	---	---
			2	17.90	138	1,090	280	-17.5	---	---
1427		DL	1	18.56	124	1,770	---	---	---	---
			2	24.56	132	1,360	---	---	---	---

Table 4-4. Differential Scanning Calorimetry Results for Tank 241-BY-108.[1] (4 sheets)

Sample Number	Sample Location		Run	Sample Weight	Transition 1		Transition 2		Transition 3	
	Seg.	Subseg.		mg	Temp. (°C)[2]	ΔH (J/g)	Temp. (°C)[2]	ΔH (J/g)	Temp. (°C)[2]	ΔH (J/g)
Core 98 (Continued)										
1431	3	A	1	36.60	129	976	328	-181	---	---
			2	18.65	123	1,060	243	181	---	---
1432		C	1	42.15	119	943	321	-68.7	---	---
			2	26.70	127	878	311	-70.2	---	---
1433		D	1	17.26	131	973	213	-8.8	303	-150
			2	17.81	133	913	213	-5.7	239	-144
1430		DL	1	21.50	127	1,366	241	-74.2	---	---
			2	32.80	119	1,084	249	-69.6	---	---
1419	4	A	1	32.40	125	802	294	-293	---	---
			2	33.60	134	939	326	-162	---	---
			3	34.98	129	854	---	-199	---	---
			4	25.08	127	771	287	-264	---	---
1420		B	1	35.74	130	822	335	-328	---	---
			2	26.82	125	863	334	-282	---	---
			3	34.05	127	712	318	-310	---	---
			4	43.13	119	824	324	-264	---	---
1421		C	1	38.32	119	590	286	-136	---	---
			2	35.48	135	602	282	-122	464	-16.1
1422		D	1	25.68	130	799	277	-62.6	---	---
			2	33.53	129	704	279	-68.5	---	---
Core 104										
1925	1	W	1	21.69	122	648	284	7.20	320	65.2
			2	14.76	119	747	241	5.76	313	89.1
1966	2	A	1	49.47	136	471	274	44.2	---	---
			2	29.20	144	458	313	61.3	---	---
1967		B	1	19.84	108	596	309	62.7	---	---
			2	13.26	115	698	---	---	---	---
1968		C	1	19.76	111	742	219	15.1	---	---
			2	43.40	132	813	241	2.78	---	---

Table 4-4. Differential Scanning Calorimetry Results for Tank 241-BY-108.[1] (4 sheets)

Sample Number	Sample Location		Run	Sample Weight	Transition 1		Transition 2		Transition 3	
	Seg.	Subseg.		mg	Temp. (°C)[2]	ΔH (J/g)	Temp. (°C)[2]	ΔH (J/g)	Temp. (°C)[2]	ΔH (J/g)
Core 104 (Continued)										
1969	3	A	1	33.86	135	812	---	---	---	---
			2	29.36	122	900	---	---	---	---
1970		C	1	14.38	103	473	---	---	---	---
			2	18.91	132	518	---	---	---	---
1971		D	1	27.51	133	611	---	---	---	---
			2	27.45	136	560	---	---	---	---
1972	4	A	1	30.70	132	946	316	-41.4	---	---
			2	28.06	135	877	---	---	---	---
			3	35.26	138	939	318	40.5	---	---
1973		C	1	10.20	108	973	304	-106	---	---
			2	15.22	123	1,100	238	-115	---	---
1974		D	1	22.71	113	742	---	---	---	---
			2	18.54	126	879	---	---	---	---
1975	5	A	1	28.50	147	718	---	---	---	---
			2	25.28	133	761	---	---	---	---
1976		B	1	15.90	118	889	344	-376	---	---
			2	25.88	137	853	362	-350	---	---
1977		C	1	15.40	134	932	356	-354	---	---
			2	21.29	135	899	312	-328	---	---
1978		D	1	26.54	134	787	---	---	---	---
			2	27.16	137	797	---	---	---	---
Core 99										
7313	1	W	1	19.94	8-153	726	193-333	311	---	---
			2	29.31	16-158	521	181-343	305	---	---
7315	2	A	1	28.86	48-227	201	227-324	109	---	---
			2	35.07	43-231	177	231-322	114	---	---
7314		D	1	16.04	22-204	263	215-332	127	375-430	-2.8
			2	16.00	24-185	195	187-345	162	380-430	-2.8

Table 4-4. Differential Scanning Calorimetry Results for Tank 241-BY-108.[1] (4 sheets)

Sample Number	Sample Location		Run	Sample Weight	Transition 1		Transition 2		Transition 3	
	Seg.	Subseg.		mg	Temp. (°C)[2]	ΔH (J/g)	Temp. (°C)[2]	ΔH (J/g)	Temp. (°C)[2]	ΔH (J/g)
Core 99 (Continued)										
7932		DL	1	20.32	45-226	738	226-265	-11.6	265-340	-14.9
			2	30.33	20-216	1,240	216-270	-35.8	272-330	-10.5
7316	3	A	1	31.84	28-230	303	236-336	81.1	400-427	-1.2
			2	18.38	12-215	344	233-327	101	430-450	-0.7
7935		DL	1	26.98	31-236	1,180	236-303	26.1	---	---
			2	24.21	32-239	1,280	239-300	26.9	---	---
7322	4	A	1	7.391	22-183	386	243-310	33.6	---	---
			2	18.07	33-255	557	---	---	---	---
7319		B	1	23.42	22-193	652	200-411	-191	---	---
			2	12.03	19-224	476	224-385	-133	---	---
7318		C	1	15.00	26-192	645	192-375	-67.0	---	---
			2	36.01	15-196	877	200-361	-77.8	---	---
7317		D	1	13.40	23-195	693	203-369	-73.7	---	---
			2	13.70	30-193	614	203-350	-60.2	---	---

Notes:

Seg. = segment
Subseg. = subsegment
Temp. = temperature
ΔH = change in enthalpy (negative sign denotes exothermic reaction).
DL = drainable liquid
W = whole segment
A, B, C, D = top, second, third, or bottom segment portion, respectively.

[1]Baldwin (1995a) and Silvers et al. (1995)

[2]The temperature columns contain peak temperatures for core 98 and 104, and temperature ranges for core 99.

4.1.2.3 Density. Density measurements were performed only on core 99 at the Pacific Northwest National Laboratory. Only a single measurement was made for each sample because a limited amount of sample was available. The density of subsegment 2A was not evaluated because sufficient sample was not available to perform an accurate density measurement. The densities of the solid samples were obtained using a displacement method. The samples were placed in a preweighed graduated cylinder with a known volume and mass of mineral oil. After the sample was placed in the mineral oil, the volume and mass of the sample/oil mixture were measured, then the mass and volume of the mineral oil were subtracted from the mass and volume of the sample/oil mixture. The density of the sample was calculated from these values (Silvers et al. 1995).

The density of the drainable liquid was obtained by accurately measuring the mass of the liquid pipetted from a fixed volume pipette. Two separate density determinations were made on the two drainable liquid samples. A density calculated during the sample preparation (that is, water leaching) yielded 1.43 g/mL.

Table 4-5 shows the density data. To obtain the overall tank density value, all individual subsegment densities were averaged, including the drainable liquid densities which were assumed to account for missing subsegments. However, the overall average was weighted by segment, that is, the subsegments from each segment were averaged, then the segment densities (four total) were averaged. As shown in Table 4-5, this produced an overall tank density of 1.51 g/mL.

Table 4-5. Core 99 Density Results for Tank 241-BY-108.[1]

Sample Number	Segment	Subsegment	Density (g/mL)
7313	1	Whole	1.59
7314	2	Drainable liquid	1.43
7397		D	1.36
7316	3	A	1.57
7398		Drainable liquid	1.43
7322	4	A	1.51
7319		B	1.51
7318		C	1.53
7317		D	1.55
Overall Tank Density			1.51

Note:
[1]Silvers et al. (1995)

4.1.3 Drill String Wash Water Contamination Check

During sampling, drill string wash water was used to clean the drill string after each core was removed. Lithium bromide was added to this wash water as a tracer, and its presence in the core samples indicates contamination by the wash water. This check, through analyses for lithium and bromide, was prescribed by the SAP (Baldwin 1995c). The SAP established notification limits of 100 μg/g for lithium and 1,200 μg/g for bromide.

Tables containing lithium and bromide data are in Appendix C. Two segments may have been contaminated with wash water because they had lithium results above the notification limit. Segment 1 of core 99, which contained only one subsegment, had a lithium mean of 115 μg/g (183 μg/mL); quarter segment B of segment 3 from core 99 had a lithium result of 149 μg/g (225 μg/mL). Bromide was not analyzed on core 99 to corroborate the lithium results, because the sampling and analysis plan (Baldwin 1995c) specifies that all anions be measured by IC as primary analytes according to the ferrocyanide DQO which includes bromide. The policy at PNNL, however, is to regard bromide as a separate analyte; all anions does not include bromide. Because bromide analysis was not specifically requested, it was not performed. Omitting the bromide analysis had little, if any, impact on the analytical results. Based on lithium bromide correction calculations, the percent water values of segment 1 and quarter segment B of segment 4 from core 99 would be about 15 percent lower (27.15 versus 29.4 percent, and 30.37 versus 35.6 percent, respectively). Only the segment B, core 99 corrected water result is statistically different than the original analysis at the 0.05 confidence level. Even with a possible percent error caused by wash water contamination, these values are above the 17 percent water safety screen criteria. For cores 98 and 104, all lithium results were less than the SAP limit, and all bromide results were less than the detection limit.

4.1.4 Vapor Data Summary

The safety screening DQO has established a notification limit of 25 percent of the lower flammability limit for headspace vapors. Prior to removing core samples, tank vapors were field tested using a combustible gas meter and an organic vapor meter. Lower flammability limits of 5 percent and 4 percent were observed in risers 12A and 7, respectively. Both results satisfied the safety screening requirement of $<$ 25 percent of the lower flammability limit (WHC 1995a).

A full vapor characterization was performed on the tank headspace gases in 1994. The data from this sampling and analysis can be found in *Tank 241-BY-108 Headspace Gas and Vapor Characterization Results for Samples Collected in March 1994 and October 1994* (Huckaby and Bratzel 1995). A calculation of the lower flammability limit using the vapor characterization data showed that the headspace gases were 3.0 percent of the lower flammability limit.

5.0 INTERPRETATION OF CHARACTERIZATION RESULTS

This section evaluates the overall quality and consistency of the available results for tank 241-BY-108 and assesses and compares these results against historical information and program requirements.

5.1 ASSESSMENT OF SAMPLING AND ANALYTICAL RESULTS

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

5.1.1 Field Observations

The analytical data from the 1995 sampling event was obtained from three cores: core 104 was removed from riser 7 near the center of the tank, and cores 98 and 99 were removed from riser 12A near the outer edge of the tank. The position of these risers met the sampling requirements of the safety screening and ferrocyanide DQOs (Babad et al. 1995 and Meacham et al. 1995). Sample recoveries were generally good for all segments from cores 98 and 104. However, sample recovery was much less than expected for segments 1 and 3 from core 99. This may have been caused by core 99 being removed from riser 12A after core 98. It was noted upon extrusion that there were several gaps in the samples of all three cores where solids were not present. The gaps in the first three segments of core 98 were assumed to be filled with drainable liquid, while those in core 104 were small. The large gaps in core 99 are less easily explained. When segment recoveries are incomplete, the representativeness of the sample is more questionable, and biases may be introduced into the data.

5.1.2 Quality Control Assessment

The quality control assessment includes an evaluation of the four quality control checks (blanks, duplicates, spikes, and standards) performed in conjunction with the chemical analyses. Because of the large amount of data collected for tank 241-BY-108, this section provides only a general evaluation and summary of some key safety areas. The original data reports (Baldwin 1995b for cores 98 and 104 and Silvers et al. 1995 for core 99) should be consulted for more detailed quality control information. The SAP (Baldwin 1995c) establishes the specific accuracy and precision criteria for the four quality control checks. Samples which had one or more quality control results outside of the criteria have been identified (by footnoting) in the Appendix A data tables.

Several quality control results for the total alpha activity standard and spike recoveries for cores 98 and 104 were outside the normal quality control criteria. However, these deviations were not significant enough to affect the criticality evaluation. Total alpha activity results for core 99 were corrected for spike recovery because of absorption effects.

The precision (estimated by the relative percent difference [RPD], defined as the absolute value of the difference between the primary and duplicate samples, divided by their mean, times one hundred) between several of the TGA and DSC duplicate pairs was greater than the limits set by the laboratory. This may be attributable to the very small samples (10 to 20 mg) used in this analysis, which imposes the need for a high degree of homogeneity in the sample to achieve reproducible results. The variability of the DSC results were taken into account when evaluating the exothermic data by comparing the 95 percent upper confidence level of the results against the energetics criteria.

The quality control results for TOC, cyanide, and nickel exhibited reasonable quality for this waste. Difficulties in producing a highly homogeneous subsample may be responsible for some of the reproducibility problems observed for these and other analytes. Sodium standard results for cores 98 and 104 were 50 to 60 percent high, indicating a potential bias in the results or a standard or sodium contamination problem.

In summary, the vast majority of the quality control results were within the boundaries specified in the SAP (Baldwin 1995c). As noted in the Appendix A tables, some samples did have quality control results outside the SAP boundaries. However, an evaluation of QC discrepancies has been made and these discrepancies have not been found to 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 by the three core samples; they are given in the subsections below. They include the comparison of phosphorus and sulfur as analyzed by ICP with phosphate and sulfate as analyzed by IC, and the comparison of total alpha and total beta with the sum of alpha and beta emitters. Other evaluations include a homogenization test to reveal whether sample results were consistently duplicated and the calculation of a mass and charge balance to help assess the overall data consistency data.

5.1.3.1 Comparison of Results from Different Analytical Methods. The following data consistency checks compare the results from two or more analytical methods for a given analyte. A close correlation between the two methods strengthens the credibility of both results, whereas a poor correlation may bring the reliability of the data into question. All analytical mean results were taken from Table 4-2.

The analytical phosphorus mean result as determined by ICP was 10,100 μg/g, which converts to 31,000 μg/g of phosphate. This compares well with the IC phosphate mean result of 26,000 μg/g. The RPD between these two phosphate estimates was a reasonable 18 percent.

The ICP sulfur value of 6,960 μg/g converts to 20,100 μg/g of sulfate. This compares favorably with the IC sulfate result of 23,400 μg/g. The RPD between these two sulfate estimates was a reasonable 15 percent.

A comparison was made between the gross beta and gross alpha activities with the sum of the individual beta and alpha emitters. The sum of the activities of the individual alpha emitters is usually determined by adding ^{241}Am and plutonium isotope activities. However, because ^{241}Am was not detected, it was not included in the calculation. The activity sum was therefore derived by the following equation:

$$\text{Sum of alpha emitters} = {}^{238}\text{Pu} + {}^{239/240}\text{Pu}$$

The activities of the individual beta emitters were summed as follows:

$$\text{Sum of beta emitters} = (2 * {}^{90}\text{Sr}) + {}^{137}\text{Cs}$$

Since ^{90}Sr is in equilibrium with its daughter product ^{90}Y, the radiochemically measured value for ^{90}Sr alone must be multiplied by 2 in order to obtain comparable numbers with total beta. The comparisons are shown in Tables 5-1 and 5-2. The total alpha activity and total beta RPDs of 16 and 1 percent, respectively, indicate the different analytical results correlate fairly well.

Table 5-1. Tank 241-BY-108 Comparison of Gross Alpha Activities With the Total of the Individual Activities.

Analyte	Half-Life (years)	Overall Mean (μCi/g)
^{238}Pu	87.8	0.00659
$^{239/240}$Pu	24,100 (^{239}Pu)	0.0459
Sum of alpha emitters		0.0525
Gross alpha		0.0619
Relative percent difference		16%

Table 5-2. Tank 241-BY-108 Comparison of Gross Beta Activities With the Total of the Individual Activities.

Analyte	Half-Life (years)	Overall Mean (μCi/g)	Beta Activities (μCi/g)
^{90}Sr	28.6	143	286
^{137}Cs	30.17	258	258
Sum of beta emitters		---	544
Gross Beta			549
Relative percent difference			1%

5.1.3.2 Homogenization Test. To evaluate the adequacy of the laboratory homogenization procedure on the samples taken from core 99, segment 1 and quarter segment 4B were homogenized, and subsamples were taken from the top and bottom. Each subsample was analyzed in duplicate by ICP and gamma energy analysis, and a total of 15 analytes were evaluated (Silvers et al. 1995). The resulting RPDs between the average of the top and bottom samples ranged from 1.1 to 19.0 percent. This indicates that a fair degree of sample homogenization was achieved for these samples, and that sample heterogeneity for the remainder of the analytes may not be a primary source of error in estimating analyte concentrations. However, some analytes may be in a chemical or physical form that would prevent them from being effectively homogenized, and any analyte near the detection limit may have large RPDs regardless of sample homogenization efficiency.

5.1.3.3 Mass and Charge Balance. The principle objective in performing a mass and charge balance is to determine whether the measurements were self-consistent. In calculating the balances, only analytes listed in Table 4-2, which were detected at a concentration of 5,000 μg/g or greater, were considered.

With the exception of sodium, all cations listed in Table 5-3 were assumed to be in their most common hydroxide or oxide form, and the concentrations of the assumed species were calculated stoichiometrically. Because precipitates are neutral species, all positive charge was attributed to the sodium cation. The acetate and carbonate data were derived from the total organic carbon and total inorganic carbon analyses, respectively. The other anionic analytes listed in Table 5-4 were assumed to be present as sodium salts and were expected to balance the positive charge exhibited by the cations. Sulfur is considered to be present as the sulfate ion and phosphorus as the phosphate ion. Both species are assumed to be completely water soluble and appear only in the anion mass and charge calculations (see Section 5.1.3.1). The concentrations of the cationic species in Table 5-3, the anionic species in Table 5-4, and the percent water were ultimately used to calculate the mass balance. The uncertainty estimates (RSDs) associated with each analyte and the uncertainty for the cation and anion totals also are given in the tables.

Table 5-3. Cation Mass and Charge Data.

Analyte	Concentration ($\mu g/g$)	Assumed Species	Concentration of Assumed Species ($\mu g/g$)	RSD (Mean) (%)	Charge ($\mu eq/g$)
Aluminum	39,800	$Al(OH)_3$	1.15E+05	29.8	0
Iron	7,190	FeO(OH)	11,400	52.8	0
Sodium	1.63E+05	Na^+	1.63E+05	14.2	7,090
Uranium	9,470	U_3O_8	11,200	60.0	0
Totals			3.01E+05	14.0	7,090

Notes:

$\mu g/g$ = microgram per gram
$\mu eq/g$ = microequivalent per gram
RSD (Mean) = relative standard deviation of the mean

Table 5-4. Anion Mass and Charge Data.

Analyte	Concentration ($\mu g/g$)	RSD (Mean) (%)	Charge ($\mu eq/g$)
Acetate (TOC)[1]	11,000 (4,480)	20.5	186
Carbonate (TIC)[1]	26,700 (5,340)	33.9	890
Fluoride	6,610	26.7	348
Nitrate	2.1E+05	18.5	3,240
Nitrite	27,300	13.0	593
Oxalate	7,500	11.4	170
Phosphate	26,000	24.0	821
Sulfate	23,400	27.9	488
Totals	3.30E+05	12.0	6,740

Note:

[1]The values in parentheses are from the TOC and TIC analytical results and were used to derive the acetate and carbonate values on the left.

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

Mass balance = % Water + 0.0001 x {Total Analyte Concentration}
= % Water + 0.0001 x $\{Al(OH)_3 + FeO(OH) + Na^+ + U_3O_8 + C_2H_3O_2^- + CO_3^{-2} + F^- + NO_3^- + NO_2^- + (COO)_2^{-2} + PO_4^{-3} + SO_4^{-2}\}$

The total analyte concentrations calculated from the above equation was 631,000 $\mu g/g$. The mean weight percent water obtained from thermogravimetric analysis reported in Table 4-2 is 27.2 percent. The mass balance resulting from adding the percent water to the total analyte concentration is 90.3 percent (see Table 5-5).

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

Total cations (microequivalents) = $Na^+/23.0$ = 7,090 microequivalents

Total anions (microequivalents) = $C_2H_3O_2^-/59.0 + CO_3^{-2}/30.0 + F^-/19.0 + NO_3^-/62.0 + NO_2^-/46.0 + (COO)_2^{-2}/44.0 + PO_4^{-3}/31.7 + SO_4^{-2}/48.1$ = 6,740 microequivalents

The charge balance obtained by dividing the sum of the positive charge by the sum of the negative charge was 1.05.

In summary, the above calculations yield reasonable mass and charge balance values (close to 1.00 for charge balance and 100 percent for mass balance), indicating that the mean analytical results for the tank were fairly self-consistent.

Table 5-5. Mass Balance Totals.

	RSD (Mean) (%)	**Concentrations ($\mu g/g$)**
Total from Table 5-3 (cations)	14.0	3.01E+05
Total from Table 5-4 (anions)	12.0	3.30E+05
Water %	19.3	2.72E+05
Grand Total	8.7	9.03E+05

5.2 COMPARISON OF HISTORICAL AND ANALYTICAL RESULTS

Comparisons were possible between the 1995 analytical results and data from the 1994 auger sampling event. The 1994 historical sampling event is described in Section 3.4; the data are tabulated in Appendix D. Because the 1994 auger samples were taken from approximately the top 50.8 cm (20 in.) of waste, their results are compared to averages of only the top segments of waste from the 1995 sampling (that is, segment 1 of cores 98, 99, and 104). Table 5-6 shows a comparison of analytical results from the 1994 and 1995 sampling events.

Table 5-6. Comparison of 1994 and 1995 Results.

Analyte or Measurement	1994 Results[1]	1995 Results[2]
Examination of drainable liquids	No immiscible organic layer discernible.	No immiscible organic layer discernible.
Organics by gas chromatograph/flame ionization detector	Normal paraffin hydrocarbons and tributyl phosphate not detected.	Normal paraffin hydrocarbons and tributyl phosphate not detected in segment 1 of cores 98 and 104. These analyses were not performed on core 99.
Weight percent water	13 percent	26.2 percent[3]
Total organic carbon	875 μg C/g	2,170 μg C/g[3]

Notes:

[1]Baldwin (1995a)

[2]Campbell et al. (1995a)

[3]Averages of results from segment 1 of cores 98, 99, and 104.

5.3 TANK WASTE PROFILE

The objective of the 1995 sampling event was to obtain a vertical profile of the waste from two widely spaced risers (Baldwin 1995c). A vertical profile was obtained from both risers, allowing a statistical assessment of the vertical and horizontal distribution of the tank waste for many of the analytes. The sample recovery was poor for some segments, which may have biased the analytical results. Information on the vertical disposition of the waste was also available from the TLM (see Figure 2-3). According to the TLM, the waste was composed of three layers. The bottom half is predicted to be PFeCN1 waste, the middle layer is PFeCN2 waste, and the upper layer is BY saltcake. The bottom two ferrocyanide layers should be indistinguishable from each other except that the PFeCN1 waste should have more ferrocyanide. These different layers, made up of two different waste types, indicate that tank contents are expected to be vertically heterogeneous. The visual descriptions of the extruded cores and segments also imply that tank contents are, to an extent, heterogeneous both vertically and horizontally (see Table 3-2) although these differences may or may not be statistically significant.

The fact that multiple risers, cores, and segments were sampled allowed a statistical procedure known as the analysis of variance (ANOVA) to be conducted on the 1995 core samples to determine whether there were horizontal or vertical differences in analyte concentrations. Three different ANOVA models were used: a three-way, random-effects nested model was conducted on analytes that had sample information from all three cores, a two-way, random-effects nested model was conducted on analytes that had sample information from a single core from both risers, and a simple one-way ANOVA was conducted on analytes that had sample information from only one core. These analyses were calculated only for analytes which had more than half of their individual measurements above the detection limit. Two assumptions were made while conducting these tests: 1) the population from which these samples were drawn was normally distributed, and 2) the samples used in making the comparisons had equal variances. The ANOVA generates a p-value which is compared with a standard significance level ($\alpha = 0.05$). If a p-value is below 0.05, there is sufficient evidence to conclude that the sample means are significantly different from each other. However, if a p-value is above 0.05, there is not sufficient evidence to conclude that the samples are significantly different from each other. A two-tailed statistical test was used in all cases.

The results of the ANOVA tests indicated that none of the 11 analytes tested for differences between the two risers showed any significance. Only 2 of 35 analytes tested for differences between the cores showed significance. These two analytes were boron and potassium, with core p-values of 0.0056 and 0.0074, respectively. On the segment level, however, only 3 of 45 analytes (sulfur, oxalate, and ^{137}Cs with p-values of 0.113, 0.318, and 0.0589, respectively) tested did not show significant differences. This evidence of vertical heterogeneity substantiates the TLM and the visual descriptions of the samples. In summary, the available evidence strongly implies vertical heterogeneity of the waste. Horizontally, the TLM made no predictions on the waste disposition, and the statistical results gave little indication of concentration differences.

5.4 COMPARISON OF ANALYTICAL AND TRANSFER DATA

The HTCE of the contents of tank 241-BY-108 is shown in Table 5-7 along with the concentration estimates from the 1995 analytical results (see Table 4-2). This comparison is presented for informational purposes only. The HTCE values are generated from a combination of inputs from the WSTRS (Agnew et al. 1995b), the Hanford Defined Wastes (Agnew 1995), and the TLM (Agnew et al. 1995a). 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 the HTCE numbers. Because the HTCE values have not been validated, they should be used with caution.

Table 5-7. Comparison of Historical Data With 1995 Analytical Results for Tank 241-BY-108 (2 sheets).

