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G. L. Smith	H4-61	X
M. J. Sutey	T4-07	X
L. D. Swenson	G3-20	X
J. D. Thomson	R2-76	X
G. L. Troyer	T6-50	X
D. A. Turner	S7-15	X
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		Safety NA							
		Env. NA							
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7. Abstract

This document provides the characterization information and interprets the data for Single-Shell Tank S-104

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

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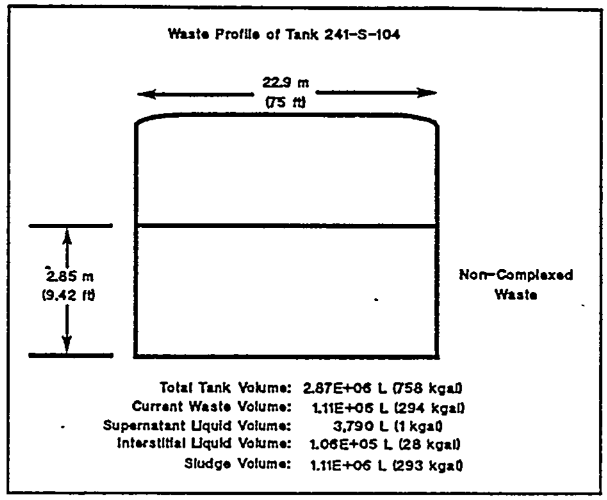
EXECUTIVE SUMMARY

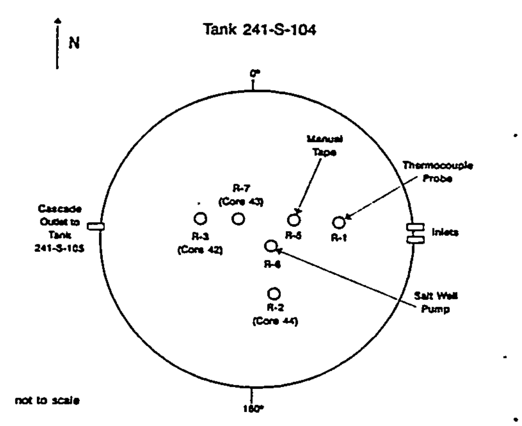
Single-Shell Tank 241-S-104 is a radioactive waste tank most recently sampled in July and August of 1992. Sampling and characterization of the waste in Tank 241-S-104 contributes toward the fulfillment of Milestone M-44-05 of the *Hanford Federal Facility Agreement and Consent Order* (Ecology, EPA, and DOE, 1993). Characterization will also provide support for the Tank Farm Operations, safety programs and design of retrieval, pretreatment, and disposal systems.



Tank 241-S-104, located in the 200 West Area S Tank Farm, was constructed in 1951 and went into service in 1953 by receiving REDOX Plant waste. Throughout the service life of the tank, REDOX process associated waste made up the majority of the waste received. Primarily REDOX plant effluent was received, however, small amounts of salt waste, laboratory waste, hot condensate, and coating removal waste were discharged to the tank. It is the first tank in a cascade with Tanks 241-S-105 and 241-S-106. The tank has an operational capacity of 2.87E+06 L (758,000 gallons), and currently contains 1.11E+06 L (294,000 gallons) of non-complexed waste, existing primarily as sludge. Approximately 1.06E+05 L (28,000 gallons) of drainable interstitial liquid and 3,790 L (1,000 gallons) of supernate remain. The tank is not classified as a Watch List tank; however, it was declared an assumed leaker in 1968, having lost nearly 9.08E+04 L (24,000 gallons) of waste. The tank was primary stabilized in 1979 and interim stabilized in 1984, with intrusion prevention completed in 1988. There are no Unreviewed Safety Questions associated with Tank 241-S-104.

The waste in Tank 241-S-104 is primarily precipitated salts, some of which are composed of radioactive isotopes. The most abundant analytes in the solids include aluminum, calcium, nickel, sodium, uranium, carbonate, nitrate, and nitrite. The water digested solids results demonstrated that the chromium and selenium concentrations were greater than their Toxicity Characteristic regulatory thresholds. The most abundant analytes in the liquid portion of the waste include aluminum, sodium, hydroxide, nitrate, nitrite, and sulfate; the chromium and lead concentrations in the liquid phase exceeded their Toxicity Characteristic regulatory thresholds. The primary radionuclide in the liquid is ^{137}Cs, while ^{90}Sr and ^{137}Cs are the major radionuclides in the solids. Comparisons to established limits of concern for selected analytes can be made by referring to the *Tank Characterization Reference Guide* (De Lorenzo et al., 1994).

The results of the analyses have been compared to the dangerous waste codes in the *Washington Dangerous Waste Regulations* (Ecology, 1991). This assessment was conducted by comparing tank analyses against dangerous waste characteristics ("D" waste codes) and against state waste codes. It did not include checking tank analyses against "U", "P", "F", or "K" waste codes since application of these codes is dependent on the source of the waste and not on particular constituent concentrations. The results indicate that the waste in this tank is adequately described in the Dangerous Waste Permit Application for the Single-Shell Tank System; this permit is discussed in the *Tank Characterization Reference Guide* (De Lorenzo et al., 1994).



Tank 241-S-104	
Tank Description	
Type:	Single-Shell
Constructed:	1951
In Service:	1952
Out of Service:	1968
Diameter:	22.9 m (75 feet)
Usable Depth:	7.0 m (23 feet)
Operating Capacity:	2.87E+06 L (758,000 gal)
Bottom Shape:	Dish
Hanford Coordinates:	36.124° North 75.665° West
Total Risers:	9
Ventilation:	Passive
Tank Status: as of September, 1994	
Contents:	Non-Complexed Waste
Total Waste Volume:	1.11E+06 L (294,000 gal)
Supernate Volume:	3,790 L (1,000 gal)
Drainable Interstitial Liquid:	1.06E+05 L (28,000 gal)
Sludge Volume:	1.11E+06 L (293,000 gal)
Manual Tape Surface Level:	2.85 m (112.25 in)
Temperature:	41.7°C (107°F)
Integrity Category:	Assumed Leaker
Isolation Status	
Primary Stabilized:	1979

Single-Shell Tank 241-S-104 Concentrations and Inventories for Critical List Analytes (as of September 1994)				
Physical Properties	**Solids**		**Liquids**	
Density	1.64 g/mL		1.28 g/mL	
pH	12.9		13.5	
Percent Water	34.3%		56.7%	
Heat Load	3,910 Watts			
Chemical Constituents	**Analyte Weight Percent[1]**	**Solid Bulk Inventory (kg)**	**Analyte Weight Percent[2]**	**Liquid Bulk Inventory (kg)**
Metals				
Al (Aluminum)	10.5%	1.92E+05	0.933%	1,270
Ca (Calcium)	0.381%	6,940	3E-04%	0.411
Cr (Chromium)	0.211%	3,850	0.263%	358
Si (Silicon)	0.120%	2,180	0.002%	2.69
Na (Sodium)	10.9%	1.98E+05	15.441%	21,000
Uranium	0.604%	11,000	---	---
Anions				
CO_3^{2-} (Carbonate)	0.373%	6,790	0.087%	118
Cl^- (Chloride)	0.288%	5,250	0.498%	677
NO_3^- (Nitrate)	17.2%	3.13E+05	21.0%	28,500
NO_2^- (Nitrite)	2.33%	42,500	2.98%	4,050
SO_4^{2-} (Sulfate)	0.180%	3,720	1.88%	2,560
Radionuclides	**Average Solid Concentration (μCi/g)**	**Solids (Ci)**	**Average Liquid Concentration (μCi/g)**	**Liquids (Ci)**
^{241}Am	0.118	194	<0.0859	<11.7
^{137}Cs	62.3	1.02E+05	63.2	8,580
Total Plutonium	0.282	462	<1.07E-04	<0.0145
^{90}Sr	310	5.08E+05	0.00406	0.551

[1]Based on the solid volume of 1.11E+06 L (1.82E+06 kg)
[2]Based on the liquid volume of 1.06E+05 L (1.36E+05 kg)

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LIST OF TERMS

ANOVA	analysis of variance
CFR	*Code of Federal Regulations*
CWR	REDOX coating waste
DL	detection limit
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U. S. Department of Energy
EPA	U. S. Environmental Protection Agency
Hz	Hertz
IC	ion chromatography
ICP	inductively coupled plasma atomic emission spectrometry
PNL	Pacific Northwest Laboratory
R	REDOX waste
REDOX	reduction oxidation
RPD	relative percent difference
RSD	relative standard deviation
TLM	Tank Layer Model
TOC	total organic carbon
TRAC	Track Radionuclide components
TWRS	Tank Waste Remediation System
WHC	Westinghouse Hanford Company

1.0 INTRODUCTION

In July and August 1992, Single-Shell Tank 241-S-104 was sampled as part of the overall characterization effort directed by the Hanford Federal Facility Agreement and Consent Order (Ecology, 1989). Sampling was also performed to determine proper handling of the waste, to address corrosivity and compatibility issues, and to comply with requirements of the *Washington Administrative Code* (Ecology, 1991). This Tank Characterization Report presents an overview of that tank sampling and analysis effort, and contains observations regarding waste characteristics. It also presents expected concentration and bulk inventory data for the waste contents based on this latest sampling data and background historical and surveillance tank information. Finally, this report makes recommendations and conclusions regarding operational safety.

1.1 PURPOSE

The purpose of this report is to describe the characteristics the waste in Single-Shell Tank 241-S-104 (hereafter, Tank 241-S-104) based on information obtained from a variety of sources. This report summarizes the available information regarding the chemical and physical properties of the waste in Tank 241-S-104, and using the historical information to place the analytical data in context, arranges this information in a format useful for making management and technical decisions concerning waste tank safety and disposal issues. In addition, conclusions and recommendations are presented based on safety issues and further characterization needs.

Specific objectives reached by the sampling and characterization of the waste in Tank 241-S-104 are:

- Contribute toward the fulfillment of the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) Milestone M-44-05 concerning the characterization of Hanford Site high-level radioactive waste tanks (Ecology, EPA, and DOE, 1993).

- Complete safety screening of the contents of Tank 241-S-104 to meet characterization requirements of the *Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 93-5* (Conway, 1993).

- Provide tank waste characterization information to the Tank Waste Remediation System (TWRS) Program Elements in accordance with the *TWRS Tank Waste Analysis Plan* (Bell, 1994).

1.2 SCOPE

A broad description of the tank and its historical background are presented first. This allows an estimation of the contents of Tank 241-S-104 based on historical process information and detailed transaction records. Next, the results of the sampling and analysis effort are summarized and interpreted both qualitatively and statistically. The information obtained from historical sources is then compared with the actual waste measurements to arrive at final waste inventory and concentration estimates. Finally, conclusions and recommendations are given based on the current knowledge of waste inventory and tank status.

1.3 ASSUMPTIONS

The concentration and inventory estimates derived for this report are considered by the authors and by the Westinghouse Hanford Company Characterization Program to be the most accurate, defensible, technically valid, and contemporary data concerning Tank 241-S-104. This Tank Characterization Report incorporates all available previous sampling, characterization, and transfer data concerning Tank 241-S-104. In addition, estimates of the current tank contents based on process knowledge and waste transaction records provide important cross-checks and corroboration of the inventory estimates derived from recent analytical data. Given that the analytical data is valid and defensible, this report is therefore the definitive characterization of the contents of Tank 241-S-104.

The term "analytical results" is used in this report to denote sample results from the most recent sampling event. Characterization data from these samples are used as the basis for the analytical section of this report, Section 5.0. The historical characterization of this tank, Section 2.4, is based on the available "historical results" prior to the 1992 sampling.

Tank 241-S-104 no longer receives waste. This tank is an assumed leaker; interim stabilization and intrusion prevention work have been completed. The characterization of Tank 241-S-104 is considered accurate and representative of the tank contents as of the date of preparation of this report: September 1994.

2.0 HISTORICAL TANK INFORMATION

The purpose of this section is to describe Tank 241-S-104 based on historical information. It is divided into five parts. A brief description and historical background of the tank comprise the first part, followed by the current tank status, a summary of the process sources that contributed to the tank waste, and an estimation of the contents of Tank 241-S-104 based on historical information. The final part details the surveillance data taken on the tank.

2.1 TANK HISTORY

Tank 241-S-104 consists of a carbon steel tank within a reinforced concrete shell and dome. As described in the *Historical Tank Content Estimate for the Southwest Quadrant of the Hanford 200 West Area* (Brevick et al., 1994), it has a diameter of 22.9 m (75 ft.), an operating depth of 7.0 m (23 ft.), and a capacity of 2.87E+06 L (758,000 gallons). The basic design of Tank 241-S-104 is shown in Figure 2-1. Instruments access Tank 241-S-104 through risers and monitor the pressure, temperature, sludge level, and other bulk tank characteristics (Bell, 1994). The position of these risers is found in Figure 2-2.

The 241-S Tank Farm was built in 1950 and 1951. It is located at the southern end of the 200 West Area. Figure 2-3 details the Hanford Site's 200 West Area and the location of the 241-S Tank Farm. Tank 241-S-104 is located on the eastern side of the second row of the 241-S Tank Farm.

Tank 241-S-104 is the first, or primary, tank in a "cascade" connecting it to Tanks 241-S-105 and 241-S-106. A cascade was a system in which a number of tanks were connected in series by pipes. The pipes were located at the top of the tanks' working depths. Waste added to the primary tank in a cascade would flow to the next tank without overfilling the primary tank. By using a cascade, fewer connections needed to be made during waste handling operations. This method reduced waste handling requirements, personnel exposure, and the chance of a loss of tank integrity from waste overflow. Another advantage of using the cascade system was waste volume reduction from the disposal of clarified liquid waste. Entrained solids and precipitates would settle in the primary tank (in this case, Tank 241-S-104), and the clarified liquids would flow through the cascade on to the secondary tanks (S-105 and S-106). This practice led to the rapid accumulation of solids in the primary tank, and allowed the disposal of clarified liquid from the secondary tanks into cribs.

Tank 241-S-104 went into service in 1953, receiving REDOX process (reduction oxidation) waste (Anderson, 1990). This waste was produced during the extraction of plutonium in the REDOX process. The REDOX waste cascaded to Tank 241-S-105 and on to Tank 241-S-106. This cascade line was not used after 1956. Waste from Tank 241-S-104 has been discharged to various tanks and to cribs. Tank 241-S-104 received its last waste additions in 1965. After losing 24,000 gallons of waste, the tank was declared an assumed leaker and taken out of service in 1968 (Brevick et al., 1994). Four dry wells were

Figure 2-1. Basic Design of Tank 241-S-104.

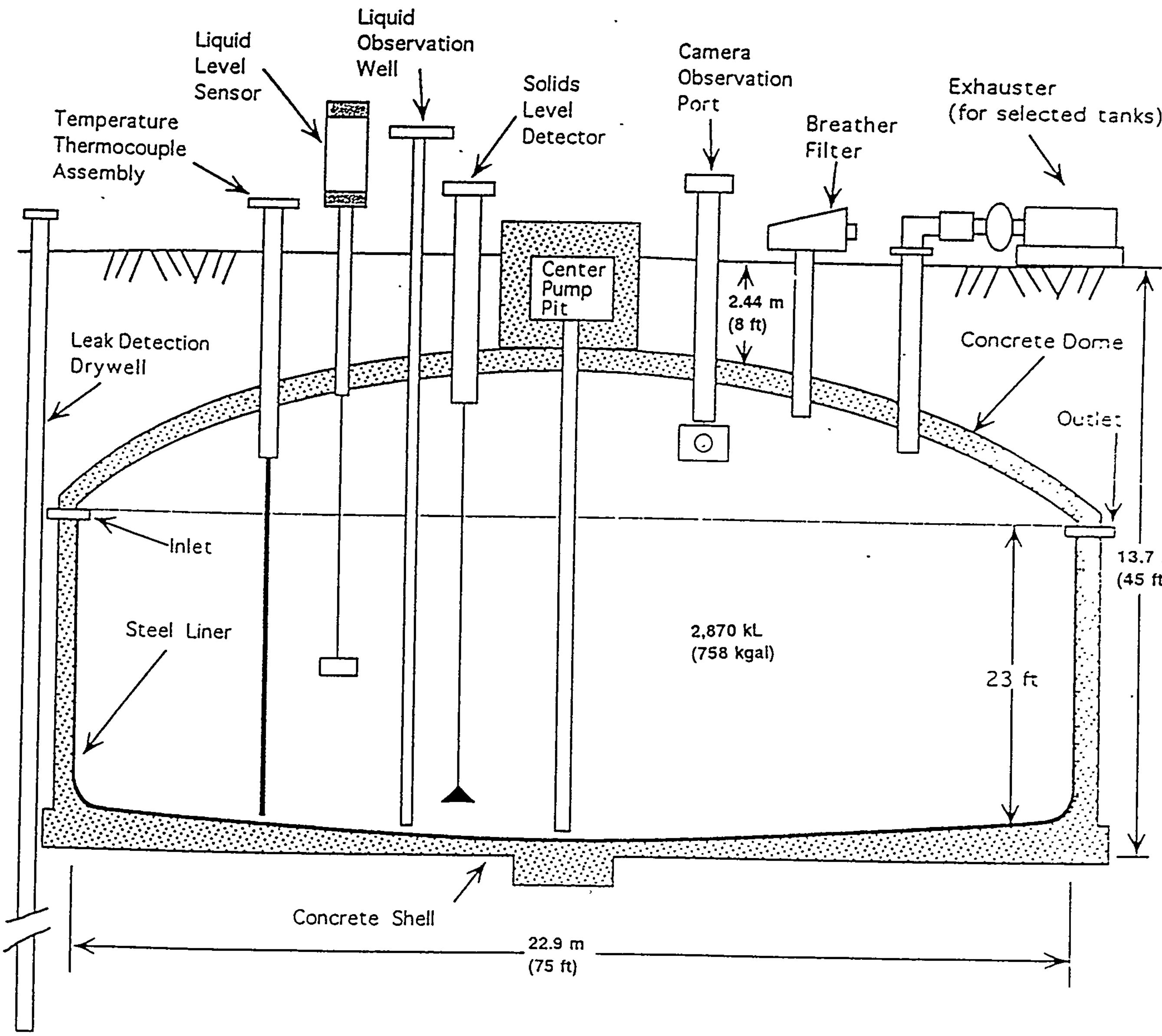
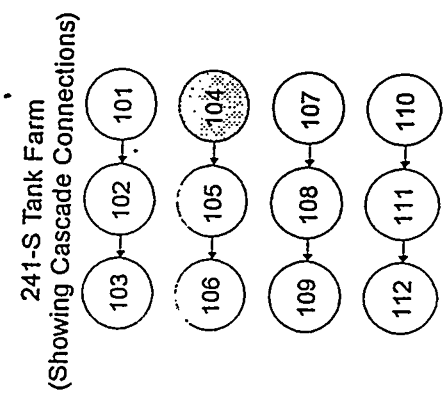


Figure 2-2. Riser Configuration for Tank 241-S-104.

No.	Dia.	Description and Comments
1	4"	Thermocouple Probe
2	4"	Capped
3	4"	Breather Filter
4	4"	Thermocouple Probe (inoperative)
5	12"	Liquid Level Reel
6	12"	Saltwell Pump
7	12"	Observation Port
8	12"	Flange
13	42"	Pump (weather covered)



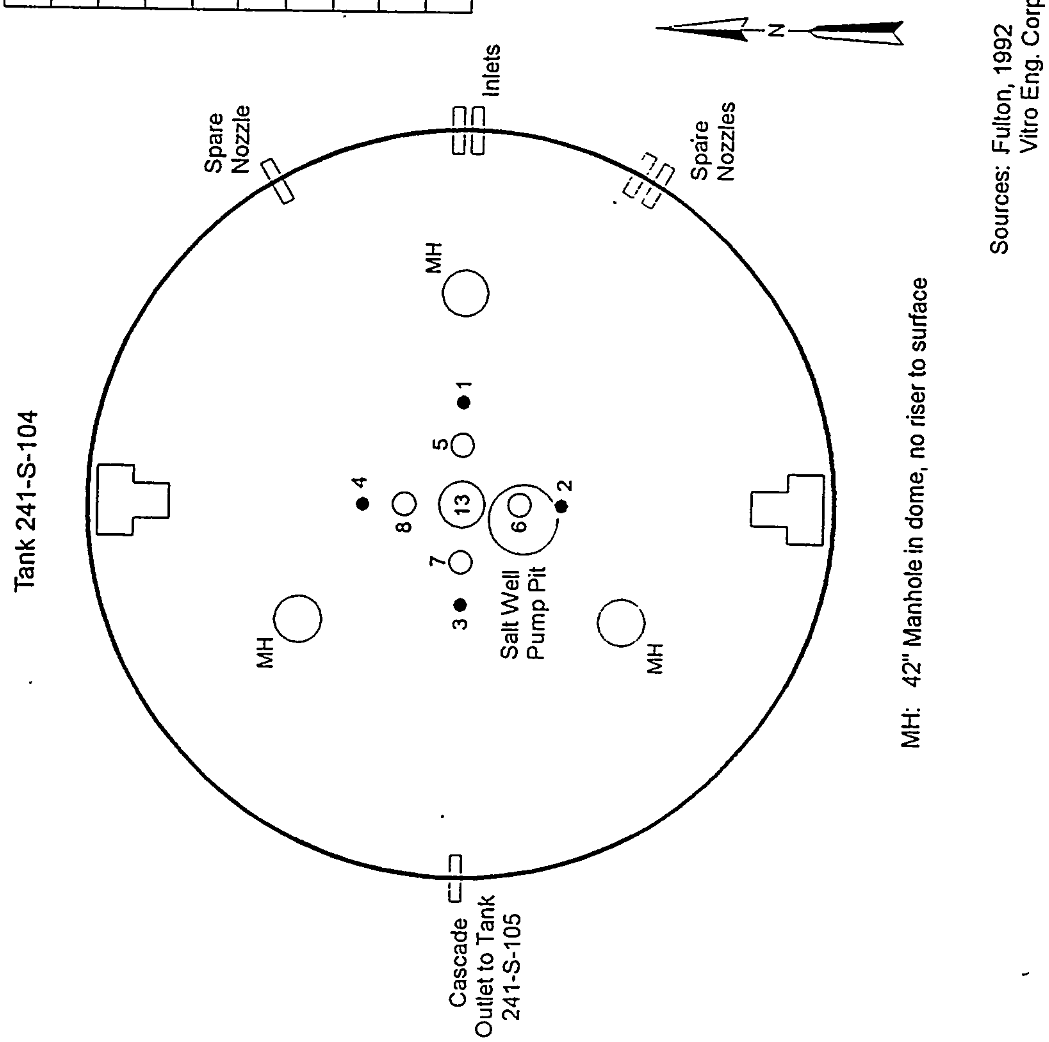
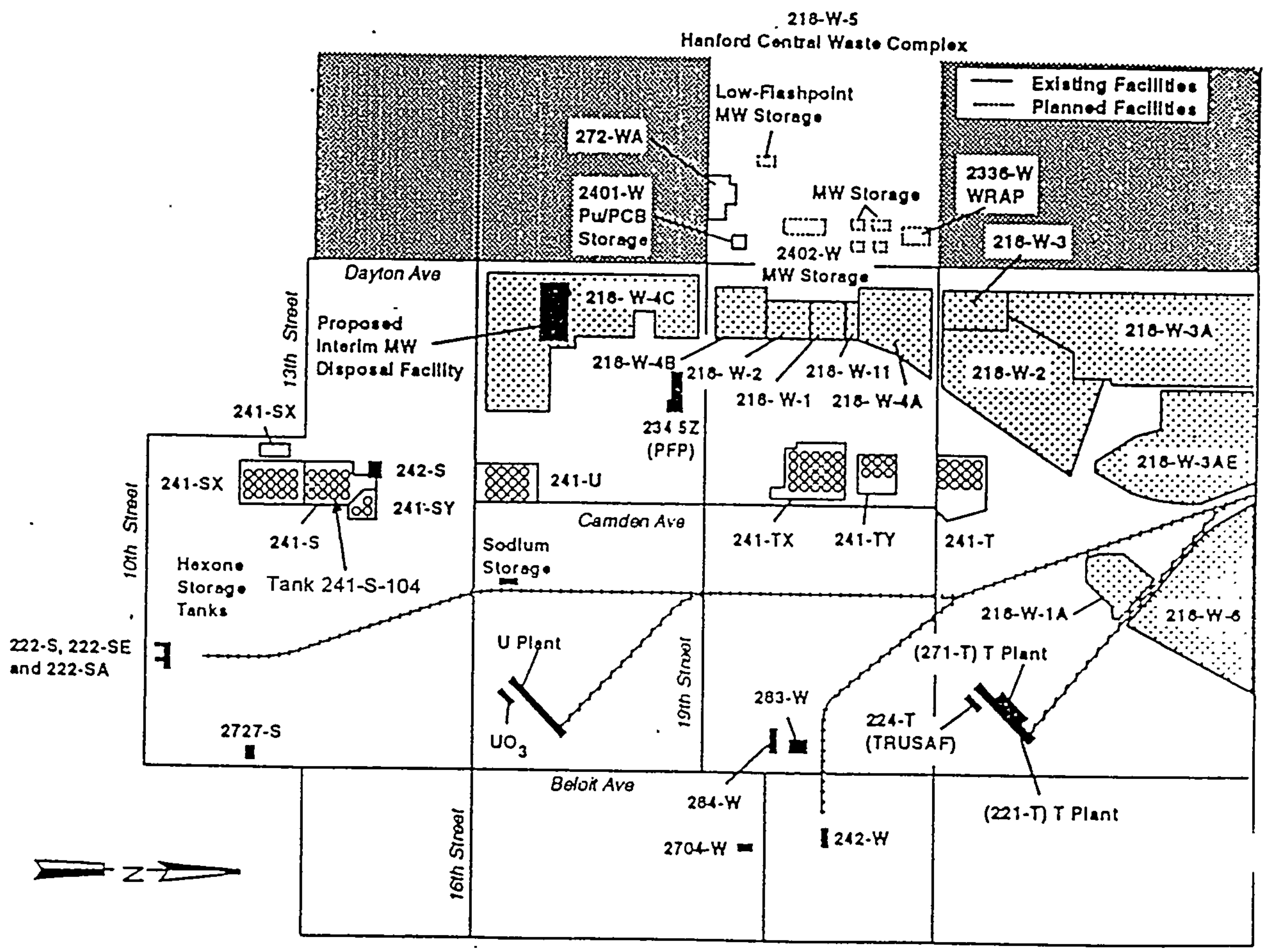


