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

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Abstract: This document summarizes the information on the historical uses, present status, and the sampling and analysis results of waste stored in Tank 241-U-106. This report supports the requirements of the Tri-Party Agreement Milestone M-44-10.

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

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LIST OF TERMS

Btu/hr	British thermal units per hour
CEO	change engineering order
CGM	combustible gas monitor
Ci	curies
Ci/L	curies per liter
cm	centimeter
df	degrees of freedom
DQO	data quality objective
DSC	differential scanning calorimetry
ECN	engineering change notice
ft	feet
GEA	gamma energy analysis
g/mL	grams per milliliter
g	gram
g/cm^3	grams per cubic meter
g/L	grams per liter
HDW	Hanford defined waste
HTCE	historical tank content estimate
IC	ion chromatography
ICP	inductively coupled plasma
in.	inch
J/g	joules per gram
kg	kilogram
kgal	kilogallon
kL	kiloliter
kW	kilowatt
L	liter
LFL	lower flammability limit
LL	lower limit
m	meter
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
M	moles per liter
MW	metal waste
n/a	not applicable
ND	not decided
NR	not reviewed
n/r	not reported

LIST OF TERMS (Continued)

ppm	parts per million
PHMC	Project Hanford Management Contractor
PUREX	plutonium uranium extraction (plant)
QC	quality control
REDOX	reduction oxidation
REML	restricted maximum likelihood estimation
RPD	relative percent difference
RSST	reactive system screening tool
SHMS	standard hydrogen monitoring system
SMM	supernatant mixing model
SMMS1	evaporator bottoms from the 242-S Evaporator (1973 to 1976)
TCP	tank characterization plan
TCR	tank characterization report
TGA	thermogravimetic analysis
TIC	total inorganic carbon
TLM	tank layer model
TOC	total organic carbon
TWRS	Tank Waste Remediation System
UL	upper limit
VSS	vapor sampling system
wt%	weight percent
°C	Celsius
°F	Fahrenheit
%	percent
μCi/L	microcuries per liter
μCi/g	microcuries per gram
μCi/mL	microcuries per milliliter
μeq/g	microequivalents per gram
μg C/mL	micrograms carbon per milliter
μg/mL	micrograms per milliliter
μg/g	micrograms per gram

1.0 INTRODUCTION

One major function of the Tank Waste Remediation System (TWRS) is to characterize wastes in support of waste management and disposal activities at the Hanford Site. Analytical data from sampling and analysis, along with other available information, are compiled and maintained in a tank characterization report (TCR). This report and its appendixes serve as the TCR for single-shell tank 241-U-106. The objectives of this report are: 1) to use characterization data in response to technical issues associated with tank 241-U-106 waste, and 2) to provide a standard characterization of this waste in terms of a best-basis inventory estimate. Section 2.0 of this report summarizes the response to technical issues, Section 3.0 shows the best-basis inventory estimate, and Section 4.0 makes recommendations regarding safety status and additional sampling. The appendixes contain supporting data and information. This report also supports the requirements of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1996), Milestone M-44-10.

1.1 SCOPE

The characterization information in this report originated from sample analyses and historical sources. Although the results of recent sample events (during or after 1989) will be used to fulfill the requirements of data quality objectives (DQOs), other information can be used to support (or question) conclusions derived from these results. Historical information for tank 241-U-106 includes surveillance information, records pertaining to waste transfers and tank operations, and expected tank contents derived from a process knowledge model. Appendix A contains historical information.

Appendix B summarizes recent sampling events (see Table 1-1), sample data obtained prior to 1989, and sampling results. The results of recent sampling events satisfied the data requirements of the tank characterization plan (TCP) for this tank (Brown and Winkelman 1996). Appendix C reports the statistical analysis and numerical manipulation of data used in issue resolution. Appendix D contains the evaluation to establish the best basis for the inventory estimate and the statistical analysis performed for this evaluation. Appendix E is a bibliography that resulted from an in-depth literature search of all known information sources applicable to tank 241-U-106 and its respective waste types.

Table 1-1. Summary of Recent Sampling.

Sample/Date[1]	Phase	Location	Segmentation	Recovery
Vapor sample 8/25/94	Gas	Single point in headspace	n/a	n/a
Grab sample 9/14/94	Liquid	Tank supernatant layer	n/a	Enough liquid was recovered to perform required analyses.
Vapor sample 3/7/95	Gas	Single point in headspace	n/a	n/a
Core sample #147 5/8/96 to 5/10/96	Solids and liquids	Riser 19 Full depth profile	Samples were subsegmented at every 1/2 segment (24 cm) [9.5 in.].	Good. The lowest segment recovery was 80%.
Core sample #148 5/8/96 to 5/10/96	Solids and liquids	Riser 2 Full depth profile	Samples were subsegmented at every 1/2 segment.	Good. The lowest segment recovery was 72%.