Analyte	1995 Analytical Result	HTCE[1] Estimate	Relative Percent Difference
METALS	µg/g	µg/g	%
Aluminum	39,800	4,670	158
Calcium	3,370	3,570	6
Chromium	255	790	102
Iron	7,190	40,600	140
Lead	439	5.8	195
Nickel	2,510	3,510	33
Potassium	2,650	233	168
Silicon	1,530	6,210	121
Sodium	163,000	124,000	27
Uranium	9470	963	163
IONS	µg/g	µg/g	%
Cl^-	1,550	1,220	24
CN^-	362	8,240[2]	183
F^-	6,660	4,580	37
NO_3^-	201,000	126,000	46
NO_2^-	27,200	9,430	97
PO_4^{-3}	25,700	18,800	31
SO_4^{-2}	23,400	92,500	119

Table 5-7. Comparison of Historical Data With 1995 Analytical Results for Tank 241-BY-108 (2 sheets).

Analyte	1995 Analytical Result	HTCE[1] Estimate	Relative Percent Difference
RADIONUCLIDES	μCi/g	μCi/g	%
^{137}Cs	258	107	83
^{238}Pu + $^{239/240}$Pu	0.0525	0.0425 (Pu)	21
^{90}Sr	143	6.32	183
PHYSICAL PROPERTIES	g/mL	g/mL	%
Percent Water	27.2	45.8	51
CARBON	μg C/g	μg C/g	%
Total Inorganic Carbon	5,340	1,370	118
Total Organic Carbon	4,480	4,180	7

Notes:

[1]Brevick et al. (1994a).

[2]This value is converted from the HTCE $Fe(CN)_6^{4-}$ concentration of 0.0845 moles/L using the HTCE density value of 1.6 g/mL.

Comparing the HTCE with the analytical values produced varied results. A total of 22 analytes were compared. Nine analytes (calcium, nickel, sodium, chloride, fluoride, nitrate, phosphate, total plutonium, and TOC) exhibited RPDs less than 50 percent. Of these, two analytes (calcium and TIC) exhibited RPDs less than 10 percent. Five analytes (aluminum, lead, potassium, uranium, and ^{90}Sr) exhibited RPDs greater than 150 percent. The RPDs for the remaining analytes were in between these two extremes.

Other observations can be made by qualitatively comparing analytical results with the predicted waste type constituents. Aluminum is predicted to be found in higher quantities in the BY saltcake than in the ferrocyanide waste. In reviewing the subsegment analytical results in Appendix A, aluminum was found in higher concentrations in the upper segments. Analytes (bismuth, nickel, and iron) characteristic of PFeCN1 and PFeCN2, ferrocyanide sludges, were found in higher concentrations in the lower segments as expected.

5.5 EVALUATION OF PROGRAM REQUIREMENTS

The two 1995 tank 241-BY-108 core samples analyzed at the 222-S Laboratory were acquired to meet the requirements of the safety screening DQO (Babad et al. 1995), the ferrocyanide DQO (Meacham et al. 1994), the pretreatment DQO (Kupfer et al. 1994), and the safety program test plan (Meacham 1995). The core sample analyzed at the Pacific Northwest National Laboratory was governed by the safety screening DQO and the historical model evaluation data requirements DQO (Simpson and McCain 1995). This sections discusses the requirements of each document and compares the analytical data to defined concentration limits. Any remaining material from the sampling event will be set aside for pretreatment studies as identified in the pretreatment DQO.

5.5.1 Safety Evaluation

Data criteria identified in the safety screening DQO (Babad et al. 1995) are used to assess the waste safety and to check for unidentified safety issues. The DQO requires samples from two widely spaced risers. This requirement was met. The three primary analyses required by the safety screening DQO include DSC to evaluate energetics, TGA to measure weight percent water, and a determination of total alpha activity. For each required analysis, a notification limit was established by the DQO which, if exceeded, could warrant further investigation to ensure tank safety. A final requirement of the safety screening DQO was to determine the flammability of tank headspace vapors. These measurements were taken prior to removing core samples. The highest measured result was 5 percent of the lower flammability limit, well below the safety screening limit of 25 percent (WHC 1995a). The flammability headspace gas of tank 241-BY-108 can also be calculated on results from the 1994 vapor sampling and analysis event (Huckaby and Bratzel 1995). As shown in Table 5-8, the hydrogen, organic vapor, and ammonia fuel represent a combined total of 3.0 percent of the LFL, well below the safety screening limit of 25 percent of the LFL. At the reported concentrations, hydrogen, organic vapor, and ammonia do not individually or collectively represent a flammability hazard.

Table 5-8. Vapor Flammability Results from 1994 Vapor Sampling and Analysis Event.[1]

Analyte	LFL	Average Concentration	Concentration as Percent of LFL
H_2	40,000 ppmv	399 ppmv	1.0 %
Total organics	46,000 mg/m^3	594 mg/m^3	1.3 %
NH_3	150,000 ppmv	1,040 ppmv	0.7 %
		Total:	3.0 %

Note:

[1]Huckaby and Bratzel (1995).

The safety screening DQO limit for criticality is 41 μCi/g; it is assessed from the total alpha activity. All results from cores 98 and 104 were well below this limit; the largest single result was 0.390 μCi/g.

The safety screening DQO has established a notification limit of 481 J/g (dry weight basis) for the DSC analysis. Of the samples from cores 98 and 104, two quarter segments from segment 5 of core 104 had averages exceeding the limit: quarter segment 5B (573.0 J/g) and quarter segment 5C (528.3 J/g). Two other samples had one result out of a duplicate pair greater than the threshold: quarter segment 4B of core 98 and a rerun from the same quarter segment. However, for both samples, the average DSC result was below the limit (473.6 and 445.4 J/g, respectively). The calculation of a 95 percent confidence interval for sample results which exceeded a decision limit was also required by the safety screening DQO. The results of these calculations are in Baldwin (1995a). For the two samples (quarter segment 4B of core 98 and its rerun) which had averages approaching the 481 J/g limit, the 95 percent upper confidence interval limit exceeded the DQO limit (697.6 and 672.0 J/g, respectively). Reactive systems screening tool runs will be made on segments with DSC results exceeding the DQO limit. These results will be reported in a revision to this document.

The DSC analyses, which exceeded the safety screening notification limit of 481 J/g, were compared to the energy equivalents of the cyanide and TOC analytical results for a given subsegment. The cyanide and TOC values were converted to a dry weight basis (see footnote 1, Table 5-9) using the corresponding percent water result for the specific run for a given subsegment. The cyanide fuel content was assumed to exist as the species disodium nickel ferrocyanide ($Na_2NiFe(CN)_6$) (Meacham et al. 1994). The necessary conversion of the cyanide analytical result (dry weight) to the weight percent of the assumed species was accomplished by the following equation:

$$Na_2NiFe(CN)_6 \text{ wt\%} = \left[\frac{X\ \mu g\ CN}{g}\right] \times \left[\frac{1\ \mu mol\ CN}{26\ \mu g\ CN}\right] \times \left[\frac{1\ \mu mol\ Na_2NiFe(CN)_6}{6\ \mu mol\ CN}\right] \times \left[\frac{316.5\ \mu g\ Na_2NiFe(CN)_6}{1\ \mu mol\ Na_2NiFe(CN)_6}\right] \times \frac{1\ g}{1 \times 10^6\ \mu g} \times 100 \text{ wt\%}$$

The resulting weight percent was inserted into the energy equivalent ferrocyanide concentration equation (Meacham et al. 1994), and the equation was manipulated algebraically to give the following energy equivalent in J/g:

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

The energy equivalent conversion for TOC (based on a sodium acetate average energetics standard) is calculated by converting the analytical results from $\mu g/g$ to weight percent (dividing by 10,000). The entire equation (Babad et al. 1994) is as follows:

$$\left[\frac{X\ \mu g\ TOC}{g}\right] * \left[\frac{1}{10,000}\right] * \left[\frac{30.2\ cal}{g}\right]\left[\frac{4.18\ J}{cal}\right] = \left[\frac{X\ J}{g}\right]$$

For a given subsegment, the energy equivalent values for cyanide and TOC were added in column 7 of Table 5-9; the DSC analytical result is in column 8. The sum of the two energy equivalents were roughly half the DSC results for three of the subsegments and well over half (88 and 59 percent) the DSC results for the other two.

Table 5-9. Comparison of Differential Scanning Calorimetry Analytical Results With Total Organic Carbon and Cyanide Energy Equivalents.

Core	Quarter Segment	Primary/ Duplicate	Analyte	Analytical Result (μg/g)[1]	Energy Equivalent (J/g)	Sum (J/g)	DSC Analytical Result (J/g)
98	4(B)	Primary (Rerun)	TOC	20,900 (32,400)	409	447	509.1 (481.3)
			CN^-	2,010 (3,110)	37.8		
104	5(B)	Primary	TOC	17,200 (27,600)	348	350	593.5
			CN^-	99.9 (160)	1.95		
104	5(B)	Duplicate	TOC	13,400 (20,800)	263	265	552.6
			CN^-	94.7 (147)	1.79		
104	5(C)	Primary	TOC	13,600 (21,100)	266	268	548.7
			CN^-	125 (194)	2.36		
104	5(C)	Duplicate	TOC	13,200 (20,500)	259	261	507.9
			CN^-	117 (181)	2.20		

Notes:

CN^- = cyanide

[1]Values in parentheses are the analytical results converted to a dry weight basis using the following equation:

$$\frac{X\mu g/g\ (\text{wet weight})}{1 - (\%\ \text{water}/100)} = X\mu g/g\ (\text{dry weight})$$

According to the SAP, the safety screening DQO limit of 17 weight percent water was superseded on cores 98 and 104 by the ferrocyanide DQO water content requirement. However, an inspection of the TGA data revealed that 10 subsegments had means below 17 percent. More importantly, a comparison was made between the samples which had DSC results greater than 481 J/g and their corresponding TGA results. All four samples with

DSC values over 481 J/g also had water contents of at least 35 percent, even though no drainable liquid was associated with any of these samples.

Because the ferrocyanide DQO requires analyses on a quarter segment basis, the notification limits were applied to the data on a quarter segment level. However, only individual limit excursions are discussed. Also, the ferrocyanide DQO limits were only applied to cores 98 and 104. Primary analyses required by the ferrocyanide DQO include DSC and TGA and measurements of the cyanide, nickel, and total organic carbon concentrations. The DSC requirements were the same as those discussed previously for the safety screening DQO. The actual TGA notification limit listed in the ferrocyanide DQO is as follows:

$$\text{weight percent water} \geq 4/3\ (\text{weight percent fuel} - 8\ \text{weight percent})$$

However, the SAP has converted this limit into an equation more readily usable by the laboratory. The applicable assumptions and calculations for this conversion are listed in Baldwin (1995c). The modified decision limit is as follows:

$$\text{weight percent water} > (0.0223 * \text{DSC exotherm [dry weight]}) - 10.7$$

Using this equation, the minimum water contents (according to the ferrocyanide DQO), required in the four samples with DSC results above 481 J/g, were calculated. Based on the DSC result of 558.0 J/g, quarter segment B of segment 4 from core 98 needed 1.74 weight percent water. The 35.61 percent result was far above that. Similarly, the other three samples had TGA results well above the required minimum as computed using the ferrocyanide TGA notification limit.

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, and 1995). This prediction has been confirmed by the tank samples analyzed to date. In order to determine 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), 17,500 kg of $Na_2NiFe(CN)_6$ were expected to remain in the tank at the end of the ferrocyanide waste transfer activity in 1957. This number compares favorably with the $Na_2NiFe(CN)_6$ inventory of 23,100 kg calculated based on the HTCE concentration for $Fe(CN)_6^{4-}$ of 0.0845 moles/L, the HTCE density value of 1.6 g/mL, and the HTCE total weight for the waste of 1.38E+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 the bottom three segments of each core because ferrocyanide waste has been predicted to comprise approximately the bottom 67 inches of the tank content (Agnew et al. 1995a). 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 the bottom three segments of core 98, 99 and 104 was 3,570 μg/g. If all the nickel originated from $Na_2NiFe(CN)_6$, then the observed nickel concentration indicates that 19,200 μg/g of $Na_2NiFe(CN)_6$ (25,100 kg of $Na_2NiFe(CN)_6$), existed in the tank before degradation. Therefore, these three sources of information place the original $Na_2NiFe(CN)_6$ inventory approximately within the 17,500- to 25,100-kg range.

The recent total cyanide analytical mean based on the bottom three segments of core 98, 99, and 104 is 421 μg/g (549 kg of cyanide) which is equivalent to 1,110 kg of $Na_2NiFe(CN)_6$. Consequently, it appears that 94 to 96 percent (1-1,110/17,500 to 1-1,110/25,100) of the ferrocyanide complex has decomposed. Even when the highest cyanide analytical mean from the bottom three segments were used (864 μg/g for core 98 which is equivalent to 2,280 kg of $Na_2NiFe(CN)_6$), a significant ferrocyanide degradation of at least 87 percent (1-2,280/17,500) is obtained.

All quarter segment results as well as the overall mean cyanide analytical result were much lower than the 39,000 μg/g ferrocyanide DQO limit. No decision limit was specified for the nickel concentration in the ferrocyanide DQO which was applied to the 1995 sampling and analysis event (Meacham et al. 1994).

The total organic carbon content notification limit was set at 30,000 μg/g; an overall tank mean TOC concentration of 4,480 μg/g was found. No quarter segment sample exceeded the limit with the exception of the TOC value for core 98, segment 4B of 32,400 μg/g which exceeded this value when compared on a dry weight basis.

The safety program test plan, applicable to cores 98 and 104, specified two primary analyses: TOC (discussed previously) and an organic screen. The organic screen targets determined the presence of tributyl phosphate and normal paraffin hydrocarbons. No decision limits were established for any analytes. Minor amounts of undecane, tridecane, tetradecane, pentadecane, nonane, dodecane, decane, and tributyl phosphate were found (see Section 4.1 for the overall means).

Core 99 was analyzed separately from cores 98 and 104 at the Pacific Northwest National Laboratory in accordance with the safety screening and historical DQOs. The safety screening requirements have already been discussed. No exothermic reactions exceeded the 481 J/g limit. The largest total alpha result was 0.450 μCi/g, well below the limit of 41 μCi/g. Two quarter segments from core 99, 2A and 2D, had percent water means below the safety screening percent water criterion of 17 percent. This segment also contained a large amount of drainable liquid (230 mL) which was 49.7 percent water. The small quantities of solids collected for these two segments could have resulted in some moisture loss during storage and analysis. In addition, the original run on quarter segment A from segment 3 had a result of 14.1 although the mean for the quarter segment was 24.6 percent.

The historical DQO specifies several analyses including ICP, IC, gamma energy analysis, and a determination of the ^{90}Sr content. All required analyses were run. No notification limits were established.

Table 5-10 displays the analyte criteria limits for the DQOs and the test plan. The number of results, which exceeded each criterion, are also included. Because the samples in which limits were exceeded have been discussed in the text, they are not addressed in Table 5-10.

Another factor in assessing tank waste safety is heat generation and waste temperature. Heat is generated in the tanks from radioactive decay. An estimate of the tank heat load was calculated from the 1995 radionuclide data. Only the radionuclides present in detected quantities were used in the heat load calculation. Table 5-11 displays the calculated heat load. As shown, the estimated heat load was 2,830 W or 9,660 Btu/hr. This value compares favorably with the 2,700 W estimated from the headspace temperature (Kummerer 1994) and is below the 40,000 Btu/hr threshold differentiating high-heat from low-heat tanks (Bergmann 1991). This value did not compare well with the HTCE estimate of 2,560 Btu/hr. Because an upper temperature limit is exhibited (see Section 2.4), it may be concluded that any heat generated from radioactive sources throughout the year is dissipated.

Table 5-10. Data Quality Objective and Test Plan Decision Variables and Criteria.

Applicable DQO or Test Plan	Applicable Core(s)	Primary Decision Variable	Decision Criteria Threshold	Number Outside Threshold[1]
Safety screening, Ferrocyanide	98, 99, 104	Total fuel content	-481 J/g	2
Ferrocyanide	98, 104	Percent water	(0.0223 * DSC exotherm [dry weight] - 10.7)	None
Safety screening	98, 99, 104	Percent water	17 weight percent	10
Safety screening	98, 99, 104	Total alpha	41 μCi/g (1 g/L)[2]	None
Ferrocyanide	98, 104	Cyanide	39,000 μg/g	None
Ferrocyanide	98, 104	TOC	30,000 μg/g	1

Notes:

[1]This column lists the number of sample means outside the limit. Limit excursions for individual samples have been discussed in detail in the accompanying text.

[2]Although the actual decision criterion listed in the DQO is 1 g/L, total alpha is measured in μCi/g rather than g/L. To convert the notification limit for total alpha into a number more readily usable by the laboratory, it was assumed that all alpha decay originates from ^{239}Pu. Assuming a tank density of 1.5 (from the sampling and analysis plan) and using the specific activity of ^{239}Pu (0.0615 Ci/g), the decision criterion may be converted to 41 μCi/g as follows (Baldwin 1995c):

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

Table 5-11. Tank 241-BY-108 Projected Heat Load.

Radionuclide	Microcuries/gram	Curies	Watts
^{137}Cs	258	3.35E+05	1,580
^{238}Pu	0.00659	8.57	0.279
$^{239/240}Pu$	0.0459	59.7	1.82
^{90}Sr	143	1.86E+05	1,250
Total		5.21E+05	2,830

5.5.2 Historical Evaluation

In addition to the safety screening DQO, core 99 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 or "fingerprint" analytes for certain waste types, including ferrocyanide waste. Tank 241-BY-108 was selected as a tank for historical evaluation because it is expected to contain a thick ferrocyanide waste layer (Agnew et al. 1995a). The first step in the evaluation is to compare the analytical results with DQO-defined concentration levels for the "fingerprint" 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 ≥ 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 waste is predicted to comprise approximately the bottom 67 inches of waste in the tank (Agnew et al. 1995a), the fourth segment of core 99 should be completely composed of this waste type. Table 5-12 compares the concentration levels for ferrocyanide waste from the historical DQO and the analytical results from segment 4. The analytical range from all subsegments of segment 4 have been reported. All analytes except bismuth had analytical results at least ten percent of the DQO-specified level.

Table 5-12. Comparison of Fingerprint Analytes with Analytical Results.

Fingerprint Analyte	Analytical Result Range[1]	Historical DQO Concentration Level[2]	Ratio
Bismuth	902 - 2,874 μg/g	25,000+ μg/g	0.036 - 0.11
Nickel	6,710 - 14,760 μg/g	4,000+ μg/g	1.7 - 3.7
Sodium	1.092E+05 - 1.283E+05 μg/g	60,000 - 1.50E+05 μg/g	1.8 - 2.1
^{137}Cs	71.3 - 2,100 μCi/g	8+ μCi/g	8.9 - 263
^{90}Sr	354 - 811 μCi/g	4+ μCi/g	89 - 203
Percent water	25.5 - 42.3 %	28 - 81 %	0.91 - 1.5

Notes:

[1]Analytical result range for segment 4 including all subsegments is from Appendix A.

[2]Historical DQO concentration levels is from Simpson and McCain (1995).

6.0 CONCLUSIONS AND RECOMMENDATIONS

The waste in tank 241-BY-108 was core sampled using the rotary mode in July and August, 1995. Three DQOs and a test plan governed the sampling and analysis of cores 98 and 104: the *Tank Safety Screening Data Quality Objective* (Babad et al. 1995), the *Data Requirements for the Ferrocyanide Safety Issue Developed through the Data Quality Objectives Process* (Meacham et al. 1994), the *Interim Data Quality Objectives for Waste Pretreatment and Vitrification* (Kupfer et al. 1994), and the *Test Plan for Samples from Hanford Waste Tanks 241-BY-103, BY-104, BY-105, BY-108, BY-110, TY-103, U-105, U-107, U-108, and U-109* (Meacham 1995). The two DQOs, which governed the sampling and analysis of core 99, were the safety screening DQO and the *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995). Although not addressed by the SAP, the analyses required by the *Data Quality Objective to Support Resolution of the Organic Complexant Safety Issue* (Turner et al. 1995) were performed while meeting the requirements of the other DQOs and the test plan. In addition, an internal letter (Kristofzski 1995) directed the laboratories to perform all feasible analyses of the waste samples on an opportunistic basis, according to the work load in the laboratory. Sample analyses for cores 98 and 104 were performed at the Westinghouse Hanford Company 222-S Laboratory, and analyses for core 99 occurred at the 325 Analytical Chemistry Laboratory and the 325 High Level Radiochemistry Laboratory of the Pacific Northwest National Laboratory.

Analytical results show that the waste contains compounds in a few selected tank areas capable of exothermic reactions in excess of the 481 J/g notification limit in the safety screening DQO. Quarter segments 5B and 5C of core 104 exhibited average exothermic reactions (dry weight) of 573.0 and 528.3 J/g, respectively. In addition, two other samples had one result of a duplicate pair greater than the limit although the averages were below the DQO limit. The percent water result from all samples exhibiting high exothermic values were greater than 35 weight percent water.

Total alpha activities were approximately one-tenth of the safety screening limit. Total organic carbon and cyanide concentrations, required by Meacham et al. (1994), were well below their respective limits, with the exception of one TOC measurement that was slightly above the limit. Analytical nickel concentrations compare favorably with historical estimates and indicate that the ferrocyanide has substantially decomposed.

Comparisons were made between the DSC results and the energy equivalents of the TOC and cyanide results for those quarter segments which had exothermic reactions greater than the 481 J/g limit. For quarter segment 4B of core 98, 80 percent of the DSC result was accounted for by the TOC energy equivalent, while the cyanide energy equivalent accounted for another 7 percent. More unsatisfactory correlations were found for the other quarter segments. The reasons for the discrepancies cannot be fully explained.

The estimated tank heat load of 2,830 W was well below the 11,700 W limit that separates high-heat from low-heat load tanks. The highest LFL measured from the tank headspace was 5 percent, which is significantly lower than the 25 percent limit (WHC 1995a).

In summary, the analytical results from the 1995 rotary core sampling show that tank 241-BY-108 is safe when compared to the safety screening and ferrocyanide data quality objectives (Baldwin 1995b). Although some exothermic activity above the safety screening limit was observed, the fuel content estimate based on the TOC and cyanide results do not indicate excessive fuel sources are present. In addition, adequate moisture is present for samples exhibiting exothermic behavior, reducing the potential for reaction propagation. The tank heat load and head space flammability were both well below their limits.

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APPENDIX A

ANALYTICAL RESULTS FROM 1995 CORE SAMPLING

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A.1 INTRODUCTION

Appendix A shows the chemical and radiological characteristics of tank 241-BY-108 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 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 weighted mean and the appropriate conversion factors. The projected tank inventory column is not applicable for percent water data. The data are listed in standard notation for values greater than 0.001 and less than 100,000. Values outside these limits are listed in scientific notation.

The tables are numbered A-1 through A-76. 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 for 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 the segment number.

Column three contains the name of the segment portion from which the sample was taken. This can be the entire segment (whole); drainable liquid (DL); or A, B, C, or D representing the top, second, third, or bottom segment portion, respectively. Some segment portions are repeated in the analyte tables, and the second entry is followed by an asterisk. The asterisk (*) identifies samples from core 99 that were analyzed for metals on a sodium peroxide-sodium hydroxide fusion. The asterisk indicates Na_2O_2 - NaOH fusion.

The Result and Duplicate columns are self-explanatory. The Mean column is the average of the result and duplicate values. All values, including those below the detection level (indicating the less-than symbol, <), were averaged. If both sample values were nondetected, the mean is expressed as a nondetected value. Values for the organic compounds were entered as U if they were nondetected, and a value of 0 was used when calculating means.

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 these 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. A density value of 1.43 g/mL was used for the conversion.

Some of the 10X dilution values for sodium were above the range of the IC method used for determining anion concentrations; therefore, the 50X dilution values were used for this report.

The tank (or analyte concentration) means for the waste in BY-108 were calculated as follows:

Segment mean: The arithmetic mean within a core was calculated by averaging the subsegment multiple analyses results.

Core mean: For each core, the core mean was calculated by averaging the segment means.

Riser mean: For each riser, the riser mean was calculated by averaging the core means associated with the riser.

Tank mean: The tank (or analyte concentration) mean was calculated by averaging the riser means. 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 or U 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 (863 kL), the specific gravity of the waste, and the appropriate conversion factors.

The four quality control (QC) parameters assessed on the tank 241-BY-108 samples were standards, spikes, duplicates, and blanks. The QC results for cores 98, 99, and 104 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:

- "1" indicates that the standard recovery was below the QC limit.

- "2" indicates that the standard recovery was above the QC limit.

- "3" indicates that the spike recovery was below the QC limit.

- "4" indicates that the spike recovery was above the QC limit.

- "5" indicates that the RPD was outside the QC limits.

- "6" indicates that there was some blank contamination.

The QC criteria specified in the SAP (Baldwin 1995c) were different for core 99 than for cores 98 and 104, and are summarized below:

- Core 99:

  90-110 percent recovery for standards and matrix spikes, ± 10 percent for RPDs, and blanks ≤ 5 percent of the analyte concentration.

- Cores 98 and 104:

  90-110 percent recovery for standards and matrix spikes, ± 10 percent for RPDs, and blanks ≤ 5 percent of the analyte concentration for all IC and ICP analytes (sludge and drainable liquid samples), and for DSC and TGA for the sludge samples only.

- 80-120 percent recovery for standards and matrix spikes, ± 20 percent for RPDs, and blanks ≤ 5 percent of the analyte concentration for TOC, TIC, TC, total alpha, and the organic screen analytes (sludge and drainable liquid samples), and for DSC and TGA for the drainable liquid samples only.