Figure 2-3. Location of the 241-S Tank Farm.



Key	
Facility Prefix	Facility Type
218	Burial Ground, Retrievable Storage Areas
241	Tank Farms

drilled and most of the supernate was removed in 1970. A P-10 pump was installed in 1974 and salt well pumping was completed in 1976. In 1978, a jet pump was installed (Welty, 1988). The tank was primary stabilized in 1979 (Welty, 1988), and later interim stabilized in December 1984 (Swaney, 1994). Primary stabilization involved the removal of most of the supernate and much of the interstitial liquid in the tank. Removing liquids minimizes the risk of waste leaking out of the tank. Interim stabilization, in this case, was an administrative designation with requirements similar to primary stabilization. Intrusion prevention was completed on Tank 241-S-104 in 1988. Intrusion prevention involves the completion of the physical effort required to minimize the potential for liquids to be inadvertently added to an inactive storage tank.

2.2 TANK STATUS

Tank 241-S-104 currently contains 1,110,000 L (294,000 gal.) of waste. Of this volume, 106,000 L (28,000 gal.) is interstitial liquid, and 3,790 L (1,000 gal.) is supernate liquid (Hanlon, 1994). Tank 241-S-104 is passively vented to the atmosphere through a breather filter (Bergmann, 1991). All monitoring systems are currently in compliance with documented standards (Hanlon, 1994). Current temperature data indicates that the highest temperature in the tank is 41.7 °C (107 °F). Tank 241-S-104 is listed as a low heat load tank (Hanlon, 1994), thus any heat generated within the tank is readily dissipated through conduction and natural convection. Waste levels and tank temperatures are further discussed in Section 2-5.

The current designation of the tank contents is non-complexed waste. This is a general term to describe waste that does not have a high content of carbon complexants or organic carbon. Tank 241-S-104 is not a Watch List tank, nor does it have Unreviewed Safety Questions associated with it. The tank is an assumed leaker, has been interim stabilized, and has undergone intrusion prevention (Hanlon, 1994).

2.3 PROCESS KNOWLEDGE

Tank 241-S-104 began its service life in 1953 with an addition of REDOX (reduction oxidation) process waste. This waste was produced during the extraction of plutonium and uranium in the REDOX process. The tank also received small amounts of REDOX process associated wastes: salt waste, laboratory waste, hot condensate containing moderate level of radionculides, coating waste, and centrifuge cake waste in multiple transfers (Anderson, 1990). All of these wastes were produced at the REDOX plant. Tank 241-S-104 reached maximum operating level during the second quarter of 1953, so any further additions caused the waste to cascade to Tank 241-S-105.

The wastes in Tank 241-S-104 began to self-boil in early 1954. In that same year, surface condensers were installed. The surface condensers allow us to concentrate wastes by disposing of vapor condensate to cribs (Brevick et al., 1994).

Coating waste from the REDOX plant continued to be added in 1955 (Jungfleisch, 1984a). Use of the cascade system was stopped in 1956, possibly due to increasing temperatures caused by an accumulation of high radioactive wastes from the REDOX Plant.

The last waste added to Tank 241-S-104 was REDOX waste supernate in 1965. The tank was assumed to be leaking soon after this and supernate was repeatedly transferred out of the tank. Table 2-1 uses a compilation of transaction records (Agnew, 1994a) to present an estimate of the total volume of waste that has been received by Tank 241-S-104. A graphical waste volume history of Tank 241-S-104 is included as Figure 2-4.

Table 2-1. Estimated Total Volume of Waste Types Received By Tank 241-S-104 (Agnew, 1994a)

Waste Type	Estimated Volume*
R	9,535,000 L (2,519,000 gal)
CWR	1,075,000 L (284,000 gal)

* Total volume is greater than 2,869,000 liters (758,000 gallons) because waste was routinely pumped from Tank 241-S-104 and also cascaded to Tank 241-S-105.

R Waste from REDOX plant activities.

CWR Coating waste from decladding of aluminum clad fuel in the REDOX plant.

2.4 HISTORICAL ESTIMATION OF THE CONTENTS OF TANK 241-S-104

A preliminary estimate of the waste constituents in Tank 241-S-104 can be developed by reviewing historical data for the tank. This section uses the process history of the tank and past sampling efforts to develop an estimation of the contents of Tank 241-S-104.

2.4.1 Process History Estimation

The major waste types received by Tank 241-S-104 are REDOX process waste (R) and REDOX coating waste (CWR). This section discusses two models that have been developed from historical transfer records to predict the chemical content of Tank 241-S-104.

The Tank Layer Model (TLM) (Agnew, 1994b) was developed at Los Alamos National Laboratory. It uses historical transfer records to estimate the volume of each waste type currently held by the tank. These volume data are combined with waste stream chemistry data to derive an estimate of the tank's current contents. The TLM estimation for Tank 241-S-104 is presented in Table 2-2. It should be noted that the TLM for Tank 241-S-104 assumes a significant amount of "unknown" solids.

The Track Radionuclide Constituents (TRAC) database program (Jungfleisch, 1984b) was developed to estimate tank compositions up to 1980. It used an algorithm to determine the various constituents that remained in the tank after radioactive decay and transfers in and out of the tank. Validation of the codes used in the TRAC model has not been performed; the conclusions should be used with caution. The TRAC and TLM models are compared in Table 2-2.

Figure 2-4. Waste Volume History of Tank 241-S-104.

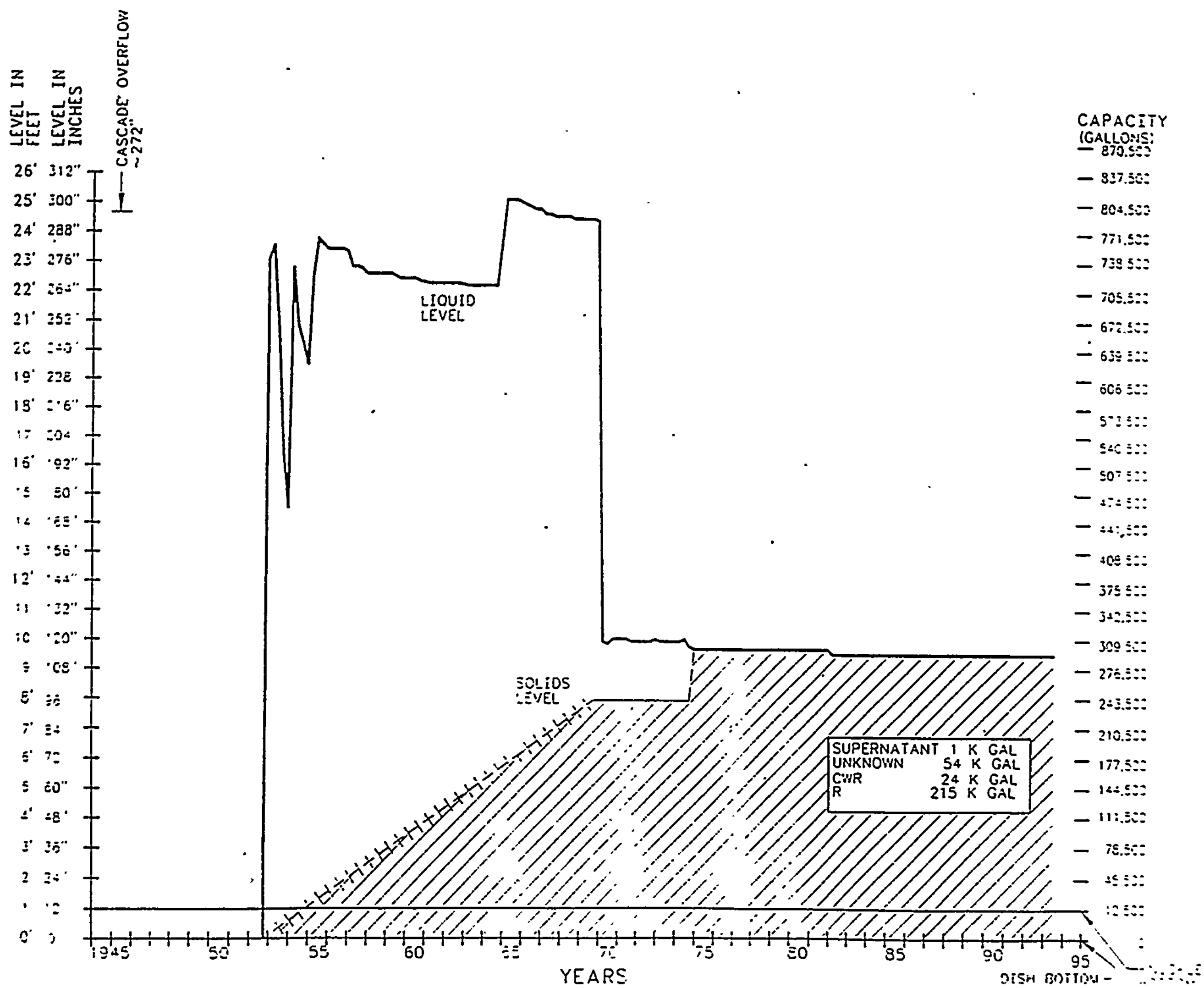


Table 2-2. Tank Layer Model (Agnew, 1994b), TRAC (Jungfleisch, 1984b), and 1976 Sampling (Horton, 1976) Estimates of Tank 241-S-104 Contents.

Tank Layer Model			TRAC	1976 Sample
Physical Properties				
Total Waste	1.71E+06 kg, 1.11E+06 L (293 kgal)			1.11E+06 L (294,000 gal)
Heat Load	5.46 kW (1.86E+04 BTU/hr)			3.42 kW
Bulk Density	1.55 g/mL			1.21 g/mL
Void Fraction	.70			
wt% Water	52.66			30.3
Chemical Constituents				
Analyte	**μg/g**	**kg**	**kg**	**kg**
Na	32,600	55,900	4.6E+05	
Al	84,200	1.44E+05	1.08E+05	96,084
Fe	2,520	4,310	2,792	3,730
Cr	12,600	21,600	46,800	
Mn	0	0	0	1,200
Ca	0	0	0	4,000
$ZrO(OH)_2$	0	0	5.4	
U	45.2	774	4,800	
OH^-	1.77E+05	3.03E+05	1.7E+05	
NO_3^-	58,800	1.01E+05	1.24E+06	9.11E+05
NO_2^-	4,940	8,470	9,200	
CO_3^{2-}	2,770	4,750	0	
SO_4^{2-}	55.6	952	770	
SiO_3^{2-}	1,170	2,010	150	
Radiological Constituents				
Total Pu	.42 μCi/g	12.0Ci	550 Ci	4.96 kg
^{137}Cs	31.0 μCi/g	53,100 Ci	40,000 Ci	1.22E+05 Ci
^{90}Sr	451 μCi/g	7.73E+05 Ci	6.0E+05 Ci	4.23E+05 Ci

The two models disagree in the sequence of waste additions to Tank 241-S-104 and in the amounts of each waste type added to the tank. The TLM shows alternating additions of R and CWR waste and a significant volume of unknown waste, while the TRAC model shows nearly all R waste being added prior to any CWR waste with no unknown layer. In the first case, clear tank layers are difficult to define due to the addition of different kinds of waste in small amounts and the unknown waste. The TRAC data, on the other hand, implies approximately 8.9 million liters (2.3 million gallons) of R waste solids overlaid by approximately 690,000 liters (183,000 gallons) of CWR waste solids. A definitive historical model of tank constituents may have to wait for further review of historical records, or for extensive chemical and radiochemical analysis.

2.4.2 Historical Sampling Estimation

Analytical data from two historical sampling events of Tank 241-S-104 are available. Sample T-4184, taken in 1974, was described as yellow with 10% solids (Wheeler, 1974). This appears to be a supernate sample. Since supernate was removed from Tank 241-S-104 in transfers and salt well pumping after 1974, this sample is likely not representative of the sludge that makes up nearly all of the tank waste. The analytical data for Sample T-4184 will thus not be further discussed in this report.

A sludge sampling from 1976 described the sludge in Tank 241-S-104 as grayish in color and sticky, with the consistency of stiff dough or putty (Horton, 1976). These results were used to develop an estimate of the tank's total contents. This estimate is compared to the estimates based on process history in Table 2-2. Note that there are very little characterization data available from this sampling event.

2.5 SURVEILLANCE DATA

2.5.1 Surface Level Readings

To determine the surface level of the waste, Tank 241-S-104 is equipped with a manual tape gauge. The manual tape uses a conductivity probe which is lowered by a hand crank until contact is made with the waste surface and an electric circuit is completed. The measurement is later manually recorded on the Computer Automated Surveillance System.

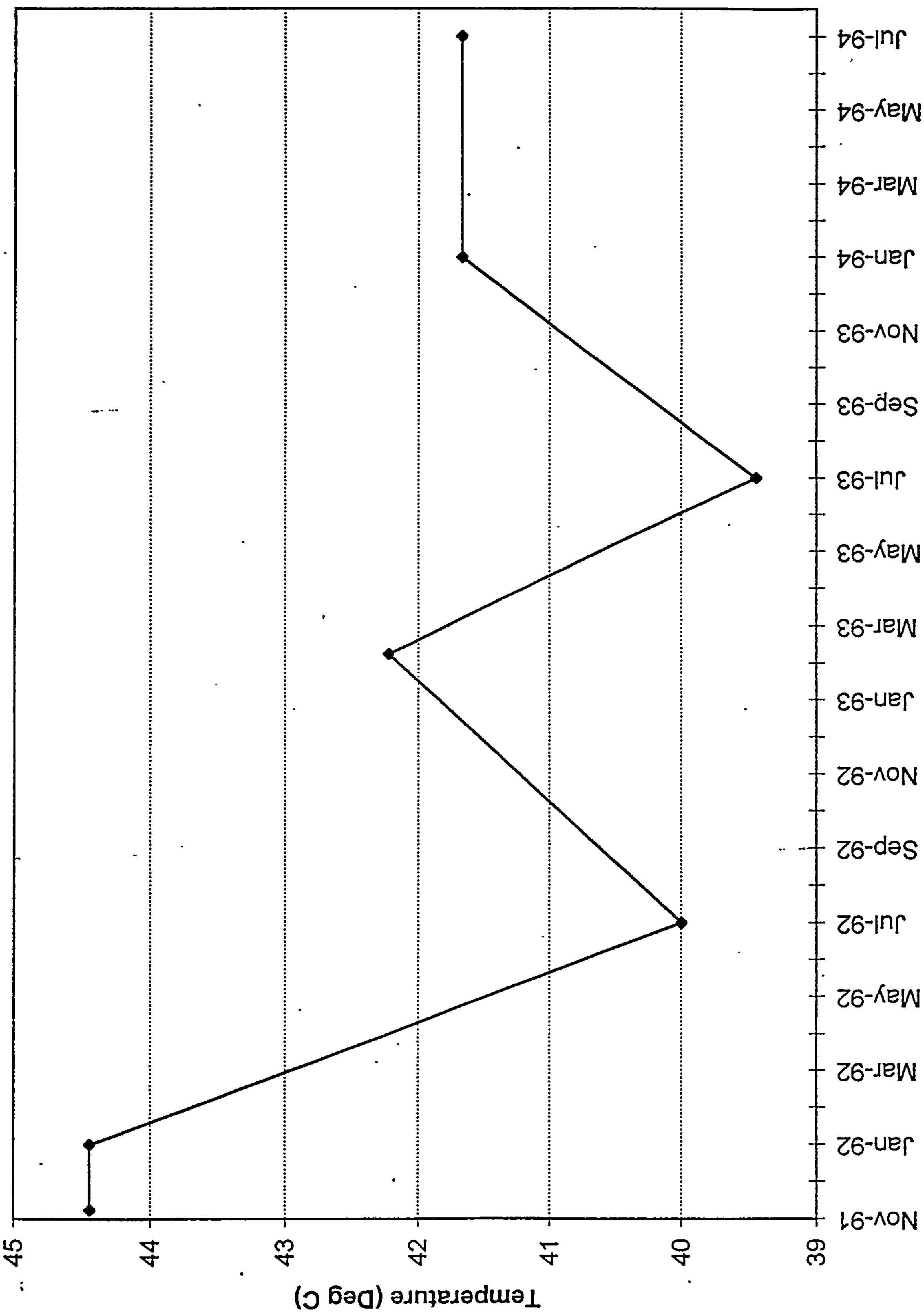
Surface level readings are currently being taken quarterly. The most recent manual tape reading was 2.85 m (112.25 inches) taken in July, 1994 (Rios, 1994). As is expected from an interim stabilized out-of-service tank, the waste level in Tank 241-S-104 has remained very consistent for several years.

2.5.2 Internal Tank Temperatures

To measure local tank temperatures, a probe with 14 thermocouples assembled in a pipe (called a thermocouple tree) is inserted into Tank 241-S-104. The thermocouple tree monitors the waste temperatures at various levels in the tank. Thirteen of the 14 thermocouples on the thermocouple tree are currently in service.

Temperature readings for Tank 241-S-104 since 1991 are plotted in Figure 2-5. Each plotted temperature is the highest of the readings recorded by the thermocouples on the thermocouple tree. The highest temperatures in the tank appear to be 1.5 - 2.3 m (60 - 90 inches) from the bottom. There were no temperature readings available before 1991. This is likely because either no temperature readings were taken, or temperature data sheets were misplaced and thus not available when the database was later compiled. Temperatures are taken biannually, and the last available temperature reading for Tank 241-S-104 was 41.7°C (107°F) taken on July 2, 1994. Figure 2-5 illustrates that temperatures have been stable since 1991, ranging between 39°C and 45°C.

Figure 2-5. Tank 241-S-104 Historical Temperature Data.



3.0 TANK SAMPLING OVERVIEW

The sampling of Tank 241-S-104 was conducted as part of an overall plan to characterize the wastes in all of the underground storage tanks on the Hanford Site. The results of these analyses will provide support for Tank Farm Operations, the various other safety programs, design of retrieval, pretreatment, and disposal systems, and fulfillment of milestones contained in the Tri-Party Agreement (Bell, 1994).

3.1 DESCRIPTION OF SAMPLING EVENT

Samples were collected by push mode core sampling on July 29 and 30, 1992 from riser 3 (Core 42), July 31 from riser 7 (Core 43), and August 2 from riser 2 (Core 44). Each core contained 6 segments. An additional segment, 6R, was taken for Core 42. For a diagram of riser location, refer to the executive summary of this document. Table 3-1 shows a list of tank farm and sample numbers with the date of sampling and location. Tables 3-2 and 3-3 show the Westinghouse Hanford Company's 222-S Laboratory and Pacific Northwest Laboratory sample numbers corresponding to the various composite and segment sample numbers that are used in Appendix A. In Table 3-2, the heading "% Water" is included because the samples were used exclusively for the % water determination. Whereas most other physical analyses were performed prior to homogenization, % water was determined after homogenization and prior to separation of the sample into the solid and liquid fractions in preparation for performing the metal, ion, and radionuclide analyses.

The core samples from Tank 241-S-104 were obtained using a core sampling truck that has sampling equipment mounted on a rotating platform. A stainless steel sampler was used to obtain a 48 cm (19 inch) long and 2.5 cm (1 inch) diameter core of waste (maximum volume of 187 milliliters). When the segment was captured within the sampler, it was sealed in a stainless steel liner within a shipping cask to prevent sample liquid from being lost.

Each sampler segment was remotely removed from the drill string and sealed within a stainless steel liner, and then placed inside a lead shielded shipping cask. The segment number was recorded and the casks were then transported to the 222-S Laboratory. All the segments were received by the laboratory on August 7, 1992. A chain of custody form was filled out for each segment.

The samples were extruded at the 222-S Laboratory between August 11 and September 11, 1992 in preparation for inorganic and radiochemical analyses.