Notes:
n/a = not applicable

[1]Dates are in mm/dd/yy format.

1.2 TANK BACKGROUND

Tank 241-U-106 is located in the 200 West Area U Tank Farm on the Hanford Site. Tank 241-U-106 is the last tank in a three-tank cascade series. The tank went into service in 1948 and received metal waste from tank 241-U-105 through cascade lines. The waste was removed from the tank in 1956 for uranium recovery operations. Between the time the tank was sluiced in 1956 and 1976, the tank received several transfers of supernatant waste. It is unlikely that these supernatant transfers added significantly to the solids volume of the tank. In 1976 and 1977, the tank received evaporator bottoms from the 242-S Evaporator (SMMS1 waste) from tank 241-S-102 (and possibly from other sources). The tank has not been interim stabilized.

Table 1-2 describes tank 241-U-106. The tank has an operating capacity of 2,010 kL (530 kgal) and contains an estimated 855 kL (226 kgal) of noncomplexed waste (Hanlon 1996). The tank is on the Organic Watch List (Public Law 101-510).

Table 1-2. Description of Tank 241-U-106.

TANK DESCRIPTION	
Type	Single-shell
Constructed	1943 to 1944
In service	1948
Diameter	23 m (75 ft)
Operating depth	5.2 m (17 ft)
Capacity	2,010 kL (530 kgal)
Bottom shape	Dish
Ventilation	Passive
TANK STATUS	
Waste classification	Noncomplexed
Total waste volume[1]	855 kL (226 kgal)
Supernatant volume	57 kL (15 kgal)
Saltcake volume[2]	798 kL (211 kgal)
Sludge volume[2]	0 kL (0 kgal)
Drainable interstitial liquid volume	257 kL (68 kgal)
Waste surface level (July 11, 1996)[3]	2.29 m (7.5 ft)
Temperature range (July 1995 to July 1996)	21 to 30 °C (70 to 87 °F)
Integrity	Sound
Watch List	Organic
SAMPLING DATE	
Vapor sample	August 25, 1994
Grab sample	September 14, 1994
Vapor sample	March 7, 1995
Core samples	May 8 to 10, 1996
SERVICE STATUS	
Declared inactive	1977
Partial interim stabilization	1982

Notes:

[1]The waste volume is estimated from surface-level measurements.

[2]Although Hanlon (1996) reports the tank contains sludge, it is evident from core sample data (Steen 1996) the waste is saltcake (unless there is a small amount of unsampled sludge in the dish bottom).

[3]Surface-level measurements are taken from the center of the tank and account for the dish bottom.

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2.0 RESPONSE TO TECHNICAL ISSUES

The following five technical issues have been identified for tank 241-U-106 (Brown et al. 1996):

- Safety screening: Does the waste pose or contribute to recognized potential safety problems?
- Organic complexants: Does the potential exist for exothermic organic complexant reactions in the waste to produce a radioactive release?
- Vapor screening: Are there flammable gases in the tank headspace above the 25 percent lower flammability limit (LFL) level? Does an organic solvent pool exist in the waste that could cause an organic solvent pool fire or ignition of organic solvents entrained in the waste solids?
- Historical model evaluation: Does the waste inventory generated by a model based on process knowledge and historical information (Agnew et al. 1996) represent the current tank waste inventory?
- Compatibility: Do safety or operational problems exist with waste in tank 241-U-106 that could inhibit the transfer of pumpable liquid from the tank into a double-shell receiver tank?

The TCP (Brown and Winkelman 1996) specifies the types of sampling and analysis required to address these issues. Data to respond to these issues is available from the recent analysis of two core samples, tank headspace flammability measurements, two vapor samples, a grab sample, and available historical information. It is detailed in the sections below. Appendix B provides sample and analysis data for tank 241-U-106.

2.1 SAFETY SCREENING

The data for screening the waste in tank 241-U-106 for potential safety problems are documented in *Tank Safety Screening Data Quality Objective*, Rev. 2 (Dukelow et al. 1995). Potential safety problems include exothermic conditions in the waste, flammable gases in the waste and/or tank headspace, and criticality conditions in the waste. Each condition is addressed separately below.

2.1.1 Exothermic Conditions (Energetics)

The first requirement in the safety screening DQO (Dukelow et al. 1995) is to ensure that exothermic constituents (organic or ferrocyanide) in tank 241-U-106 are insufficient to cause a safety hazard. Because of this requirement, the energetics in tank 241-U-106 waste were evaluated. The safety screening DQO required the waste sample profile be tested for energetics every 24 cm (9.5 in.) to determine whether the energetics exceeded the safety threshold limit. The threshold limit for energetics is 480 J/g on a dry weight basis.