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Table A-1. Tank 241-BY-108 Analytical Results: Aluminum (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	1.357E+05	1.318E+05	1.338E+05[3]	39,800	29.8	51,700
		Whole*	1.044E+05	1.354E+05	1.199E+05[3,5]			
7942	99:2	A	8,327	10,450	9,389[5]			
7932		DL	35,450 µg/mL	34,930 µg/mL	35,190 µg/mL (24,610 µg/g)[4]			
7943		D	70,940	67,090	69,020[3]			
		D*	60,890	---	60,890			
7944	99:3	A	37,340	32,120	34,730[5,3]			
		A*	25,700	---	25,700			
7935		DL	37,440 µg/mL	37,430 µg/mL	37,440 µg/mL (26,180 µg/g)			
7945	99:4	A	14,620	14,340	14,480			
		A*	15,480	---	15,480			
7946		B	13,070	10,380	11,730[5,6]			
		B*	11,190	---	11,190			
7947		C	7,155	7,158	7,157			
		C*	7,430	---	7,430			
7948		D	8,608	8,725	8,667[6]			
		D*	8,166	---	8,166			
2161	104:1	Whole	23,100	14,600	18,900[5]			

Table A-1. Tank 241-BY-108 Analytical Results: Aluminum (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	34,600	55,800	45,200[5]	Cont'd	Cont'd	Cont'd
2163		B	42,700	41,700	42,200			
2164		C	36,800	32,400	34,600[5]			
2165	104:3	A	29,700	29,400	29,600[4]			
2166		C	52,900	54,200	53,600			
2167		D	31,100	27,900	29,500[5]			
2168	104:4	A	11,800	11,300	11,600[5]			
2169		C	25,200	25,800	25,500			
2170		D	27,400	26,300	26,800			
2171	104:5	A	23,600	22,600	23,100			
2172		B	24,900	24,600	24,700			
2174		C	24,200	24,300	24,300			
2175		D	21,000	22,300	21,600			

Note:

*Na_2O_2 - NaOH fusion

Table A-2. Tank 241-BY-108 Analytical Results: Antimony (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
7941	99:1	Whole	129	106	118[5]	< 186	N/A	< 242
		Whole*	< 75.6	111	93.3			
7942	99:2	A	91	< 90.17	91			
7932		DL	< 6.25 μg/mL	< 6.25 μg/mL	< 6.25 μg/mL (< 4.37 μg/g)			
7943		D	< 29.75	< 30.65	< 30.20			
		D*	58	---	58			
7944	99:3	A	< 82.50	< 70.45	< 76.48			
		A*	< 75.3	---	< 75.3			
7935		DL	< 6.25 μg/mL	< 6.25 μg/mL	< 6.25 μg/mL (< 4.37 μg/g)			
7945	99:4	A	< 92.85	106	99.4			
		A*	< 96.34	---	< 96.35			
7946		B	135	148	142			
		B*	< 92.85	---	< 92.85			
7947		C	107	84	96[5]			
		C*	< 95.6	---	< 95.6			
7948		D	102	< 114.2	108			
		D*	< 90.83	---	< 90.83			
2161	104:1	Whole	< 199.6	< 196.4	< 198.0[1]			

Table A-2. Tank 241-BY-108 Analytical Results: Antimony (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	< 270.4	< 271.0	< 270.7[1,3]	Cont'd	Cont'd	Cont'd
2163		B	< 271.8	< 300.0	< 285.9[1]			
2164		C	< 211.4	< 205.0	< 208.4[1]			
2165	104:3	A	< 64.7	< 64.1	< 64.4[1,3]			
2166		C	< 63.7	< 61.0	< 62.4[1]			
2167		D	< 92.9	< 105	< 99.0[1]			
2168	104:4	A	< 89.6	< 89.6	< 89.6			
2169		C	< 117	< 117	< 117			
2170		D	< 56.5	< 56.5	< 56.5			
2171	104:5	A	< 248.3	< 246.1	< 247.2			
2172		B	< 205.3	210.7	208.0			
2174		C	< 474.8	< 518.6	< 496.7			
2175		D	< 298.0	< 296.8	< 297.4			

Table A-3. Tank 241-BY-108 Analytical Results: Arsenic (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	282	222	252	< 116	N/A	< 151
		Whole*	167	256	212[5]			
7942	99:2	A	< 138.9	< 144.3	< 141.6			
7932		DL	30 µg/mL	32 µg/mL	31 µg/mL (22 µg/g)			
7943		D	83	73	78			
		D*	112	---	112			
7944	99:3	A	< 132.0	< 112.7	< 122.4			
		A*	< 120.5	---	< 120.5			
7935		DL	34 µg/mL	32 µg/mL	33 µg/mL (23 µg/g)			
7945	99:4	A	< 148.6	< 136.5	< 142.6			
		A*	< 154.1	---	< 154.1			
7946		B	220	214	217			
		B*	< 148.6	---	< 148.6			
7947		C	< 146.9	115	131			
		C*	< 153.0	---	< 153.0			
7948		D	< 161.9	< 182.6	< 172.3[6]			
		D*	< 145.3	---	< 145.3			
2161	104:1	Whole	< 49.90	< 49.10	< 49.50			

Table A-3. Tank 241-BY-108 Analytical Results: Arsenic (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	< 67.60	< 67.75	< 67.68[1]	Cont'd	Cont'd	Cont'd
2163		B	< 67.95	< 75.00	< 71.48[1]			
2164		C	< 52.85	< 51.25	< 52.05[1]			
2165	104:3	A	< 108	< 107	< 108			
2166		C	< 106	< 102	< 104			
2167		D	< 155	< 175	< 165			
2168	104:4	A	< 149	< 149	< 149			
2169		C	< 196	< 196	< 196			
2170		D	< 94.1	< 94.1	< 94.1			
2171	104:5	A	< 62.07	< 61.52	< 61.80			
2172		B	< 51.33	< 48.17	< 49.75			
2174		C	< 118.7	< 129.7	< 124.2			
2175		D	< 74.5	< 74.2	< 74.4			

Table A-4. Tank 241-BY-108 Analytical Results: Boron (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	383	363	373[6]	250	70.2	325
		Whole*	694	1,038	866[5,6]			
7942	99:2	A	598	149	374[5,6]			
7932		DL	43 µg/mL	40 µg/mL	42 µg/mL (29 µg/g)[6]			
7943		D	63	64	64[6]			
		D*	147	---	147[6]			
7944	99:3	A	1,088	415	752[5,6]			
		A*	635	---	635[6]			
7935		DL	44 µg/mL	45 µg/mL	45 µg/mL (31 µg/g)[6]			
7945	99:4	A	293	390	342[5,6]			
		A*	404	---	404			
7946		B	460	405	433[5,6]			
		B*	433	---	433			
7947		C	828	543	686[6]			
		C*	254	---	254			
7948		D	1,119	456	788[5,6]			
		D*	397	---	397			
2161	104:1	Whole	< 49.9	56.7	53.3[2,4]			

Table A-4. Tank 241-BY-108 Analytical Results: Boron (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	< 67.60	< 67.75	<67.68[2]	Cont'd	Cont'd	Cont'd
2163		B	<67.95	< 75.00	< 71.48[2]			
2164		C	< 52.85	< 51.25	< 52.05[2]			
2165	104:3	A	< 53.1	< 53.4	< 53.3[2]			
2166		C	< 53.1	< 50.8	< 52.0[2]			
2167		D	< 77.3	< 87.6	< 82.5[2]			
2168	104:4	A	< 74.7	< 74.7	< 74.7[2,4]			
2169		C	< 97.9	< 97.9	< 97.9[2]			
2170		D	< 47.0	< 47.0	< 47.0[2]			
2171	104:5	A	< 62.07	< 61.52	< 61.80[2]			
2172		B	163.3	163.4	163.4[2]			
2174		C	< 118.7	< 129.7	< 124.2[2]			
2175		D	< 74.5	< 74.2	< 74.4[2]			

Table A-5. Tank 241-BY-108 Analytical Results: Barium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
7941	99:1	Whole	24	< 19.49	22	124	38.4	161
		Whole*	15	23	19[5]			
7942	99:2	A	< 17.36	< 18.03	< 17.70			
7932		DL	< 1.25 μg/mL	< 1.25 μg/mL	< 1.25 μg/mL (< 0.874 μg/g)			
7943		D	< 5.949	< 6.129	< 6.039			
		D*	13	---	13			
7944	99:3	A	< 16.50	16	16			
		A*	17	---	17			
7935		DL	< 1.25 μg/mL	< 1.25 μg/mL	< 1.25 μg/mL (< 0.874 μg/g)			
7945	99:4	A	257	262	260			
		A*	285	---	285			
7946		B	619	445	532[5]			
		B*	556	---	556			
7947		C	87	90	89			
		C*	99	---	99			
7948		D	117	120	119			
		D*	115	---	115			
2161	104:1	Whole	< 49.90	< 49.10	< 49.50			

Table A-5. Tank 241-BY-108 Analytical Results: Barium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	257.1	409.7	333.4[5]	Cont'd	Cont'd	Cont'd
2163		B	340.3	329.5	334.9			
2164		C	143.9	130.8	137.3			
2165	104:3	A	75.10	80.40	77.75			
2166		C	258.0	265.0	261.5			
2167		D	110	< 87.6	98.8			
2168	104:4	A	< 74.7	< 74.7	< 74.7			
2169		C	< 97.9	< 97.9	< 97.9			
2170		D	< 47.0	< 47.0	< 47.0			
2171	104:5	A	< 62.07	< 61.52	< 61.80			
2172		B	406.2	404.9	405.5			
2174		C	599.5	598.1	598.8			
2175		D	249.0	263.3	256.1			

Table A-6. Tank 241-BY-108 Analytical Results: Beryllium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	< 9.950	< 9.747	< 9.848[1]	< 6.73	N/A	< 8.75
		Whole*	< 7.559	< 10.57	< 9.065			
7942	99:2	A	< 8.680	< 9.015	< 8.848[1]			
7932		DL	< 0.625 µg/mL	< 0.625 µg/mL	< 0.625 µg/mL (< 0.437 µg/g)			
7943		D	< 2.975	< 3.065	< 3.020[1]			
		D*	< 4.433	---	< 4.433			
7944	99:3	A	< 8.250	< 7.043	< 7.647[1]			
		A*	< 7.530	---	< 7.530			
7935		DL	< 0.625 µg/mL	< 0.625 µg/mL	< 0.625 µg/mL (< 0.437 µg/g)			
7945	99:4	A	< 9.285	< 8.533	< 8.909[1]			
		A*	< 9.634	---	< 9.634			
7946		B	< 9.980	< 10.08	< 10.03[1]			
		B*	< 9.285	---	< 9.285			
7947		C	< 9.183	< 6.920	< 8.052[1]			
		C*	< 9.560	---	< 9.560			
7948		D	< 10.12	< 11.42	< 10.77[1]			
		D*	< 9.083	---	< 9.083			
2161	104:1	Whole	< 4.990	< 4.910	< 4.950			

Table A-6. Tank 241-BY-108 Analytical Results: Beryllium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	< 6.760	< 6.775	< 6.768	Cont'd	Cont'd	Cont'd
2163		B	< 6.795	< 7.500	< 7.148			
2164		C	< 5.285	< 5.125	< 5.205			
2165	104:3	A	< 5.31	< 5.34	< 5.33			
2166		C	< 5.31	< 5.08	< 5.20			
2167		D	< 7.73	< 8.76	< 8.25			
2168	104:4	A	< 7.47	< 7.47	< 7.47			
2169		C	< 9.78	< 9.78	< 9.78			
2170		D	< 4.70	< 4.70	< 4.70			
2171	104:5	A	< 6.207	< 6.152	< 6.180			
2172		B	< 5.134	< 4.817	< 4.976			
2174		C	< 11.87	< 12.97	< 12.42			
2175		D	< 7.450	< 7.420	< 7.44			

Table A-7. Tank 241-BY-108 Analytical Results: Bismuth (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	318	< 194.9	256	< 495	N/A	< 644
		Whole*	< 151.2	< 211.4	< 181.3			
7942	99:2	A	< 173.6	< 180.3	< 177.0			
7932		DL	< 12.5 µg/mL	< 12.5 µg/mL	< 12.5 µg/mL (< 8.74 µg/g)			
7943		D	< 59.49	< 61.29	< 60.39			
		D*	< 88.65	---	< 88.65			
7944	99:3	A	< 165.0	< 140.9	< 153.0			
		A*	< 150.6	---	< 150.6			
7935		DL	< 12.5 µg/mL	< 12.5 µg/mL	< 12.5 µg/mL (< 8.74 µg/g)			
7945	99:4	A	1,279	1,369	1,324			
		A*	1,378	---	1,378			
7946		B	3,245	2,502	2,874[5,6]			
		B*	2,823	---	2,823			
7947		C	878	926	902			
		C*	933	---	933			
7948		D	1,123	1,174	1,149[6]			
		D*	1,075	---	1,075			
2161	104:1	Whole	< 99.80	< 98.20	< 99.00[1]			

Table A-7. Tank 241-BY-108 Analytical Results: Bismuth (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	< 135.2	< 135.5	< 135.4[1]	Cont'd	Cont'd	Cont'd
2163		B	< 135.9	< 150.0	< 143.0[1]			
2164		C	< 105.7	< 102.5	< 104.1[1]			
2165	104:3	A	< 108	< 107	< 108			
2166		C	< 106	< 102	< 104			
2167		D	< 155	< 175	< 165			
2168	104:4	A	< 149	< 149	< 149			
2169		C	< 196	< 196	< 196			
2170		D	< 94.1	< 94.1	< 94.1			
2171	104:5	A	< 124.1	< 123.0	< 123.6			
2172		B	765.6	764.7	765.2			
2174		C	2,170	1,800	1,980[3,5]			
2175		D	1,720	1,770	1,740			

Table A-8. Tank 241-BY-108 Analytical Results: Cadmium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	< 29.85	< 29.24	< 29.54	< 16.3	N/A	< 21.2
		Whole*	< 22.68	< 31.71	< 27.20			
7942	99:2	A	< 26.04	< 27.05	< 26.55			
7932		DL	< 1.875 µg/mL	< 1.875 µg/mL	< 1.875 µg/mL (< 1.311 µg/g)			
7943		D	< 8.924	< 9.194	< 9.059			
		D*	< 13.30	---	< 13.30			
7944	99:3	A	< 24.75	< 21.13	< 22.94			
		A*	< 22.59	---	< 22.59			
7935		DL	< 1.875 µg/mL	< 1.875 µg/mL	< 1.875 µg/mL (< 1.311 µg/g)			
7945	99:4	A	< 27.86	< 25.60	< 26.73			
		A*	< 28.90	---	< 28.90			
7946		B	57	76	67[5]			
		B*	< 27.86	---	< 27.86			
7947		C	< 27.55	< 20.76	< 24.16			
		C*	< 28.68	---	< 28.68			
7948		D	< 30.36	< 34.25	< 32.31			
		D*	< 27.25	---	< 27.25			
2161	104:1	Whole	< 9.980	< 9.820	< 9.900[1]			

Table A-8. Tank 241-BY-108 Analytical Results: Cadmium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	< 13.52	< 13.55	< 13.54[1]	Cont'd	Cont'd	Cont'd
2163		B	< 13.59	< 15.00	< 14.30[1]			
2164		C	< 10.57	< 10.25	< 10.41[1]			
2165	104:3	A	< 5.31	< 5.34	< 5.33			
2166		C	< 5.31	< 5.08	< 5.20			
2167		D	< 7.73	< 8.76	< 8.25			
2168	104:4	A	< 7.47	< 7.47	< 7.47			
2169		C	< 9.78	< 9.78	< 9.78			
2170		D	< 4.70	< 4.70	< 4.70			
2171	104:5	A	< 12.41	< 12.30	< 12.35			
2172		B	< 10.27	< 9.634	< 9.952			
2174		C	< 23.74	< 25.93	< 24.84			
2175		D	< 14.90	< 14.84	< 14.87			

Table A-9. Tank 241-BY-108 Analytical Results: Calcium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	739	437	588[5,6]	3,370	42.6	4,380
		Whole*	3,071	3,978	3,525[5,6]			
7942	99:2	A	1,925	2,164	2,045[5,6]			
7932		DL	< 6.25 µg/mL	< 6.25 µg/mL	< 6.25 µg/mL (< 4.37 µg/g)			
7943		D	855	888	872[6]			
		D*	1,759	---	1,759[6]			
7944	99:3	A	1,132	1,035	1,084[6]			
		A*	3,257	---	3,257[6]			
7935		DL	< 6.25 µg/mL	< 6.25 µg/mL	< 6.25 µg/mL (< 4.37 µg/g)			
7945	99:4	A	11,280	11,410	11,350			
		A*	16,030	---	16,030			
7946		B	11,870	8,471	10,170[5,6]			
		B*	15,460	---	15,460			
7947		C	15,620	15,520	15,570			
		C*	20,640	---	20,640			
7948		D	7,973	8,038	8,010[6]			
		D*	11,460	---	11,460			
2161	104:1	Whole	292.4	249.5	271.0[2,4,5]			

Table A-9. Tank 241-BY-108 Analytical Results: Calcium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	2,640	4,420	3,530[5]	Cont'd	Cont'd	Cont'd
2163		B	2,830	2,740	2,780			
2164		C	1,700	1,510	1,610[5]			
2165	104:3	A	1,040	1,120	1,080[2,4]			
2166		C	3,000	3,060	3,030[2]			
2167		D	1,730	1,470	1,600[2,5]			
2168	104:4	A	187.0	128.0	157.5[5]			
2169		C	384.0	378.0	381.0			
2170		D	99.60	97.10	98.35			
2171	104:5	A	450.5	415.0	432.8[4]			
2172		B	5,740	5,810	5,770			
2174		C	6,360	6,050	6,200[4]			
2175		D	16,400	17,400	16,900			

Table A-10. Tank 241-BY-108 Analytical Results: Cerium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
7941	99:1	Whole	< 199.0	< 194.9	< 197.0	< 123	N/A	< 160
		Whole*	< 151.2	< 211.4	< 181.3			
7942	99:2	A	< 173.6	< 180.3	< 177.0			
7932		DL	< 12.5 μg/mL	< 12.5 μg/mL	< 12.5 μg/mL (< 8.74 μg/g)			
7943		D	< 59.49	< 61.29	< 60.39			
		D*	< 88.65	---	< 88.65			
7944	99:3	A	< 165.0	< 140.9	< 153.0			
		A*	< 150.6	---	< 150.6			
7935		DL	< 12.5 μg/mL	< 12.5 μg/mL	< 12.5 μg/mL (< 8.74 μg/g)			
7945	99:4	A	< 185.7	214	200			
		A*	< 192.7	---	< 192.7			
7946		B	< 199.6	< 201.6	< 200.6			
		B*	< 185.7	---	< 185.7			
7947		C	202	188	195			
		C*	< 191.2	---	< 191.2			
7948		D	< 202.4	< 228.3	< 215.4			
		D*	< 181.7	---	< 181.7			
2161	104:1	Whole	< 99.80	< 98.20	< 99.00			

Table A-10. Tank 241-BY-108 Analytical Results: Cerium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	< 135.2	< 135.5	< 135.4	Cont'd	Cont'd	Cont'd
2163		B	< 135.9	< 150.0	< 143.0			
2164		C	< 105.7	< 102.5	< 104.1			
2165	104:3	A	< 108	< 107	< 108			
2166		C	< 106	< 102	< 104			
2167		D	< 155	< 175	< 165			
2168	104:4	A	< 149	< 149	< 149			
2169		C	< 196	< 196	< 196			
2170		D	< 94.1	< 94.1	< 94.1			
2171	104:5	A	< 124.15	< 123.04	< 124.0			
2172		B	445.5	446.3	445.9			
2174		C	< 237.4	< 259.3	< 248.5			
2175		D	< 149.0	< 148.4	< 148.7			

Table A-11. Tank 241-BY-108 Analytical Results: Chromium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	146	152	149	255	34.7	332
		Whole*	127	169	148[5,6]			
7942	99:2	A	72	122	97[5,6]			
7932		DL	280 µg/mL	277 µg/mL	279 µg/mL (195 µg/g)			
7943		D	177	173	175[6]			
		D*	176	---	176[6]			
7944	99:3	A	164	178	171[6]			
		A*	154	---	154[6]			
7935		DL	294 µg/mL	291 µg/mL	293 µg/mL (205 µg/g)			
7945	99:4	A	613	545	579[5]			
		A*	619	---	619[6]			
7946		B	567	398	483[5,6]			
		B*	479	---	479[6]			
7947		C	90	79	85[5]			
		C*	97	---	97[6]			
7948		D	103	119	111[6]			
		D*	109	---	109[6]			
2161	104:1	Whole	93.10	92.76	92.93			

Table A-11. Tank 241-BY-108 Analytical Results: Chromium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	114.5	165.6	140.1[5]	Cont'd	Cont'd	Cont'd
2163		B	129.6	123.2	126.4[5]			
2164		C	138.4	117.0	127.7			
2165	104:3	A	146.0	138.0	142.0[4]			
2166		C	162.0	163.0	162.5			
2167		D	238.0	271.0	254.5[5]			
2168	104:4	A	106.0	104.0	105.0			
2169		C	216.0	222.0	219.0			
2170		D	201.0	202.0	201.5			
2171	104:5	A	403.0	383.5	393.3			
2172		B	2,080	2,060	2,070			
2174		C	1,200	1,100	1,150			
2175		D	217.3	233.3	225.3			

Table A-12. Tank 241-BY-108 Analytical Results: Cobalt (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	58	45	52[5,6]	34.2	22.7	44.5
		Whole*	20	35	28[5]			
7942	99:2	A	44	42	43[5]			
7932		DL	9 µg/mL	9 µg/mL	9 µg/mL (6 µg/g)			
7943		D	27	31	29[5,6]			
		D*	19	---	19			
7944	99:3	A	63	50	57[5,6]			
		A*	22	---	22			
7935		DL	9 µg/mL	9 µg/mL	9 µg/mL (6 µg/g)			
7945	99:4	A	81	71	76[5,6]			
		A*	41	---	41			
7946		B	93	89	91[6]			
		B*	38	---	38			
7947		C	96	74	85[5,6]			
		C*	34	---	34			
7948		D	94	129	112[5,6]			
		D*	37	---	37			
2161	104:1	Whole	< 19.96	< 19.64	< 19.80			

Table A-12. Tank 241-BY-108 Analytical Results: Cobalt (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	< 27.04	< 27.10	< 27.07[1]	Cont'd	Cont'd	Cont'd
2163		B	< 27.18	< 30.00	< 28.59[1]			
2164		C	< 21.14	< 20.50	< 20.82[1]			
2165	104:3	A	< 21.6	< 21.4	< 21.5			
2166		C	< 21.2	< 20.3	< 20.8			
2167		D	< 30.9	< 35.0	< 33.0			
2168	104:4	A	< 29.9	< 29.9	< 29.9			
2169		C	< 39.1	< 39.1	< 39.1			
2170		D	< 18.8	< 18.8	< 18.8			
2171	104:5	A	29.44	31.53	30.48			
2172		B	27.44	< 19.27	23.40			
2174		C	< 47.48	< 51.86	< 49.67			
2175		D	< 29.80	< 29.70	< 29.74			

Table A-13. Tank 241-BY-108 Analytical Results: Copper (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	< 19.90	< 19.49	< 19.70[6]	< 45.9	N/A	< 59.7
		Whole*	90	43	67[5,6]			
7942	99:2	A	< 17.36	327	172[6]			
7932		DL	4 µg/mL	4 µg/mL	4 µg/mL (3 µg/g)			
7943		D	234	23	129[5,6]			
		D*	20	---	20[6]			
7944	99:3	A	100	75	88[5,6]			
		A*	32	---	32[6]			
7935		DL	10 µg/mL	10 µg/mL	10 µg/mL (7 µg/g)			
7945	99:4	A	128	< 17.07	72.6[6]			
		A*	36	---	36[6]			
7946		B	63	45	54[5,6]			
		B*	31	---	31[6]			
7947		C	435	269	352[5,6]			
		C*	66	---	66[6]			
7948		D	247	169	208[5,6]			
		D*	105	---	105[6]			
2161	104:1	Whole	< 9.98	< 9.82	< 9.90			

Table A-13. Tank 241-BY-108 Analytical Results: Copper (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	< 13.52	< 13.55	< 13.54	Cont'd	Cont'd	Cont'd
2163		B	< 13.59	< 15.00	< 14.30			
2164		C	< 10.57	< 10.25	< 10.41			
2165	104:3	A	< 10.8	< 10.7	< 10.8			
2166		C	< 10.6	< 10.2	< 10.4			
2167		D	< 15.5	< 17.5	< 16.5			
2168	104:4	A	< 14.9	< 14.9	< 14.9			
2169		C	< 19.6	< 19.6	< 19.6			
2170		D	< 9.41	< 9.41	< 9.41			
2171	104:5	A	< 12.41	< 12.30	< 12.4			
2172		B	21.57	22.93	22.25			
2174		C	< 23.74	< 25.93	< 24.84			
2175		D	18.35	20.30	19.32[5]			

Table A-14. Tank 241-BY-108 Analytical Results: Dysprosium.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
7941	99:1	Whole	< 99.50	< 97.47	< 98.48	< 69.4	N/A	< 90.2
		Whole*	< 75.59	< 105.7	< 90.65			
7942	99:2	A	< 86.81	< 90.17	< 88.49			
7932		DL	< 6.25 μg/mL	< 6.25 μg/mL	< 6.25 μg/mL (< 4.37 μg/g)			
7943		D	< 29.75	< 30.65	< 30.20			
		D*	< 44.33	---	< 44.33			
7944	99:3	A	< 82.51	< 70.43	< 76.47			
		A*	< 75.30	---	< 75.30			
7935		DL	< 6.25 μg/mL	< 6.25 μg/mL	< 6.25 μg/mL (< 4.37 μg/g)			
7945	99:4	A	< 92.85	< 85.33	< 89.08			
		A*	< 96.34	---	< 96.34			
7946		B	< 99.80	< 100.8	< 100.3			
		B*	< 92.85	---	< 92.85			
7947		C	< 91.83	< 69.21	< 80.52			
		C*	< 95.60	---	< 95.60			
7948		D	< 101.2	< 114.2	< 107.7			
		D*	< 90.83	---	< 90.83			

Table A-15. Tank 241-BY-108 Analytical Results: Europium.