Twenty-seven composite and segment samples were shipped to the Pacific Northwest Laboratory. The samples received included sub-samples of the composites, segments from the three cores, a field blank, and a 222-S Hot-Cell blank.

For a further description of core sampling procedures, see the *Tank Characterization Reference Guide* (De Lorenzo et al., 1994).

Table 3-1. Tank 241-S-104 Sample Numbers and Locations.

Core	Riser	Segment	Tank Farm Sample Number	Shipping Sample Number	Cask	Date Sampled
42	3	1	92-033	S92-018	1001C	7-29-92
42	3	2	92-034	S92-018	C1053	7-29-92
42	3	3	92-035	S92-018	C1017	7-29-92
42	3	4	92-036	S92-019	1012C	7-29-92
42	3	5	92-037	S92-019	C1042	7-29-92
42	3	6	92-038	S92-019	1003C	7-30-92
42	3	6R	92-038R	S92-020	C1046	7-30-92
43	7	1	92-039	S92-016	C1047	7-31-92
43	7	2	92-040	S92-016	C1033	7-31-92
43	7	3	92-041	S92-016	C1049	7-31-92
43	7	4	92-042	S92-017	1009C	7-31-92
43	7	5	92-043	S92-017	C1024	7-31-92
43	7	6	92-044	S92-017	C1032	7-31-92
44	2	1	92-045	S92-013	C1019	8-02-92
44	2	2	92-046	S92-013	C1027	8-02-92
44	2	3	92-047	S92-013	C1025	8-02-92
44	2	4	92-048	S92-014	1013C	8-02-92
44	2	5	92-049	S92-014	1011C	8-02-92
44	2	6	92-050	S92-014	C1030	8-02-92
Water Samples				S92-015	1005C	

Table 3-2. Tank 241-S-104 Composite and Liquid Tracking Numbers from the 222-S Laboratory.

	Solid	Liquid	%Water
Core 42 Composite 1	F2171	F2247	F2199
Core 42 Composite 2	F2172		F2201
Core 43 Composite 1	F2175	F2249	F2203
Core 43 Composite 2	F2176		F2205
Core 44 Composite 1	F2177	F2248	
Core 44 Composite 2	F2178		F2210

Table 3-3. Tank 241-S-104 Sample Numbers from Pacific Northwest Laboratory.

Core 42 Segment 3	93-01073
Core 42 Segment 1	93-01071
Core 42 Segment 5	93-01074
Core 43 Segment 2	93-01751
Core 43 Segment 1	93-01750
Core 43 Segment 3	93-01068
Core 43 Segment 5	93-01069
Core 43 Segment 4	93-01752
Core 44 Segment 5	93-01064
Core 44 Segment 3	93-01065
Core 44 Segment 2	93-01066
Core 44 Segment 1	93-01067
Core 44 Segment 6	93-01815
Core 42 Composite 1	93-01076
Core 43 Composite 1	93-01757
Core 43 Composite 2	93-01758
Core 44 Composite 1	93-01760
Core 44 Composite 2	93-01759
Hot Cell Blank	93-1077 ml
Field Blank	93-1078 ml

3.2 REQUESTED ANALYSES

The requested analytes from the 222-S Laboratory are located in Table 3-4. Since not enough sample was available for a full characterization, each type of analysis was prioritized, and the sample was analyzed until there was no longer enough sample left for further work. From the Pacific Northwest Laboratory, the requested analyses were volatile organic analysis, rheology, Pu and U isotopic, extractable halides, and semi-volatile analysis. These samples and the requested analyses are as follows (Kocher, 1993).

Volatile organic analysis:
Core 42, segments 1, 3, 5.
Core 43, segments 1, 2, 3, 4, 5, 6.
Core 44, segments 1, 2, 3, 4, 5, 6.

Semi-volatile organic analysis and Extractable organic halides:
Core 42, composites 1, 2.
Core 43, composites 1, 2.
Core 44, composites 1, 2.

Pu and U isotopic:	Core 42, composites 1, 2 and segment 6R. Core 43, composites 1, 2 and segment 6R. Core 44, composites 1, 2 and segment 6R.
Volatile and semi-volatile organic analyses:	Hot cell blank. Field blank.
Rheology & Physical:	Core 42, segments 2, 4.

Table 3-4. Tank 241-S-104 Samples and Requested Analytes.

Laboratory Sample Numbers	Requested Analytes
F2247, F2249, F2248, F2199, F2201, F2203, F22-5, F2210	Al, Sb, As, Ba, Be, Bi, B, Cd, Ca, Ce, Cr, Co, Cu, Fe, La, Pb, Mg, Mn, Ni, P, K, Se, Si, Ag, Na, Sr, S, Sn, Ti, Zn, Zr, NH_3, CO_3^{2-}, Cl^- CN^-, F^-, NO_3^-, NO_2^-, PO_4^{3-}, SO_4^{2-}, ^{241}Am, ^{137}Cs, ^{60}Co, ^{154}Eu, ^{155}Eu, $^{239/240}Pu$, ^{79}Se, ^{90}Sr, Total alpha, Total beta, %Water, pH, TGA, TOC
F2171, F2172, F2175, F2176, F2177, F2178	Al, Sb, As, Ba, Be, Bi, B, Cd, Ca, Ce, Cr, Co, Cu, Fe, La, Pb, Mg, Mn, Hg, Ni, P, K, Se, Si, Ag, Na, Sr, S, Sn, Ti, U, Zn, Zr, NH_3, CO_3^{2-}, Cl^- CN^-, F^-, NO_3^-, NO_2^-, PO_4^{3-}, SO_4^{2-}, ^{241}Am, ^{14}C, ^{137}Cs, ^{60}Co, ^{154}Eu, ^{155}Eu, ^{129}I, ^{237}Np, ^{238}Pu, $^{239/240}Pu$, ^{79}Se, ^{90}Sr, ^{99}Tc, ^{3}H, Total alpha, Total beta, pH, TGA, TOC

4.0 SAMPLE HANDLING AND ANALYTICAL SCHEME

4.1 WASTE DESCRIPTION

The samples obtained from core sampling activities in Tank 241-S-104 were a mixture of air, liquids, and solids. After extrusion from the sampler, photographs were taken of the sample with appropriate jar numbers and color comparator chart posed in the same photograph. Visual characteristics of extruded samples were recorded in the appropriate log book, paying careful attention to sample volume, liquid/solid ratio, color, consistency, and homogeneity. The following is a description of the contents of each core segment (Kocher, 1993). In order to maintain consistency in reporting observations that are by nature subjective, the following is taken nearly verbatim from the laboratory narrative.

Core 42

Segment 1: Sample recovery was about 75% (214.13 g), including 23.99 g of liquids.

Segment 2: Sample recovery was 100% (253.85 g) with no drainable liquids. The consistency of the sample was like wet mud, gray in color, and homogeneous.

Segment 3: The sampler valve was partially open. Approximately 100 g of tank waste adhered to the outside of the sampler and inside the sleeve. The waste was washed out of the sleeve with Q-water. A total of 223.96 g of solids were recovered from the sample. There were no drainable liquids.

Segment 4: The sampler was completely full of thick, gray solids (274.45 g). There were no drainable liquids.

Segment 5: Sample recovery was 60% (197.86 g) with no drainable liquids. The segment was lighter in color on the bottom and darker and "liquidy" on the top. Except for a gradual increase in normal paraffin hydrocarbon concentration from bottom to top, the segment was homogeneous. The segment was very dry and the volatile organic analysis sample was difficult to acquire without airspace.

Segment 6: The sampler valve was left open. The sample was 1/3 full of light gray solids (96.95 g). There were no drainable liquids. After sampling for weight percent water, segment 6 was blended with 6R (below).

Segment 6R: Sampler recovery was about 10% (60.07 g), with no drainable liquids. The solids were a light gray, very thick and only slightly moist. The waste was homogeneous though with more normal paraffin hydrocarbon at the top of the segment. Approximately 100 milliliters of liner liquid that appeared to be normal paraffin hydrocarbon was collected and discarded.

Core 43

Segment 1: Sample recovery was 75% (187.25 g) and contained about 30 milliliters of drainable liquids (32.93 g). Approximately 25 g of solids were at the very surface followed by approximately 50 milliliters of liquid. After this, there were solids to the top of the sample. Solids were liquidy, especially in the middle. The solids appeared homogeneous throughout. A differential scanning calorimeter/thermogravimetric analysis was taken from the solids at the top. The solids possessed the consistency of butter and were gray-brown in color.

Segment 2: Sample recovery was 100% (266.578 g), with no drainable liquids. The waste was gray, thicker at the bottom than at the top, appeared to be completely homogeneous, and possessed the consistency of wet mud. Gas bubbles accounted for about 2 % of the total volume.

Segment 3: The valve was left halfway open. Sample recovery was 100% (248.03 g) with no drainable liquids. Approximately 50 g of solid material escaped out of the sampler before the extruder tray was put into place. The sample was scraped off the top of the extruder table and placed in jar F-2049. Approximately 150 g of solids were washed out of the sampler sleeve. The sample was homogeneous and gray, with a mud-like consistency.

Segment 4: Sample recovery was 100% (287.28 g), with no drainable liquids. The waste was very thick - a consistency like plaster of paris. Solids were completely homogeneous and dark gray in color.

Segment 5: Sample recovery was 80% (276.83 g), with no drainable liquids. The segment material was thicker at the bottom and gradually got thinner toward the top. The differential scanning calorimetry and thermogravimetric analysis samples were taken from both the bottom and the top. The volatile organic analysis sample contained material from the bottom and the top. The sample was light gray at the bottom and dark gray at the top.

Segment 6: Sample recovery was about 33% (198.28 g), with no drainable liquids. The segment contained gray, homogeneous solids, with the consistency of setting plaster of paris.

Core 44

Segment 1: The sampler contained 50% solids (203.27 g) and 50% liquids (76.87 g). The sample consistency was much like wet mud but viscous enough to retain the cylindrical shape of the sampler. The solids appeared completely homogeneous and brown/gray in color. There was some different, crusty material near the top of the segment. This material was placed in vial F-2033.

Segment 2: Sample recovery was 100% (267.71 g) and contained no drainable liquids. The solids were homogeneous, grayish/brown, wet, and possessed the consistency of wet mud.

Segment 3: Sample recovery was 100% (293.40 g) with no drainable liquids. The solids were completely homogeneous except for the fact that the percentage of interstitial liquid was greater at the top end than at the bottom end - approximately 10% at the bottom and 40% at the top with an even and gradual increase in water from bottom to top. The color of the solids appeared dark gray and the consistency was dependent upon the percent water content present but generally was like wet mud.

Segment 4: Sample recovery was 100% (265.22 g) with no drainable liquids. The segment possessed about 10% interstitial liquid. Sample was very thick and completely homogeneous and possessed the consistency of modeling clay.

Segment 5: Sample recovery was about 33% (176.58 g) and contained no drainable liquids. The sample was homogeneous, gray, and very thick, like modeling clay.

Segment 6: Sample recovery was about 50% (172.22 g) with no drainable liquids. Solids appeared to contain about 12% moisture. The material was light brown/tan, crackly and rigid like plaster of Paris, but not as adhesive. There were light and dark areas on the surface of the solids. While the light and dark areas were not very pronounced, the solids were not perfectly homogeneous. There was a 9 inch void at the bottom of the sampler.

4.2 HOLD TIME CONSIDERATIONS

For a description of hold time considerations see the *Tank Characterization Reference Guide* (De Lorenzo et al., 1994).

4.3 SAMPLE PREPARATION

When a sample contained more than 25 milliliters of drainable liquid, the liquid was analyzed separately from the solids. When the volume of the liquid was less than 25 milliliters, a determination was made whether the liquid sample was actually normal paraffin hydrocarbon. When it was found to be normal paraffin hydrocarbon, it was drained off. When the quantity of liquid is not normal paraffin hydrocarbon, it was retained with the sample for eventual homogenization. For a further discussion of sample preparation procedures, see the *Tank Characterization Reference Guide* (De Lorenzo et al., 1994).

4.4 ANALYTICAL METHODS

This section lists the analytes and the respective analytical procedures that were used to characterize the waste in Tank 241-S-104. Procedures for physical, and rheological analyses are listed in Table 4-1. Procedures for inorganic and radiochemical analyses are listed in Table 4-2. Procedures for organic analyses are listed in Table 4-3. Two composites from each core were analyzed in accordance with the complete baseline case core composite scenario detailed in Winters et al. (1990) and as amended by Hill (1991). Several of the analytical tests performed on the composites were also done on the segments, but only for those analytes of importance to a program. Since the drainable liquids obtained were not enough to perform all the analyses requested, only highest priority analyses were performed and no duplicate analyses were run on the liquid composite.

Table 4-1. Analytical Methods for Physical and Rheological Tests.

Analyte	Procedure
Shear Strength	PNL-ALO-501
Shear Stress/Shear Rate	PNL-ALO-501/502
Wt. % Solids	PNL-ALO-504
Particle Size	T044-A-01712F
TGA	LA-560-112
DSC	LA-14-113
Specific Gravity	LA-510-112
% Water	LA-564-101
Settling Velocity	PNL-ALO-501
Settling Behavior	PNL-ALO-501

Table 4-2. Analytical Methods For Chemical And Radiochemical Analyses.

Analyte	Method	Procedure
F^-, Cl^-, NO_2^-, NO_3^-, PO_4^{3-}, SO_4^{2-}	Ion Chromatography	LA-533-105
NO_2^-	Spectrometry	LA-645-001
NH_3	Kjeldahl[1]	LA-634-102
OH^-	Direct	LA-212-103
CN^-	Distillation/Spectrometric	LA-695-102
TIC	Direct	LA-344-105
As, Se	GHAA[2]	LA-355-131
Hg	CVAA[3]	LA-325-102
Total Metals	Inductively Coupled Plasma	LA-505-151
U	Laser Fluorimetry	LA-925-106
^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu, ^{241}Am	Gamma Energy Analysis	LA-548-121
^{238}Pu, $^{239/240}Pu$, ^{241}Am	Alpha Spectrometry	LA-503-156
^{14}C ^{3}H ^{79}Se ^{99}Tc	Liquid Scintillation	LA-348-104 LA-218-113 LA-365-132 LA-438-101
^{90}Sr	separation/Beta[4]	LA-220-101
^{129}I	Gamma Energy Analysis	LA-378-101
^{237}Np	Alpha Proportional Counting	LA-933-141
^{244}Cm	separation/Alpha/AEA[5]	LA-508-051
Specific Gravity	Direct	
Total Alpha	Proportional Counting	LA-508-101
CO_3^{-2}/C	Total inorganic carbon	LA-622-102
TOC	Total organic carbon	LA-344-105
Pu Isotopic	Fusion/mass spectrometry	PNL-ALO-423 PNL-MA-597
U Isotopic	Mass spectrometry	PNL-ALO-445
Total Beta	Proportional Counting	LA-508-101

[1]Ammonia analysis by caustic addition, distillation, and capture in a boric acid solution
[2]Gaseous Hydride Atomic Absorption Spectrometry
[3]Cold Vapor Atomic Absorption Spectrometry
[4]Chemical separation along with Total Beta Proportional Counting
[5]Chemical separation along with Alpha Proportional Counting and Alpha Energy Analysis.

Table 4-3. Analytical Methods for Organic Analyses.

Analysis	Method	Procedure
Volatile Organic	Gas Chromatography/Mass Spectrometry	PNL-ALO-335
Semi-Volatile Organic	Gas Chromatography/Mass Spectrometry	PNL-ALO-345
Extractable Organic Halides	Microcoulometric Titration	PNL-ALO-320.2
Total Organic Halides	Microcoulometric Titration	PNL-ALO-321

4.4.1 Physical and Rheological Tests

Physical and rheological tests were conducted at the Pacific Northwest Laboratory on segments 2 and 4 of core 42 of Tank 241-S-104 core samples. The rheological testing on these samples included shear strength and shear stress, both as a function of shear rate. Physical properties measured settling behavior, density, wt. % solids and wt.% dissolved solids. Settling behavior measurements included both settling rates, vol.% settled solids and both wt% and vol% centrifuged solids. The settling velocity and vol% settled solids measurements were performed on 1:1 and 3:1 water:sample dilutions.

Physical tests completed at 222-S Laboratory included particle size analysis, thermogravimetric analysis, differential scanning calorimetry, specific gravity, and %water analyses. Table 4-1 lists the analytical methods used for physical and rheological properties.

4.4.2 Chemical and Radionuclide Constituent Analysis

Chemical and radionuclide analyses were performed at the 222-S and at the Pacific Northwest Laboratories. Duplicate analyses were performed on every sample. Table 4-2 lists the analytical methods used.

Quality control procedures were conducted in accordance with the requirements listed in Bell (1994). In summary, those requirements are:

- one laboratory control standard per analytical batch,
- one blank per batch,
- one matrix spike per core per matrix
- 100% duplicates on all homogenization test samples and core composite samples,
- one duplicate per analytical batch for direct segment samples,
- a duplicate to verify each detected exotherm for differential scanning calorimetry analysis.

Exceptions are allowed for specific analytes or procedures:

- % water is always run in duplicate
- ^{90}Sr, ^{79}Se, ^{99}Tc, ^{129}I, Pu, and Am have a tracer or carrier added to each sample, no additional matrix spikes are required,
- Gamma energy analysis and pH do not require a spike,
- a matrix spike for Np is requested on each sample.

4.4.3 Organic Constituent Analysis

All organic analyses of the samples from Tank 241-S-104 were performed at the Pacific Northwest Laboratory. A U.S. Environmental Protection Agency Contract Laboratory Procedure type organics speciation analysis was performed on the core composites. No levels of organic compounds above the Contract Required Quantitation Limit were found in any of the samples, and they were not expected to contribute to the sample matrix. The organic analyses performed were volatile and semi-volatile organic analyses, total organic halides, and extractable organic halides. Duplicates were performed for all of these analyses. Table 4-3 lists the analyses and procedure numbers, and Table 3-3 lists the core and segment numbers used for the organic analyses.

4.5 MODULE SPECIFIC ANALYSES

The characterization program for Tank 241-S-104 was intended to satisfy criteria set by the Tank Waste Remediation System (TWRS). The TWRS sample characterization objectives are to provide adequate description of physical, chemical, and radiological properties of Hanford Site tank wastes to support resolution of Unreviewed Safety Questions, other safety issues surrounding the Watch List tanks, and the design of retrieval, pretreatment, and final disposal systems (Bell, 1994). For this specific tank, analyses to provide sufficient information to confidently determine whether constituent concentrations are within safe operating limits were performed.

5.0 ANALYTICAL RESULTS AND WASTE INVENTORY

The chemical, radiochemical, and physical results associated with Tank 241-S-104 are presented within this document as indicated in Table 5-1. The samples from which these results were derived were collected from 7-29-92 through 8-2-1992. This sampling event was the most recent regarding Tank 241-S-104 and reflects the most accurate characterization of the tank waste available at the present time.

Table 5-1. Analytical Data Presentation Tables.

Analysis	Tabulated Results
Metals	Table A-1
Anions	Table A-2
Radionuclides	Table A-3
Physical Properties and Miscellaneous Chemical Data	Table A-4
Volatile Organics	Table A-5
Semivolatile Organics	Table A-6
Tank Characterization Report Results for the Liquid and Solid Phases of 241-S-104	Table 5-9

In cases where a duplicate analysis was performed on a sample, the data presented in the Appendix A tables were obtained by calculating an average concentration value from the initial and duplicate results. If an analyte was detected by the original but not by the duplicate sample evaluation, or vise-versa, only the single positive result was reported. When both sample runs failed to detect an analyte, the detection limit preceded by a less than (<) sign was recorded as the sample result.

The Appendix A tables treated the liquid and solid laboratory sample data separately. Where applicable, the solid data was further divided according to preparation procedure. A representative tank concentration for each analyte was determined for both matrices and reported in Table 5-9. Most of these values were derived according to a statistical model (Jensen, 1994) and were accompanied by a standard deviation of the mean estimate. When more than one preparation procedure was utilized to evaluate an analyte, the representative tank concentration was obtained from the procedure yielding the highest values. When the statistical model could not be applied due to insufficient data, representative tank concentrations were obtained by calculating simple averages. If all available sample analyses failed to detect a particular analyte, the tank concentration of the analyte was reported to be less than the highest recorded detection limit. Detection limit values were not utilized in any of the calculations from which representative tank concentration values and standard deviation estimates were derived.

The projected tank inventory value for the liquid in Tank 241-S-104 was calculated by multiplying the mean analyte concentration by the volume of drainable liquid in the tank at the time of sampling, 1.06E+05 liters. The amount of each constituent present in the 1.11E+06 liters of solid phase waste was also estimated in the Appendix A tables. The appropriate conversion factors were included in the calculations to obtain the reported units. The supernatant liquid was not included in the tank inventory estimate due to its small (0.34%) contribution to the waste volume. In addition, analytical results were not reported for supernate.

5.1 CHEMICAL ANALYSES

5.1.1 Elemental Constituents

Sodium was the major metal constituent in the liquid phase of the waste and exhibited a concentration of 1.55E+05 μg/g; aluminum and chromium concentrations exceeded 1000 μg/g and were relatively high compared to other metals. Although analyzed, the following elements were not detected in the liquid portion of the tank waste: As, Ba, Bi, Ce, Ni, Se, Ag, Ti, and Zr.

With respect to the solid phase of Tank 241-S-104, Al, Ca, Cr, Fe, Mn, Ni, Si, Na, and U were all detected in concentrations exceeding 1000 μg/g; however, of these, sodium and aluminum were by far the most abundant. Of the evaluated analytes, only Be, Bi, La, and Hg were not detected in the solid samples. This is consistent with what is known about REDOX process chemistry and the transfer activity of this tank. Historical estimates for Al, Cr, Fe, and Na (Brevick, 1994) were compared in Table 5-2 to the analytical results acquired from the sample analyses of Tank 241-S-104. Since the historical estimates pertain to the entire contents of the tank without regard to separate liquid and solid phases, the analytical results used for comparison were obtained by adding the liquid and solid total tank inventory values.

Table 5-2. Comparison of Analytical and Historical Data for Elemental Constituents of Tank 241-S-104.

Element	Estimates From Laboratory Results (kg)	Historical Estimate (kg)	Relative Percent Difference[1]
Al	192,000	144,000	29%
Cr	3,850	21,600	-139%
Fe	2,820	4,310	-38%
Na	198,000	55,900	121%

[1]RPD = Difference between Laboratory Results and Historical Estimates divided by their average.

5.1.2 Anions

The most abundant anion in both the liquid and solid phases of the waste was reported to be nitrate. However, judging from the liquid phase hydroxide concentration and the historical data, it is reasonable to assume that the solid phase contains a substantial amount of hydroxide salts, and possibly oxides as well. Ammonia was not present in the tank above detection limits. Historical estimates for nitrate, nitrite, carbonate, and sulfate (Brevick, 1994) were compared in Table 5-3 to the analytical results acquired from the sample analyses of Tank 241-S-104. A historically derived hydroxide value was available, but since hydroxide in the form of precipitated salts could not be accounted for by the laboratory analyses, a comparison would be meaningless. As previously mentioned, the historical estimates pertain to the entire contents of the tank without regard to separate liquid and solid phases, and the analytical results used for comparison were obtained by adding the liquid and solid total tank inventory values.