Sample Number	Core: Segment	Sub-segment	Result µg/g	Duplicate µg/g	Mean µg/g	Overall Mean µg/g	RSD (mean) %	Projected Inventory kg
7941	99:1	Whole	< 199.0	< 194.9	< 197.0	< 139	N/A	< 181
		Whole*	< 151.2	< 211.4	< 181.3			
7942	99:2	A	< 173.6	< 180.3	< 177.0			
7932		DL	< 12.5 µg/mL	< 12.5 µg/mL	< 12.5 µg/mL (< 8.74 µg/g)			
7943		D	< 59.49	< 61.29	< 60.39			
		D*	< 88.65	---	< 119.6			
7944	99:3	A	< 165.0	< 140.9	< 153.0			
		A*	< 150.6	---	< 150.6			
7935		DL	< 12.5 µg/mL	< 12.5 µg/mL	< 12.5 µg/mL (< 8.74 µg/g)			
7945	99:4	A	< 185.7	< 170.7	< 178.2			
		A*	< 192.7	---	< 192.7			
7946		B	< 199.6	< 201.6	< 200.6			
		B*	< 185.7	---	< 185.7			
7947		C	< 183.7	< 138.4	< 161.1			
		C*	< 191.2	---	< 191.2			
7948		D	< 202.4	< 228.3	< 215.4			
		D*	< 181.7	---	< 181.7			

Table A-16. Tank 241-BY-108 Analytical Results: Iron (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
7941	99:1	Whole	1,488	971	1,230[5,6]	7,190	52.8	9,350
		Whole*	1,028	1,411	1,220[5,6]			
7942	99:2	A	5,112	2,510	3,811[5,6]			
7932		DL	118 μg/mL	117 μg/mL	118 μg/mL (82.5 μg/g)			
7943		D	710	1,145	928[5,6]			
		D*	544	---	544[6]			
7944	99:3	A	1,608	1,769	1,689[6]			
		A*	1,247	---	1,247[6]			
7935		DL	97 μg/mL	104 μg/mL	101 μg/mL (70.6 μg/g)			
7945	99:4	A	19,490	19,040	19,270			
		A*	20,150	---	20,150			
7946		B	29,050	21,330	25,190[5]			
		B*	27,210	---	27,210			
7947		C	32,260	35,090	33,680			
		C*	34,810	---	34,810			
7948		D	44,490	44,700	44,600			
		D*	41,980	---	41,980			
2161	104:1	Whole	1,000	1,210	1,105[4,5]			

Table A-16. Tank 241-BY-108 Analytical Results: Iron (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	3,140	5,110	4,125[5]	Cont'd	Cont'd	Cont'd
2163		B	3,200	3,150	3,175			
2164		C	2,210	2,000	2,110			
2165	104:3	A	1,330	1,440	1,380[4]			
2166		C	3,370	3,500	3,440			
2167		D	2,630	2,240	2,440[5]			
2168	104:4	A	332.0	297.0	314.5[5]			
2169		C	691.0	754.0	722.5			
2170		D	311.0	305.0	308.0			
2171	104:5	A	2,080	2,000	2,040[3]			
2172		B	17,800	17,700	17,700			
2174		C	30,700	26,500	28,600[5]			
2175		D	37,600	40,000	38,800			

Table A-17. Tank 241-BY-108 Analytical Results: Lanthanum (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	< 99.5	< 97.47	< 98.49	< 67.4	N/A	< 87.6
		Whole*	< 75.55	< 105.7	< 90.63			
7942	99:2	A	< 86.81	< 90.17	< 88.49			
7932		DL	< 6.25 µg/mL	< 6.25 µg/mL	< 6.25 µg/mL (< 4.37)			
7943		D	< 29.75	< 30.65	< 30.20			
		D*	< 44.33	---	< 44.33			
7944	99:3	A	< 82.51	< 70.40	< 76.5			
		A*	< 75.3	---	< 75.3			
7935		DL	< 6.25 µg/mL	< 6.25 µg/mL	< 6.25 µg/mL (< 4.37 µg/g)			
7945	99:4	A	< 92.85	< 85.30	< 89.08			
		A*	< 96.32	---	< 96.32			
7946		B	< 99.8	< 100.8	< 100.3			
		B*	< 92.85	---	< 92.85			
7947		C	< 91.8	< 69.2	< 80.5			
		C*	< 95.6	---	< 95.6			
7948		D	< 101.2	< 114.2	< 107.7			
		D*	< 90.83	---	< 90.83			
2161	104:1	Whole	< 49.90	< 49.10	< 49.5			

Table A-17. Tank 241-BY-108 Analytical Results: Lanthanum (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	< 67.60	< 67.75	< 67.68	Cont'd	Cont'd	Cont'd
2163		B	< 67.95	< 75.00	< 71.48			
2164		C	< 52.85	< 51.25	< 52.05			
2165	104:3	A	< 53.1	< 53.4	< 53.3			
2166		C	< 53.1	< 50.8	< 52.0			
2167		D	< 77.3	< 87.6	< 82.5			
2168	104:4	A	< 74.7	< 74.7	< 74.7			
2169		C	< 97.9	< 97.9	< 97.9			
2170		D	< 47.0	< 47.0	< 47.0			
2171	104:5	A	< 62.07	< 61.52	< 61.80			
2172		B	< 51.33	< 48.17	< 49.75			
2174		C	< 118.7	< 129.7	< 124.2			
2175		D	< 74.50	< 74.20	< 74.35			

Table A-18. Tank 241-BY-108 Analytical Results: Lead (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	351	256	304[5,6]	439	43.3	571
		Whole*	232	345	289[5,6]			
7942	99:2	A	159	144	152[6]			
7932		DL	91 µg/mL	91 µg/mL	91 µg/mL (64 µg/g)			
7943		D	106	94	100[5,6]			
		D*	177	---	177[6]			
7944	99:3	A	167	150	159[5,6]			
		A*	177	---	177[6]			
7935		DL	100 µg/mL	97 µg/mL	98.5 µg/mL (68.9 µg/g)			
7945	99:4	A	1,075	1,156	1,116[6]			
		A*	1,154	---	1,154[6]			
7946		B	1,141	902	1,022[5,6]			
		B*	995	---	995[6]			
7947		C	1,047	1,125	1,086[6]			
		C*	1,144	---	1,144[6]			
7948		D	1,544	1,628	1,586[6]			
		D*	2,856	---	2,856[6]			
2161	104:1	Whole	< 99.8	< 98.2	< 99.0[1,4]			

Table A-18. Tank 241-BY-108 Analytical Results: Lead (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	< 135.2	165.0	150.1[1,4]	Cont'd	Cont'd	Cont'd
2163		B	151.6	153.1	152.4[1]			
2164		C	125.9	< 102.5	114.2[1]			
2165	104:3	A	< 108	< 107	< 108[1,4]			
2166		C	164.0	153.0	158.5[1]			
2167		D	< 155	< 175	< 165[1]			
2168	104:4	A	< 149	< 149	< 149			
2169		C	< 196	< 196	< 196			
2170		D	127.0	128.0	127.5			
2171	104:5	A	191.8	210.2	201.0			
2172		B	1,310	1,320	1,320			
2174		C	1,860	1,730	1,790			
2175		D	2,750	2,900	2,830			

Table A-19. Tank 241-BY-108 Analytical Results: Magnesium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
7941	99:1	Whole	368	247	308[5]	447	31.7	581
		Whole*	186	313	250[5]			
7942	99:2	A	< 173.6	< 180.3	< 177.1			
7932		DL	< 12.5 μg/mL	< 12.5 μg/mL	< 12.5 μg/mL (< 8.74 μg/g)			
7943		D	75	< 61.29	68			
		D*	128	---	128			
7944	99:3	A	199	147	173[5]			
		A*	< 150.6	---	150.6			
7935		DL	< 12.5 μg/mL	< 12.5 μg/mL	< 12.5 μg/mL (< 8.74 μg/g)			
7945	99:4	A	1,293	1,143	1,218[5]			
		A*	1,480	---	1,480			
7946		B	1,511	1,199	1,355[5,6]			
		B*	1,459	---	1,459			
7947		C	1,141	1,188	1,165			
		C*	1,280	---	1,280			
7948		D	1,233	1,209	1,221[6]			
		D*	1,374	---	1,374			
2161	104:1	Whole	< 99.8	< 98.2	< 99.0[4]			

Table A-19. Tank 241-BY-108 Analytical Results: Magnesium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	665.9	1,110	887.9[5]	Cont'd	Cont'd	Cont'd
2163		B	690.5	675.7	683.1			
2164		C	461.0	399.3	430.1[5]			
2165	104:3	A	246.0	257.0	251.5[4]			
2166		C	754.0	788.0	771.0			
2167		D	394.0	278.0	336.0[5]			
2168	104:4	A	< 149	< 149	< 149			
2169		C	< 196	< 196	< 196			
2170		D	< 94.1	< 94.1	< 94.1			
2171	104:5	A	< 124.1	< 123.0	< 123.6			
2172		B	1,070	1,010	1,040			
2174		C	1,300	1,240	1,270			
2175		D	1,140	1,190	1,160			

Table A-20. Tank 241-BY-108 Analytical Results: Manganese (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	305	269	287[5,6]	209	61.5	272
		Whole*	24	29	27[5]			
7942	99:2	A	335	298	317[5,6]			
7932		DL	< 0.625 µg/mL	< 0.625 µg/mL	< 0.625 µg/mL (< 0.437 µg/g)			
7943		D	206	285	246[5,6]			
		D*	13	---	13			
7944	99:3	A	746	535	641[5,6]			
		A*	15	---	15			
7935		DL	< 0.625 µg/mL	< 0.625 µg/mL	< 0.625 µg/mL (< 0.437 µg/g)			
7945	99:4	A	1024	467	746[3,5,6]			
		A*	300	---	300			
7946		B	803	644	724[3,5,6]			
		B*	328	---	328			
7947		C	1069	966	1018[3,6]			
		C*	366	---	366			
7948		D	1234	1554	1394[3,5,6]			
		D*	498		498			
2161	104:1	Whole	13.90	14.62	14.26[1]			

Table A-20. Tank 241-BY-108 Analytical Results: Manganese (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
2162	104:2	A	70.61	113.9	92.26[1,5]	Cont'd	Cont'd	Cont'd
2163		B	66.50	65.56	66.03[1]			
2164		C	40.70	34.71	37.70[1,5]			
2165	104:3	A	21.10	22.40	21.75			
2166		C	72.40	74.90	73.65			
2167		D	40.70	34.10	37.40[5]			
2168	104:4	A	< 14.9	< 14.9	< 14.9			
2169		C	< 19.6	< 19.6	< 19.6			
2170		D	< 9.41	< 9.41	< 9.41			
2171	104:5	A	15.11	14.20	14.65			
2172		B	281.6	280.5	281.0			
2174		C	409.2	353.2	381.2[1,5]			
2175		D	374.9	400.5	387.7			

Table A-21. Tank 241-BY-108 Analytical Results: Molybdenum (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
7941	99:1	Whole	< 59.7	< 58.48	< 59.1	< 54.1	N/A	< 70.3
		Whole*	< 45.35	< 63.43	< 54.39			
7942	99:2	A	< 52.08	< 54.10	< 53.09			
7932		DL	14 μg/mL	14 μg/mL	14 μg/mL (9.8 μg/g)			
7943		D	< 17.85	< 18.39	< 18.12			
		D*	< 26.60	---	< 26.60			
7944	99:3	A	< 49.51	< 42.26	< 45.89			
		A*	< 45.18	---	< 45.18			
7935		DL	15 μg/mL	15 μg/mL	15 μg/mL (10 μg/g)			
7945	99:4	A	< 55.71	< 51.20	< 53.46			
		A*	< 57.80	---	< 57.8			
7946		B	< 59.88	< 60.48	< 60.18			
		B*	< 55.71	---	< 55.71			
7947		C	< 55.10	< 41.52	< 48.31			
		C*	< 57.36	---	< 57.36			
7948		D	< 60.73	< 68.49	< 64.61			
		D*	< 54.50	---	< 54.5			
2161	104:1	Whole	< 49.9	< 49.1	< 49.5			

Table A-21. Tank 241-BY-108 Analytical Results: Molybdenum (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
2162	104:2	A	< 67.60	< 67.75	< 67.68	Cont'd	Cont'd	Cont'd
2163		B	< 67.95	< 75.00	< 71.48			
2164		C	< 52.85	< 51.25	< 52.05			
2165	104:3	A	< 53.1	< 53.4	< 53.3			
2166		C	< 53.1	< 50.8	< 52.0			
2167		D	< 77.3	< 87.6	< 82.5			
2168	104:4	A	< 74.7	< 74.7	< 74.7			
2169		C	< 97.9	< 97.9	< 97.9			
2170		D	< 47.0	< 47.0	< 47.0			
2171	104:5	A	< 62.07	< 61.52	< 61.80			
2172		B	< 51.33	< 48.17	< 49.75			
2174		C	< 118.7	< 129.7	< 124.2			
2175		D	< 74.50	< 74.20	< 74.35			

Table A-22. Tank 241-BY-108 Analytical Results: Neodymium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	101	< 97.47	99.2[6]	< 119	N/A	< 155
		Whole*	125	232	179[5,6]			
7942	99:2	A	108	< 90.17	99.1[6]			
7932		DL	< 6.25 µg/mL	< 6.25 µg/mL	< 6.25 µg/mL (< 4.37 µg/g)			
7943		D	< 29.75	< 30.65	< 30.2			
		D*	108	---	108[6]			
7944	99:3	A	97	82	89.5[5,6]			
		A*	127	---	127[6]			
7935		DL	< 6.25 µg/mL	< 6.25 µg/mL	< 6.25 µg/mL (4.37 µg/g)			
7945	99:4	A	143	186	165[5,6]			
		A*	145	---	145[6]			
7946		B	154	176	165[5,6]			
		B*	161	---	161[6]			
7947		C	191	174	183[6]			
		C*	174	---	174[6]			
7948		D	171	200	186[5,6]			
		D*	199	---	199[6]			
2161	104:1	Whole	< 99.80	< 98.20	< 99.00			

Table A-22. Tank 241-BY-108 Analytical Results: Neodymium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	< 135.2	< 135.5	< 135.4	Cont'd	Cont'd	Cont'd
2163		B	< 135.9	< 150.0	< 143.0			
2164		C	< 105.7	< 102.5	< 104.1			
2165	104:3	A	< 108	< 107	< 108			
2166		C	< 106	< 102	< 104			
2167		D	< 155	< 175	< 165			
2168	104:4	A	< 149	< 149	< 149			
2169		C	< 196	< 196	< 196			
2170		D	< 94.1	< 94.1	< 94.1			
2171	104:5	A	< 124.1	< 123.0	< 123.6			
2172		B	< 102.7	< 96.34	< 99.52			
2174		C	< 237.4	< 259.3	< 248.4			
2175		D	< 149.0	< 148.4	< 148.7			

Table A-23. Tank 241-BY-108 Analytical Results: Nickel (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
1483	98:1	Whole	253.6	244.8	249.2[3]	2,510	41.8	3,260
1484	98:2	A	337.9	359.4	348.7			
1485		C	447.4	469.1	458.3			
1486		D	1,550	1,550	1,550[4]			
1487	98:3	A	1,280	1,350	1,310			
1488		C	1,090	927.3	1,010[5]			
1489		D	744.9	832.1	788.5[4,5]			
1490	98:4	A	14,900	14,800	14,800			
1491		B	9,920	9,790	9,850			
1492		C	5,650	5,670	5,660			
1493		D	3,600	3,610	3,600			
7941	99:1	Whole*	473	674	574[3,5,6]			
7932	99:2	DL	310 μg/mL	306 μg/mL	308 μg/mL (215 μg/g)			
7943		D	532	---	532			
7944	99:3	A	836	---	836			
7935		DL	238 μg/mL	243 μg/mL	241 μg/mL (169 μg/g)			

Table A-23. Tank 241-BY-108 Analytical Results: Nickel (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7945	99:4	A*	14,670	---	14,760	Cont'd	Cont'd	Cont'd
7946		B*	16,740	---	16,740			
7947		C*	6,710	---	6,710			
7948		D*	7,209	---	7,209			
2161	104:1	Whole	130.4	118.0	124.2[1]			
2162	104:2	A	287.1	390.0	338.6[1,5]			
2163		B	275.0	267.8	271.4[1]			
2164		C	432.5	385.6	409.0[1,5]			
2165	104:3	A	249.0	254.0	251.5[4]			
2166		C	291.0	297.0	294.0			
2167		D	1,080	1,120	1,100			
2168	104:4	A	760.0	809.0	784.5[4]			
2169		C	1,350	1,360	1,360			
2170		D	862.0	921.0	891.5			
2171	104:5	A	1,220	1,170	1,200[4]			
2172		B	12,200	12,100	12,200			
2174		C	12,700	12,900	12,800			
2175		D	7,810	8,340	8,080			

Table A-24. Tank 241-BY-108 Analytical Results: Palladium.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	< 597	< 584.8	< 590.9	< 413	N/A	< 537
		Whole*	< 453.5	< 634.3	< 543.9			
7942	99:2	A	< 520.8	< 541.0	< 530.9			
7932		DL	< 37.5 µg/mL	< 37.5 µg/mL	< 37.5 µg/mL (< 26.2 µg/g)			
7943		D	< 178.5	< 183.9	< 181.2			
		D*	< 266.0	---	< 266.0			
7944	99:3	A	< 422.6	< 422.6	< 422.6			
		A*	< 451.8	---	< 451.8			
7935		DL	< 37.5 µg/mL	< 37.5 µg/mL	< 37.5 µg/mL (< 26.2 µg/g)			
7945	99:4	A	< 557.1	< 512.0	< 534.6			
		A*	< 578.0	---	< 578			
7946		B	< 598.8	< 604.8	< 601.8			
		B*	< 557.1	---	< 557.1			
7947		C	< 551.0	< 415.2	< 483.1			
		C*	< 573.6	---	< 573.6			
7948		D	< 607.3	< 684.9	< 646.1			
		D*	< 545.0	---	< 545.0			

Table A-25. Tank 241-BY-108 Analytical Results: Phosphorus (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	23,900	29,550	26,730[5]	10,100	31.4	13,100
		Whole*	3,821	715	2,270[5]			
7942	99:2	A	709	828	769[5]			
7932		DL	467 µg/mL	462 µg/mL	465 µg/mL (325 µg/g)			
7943		D	2,505	2,230	2,368[5]			
		D*	233	---	233			
7944	99:3	A	5,405	7,079	6,242[5]			
		A*	490	---	490			
7935		DL	452 µg/mL	457 µg/mL	455 µg/mL (318 µg/g)			
7945	99:4	A	14,260	12,930	13,600			
		A*	625	---	625			
7946		B	20,100	28,140	24,120			
		B*	3,840	---	3,840			
7947		C	24,630	24,630	24,630			
		C*	1,605	---	1,605			
7948		D	26,870	27,830	27,350			
		D*	1,437	---	1,437			
2161	104:1	Whole	33,000	32,500	32,800			

Table A-25. Tank 241-BY-108 Analytical Results: Phosphorus (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
2162	104:2	A	2,340	4,140	3,240[5]	Cont'd	Cont'd	Cont'd
2163		B	6,400	4,650	5,520[5]			
2164		C	2,050	3,450	2,750[5]			
2165	104:3	A	5,210	4,390	4,800[4,5]			
2166		C	3,110	2,370	2,740[5]			
2167		D	4,710	3,510	4,110[5]			
2168	104:4	A	2,600	11,000	6,800[4,5]			
2169		C	6,320	4,030	5,180[5]			
2170		D	1,290	1,320	1,300			
2171	104:5	A	5,430	5,140	5,290			
2172		B	14,200	13,700	13,900			
2174		C	12,900	15,800	14,400[4,5]			
2175		D	19,500	20,700	20,100			

Table A-26. Tank 241-BY-108 Analytical Results: Potassium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole*	4,498	8,232	6,365[5]	2,650	54.2	3,450
7932	99:2	DL	2,656 µg/mL	2,614 µg/mL	2,635 µg/mL (1,842 µg/g)			
7943		D	4,416	---	4,416			
7944	99:3	A*	3,879	---	3,879			
7935		DL	2,780 µg/mL	2,811 µg/mL	2,800 µg/mL (1958 µg/g)			
7945	99:4	A*	4,826	---	4,826			
7946		B*	4,904	---	4,904			
7947		C*	4,549	---	4,549			
7948		D*	4,777	---	4,777			
2161	104:1	Whole	389.0	< 294.6	341.8			
2162	104:2	A	570.5	847.6	709.1[5]			
2163		B	1,260	1,020	1,140[5]			
2164		C	1,270	1,270	1,270			
2165	104:3	A	1,410	1,430	1,420[4]			
2166		C	1,270	1,170	1,220			
2167		D	1,030	1,170	1,100[5]			
2168	104:4	A	904.0	807.0	855.5[4,5]			
2169		C	1,800	2,010	1,905[5]			
2170		D	2,120	2,040	6,365			

Table A-26. Tank 241-BY-108 Analytical Results: Potassium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2171	104:5	A	1,530	1,390	1,460[4]	Cont'd	Cont'd	Cont'd
2172		B	1,550	1,460	1,510			
2174		C	1,940	2,130	2,040			
2175		D	1,890	2,110	2,000[5]			

Table A-27. Tank 241-BY-108 Analytical Results: Rhodium.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	< 597	< 584.8	< 590.9	< 417	N/A	< 542
		Whole*	< 453.5	< 634.3	< 543.9			
7942	99:2	A	< 520.8	< 541.1	< 531.0			
7932		DL	< 37.5 µg/mL	< 37.5 µg/mL	< 37.5 µg/mL (< 26.2 µg/g)			
7943		D	< 178.5	< 183.9	< 181.2			
		D*	< 266.0	---	< 266			
7944	99:3	A	< 495.1	< 422.6	< 458.9			
		A*	< 451.8	---	< 451.8			
7935		DL	< 37.5 µg/mL	< 37.5 µg/gmL	< 37.5 µg/mL (< 26.2 µg/g)			
7945	99:4	A	< 557.1	< 512.0	< 534.6			
		A*	< 578.0	---	< 578			
7946		B	< 598.8	< 604.8	< 601.8			
		B*	< 557.1	---	< 557.1			
7947		C	< 551.0	< 415.2	< 483.1			
		C*	< 573.6	---	< 573.6			
7948		D	< 607.3	< 684.9	< 646.1			
		D*	< 545.0	---	< 545.0			

Table A-28. Tank 241-BY-108 Analytical Results: Samarium.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
2161	104:1	Whole	< 99.80	< 98.20	< 99.00	< 131	N/A	< 170
2162	104:2	A	< 135.2	< 135.5	< 135.4			
2163		B	< 135.9	< 150.0	< 143.0			
2164		C	< 105.7	< 102.5	< 104.1			
2165	104:3	A	< 108	< 107	< 108			
2166		C	< 106	< 102	< 104			
2167		D	< 155	< 175	< 165			
2168	104:4	A	< 149	< 149	< 149			
2169		C	< 196	< 196	< 196			
2170		D	< 94.1	< 94.1	< 94.1			
2171	104:5	A	< 124.1	< 123.0	< 123.6			
2172		B	< 102.7	< 96.34	< 99.52			
2174		C	< 237.4	< 259.3	< 248.4			
2175		D	< 149.0	< 148.4	< 148.7			

Table A-29. Tank 241-BY-108 Analytical Results: Selenium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	< 199.0	< 194.9	< 197.0	< 135	N/A	< 176
		Whole*	< 151.2	< 211.4	< 181.3			
7942	99:2	A	< 173.6	< 180.3	< 177.0			
7932		DL	< 12.5 µg/mL	< 12.5 µg/mL	< 12.5 µg/mL (< 8.74 µg/g)			
7943		D	< 59.49	< 61.29	< 60.39			
		D*	< 88.65	---	< 88.65			
7944	99:3	A	< 165.0	< 140.9	< 153.0			
		A*	< 150.6	---	< 150.6			
7935		DL	< 12.5 µg/mL	< 12.5 µg/mL	< 12.5 µg/mL (< 8.74 µg/g)			
7945	99:4	A	< 185.7	< 170.7	< 178.2			
		A*	< 192.7	---	< 192.7			
7946		B	< 199.6	< 201.6	< 200.6			
		B*	< 185.7	---	< 185.7			
7947		C	< 183.7	< 152	< 168			
		C*	< 191.2	---	< 191.2			
7948		D	< 202.4	< 228.3	< 215.4			
		D*	< 181.7	---	< 181.7			
2161	104:1	Whole	< 99.80	< 98.20	< 99.00			

Table A-29. Tank 241-BY-108 Analytical Results: Selenium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
2162	104:2	A	< 135.2	< 135.5	< 135.4	Cont'd	Cont'd	Cont'd
2163		B	< 135.9	< 150.0	< 143.0			
2164		C	< 105.7	< 102.5	< 104.1			
2165	104:3	A	< 108	< 107	< 108			
2166		C	< 106	< 102	< 104			
2167		D	< 155	< 175	< 165			
2168	104:4	A	< 149	< 149	< 149			
2169		C	< 196	< 196	< 196			
2170		D	< 94.1	< 94.1	< 94.1			
2171	104:5	A	< 124.1	< 123.0	< 123.6			
2172		B	< 102.7	< 96.34	< 99.52			
2174		C	< 237.4	< 259.3	< 248.4			
2175		D	< 149.0	< 148.4	< 148.7			

Table A-30. Tank 241-BY-108 Analytical Results: Silicon (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	6,917	4,939	5,928[5,6]	1,530	51.4	1,990
		Whole*	2,650	4,150	3,400[5]			
7942	99:2	A	< 868.1	1,072	970.1			
7932		DL	< 62.50 µg/mL	< 62.50 µg/mL	< 62.50 µg/mL (< 43.71 µg/g)			
7943		D	1,183	1,150	1,167[6]			
		D*	1,127	---	1,127			
7944	99:3	A	1,935	1,582	1,759[5]			
		A*	1,086	---	1,086			
7935		DL	108 µg/mL	119 µg/mL	114 µg/mL (< 79.7 µg/g)[6]			
7945	99:4	A	2,929	4,696	3,813[5]			
		A*	2,720	---	2,720			
7946		B	4,194	4,532	4,363			
		B*	2,287	---	2,287			
7947		C	2,175	2,045	2,110			
		C*	1,554	---	1,554			
7948		D	2,567	2,746	2,657			
		D*	1,784	---	1,784			
2161	104:1	Whole	200.4	378.8	289.6[1,5]			

Table A-30. Tank 241-BY-108 Analytical Results: Silicon (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	315.8	282.2	299.0[1,5]	Cont'd	Cont'd	Cont'd
2163		B	268.0	279.3	273.6[1]			
2164		C	220.9	245.2	233.1[1,5]			
2165	104:3	A	241.0	322.0	281.5[1,5]			
2166		C	263.0	254.0	258.5[1]			
2167		D	431.0	527.0	479.0[1,5]			
2168	104:4	A	201.0	302.0	251.5[2,4,5]			
2169		C	411.0	420.0	415.5[2]			
2170		D	372.0	476.0	424.0[2,5]			
2171	104:5	A	2,010	1,950	1,980[2]			
2172		B	3,460	3,340	3,400[2]			
2174		C	2,520	2,550	2,540[2,4]			
2175		D	1,860	1,970	1,910[2]			

Table A-31. Tank 241-BY-108 Analytical Results: Silver (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	< 29.85	< 29.24	< 29.55[2]	< 49.9	N/A	< 64.9
		Whole*	< 22.68	< 31.71	< 27.20			
7942	99:2	A	< 26.04	< 27.05	< 26.55[2]			
7932		DL	< 1.875 µg/mL	< 1.875 µg/mL	< 1.875 µg/mL (< 1.311 µg/g)			
7943		D	< 8.924	< 9.194	< 9.059[2]			
		D*	< 13.30	---	< 13.30			
7944	99:3	A	< 24.75	< 21.13	< 22.94[2]			
		A*	< 22.59	---	< 22.59			
7935		DL	< 1.875 µg/mL	< 1.875 µg/mL	< 1.875 µg/mL (< 1.311 µg/g)			
7945	99:4	A	32	33	33[2]			
		A*	< 28.90	---	< 28.90			
7946		B	< 29.94	32	31[2]			
		B*	< 27.86	---	< 27.86			
7947		C	39	31	35[2,5]			
		C*	< 28.68	---	< 28.68			
7948		D	33	38	36[2,5,6]			
		D*	< 27.25	---	< 27.25			
2161	104:1	Whole	< 9.980	< 9.820	< 9.900[1]			

Table A-31. Tank 241-BY-108 Analytical Results: Silver (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	< 13.52	< 13.55	< 13.54[1]	Cont'd	Cont'd	Cont'd
2163		B	< 13.59	< 15.00	< 14.30[1]			
2164		C	< 10.57	< 10.25	< 10.41[1]			
2165	104:3	A	< 10.8	< 10.7	< 10.8			
2166		C	< 10.6	< 10.2	< 10.4			
2167		D	< 15.5	< 17.5	< 16.5			
2168	104:4	A	< 14.9	< 14.9	< 14.9			
2169		C	< 19.6	< 19.6	< 19.6			
2170		D	< 9.41	< 9.41	< 9.41			
2171	104:5	A	< 12.41	< 12.30	< 12.36			
2172		B	< 10.27	< 9.634	< 9.952			
2174		C	< 23.74	< 25.93	< 24.84			
2175		D	< 14.90	< 14.84	< 14.87			

Table A-32. Tank 241-BY-108 Analytical Results: Sodium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	95,300	95,730	95,520[1]	1.63E+05	14.2	2.12E+05
		Whole*	N/A	N/A	N/A			
7942	99:2	A	2.017E+05	2.016E+05	2.017E+05[1]			
7932		DL	2.016E+05 µg/mL[1]	1.880E+05 µg/mL[1]	1.948E+05µg/mL (1.362E+05 µg/g)			
7943		D	1.399E+05	1.470E+05	1.435E+05[1]			
		D*	N/A	N/A	N/A			
7944	99:3	A	1.695E+05	1.820E+05	1.758E+05[1]			
		A*	N/A	N/A	N/A			
7935		DL	1.853E+05 µg/mL[1]	1.950E+05 µg/mL[1]	1.902E+05µg/mL (1.330E+05 µg/g)			
7945	99:4	A	1.355E+05	1.210E+05	1.283E+05[1,5]			
		A*	N/A	N/A	N/A			
7946		B	1.034E+05	1.149E+05	1.092E+05[1]			
		B*	N/A	N/A	N/A			
7947		C	1.118E+05	1.149E+05	1.134E+05[1]			
		C*	N/A	N/A	N/A			
7948		D	1.176E+05	1.172E+05	1.174E+05[1]			
		D*	N/A	N/A	N/A			
2161	104:1	Whole	2.19E+05	2.23E+05	2.21E+05[2]			

Table A-32. Tank 241-BY-108 Analytical Results: Sodium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	2.17E+05	1.87E+05	2.02E+05[2,3]	Cont'd	Cont'd	Cont'd
2163		B	1.91E+05	1.94E+05	1.93E+05[2]			
2164		C	1.83E+05	1.88E+05	1.85E+05[2]			
2165	104:3	A	1.81E+05	1.83E+05	1.82E+05[2,4]			
2166		C	1.63E+05	1.58E+05	1.60E+05[2]			
2167		D	1.89E+05	1.91E+05	1.90E+05[2]			
2168	104:4	A	2.24E+05	2.21E+05	2.22E+05[2,4]			
2169		C	1.94E+05	1.85E+05	1.90E+05[2]			
2170		D	1.79E+05	1.81E+05	1.80E+05[2]			
2171	104:5	A	1.87E+05	1.82E+05	1.84E+05[2]			
2172		B	1.32E+05	1.30E+05	1.31E+05[2]			
2174		C	1.25E+05	1.31E+05	1.28E+05[2]			
2175		D	1.39E+05	1.47E+05	1.43E+05[2]			

Note:

[1]The dilution results were used instead of the original sample results for the drainable liquid, because the sodium concentration in the original samples was greater than the measurable range of the analytical instrument.

Table A-33. Tank 241-BY-108 Analytical Results: Strontium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	27	22	25[5]	3,190	66.2	4,150
		Whole*	58	70	64[5,6]			
7942	99:2	A	< 8.681	< 9.017	< 8.849			
7932		DL	< 0.625 µg/mL	< 0.625 µg/mL	< 0.625 µg/mL (< 0.437 µg/g)			
7943		D	15	13	14[5]			
		D*	35	---	35[6]			
7944	99:3	A	162	201	182[5]			
		A*	310	---	310[6]			
7935		DL	2 µg/mL	5 µg/mL	4 µg/mL (3 µg/g)[5]			
7945	99:4	A	12,490	12,750	12,620			
		A*	13,890	---	13,890			
7946		B	27,380	18,730	23,055[5]			
		B*	25,030	---	25,030			
7947		C	1,084	1,097	1,091			
		C*	1,260	---	1,260			
7948		D	1,452	1,471	1,462			
		D*	1,468	---	1,468			
2161	104:1	Whole	32.90	36.42	34.66[5]			

Table A-33. Tank 241-BY-108 Analytical Results: Strontium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	101.9	163.5	132.7[5]	Cont'd	Cont'd	Cont'd
2163		B	104.1	102.1	103.1[5]			
2164		C	147.9	130.1	139.0			
2165	104:3	A	30.00	34.20	32.10[5]			
2166		C	117.0	120.0	118.5			
2167		D	554.0	625.0	589.5[5]			
2168	104:4	A	41.70	33.80	37.75[5]			
2169		C	130.0	134.0	132.0			
2170		D	12.40	13.20	12.80			
2171	104:5	A	634.4	611.0	622.7			
2172		B	25,600	25,500	25,600			
2174		C	39,400	40,000	39,700			
2175		D	9,540	10,100	9,820			

Table A-34. Tank 241-BY-108 Analytical Results: Sulfur.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2161	104:1	Whole	1,190	949.3	1,070[1,5]	6,960	30.2	9,050
2162	104:2	A	3,520	3,290	3,410[1]			
2163		B	5,850	5,630	5,740[1]			
2164		C	5,160	4,820	4,990[1]			
2165	104:3	A	3,190	3,320	3,260[1,4]			
2166		C	2,680	2,760	2,720[1]			
2167		D	7,100	8,860	7,980[1,5]			
2168	104:4	A	4,420	3,890	4,160[4,5]			
2169		C	16,500	16,100	16,300			
2170		D	24,200	26,400	25,300			
2171	104:5	A	29,200	27,700	28,400			
2172		B	5,170	5,060	5,110			
2174		C	1,700	2,090	1,900[5]			
2175		D	907.2	946.9	927.0			

Table A-35. Tank 241-BY-108 Analytical Results: Tellurium.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
7941	99:1	Whole	< 995.0	< 974.7	< 984.9	< 694	N/A	< 902
		Whole*	< 755.9	< 1,057	< 906.5			
7942	99:2	A	< 868.1	< 901.7	< 884.9			
7932		DL	< 62.5 μg/mL	< 62.5 μg/mL	< 62.5 μg/mL (< 43.7 μg/g)			
7943		D	< 297.5	< 306.5	< 302.0			
		D*	< 443.3	---	< 443.3			
7944	99:3	A	< 825.1	< 704.3	< 764.7			
		A*	< 753.0	---	< 753.0			
7935		DL	< 62.5 μg/mL	< 62.5 μg/mL	< 62.5 μg/mL (< 43.7 μg/g)			
7945	99:4	A	< 928.5	< 853.3	< 890.9			
		A*	< 963.4	---	< 963.4			
7946		B	< 998.0	< 1,008	< 1,003			
		B*	< 928.5	---	< 928.5			
7947		C	< 918.3	< 692.1	< 805.2			
		C*	< 956.0	---	< 956.0			
7948		D	< 1,012	< 1,142	< 1,077			
		D*	< 908.3	---	< 908.3			

Table A-36. Tank 241-BY-108 Analytical Results: Thallium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	< 995.0	< 974.7	< 984.9	< 479	N/A	< 623
		Whole*	< 755.9	< 1,057	< 906.5			
7942	99:2	A	< 868.1	< 901.7	< 884.9			
7932		DL	76 µg/mL	75 µg/mL	76 µg/mL (53 µg/g)			
7943		D	< 297.5	< 306.5	< 302.0			
		D*	< 443.3	---	< 443.3			
7944	99:3	A	< 825.1	< 704.3	< 764.7			
		A*	< 753.0	---	< 753.0			
7935		DL	77 µg/mL	77 µg/mL	77 µg/mL (54 µg/g)			
7945	99:4	A	< 928.5	< 853.3	< 890.9			
		A*	< 963.4	---	< 963.4			
7946		B	< 998.0	< 1,008	< 1,003			
		B*	< 928.5	---	< 928.5			
7947		C	< 918.3	< 692.1	< 805.2			
		C*	< 956.0	---	< 956.0			
7948		D	< 1,012	< 1,142	< 1,077			
		D*	< 908.3	---	< 908.3			
2161	104:1	Whole	< 199.6	< 196.4	< 198.0			

Table A-36. Tank 241-BY-108 Analytical Results: Thallium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	< 270.4	< 271.0	< 271.7[1]	Cont'd	Cont'd	Cont'd
2163		B	< 271.8	< 300.0	< 285.9[1]			
2164		C	< 211.4	< 205.0	< 208.2[1]			
2165	104:3	A	< 216	< 214	< 215			
2166		C	< 212	< 203	< 208			
2167		D	< 309	< 350	< 330			
2168	104:4	A	< 299	< 299	< 299			
2169		C	< 391	< 391	< 391			
2170		D	< 188	< 188	< 188			
2171	104:5	A	< 248.3	< 246.1	< 247.2			
2172		B	< 205.3	< 192.7	< 199.0			
2174		C	< 474.8	< 518.6	< 497.4			
2175		D	< 298.0	< 296.8	< 297.4			

Table A-37. Tank 241-BY-108 Analytical Results: Thorium.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
7941	99:1	Whole	< 1,592	< 1,559	< 1,576	< 1,110	N/A	< 1,440
		Whole*	< 1,209	< 1,691	< 1,450			
7942	99:2	A	< 1,389	< 1,443	< 1,416			
7932		DL	< 100 μg/mL	< 100 μg/mL	< 100 μg/mL (< 69.9 μg/g)			
7943		D	< 475.9	< 490.3	< 483.1			
		D*	< 709.2	---	< 709.2			
7944	99:3	A	< 1,320	< 1,127	< 1,224			
		A*	< 1,205	---	< 1,205			
7935		DL	< 100 μg/mL	< 100 μg/mL	< 100 μg/mL (< 69.9 μg/g)			
7945	99:4	A	< 1,486	< 1,365	< 1,426			
		A*	< 1,541	---	< 1,541			
7946		B	< 1,597	< 1,613	< 1,605			
		B*	< 1,486	---	< 1,486			
7947		C	< 1,469	< 1,107	< 1,288			
		C*	< 1,530	---	< 1,530			
7948		D	< 1,619	< 1,826	< 1,723			
		D*	< 1,453	---	< 1,453			

Table A-38. Tank 241-BY-108 Analytical Results: Tin.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	< 1,990	< 1,949	< 1,970	< 1,390	N/A	< 1,810
		Whole*	< 1,512	< 2,114	< 1,813			
7942	99:2	A	< 1,736	< 1,803	< 1,770			
7932		DL	< 125 µg/mL	< 125 µg/mL	< 125 µg/mL (< 87.4 µg/g)			
7943		D	< 594.9	< 612.9	< 603.9			
		D*	< 886.5	---	< 886.5			
7944	99:3	A	< 1,650	< 1,409	< 1,530			
		A*	< 1,506	---	< 1,506			
7935		DL	< 125 µg/mL	< 125 µg/mL	< 125 µg/mL (< 87.4 µg/g)			
7945	99:4	A	< 1,857	< 1,707	< 1,782			
		A*	< 1,927	---	< 1,927			
7946		B	< 1,996	< 2,016	< 2,006			
		B*	< 1,857	---	< 1,857			
7947		C	< 1,837	< 1,384	< 1,611			
		C*	< 1,912	---	< 1,912			
7948		D	< 2,024	< 2,283	< 2,154			
		D*	< 1,817	---	< 1,817			

Table A-39. Tank 241-BY-108 Analytical Results: Titanium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	358	181	270[5,6]	74.9	29.8	97.4
		Whole*	45	70	58[5,6]			
7942	99:2	A	22	26	24[5,6]			
7932		DL	< 0.625 µg/mL	< 0.625 µg/mL	< 0.625 µg/mL (< 0.437 µg/g)			
7943		D	23	22	23[6]			
		D*	22	---	22[6]			
7944	99:3	A	38	28	33[5,6]			
		A*	20	---	20[6]			
7935		DL	< 0.625 µg/mL	< 0.625 µg/mL	< 0.625 µg/mL (< 0.437 µg/g)			
7945	99:4	A	64	56	60[5,6]			
		A*	41	---	41[6]			
7946		B	478	412	445[5,6]			
		B*	46	---	46[6]			
7947		C	58	56	57[6]			
		C*	34	---	34[6]			
7948		D	76	83	80[6]			
		D*	40	---	40[6]			
2161	104:1	Whole	10.82	11.39	11.11			

Table A-39. Tank 241-BY-108 Analytical Results: Titanium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	178.8	282.3	230.5[5]	Cont'd	Cont'd	Cont'd
2163		B	198.0	193.8	195.9			
2164		C	121.0	109.2	115.1[5]			
2165	104:3	A	62.70	67.40	65.05			
2166		C	195.0	201.0	198.0			
2167		D	78.80	56.90	67.85[5]			
2168	104:4	A	< 14.9	< 14.9	< 14.9			
2169		C	< 19.6	< 19.6	< 19.6			
2170		D	< 9.41	< 9.41	< 9.41			
2171	104:5	A	< 12.41	< 12.30	< 12.36			
2172		B	35.36	32.94	34.15			
2174		C	48.26	44.23	46.24			
2175		D	46.14	48.60	47.37			

Table A-40. Tank 241-BY-108 Analytical Results: Tungsten.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
7941	99:1	Whole	< 995.0	< 974.7	< 984.9	< 744	N/A	< 967
		Whole*	< 755.9	< 1,057	< 906.5			
7942	99:2	A	< 868.1	< 901.7	< 884.9			
7932		DL	63 μg/mL	< 62.5 μg/mL	63 μg/mL (44 μg/g)			
7943		D	< 297.5	< 306.5	< 302.0			
		D*	< 443.3	---	< 443.3			
7944	99:3	A	< 825.1	< 704.3	< 764.7			
		A*	< 753.0	---	< 753.0			
7935		DL	776 μg/mL	772 μg/mL	774 μg/mL (541 μg/g)			
7945	99:4	A	< 928.5	< 853.3	< 890.9			
		A*	< 963.4	---	< 963.4			
7946		B	< 998.0	< 1,008	< 1,003			
		B*	< 928.5	---	< 928.5			
7947		C	< 918.3	< 692.1	< 805.2			
		C*	< 956.0	---	< 956.0			
7948		D	< 1,012	< 1,142	< 1,077			
		D*	< 908.3	---	< 908.3			

Table A-41. Tank 241-BY-108 Analytical Results: Uranium (3 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	< 3,980	< 3,899	< 3,940[1]	9,470	60.0	12,300
		Whole[1]	101	102	102			
		Whole*	< 3,023	< 4,228	< 3,626			
7942	99:2	A	< 3,472	< 3,607	< 3,540[1]			
		A[1]	22.0	30.5	26.3			
7932		DL	< 250 µg/mL	< 250 µg/mL	< 250 µg/mL (< 175 µg/g)			
7943		D	< 1,190	< 1,226	< 1,208[1]			
		D[1]	126	124	125			
		D*	< 1,773	---	< 1,773			
7944	99:3	A	< 3,300	< 2,817	< 3,059[1]			
		A[1]	501	535	518			
		A*	< 3,012	---	< 3,012			
7935		DL	< 250 µg/mL	< 250 µg/mL	< 250 µg/mL (< 175 µg/g)			
7945	99:4	A	30,960	31,600	31,280[1]			
		A[1]	32,300	31,900	32,100			
		A*	33,220	---	33,220			
7946		B	61,810	46,560	54,190[1,5]			
		B[1]	54,900	48,600	51,800			
		B*	54,720	---	54,720			

Table A-41. Tank 241-BY-108 Analytical Results: Uranium (3 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7947	99:4 Cont'd	C	40,880	44,370	42,630[1]	Cont'd	Cont'd	Cont'd
		C[1]	46,700	48,200	47,500			
		C*	46,940	---	46,940			
7948		D	51,490	51,630	51,560			
		D[1]	45,800	50,400	48,100			
		D*	50,670	---	50,670			
2161	104:1	Whole	< 399.2	< 392.8	< 396.0			
2162	104:2	A	< 540.8	< 542.0	< 541.4			
2163		B	< 543.6	< 600.0	< 571.8			
2164		C	< 422.8	< 410.0	< 416.4			
2165	104:3	A	< 531	< 534	< 533			
2166		C	< 531	< 508	< 520			
2167		D	1,180	1,340	1,260[5]			
2168	104:4	A	< 747	< 747	< 747			
2169		C	< 978	< 978	< 978			
2170		D	< 470	< 470	< 470			

Table A-41. Tank 241-BY-108 Analytical Results: Uranium (3 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2171	104:5	A	1,600	1,540	1,570	Cont'd	Cont'd	Cont'd
2172		B	15,400	15,400	15,400			
2174		C	47,400	49,800	48,600			
2175		D	50,300	53,300	51,800			

Note:

[1]Results from the laser fluorimetry analysis.

Table A-42. Tank 241-BY-108 Analytical Results: Vanadium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
7941	99:1	Whole	57	48	53[5]	< 47.3	N/A	< 61.5
		Whole*	57	55	56			
7942	99:2	A	< 17.36	< 18.03	< 17.70			
7932		DL	< 1.25 μg/mL	< 1.25 μg/mL	< 1.25 μg/mL (< 0.874 μg/g)			
7943		D	7	< 6.129	7			
		D*	15	---	15			
7944	99:3	A	22	22	22[6]			
		A*	19	---	19			
7935		DL	< 1.25 μg/mL	< 1.25 μg/mL	< 1.25 μg/mL (< 0.874 μg/g)			
7945	99:4	A	23	27	25[5]			
		A*	< 19.27	---	< 19.27			
7946		B	28	29	29[6]			
		B*	20	---	20			
7947		C	28	25	27[5]			
		C*	< 19.12	---	< 19.12			
7948		D	26	32	29[5,6]			
		D*	21	---	21			
2161	104:1	Whole	69.40	67.92	68.66[1]			

Table A-42. Tank 241-BY-108 Analytical Results: Vanadium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	< 67.60	< 67.75	< 67.68	Cont'd	Cont'd	Cont'd
2163		B	< 67.95	< 75.00	< 71.48			
2164		C	< 52.85	< 51.25	< 52.05			
2165	104:3	A	< 53.1	< 53.4	< 53.3			
2166		C	< 53.1	< 50.8	< 52.0			
2167		D	< 77.3	< 87.6	< 82.5			
2168	104:4	A	< 74.7	< 74.7	< 74.7			
2169		C	< 97.9	< 97.9	< 97.9			
2170		D	< 47.0	< 47.0	< 47.0			
2171	104:5	A	< 62.07	< 61.52	< 61.80			
2172		B	< 51.33	< 48.17	< 49.75			
2174		C	< 118.7	< 129.7	< 124.2			
2175		D	< 74.50	< 74.20	< 74.35			

Table A-43. Tank 241-BY-108 Analytical Results: Yttrium.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	< 19.90	< 19.49	< 19.70	< 14.4	N/A	< 18.7
		Whole*	< 15.12	< 21.14	< 18.13			
7942	99:2	A	< 17.36	< 18.03	< 17.70			
7932		DL	< 1.25 µg/mL	< 1.25 µg/mL	< 1.25 µg/mL (< 0.874 µg/g)			
7943		D	< 5.949	< 6.129	< 6.039			
		D*	< 8.865	---	< 8.865			
7944	99:3	A	< 16.50	< 14.09	< 15.30			
		A*	< 15.06	---	< 15.06			
7935		DL	< 1.25 µg/mL	< 1.25 µg/mL	< 1.25 µg/mL (< 0.874 µg/g)			
7945	99:4	A	< 18.57	< 17.07	< 17.82			
		A*	< 19.27	---	< 19.27			
7946		B	< 19.96	< 20.16	< 20.06			
		B*	20	---	20			
7947		C	21	21	21			
		C*	20	---	20			
7948		D	24	25	25			
		D*	25	---	25			

Table A-44. Tank 241-BY-108 Analytical Results: Zinc (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	< 39.80	< 38.99	< 39.40	83.5	33.4	109
		Whole*	42	50	46[5]			
7942	99:2	A	71	250	160[5,6]			
7932		DL	7 µg/mL	7 µg/mL	7 µg/mL (5 µg/g)			
7943		D	50	49	50			
		D*	32	---	32			
7944	99:3	A	103	98	101[6]			
		A*	69	---	69			
7935		DL	12 µg/mL	12 µg/mL	12 µg/mL (8.4 µg/g)			
7945	99:4	A	297	228	263[5,6]			
		A*	235	---	235			
7946		B	63	< 40.32	52			
		B*	150	---	150			
7947		C	354	310	332[5,6]			
		C*	247	---	247			
7948		D	396	368	382			
		D*	303	---	303			
2161	104:1	Whole	37.93	44.46	41.19[1,5]			

Table A-44. Tank 241-BY-108 Analytical Results: Zinc (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	30.57	40.29	35.43[1,5]	Cont'd	Cont'd	Cont'd
2163		B	32.24	33.76	33.00[1]			
2164		C	31.29	30.30	30.79[1]			
2165	104:3	A	33.90	25.90	29.90[1,5]			
2166		C	35.90	30.20	33.05[1,5]			
2167		D	32.30	32.10	32.20[1]			
2168	104:4	A	20.80	17.90	19.35[5]			
2169		C	30.90	26.30	28.60[5]			
2170		D	28.30	24.80	26.55[5]			
2171	104:5	A	26.43	23.91	25.17			
2172		B	250.8	247.2	249.0			
2174		C	245.9	225.6	235.7			
2175		D	225.3	234.6	230.0			

Table A-45. Tank 241-BY-108 Analytical Results: Zirconium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7941	99:1	Whole	174	187	181[6]	< 34.7	N/A	< 45.1
		Whole*	N/A	N/A	N/A			
7942	99:2	A	< 17.36	< 18.03	< 17.70			
7932		DL	< 1.25 µg/mL	< 1.25 µg/mL	< 1.25 µg/mL (< 0.874 µg/g)			
7943		D	< 5.949	< 6.129	< 6.039			
		D*	N/A	N/A	N/A			
7944	99:3	A	< 16.50	< 14.09	< 15.30			
		A*	N/A	N/A	N/A			
7935		DL	< 1.25 µg/mL	< 1.25 µg/mL	< 1.25 µg/mL (< 0.874 µg/g)			
7945	99:4	A	< 18.57	< 17.07	< 17.82			
		A*	N/A	N/A	N/A			
7946		B	33	< 20.16	27			
		B*	N/A	N/A	N/A			
7947		C	< 18.37	< 13.84	< 16.11			
		C*	N/A	N/A	N/A			
7948		D	< 20.24	< 22.83	< 21.54			
		D*	N/A	N/A	N/A			
2161	104:1	Whole	< 9.980	< 9.820	< 9.900[3]			