Table 5-3. Comparison of Analytical and Historical Results for 241-S-104 Anions.

Analyte	Estimates From Laboratory Results (kg)	Historical Estimate (kg)	Relative Percent Difference[1]
Carbonate	7,200	4,750	41%
Nitrate	356,000	101,000	112%
Nitrite	48,400	8470	140%
Sulfate (IC)	6,440	952	148%

[1]RPD = Difference between Laboratory Results and Historical Estimates divided by their average.

After calculating theoretical values for phosphate and sulfate from both the liquid and solid phosphorous and sulfur data derived from Inductively Coupled Plasma (ICP) analyses, the results were compared to the corresponding data obtained by ion chromatography (IC). The comparison is displayed in Table 5-4. Except in the case involving liquid phase phosphate results, ion chromatography revealed higher sulfate and phosphate concentrations than the ICP analyses. The phosphate and sulfate anions apparently exist in a soluble form and in small concentrations.

Table 5-4. Comparison of ICP and IC Results for Phosphate and Sulfate.

Analyte	Liquid Phase		Solid Phase	
	IC Result (μg/g)	ICP Result (μg/g)	IC Result (μg/g)	ICP Result (μg/g)
Phosphate	< 0.781	19.2	1,450	286
Sulfate	18,800	1,230	2,270	1,416

5.2 RADIOLOGICAL DETERMINATIONS

5.2.1 Analytical and Historical Comparison

The major radioactive constituents in the waste were ^{137}Cs and ^{90}Sr; both had bulk tank inventories of over 100,000 Ci. Also detected in the tank waste were ^{241}Am, ^{14}C, $^{239/240}Pu$, ^{79}Se, ^{99}Tc, ^{3}H, and isotopic U. Historical estimates were available only for isotopic Pu, Cs, and Sr. The historical constituent values given in Agnew (1994b), and included in this report in Table 2-2, were determined the best historical estimates and have been used to draw comparisons with the recent analytical data. Since only one value is given in Agnew, it is assumed that this value was the total tank inventory. To derive a total tank value based on the recent analytical data, the liquid and solid inventories were added together. This data comparison is presented in Table 5-5. As can be seen from the table, the historical and recent analytical results agree moderately for both Cs and Sr, while there is poor agreement for Pu.

Table 5-5. Comparison of Analytical and Historical Isotopic Results.

Analyte	Estimates From Laboratory Results (Ci)	Historical Estimate (Ci)	Relative Percent Difference[1]
^{137}Cs	1.02E+05	0.531E+05	63.1%
Pu	462	12.0	190%
^{90}Sr	5.08E+05	7.73E+05	-41.4%

[1]RPD = Difference between Laboratory Results and Historical Estimates divided by their average.

5.2.2 Comparison of Total Alpha and Beta Activities with Gross Alpha and Beta Activities

A comparison was made between the sums of the gross beta and gross alpha activities with the sums of the activities of the individual beta and alpha emitters. This was done as a check on the accuracy of the two analyses. A close agreement indicates that both analyses were probably representative of the tank contents. Conversely, poor agreement indicates that at least one of the results were not representative of the tank contents. The activities of the individual beta emitters were summed according to the following equation:

$$\text{Total beta} = 1.42(2 * {}^{90}Sr) + 1.51({}^{137}Cs)$$

(The coefficients 1.42 and 1.51 account for the detector efficiencies calibrated to ^{60}Co.)

The activities of the individual alpha emitters were summed according to:

$$\text{Total alpha} = {}^{239/240}Pu + {}^{241}Am$$

The comparisons are given in Tables 5-5a and 5-5b. The values for the individual cores in Table 5-5a are the means of the solid sample and duplicate solid sample results. The values for the 'liquid' column in Table 5-5a are the means of all liquid sample results and were taken from Table 5-9. As can be seen in Table 5-5a, the individual beta and gross beta activities agree closely with the exception of those for the Core 42 solid samples. It is possible that the discrepancy was caused by a misplaced decimal point.

Table 5-5a. Tank 241-S-104 Comparison of Gross Beta Activities with the Total of the Individual Activities.

Analyte	Core 42 (μci/g)	Core 43 (μCi/g)	Core 44 (μCi/g)	Liquid (μCi/g)
^{90}Sr	306	316	308	0.0052
^{137}Cs	64.5	58.7	63.7	80.9
Total Beta	966	985	970	122
Gross Beta	91.7	954	880	127
Relative Percent Difference[1]	165%	3.2%	9.7%	-3.8%

[1]Relative Percent Difference = Difference between total activities and gross activities divided by their average

Table 5-5b. Tank 241-S-104 Comparison of Gross Alpha Activities with the Total of the Individual Activities.

Analyte	Solid (μci/g)	Relative Percent Difference[1]	Liquid (μCi/g)	Relative Percent Difference[1]
$^{239/240}Pu$	0.282	-42.7%	1.07E-04	-51.7%
^{241}Am	0.118		0.0859	
Total Alpha	0.400		0.0860	
Gross Alpha	0.617		0.146	

[1]Relative Percent Difference = Difference between total activities and gross activities divided by their average

The values in Table 5-5b for the solids are the means of the results from the preferred digestion. The liquid values are the means of all liquid sample results. The data are also presented in Table 5-9. The individual alpha activities and the gross alpha sample results do not agree closely, but do not disagree enough to indicate a serious problem with the analyses.

5.3 ORGANIC CONSTITUENTS

None of the target analytes associated with the volatile and semi-volatile organic analyses were detected, as indicated by Tables A-5 and A-6, during the evaluation of samples from Tank 241-S-104. Because of their volatile nature and relatively small contribution to the waste as indicated by the historical records, the appearance of these compounds was not expected. The appearance of several normal paraffin hydrocarbons was reported by the laboratory as tentatively identified compounds, but these constituents may be the result of hydrostatic fluid contamination from the sampling process. Several silicone derivatives were also detected during the sample analyses. These compounds were most likely column degradation products, caused by the high pH of the sample matrix.

5.4 PHYSICAL MEASUREMENTS

The physical measurements were primarily performed on core 42, segments 2 and 4. Results of the physical measurements are presented in Table 5-6. Particle size analysis was administered on cores 42, 43 and 44. Some physical properties were not measured on segment 4 because an accurate volume could not be measured on the centrifuged sample and no centrifuged supernate was obtained.

Table 5-6. Tank 241-S-104, Core 42 Physical Measurements (Kocher, 1993).

Physical Property		Segment 2	Segment 4
Density (g/mL)	Sample	1.64	N/A
	Centrifuged Supernate	1.28	N/A
	Centrifuged Solid	1.71	N/A
Settled Solids	Vol %	100 (no dilution)	100 (no dilution)
		88 (1:1 dilution)	100 (1:1 dilution)
		60 (3:1 dilution)	80 (3:1 dilution)
Centrifuged Solids	wt% Solids	62.3	67.7
	wt% Undissolved Solids	55.4	N/A

N/A = Not Applicable

5.4.1 Density and Percent Solids

The density measurement was performed on segment 2 only. The overall sample density was 1.64 g/mL. The centrifuged supernate density was determined to be 1.28 g/mL and the centrifuged solid density was 1.71 g/mL.

The volume percent settled solids measured on the as received segments did not exhibit settling over a 3 day period. Two dilutions (1:1 and 3:1 water to sample) were prepared for each of the segments. No settling was observed for the 1:1 dilution of segment 4. The 3:1 dilution of segment 4 settled to a final volume percent of 80. Segment 2 dilutions of 1:1 and 3:1 reached a final volume percent settled solids of 88 and 60, respectively.

Weight percent of solids and undissolved solids was performed on the centrifuged samples. For wt% solids segment 2 was 62.3% and segment 4 was 67.7%. Only segment 2 was measured for Wt% undissolved solids at 55.4%.

5.4.2 Particle Size

Particle size analysis was performed using a Particle Size Analyzer. The acquisition range was 0.5 to 150 microns. Table 5-7 summarizes the results of the analysis. The analysis reveals that 92% of the particles are between 0.5 to 2.0 microns in diameter and 83% of the particle volume is occupied by particles of size 2 to 150 microns.

Table 5-7. Summary of Particle Size Distribution for Tank 241-S-104.

Particle Size Intervals (μm)	Number Distribution Range	Average Number Distribution %	Volume Distribution Range	Average Volume Distribution %
0.5-1.0	52.2-86	72.9	0-11.2	3.53
1-2	11.2-27.6	18.77	0-12.2	6.24
2-5	0.8-10.3	5.83	2.2-42.4	23.14
5-10	0.6-5.4	2.06	1.4-33.6	15.23
10-20	2-3	0.38	1.4-32.6	15.23
20-50	0	0	5-30	15.09
50-150	0	0	0-80	14.58

5.4.3 Rheology

Shear stress as a function of shear rate was measured for 1:1, 1.33:1, and 3:1 dilutions of samples from core 42, segments 2 and 4. All dilutions for both segments exhibited yield psuedoplastic behavior, and their flow properties are presented in Table 5-8. Table 5-8a shows the power law curve fit parameters.

Table 5-8. Flow Properties. (2 sheets)

					Critical		
Segment	Dilution Water: Sample	Temp (°C)	Run	Pipe Diameter cm (in)	Velocity M/sec (ft/sec)	Flow Rate L/min (gal/min)	Reynolds Number
		30	1	5.08 (2)	1.16 (3.8)	148 (39)	6,400
				7.62 (3)	1.04 (3.4)	295 (78)	7,600
2	1 : 1		2	5.08 (2)	1.07 (3.5)	140 (37)	7,200
				7.62 (3)	0.098 (3.2)	276 (73)	8,800
		95	3	5.08 (2)	0.88 (2.9)	114 (30)	7,900
				7.62 (3)	0.79 (2.6)	227 (60)	10,100
			4	5.08 (2)	0.85 (2.8)	110 (29)	9,300
				7.62 (3)	0.76 (2.5)	220 (58)	11,500
	1 : 1	28	5	5.08 (2)	7.19 (23.6)	935 (247)	2,800
				7.62 (3)	6.07 (19.9)	1730 (458)	3,100
			7	5.08 (2)	4.66 (15.3)	605 (160)	2,900
				7.62 (3)	4.08 (13.4)	1170 (308)	3,200
4	1.3 : 1	30	1	5.08 (2)	2.59 (8.5)	337 (89)	31,100
				7.62 (3)	2.35 (7.7)	670 (177)	40,800
			2	5.08 (2)	2.32 (7.6)	303 (80)	18,600
				7.62 (3)	2.10 (6.9)	598 (158)	24,600
			1	5.08 (2)	1.74 (5.7)	227 (60)	9,300
		95		7.62 (3)	1.55 (5.1)	447 (118)	11,900
			2	5.08 (2)	1.58 (5.2)	204 (54)	11,100
				7.62 (3)	1.43 (4.7)	405 (107)	14,100
		30	1	5.08 (2)	0.73 (2.4)	95 (25)	6,600
				7.62 (3)	0.64 (2.1)	185 (49)	8,000
2	3 : 1		2	5.08 (2)	0.70 (2.3)	91 (24)4	6,800
				7.62 (3)	0.64 (2.1)	182 (48)	8,400
		95	3	5.08 (2)	0.67 (2.2)	87 (23)	10,100
				7.62 (3)	0.61 (2.0)	174 (46)	13,300

Table 5-8. Flow Properties. (2 sheets)

Segment	Dilution Water: Sample	Temp (°C)	Run	Pipe Diameter cm (in)	Critical Velocity M/sec (ft/sec)	Critical Flow Rate L/min (gal/min)	Critical Reynolds Number
			4	5.08 (2)	0.67 (2.2)	87 (23)	10,400
				7.62 (3)	0.61 (2.0)	174 (46)	13,800
4	3 : 1	30	1	5.08 (2)	1.37 (4.5)	178 (47)	6,200
				7.62 (3)	1.25 (4.1)	356 (94)	7,400
			2	5.08 (2)	1.37 (4.5)	178 (47)	6,500
				7.62 (3)	1.25 (4.1)	356 (94)	7,700
		95	1	5.08 (2)	1.25 (4.1)	159 (42)	9,600
				7.62 (3)	1.10 (3.6)	314 (83)	12,500
			2	5.08 (2)	1.22 (4.0)	155 (41)	6,900
				7.62 (3)	1.10 (3.6)	310 (82)	8,300

Table 5-8a. Power Law Curve Fit Parameters.

Segment	Dilution Water: Sample	Temp. (°C)	Run	Yield Point (Pa)	Consistency Factor (Pa sec)	Flow Behavior index
2	1:1	30	1	3.60	4.07×10^{-2}	0.741
			2	3.45	2.39×10^{-2}	0.810
		95	3	2.42	1.01×10^{-2}	0.927
			4	2.73	1.25×10^{-2}	0.834
4	1:1	28	5	32.0	6.55×10^{-1}	0.792
			7	14.1	9.26×10^{-1}	0.649
	1.33:1	30	1	17.2	9.96×10^{-2}	0.760
			2	15.5	4.74×10^{-2}	0.842
		95	3	10.4	1.66×10^{-2}	0.933
			4	10.2	1.46×10^{-2}	0.902
2	3:1	30	1	1.26	1.45×10^{-2}	0.812
			2	1.26	1.23×10^{-2}	0.838
		95	3	1.55	4.20×10^{-3}	0.981
			4	1.59	3.78×10^{-3}	1.00
4	3:1	30	1	4.35	4.26×10^{-2}	0.762
			2	4.54	4.07×10^{-2}	0.761
		95	3	4.83	8.37×10^{-3}	0.974
			4	3.77	2.97×10^{-2}	0.779

5.5 DATA PRESENTATION

The Tank Characterization Report Results reported in Table 5-9 are the final constituent estimates for this document. The values are equal to the mean values presented in the Appendix A tables. If laboratory results were not available for an analyte, the Tank Characterization Result was derived from historical data, if possible.

Table 5-9. Tank Characterization Report Data in Single-Shell Tank 241-S-104. (4 sheets)

Analyte	Tank Characterization Report			Total Tank Inventory	
Metals	Liquid		Solid (μg/g)	Liquid (kg)	Solid (kg)
	(μg/mL)	(μg/g)			
Aluminum	12,000	9,380	1.17E+05	1,270	1.92E+05
Antimony	8.52	6.66	37.2	0.903	61.0
Arsenic	< 0.975	< 0.762	5.46	< 0.103	8.95
Barium	< 0.100	< 0.0781	33.1	< 0.0106	54.3
Beryllium	0.187	0.146	< 1.50	0.0198	< 2.46
Bismuth	< 2.30	< 1.80	< 45.7	< 0.244	< 74.9
Boron	6.54	5.11	26.6	0.693	43.6
Cadmium	0.0828	0.0647	3.66	0.00878	6.00
Calcium	3.88	3.03	4,230	0.411	6,940
Cerium	< 3.20	< 2.50	22.1	< 0.339	36.2
Cesium	---	---	---	---	---
Chromium	3,380	2,640	2,350	358	3,850
Cobalt	0.229	0.179	2.52	0.0243	4.13
Copper	0.250	0.195	54.7	0.0265	89.7
Dysprosium	---	---	---	---	---
Iron	3.78	2.95	1,720	0.401	2,820
Lanthanum	0.258	0.202	< 10.5	0.0273	< 17.2
Lead	13.1	10.2	29.6	1.39	48.5
Lithium	---	---	---	---	---
Magnesium	0.510	0.398	157	0.0541	257
Manganese	0.0395	0.0309	1,150	0.00419	1,890
Mercury	---	---	< 0.126	---	< 0.207
Molybdenum	---	---	---	---	---
Neodymium	---	---	---	---	---
Neptunium	---	---	---	---	---
Nickel	< 0.375	< 0.293	56.0	< 0.0398	91.8
Phosphorus	8.02	6.27	93.2	0.850	153
Potassium	811	634	300	86.0	492
Plutonium	---	---	---	---	---
Rhenium	---	---	---	---	---
Rhodium	---	---	---	---	---

Table 5-9. Tank Characterization Report Data in Single-Shell Tank 241-S-104. (4 sheets)

Analyte	Tank Characterization Report			Total Tank Inventory	
Metals (continued)	Liquid (μg/mL)	Liquid (μg/g)	Solid (μg/g)	Liquid (kg)	Solid (kg)
Ruthenium	---	---	---	---	---
Samarium	---	---	---	---	---
Selenium	< 3.52	< 2.75	45.7	< 0.373	74.9
Silicon	25.4	19.8	1,330	2.69	2,180
Silver	< 0.225	< 0.176	1.58	< 0.0239	2.59
Sodium	1.98E+05	1.55E+05	1.21E+05	21,000	1.98E+05
Strontium	0.0478	0.0373	424	0.00507	695
Sulfur	525	410	472	55.7	774
Tin	3.17	2.48	2.82	0.336	4.62
Tellurium	---	---	---	---	---
Thorium	---	---	---	---	---
Titanium	< 0.175	< 0.137	7.63	< 0.0186	12.5
Thallium	---	---	---	---	---
Uranium	---	---	6,690	---	11,000
Vanadium	---	---	---	---	---
Zinc	7.39	5.77	224	0.783	367
Zirconium	< 0.300	< 0.234	33.6	< 0.0318	55.1
Ions	**Liquid (μg/mL)**	**Liquid (μg/g)**	**Solid (μg/g)**	**Liquid (kg)**	**Solid (kg)**
Ammonia (NH_3)	< 40.0	< 31.3	< 9,000	< 4.24	< 14,800
Carbonate (CO_3^{2-})	1,110	867	4,140	118	6,790
Chloride (Cl^-)	6,390	4,990	3,200	677	5,250
Chromium (VI) (Cr^{+6})	---	---	---	---	---
Cyanide (CN^-)	2.69	2.10	3.70	0.285	6.07
Fluoride (F^-)	2,950	2,300	145	313	238
Hydroxide (OH^-)	44,300	34,600	---	4,700	---
Nitrate (NO_3^-)	2.69E+05	2.10E+05	1.91E+05	28,500	3.13E+05
Nitrite (NO_2^-)	38,200	29,800	25,900	4,050	42,500
Phosphate (PO_4^{3-})	< 1.00	< 0.781	<2,190	< 0.106	<3,590
Sulfate (SO_4^{2-})	24,100	18,800	2,270	2,560	3,720

Table 5-9. Tank Characterization Report Data in Single-Shell Tank 241-S-104. (4 sheets)

Analyte	Tank Characterization Report			Total Tank Inventory	
Radionuclides	**Liquid (μCi/mL)**	**Liquid (μCi/g)**	**Solid (μCi/g)**	**Liquid (Ci)**	**Solid (Ci)**
^{241}Am	< 0.110	< 0.0859	0.118	< 11.7	194
^{14}C	---	---	9.01E-04	---	1.48
^{137}Cs	80.9	63.2	62.3	8,580	1.02E+05
^{60}Co	< 0.00257	< 0.00201	< 0.0840	< 0.272	< 138
^{154}Eu	< 0.00967	< 0.00755	< 0.317	< 1.03	< 520
^{155}Eu	< 0.0470	< 0.0367	< 0.463	< 4.98	< 759
^{129}I	---	---	< 0.0334	---	< 54.8
^{237}Np	---	---	< 0.0216	---	< 35.4
^{238}Pu	---	---	< 0.0180	---	< 29.5
$^{239/240}$Pu	< 1.37E-04	< 1.07E-04	0.282	< 0.0145	462
^{79}Se	---	---	0.00130	---	2.15
^{90}Sr	0.00520	0.00406	310	0.551	5.08E+05
^{99}Tc	---	---	0.0242	---	39.7
^{3}H	---	---	0.00338	---	5.54
Uranium	---	---	2.42E-06	---	0.00397
Total Alpha	0.187	0.146	0.617	19.8	1,010
Total Beta	127	99.2	641	13,500	1.05E+06
Physical Properties					
pH	13.5	---	12.9	---	---
Percent Water	56.7%	---	34.3 %	---	---
Thermo-gravimetric Analysis	55.0%	---	42.9 %	---	---
Total Organic Carbon	598 (μg/mL)	467 (μg/g)	1,730 (μg/g)	63.4 (kg)	2,840 (kg)
Sample Density	---	---	1.64 (g/mL)	---	---
Centrifuged Supernate Density	1.28 (g/mL)	---	---	---	---
Volatile Organic			μg/g		kg
Methoxytrimethyl Silane	---	---	579	---	950
Trimethyl Silanol	---	---	772	---	1,270
Hexamethyl Disiloxane	---	---	629	---	1,030

Table 5-9. Tank Characterization Report Data in Single-Shell Tank 241-S-104. (4 sheets)

Analyte	Tank Characterization Report			Total Tank Inventory	
Semivolatile Organic			µg/g		kg
Dodecane	---	---	65.5	---	107
Tridecane	---	---	240	---	394
Tetradecane	---	---	201	---	344
Pentadecane	---	---	18.0	---	30.8

6.0 ANALYTICAL RESULTS INTERPRETATION

6.1 TANK WASTE PROFILE

The waste in Tank 241-S-104 consists of sludge which is approximately 34.3% water by weight. Additionally, the sludge is covered by approximately 1,000 gallons of supernate. Sodium, aluminum, chromium, and nitrate were the major constituents in the liquid phase of the waste. With respect to the solid phase of the waste, Al, Ca, Cr, Fe, Mn, Ni, Si, Na, and U were all detected in concentrations exceeding 1000 μg/g; however, sodium and aluminum were by far the most abundant. The most abundant anion in the solid phase of the waste was reported to be nitrate. However, judging from the liquid phase hydroxide concentration and the historical data, it is reasonable to assume that the solid contains a substantial amount of hydroxide salts. The ^{137}Cs isotope was the largest contributor to the radioactivity of the liquid waste. Activity originating from the solid phase of the waste was predominantly due to ^{90}Sr and ^{137}Cs.

6.2 WASTE SUMMARY AND CONDITIONS

6.2.1 Projected Tank Heat Load

Temperature information for Tank 241-S-104 was given in section 2.5.2. The amount of heat resulting from radioactivity in the tank was calculated in Table 6-1. Detection limits for some of the analytes were included in the calculation in order to obtain the most conservative estimate possible. The heat load for Tank 241-S-104 is 3,910 watts. The temperature of the tank generally ranges between 103 and 112°F. Since an upper temperature limit is exhibited, it may be concluded that any heat generated from radioactive sources throughout the year is slowly dissipated.

6.2.2 Regulatory Limits

For the liquid and solid phase of the sample, none of the average concentrations of the Toxicity Characteristic Leaching Procedure Metals defined in the *Code of Federal Regulations*, 40 CFR Part 261 exceeded their specified limits. However, the pH of the liquid phase at 13.5 and at 12.9 for the solid phase is above the Resource Conservation and Recovery Act pH limit of 12.5, established for corrosivity (EPA, 1990).