Table A-45. Tank 241-BY-108 Analytical Results: Zirconium (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	20.87	35.17	28.02[3,5]	Cont'd	Cont'd	Cont'd
2163		B	15.96	< 15.00	15.48			
2164		C	< 10.57	< 10.25	< 10.41			
2165	104:3	A	< 10.8	< 10.7	< 10.8[3]			
2166		C	20.10	20.20	20.15			
2167		D	< 15.5	< 17.5	< 16.5			
2168	104:4	A	< 14.9	< 14.9	< 14.9			
2169		C	< 19.6	< 19.6	< 19.6			
2170		D	< 9.41	< 9.41	< 9.41			
2171	104:5	A	< 12.41	< 12.30	< 12.36			
2172		B	< 10.27	< 9.634	< 9.952			
2174		C	31.16	< 25.93	28.55			
2175		D	< 14.90	< 14.84	< 14.87			

Table A-46. Tank 241-BY-108 Analytical Results: Chloride (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2484	98:1	Whole	1,030	1,320	1,180[5]	1,540	9.66	2,000
1373		DL	4,920 µg/mL	5,020 µg/mL	4,970 µg/mL (3,480 µg/g)			
2490	98:2	A	1,360	1,320	1,340			
1427		DL	3,740 µg/mL	3,790 µg/mL	3,760 µg/mL (2,630 µg/g)			
2491		C	1,780	1,550	1,670[5]			
2492		D	2,180	2,110	2,140			
2493	98:3	A	1,500	1,750	1,620[5]			
1430		DL	4,010 µg/mL	4,030 µg/mL	4,020 µg/mL (2,810 µg/g)			
2494		C	1,320	1,870	1,600[5]			
2495		D	1,760	1,420	1,590[5]			
2496	98:4	A	1,340	1,260	1,300			
2497		B	910	1,300	1,100[5]			
2498		C	2,030	1,690	1,860[5]			
3707		D	1,200	1,270	1,240			
7941	99:1	Whole	700	700	700[3]			
7942	99:2	A	800	800	800			
7932		DL	3,300 µg/mL	3,300 µg/mL	3,300 µg/mL (2,310 µg/g)			
7943		D	1,200	1,100	1,150			

Table A-46. Tank 241-BY-108 Analytical Results: Chloride (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
7944	99:3	A	1,200	1,100	1,150	Cont'd	Cont'd	Cont'd
7935		DL	3,400 μg/mL	3,400 μg/mL	3,400 μg/mL (2,380 μg/g)			
7945	99:4	A	1,400	1,200	1,300[5]			
7946		B	1,600	1,400	1,500[5]			
7947		C	1,400	1,300	1,350			
7948		D	1,300	1,100	1,200[5]			
2536	104:1	Whole	< 210	< 210	< 210[3]			
2558	104:2	A	1,620	474	1,050[5]			
2559		B	1,120	1,400	1,260[5]			
2560		C	1,520	1,400	1,460			
2561	104:3	A	1,820	1,670	1,740			
2562		C	1,480	970	1,220[5]			
2563		D	1,440	1,520	1,480			
2564	104:4	A	1,840	2,060	1,950[5]			
2565		C	2,350	2,090	2,220[5]			
2566		D	2,010	2,090	2,050			
2568	104:5	A	2,390	1,760	2,080[5]			
2569		B	2,570	2,750	2,660			
2570		C	3,590	2,870	3,230[5]			
2571		D	1,710	1,720	1,720[4]			

Table A-47. Tank 241-BY-108 Analytical Results: Cyanide (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1390	98:1	Whole	350.0	364.0	357.0[4]	362	65.8	471
1404	98:2	A	293.0	302.0	297.5			
1399		C	201.0	195.0	198.0[2]			
1396		D	351.0	340.0	345.5			
1431	98:3	A	166.0	165.0	165.5[3]			
1432		C	92.80	111.0	101.9[5]			
1433		D	286.0	265.0	275.5			
1419	98:4	A	1,740	1,900	1,820[4]			
1420		B	2,010	1,720	1,860[5]			
1421		C	1,850	1,880	1,860			
1422		D	2,890	3,080	2,980			
7941	99:1	Whole	< 260	95	178[3]			
7942	99:2	A	116	120	118			
7932		DL	715 µg/mL	711 µg/mL	713 µg/mL (499 µg/g)[3]			
7943		D	149	135	142			
7944	99:3	A	195	191	193			
7935		DL	521 µg/mL	532 µg/mL	527 µg/mL (368 µg/g)			

Table A-47. Tank 241-BY-108 Analytical Results: Cyanide (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7945	99:4	A	742	760	751	Cont'd	Cont'd	Cont'd
7946		B	1,660	1,650	1,660			
7947		C	---	1,660	1,660			
7948		D	1,150	---	1,150			
1925	104:1	Whole	60.20	57.40	58.80[2,3]			
1966	104:2	A	69.80	62.90	66.35[5]			
1967		B	112.0	80.80	96.40[5]			
1968		C	390.0	310.0	350.0[2,5]			
1969	104:3	A	163.0	161.0	162.0[2]			
1970		C	150.0	160.0	155.0			
1971		D	181.0	166.0	173.5			
1972	104:4	A	68.00	49.90	58.95[5]			
1973		C	79.80	75.40	77.60[3]			
1974		D	39.80	38.87	39.33			
1975	104:5	A	36.50	39.40	37.95			
1976		B	99.90	94.70	97.30[4]			
1977		C	125.0	117.0	121.0[3]			
1978		D	98.40	98.30	98.35[1]			

Table A-48. Tank 241-BY-108 Analytical Results: Fluoride (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2484	98:1	Whole	4,100	3,910	4,010	6,610	26.7	8,590
1373		DL	< 632 µg/mL	< 632 µg/mL	< 632 µg/mL (442 µg/g)			
2490	98:2	A	6,940	6,630	6,780			
1427		DL	< 632 µg/mL	< 632 µg/mL	< 632 µg/mL (442 µg/g)			
2491		C	13,200	8,810	11,000[3,5]			
2492		D	11,400	17,400	14,400[5]			
2493	98:3	A	9,730	11,900	10,800[5]			
1430		DL	< 632 µg/mL	< 632 µg/mL	< 632 µg/mL (442 µg/g)			
2494		C	13,100	12,800	13,000			
2495		D	29,600	32,400	31,000[3]			
2496	98:4	A	6,860	10,800	8,830[5]			
2497		B	375	3,670	2,020[5]			
2498		C	< 136	< 132	< 134			
3707		D	456.4	452.0	454			
7941	99:1	Whole	6,600	5,400	6,000[5]			
7942	99:2	A	< 500	< 500	< 500			
7932		DL	< 400 µg/mL	< 400 µg/mL	< 400 µg/mL (280 µg/g)			
7943		D	3,900	3,800	3,850			

Table A-48. Tank 241-BY-108 Analytical Results: Fluoride (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7944	99:3	A	5,600	4,800	5,200[5]	Cont'd	Cont'd	Cont'd
7935		DL	< 600 µg/mL	< 600 µg/mL	< 600 µg/mL (420 µg/g)			
7945	99:4	A	8,300	5,200	6,750[5]			
7946		B	< 600	< 500	< 550			
7947		C	< 600	< 500	< 550			
7948		D	< 500	< 400	< 450			
2536	104:1	Whole	5,750	11,000	8,380[3,5]			
2558	104:2	A	4,280	3,170	3,720[5]			
2559		B	7,290	5,920	6,600[5]			
2560		C	6,700	5,930	6,320[5]			
2561	104:3	A	5,170	5,380	5,280			
2562		C	3,380	8,720	6,050[3,5]			
2563		D	8,200	8,280	8,240			
2564	104:4	A	7,660	8,650	8,160[5]			
2565		C	12,600	12,700	12,600			
2566		D	19,300	19,000	19,200			
2568	104:5	A	26,400	23,400	24,900[5]			
2569		B	5,540	3,770	4,650[5]			
2570		C	< 966.2	< 911	< 939			
2571		D	< 86.6	96.40	91.5			

Table A-49. Tank 241-BY-108 Analytical Results: Nitrate (3 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2484	98:1	Whole	1.55E+05	1.44E+05	1.50E+05	2.01E+05	18.5	2.61E+05
1373		DL	3.56E+05 µg/mL	3.60E+05 µg/mL	3.58E+05 µg/mL (2.50E+05 µg/g)[3]			
2490	98:2	A	2.20E+05	2.48E+05	2.34E+05[5]			
1427		DL	2.71E+05 µg/mL	2.73E+05 µg/mL	2.72E+05 µg/mL (1.90E+05 µg/g)			
2491		C	1.12E+05	1.94E+05	1.53E+05[5]			
2492		D	2.29E+05	1.61E+05	1.95E+05[5]			
2493	98:3	A	1.29E+05	1.52E+05	1.40E+05[5]			
1430		DL	2.54E+05 µg/mL	2.51E+05 µg/mL	2.52E+05 µg/mL (1.77E+05 µg/g)			
2494		C	1.02E+05	1.48E+05	1.25E+05[5]			
2495		D	1.39E+05	1.01E+05	1.20E+05[5]			
2496	98:4	A	69,400	58,300	63,800[5]			
2497		B	37,700	52,800	45,200[5]			
2498		C	63,100	62,500	62,800			
3707		D	50,500	51,000	50,700			
7941	99:1	Whole	55,000	67,000	61,000[4,5]			

Table A-49. Tank 241-BY-108 Analytical Results: Nitrate (3 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
7942	99:2	A	5.90E+05	6.10E+05	6.0E+05	Cont'd	Cont'd	Cont'd
7932		DL	2.30E+05 μg/mL	2.36E+05 μg/mL	2.33E+05 μg/mL (1.63E+05 μg/g)			
7943		D	2.47E+05	2.54E+05	2.51E+05			
7944	99:3	A	2.35E+05	3.29E+05	2.82E+05[5]			
7935		DL	2.04E+05 μg/mL	2.26E+05 μg/mL	2.15E+05 μg/mL (1.50E+05 μg/g)			
7945	99:4	A	1.01E+05	1.97E+05	1.49E+05[5]			
7946		B	69,000	65,000	67,000			
7947		C	54,000	53,000	53,500			
7948		D	50,000	42,000	46,000[5]			
2536	104:1	Whole	5.65E+05	3.78E+05	4.72E+05[3,5]			
2558	104:2	A	3.75E+05	5.15E+05	4.45E+05[5]			
2559		B	1.63E+05	1.75E+05	1.69E+05			
2560		C	1.85E+05	2.15E+05	2.00E+05[5]			
2561	104:3	A	2.24E+05	1.99E+05	2.12E+05			
2562		C	1.50E+05	94,900	1.22E+05			
2563		D	2.41E+05	2.22E+05	2.32E+05			
2564	104:4	A	2.02E+05	2.40E+05	2.21E+05[5]			
2565		C	1.52E+05	1.38E+05	1.45E+05			
2566		D	1.30E+05	1.24E+05	1.27E+05			

Table A-49. Tank 241-BY-108 Analytical Results: Nitrate (3 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2568	104:5	A	1.19E+05	1.26E+05	1.22E+05	Cont'd	Cont'd	Cont'd
2569		B	1.16E+05	1.15E+05	1.16E+05			
2570		C	1.11E+05	1.09E+05	1.10E+05			
2571		D	91,200	1.11E+05	1.01E+05[3,5]			

Table A-50. Tank 241-BY-108 Analytical Results: Nitrite (3 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2484	98:1	Whole	17,000	21,700	19,400[5]	27,300	13.0	35,500
1373		DL	90,900 µg/mL	91,500 µg/mL	91,200 µg/mL (63,800 µg/g)[3]			
2490	98:2	A	21,900	21,200	21,600			
1427		DL	70,900 µg/mL	72,400 µg/mL	71,600 µg/mL (50,100 µg/g)			
2491		C	23,500	23,800	23,600			
2492		D	32,600	31,900	32,200			
2493	98:3	A	25,200	29,900	27,600[5]			
1430		DL	73,800 µg/mL	72,000 µg/mL	72,900 µg/mL (51,000 µg/g)			
2494		C	23,700	34,700	29,200[5]			
2495		D	31,300	25,200	28,200[5]			
2496	98:4	A	37,200	30,800	34,000[5]			
2497		B	26,100	36,400	31,200[5]			
2498		C	48,400	48,600	48,500			
3707		D	42,900	44,300	43,600			
7941	99:1	Whole	8,000	8,200	8,100[3]			

Table A-50. Tank 241-BY-108 Analytical Results: Nitrite (3 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7942	99:2	A	12,400	11,300	11,900	Cont'd	Cont'd	Cont'd
7932		DL	57,100 µg/mL	56,300 µg/mL	56,700 µg/mL (39,700 µg/g)			
7943		D	20,800	19,300	20,100			
7944	99:3	A	20,300	17,700	19,000[5]			
7935		DL	60,500 µg/mL	61,100 µg/mL	60,800 µg/mL (42,500 µg/g)			
7945	99:4	A	35,000	31,000	33,000[5]			
7946		B	48,000	44,000	46,000			
7947		C	42,000	43,000	42,500			
7948		D	40,000	34,000	37,000			
2536	104:1	Whole	< 1,320	3,740	2,530[3]			
2558	104:2	A	12,000	7,240	9,620[5]			
2559		B	17,600	17,700	17,600			
2560		C	20,900	19,500	20,200			
2561	104:3	A	22,500	22,700	22,600			
2562		C	21,400	14,800	18,100[5]			
2563		D	21,000	22,300	21,600			
2564	104:4	A	22,700	26,400	24,600[5]			
2565		C	31,000	30,700	30,800			
2566		D	38,800	40,000	39,400[5]			

Table A-50. Tank 241-BY-108 Analytical Results: Nitrite (3 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2568	104:5	A	33,400	36,000	34,700	Cont'd	Cont'd	Cont'd
2569		B	46,700	50,700	48,700			
2570		C	55,400	53,500	54,400			
2571		D	46,500	46,500	46,500[3]			

Table A-51. Tank 241-BY-108 Analytical Results: Oxalate (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2484	98:1	Whole	5,410	4,610	5,010[5]	7,500	11.4	9,750
1373		DL	< 5,060 µg/mL	< 5,060 µg/mL	< 5,060 µg/mL (3,540 µg/g)			
2490	98:2	A	8,030	8,160	8,090			
1427		DL	< 5,060 µg/mL	< 5,060 µg/mL	< 5,060 µg/mL (3,540 µg/g)			
2491		C	12,800	15,100	14,000[4,5]			
2492		D	19,700	19,100	19,400			
2493	98:3	A	9,930	10,600	10,300			
1430		DL	< 5,060 µg/mL	< 5,060 µg/mL	< 5,060 µg/mL (3,540 µg/g)			
2494		C	6,900	7,700	7,300[5]			
2495		D	3,020	3,040	3,030[2]			
2496	98:4	A	< 709	1,940	1,320[2]			
2497		B	27,900	3,610	15,800[5]			
2498		C	2,510	2,520	2,520			
3707		D	983.1	562.0	773[5]			
2536	104:1	Whole	5,840	8,180	7,010[3,5]			
2558	104:2	A	10,300	7,210	8,760[5]			
2559		B	15,200	14,700	15,000			
2560		C	10,900	10,600	10,800			

Table A-51. Tank 241-BY-108 Analytical Results: Oxalate (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2561	104:3	A	8,070	8,410	8,240	Cont'd	Cont'd	Cont'd
2562		C	4,870	3,310	4,090[5]			
2563		D	11,100	11,100	11,100			
2564	104:4	A	12,600	12,600	12,600			
2565		C	7,240	6,960	7,100			
2566		D	4,090	3,530	3,810[5]			
2568	104:5	A	2,810	2,650	2,730[5]			
2569		B	24,700	< 6,520	15,600			
2570		C	< 7,805	< 7,360	< 7,580			
2571		D	1,170	1,910	1,540[2,5]			

Table A-52. Tank 241-BY-108 Analytical Results: Phosphate (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2484	98:1	Whole	8,210	10,000	9,110[5]	26,000	24.0	33,800
1373		DL	< 6,080 µg/mL	< 6,080 µg/mL	< 6,080 µg/mL (4,250 µg/g)			
2490	98:2	A	11,700	4,470	8,100[5]			
1427		DL	< 6,080 µg/mL	< 6,080 µg/mL	< 6,080 µg/mL (4,250 µg/g)			
2491		C	14,500	16,100	15,300[5]			
2492		D	17,100	5,690	11,400[5]			
2493	98:3	A	6,230	10,900	8,560[5]			
1430		DL	< 6,080 µg/mL	< 6,080 µg/mL	< 6,080 µg/mL (4,250 µg/g)			
2494		C	20,500	9,740	15,100[5]			
2495		D	3,440	46,100	24,800[5]			
2496	98:4	A	22,800	64,300	43,600[5]			
2497		B	8,120	39,600	23,900[5]			
2498		C	36,600	40,800	38,700[5]			
3707		D	58,500	53,800	56,200[2]			
7941	99:1	Whole	63,000	52,000	57,500[5]			
7942	99:2	A	2,200	2,100	2,150			
7932		DL	700 µg/mL	700 µg/mL	700 µg/mL (490 µg/g)			
7943		D	14,100	13,500	13,800			

Table A-52. Tank 241-BY-108 Analytical Results: Phosphate (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7944	99:3	A	7,600	9,700	8,650[5]	Cont'd	Cont'd	Cont'd
7935		DL	1,300 µg/mL	1,300 µg/mL	1,300 µg/mL (909 µg/g)			
7945	99:4	A	19,700	13,400	16,600[5]			
7946		B	32,000	46,000	39,000[5]			
7947		C	60,000	67,000	63,500[5]			
7948		D	79,000	78,000	78,500			
2536	104:1	Whole	50,800	98,800	74,800[3,5]			
2558	104:2	A	< 7,830	< 3,330	< 5,580			
2559		B	23,100	9,010	16,100[5]			
2560		C	8,630	5,650	7,140[5]			
2561	104:3	A	9,700	9,970	9,840			
2562		C	8,110	67,200	37,700[5]			
2563		D	10,200	8,180	9,190[5]			
2564	104:4	A	31,100	33,300	32,200			
2565		C	23,300	22,900	23,100			
2566		D	6,280	3,540	4,910[5]			
2568	104:5	A	10,300	11,600	11,000[5]			
2569		B	< 15,710	< 18,400	< 17,100			
2570		C	< 22,000	< 20,700	< 21,400			
2571		D	28,300	27,900	28,100			

Table A-53. Tank 241-BY-108 Analytical Results: Sulfate (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2484	98:1	Whole	6,660	5,760	6,210[5]	23,400	27.9	30,400
1373		DL	< 6,920 µg/mL	< 6,920 µg/mL	< 6,920 µg/mL (4,840 µg/g)			
2490	98:2	A	11,600	11,600	11,600			
1427		DL	< 6,920 µg/mL	< 6,920 µg/mL	< 6,920 µg/mL (4,840 µg/g)			
2491		C	39,900	22,000	30,900[5]			
2492		D	30,700	59,400	45,000[5]			
2493	98:3	A	43,000	50,700	46,800[5]			
1430		DL	< 6,920 µg/mL	< 6,920 µg/mL	< 6,920 µg/mL (4,840 µg/g)			
2494		C	56,700	62,700	59,700[5]			
2495		D	130,000	117,000	124,000[5]			
2496	98:4	A	41,000	29,700	35,400[5]			
2497		B	1.50E+05	12,400	81,200[3,5]			
2498		C	6,380	7,060	6,720[5]			
3707		D	4,480	12,000	8,420[5]			
7941	99:1	Whole	1,300	1,100	1,200[5,6]			
7942	99:2	A	900	900	900			
7932		DL	1,100 µg/mL	1,000 µg/mL	1,100 µg/mL (734 µg/g)			
7943		D	9,800	9,500	9,650			

Table A-53. Tank 241-BY-108 Analytical Results: Sulfate (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
7944	99:3	A	19,600	15,400	17,500[5]	Cont'd	Cont'd	Cont'd
7935		DL	1,600 µg/mL	1,600 µg/mL	1,600 µg/mL (1,120 µg/g)			
7945	99:4	A	57,800	21,400	39,600[5]			
7946		B	6,000	4,000	5,000[5]			
7947		C	15,000	17,000	16,000[5]			
7948		D	21,000	9,000	15,000[5]			
2536	104:1	Whole	< 1,680	5,840	3,760[3]			
2558	104:2	A	15,100	10,100	12,600[5]			
2559		B	19,800	19,800	19,800			
2560		C	18,000	16,400	17,200			
2561	104:3	A	11,300	12,000	11,600			
2562		C	8,990	5,880	7,440[5]			
2563		D	27,900	29,000	28,400			
2564	104:4	A	25,700	29,300	27,500[5]			
2565		C	48,600	48,500	48,600			
2566		D	86,400	88,000	87,200			
2568	104:5	A	1.16E+05	1.03E+05	1.10E+05			
2569		B	34,200	28,900	31,600[5]			
2570		C	25,300	24,400	24,800			
2571		D	2,960	2,600	2,780[5]			

Table A-54. Tank 241-BY-108 Analytical Results: Americium-241.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
7941	99:1	Whole	< 0.03	0.116	0.07	< 0.187	N/A	< 243
7942	99:2	A	< 0.1	< 0.06	< 0.08			
7932		DL	< 0.07 µCi/mL	< 0.07 µCi/mL	< 0.07 µCi/mL (< 0.05 µCi/g)			
7943		D	< 0.04	< 0.03	< 0.04			
7944	99:3	A	< 0.04	< 0.03	< 0.04			
7935		DL	< 0.07 µCi/mL	< 0.07 µCi/mL	< 0.07 µCi/mL (< 0.05 µCi/g)			
7945	99:4	A	0.0194	0.0164	0.0179[5]			
7946		B	< 0.09	0.0320	0.06			
7947		C	< 0.8	< 0.7	< 0.8			
7948		D	< 1	< 2	< 2			

Table A-55. Tank 241-BY-108 Analytical Results: Cesium-134.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μCi/g	μCi/g	μCi/g	μCi/g	%	Ci
7941	99:1	Whole	< 0.008	< 0.02	< 0.01	< 0.108	N/A	< 140
7942	99:2	A	< 0.05	< 0.02	< 0.04			
7932		DL	< 0.03 μCi/mL	< 0.03 μCi/mL	< 0.03 μCi/mL (< 0.0210 μCi/g)			
7943		D	< 0.008	< 0.009	< 0.009			
7944	99:3	A	< 0.009	< 0.008	< 0.009			
7935		DL	< 0.04 μCi/mL	< 0.03 μCi/mL	< 0.04 μCi/mL (< 0.0280 μCi/g)			
7945	99:4	A	< 0.005	< 0.004	< 0.005			
7946		B	< 0.02	< 0.02	< 0.02			
7947		C	< 0.4	< 0.4	< 0.4			
7948		D	< 0.5	< 0.5	< 0.5			

Table A-56. Tank 241-BY-108 Analytical Results: Cesium-137.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μCi/g	μCi/g	μCi/g	μCi/g	%	Ci
7941	99:1	Whole	20.2	17.7	19.0[5]	258	77.9	3.35E+05
7942	99:2	A	23.9	33.0	28.5[5,6]			
7932		DL	129 μCi/mL	130 μCi/mL	130 μCi/mL (90.9 μCi/g)			
7943		D	48.2	45.3	46.8			
7944	99:3	A	43.4	49.6	46.5[5]			
7935		DL	141 μCi/mL	137 μCi/mL	139 μCi/mL (97.2 μCi/g)			
7945	99:4	A	70.5	72.1	71.3			
7946		B	113	94.8	104[5]			
7947		C	1,200	1,340	1,270[5]			
7948		D	2,080	2,120	2,100			

Table A-57. Tank 241-BY-108 Analytical Results: Cobalt-60.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μCi/g	μCi/g	μCi/g	μCi/g	%	Ci
7941	99:1	Whole	0.00849	< 0.006	0.00725[6]	< 0.00911	N/A	< 11.8
7942	99:2	A	< 0.02	< 0.003	< 0.01			
7932		DL	< 0.003 μCi/mL	< 0.003 μCi/mL	< 0.003 μCi/mL (< 0.00210 μCi/g)			
7943		D	0.00194	0.00283	0.00239[5]			
7944	99:3	A	0.00329	0.00230	0.00280[5]			
7935		DL	< 0.003 μCi/mL	< 0.003 μCi/mL	< 0.003 μCi/mL (< 0.00210 μCi/g)			
7945	99:4	A	0.0132	0.00544	0.00932[5,6]			
7946		B	0.00621	0.00775	0.00698[5,6]			
7947		C	< 0.03	< 0.03	< 0.03			
7948		D	< 0.04	< 0.04	< 0.04			

Table A-58. Tank 241-BY-108 Analytical Results: Europium-154.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
7932	99:2	DL	< 0.006 µCi/mL	< 0.006 µCi/mL	< 0.006 µCi/mL (< 0.00420 µCi/g)	< 0.0455	N/A	< 59.2
7935	99:3	DL	< 0.007 µCi/mL	< 0.007 µCi/mL	< 0.007 µCi/mL (< 0.00490 µCi/g)			
7945	99:4	A	0.0393	0.0354	0.0374			
7946		B	0.0828	0.0620	0.0724[5]			
7947		C	< 0.2	< 0.2	< 0.2			
7948		D	< 0.2	< 0.2	< 0.2			