6.2.3 Leak Inventory Estimate

Tank 241-S-104 was designated an assumed leaker in 1968 after losing approximately 90,800 L (24,000 gallons) of waste. An estimated inventory for the constituents in this lost waste has been generated based on the 90,800 L (24,000 gallon) leak volume. To derive the inventory, only the analytical liquid data was utilized. Table 6-2 presents the estimated amount of each analyte in the leaked waste. This inventory is useful to estimate possible contamination to the environment surrounding the tank.

Table 6-1. Tank 241-S-104 Projected Heat Load.

Radionuclide	Ci	Watts
^{241}Am	194	6.36
^{137}Cs	1.02E+05	481
^{60}Co	< 138	< 2.13
^{154}Eu	< 520	< 4.70
^{155}Eu	< 759	< 0.552
^{129}I	< 54.8	< 0.0256
^{237}Np	< 35.4	< 1.02
^{238}Pu	< 29.5	< 0.962
$^{239/240}Pu$	462	14.1
^{90}Sr	5.08E+05	3,400
^{99}Tc	39.7	0.0199
Watts	**3,910**	

Table 6-2. Inventory Assumed Leaked From Tank 241-S-104.

Analyte	Amount Assumed Leaked	Analyte	Amount Assumed Leaked
Metal	**(kg)**	**Metal**	**(kg)**
Aluminum (Al)	1,090	Magnesium (Mg)	0.0464
Antimony (Sb)	0.774	Manganese (Mn)	3.59E-03
Arsenic (As)	< 0.0883	Nickel (Ni)	< 0.0341
Barium (Ba)	< 9.08E-03	Phosphorus (P)	0.728
Beryllium (Be)	0.0170	Potassium (K)	73.7
Bismuth (Bi)	< 0.209	Selenium (Se)	< 0.320
Boron (B)	0.594	Silicon (Si)	2.31
Cadmium (Cd)	7.52E-03	Silver (Ag)	< 0.0205
Calcium (Ca)	0.352	Sodium (Na)	18,00
Cerium (Ce)	< 0.291	Strontium (Sr)	4.35E-03
Chromium (Cr)	307	Sulfur (S)	47.7
Cobalt (Co)	0.0208	Tin (Sn)	0.288
Copper (Cu)	0.0227	Titanium (Ti)	< 0.0159
Iron (Fe)	0.344	Zinc (Zn)	0.671
Lanthanum (La)	0.0234	Zirconium (Zr)	< 0.0273
Lead (Pb)	1.19		
Ion	**(kg)**	**Ion**	**(kg)**
Ammonia	< 3.63	Hydroxide	4,030
Carbonate	101	Nitrate	2,440
Chloride	580	Nitrite	3,470
Cyanide	0.244	Phosphate	< 0.0908
Fluoride	268	Sulfate	2,190
Radionuclide	**(Ci)**	**Radionuclide**	**(Ci)**
^{241}Am	< 10.0	$^{239/240}$Pu	< 0.0124
^{137}Cs	7,350	^{90}Sr	0.472
^{60}Co	< 0.233	Total Alpha	17.0
^{154}Eu	< 0.883	Total Beta	11,600
^{155}Eu	< 4.27		

6.3 PROGRAM ELEMENT SPECIFIC ANALYSES

The sampling and analysis of Hanford Site waste tanks is driven by the need to satisfy the characterization requirements of the various Tank Waste Remediation System (TWRS) program elements. These characterization needs are implemented and documented through the Data Quality Objective (DQO) process, and expressed in a series of program specific DQO documents. The data needs are summarized in the *TWRS Tank Waste Analysis Plan* (Bell, 1994).

This Tank Characterization Report is the final step in the characterization of Tank 241-S-104. According to the process and issue based data requirements, the inventory estimates and waste properties contained in this report can be applied to the data requirements of the various program elements. Contained in Table 6-3 is a summary of which program data needs are fulfilled through this characterization of the waste in Tank 241-S-104, based on a review of the stated sampling and analysis requirements. In the future, the applicability of Tank Characterization Report results to each TWRS program element will be documented in tank specific Tank Characterization Plans, prior to the tank sampling.

Table 6-3. Applicability of Characterization Information to the Data Needs of the TWRS Program Elements.

Data Quality Objective	Applicability to Characterization of Tank 241-S-104
Tank Safety Screening	applies[1]
Ferrocyanide Safety Issue	does not apply
Flammable Gas Tanks Crust Burn Issue	does not apply
Generic Tank Vapor Issue Resolution	not addressed
Flammable Gas Tank	not completed
Waste Compatibility	does not apply
Organic Fuel Rich Tank	does not apply
Rotary Core Vapor Sampling	does not apply
Evaporator Operations	not completed
Process Control	not completed
Waste Tank Retrieval	not completed
Waste Tank Pretreatment	not completed
High-Level Waste Immobilization	not completed
Low-Level Waste Immobilization	not completed
Solid, Low-Level Waste Disposal	not completed
RCRA Part B Permit Application	not completed
Tank C-106 High-Heat Safety Issue	does not apply
Organic Layer Sampling of Tank C-103	does not apply
Tank C-103 Vapor and Gas Sampling	does not apply

1 The sampling requirement for the Safety Screening Data Quality Objective (Babad, 1994) calls for both vertical waste samples and a vapor space sample. The sampling and analysis of Tank 241-S-104 supports full characterization of the waste in the tank; vapor space sampling or characterization was not conducted as part of this activity.

applies - The data needs expressed in this Data Quality Objectives document are fulfilled through this characterization report.

does not apply - The data needs expressed in this Data Quality Objectives document do not apply to the waste in Tank 241-S-104.

not addressed - The data needs expressed in this Data Quality Objectives document were not addressed by this characterization report.

not complete - At the date of preparation of this report, this Data Quality Objectives document has not yet been completed.

7.0 ANALYTICAL INTERPRETATION

7.1 MASS AND CHARGE BALANCE

The principle objective for performing a mass and charge balance is to determine if the measurements are self-consistent. In calculating the balances, only analytes listed in Table 5-9 which were detected at a concentration of 1,000 µg/g or greater in the solid phase of the waste were considered. As a note, all values in Tables 7-1, 7-2, and 7-3 were rounded to three significant figures.

With the exception of sodium, all analytes listed in Table 7-1 were assumed to be present in the tank waste as hydroxide or oxide precipitates, and the concentrations of the assumed species were calculated stoichiometrically. For example, 117,000 µg/g of aluminum were detected in the solid phase of the tank, and this translated into 338,000 µg/g of aluminum hydroxide as demonstrated by the following equation:

$$338{,}000\ \mu g/g\ Al(OH)_3 = 117{,}000\ \mu g/g\ Al \div 27\ \mu g/\mu mol\ Al * 78\ \mu g/\mu mol\ Al(OH)_3$$

The concentrations of the assumed species, which are summed in Table 7-1, were ultimately utilized to calculate the mass balance. Since precipitates are neutral species, all positive charge was attributed to the sodium cation.

Table 7-1. Cation Mass and Charge Data.

	Concentration (µg/g)	Assumed Species	Concentration of Assumed Species (µg/g)	Charge µmol/g
Aluminum	117,000	$Al(OH)_3$	338,000	0
Calcium	4,230	CaO	5,920	0
Chromium	2,350	CrO_3	4,520	0
Iron	1,720	$Fe(O)(OH)$	2,740	0
Manganese	1,150	MnO_2	1,820	0
Silicon	1,330	SiO_2	2,850	0
Sodium	121,000	Na^+	121,000	5,260
Uranium	6,690	$UO_2(OH)_2$	8,550	0
Totals			485,000	5,260

The anionic analytes listed in Table 7-2 were assumed to be present as sodium salts and were expected to balance the positive charge exhibited by sodium in Table 7-1. However, a charge imbalance was initially observed, and the excess positive charge was compensated by assuming that hydroxide ions provided the balance of negative charge. It should be noted that carbonate and acetate data were derived from the Total Inorganic Carbon and Total Organic Carbon analyses, respectively. The concentrations of the anionic species, which are summed in Table 7-2, were utilized to calculate the mass balance in Table 7-3.

Table 7-2. Anion Mass and Charge Data.

	Concentration (µg/g)	Charge (µmol/g)
Carbonate (TIC)	4,140	138
Acetate (TOC)	1,730	28.8
Chloride	3,200	90.1
Nitrate	191,000	3,080
Nitrite	25,900	563
Sulfate	2,270	47.3
Charge Subtotal		3,950
Hydroxide (Est.)	22,300	1,310
Totals	250,000	5,260

The following equation illustrates that the sum of the total concentration of the assumed species in Table 7-1, the total concentration of anionic analytes in Table 7-2, and the laboratory derived value for percent water should equal 1,000,000 µg/g.

$$1{,}000{,}000\ \mu g/g = Al(OH)_3 + CaO + CrO_3 + Fe(O)(OH) + MnO_2 + SiO_2 + Na^+ + UO_2(OH)_2 + CO_3^{2-} + C_2H_3O^- + Cl^- + NO_3^- + NO_2^- + SO_4^{2-} + OH^- + H_2O$$

Table 7-3 demonstrates that the calculated mass balance exhibited an error of only 8%.

Table 7-3. Mass Balance Totals.

	Concentration (µg/g)
Total From Table 7-1	485,000
Total From Table 7-2	250,000
Water	343,000
Grand Total	1,080,000

7.2 STATISTICAL ANALYSIS

As mentioned in section 3.0, three core samples were taken from Tank 241-S-104. Two core composite samples were made for each core from the homogenized solid segment waste, and primary and duplicate results were obtained from each core composite.

The statistics in this section were calculated for analytes with concentrations greater than 10 times their detection limits (DL). Analytical Evaluation and Reporting personnel within the TWRS Information Management Systems identified a list of "special analytes" that have exceptions to this rule (Table 7-4). Statistics were calculated for these analytes if the concentrations were greater than 3 times their DL (Jensen, 1994). For a number of analytes, the concentrations of some samples were greater than a particular limit (3 or 10 times the DL), while the other samples were less than that limit. In these cases, the statistics were calculated using all of the data whether it was above or below the particular limit (3 or 10 DL). The above rules do not apply to alpha or beta/gamma counting methods.

Table 7-4. Special Analyte List.

Aluminum	Nitrate
Bismuth	Nitrite
Calcium	Phosphate
Chromium	Carbonate
Iron	Fluoride
Silicon	Chloride
Sodium	Total Organic Carbon
Zirconium	Cyanide

Using the hierarchical structure of the core composite data, estimates of the spatial variance (σ^2(S)), compositing variance (σ^2(C)), and analytical measurement variance (σ^2(A)) were obtained for each analyte. The spatial variance is a measure of the variability between cores. The compositing variance measures the variability between composite samples within the same core. The analytical measurement variance measures the difference between the analytical results from the sample and duplicate samples.

To test the significance of the variance components, an analysis of variance (ANOVA) was calculated (Jensen, 1994). The mean square error terms in the ANOVA table were used to test the spatial and composite variability. The estimates of each component of variability along with the p-values (significance level) are given in Table 7-5. A p-value less than 0.05 indicates that σ^2(S) or σ^2(C) are significantly different from zero at the 0.05 significance level. The only major analyte not included in this statistical analysis was water, as no statistics were conducted on it.

The p-values from the tests on σ^2(S) were statistically significant for 10 out of 34 analytes tested. The 10 analytes in which differences in concentrations were found represent less than 1% of the tank contents. This indicates that the solid portion of the tank contents is relatively homogeneous.

The p-values from the tests on σ^2(C) were statistically significant for 7 out of 34 analytes tested. The 10 analytes in which differences in concentrations were found represent approximately 15% of the tank contents. This indicates that the compositing error is not unusually large.

7.3 ANALYTICAL ERROR ESTIMATION

An attempt is always made to quantify the different sources of error possible during the chemical analysis of a sample. When these errors are summarized, they give a strong indication of data reliability. If one or more of the error estimates are outside the acceptable limits, the accuracy of the concentration estimate is drawn into question. Possible sources of error are sample contamination, matrix interferences, analytical method error, and poor instrument calibration.

Analytical error is composed of two parts, random and systematic. Table 7-6 gives both the analytical and systematic error estimates for Tank 241-S-104, organized by analyte.

Table 7-5. Variance Components Estimates.

Analyte	σ^2(S)	Test: σ^2(S)=0 p-value	σ^2(C)	Test: σ^2(C)=0 p-value	σ^2(A)
[1]ICP.f.Al	1.30E+06	0.265	1.94E-22	0.676	1.51E+07
ICP.f.B	6.63E+02	0.149	1.17E-13	0.626	1.54E+03
ICP.f.Ba	9.02E+00	0.041*	1.68E-13	0.489	3.80E+00
ICP.f.Ca	1.68E+07	0.285	4.97E+06	0.398	5.99E+07
ICPf.f.Cr	2.26E+04	0.008*	2.68E-20	0.756	5.09E+03
ICP.f.Cu	5.57E-24	0.668	3.00E+01	0.335	6.70E+02
ICP.f.Fe	1.46E-15	0.518	3.92E+03	0.269	1.39E+04
[2]ICP.a.K	2.34E+03	0.010*	1.27E+02	1.137	5.63E+01
ICP.f.Mg	7.73E+03	0.275	3.30E+03	0.361	2.29E+04
ICP.f.Mn	1.13E+05	0.113	4.40E+04	0.062	2.71E+04
ICP.a.Na	2.60E+06	0.414	2.10E+07	0.043*	1.02E+07
ICP.f.Ni	3.98E-29	0.835	6.71E-23	0.891	2.21E+06
ICP.f.S	5.68E-26	0.650	1.60E+02	0.320	2.08E+03
ICP.f.Si	1.31E+04	0.241	1.34E-21	0.701	1.30E+05
ICP.f.Sr	3.22E+02	0.345	4.80E+02	0.267	1.38E+03
ICP.f.Zn	3.52E+04	0.260	7.94E+03	0.401	1.03E+05
ICP.a.Zr	7.37E+19	0.784	3.87E+00	0.012*	1.41E+00
[3]IC.Cl^-	2.42E+04	0.001*	1.62E-42	0.991	1.06E+04
IC.F^-	3.95E+03	0.000*	1.66E-52	0.529	8.61E-01
IC.NO_3^-	4.50E-05	0.487	1.58E+08	0.080	1.21E+08
IC.SO_4^{-2}	7.15E+03	0.028*	2.29E-24	0.944	1.85E+04
NO_2^-.Spec	3.47E-18	0.753	5.28E+06	0.034*	3.38E+06
CO_3^{-2}.TIC	5.22E-29	0.700	2.73E+06	0.001*	3.63E+05
pH	1.42E-32	0.717	1.72E-21	0.415	7.56E-01
CN^-	1.85E-20	0.718	2.41E-01	0.002*	3.92E-02
U	3.44E+05	0.087	4.45E+04	0.308	1.79E+05
^3H	3:42E-35	0.813	4.59E-07	0.131	9.89E-07
$^{239/240}Pu$	1.34E-02	0.015*	9.59E-04	0.043*	4.64E-04
^{90}Sr	5.32E-19	0.929	1.03E+02	0.190	5.41E+02
^{99}Tc	2.23E-06	0.310	4.99E-06	0.018*	1.49E-06
Gross.alpha	5.48E-02	0.040*	3.22E-03	0.321	1.46E-02
Gross.beta	2.27E+05	0.001*	1.98E+03	0.118	2.00E+03
^{14}C	5.67E-09	0.425	3.38E-08	0.241	8.08E-08
^{137}Cs	9.34E+00	0.040*	2.01E-18	0.507	3.99E+00

[1]ICP.f = Inductively Coupled Plasma, KOH/Nickel fusion dissolution
[2]ICP.a = Inductively Coupled Plasma, acid digestion
[3]IC = Ion Chromatography, water digestion
* = significant at the α=0.05 level

Table 7-6. Measurement Error Estimates for Tank 241-S-104. (2 pages)

Analyte	Analytical error estimate - 1 RSD (%)		Systematic error estimate - 1 RSD (%)	
	From sample results	From standard results	From standard results*	From spike analyses
Aluminum	3.6	2.5	4.2	5,400
Barium	6.0	2.6	1.8	1.9
Boron	127	4.7	5.1	2.5
Calcium	183	3.4	3.3	26.1
Cerium	9.97	3.2	8.1	4.8
Chromium	3.4	2.9	1.9	120
Cobalt	13.4	2.8	6.4	6.3
Copper	47.3	2.2	2.9	4.8
Iron	44.3	2.6	3.8	77.1
Lead	33.8	3.2	3.9	4.6
Magnesium	96.6	2.9	2.0	4.6
Manganese	135	2.4	5.9	43.2
Nickel	38.1	2.7	2.3	202
Phosphorus	35.3	4.4	3.1	3.8
Potassium	2.5	3.9	27.6	12.4
Silicon	29.8	4.2	1.9	23.6
Sodium	2.6	2.7	80.4	23,000
Strontium	8.8	2.7	1.8	9.8
Sulfur	9.7	3.8	1.7	56.6
Titanium	17.7	3.3	3.8	4.2
Uranium	6.3	0.9	3.2	12.1
Zinc	143	2.4	1.5	2.8
Zirconium	3.5	4.2	4.6	9.2
Chlorine	3.8	4.7	5.3	27.0
Cyanide	5.3	3.5	0.9	2.6
Nitrate	7.0	4.3	2.3	17.7
Nitrite	6.2	4.6	2.5	57.4
Sulfate	8.5	3.9	2.3	2.1
Total Inorganic Carbon	16.5	NA	2.0	5.4
Total Organic Carbon	7.4	3.4	2.9	3.1
% Water	4.2	0.8	0.8	NA

Table 7-6. Measurement Error Estimates for Tank 241-S-104. (2 pages)

Analyte	Analytical error estimate - 1 RSD (%)		Systematic error estimate - 1 RSD (%)	
	From sample results	From standard results	From standard results*	From spike analyses
pH	8.7	0.4	0.7	NA
^{241}Am	5.7	23.3	8.1	55.6
^{14}C	31.5	7.9	13.7	19.6
^{137}Cs	3.2	2.2	4.0	NA
$^{239/240}Pu$	7.6	NA	4.7	25.8
^{90}Sr	7.5	5.5	5.0	5.5
^{99}Tc	5.0	10.0	1.8	33.6
^{3}H	29.5	11.3	2.9	17.5

* Calculated from the laboratory measurement control system standards analyzed in conjunction with the samples.
NA: Data not available.

7.3.1 Systematic Analytical Error

Systematic error estimates are determined from the analysis of reference standards or spike recoveries. Reference standards are samples used to estimate the accuracy of the analytical method, and are analyzed in conjunction with the duplicate samples. They are prepared by adding a known amount of a particular analyte at a concentration other than that used for equipment calibration. The laboratory measurement control system has set a quality control criterion of no standard run in conjunction with the analytical samples being larger than three times the historical results. These values are listed in column 4 of Table 7-6. Matrix spikes are used to estimate the bias of the analytical method due to matrix interferences. Spike samples are prepared by splitting a sample into two aliquots and adding a known amount of a particular analyte to one aliquot to calculate a percent recovery. The quality control criterion for spikes is 100 ± 25% recovery. The numbers listed in column 5 of Table 7-6 are the relative standard deviations (RSD) of the spikes for each analyte.

About half of the analytes listed in Table 7-6 had one or more spikes that were outside the 100 ± 25% recovery limits. Aluminum, sodium, and technicium-99 had all three spikes outside the prescribed limits, while most of the others had just one of three outside the limits. Several of these elements were metals found in relatively high concentrations in the tank. Spike failures for major elements in general are frequently caused by a high element concentration in the sample. When the added spike concentration is insignificant compared to the concentration present in the sample, a failure usually occurs. Also, the standard results for potassium, sodium, and uranium (column 4 data) exceeded the criteria of three times the historical results (column 3 data), which may indicate a problem with the analytical method.

7.3.2 Random Analytical Error

The random analytical error can be estimated from the historical base of reference standards or from the analytical results (variation between duplicate samples). These reference standards are determined the same way as the ones for systematic error, but are typically derived from 50 samples and updated every year (column 3). To determine the error due to the analytical results of the duplicate samples (column 2), a relative percent difference (RPD) is calculated for each duplicate pair. The RPD is a measure of variability and is defined as the absolute value of one duplicate minus the other, divided by the mean. An RSD is then calculated by taking the standard deviation of the two or more duplicate pairs and dividing by the overall analyte mean. The RSD is a unitless measure of variability and allows the comparison of variation across constituents whose magnitudes may vary widely. The laboratory measurement control system has set the quality control criterion of no RPD being larger than the RSD times three for a given analyte. All data presented in this section were calculated for analytes with detected values only (no "non-detects").

Only five of the analytes listed in Table 7-6 had one RPD value exceeding the criterion of three times the random analytical error from sample results (RSD). Of these five, no problem was detected in the analytical procedure for three of them, strontium, uranium, and pH. The reference standard for potassium on the duplicate pair that exceeded the criterion was 155.8, indicating possible problems with the analytical method. C-14 had one spike recovery slightly outside the prescribed limits (72.9). The results for duplicate samples generally gave very good precision.

7.4 DATA VALIDATION FINDINGS

The primary objective of data validation is to ensure the usability and defensibility of the data produced for the tank. This was accomplished through a detailed examination of the data package which attempted to verify that proper and acceptable analytical techniques had been applied. Evaluations such as instrument calibration checks, matrix spikes, duplicates, and blank analyses were reviewed, and the corresponding results were compared to relevant quality control criteria. Additionally, the data package was checked for the correct submission of required deliverables, correct transcription of raw data to the summary forms, and for proper calculation of a number of parameters. Data which failed to satisfy the established quality objectives were qualified as reported in WHC (1993).

8.0 CONCLUSION AND RECOMMENDATIONS

8.1 SAFETY ISSUES

Characterization of Tank 241-S-104 supports the classification of the tank as non-Watch List. Given the current tank inventory of fissionable radionuclides and organic or exothermic waste constituents, no credible potential exists for further loss of tank integrity or release of radioactivity due to in-tank processes. Tank 241-S-104 is an Assumed Leaker; however, the liquid volume and waste level in the tank have remained relatively constant since 1968 (Anderson, 1990; Hanlon, 1994). Tank 241-S-104 is within established operating safety requirements, as defined by applicable Data Quality Objectives.

Thermocouple data support the conclusion that there are no significant heat-generating processes within the tank waste; there is no credible risk of self-boiling or excessive heating of the current tank contents. Given the generally stable waste properties, and taking into account the still questionable tank integrity, the continued storage of the waste in Tank 241-S-104 poses no unreasonable risk to personnel, the public, or the environment.

8.2 FURTHER CHARACTERIZATION NEEDS

Characterization of the solid and liquid contents of Tank 241-S-104 has been performed in this report. While the current characterization is quite extensive, further sampling and analysis of the contents of Tank 241-S-104 is suggested for the following waste properties:

- An analysis of the tank vapor space would allow final resolution of any safety concerns regarding the presence of flammable or noxious fumes.
- Since Tank 241-S-104 has a substantial amount of R and R-associated waste, further characterization to narrow the limits of uncertainty would be warranted, either in Tank 241-S-104, or in a tank with a similar process history and waste matrix.

8.3 CONCLUSIONS

This tank characterization report supports the tank classification as a non-Watch List tank. Therefore, continued operation of Tank 241-S-104 poses no unreasonable risk of radiation exposure, gaseous emissions, or liquid releases to the environment.