Table A-59. Tank 241-BY-108 Analytical Results: Europium-155.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μCi/g	μCi/g	μCi/g	μCi/g	%	Ci
7932	99:2	DL	< 0.1 μCi/mL	< 0.1 μCi/mL	< 0.1 μCi/mL (< 0.07 μCi/g)	< 0.389	N/A	< 506
7935	99:3	DL	< 0.1 μCi/mL	< 0.1 μCi/mL	< 0.1 μCi/mL (< 0.07 μCi/g)			
7945	99:4	A	0.0383	0.0367	0.0375			
7946		B	0.0862	0.0675	0.0769[5]			
7947		C	< 2	< 2	< 2			
7948		D	< 2	< 2	< 2			

Table A-60. Tank 241-BY-108 Analytical Results: Plutonium-238.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
7941	99:1	Whole	0.021	0.00833	0.015[5,6]	0.00659	45.7	8.57
7942	99:2	A	0.00122	0.00243	0.00183[5,6]			
7943		D	0.00115	0.00235	0.000693			
7944	99:3	A	0.00187	0.00160	0.00174[5]			
7945	99:4	A	0.0111	0.00302	0.00706[5,6]			
7946		B	0.00660	0.00606	0.00633[6]			
7947		C	0.00958	0.00754	0.00856[5]			
7948		D	0.0123	0.00915	0.0107[5]			

Table A-61. Tank 241-BY-108 Analytical Results: Plutonium-239/240.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
7941	99:1	Whole	0.00597	0.00537	0.00567[5,6]	0.0459	91.5	59.7
7942	99:2	A	3.53E-04	8.28E-04	5.91E-04[5,6]			
7943		D	0.00143	9.15E-04	0.00117[5]			
7944	99:3	A	0.00336	0.00502	0.00419[5]			
7945	99:4	A	0.219	0.109	0.164[5]			
7946		B	0.247	0.194	0.221[5]			
7947		C	0.142	0.137	0.140			
7948		D	0.169	0.165	0.167			

Table A-62. Tank 241-BY-108 Analytical Results: Strontium-90.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
7941	99:1	Whole	3.43	2.94	3.19[4,5]	143	95.5	1.86E+05
7942	99:2	A	0.260	0.270	0.265[6]			
7943		D	2.94	2.87	2.91			
7944	99:3	A	5.32	10.1	7.71[5]			
7945	99:4	A	338	369	354[2]			
7946		B	533	376	455[5]			
7947		C	589	662	626[5]			
7948		D	765	856	811[5]			

Table A-63. Tank 241-BY-108 Analytical Results: Total Alpha (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
1391	98:1	Whole	0.00222	0.00371	0.00297[3,5,6]	0.0619	43.3	80.5
1405	98:2	A	0.00238	0.00186	0.00212[5]			
1400		C	< 0.00263	0.00398	0.00331			
1398		D	0.0267	0.0282	0.0275			
1480	98:3	A	0.00763	0.00393	0.00578[5]			
1481		C	< 0.00466	< 0.00593	< 0.00530			
1482		D	< 0.0206	< 0.0173	< 0.0190			
1423	98:4	A	< 0.0145	< 0.00736	< 0.0109			
1424		B	< 0.00747	0.0610	0.0342			
1425		C	0.241	0.313	0.277[5]			
1426		D	0.352	0.368	0.360			
7941	99:1	Whole	0.0422	0.191	0.117[5,6]			
7942	99:2	A	0.00186	0.00784	0.00485[5,6]			
7932		DL	0.00365 µg/mL	< 0.0013 µg/mL	0.0025 µg/mL (0.00175 µg/g)			
7943		D	0.00419	0.00280	0.00350[5,6]			
7944	99:3	A	0.00419	0.0101	0.00970			
7935		DL	< 0.0014 µg/mL	< 0.0014 µg/mL	< 0.0014 µg/mL (<9.79E-04 µg/g)			

Table A-63. Tank 241-BY-108 Analytical Results: Total Alpha (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
7945	99:4	A	0.150	0.174	0.162[5]	Cont'd	Cont'd	Cont'd
7946		B	0.378	0.282	0.330[5]			
7947		C	0.450	0.293	0.372[5]			
7948		D	0.367	0.302	0.335[5]			
2001	104:1	Whole	< 6.35E-04	< 0.00151	< 0.00107[3]			
2002	104:2	A	0.00366	0.00318	0.00342[3]			
2003		B	0.00474	0.00512	0.00493			
2004		C	0.00620	0.00617	0.00619			
2005	104:3	A	< 0.00330	0.00183	0.00257			
2006		C	0.00405	< 0.00469	0.00437			
2007		D	0.0186	0.0182	0.0184[6]			
2008	104:4	A	0.00214	< 0.00283	0.00249[3]			
2009		C	< 0.00466	< 0.00350	< 0.00408			
2010		D	7.44E-04	< 9.72E-04	8.58E-04			
2011	104:5	A	0.0177	0.0108	0.0143[3,5,6]			
2012		B	0.179	0.181	0.180			
2013		C	0.266	0.306	0.286			
2014		D	0.390	0.374	0.382[4]			

Table A-64. Tank 241-BY-108 Analytical Results: Total Beta.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µCi/g	µCi/g	µCi/g	µCi/g	%	Ci
7941	99:1	Whole	26.1	22.1	24.1[5]	549	88.1	7.14E+05
7942	99:2	A	23.9	30.3	27.1[5,6]			
7932		DL	142 µCi/mL	144 µCi/mL	143 µCi/mL (100 µCi/g)			
7943		D	49.4	45.7	47.6[6]			
7944	99:3	A	52.3	63.1	57.7[5]			
7935		DL	146 µCi/mL	141 µCi/mL	144 µCi/mL (101 µCi/g)			
7945	99:4	A	737	721	729			
7946		B	1,220	841	1,030[5]			
7947		C	2,520	2,710	2,620			
7948		D	3,690	3,840	3,770			

Table A-65. Tank 241-BY-108 Analytical Results: Total Carbon.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg C/g	μg C/g	μg C/g	μg C/g	%	kg C
7941	99:1	Whole	2,440	2,090	2,270[5]	8,970	39.6	11,700
7942	99:2	A	2,360	2,460	2,410			
7932		DL	9,900 μg/mL	9,500 μg/mL	9,700 μg/mL (6,780 μg/g)[4]			
7943		D	4,830	4,570	4,700			
7944	99:3	A	16,700	11,700	14,200[5]			
7935		DL	9,600 μg/mL	9,200 μg/mL	9,400 μg/mL (6,570 μg/g)			
7945	99:4	A	30,100	29,800	30,000			
7946		B	19,000	18,800	18,900			
7947		C	16,100	15,200	15,700			
7948		D	9,190	10,600	9,900[5]			

Table A-66. Tank 241-BY-108 Analytical Results: Total Inorganic Carbon.

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg C/g	μg C/g	μg C/g	μg C/g	%	kg C
7941	99:1	Whole	1,150	1,170	1,160	5,340	33.9	6,940
7942	99:2	A	1,470	1,590	1,530			
7932		DL	8,500 μg/mL	6,400 μg/mL	7,450 μg/mL (5,210 μg/g)[3,5]			
7943		D	2,340	2,480	2,410			
7944	99:3	A	13,100	9,100	11,100[5]			
7935		DL	7,200 μg/mL	8,100 μg/mL	7,650 μg/mL (5,350 μg/g)[5]			
7945	99:4	A	13,600	12,700	13,200[3]			
7946		B	5,090	5,530	5,310			
7947		C	10,500	11,000	10,800			
7948		D	6,050	6,910	6,480[5]			

Table A-67. Tank 241-BY-108 Analytical Results: Total Organic Carbon (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg C/g	µg C/g	µg C/g	µg C/g	%	kg C
1390	98:1	Whole	2,330	2,230	2,280	4,480	20.5	5,820
1373		DL	2,640 µg/mL	2,740µg/mL	2,690 µg/mL (1,880 µg/g)			
1404	98:2	A	3,600	3,620	3,610			
1427		DL	2,710 µg/mL	2,720 µg/mL	2,720 µg/mL (1,900 µg/g)			
1399		C	5,500	6,030	5,760			
1396		D	9,060	9,760	9,410			
1431	98:3	A	3,980	4,100	4,040			
1430		DL	2,550 µg/mL	2,510 µg/mL	2,530 µg/mL (1,770 µg/g)			
1432		C	3,870	3,720	3,800			
1433		D	3,040	3,240	3,140			
1419	98:4	A	10,400	12,600	11,500			
1420		B	20,900	20,700	20,800			
1421		C	5,670	5,870	5,770[4]			
1422		D	3,500	3,370	3,440			
7941	99:1	Whole	1,290	920	1,110[5]			
7942	99:2	A	890	870	880			
7932		DL	1,400 µg/mL	3,100 µg/mL	2,250 µg/mL (1,570 µg/g)[5]			
7943		D	2,490	2,090	2,290[5]			

Table A-67. Tank 241-BY-108 Analytical Results: Total Organic Carbon (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg C/g	μg C/g	μg C/g	μg C/g	%	kg C
7944	99:3	A	3,540	2,670	3,110[5]	Cont'd	Cont'd	Cont'd
7935		DL	2,400 μg/mL	1,100 μg/mL	1,750 μg/mL (1,220 μg/g)[5]			
7945	99:4	A	16,500	17,100	16,800			
7946		B	13,900	13,300	13,600			
7947		C	5,600	4,170	4,890[5]			
7948		D	3,140	3,700	3,420[5]			
1925	104:1	Whole	3,000	2,500	2,750[3]			
1966	104:2	A	2,450	2,380	2,420			
1967		B	4,240	4,840	4,540			
1968		C	2,810	2,870	2,840			
1969	104:3	A	1,990	2,130	2,060			
1970		C	1,590	1,480	1,540			
1971		D	6,550	6,240	6,400			
1972	104:4	A	4,760	4,970	4,860			
1973		C	2,300	2,810	2,560			
1974		D	2,670	2,210	2,440			
3173	104:5	A	4,060	4,210	4,140			
1976		B	17,200	13,400	15,300[5]			
1977		C	13,600	13,200	13,400			
1978		D	7,720	7,580	7,650			

Table A-68. Tank 241-BY-108 Analytical Results: Percent Water (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			%	%	%	%	%	%
1390	98:1	Whole	21.85	19.76	20.80	27.2	19.3	N/A
1373		DL	31.90	34.04	32.97			
1404	98:2	A	14.64	14.87	14.75			
1427		DL	27.11	25.03	26.07			
1399		C	43.90	39.74	41.82			
1393		D	38.92	36.38	37.65			
1396			8.560	9.360	8.960			
			40.98	44.12	42.55			
1431	98:3	A	41.31	38.53	39.92			
1430		DL	38.58	39.47	39.02			
1432		C	43.77	44.47	44.12			
1433		D	34.52	38.56	36.54[5]			
1419	98:4	A	28.88	36.23	32.55[5]			
			36.64	36.69	36.66			
1420		B	35.41	35.81	35.61			
1421		C	38.31	39.82	39.06			
1422		D	36.49	36.40	36.45			
7313	99:1	Whole	32.7	26.1	29.4			
7315	99:2	A	7.8	6.6	7.2			
7932		DL	52.6	46.7	49.7			
7314		D	17.9	15.5	16.7			

Table A-68. Tank 241-BY-108 Analytical Results: Percent Water (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			%	%	%	%	%	%
7316	99:3	A	14.1	35.0	24.6	Cont'd	Cont'd	Cont'd
7935		DL	52.1	52.6	52.4			
7322	99:4	A	25.8	25.1	25.5			
7319		B	35.3	35.9	35.6			
7318		C	35.6	36.2	35.9			
7317		D	40.6	44.0	42.3			
1925	104:1	Whole	24.90	23.78	24.34			
1966	104:2	A	20.84	19.25	20.05			
1967		B	33.54	29.90	31.72[5]			
1968		C	15.40	9.880	12.64[5]			
1969	104:3	A	7.150	7.790	7.470			
1970		C	11.12	7.680	9.400[5]			
1971		D	8.070	7.820	7.945			
1972	104:4	A	31.01	33.09	32.05			
1973		C	41.10	41.13	41.12			
1974		D	9.770	8.800	9.285[5]			
1975	104:5	A	9.370	8.980	9.175			
1976		B	37.69	35.62	36.66			
1977		C	35.50	35.50	35.50			
1978		D	32.34	34.59	33.47			

Table A-69. Tank 241-BY-108 Analytical Results: Undecane (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2289	98:1	Whole	U	U	U	23.5	50.8	30.6
2290	98:2	A	U	U	U			
2291		C	11.8	9.89	10.9			
2292		D	46.6	44.4	45.5			
2293	98:3	A	U	U	U			
2294		C	U	U	U			
2295	98:4	A	94.2	88.0	91.1			
2296		B	164	124	144			
2297		C	102	111	107			
2298		D	U	U	U			
2338	104:1	Whole	U	U	U			
2343	104:2	A	U	U	U			
2344		B	U	U	U			
2345		C	5.18	4.08	4.63			
2346	104:3	A	1.47	1.70	1.59			
2347		C	5.01	3.78	4.40			
2348		D	32.4	21.2	26.8			
2349	104:4	A	9.67	6.24	7.96			
2350		C	U	U	U			
2351		D	4.99	3.34	4.17			

Table A-69. Tank 241-BY-108 Analytical Results: Undecane (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
2352	104:5	A	55.9	50.3	53.1	Cont'd	50.8	30.6
2353		B	100	171	136			
2354		C	107	186	147			
2355		D	8.77	22.1	15.4			

Table A-70. Tank 241-BY-108 Analytical Results: Tridecane (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2289	98:1	Whole	U	U	U	71.3	45.2	92.7
2290	98:2	A	U	U	U			
2291		C	55.9	47.6	51.8			
2292		D	234	178	206			
2293	98:3	A	6.81	8.52	7.67			
2294		C	2.87	2.96	2.92			
2295	98:4	A	233	226	230			
2296		B	478	337	408[5]			
2297		C	275	334	305			
2298		D	6.07	7.48	6.78			
2338	104:1	Whole	U	U	U			
2343	104:2	A	U	U	U			
2344		B	U	U	U			
2345		C	18.4	14.5	16.5			
2346	104:3	A	1.07	1.64	1.36			
2347		C	13.4	12.5	13.0			
2348		D	142	87.1	115			
2349	104:4	A	42.3	25.5	33.9			
2350		C	2.63	4.44	35.4			
2351		D	13.5	9.46	11.5			

Table A-70. Tank 241-BY-108 Analytical Results: Tridecane (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
2352	104:5	A	161	142	152	Cont'd	Cont'd	Cont'd
2353		B	270	452	361			
2354		C	325	481	403			
2355		D	20.3	55.3	37.8			

Table A-71. Tank 241-BY-108 Analytical Results: Tetradecane (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2289	98:1	Whole	U	U	U	55.1	41.8	71.6
2290	98:2	A	U	U	U			
2291		C	49.6	41.2	45.4			
2292		D	196	189	193			
2293	98:3	A	7.18	8.80	7.99			
2294		C	U	U	U			
2295	98:4	A	163	150	157			
2296		B	372	214	293[5]			
2297		C	187	228	208			
2298		D	4.54	5.39	4.97			
2338	104:1	Whole	U	U	U			
2343	104:2	A	U	U	U			
2344		B	U	U	U			
2345		C	14.4	13.2	13.8			
2346	104:3	A	U	U	U			
2347		C	15.3	12.1	13.7			
2348		D	135	95	115			
2349	104:4	A	38.7	27.0	32.9			
2350		C	U	U	U			
2351		D	12.4	10.6	11.5			

Table A-71. Tank 241-BY-108 Analytical Results: Tetradecane (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2352	104:5	A	146	140	143	Cont'd	Cont'd	Cont'd
2353		B	186	298	242			
2354		C	241	360	301			
2355		D	12.9	39.9	26.4			

Table A-72. Tank 241-BY-108 Analytical Results: Tri-n-butylphosphate (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2289	98:1	Whole	U	U	U	0.0745	N/A	0.0969
2290	98:2	A	U	U	U			
2291		C	U	U	U[2]			
2292		D	U	U	U			
2293	98:3	A	U	U	U			
2294		C	U	U	U			
2295	98:4	A	U	U	U			
2296		B	U	U	U			
2297		C	U	U	U			
2298		D	U	U	U			
2338	104:1	Whole	U	U	U			
2343	104:2	A	U	U	U			
2344		B	U	U	U			
2345		C	U	U	U			
2346	104:3	A	U	U	U			
2347		C	U	U	U			
2348		D	U	U	U[1]			
2349	104:4	A	U	U	U			
2350		C	U	U	U			
2351		D	U	U	U			

Table A-72. Tank 241-BY-108 Analytical Results: Tri-n-butylphosphate (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2352	104:5	A	5.97	U	2.99	Cont'd	Cont'd	Cont'd
2353		B	U	U	U			
2354		C	U	U	U[1]			
2355		D	U	U	U[1]			

Table A-73. Tank 241-BY-108 Analytical Results: Pentadecane (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2289	98:1	Whole	U	U	U	22.4	43.5	29.1
2290	98:2	A	U	U	U			
2291		C	22.1	18.5	20.3			
2292		D	76.7	71.5	74.1			
2293	98:3	A	U	U	U			
2294		C	U	U	U			
2295	98:4	A	69.3	61.3	65.3			
2296		B	108	80.7	94.4			
2297		C	57.3	105	81.2			
2298		D	U	U	U			
2338	104:1	Whole	U	U	U			
2343	104:2	A	U	U	U			
2344		B	U	U	U			
2345		C	7.64	6.11	6.88			
2346	104:3	A	U	U	U			
2347		C	6.32	4.44	5.38			
2348		D	60.0	31.1	45.6			

Table A-73. Tank 241-BY-108 Analytical Results: Pentadecane (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2349	104:4	A	17.5	10.2	13.9	Cont'd	Cont'd	Cont'd
2350		C	U	U	U			
2351		D	8.03	5.60	6.82			
2352	104:5	A	106	105	106			
2353		B	83.6	131	107			
2354		C	93.4	129	111			
2355		D	U	13.4	6.70			

Table A-74. Tank 241-BY-108 Analytical Results: Nonane (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2289	98:1	Whole	U	U	U	0.988	N/A	1.28
2290	98:2	A	U	U	U			
2291		C	U	U	U[2]			
2292		D	U	U	U			
2293	98:3	A	U	U	U			
2294		C	U	U	U[2]			
2295	98:4	A	U	U	U			
2296		B	U	U	U[1]			
2297		C	12.2	11.6	11.9			
2298		D	U	U	U			
2338	104:1	Whole	U	U	U			
2343	104:2	A	U	U	U			
2344		B	U	U	U			
2345		C	U	U	U			
2346	104:3	A	U	U	U			
2347		C	U	U	U			
2348		D	U	U	U[1]			
2349	104:4	A	U	U	U			
2350		C	U	U	U			
2351		D	U	U	U			

Table A-74. Tank 241-BY-108 Analytical Results: Nonane (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2352	104:5	A	6.54	5.56	6.05	Cont'd	Cont'd	Cont'd
2353		B	U	U	U			
2354		C	11.9	25.0	18.5[1]			
2355		D	U	U	U[1]			

Table A-75. Tank 241-BY-108 Analytical Results: Dodecane (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2289	98:1	Whole	U	U	U	58.8	48.4	76.4
2290	98:2	A	U	U	U			
2291		C	39.4	30.1	34.8			
2292		D	140	133	137			
2293	98:3	A	7.14	9.47	8.31			
2294		C	U	U	U			
2295	98:4	A	214	201	208			
2296		B	397	293	345			
2297		C	255	270	263			
2298		D	7.08	7.92	7.50			
2338	104:1	Whole	U	U	U			
2343	104:2	A	U	U	U			
2344		B	U	U	U			
2345		C	13.6	10.7	12.2			
2346	104:3	A	1.90	1.64	1.77			
2347		C	14.0	9.25	23.3			
2348		D	92.5	57.3	74.9			
2349	104:4	A	25.0	18.3	21.7			
2350		C	U	U	U			
2351		D	11.3	9.49	10.4			

Table A-75. Tank 241-BY-108 Analytical Results: Dodecane (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
2352	104:5	A	129	125	127	Cont'd	Cont'd	Cont'd
2353		B	241	405	323			
2354		C	285	425	355			
2355		D	20.0	53.1	36.6			

Table A-76. Tank 241-BY-108 Analytical Results: Decane (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2289	98:1	Whole	U	U	U	3.42	N/A	4.45
2290	98:2	A	U	U	U			
2291		C	U	U	U			
2292		D	10.2	9.31	9.76			
2293	98:3	A	U	U	U			
2294		C	U	U	U			
2295	98:4	A	U	U	U			
2296		B	U	U	U			
2297		C	28.1	29.3	28.7			
2298		D	U	U	U			
2338	104:1	Whole	U	U	U			
2343	104:2	A	U	U	U			
2344		B	U	U	U			
2345		C	U	U	U			
2346	104:3	A	U	U	U			
2347		C	U	U	U			
2348		D	U	U	U			
2349	104:4	A	U	U	U			
2350		C	U	U	U			
2351		D	U	U	U			

Table A-76. Tank 241-BY-108 Analytical Results: Decane (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD (mean)	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
2352	104:5	A	13.9	13.6	13.8	Cont'd	Cont'd	Cont'd
2353		B	25.5	42.8	34.2			
2354		C	26.8	46.0	36.4			
2355		D	U	U	U			

APPENDIX B

SAMPLE ANALYSIS AND PROCEDURES

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B.1 INTRODUCTION

For a brief discussion of the analyses performed by 222-S Laboratory of the Westinghouse Hanford Company and 325 facilities of the Pacific Northwest National Laboratory (see Section 3.3). Appendix B discusses each analysis in more detail. The 222-S Laboratory analyzed core 98 and 104; the 325 facilities analyzed core 99. There are brief descriptions of the analyses, problems encountered, and a list of the quality control tests used. Table B-1 lists all samples; the core, segment, and segment portion from which the samples were taken; and the analyses performed on the sample. Tables B-2 and B-3 lists the procedure titles and numbers used for each analysis.

B.2 SAMPLE ANALYSES

B.2.1 Westinghouse Hanford Company 222-S Laboratory (Cores 98 and 104)

B.2.1.1 Thermodynamic Analysis and DSC. Thermodynamic Analysis (TGA) measures the rate of mass loss of a sample subjected to a constant rate of temperature increase. It measures thermal decomposition temperatures, water content, and reaction temperatures. DSC measures the heat released or absorbed by a sample while the temperature of the sample is increased at a constant rate. Data generated by DSC analyses are often used to measure thermal decomposition temperatures, heats of reaction, reaction temperatures, melting points, and solid-solid transition temperatures.

TGA and DSC analyses were performed directly on homogenized samples. Quality control included duplicates and standards. Both analyses were performed under a nitrogen purge using one of the following instruments: Perkin-Elmer® or Mettler®.

B.2.1.2 Metals. Total metals were measured by inductively coupled plasma/atomic emission spectrometry. The samples were prepared using an acid digestion. Quality control tests included duplicate samples, blanks, spikes, and standard recoveries.

B.2.1.3 Anions. Concentrations of selected ions were measured on water-leached samples using ion chromatography.

B.2.1.4 Cyanide. Cyanide analyses were performed on all solid samples using microdistillation and coulometry. Samples were prepared for analysis by dissolution in ethylenediaminetetraacetic (EDTA) acid. Quality control tests included blanks, spikes, standards, and duplicate analyses.

B.2.1.5 Total Organic Carbon. Analyses for TOC were performed on all samples using the persulfate/coulometry method. Quality control tests included blanks, spikes, standards, and duplicate analyses. Total organic carbon may include some of the cyanide, but will not include aliphatic hydrocarbons.

B.2.1.6 Total Alpha Analysis. Total alpha analyses were performed on fused samples using an alpha proportional counter. Two fusions were prepared for each sample to obtain duplicate results. Quality control tests included blanks, duplicates, standards, and spikes.

B.2.1.7 Organic Compounds. Analyses were performed using the flame ionization detector/gas chromatograph method to measure the specific organic compounds in the waste. Quality control tests included method blanks and matrix spikes.

B.2.2 Pacific Northwest National Laboratory 325 Laboratory (Core 99)

B.2.2.1 Thermodynamic Analysis and DSC. TGA and DSC analyses were performed directly on the homogenized waste samples. Both analyses were performed in platinum pans under a nitrogen purge. Quality control included duplicates and standards.

B.2.2.2 Density. Density measurements were performed on all samples with the exception of segment 2A which had insufficient sample for an accurate measurement (only 2.5 cm [1 in.] of sample was retrieved). Density measurements were not performed in duplicate because of the small amount of sample available. Limited sample also prevented the use of the standard technical procedure. An experimental displacement method using mineral oil was substituted.

B.2.2.3 Metals. The concentrations of metals were determined by ICP on solid samples prepared by fusion using potassium hydroxide-potassium nitrate in a nickel crucible or sodium peroxide-sodium hydroxide in a zirconium crucible. Drainable liquids were prepared for analysis by digestion in hydrochloric and nitric acids.

Quality control measures included performing the analyses in duplicate with the exception of the sodium peroxide-sodium hydroxide fused samples from segments 2, 3, and 4. Other quality control measures used were serial dilution percent difference calculations, blank and matrix spike recovery determinations, verification and continuing calibrations, and processing blanks.

B.2.2.4 Anions. Concentrations of selected anions were measured using IC on solid samples prepared by a water-leach process and on diluted drainable liquid samples.

Quality control measures for the anion analyses included performing the analyses in duplicate, using leach processing, matrix and blank spikes for the solid samples, and a dilution blank for drainable liquids.