9.0 REFERENCES

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APPENDIX A

ANALYTICAL RESULTS

A.1 INTRODUCTION

A.1.1 Appendix A presents the chemical and radiological characteristics of Tank 241-S-104 in a tabular form, in terms of the specific concentrations of metals, anions, radionuclides, physical properties, and volatile and semivolatile compounds.

The data table for each analyte lists laboratory sample identification, an analytical data result for each sample, range of results, standard deviation, an evaluated data result, and a projected tank inventory for the particular analyte. The projected tank inventory column is not applicable for the specific gravity, ph, or percent water data. The data are listed in standard notation for values >.001 and <.100,000. Values outside these limits are listed in scientific notation.

A.2 TABLE DESCRIPTION

A.2.1 Abbreviations

Standard abbreviations are used to describe analytical methods.

Metals:	ICP - Inductively Coupled Plasma (generic for all metals unless otherwise known)
	GHAA - Gaseous Hydride Atomic Absorption
	CVAA - Cold Vapor Atomic Absorption
Anions:	IC - Ion Chromatography
Radionuclides:	GEA - Gamma Energy Analysis
	AEA - Alpha Energy Analysis
	APC - Alpha Proportional Counting
	BPC - Beta Proportional Counting
	LSC - Liquid Scintillation Counting
Physical Properties:	PT - Physical Testing
	DM - Direct Measurement
	DSC - Differential Scanning Calorimetry
	TGA - Thermogravimetric Analysis

A.3 Column Headings

A.3.1 The "Analyte" column contains, in addition to the name of the analyte or physical characteristic; information about the method of measurement, and in the case of the metals, information about the method of digestion. The method of digestion is listed for the metals, because unlike the other analytes, different digestion procedures are typically used for the same metal.

Possible digestion methods are: d - direct; a - acid digestion; w - water leach; and f - potassium hydroxide fusion, followed by acid digestion.

The analyte and method are presented as follows: "method.analyte," or, (in the case of a metal) "method.digestion.analyte." For example, the specific concentration of ^{90}Sr was measured with a beta proportional counter and is listed "BPC.^{90}Sr." A specific concentration of Pb was determined by the inductively coupled plasma method which was preceded by acid digestion, and is listed as "ICP.a.Pb."

A.3.2 The "Laboratory Sample Identification" column lists the samples for which the analyte was measured; this identification number is different from the number assigned to the samples at the tank farm. Sampling rationale, locations, and descriptions of sampling events are contained in Section 3.0.

A.3.3 "Analytical Data Result" is the specific concentration of the analyte determined at different sampling points. No quality control data such as matrix spikes, serial dilutions, or duplicate analyses are listed. This information may be obtained from the 241-S-104 data package (WHC-SD-WM-DP-031, Rev 0). Data which was qualified as estimated (denoted by "J" or "UJ" in the data package) will be enclosed in parentheses, i.e., (395) μg/ml. Unqualified data will be entered in standard form.

A.3.4 The "Range of Values" column lists the highest and the lowest values for a particular analyte.

A.3.5 The Mean is derived as discussed in Section 5.0

A.3.6 Column 6 "Standard Deviation (Mean)" is computed for those results greater than the detection limit, as discussed in Section 5.0.

A.3.7 Column 7, "Projected Inventory," is the product of the concentration of the analyte and the volume of the waste in the tank (106,000 L liquid, or 1.11E+06L of solid). Appropriate conversion factors are used to obtain the desired result of kilograms of mass or Curies of radioactivity.

LIST OF TABLES FOR APPENDIX A

LIST OF TABLES FOR APPENDIX A (continued)

Table A-1. Tank 241-S-104 Analytical Data: Aluminum

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.Al	Sample 2247	(12,400)	11,000 to 12,500	12,000	N/A	1,270
	Sample 2249	(11,000)				
	Sample 2248	(12,500)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.Al	Sample 2171	(36,100)	21,800 to 62,300	38,900	7,110	63,800
	Sample 2172	(50,500)				
	Sample 2175	(21,800)				
	Sample 2176	(28,100)				
	Sample 2177	(62,300)				
	Sample 2178	(34,300)				
ICP.f.Al	Sample 2171	(1.13E+05)	1.13E+05 to 1.20E+05	1.17E+05	1,300	1.92E+05
	Sample 2172	(1.16E+05)				
	Sample 2175	(1.20E+05)				
	Sample 2176	(1.18E+05)				
	Sample 2177	(1.19E+05)				
	Sample 2178	(1.15E+05)				
ICP.w.Al	Sample 2171	6,490	1,540 to 6,490	4,680	1,560	7,680
	Sample 2172	6,240				
	Sample 2175	(6,080)				
	Sample 2176	(6,140)				
	Sample 2177	(1,540)				
	Sample 2178	(1,590)				

Table A-1. Tank 241-S-104 Analytical Data: Antimony

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
ICP.a.Sb	Sample 2247	(7.78)	7.48 to 10.3	8.52	N/A	0.903
	Sample 2249	(7.48)				
	Sample 2248	(10.3)				
Metal (Solid)		μg/g	μg/g	μg/g	μg/g	kg
ICP.a.Sb	Sample 2171	(< 35.4)	34.0 to 40.5	37.2	N/A	61.0
	Sample 2172	(< 36.2)				
	Sample 2175	(34.0)				
	Sample 2176	(< 35.1)				
	Sample 2177	(37.0)				
	Sample 2178	(40.5)				
ICP.f.Sb	Sample 2171	(< 183)	< 74.5 to < 183	< 183	N/A	< 300
	Sample 2172	(< 182)				
	Sample 2175	(< 75.5)				
	Sample 2176	(< 74.5)				
	Sample 2177	(< 178)				
	Sample 2178	(< 177)				
ICP.w.Sb	Sample 2171	(< 37.2)	< 35.6 to < 37.3	< 37.3	N/A	< 61.2
	Sample 2172	(< 37.3)				
	Sample 2175	(< 35.6)				
	Sample 2176	(< 36.0)				
	Sample 2177	(< 36.3)				
	Sample 2178	(< 36.3)				

Table A-1. Tank 241-S-104 Analytical Data: Arsenic

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.As	Sample 2247	(< 0.975)	< 0.390 to < 0.975	< 0.975	N/A	< 0.103
	Sample 2249	(< 0.390)				
	Sample 2248	(< 0.390)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.As	Sample 2171	(< 2.90)	< 2.90 to 5.46	5.46	N/A	8.95
	Sample 2172	(< 2.97)				
	Sample 2175	< 2.99				
	Sample 2176	< 3.06				
	Sample 2177	< 3.05				
	Sample 2178	(5.46)				
ICP.f.As	Sample 2171	(< 15.0)	< 14.9 to < 19.4	< 19.4	N/A	< 31.8
	Sample 2172	(< 14.9)				
	Sample 2175	< 19.4				
	Sample 2176	< 19.1				
	Sample 2177	(< 15.5)				
	Sample 2178	(< 15.4)				
ICP.w.As	Sample 2171	< 3.05	< 3.05 to < 3.16	< 3.16	N/A	< 5.18
	Sample 2172	< 3.06				
	Sample 2175	< 3.10				
	Sample 2176	< 3.14				
	Sample 2177	< 3.16				
	Sample 2178	< 3.16				
GHAA.As	Sample 2171	< 0.250	N/A	< 0.250	N/A	< 0.41
	Sample 2172	< 0.250				
	Sample 2175	< 0.250				
	Sample 2176	(< 0.250)				
	Sample 2178	(< 0.250)				

Table A-1. Tank 241-S-104 Analytical Data: Barium

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.Ba	Sample 2247	(< 0.100)	< 0.0400 to < 0.100	< 0.100	N/A	< 0.0106
	Sample 2249	(< 0.0400)				
	Sample 2248	(< 0.0400)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.Ba	Sample 2171	(20.4)	19.8 to 25.9	21.6	1.00	35.4
	Sample 2172	(22.5)				
	Sample 2175	(19.8)				
	Sample 2176	(19.9)				
	Sample 2177	(25.9)				
	Sample 2178	(20.9)				
ICP.f.Ba	Sample 2171	(28.1)	28.1 to 36.2	33.1	1.82	54.3
	Sample 2172	(31.1)				
	Sample 2175	33.8				
	Sample 2176	34.6				
	Sample 2177	(36.2)				
	Sample 2178	(35.0)				
ICP.w.Ba	Sample 2171	(1.61)	< 0.306 to 1.61	0.643	N/A	1.05
	Sample 2172	< 0.306				
	Sample 2175	0.314				
	Sample 2176	0.319				
	Sample 2177	< 0.306				
	Sample 2178	0.329				

Table A-1. Tank 241-S-104 Analytical Data: Beryllium

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
ICP.a.Be	Sample 2247	(0.215)	0.162 to 0.215	0.187	N/A	0.0198
	Sample 2249	(0.162)				
	Sample 2248	(0.184)				
Metal (Solid)		μg/g	μg/g	μg/g	μg/g	kg
ICP.a.Be	Sample 2171	(< 0.290)	< 0.290 to < 0.297	< 0.297	N/A	< 0.487
	Sample 2172	(< 0.297)				
	Sample 2175	(< 0.290)				
	Sample 2176	< 0.296				
	Sample 2177	< 0.295				
	Sample 2178	(< 0.290)				
ICP.f.Be	Sample 2171	(< 1.50)	< 1.47 to < 1.50	< 1.50	N/A	< 2.46
	Sample 2172	(< 1.49)				
	Sample 2175	< 1.49				
	Sample 2176	< 1.47				
	Sample 2177	(< 1.50)				
	Sample 2178	(< 1.49)				
ICP.w.Be	Sample 2171	(< 0.305)	< 0.300 to < 0.306	< 0.306	N/A	< 0.502
	Sample 2172	(< 0.306)				
	Sample 2175	< 0.300				
	Sample 2176	< 0.304				
	Sample 2177	< 0.306				
	Sample 2178	< 0.306				

Table A-1. Tank 241-S-104 Analytical Data: Bismuth

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.Bi	Sample 2247	(< 2.30)	< 0.920 to < 2.30	< 2.30	N/A	< 0.244
	Sample 2249	(< 0.920)				
	Sample 2248	(< 0.920)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.Bi	Sample 2171	(< 5.61)	< 5.61 to < 8.38	< 8.38	N/A	< 13.7
	Sample 2172	(< 5.74)				
	Sample 2175	(< 8.20)				
	Sample 2176	(< 8.38)				
	Sample 2177	(< 8.37)				
	Sample 2178	(< 8.23)				
ICP.f.Bi	Sample 2171	(< 29.0)	< 28.8 to < 45.7	< 45.7	N/A	< 74.9
	Sample 2172	(< 28.8)				
	Sample 2175	(< 45.7)				
	Sample 2176	(< 45.1)				
	Sample 2177	(< 42.5)				
	Sample 2178	(< 42.2)				
ICP.w.Bi	Sample 2171	(< 5.89)	< 5.89 to < 8.67	< 8.67	N/A	< 14.2
	Sample 2172	< 5.92				
	Sample 2175	(< 8.50)				
	Sample 2176	(< 8.60)				
	Sample 2177	(< 8.67)				
	Sample 2178	(< 8.66)				

Table A-1. Tank 241-S-104 Analytical Data: Boron

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
ICP.a.B	Sample 2247	(8.18)	5.15 to 8.18	6.54	N/A	0.693
	Sample 2249	(5.15)				
	Sample 2248	(6.29)				
Metal (Solid)		μg/g	μg/g	μg/g	μg/g	kg
ICP.a.B	Sample 2171	(12.0)	9.30 to 23.2	14.4	3.49	23.6
	Sample 2172	(9.66)				
	Sample 2175	(9.30)				
	Sample 2176	(12.7)				
	Sample 2177	(19.5)				
	Sample 2178	(23.2)				
ICP.f.B	Sample 2171	(< 5.00)	< 4.96 to 92.4	26.6	18.7	43.6
	Sample 2172	(< 4.96)				
	Sample 2175	(35.2)				
	Sample 2176	(92.4)				
	Sample 2177	(10.6)				
	Sample 2178	(12.2)				
ICP.w.B	Sample 2171	(10.8)	6.31 to 10.8	9.08	1.28	14.9
	Sample 2172	(9.27)				
	Sample 2175	(10.5)				
	Sample 2176	(10.8)				
	Sample 2177	(6.77)				
	Sample 2178	(6.31)				

Table A-1. Tank 241-S-104 Analytical Data: Cadmium

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
ICP.a.Cd	Sample 2247	(< 0.175)	0.0762 to < 0.175	0.0828	N/A	0.00878
	Sample 2249	(0.0762)				
	Sample 2248	(0.0893)				
Metal (Solid)		μg/g	μg/g	μg/g	μg/g	kg
ICP.a.Cd	Sample 2171	(< 0.677)	< 0.676 to 0.836	0.794	N/A	1.30
	Sample 2172	(0.735)				
	Sample 2175	< 0.676				
	Sample 2176	< 0.690				
	Sample 2177	(0.836)				
	Sample 2178	(0.812)				
ICP.f.Cd	Sample 2171	(< 3.50)	< 3.47 to 3.75	3.66	N/A	6.00
	Sample 2172	(< 3.47)				
	Sample 2175	(3.75)				
	Sample 2176	(3.58)				
	Sample 2177	(< 3.50)				
	Sample 2178	(< 3.47)				
ICP.w.Cd	Sample 2171	(0.900)	< 0.700 to 0.900	0.900	N/A	1.48
	Sample 2172	< 0.714				
	Sample 2175	< 0.700				
	Sample 2176	< 0.708				
	Sample 2177	< 0.714				
	Sample 2178	< 0.713				

Table A-1. Tank 241-S-104 Analytical Data: Calcium

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
ICP.a.Ca	Sample 2247	(3.88)	< 0.0500 to 3.88	3.88	N/A	0.411
	Sample 2249	(< 0.0500)				
	Sample 2248	(< 0.0500)				
Metal (Solid)		μg/g	μg/g	μg/g	μg/g	kg
ICP.a.Ca	Sample 2171	(187)	187 to 328	247	25.5	405
	Sample 2172	(207)				
	Sample 2175	328				
	Sample 2176	(236)				
	Sample 2177	(271)				
	Sample 2178	(250)				
ICP.f.Ca	Sample 2171	(697)	542 to 18,200	4,230	3,380	6,940
	Sample 2172	(542)				
	Sample 2175	(765)				
	Sample 2176	(1,400)				
	Sample 2177	3,750				
	Sample 2178	(18,200)				
ICP.w.Ca	Sample 2171	(434)	73.4 to 434	156	57.9	256
	Sample 2172	(108)				
	Sample 2175	(115)				
	Sample 2176	(99.6)				
	Sample 2177	(104)				
	Sample 2178	(73.4)				

Table A-1. Tank 241-S-104 Analytical Data: Cerium

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.Ce	Sample 2247	(< 3.20)	< 1.28 to < 3.20	< 3.20	N/A	< 0.339
	Sample 2249	(< 1.28)				
	Sample 2248	(< 1.28)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.Ce	Sample 2171	(19.4)	18.0 to 27.6	22.1	N/A	36.2
	Sample 2172	(24.1)				
	Sample 2175	(27.6)				
	Sample 2176	(20.8)				
	Sample 2177	(22.8)				
	Sample 2178	(18.0)				
ICP.f.Ce	Sample 2171	(< 49.0)	< 42.7 to < 63.6	< 63.6	N/A	< 104
	Sample 2172	(< 48.6)				
	Sample 2175	< 63.6				
	Sample 2176	< 62.7				
	Sample 2177	(< 43.0)				
	Sample 2178	(< 42.7)				
ICP.w.Ce	Sample 2171	< 9.96	< 8.60 to < 10.0	< 10.0	N/A	< 16.4
	Sample 2172	< 10.0				
	Sample 2175	< 8.60				
	Sample 2176	< 8.70				
	Sample 2177	< 8.77				
	Sample 2178	< 8.76				

Table A-1. Tank 241-S-104 Analytical Data: Chromium

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.Cr	Sample 2247	(3,580)	3,060 to 3,580	3,380	N/A	358
	Sample 2249	(3,060)				
	Sample 2248	(3,490)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.Cr	Sample 2171	2,520	2,180 to 2,520	2,350	63.3	3,850
	Sample 2172	2,430				
	Sample 2175	(2,240)				
	Sample 2176	(2,330)				
	Sample 2177	(2,180)				
	Sample 2178	2,390				
ICP.f.Cr	Sample 2171	(2,500)	2,190 to 2,540	2,350	89.2	3,850
	Sample 2172	(2,540)				
	Sample 2175	(2,350)				
	Sample 2176	(2,300)				
	Sample 2177	2,190				
	Sample 2178	2,250				
ICP.w.Cr	Sample 2171	2,620	562 to 2,620	1,900	663	3,120
	Sample 2172	2,550				
	Sample 2175	(2,490)				
	Sample 2176	(2,580)				
	Sample 2177	(581)				
	Sample 2178	(562)				

Table A-1. Tank 241-S-104 Analytical Data: Cobalt

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
ICP.a.Co	Sample 2247	(< 0.475)	0.223 to < 0.475	0.229	N/A	0.0243
	Sample 2249	(0.223)				
	Sample 2248	(0.234)				
Metal (Solid)		μg/g	μg/g	μg/g	μg/g	kg
ICP.a.Co	Sample 2171	(2.56)	1.95 to 2.84	2.52	N/A	4.13
	Sample 2172	(2.84)				
	Sample 2175	(2.67)				
	Sample 2176	(2.69)				
	Sample 2177	(1.95)				
	Sample 2178	(2.43)				
ICP.f.Co	Sample 2171	(< 5.00)	< 4.96 to < 9.44	< 9.44	N/A	< 15.5
	Sample 2172	(< 4.96)				
	Sample 2175	(< 9.44)				
	Sample 2176	(< 9.31)				
	Sample 2177	(< 6.00)				
	Sample 2178	(7.34)				
ICP.w.Co	Sample 2171	(< 1.02)	< 1.02 to 1.36	1.36	N/A	2.23
	Sample 2172	(< 1.02)				
	Sample 2175	(< 1.20)				
	Sample 2176	(< 1.21)				
	Sample 2177	(1.36)				
	Sample 2178	(< 1.22)				

Table A-1. Tank 241-S-104 Analytical Data: Copper

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.Cu	Sample 2247	(< 0.150)	< 0.150 to 0.317	0.250	N/A	0.0265
	Sample 2249	(0.317)				
	Sample 2248	(0.182)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.Cu	Sample 2171	(31.4)	12.8 to 33.4	19.4	6.49	31.8
	Sample 2172	33.4				
	Sample 2175	(12.9)				
	Sample 2176	(12.3)				
	Sample 2177	13.7				
	Sample 2178	12.8				
ICP.f.Cu	Sample 2171	(59.3)	30.7 to 73.3	54.7	7.80	89.7
	Sample 2172	(73.3)				
	Sample 2175	(61.5)				
	Sample 2176	(31.5)				
	Sample 2177	(71.7)				
	Sample 2178	(30.7)				
ICP.w.Cu	Sample 2171	(4.86)	< 0.612 to 4.86	1.47	0.811	2.41
	Sample 2172	(1.33)				
	Sample 2175	0.691				
	Sample 2176	0.921				
	Sample 2177	< 0.612				
	Sample 2178	(0.945)				

Table A-1. Tank 241-S-104 Analytical Data: Iron

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.Fe	Sample 2247	(4.07)	2.84 to 4.42	3.78	N/A	0.401
	Sample 2249	(2.84)				
	Sample 2248	(4.42)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.Fe	Sample 2171	(686)	628 to 1,050	771	73.5	1,260
	Sample 2172	904				
	Sample 2175	(628)				
	Sample 2176	(638)				
	Sample 2177	(1,050)				
	Sample 2178	713				
ICP.f.Fe	Sample 2171	(1,500)	1,500 to 1,780	1,720	42.5	2,820
	Sample 2172	(1,760)				
	Sample 2175	(1,780)				
	Sample 2176	(1,730)				
	Sample 2177	1,750				
	Sample 2178	1,770				
ICP.w.Fe	Sample 2171	(55.0)	< 2.04 to 55.0	12.4	9.68	20.3
	Sample 2172	(8.38)				
	Sample 2175	(3.76)				
	Sample 2176	(3.92)				
	Sample 2177	< 2.04				
	Sample 2178	< 2.04				

Table A-1. Tank 241-S-104 Analytical Data: Lanthanum

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.La	Sample 2247	(< 0.500)	0.240 to < 0.500	0.258	N/A	0.0273
	Sample 2249	(0.275)				
	Sample 2248	(0.240)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.La	Sample 2171	(< 1.55)	< 1.55 to < 2.07	< 2.07	N/A	< 3.39
	Sample 2172	(< 1.58)				
	Sample 2175	< 2.03				
	Sample 2176	< 2.07				
	Sample 2177	< 2.07				
	Sample 2178	(< 2.03)				
ICP.f.La	Sample 2171	(< 8.00)	< 7.94 to < 10.5	< 10.5	N/A	< 17.2
	Sample 2172	(< 7.94)				
	Sample 2175	< 9.94				
	Sample 2176	< 9.80				
	Sample 2177	(< 10.5)				
	Sample 2178	(< 10.4)				
ICP.w.La	Sample 2171	(< 1.63)	< 1.63 to < 2.14	< 2.14	N/A	< 3.51
	Sample 2172	(< 1.63)				
	Sample 2175	< 2.10				
	Sample 2176	< 2.12				
	Sample 2177	< 2.14				
	Sample 2178	< 2.14				

Table A-1. Tank 241-S-104 Analytical Data: Lead

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
ICP.a.Pb	Sample 2247	(17.3)	9.72 to 17.3	13.1	N/A	1.39
	Sample 2249	(9.72)				
	Sample 2248	(12.3)				
Metal (Solid)		μg/g	μg/g	μg/g	μg/g	kg
ICP.a.Pb	Sample 2171	(40.5)	< 8.37 to 44.4	29.6	N/A	48.5
	Sample 2172	(29.4)				
	Sample 2175	(44.4)				
	Sample 2176	(13.8)				
	Sample 2177	(< 8.37)				
	Sample 2178	(19.7)				
ICP.f.Pb	Sample 2171	(< 35.5)	< 35.2 to < 42.5	< 42.5	N/A	< 69.7
	Sample 2172	(< 35.2)				
	Sample 2175	(< 38.8)				
	Sample 2176	(< 38.2)				
	Sample 2177	(< 42.5)				
	Sample 2178	(< 42.2)				
ICP.w.Pb	Sample 2171	(< 7.21)	< 7.21 to < 8.67	< 8.67	N/A	< 14.2
	Sample 2172	(< 7.24)				
	Sample 2175	(< 8.50)				
	Sample 2176	(< 8.60)				
	Sample 2177	(< 8.67)				
	Sample 2178	(< 8.66)				

Table A-1. Tank 241-S-104 Analytical Data: Magnesium

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.Mg	Sample 2247	(0.885)	0.217 to 0.885	0.510	N/A	0.0541
	Sample 2249	(0.217)				
	Sample 2248	(0.429)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.Mg	Sample 2171	(33.8)	33.8 to 58.5	42.8	5.17	70.2
	Sample 2172	(37.9)				
	Sample 2175	(36.8)				
	Sample 2176	(42.5)				
	Sample 2177	(58.5)				
	Sample 2178	(47.3)				
ICP.f.Mg	Sample 2171	(75.0)	75.0 to 447	157	71.0	257
	Sample 2172	(77.7)				
	Sample 2175	(92.0)				
	Sample 2176	(99.4)				
	Sample 2177	150				
	Sample 2178	(447)				
ICP.w.Mg	Sample 2171	(23.5)	3.82 to 23.5	8.34	3.32	13.7
	Sample 2172	(3.82)				
	Sample 2175	(7.19)				
	Sample 2176	(6.13)				
	Sample 2177	(5.01)				
	Sample 2178	(4.42)				

Table A-1. Tank 241-S-104 Analytical Data: Manganese

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
ICP.a.Mn	Sample 2247	(< 0.0750)	< 0.0300 to < 0.0750	0.0395	N/A	0.00419
	Sample 2249	(0.0395)				
	Sample 2248	(< 0.0300)				
Metal (Solid)		μg/g	μg/g	μg/g	μg/g	kg
ICP.a.Mn	Sample 2171	(793)	772 to 1,320	927	136	1,520
	Sample 2172	787				
	Sample 2175	(772)				
	Sample 2176	(810)				
	Sample 2177	(1,320)				
	Sample 2178	(1,070)				
ICP.f.Mn	Sample 2171	(950)	618 to 1,740	1,150	217	1,890
	Sample 2172	(1,170)				
	Sample 2175	(1,030)				
	Sample 2176	(618)				
	Sample 2177	(1,740)				
	Sample 2178	(1,390)				
ICP.w.Mn	Sample 2171	(2.58)	< 0.300 to 2.58	1.55	N/A	2.54
	Sample 2172	(0.510)				
	Sample 2175	< 0.300				
	Sample 2176	< 0.304				
	Sample 2177	< 0.306				
	Sample 2178	< 0.306				

Table A-1. Tank 241-S-104 Analytical Data: Mercury

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Solid)		μg/g	μg/g	μg/g	μg/g	kg
CVAA.Hg	Sample 2171	< 0.126	< 0.125 to < 0.126	< 0.126	N/A	< 0.207
	Sample 2172	< 0.126				
	Sample 2175	< 0.125				
	Sample 2176	< 0.125				
	Sample 2178	< 0.125				

Table A-1. Tank 241-S-104 Analytical Data: Nickel

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.Ni	Sample 2247	(< 0.375)	< 0.150 to < 0.375	< 0.375	N/A	< 0.0398
	Sample 2249	(< 0.150)				
	Sample 2248	(< 0.150)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.Ni	Sample 2171	(51.2)	50.0 to 67.2	56.0	2.52	91.8
	Sample 2172	(57.9)				
	Sample 2175	(50.0)				
	Sample 2176	(55.5)				
	Sample 2177	67.2				
	Sample 2178	(54.4)				
ICP.w.Ni	Sample 2171	1.78	1.61 to < 1.84	1.70	N/A	2.79
	Sample 2172	1.61				
	Sample 2175	< 1.80				
	Sample 2176	< 1.82				
	Sample 2177	< 1.84				
	Sample 2178	< 1.83				

Table A-1. Tank 241-S-104 Analytical Data: Phosphorus

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
ICP.a.P	Sample 2247	(9.01)	7.43 to 9.01	8.02	N/A	0.850
	Sample 2249	(7.62)				
	Sample 2248	(7.43)				
Metal (Solid)		μg/g	μg/g	μg/g	μg/g	kg
ICP.a.P	Sample 2171	(25.1)	16.2 to 25.1	21.2	N/A	34.8
	Sample 2172	(20.0)				
	Sample 2175	(20.3)				
	Sample 2176	(16.2)				
	Sample 2177	(21.2)				
	Sample 2178	(24.3)				
ICP.f.P	Sample 2171	(110)	79.5 to 110	93.2	N/A	153
	Sample 2172	(103)				
	Sample 2175	(79.5)				
	Sample 2176	(95.6)				
	Sample 2177	(84.9)				
	Sample 2178	(86.1)				
ICP.w.P	Sample 2171	(16.0)	< 8.15 to 16.0	11.4	N/A	18.7
	Sample 2172	< 10.1				
	Sample 2175	8.44				
	Sample 2176	9.67				
	Sample 2177	< 8.16				
	Sample 2178	< 8.15				

Table A-1. Tank 241-S-104 Analytical Data: Potassium

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.K	Sample 2247	(664)	664 to 947	811	N/A	86.0
	Sample 2249	(821)				
	Sample 2248	(947)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.K	Sample 2171	(359)	258 to 359	300	28.4	492
	Sample 2172	(354)				
	Sample 2175	(268)				
	Sample 2176	(270)				
	Sample 2177	(258)				
	Sample 2178	(288)				
ICP.w.K	Sample 2171	343	114 to 343	253	68.0	414
	Sample 2172	317				
	Sample 2175	(318)				
	Sample 2176	(302)				
	Sample 2177	114				
	Sample 2178	(120)				

Table A-1. Tank 241-S-104 Analytical Data: Selenium

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.Se	Sample 2247	(< 3.52)	< 1.41 to < 3.52	< 3.52	N/A	< 0.373
	Sample 2249	(< 1.41)				
	Sample 2248	(< 1.41)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.Se	Sample 2171	(< 8.03)	< 8.03 to 75.1	45.7	N/A	74.9
	Sample 2172	(< 8.22)				
	Sample 2175	(< 12.6)				
	Sample 2176	(< 12.9)				
	Sample 2177	(16.2)				
	Sample 2178	(75.1)				
ICP.f.Se	Sample 2171	(< 41.5)	< 41.2 to < 70.1	< 70.1	N/A	< 115
	Sample 2172	(< 41.2)				
	Sample 2175	(< 70.1)				
	Sample 2176	< 69.1				
	Sample 2177	(< 65.5)				
	Sample 2178	(< 65.0)				
ICP.w.Se	Sample 2171	(< 8.43)	< 8.43 to 37.5	31.8	N/A	52.2
	Sample 2172	(< 8.47)				
	Sample 2175	(< 13.1)				
	Sample 2176	(< 13.3)				
	Sample 2177	(37.5)				
	Sample 2178	(26.0)				
GHAA.Se	Sample 2171	< 0.250	< 0.250 to 0.296	0.296	N/A	0.485
	Sample 2172	< 0.250				
	Sample 2175	< 0.250				
	Sample 2176	< 0.250				
	Sample 2178	0.296				

Table A-1. Tank 241-S-104 Analytical Data: Silicon

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
ICP.a.Si	Sample 2247	(52.9)	9.54 to 52.9	25.4	N/A	2.69
	Sample 2249	(13.8)				
	Sample 2248	(9.54)				
Metal (Solid)		μg/g	μg/g	μg/g	μg/g	kg
ICP.a.Si	Sample 2171	(167)	155 to 255	192	18.6	315
	Sample 2172	(155)				
	Sample 2175	(178)				
	Sample 2176	(199)				
	Sample 2177	(255)				
	Sample 2178	(196)				
ICP.f.Si	Sample 2171	(1,030)	1,030 to 1,630	1,330	123	2,180
	Sample 2172	(1,130)				
	Sample 2175	(1,180)				
	Sample 2176	(1,630)				
	Sample 2177	(1,420)				
	Sample 2178	(1,560)				
ICP.w.Si	Sample 2171	(95.1)	14.7 to 95.1	39.8	16.9	65.3
	Sample 2172	(49.6)				
	Sample 2175	(34.1)				
	Sample 2176	(28.7)				
	Sample 2177	(16.6)				
	Sample 2178	(14.7)				

Table A-1. Tank 241-S-104 Analytical Data: Silver

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.Ag	Sample 2247	(< 0.225)	< 0.0900 to < 0.225	< 0.225	N/A	< 0.0239
	Sample 2249	(< 0.0900)				
	Sample 2248	(< 0.0900)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.Ag	Sample 2171	(< 0.967)	< 0.965 to < 0.990	< 0.990	N/A	< 1.62
	Sample 2172	(< 0.990)				
	Sample 2175	(< 0.965)				
	Sample 2176	(< 0.986)				
	Sample 2177	(< 0.984)				
	Sample 2178	(< 0.968)				
ICP.f.Ag	Sample 2171	(< 5.00)	< 4.41 to < 5.00	< 5.00	N/A	< 8.20
	Sample 2172	(< 4.96)				
	Sample 2175	(< 4.47)				
	Sample 2176	(< 4.41)				
	Sample 2177	(< 5.00)				
	Sample 2178	(< 4.96)				
ICP.w.Ag	Sample 2171	(1.73)	< 1.01 to 1.73	1.58	N/A	2.59
	Sample 2172	(< 1.20)				
	Sample 2175	(1.42)				
	Sample 2176	(< 1.01)				
	Sample 2177	(< 1.02)				
	Sample 2178	(< 1.02)				

Table A-1. Tank 241-S-104 Analytical Data: Sodium

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.Na	Sample 2247	(2.06E+05)	1.93E+05 to 2.06E+05	1.98E+05	N/A	21,000
	Sample 2249	(1.93E+05)				
	Sample 2248	(1.95E+05)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.Na	Sample 2171	(1.31E+05)	1.17E+05 to 1.31E+05	1.21E+05	2,280	1.98E+05
	Sample 2172	(1.19E+05)				
	Sample 2175	(1.17E+05)				
	Sample 2176	(1.18E+05)				
	Sample 2177	(1.18E+05)				
	Sample 2178	(1.22E+05)				
ICP.f.Na	Sample 2171	(1.25E+05)	1.13E+05 to 1.25E+05	1.18E+05	1,660	1.94E+05
	Sample 2172	(1.18E+05)				
	Sample 2175	(1.20E+05)				
	Sample 2176	(1.17E+05)				
	Sample 2177	(1.13E+05)				
	Sample 2178	(1.17E+05)				
ICP.w.Na	Sample 2171	(1.18E+05)	36,700 to 1.21E+05	92,100	27,200	1.51E+05
	Sample 2172	(1.21E+05)				
	Sample 2175	(1.19E+05)				
	Sample 2176	(1.19E+05)				
	Sample 2177	(36,700)				
	Sample 2178	(38,800)				

Table A-1. Tank 241-S-104 Analytical Data: Strontium

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
ICP.a.Sr	Sample 2247	(< 0.0750)	< 0.0300 to < 0.0750	0.0478	N/A	0.00507
	Sample 2249	(< 0.0300)				
	Sample 2248	(0.0478)				
Metal (Solid)		μg/g	μg/g	μg/g	μg/g	kg
ICP.a.Sr	Sample 2171	(317)	274 to 363	326	13.2	535
	Sample 2172	(363)				
	Sample 2175	(328)				
	Sample 2176	(347)				
	Sample 2177	(325)				
	Sample 2178	(274)				
ICP.f.Sr	Sample 2171	(408)	373 to 480	424	17.4	695
	Sample 2172	(417)				
	Sample 2175	(428)				
	Sample 2176	(480)				
	Sample 2177	(429)				
	Sample 2178	(373)				
ICP.w.Sr	Sample 2171	(1.08)	< 0.408 to 1.08	0.842	N/A	1.38
	Sample 2172	< 0.408				
	Sample 2175	0.852				
	Sample 2176	0.764				
	Sample 2177	0.688				
	Sample 2178	0.824				

Table A-1. Tank 241-S-104 Analytical Data: Sulfur

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.S	Sample 2247	(543)	490 to 543	525	N/A	55.7
	Sample 2249	(490)				
	Sample 2248	(541)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.S	Sample 2171	(432)	348 to 432	394	19.7	646
	Sample 2172	(410)				
	Sample 2175	(412)				
	Sample 2176	(401)				
	Sample 2177	(348)				
	Sample 2178	(363)				
ICP.f.S	Sample 2171	465	439 to 538	472	14.1	774
	Sample 2172	468				
	Sample 2175	472				
	Sample 2176	(439)				
	Sample 2177	(449)				
	Sample 2178	(538)				
ICP.w.S	Sample 2171	(474)	99.1 to 474	340	120	558
	Sample 2172	(449)				
	Sample 2175	(450)				
	Sample 2176	(470)				
	Sample 2177	(99.1)				
	Sample 2178	(99.1)				

Table A-1. Tank 241-S-104 Analytical Data: Tin

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.Sn	Sample 2247	(3.29)	2.85 to 3.36	3.17	N/A	0.336
	Sample 2249	(2.85)				
	Sample 2248	(3.36)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.Sn	Sample 2171	(< 2.22)	< 1.54 to < 2.28	1.81	N/A	2.97
	Sample 2172	(< 2.28)				
	Sample 2175	(< 1.54)				
	Sample 2176	(1.84)				
	Sample 2177	(< 1.57)				
	Sample 2178	(1.77)				
ICP.f.Sn	Sample 2171	(< 11.5)	< 7.94 to < 11.5	< 11.5	N/A	< 18.7
	Sample 2172	(< 11.4)				
	Sample 2175	(< 8.95)				
	Sample 2176	< 8.82				
	Sample 2177	(< 8.00)				
	Sample 2178	(< 7.94)				
ICP.w.Sn	Sample 2171	(2.51)	< 1.63 to 3.12	2.82	N/A	4.62
	Sample 2172	(< 2.35)				
	Sample 2175	(3.12)				
	Sample 2176	(2.84)				
	Sample 2177	< 1.63				
	Sample 2178	< 1.63				

Table A-1. Tank 241-S-104 Analytical Data: Titanium

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.Ti	Sample 2247	(< 0.175)	< 0.0700 to < 0.175	< 0.175	N/A	< 0.0186
	Sample 2249	(< 0.0700)				
	Sample 2248	(< 0.0750)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.Ti	Sample 2171	(5.00)	3.80 to 10.3	6.35	1.69	10.4
	Sample 2172	(6.10)				
	Sample 2175	(3.80)				
	Sample 2176	(4.01)				
	Sample 2177	(8.82)				
	Sample 2178	(10.3)				
ICP.f.Ti	Sample 2171	(3.50)	3.50 to 12.8	7.63	N/A	12.5
	Sample 2172	(3.95)				
	Sample 2175	(10.1)				
	Sample 2176	(6.79)				
	Sample 2177	(8.64)				
	Sample 2178	12.8				
ICP.w.Ti	Sample 2171	(3.48)	< 0.408 to 3.48	3.48	N/A	5.70
	Sample 2172	(< 0.408)				
	Sample 2175	(0.784)				
	Sample 2176	(< 0.506)				
	Sample 2177	< 0.510				
	Sample 2178	< 0.509				

Table A-1. Tank 241-S-104 Analytical Data: Uranium

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
LF.U	Sample 2171	6,810	5,740 to 7,520	6,690	367	11,000
	Sample 2172	7,090				
	Sample 2175	6,790				
	Sample 2176	7,520				
	Sample 2177	(6,170)				
	Sample 2178	(5,740)				

Table A-1. Tank 241-S-104 Analytical Data: Zinc

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.Zn	Sample 2247	(8.96)	4.67 to 8.96	7.39	N/A	0.783
	Sample 2249	(8.53)				
	Sample 2248	(4.67)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.Zn	Sample 2171	(29.4)	12.1 to 29.4	20.1	3.91	33.0
	Sample 2172	(20.0)				
	Sample 2175	(25.0)				
	Sample 2176	(21.5)				
	Sample 2177	(12.6)				
	Sample 2178	(12.1)				
ICP.f.Zn	Sample 2171	(73.6)	71.1 to 816	224	147	367
	Sample 2172	(75.4)				
	Sample 2175	(71.1)				
	Sample 2176	(88.3)				
	Sample 2177	(220)				
	Sample 2178	(816)				
ICP.w.Zn	Sample 2171	(32.1)	< 2.55 to 32.1	14.0	6.30	23.0
	Sample 2172	(18.8)				
	Sample 2175	(13.9)				
	Sample 2176	(11.9)				
	Sample 2177	< 2.55				
	Sample 2178	(7.12)				

Table A-1. Tank 241-S-104 Analytical Data: Zirconium

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Metal (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
ICP.a.Zr	Sample 2247	(< 0.300)	< 0.120 to < 0.300	< 0.300	N/A	< 0.0318
	Sample 2249	(< 0.120)				
	Sample 2248	(< 0.120)				
Metal (Solid)		µg/g	µg/g	µg/g	µg/g	kg
ICP.a.Zr	Sample 2171	31.6	31.6 to 35.7	33.6	0.873	55.1
	Sample 2172	35.7				
	Sample 2175	(34.2)				
	Sample 2176	(34.9)				
	Sample 2177	35.0				
	Sample 2178	30.4				
ICP.f.Zr	Sample 2171	(10.9)	8.68 to 33.8	21.2	6.07	34.8
	Sample 2172	(8.68)				
	Sample 2175	(27.1)				
	Sample 2176	(33.8)				
	Sample 2177	(21.6)				
	Sample 2178	(25.1)				
ICP.w.Zr	Sample 2171	(< 0.813)	< 0.813 to < 1.12	< 1.12	N/A	< 1.84
	Sample 2172	(< 0.816)				
	Sample 2175	< 1.10				
	Sample 2176	< 1.11				
	Sample 2177	< 1.12				
	Sample 2178	< 1.12				

Table A-2. Tank 241-S-104 Analytical Data: Ammonia

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Cation (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
KTN.NH_3	Sample 2247	(< 40.0)	N/A	< 40.0	N/A	< 4.24
	Sample 2249	(< 40.0)				
	Sample 2248	(< 40.0)				
Cation (Solid)		μg/g	μg/g	μg/g	μg/g	kg
KTN.NH_3	Sample 2171	< 4,500	< 4,500 to < 9,000	< 9,000	N/A	< 14,800
	Sample 2172	< 4,500				
	Sample 2175	< 4,500				
	Sample 2176	< 4,500				
	Sample 2178	< 9,000				

Table A-2. Tank 241-S-104 Analytical Data: Carbonate

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Anion (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
TIC.CO_3^{2-}	Sample 2247	(1,370)	922 to 1,370	1,110	N/A	118
	Sample 2249	(1,030)				
	Sample 2248	(922)				
Anion (Solid)		μg/g	μg/g	μg/g	μg/g	kg
TIC.CO_3^{2-}	Sample 2171	(2,760)	2,760 to 7,350	4,140	697	6,790
	Sample 2172	(4,570)				
	Sample 2175	(3,260)				
	Sample 2176	(3,960)				
	Sample 2178	(7,350)				

Table A-2. Tank 241-S-104 Analytical Data: Chloride

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Anion (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
IC.Cl⁻	Sample 2247	(5,920)	5,730 to 7,520	6,390	N/A	677
	Sample 2249	(5,730)				
	Sample 2248	(7,520)				
Anion (Solid)		µg/g	µg/g	µg/g	µg/g	kg
IC.Cl⁻	Sample 2171	(3,150)	3,070 to 3,390	3,200	94.7	5,250
	Sample 2172	(3,120)				
	Sample 2175	(3,070)				
	Sample 2176	(3,090)				
	Sample 2178	(3,390)				

Table A-2. Tank 241-S-104 Analytical Data: Cyanide

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Anion (Liquid)		µg/mL	µg/mL	µg/mL	µg/mL	kg
Dist/Spec. CN⁻	Sample 2247	(2.74)	2.64 to 2.74	2.69	N/A	0.285
	Sample 2249	(2.68)				
	Sample 2248	(2.64)				
Anion (Solid)		µg/g	µg/g	µg/g	µg/g	kg
Dist/Spec. CN⁻	Sample 2171	(4.04)	2.85 to 4.04	3.70	0.208	6.07
	Sample 2172	(2.85)				
	Sample 2175	4.00				
	Sample 2176	3.91				
	Sample 2178	3.31				

Table A-2. Tank 241-S-104 Analytical Data: Fluoride

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Anion (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
IC.F⁻	Sample 2247	(1,860)	1,860 to 4,270	2,950	N/A	313
	Sample 2249	(2,720)				
	Sample 2248	(4,270)				
Anion (Solid)		μg/g	μg/g	μg/g	μg/g	kg
IC.F⁻	Sample 2171	(< 110)	< 108 to < 219	145	36.3	238
	Sample 2172	(< 110)				
	Sample 2175	(< 108)				
	Sample 2176	(< 109)				
	Sample 2178	(< 219)				

Table A-2. Tank 241-S-104 Analytical Data: Hydroxide

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Anion (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
$H^+.OH^-$	Sample 2247	51,200	40,500 to 51,200	44,300	N/A	4,700
	Sample 2249	40,500				
	Sample 2248	41,100				

Table A-2. Tank 241-S-104 Analytical Data: Nitrate

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Anion (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
$IC.NO_3^-$	Sample 2247	(2.47E+05)	2.47E+05 to 2.94E+05	2.69E+05	N/A	28,500
	Sample 2249	(2.65E+05)				
	Sample 2248	(2.94E+05)				
Anion (Solid)		μg/g	μg/g	μg/g	μg/g	kg
$IC.NO_3^-$	Sample 2171	(1.84E+05)	1.67E+05 to 2.04E+05	1.91E+05	6,030	3.13E+05
	Sample 2172	(2.04E+05)				
	Sample 2175	(1.92E+05)				
	Sample 2176	(1.67E+05)				
	Sample 2178	(1.91E+05)				

Table A-2. Tank 241-S-104 Analytical Data: Nitrite

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Anion (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
$IC.NO_2^-$	Sample 2247	(44,000)	35,300 to 44,000	38,200	N/A	4,050
	Sample 2249	(35,300)				
	Sample 2248	(35,400)				
Anion (Solid)		μg/g	μg/g	μg/g	μg/g	kg
$IC.NO_2^-$	Sample 2171	(21,400)	17,900 to 24,500	20,800	1,570	34,100
	Sample 2172	(19,900)				
	Sample 2175	(17,900)				
	Sample 2176	(18,500)				
	Sample 2178	(24,500)				
$Spec.NO_2^-$	Sample 2171	(27,100)	20,800 to 28,200	25,900	1,080	42,500
	Sample 2172	(25,500)				
	Sample 2175	(28,200)				
	Sample 2176	(20,800)				
	Sample 2178	(27,100)				

Table A-2. Tank 241-S-104 Analytical Data: Phosphate

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Anion (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
$IC.PO_4^{3-}$	Sample 2247	(< 1.00)	N/A	< 1.00	N/A	< 0.106
	Sample 2249	(< 1.00)				
	Sample 2248	(< 1.00)				
Anion (Solid)		μg/g	μg/g	μg/g	μg/g	kg
$IC.PO_4^{3-}$	Sample 2171	(< 1,100)	< 1,080 to < 2,190	< 2,190	N/A	< 3,590
	Sample 2172	(< 1,100)				
	Sample 2175	(< 1,080)				
	Sample 2176	(< 1,090)				
	Sample 2178	(< 2,190)				