B.2.2.5 Total Cyanide. The cyanide concentrations of the samples from core 99 were determined by argentometric titration or by colorimeter after preparation of the direct samples using microdistillation. Initial plans were to argentometrically titrate the microdistilled samples because high concentrations of cyanide were expected in the waste. After titrating samples from segment 1 and 2 and finding no appreciable cyanide, colorimetry was used to analyze the residual from the first samples and the remaining samples.

Quality control measures included duplicate analyses, blank spikes, matrix spikes, and distillation blanks.

B.2.2.6 Total Inorganic Carbon, Total Organic Carbon, and Total Carbon. Analyses for carbon were performed directly on the homogenized material from core 99, segment 1 and quarter segments 2A, 2D, 3A, and 4A through 4D and on dilute solutions of drainable liquid. Carbon concentrations of waste samples were determined by the hot persulfate/coulometry method. Diluted drainable liquid solutions were also analyzed using a UV-catalyzed method.

Quality control measures included duplicate analyses, processing blanks for the drainable liquids, and matrix spikes for the drainable liquid UV-catalyzed method and for the solid hot persulfate analyses. Total orgnic carbon may include some of the cyanide, but it will not include aliphatic hydrocarbons.

B.2.2.7 Total Alpha Activity. Initial analyses of total alpha activity were measured using scintillation counters. The high beta/gamma content of the samples made high dilutions of the sample necessary, with subsequent low alpha activity and very long counting times. The samples contained solid material which attenuated much of the alpha activity, possibly a result of solids from the fusion flux. Samples were counted with and without a ^{239}Pu spike, and the net plutonium count rates were averaged to obtain a correction factor of 0.722 $\pm$ 20 percent to account for the attenuation. The factor was applied uniformly to all fused samples. Drainable liquid samples, which were prepared by an acid digestion, were not corrected.

Quality control measures included duplicate analyses, hot cell blanks, and standard recoveries.

B.2.2.8 Plutonium Analyses. Plutonium analyses were performed on all fused samples. (Drainable liquid samples were not analyzed for plutonium.) Samples were counted by alpha energy analysis following separation.

Standards, blanks, matrix spikes, and duplicate analyses were used as quality control tests.

B.2.2.9 Total Beta Analysis. Total beta analyses were performed on all samples. The samples were using beta gas flow proportional counters. Quality control tests for the total beta analysis included blanks and duplicates.

B.2.2.10 Strontium-90 Analysis. Strontium-90 analyses were performed on all fused samples. (Drainable liquids were not analyzed for ^{90}Sr.) Following separation, the samples were counted using a beta gas flow counter.

Quality control tests consisted of duplicate analyses, matrix spikes, standards, and blanks.

B.2.2.11 Gamma Energy Analysis. Gamma energy analyses were performed on all samples; counting was performed using germanium gamma detectors.

Quality control tests included duplicate analyses and blanks.

B.2.2.12 Uranium Analysis. Analyses were performed for total uranium using laser fluorimetry on all fused samples. Quality control tests included standards, blanks, and duplicates.

Table B-1. Summary of Samples and Analyses (7 sheets).[1]

Segment	Quarter Segment	Sample Number[2]	Analyses
CORE 98			
1	Drainable Liquid	1373	TGA(PE), DSC(PE), TOC, ICP, IC
	Whole Segment[3]	1390	TGA(PE), DSC(PE), CN, TOC
		1391	Total alpha
		1483	ICP
		2289	FID/GC
		2484	IC
2	A	1404	TGA(PE), DSC(PE), CN, TOC
		1405	Total alpha
		1484	ICP
		2290	FID/GC
		2490	IC
	C	1399	TGA(M), DSC(M), TOC, CN
		1400	Total alpha
		1485	ICP
		2291	FID/GC
		2491	IC
	D	1393	TGA(M)
		1396	TGA(PE), TGA(M), DSC(PE), TOC, CN
		1398	Total alpha
		1486	ICP
		2292	FID/GC
		2492	IC
	Drainable Liquid	1427	TGA(PE), DSC(PE) TOC, ICP, IC
3	A	1431	TGA(M), DSC(M), TOC, CN
		1480	Total alpha
		1487	ICP
		2293	FID/GC
		2493	IC

Table B-1. Summary of Samples and Analyses (7 sheets).[1]

Segment	Quarter Segment	Sample Number[2]	Analyses
3 (Cont'd)	C	1432	TGA(M), DSC(M), TOC, CN
		1481	Total alpha
		1488	ICP
		2294	FIC/GC
		2494	IC
	D	1433	TGA(M), DSC(M), TOC, CN
		1482	Total alpha
		1489	ICP
		2495	IC
	Drainable Liquid	1430	TGA(M), DSC(M), TOC, ICP, IC
4	A	1419	TGA(M), TGA(M) Rerun, DSC(M), DSC(M) Rerun, TOC, CN
		1423	Total alpha
		1490	ICP
		2295	FID/GC
		2496	IC
	B	1420	TGA(M), DSC(M), DSC(M) Rerun, TOC, CN
		1424	Total alpha
		1491	ICP
		2296	FID/GC
		2497	IC
		2639	RSST
	C	1421	TGA(M), DSC(M), TOC, CN
		1425	Total alpha
		1492	ICP
		2297	FID/GC
		2498	IC
	D	1422	TGA(M), DSC(M), TOC, CN
		1426	Total alpha
		1493	ICP
		2298	FID/GC
		3707	IC

Table B-1. Summary of Samples and Analyses (7 sheets).[1]

Segment	Quarter Segment	Sample Number[2]	Analyses
CORE 104			
1	Whole Segment	1925	TGA(PE), DSC(PE), TOC, CN
		2001	Total alpha
		2161	ICP
		2338	FID/GC
		2536	IC
2	A	1966	TGA(M), DSC(M), TOC, CN
		2002	Total alpha
		2162	ICP
		2343	FID/GC
		2558	IC
	B	1967	TGA(M), DSC(M), TOC, CN
		2003	Total alpha
		2163	ICP
		2344	FID/GC
		2559	IC
	C	1968	TGA(PE), DSC(PE), TOC, CN
		2004	Total alpha
		2164	ICP
		2345	FID/GC
		2560	IC
3	A	1969	TGA(PE), DSC(PE), TOC, CN
		2005	Total alpha
		2165	ICP
		2346	FID/GC
		2561	IC
	C	1970	TGA(M), DSC(PE), TOC, CN
		2006	Total alpha
		2166	ICP
		2347	FID/GC
		2562	IC

Table B-1. Summary of Samples and Analyses (7 sheets).[1]

Segment	Quarter Segment	Sample Number[2]	Analyses
3 (Cont'd)	D	1971	TGA(M), DSC(PE), TOC, CN
		2007	Total alpha
		2167	ICP
		2348	FID/GC
		2563	IC
4	A	1972	TGA(M), DSC(M), TOC, CN
		2008	Total alpha
		2168	ICP
		2349	FID/GC
		2564	IC
	C	1973	TGA(M), DSC(M), TOC, CN
		2009	Total alpha
		2169	ICP
		2350	FID/GC
		2565	IC
	D	1974	TGA(PE), DSC(PE), TOC, CN
		2010	Total alpha
		2170	ICP
		2351	FID/GC
		2566	IC
5	A	1975	TGA(PE), DSC(PE), CN
		2011	Total alpha
		2171	ICP
		2352	FID/GC
		2568	IC
		3173	TOC
	B	1976	TGA(M), DSC(M), TOC, CN
		2012	Total alpha
		2172	ICP
		2353	FID/GC
		2569	IC
		3174	RSST

Table B-1. Summary of Samples and Analyses (7 sheets).[1]

Segment	Quarter Segment	Sample Number[2]	Analyses
5 (Cont'd)	C	1977	TGA(M), DSC(M), TOC, CN
		2013	Total alpha
		2174	ICP
		2354	FID/GC
		2570	IC
	D	1978	TGA(PE), DSC(PE), TOC, CN
		2014	Total alpha
		2175	ICP
		2355	FID/GC
		2571	IC
CORE 99			
1	Whole Segment	7313, 7313-2	TGA, DSC, Density[4]
		7941-C, 7941-C2	IC
		7941-G, 7941-G2	CN
		7941-H1T, 7941-H2T	KOH-KNO_3 fusion, ICP, Radchem[5]
		7941-J, 7941-J2	TIC, TOC, TC
		7941-N1, 7941-N2	Na_2O_2-NaOH fusion, ICP
2	Drainable Liquid	7932, 7932-2	TGA, DSC
		7397	Density
		7932-A1, 7932-A2	HNO_3-HCl acid digestion, ICP, Radchem[5]
		7932-C, 7932-C2	IC
		7932-G, 7932-G2	CN
		7932-J, 7932-J2	TIC, TOC, TC
	A	7315, 7315-2	TGA, DSC
		7942-C, 7942-C2	IC
		7942-G, 7942-G2	CN
		7942-H1, 7942-H2	KOH-KNO_3 fusion, ICP, Radchem[5]
		7942-J, 7942-J2	TIC, TOC, TC
		7942-N1, 7942-N2	Na_2O_2-NaOH fusion, ICP

Table B-1. Summary of Samples and Analyses (7 sheets).[1]

Segment	Quarter Segment	Sample Number[2]	Analyses
2 (Cont'd)	D	7314, 7314-2	DSC, TGA, Density
		7943-C, 7943-C2	IC
		7943-G, 7943-G2	CN
		7943-H1, 7943-H2	KOH-KNO_3 fusion, ICP, Radchem[5]
		7943-J, 7943-J2	TIC, TOC, TC
		7943-N1	Na_2O_2-NaOH fusion, ICP
3	Drainable Liquid	7935, 7935-2	DSC, TGA
		7398	Density
		7935-A1, 7935-A2	HNO_3-HCl acid digestion, ICP, Radchem[5]
		7935-C, 7935-C2	IC
		7935-G, 7935-G2	CN
		7935-J, 7935-J2	TIC, TOC, TC
	A	7316, 7316-2	DSC, TGA, Density
		7944-C, 7944-C2	IC
		7944-G, 7944-G2	CN
		7944-H1, 7944-H2	KOH-KNO_3 fusion, ICP, Radchem[5]
		7944-J, 7944-J2	TIC, TOC, TC
		7944-N	Na_2O_2-NaOH fusion, ICP
4	A	7322, 7322-2	DSC, TGA, Density
		7945-C, 7945-C2	IC
		7945-G, 7945-G2	CN
		7945-H1, 7945-H2	KOH-KNO_3 fusion, ICP, Radchem[5]
		7945-J, 7945-J2	TIC, TOC, TC
		7945-N1	Na_2O_2-NaOH fusion, ICP
	B	7319, 7319-2	DSC, TGA, Density
		7946-C, 7946-C2	IC
		7946-G, 7946-G2	CN
		7946-H1, 7946-H2	KOH-KNO_3 fusion, ICP, Radchem[5]
		7946-J, 7946-J2	TIC, TOC, TC
		7946-N1	Na_2O_2-NaOH fusion, ICP

Table B-1. Summary of Samples and Analyses (7 sheets).[1]

Segment	Quarter Segment	Sample Number[2]	Analyses
4 (Cont'd)	C	7318, 7318-2	DSC, TGA, Density
		7947-C, 7947-C2	IC
		7947-G, 7947-G2	CN
		7947-H1, 7947-H2	KOH-KNO_3 fusion, ICP, Radchem[5]
		7947-J, 7947-J2	TIC, TOC, TC
		7947-N1	Na_2O_2-NaOH fusion, ICP
	D	7317, 7317-2	DSC, TGA, Density
		7948-C, 7948-C2	IC
		7948-G, 7948-G2	CN
		7948-H1, 7948-H2	KOH-KNO_3 fusion, ICP, Radchem[5]
		7948-J, 7948-J2	TIC, TOC, TC
		7948-N1	Na_2O_2-NaOH fusion, ICP

Notes:

CN = cyanide
TC = total carbon
M = Mettler® [1]
PE = Perkin-Elmer® [2]

[1]Baldwin 1995a and Silvers et al. 1995.

[2]Sample numbers for cores 98, 99, and 104 were abbreviated. Sample numbers for cores 98 and 104 (analyzed at 222-S Laboratory) all contain the prefix 'S95T000'. Duplicate samples have the same number as the originals. Sample numbers for core 99 (analyzed at PNNL) contain the prefix '95-0'. Additionally, core 99 sample numbers contain a letter-number suffix which identifies the specific analysis and differentiates the original sample from the duplicate (exceptions are the sample numbers for the TGA and DSC analyses). These are left on the sample numbers for clarity.

[3]The "whole segment" contains all solids from that particular segment.

[4]Density measurements were not run in duplicate because of insufficient sample.

[5]Radchem includes analyses for total alpha, total beta, ^{90}Sr, $^{239/240}Pu$, gamma energy analysis, and uranium. Uranium analyses were not performed on the drainable liquid portions of core 99.

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

[2] Perkins-Elmer is a registered trademark of Perkins Research and Manufacturing Company, Canoga Park, California.

Table B-2. Analytical Procedures, Cores 98 and 104.[1]

Analysis	Instrument	Preparation Procedure	Procedure Number
Energetics by DSC	Mettler® Perkin-Elmer®	N/A	LA-514-113, Rev. B-1 LA-514-114, Rev. B-O
Percent Water by TGA	Mettler® Perkin-Elmer®	N/A	LA-560-112, Rev. A-2 LA-514-114, Rev. B-0
Total Alpha Activity	Alpha proportional counter	LA-549-141, Rev. D-0	LA-508-101, Rev. D-2
Nickel, lithium and other metals by ICP	Inductively coupled plasma spectrometer	LA-549-141, Rev. D-0 LA-505-158, Rev. A-4	LA-505-151, Rev. A-1
Bromide (and other anions) by ICP	Ion chromatograph	LA-504-101, Rev. D-0	LA-533-105, Rev.D-0
Total Organic Carbon	Coulometer	Hot persulfate oxidation	LA-342-100, Rev. C-O
Cyanide	Spectrophotometer	Microdistillation	LA-695-102, Rev. D-O
FID/GC	Gas chromatograph/ mass spectrometer	N/A	LA-523-437, Rev. A-0

Notes:

N/A = Not Available

[1]Baldwin (1995a).

Table B-3. Analytical Procedures, Core 99 (2 sheets).[1]

Analysis	Instrument/ Procedure Title	Preparation Procedure	Procedure Number
Percent Water	Thermogravimetric analysis	Direct	PNL-ALO-508
Energetics	Differential scanning calorimetry	Direct	PNL-ALO-508
Density	N/A	Direct	PNL-ALO-501
ICP	Inductively coupled argon plasma atomic emission spectrometer	$KOH-KNO_3$ fusion PNL-ALO-115	PNL-ALO-211
		Na_2O_2-NaOH fusion PNL-ALO-114	
		$HCl-HNO_3$ digestion PNL-ALO-128	
IC	Ion chromatograph	Water leach PNL-ALO-103	PNL-ALO-212
Cyanide	Spectrophotometer	Microdistillation PNL-ALO-285	PNL-ALO-289
TIC, TOC, TC	Coulometer	Direct analysis	PNL-ALO-381
Total alpha	Scintillation counter	$KOH-KNO_3$ fusion PNL-ALO-115	PNL-ALO-420/421
		Na_2O_2-NaOH fusion PNL-ALO-114	
		$HCl-HNO_3$ digestion PNL-ALO-128	
Plutonium	Separation and alpha energy analysis	$KOH-KNO_3$ fusion PNL-ALO-115	PNL-ALO-423/422
		Na_2O_2-NaOH fusion PNL-ALO-114	
		$HCl-HNO_3$ digestion PNL-ALO-128	
Total beta	Beta gas proportional counting	$KOH-KNO_3$ fusion PNL-ALO-115	PNL-ALO-430/431
		Na_2O_2-NaOH fusion PNL-ALO-114	
		$HCl-HNO_3$ digestion PNL-ALO-128	

Table B-3. Analytical Procedures, Core 99 (2 sheets).[1]

Analysis	Instrument/ Procedure Title	Preparation Procedure	Procedure Number
^{90}Sr	Beta gas proportional counting	KOH-KNO_3 fusion PNL-ALO-115	PNL-ALO-433/431
		Na_2O_2-$NaOH$ fusion PNL-ALO-114	
Gamma energy analysis	Gamma counting	KOH-KNO_3 fusion PNL-ALO-115	PNL-ALO-450
		Na_2O_2-$NaOH$ fusion PNL-ALO-114	
		HCl-HNO_3 digestion PNL-ALO-128	

Note:
[1]Silvers et al. (1995)

Table B-4. Analytical Procedures for August 1994 Auger Samples.[1]

Analyte	Instrument	Preparation Procedure	Procedure Number
Organic compounds	Gas chromatograph	N/A	Experimental[2]
Total organic carbon	Coulometer	Persulfate oxidation	LA-344-105
Weight percent water by TGA	N/A	N/A	LA-560-112

Note:
[1]Campbell et al. 1995a

[2]Pool and Bean 1994.

APPENDIX C

DRILL STRING WASH WATER CONTAMINATION CHECK DATA

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C.1 INTRODUCTION

Appendix C presents the chemical results of the drill string wash water contamination check. The two analytes added to the drill string wash water as tracers were lithium and bromide. The analytical results for these two analytes are given in Tables C-1 and C-2, respectively. Overall means, RSDs, and projected inventories were not calculated for these analytes because they are not waste constituents.

C.2 ANALYTE TABLE DESCRIPTION

The "Sample Number" column lists the laboratory sample for which the analyte was measured. Sampling rationale, locations, and descriptions of sampling events are discussed in 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 the segment number.

Column three contains the name of the segment portion from which the sample was taken. This can be the entire segment (whole); drainable liquid (DL), or "A", "B", "C", or "D" describing the top, second, third, or bottom segment portion, respectively. Some segment portions are repeated in the analyte tables, with the second entry followed by an asterisk. The asterisk identifies samples from core 99 that were analyzed for metals on a sodium peroxide-sodium hydroxide fusion.

The "Result" and "Duplicate" columns are self-explanatory. The "Mean" column is the average of the result and duplicate values. All values, including those below the detection level (indicating the "less-than" symbol, <), were averaged. The mean was only expressed as a nondetected value if both sample values were nondetected. 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 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 these original data. The means may appear to have been rounded up in some cases and rounded down in others. However, this is strictly because the analytical results are shown in the tables to only three significant figures, and not because the means were incorrectly calculated.

Analytic values for drainable liquids, reported by the laboratory in μg/mL, were converted to units of μg/g for the purposes of calculating the overall means for those analytes. A density value of 1.43 g/mL was used for the conversion.

The four QC parameters assessed on the tank 241-BY-108 samples were standards, spikes, duplicates, and blanks. The QC results for cores 98, 99, and 104 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:

- "1" indicates that the standard recovery was below the QC limit.

- "2" indicates that the standard recovery was above the QC limit.

- "3" indicates that the spike recovery was below the QC limit.

- "4" indicates that the spike recovery was above the QC limit.

- "5" indicates that the RPD was outside the QC limits.

- "6" indicates that there was some blank contamination.

The QC criteria for lithium and bromide specified in the SAP (Baldwin 1995c) were identical for all three cores. These criteria are summarized as follows: 90-110 percent recovery for standards and matrix spikes, ± 10 percent for RPDs, and blanks ≤ 5 percent of the analyte concentration.

Table C-1. Tank 241-BY-108 Analytical Results: Lithium (3 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
1483	98:1	Whole	18.42	17.60	18.01	N/A	N/A	N/A
1373		DL	< 4.01 µg/mL	< 4.01 µg/mL	< 4.01 µg/mL (< 2.80 µg/g)			
1484	98:2	A	< 4.84	< 4.84	< 4.84			
1427		DL	< 4.01 µg/mL	< 4.01 µg/mL	< 4.01 µg/mL (< 2.80 µg/g)			
1485		C	< 4.975	< 4.803	< 4.890			
1486		D	< 4.808	< 4.630	< 4.720			
1487	98:3	A	< 9.99	< 9.92	< 9.96			
1430		DL	< 4.01 µg/mL	< 4.01 µg/mL	< 4.01 µg/mL (< 2.80 µg/g)			
1488		C	< 9.41	< 9.27	< 9.34			
1489		D	< 9.72	< 9.65	< 9.69			
1490	98:4	A	< 9.54	< 9.56	< 9.55			
1491		B	< 9.67	< 9.68	< 9.68			
1492		C	< 9.47	< 9.46	< 9.47			
1493		D	< 10.76	< 10.78	< 10.77			
7941	99:1	Whole	109	121	115[5,6]			
		Whole*	52	80	66[5]			

Table C-1. Tank 241-BY-108 Analytical Results: Lithium (3 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
7942	99:2	A	< 52.08	< 54.10	< 53.09	Cont'd	Cont'd	Cont'd
7932		DL	< 3.75 μg/mL	< 3.75 μg/mL	< 3.75 μg/mL (< 2.62 μg/g)			
7943		D	54	49	52[6]			
		D*	60	---	60			
7944	99:3	A	< 49.51	< 42.26	< 45.89			
		A*	48	---	48			
7935		DL	< 3.75 μg/mL	< 3.75 μg/mL	< 3.75 μg/mL (< 2.62 μg/g)			
7945	99:4	A	< 55.71	< 51.20	< 53.46			
		A*	< 57.80	---	< 57.80			
7946		B	127	171	149[5]			
		B*	< 55.71	---	< 55.71			
7947		C	< 55.10	< 41.52	< 48.31			
		C*	< 57.36	---	< 57.36			
7948		D	< 60.73	< 68.49	< 64.61			
		D*	< 54.50	---	< 54.50			
2161	104:1	Whole	26.51	25.23	25.87			

Table C-1. Tank 241-BY-108 Analytical Results: Lithium (3 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2162	104:2	A	< 13.52	< 13.55	< 13.54	Cont'd	Cont'd	Cont'd
2163		B	< 13.59	< 15.00	< 14.30			
2164		C	< 10.57	< 10.25	< 10.41			
2165	104:3	A	< 10.8	< 10.7	< 10.8			
2166		C	< 10.6	< 10.2	< 10.4			
2167		D	< 15.5	< 17.5	< 16.5			
2168	104:4	A	< 14.9	< 14.9	< 14.9			
2169		C	< 19.6	< 19.6	< 19.6			
2170		D	< 9.41	< 9.41	< 9.41			
2171	104:5	A	< 12.41	< 12.30	< 12.36			
2172		B	< 10.27	< 9.634	< 9.952			
2174		C	< 23.74	< 25.93	< 24.84			
2175		D	< 14.90	< 14.84	< 14.87			

Note:

*Na_2O_2 - NaOH fusion

Table C-2. Tank 241-BY-108 Analytical Results: Bromide (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD	Projected Inventory
			μg/g	μg/g	μg/g	μg/g	%	kg
2484	98:1	Whole	< 622.9	< 641	< 632	N/A	N/A	N/A
1373		DL	< 6,450 μg/mL	< 6,450 μg/mL	< 6,450 μg/mL (< 4,510 μg/g)			
2490	98:2	A	< 677.6	< 670	< 674			
1427		DL	< 6,450 μg/mL	< 6,450 μg/mL	< 6,450 μg/mL (< 4,510 μg/g)			
2491		C	< 1,031	< 991	< 1,010			
2492		D	< 1,245	< 1,180	< 1,210			
2493	98:3	A	< 1,080	< 973	< 1,030			
1430		DL	< 6,450 μg/mL	< 6,450 μg/mL	< 6,450 μg/mL (< 4,510 μg/g)			
2494		C	< 461	< 468	< 465			
2495		D	< 723	< 695	< 709			
2496	98:4	A	< 850	< 818	< 834			
2497		B	< 583	< 553	< 568			
2498		C	< 1,320	< 1,280	< 1,300			
3707		D	< 521	< 551	< 536			
2536	104:1	Whole	< 1,550	< 1,550	< 1,550[3]			
2558	104:2	A	< 3,330	< 1,420	< 2,380			
2559		B	< 2,440	< 2,110	< 2,280			
2560		C	< 1,760	< 1,760	< 1,760			

Table C-2. Tank 241-BY-108 Analytical Results: Bromide (2 sheets).

Sample Number	Core: Segment	Sub-segment	Result	Duplicate	Mean	Overall Mean	RSD	Projected Inventory
			µg/g	µg/g	µg/g	µg/g	%	kg
2561	104:3	A	< 1,470	< 1,470	< 1,470	Cont'd	Cont'd	Cont'd
2562		C	< 943	< 862	< 903			
2563		D	< 1,120	< 1,100	< 1,110			
2564	104:4	A	< 3,370	< 3,610	< 3,490			
2565		C	< 2,480	< 2,380	< 2,430			
2566		D	< 342	< 342	< 342			
2568	104:5	A	< 416	< 416	< 416			
2569		B	< 6,687	< 7,820	< 7,250			
2570		C	< 9,364	< 8,830	< 9,100			
2571		D	< 231	< 231	< 231			

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APPENDIX D

ANALYTICAL RESULTS FROM AUGUST 1994 AUGER SAMPLES

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D.1 SUMMARY OF RESULTS

As discussed in Section 3.4, auger samples were taken from risers 16 and 17 of tank 241-BY-108. Table D-1 summarizes these results.

Table D-1. August 1994 Auger Sample Analytical Results.[1]

Analyte or Measurement	Result[2]	Mean
Examination of drainable liquids	No immiscible organic layer discernible	N/A
Organics by gas chromatograph/flame ionization detector	Normal paraffin hydrocarbons and tributyl phosphate not detected	N/A
Weight percent water	Riser 16 - 16 weight percent	13 weight percent
	Riser 17 upper - 14 weight percent	
	Riser 17 lower - 6 weight percent	
Total organic carbon	Riser 16 - 1,200 μg/g	875 μg/g
	Riser 17 upper - 600 μg/g	
	Riser 17 lower - 500 μg/g	

Note:

[1]Campbell et al. 1995a.

[2]Samples labeled as riser 16 originated from riser 1. Samples labeled as riser 17 originated from riser 12A.

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