Table A-2. Tank 241-S-104 Analytical Data: Sulfate

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Anion (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
$IC.SO_4^{2-}$	Sample 2247	(6,320)	6,320 to 53,200	24,100	N/A	2,560
	Sample 2249	(12,800)				
	Sample 2248	(53,200)				
Anion (Solid)		μg/g	μg/g	μg/g	μg/g	kg
$IC.SO_4^{2-}$	Sample 2171	(2,390)	2,170 to 2,400	2,270	62.6	3,720
	Sample 2172	(2,400)				
	Sample 2175	(2,210)				
	Sample 2176	(2,310)				
	Sample 2178	(2,170)				

Table A-3. Tank 241-S-104 Analytical Data: Americium-241

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Radionuclide (Liquid)		µCi/mL	µCi/mL	µCi/mL	µCi/mL	Ci
GEA.^{241}Am	Sample 2247	(< 0.105)	< 0.105 to < 0.110	< 0.110	N/A	< 11.7
	Sample 2249	(< 0.105)				
	Sample 2248	(< 0.110)				
Radionuclide (Solid)		µCi/g	µCi/g	µCi/g	µCi/g	Ci
GEA.^{241}Am	Sample 2171	(< 0.699)	< 0.262 to < 0.699	< 0.699	N/A	< 1,150
	Sample 2172	(< 0.695)				
	Sample 2175	(< 0.434)				
	Sample 2176	(< 0.439)				
	Sample 2177	(< 0.267)				
	Sample 2178	(< 0.262)				
Radionuclide (Liquid)		µCi/mL	µCi/mL	µCi/mL	µCi/mL	Ci
AEA.^{241}Am	Sample 2247	(< 8.15E-05)	< 6.72E-05 to < 9.49E-05	< 9.49E-05	N/A	< 0.0101
	Sample 2249	(< 9.49E-05)				
	Sample 2248	(< 6.72E-05)				
Radionuclide (Solid)		µCi/g	µCi/g	µCi/g	µCi/g	Ci
AEA.^{241}Am	Sample 2171	(0.111)	0.111 to 0.126	0.118	N/A	194
	Sample 2172	(0.117)				
	Sample 2175	(0.120)				
	Sample 2176	(0.126)				
	Sample 2177	(0.123)				
	Sample 2178	(0.111)				

Table A-3. Tank 241-S-104 Analytical Data: Carbon-14

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Radionuclide (Solid)		µCi/g	µCi/g	µCi/g	µCi/g	Ci
LSC.^{14}C	Sample 2171	5.36E-04	5.36E-04 to 0.00118	9.01E-04	1.19E-04	1.48
	Sample 2172	0.00101				
	Sample 2175	5.62E-04				
	Sample 2176	0.00102				
	Sample 2177	(0.00110)				
	Sample 2178	(0.00118)				

Table A-3. Tank 241-S-104 Analytical Data: Cesium-137

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Radionuclide (Liquid)		µCi/mL	µCi/mL	µCi/mL	µCi/mL	Ci
GEA.^{137}Cs	Sample 2247	(78.0)	78.0 to 86.5	80.9	N/A	8,580
	Sample 2249	(78.1)				
	Sample 2248	(86.5)				
Radionuclide (Solid)		µCi/g	µCi/g	µCi/g	µCi/g	Ci
GEA.^{137}Cs	Sample 2171	(64.7)	57.0 to 64.7	62.3	1.86	1.02E+05
	Sample 2172	(64.3)				
	Sample 2175	(60.3)				
	Sample 2176	(57.0)				
	Sample 2177	(63.5)				
	Sample 2178	(63.9)				

Table A-3. Tank 241-S-104 Analytical Data: Cobalt-60

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Radionuclide (Liquid)		µCi/mL	µCi/mL	µCi/mL	µCi/mL	Ci
GEA.^{60}Co	Sample 2247	(< 0.00250)	< 0.00246 to < 0.00257	< 0.00257	N/A	< 0.272
	Sample 2249	(< 0.00257)				
	Sample 2248	(< 0.00246)				
Radionuclide (Solid)		µCi/g	µCi/g	µCi/g	µCi/g	Ci
GEA.^{60}Co	Sample 2171	(< 0.0840)	< 0.0137 to < 0.0840	< 0.0840	N/A	< 138
	Sample 2172	(< 0.0700)				
	Sample 2175	(< 0.0333)				
	Sample 2176	(< 0.0344)				
	Sample 2177	(< 0.0137)				
	Sample 2178	(< 0.0143)				

Table A-3. Tank 241-S-104 Analytical Data: Europium-154

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Radionuclide (Liquid)		µCi/mL	µCi/mL	µCi/mL	µCi/mL	Ci
GEA.^{154}Eu	Sample 2247	(< 0.00967)	< 0.00834 to < 0.00967	< 0.00967	N/A	< 1.03
	Sample 2249	(< 0.00834)				
	Sample 2248	(< 0.00948)				
Radionuclide (Solid)		µCi/g	µCi/g	µCi/g	µCi/g	Ci
GEA.^{154}Eu	Sample 2171	(< 0.317)	< 0.0411 to < 0.317	< 0.317	N/A	< 520
	Sample 2172	(< 0.269)				
	Sample 2175	(< 0.0984)				
	Sample 2176	(< 0.0928)				
	Sample 2177	(< 0.0411)				
	Sample 2178	(< 0.0433)				

Table A-3. Tank 241-S-104 Analytical Data: Europium-155

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Radionuclide (Liquid)		µCi/mL	µCi/mL	µCi/mL	µCi/mL	Ci
GEA.^{155}Eu	Sample 2247	(< 0.0449)	< 0.0449 to < 0.0470	< 0.0470	N/A	< 4.98
	Sample 2249	(< 0.0449)				
	Sample 2248	(< 0.0470)				
Radionuclide (Solid)		µCi/g	µCi/g	µCi/g	µCi/g	Ci
GEA.^{155}Eu	Sample 2171	(< 0.461)	< 0.115 to < 0.463	< 0.463	N/A	< 759
	Sample 2172	(< 0.463)				
	Sample 2175	(< 0.188)				
	Sample 2176	(< 0.188)				
	Sample 2177	(< 0.116)				
	Sample 2178	(< 0.115)				

Table A-3. Tank 241-S-104 Analytical Data: Iodine-129

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Radionuclide (Solid)		µCi/g	µCi/g	µCi/g	µCi/g	Ci
GEA.^{129}I	Sample 2171	(< 0.0196)	< 0.0143 to < 0.0334	< 0.0334	N/A	< 54.8
	Sample 2172	(< 0.0244)				
	Sample 2175	(< 0.0172)				
	Sample 2176	(< 0.0143)				
	Sample 2177	(< 0.0214)				
	Sample 2178	(< 0.0334)				

Table A-3. Tank 241-S-104 Analytical Data: Neptunium-237

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Radionuclide (Solid)		μCi/g	μCi/g	μCi/g	μCi/g	Ci
APC.^{237}Np	Sample 2171	(< 0.0216)	< 0.0107 to < 0.0216	< 0.0216	N/A	< 35.4
	Sample 2172	(< 0.0213)				
	Sample 2175	(< 0.0215)				
	Sample 2176	(< 0.0212)				
	Sample 2177	< 0.0216				
	Sample 2178	< 0.0107				

Table A-3. Tank 241-S-104 Analytical Data: Plutonium-238

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Radionuclide (Solid)		μCi/g	μCi/g	μCi/g	μCi/g	Ci
AEA.^{238}Pu	Sample 2171	(< 0.00901)	< 0.00895 to < 0.0180	< 0.0180	N/A	< 29.5
	Sample 2172	(< 0.00895)				
	Sample 2175	< 0.0179				
	Sample 2176	< 0.0177				
	Sample 2177	(< 0.0180)				
	Sample 2178	(< 0.0179)				

Table A-3. Tank 241-S-104 Analytical Data: Plutonium-239/240

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Radionuclide (Liquid)		μCi/mL	μCi/mL	μCi/mL	μCi/mL	Ci
AEA.$^{239/240}$Pu	Sample 2247	(< 1.37E-04)	< 6.41E-05 to < 1.37E-04	< 1.37E-04	N/A	< 0.0145
	Sample 2249	(< 6.41E-05)				
	Sample 2248	(< 6.88E-05)				
Radionuclide (Solid)		μCi/g	μCi/g	μCi/g	μCi/g	Ci
AEA.$^{239/240}$Pu	Sample 2171	(0.137)	0.137 to 0.385	0.282	0.0683	462
	Sample 2172	(0.155)				
	Sample 2175	(0.305)				
	Sample 2176	(0.373)				
	Sample 2177	(0.385)				
	Sample 2178	(0.338)				

Table A-3. Tank 241-S-104 Analytical Data: Selenium-79

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Radionuclide (Solid)		μCi/g	μCi/g	μCi/g	μCi/g	Ci
LSC.^{79}Se	Sample 2171	(< 1.27E-04)	< 1.22E-04 to 0.00130	0.00130	N/A	2.15
	Sample 2172	(0.00130)				
	Sample 2175	(< 1.22E-04)				
	Sample 2176	(< 1.23E-04)				
	Sample 2177	(< 1.48E-04)				
	Sample 2178	(< 1.47E-04)				

Table A-3. Tank 241-S-104 Analytical Data: Strontium-90

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Radionuclide (Liquid)		μCi/mL	μCi/mL	μCi/mL	μCi/mL	Ci
BPC.^{90}Sr	Sample 2247	(0.00295)	0.00244 to 0.0102	0.00520	N/A	0.551
	Sample 2249	(0.0102)				
	Sample 2248	(0.00244)				
Radionuclide (Solid)		μCi/g	μCi/g	μCi/g	μCi/g	Ci
BPC.^{90}Sr	Sample 2171	(288)	288 to 328	310	7.89	5.08E+05
	Sample 2172	(324)				
	Sample 2175	(303)				
	Sample 2176	(328)				
	Sample 2177	(327)				
	Sample 2178	(288)				

Table A-3. Tank 241-S-104 Analytical Data: Technetium

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Radionuclide (Solid)		μCi/g	μCi/g	μCi/g	μCi/g	Ci
LSC.^{99}Tc	Sample 2171	(0.0253)	0.0211 to 0.0282	0.0242	0.00131	39.7
	Sample 2172	(0.0260)				
	Sample 2175	(0.0221)				
	Sample 2176	(0.0211)				
	Sample 2177	(0.0282)				
	Sample 2178	(0.0224)				

Table A-3. Tank 241-S-104 Analytical Data: Tritium

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Radionuclide (Solid)		μCi/g	μCi/g	μCi/g	μCi/g	Ci
LSC.^{3}H	Sample 2171	0.00195	0.00195 to 0.00458	0.00338	3.99E-04	5.54
	Sample 2172	0.00458				
	Sample 2175	0.00315				
	Sample 2176	0.00295				
	Sample 2177	(0.00323)				
	Sample 2178	(0.00438)				

Table A-3. Tank 241-S-104 Analytical Data: Uranium

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Radionuclide (Solid)		μCi/g	μCi/g	μCi/g	μCi/g	Ci
LF.U	Sample 2171	2.89E-06	9.99E-08 to 6.79E-06	2.42E-06	N/A	0.00397
	Sample 2172	1.76E-06				
	Sample 2175	2.63E-06				
	Sample 2176	9.99E-08				
	Sample 2177	3.66E-07				
	Sample 2178	6.79E-06				

Table A-3. Tank 241-S-104 Analytical Data: Total Alpha

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Radionuclide (Liquid)		μCi/mL	μCi/mL	μCi/mL	μCi/mL	Ci
APC.Total α	Sample 2247	(0.146)	0.146 to 0.228	0.187	N/A	19.8
	Sample 2249	(0.188)				
	Sample 2248	(0.228)				
Radionuclide (Solid)		μCi/g	μCi/g	μCi/g	μCi/g	Ci
APC.Total α	Sample 2171	0.701	0.314 to 0.957	0.617	0.141	1,010
	Sample 2172	0.578				
	Sample 2175	(0.793)				
	Sample 2176	(0.957)				
	Sample 2177	0.460				
	Sample 2178	0.314				

Table A-3. Tank 241-S-104 Analytical Data: Total Beta

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Radionuclide (Liquid)		μCi/mL	μCi/mL	μCi/mL	μCi/mL	Ci
BPC.Total β	Sample 2247	(116)	116 to 138	127	N/A	13,500
	Sample 2249	(127)				
	Sample 2248	(138)				
Radionuclide (Solid)		μCi/g	μCi/g	μCi/g	μCi/g	Ci
BPC.Total β	Sample 2171	85.0	85.0 to 986	641	276	1.05E+06
	Sample 2172	98.3				
	Sample 2175	(922)				
	Sample 2176	(986)				
	Sample 2177	940				
	Sample 2178	820				

Table A-4. Tank 241-S-104 Analytical Data: Percent Water

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)
Physical Property (Liquid)		%	%	%	%
% H_2O	Sample 2247	(56.9)	56.2 to 56.9	56.7	N/A
	Sample 2249	(56.2)			
	Sample 2248	(56.9)			
Physical Property (Solid)		%	%	%	%
% H_2O	Sample 2199	35.6	29.3 to 37.8	34.3	N/A
	Sample 2201	34.8			
	Sample 2203	29.3			
	Sample 2205	33.8			
	Sample 2210	37.8			

Table A-4. Tank 241-S-104 Analytical Data: pH

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)
Physical Property (Liquid)					
pH	Sample 2247	(13.7)	13.1 to 13.7	13.5	N/A
	Sample 2249	(13.6)			
	Sample 2248	(13.1)			
Physical Property (Solid)					
pH	Sample 2171	(11.7)	11.7 to 13.4	12.9	0.251
	Sample 2172	(13.4)			
	Sample 2175	(12.8)			
	Sample 2176	13.0			
	Sample 2178	(13.1)			

Table A-4. Tank 241-S-104 Analytical Data: Thermogravimentric Analysis

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)
Physical Property (Liquid)		%	%	%	%
TGA	Sample 2247	55.7	54.3 to 55.7	55.0	N/A
	Sample 2249	54.3			
	Sample 2248	55.1			
Physical Property (Solid)		%	%	%	%
TGA	Sample 2171	(24.7)	24.7 to 94.3	42.9	N/A
	Sample 2172	(35.0)			
	Sample 2175	29.0			
	Sample 2176	31.6			
	Sample 2178	94.3			

Table A-4. Tank 241-S-104 Analytical Data: Total Organic Carbon

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Physical Property (Liquid)		μg/mL	μg/mL	μg/mL	μg/mL	kg
TIC/TOC.TOC	Sample 2247	(677)	517 to 677	598	N/A	63.4
	Sample 2249	(600)				
	Sample 2248	(517)				
Physical Property (Solid)		μg/g	μg/g	μg/g	μg/g	kg
	Sample 2171	(2,280)	< 1,100 to 2,280	1,730	N/A	2,840
	Sample 2172	(1,300)				
	Sample 2175	(2,210)				
	Sample 2176	(1,140)				
	Sample 2178	(< 1,100)				

Table A-4. Tank 241-S-104 Analytical Data: Density

Analyte	Laboratory Sample Identification	Analytical Data Result
Physical Property		**g/mL**
Sample Density	Segment 2	1.64
Centrifuged Supernate Density	Segment 2	1.28
Centrifuged Solid Density	Segment 2	1.71

Table A-4. Tank 241-S-104 Analytical Data: Weight Percent

Analyte	Laboratory Sample Identification	Analytical Data Result
Physical Property		**g/mL**
Wt % Solids	Segment 2	62.3
	Segment 4	67.7
Wt % Undissolved Solids	Segment 2	55.4
Wt % Centrifuged Solids	Segment 2	86.1
	Segment 4	100

Table A-5. Tank 241-S-104 Analytical Data: Volatile Organic Analyses

Volatile Organic Compound	Result µg/L	Volatile Organic Compound	Result µg/L
Chloromethane	ND	1,2-Dichloropropane	ND
Bromomethane	ND	cis-1,3-Dichloropropene	ND
Vinyl Chloride	ND	Trichloroethene	ND
Chloroethane	ND	Dibromochloromethane	ND
Methylene Chloride	ND	1,1,2-Trichloroethane	ND
Acetone	ND	Benzene	ND
Carbon Disulfide	ND	trans-1,3-Dichloropropene	ND
1,1-Dichloroethene	ND	Bromoform	ND
1,1-Dichloroethane	ND	4-Methyl-2-Pentanone	ND
1,2-Dichloroethene (total)	ND	2-Hexanone	ND
Chloroform	ND	Tetrachloroethene	ND
1,2-Dichloroethane	ND	1,1,2,2-Tetrachloroethane	ND
2-Butanone	ND	Toluene	ND
1,1,1-Trichloroethane	ND	Chlorobenzene	ND
Carbon Tetrachloride	ND	Ethylbenzene	ND
Vinyl Acetate	ND	Styrene	ND
Bromodichloromethane	ND	Xylene (total)	ND

Table A-5. Tank 241-S-104 Analytical Data: Tentatively Identified Compounds

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Volatile Organic		µg/g	µg/g	µg/g	µg/g	kg
GC/MS. Methoxytri-methyl Silane	Sample 93-01073	(1,400)	31.0 to 1,900	579	N/A	950
	Sample 93-01071	(1,900)				
	Sample 93-01074	(650)				
	Sample 93-01751	(320)				
	Sample 93-01750	(600)				
	Sample 93-01068	(370)				
	Sample 93-01069	(380)				
	Sample 93-01752	(720)				
	Sample 93-01064	(920)				
	Sample 93-10165	(31.0)				
	Sample 93-10166	(65.0)				
	Sample 93-01067	(88.0)				
	Sample 93-01815	(88.0)				

Table A-5. Tank 241-S-104 Analytical Data: Tentatively Identified Compounds

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Volatile Organic		µg/g	µg/g	µg/g	µg/g	kg
GC/MS. Trimethyl Silanol	Sample 93-01073	(2,400)	110 to 2,400	772	N/A	1,270
	Sample 93-01071	(1,600)				
	Sample 93-01074	(110)				
	Sample 93-01751	(1,000)				
	Sample 93-01750	(900)				
	Sample 93-01068	(1,000)				
	Sample 93-01069	(400)				
	Sample 93-01752	(810)				
	Sample 93-01064	(120)				
	Sample 93-10165	(920)				
	Sample 93-10166	(200)				
	Sample 93-01067	(290)				
	Sample 93-01815	(290)				

Table A-5. Tank 241-S-104 Analytical Data: Tentatively Identified Compounds

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Volatile Organic		µg/g	µg/g	µg/g	µg/g	kg
GC/MS. Hexamethyl Disiloxane	Sample 93-01073	(2,900)	74.0 to 2,900	629	N/A	1,030
	Sample 93-01071	(1,200)				
	Sample 93-01074	(190)				
	Sample 93-01751	(420)				
	Sample 93-01750	(450)				
	Sample 93-01068	(440)				
	Sample 93-01069	(560)				
	Sample 93-01752	(530)				
	Sample 93-01064	(110)				
	Sample 93-10165	(74.0)				
	Sample 93-10166	(220)				
	Sample 93-01067	(540)				
	Sample 93-01815	(540)				

Table A-6. Tank 241-S-104 Analytical Data: Semivolatile Organic Analyses

Semivolatile Organic Compound	Result µg/L	Semivolatile Organic Compound	Result µg/L
Phenol	ND	2,6-Dinitrotoluene	ND
bis(2-Chloroethyl)ether	ND	3-Nitroaniline	ND
2-Chlorophenol	ND	Acenaphthene	ND
1,3-Dichlorobenzene	ND	2,4-Dinitrophenol	ND
1,4-Dichlorobenzene	ND	4-Nitrophenol	ND
Benzyl alcohol	ND	Dibenzofuran	ND
1,2-Dichlorobenzene	ND	2,4-Dinitrotoluene	ND
2-Methylphenol	ND	Diethylphthalate	ND
bis(2-Chloroisopropyl)ether	ND	4-Chlorophenyl-phenylether	ND
4-Methylphenol	ND	Fluorene	ND
N-Nitroso-di-n-propylamine	ND	4-Nitroanaline	ND
Hexachloroethane	ND	4,6-Dinitro-2-methylphenol	ND
Nitrobenzene	ND	N-Nitrosodiphenylamine	ND
Isophorone	ND	4-Bromophenyl-phenylether	ND
2-Nitrophenol	ND	Hexachlorobenzene	ND
2,4-Dimethylphenol	ND	Pentachlorophenol	ND
Benzoic acid	ND	Phenanthrene	ND
bis(2-Chloroethoxy)methane	ND	Anthracene	ND
2,4-Dichlorophenol	ND	Di-n-butylphthalate	ND
1,2,4-Trichlorobenzene	ND	Fluoranthene	ND
Naphthalene	ND	Pyrene	ND
4-Chloroaniline	ND	Butylbenzylphthalate	ND
Hexachlorobutadiene	ND	3,3'-Dichlorobenzidine	ND
4-Chloro-3-methylphenol	ND	Benzo(a)anthracene	ND
2-Methylnaphthalene	ND	Chrysene	ND
Hexachlorocyclopentadiene	ND	Bis(2-Ethylhexyl)phthalate	ND
2,4,6-Trichlorophenol	ND	Benzo(b)fluoranthene	ND
2,4,5-Trichlorophenol	ND	Benzo(k)fluoranthene	ND
2-Chloronaphthalene	ND	Benzo(a)pyrene	ND
2-Nitroaniline	ND	Indeno(1,2,3-cd)pyrene	ND
Dimethylphthalate	ND	Dibenz(a,h)anthracene	ND
Acenaphthylene	ND	Benzo(g,h,i)perylene	ND

Table A-6. Tank 241-S-104 Analytical Data: Tentatively Identified Compounds

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Semivolatile Organic		µg/g	µg/g	µg/g	µg/g	kg
GC/MS. Dodecane	Sample 93-01756	21.5	21.5 to 175	65.5	N/A	107
	Sample 93-01076	66.0				
	Sample 93-01757	175				
	Sample 93-01758	43.0				
	Sample 93-01759	21.5				
	Sample 93-01760	66.0				

Table A-6. Tank 241-S-104 Analytical Data: Tentatively Identified Compounds

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Semivolatile Organic		µg/g	µg/g	µg/g	µg/g	kg
GC/MS. Tridecane	Sample 93-01756	89.0	89.0 to 625	240	N/A	394
	Sample 93-01076	240				
	Sample 93-01757	625				
	Sample 93-01758	155				
	Sample 93-01759	89.0				
	Sample 93-01760	240				

Table A-6. Tank 241-S-104 Analytical Data: Tentatively Identified Compounds

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Semivolatile Organic		μg/g	μg/g	μg/g	μg/g	kg
GC/MS. Tetradecane	Sample 93-01756	74.5	74.5 to 520	201	N/A	330
	Sample 93-01076	216				
	Sample 93-01757	520				
	Sample 93-01758	130				
	Sample 93-01759	74.5				
	Sample 93-01760	216				

Table A-6. Tank 241-S-104 Analytical Data: Tentatively Identified Compounds

Analyte	Laboratory Sample Identification	Analytical Data Result	Range of Values	Mean	Standard Deviation (Mean)	Projected Inventory
Semivolatile Organic		μg/g	μg/g	μg/g	μg/g	kg
GC/MS. Pentadecane	Sample 93-01076	15.0	15.0 to 24.0	18.0	N/A	29.5
	Sample 93-01757	24.0				
	Sample 93-01760	15.0				