Results obtained using differential scanning calorimetry (DSC) indicated that all but two samples exceeded the energetics threshold limit of 480 J/g. The two samples that did not exceed the threshold limit, in the measured results, were the upper and lower half of segment 5 of core 148. The upper 95 percent confidence interval for the upper half of segment 5 was over the threshold limit at 578 J/g. The overall tank mean energetics for all samples is 650 J/g, with an upper 95 percent confidence limit for the overall tank mean of 1,060 J/g. Appendix C contains a statistical analysis of the data. Because the energetics in the tank exceeded the threshold limit of 480 J/g, the organic DQO provides guidance for the continued evaluation of analytical results.

2.1.2 Flammable Gas

Vapor phase measurements, which were taken in the tank headspace before and during the core sampling event in May 1996, indicated that the highest recorded measurement of flammable gas was 6 percent of the LFL, well below the safety screening threshold of 25 percent of the LFL. Appendix B contains data from these vapor phase measurements.

2.1.3 Criticality

The safety threshold limit for screening for criticality is 1 gram of plutonium per liter of waste. Criticality screening is performed by measuring total alpha activity and assuming that all detected alpha is from ^{239}Pu. Total alpha was converted to ^{239}Pu for each sample. The sample with the highest total alpha activity was the lower half of segment 3 of core 148 with 0.049 g ^{239}Pu/L and an upper 95 percent confidence interval on the mean of the sample and duplicate of 0.121 g ^{239}Pu/L. The overall tank mean was 0.03 g ^{239}Pu/L with a one-sided upper 95 percent confidence interval on the overall tank mean of 0.07 g ^{239}Pu/L. Appendix C contains a statistical analysis of the data. The measured alpha in the tank indicates the tank is well under the screening criticality threshold limit; therefore, criticality is not a concern for this tank.

2.2 ORGANIC COMPLEXANTS

The data required to support the issue of organic complexants is documented in *Data Quality Objective to Support Resolution of the Organic Complexant Safety Issue*, Rev. 2 (Turner et al. 1995). This section provides the results of the analysis for the organic DQO. Further evaluation must be performed by the Organic Safety Program before tank 241-U-106 can be categorized safe, conditionally safe, or unsafe according to the organic DQO. The purpose of the continued evaluation is to determine whether the moisture that will remain in the tank after pumping will be enough to quench a propagating exothermal reaction. When further evaluation of the data for the organic DQO is available, the results will be published in a revision of this report.

2.2.1 Total Organic Carbon

The first requirement of the organic DQO is to compare the total organic carbon (TOC) content to the threshold limit of 3.0 dry weight percent. The TOC was above 3.0 dry weight percent in most samples. The only samples that did not exceed 3.0 dry weight percent TOC were the upper and lower half of segment 5 of cores 147 and 148 and the lower half of segment 3 of core 147. One-sided upper 95 percent confidence intervals on the mean of the sample and duplicate pairs were over 3.0 dry weight percent except for the lower half of segment 5 of cores 147 and 148. The overall tank average for TOC was 3.7 dry weight percent with a one-sided upper 95 percent confidence interval on the overall tank mean of 6.5 weight percent. Appendix C provides the statistical analysis of the data. In conclusion, all waste in the tank is well over the TOC threshold limit specified in the organic DQO with the possible exception of the bottom 24.13 cm (9.5 in.).

2.2.2 Tank Moisture

The second requirement of the organic DQO is to compare the moisture content of the tank waste with the threshold limit of 17 weight percent. All but two samples showed a moisture content over 30 weight percent, well over the threshold limit of 17 weight percent. The upper half of segment 5 of core 148 had a moisture content of 27 weight percent water and a one-sided lower 95 percent confidence limit on the sample/duplicate average of 16.5 weight percent water (just under the limit). The lower half of segment 5 of core 148 had a moisture content of 16.6 weight percent water. The overall tank average for moisture content was 40 weight percent with a lower 95 percent confidence limit on the tank average of 22.5 weight percent. Appendix C provides the statistical analysis of the data. In conclusion, most waste in the tank has enough moisture to quench an exothermic reaction with the possible exception of the lower 24.13 cm (19 in.). Note that segment 5 of core 148 had the only samples that did not exceed the safety screening energetics threshold, and it did not exceed the TOC limit.

2.2.3 Secondary Analyses for the Organic Data Quality Objective

The organic DQO specifies several secondary analyses contingent on the outcome of the primary analyses (TOC and moisture). Some secondary analyses were performed for tank 241-U-106 because of its high TOC content.

Because of the high TOC observed in tank 241-U-106, adiabatic calorimetry was required as a secondary analysis for the sample that exhibited the highest exothermic energy from DSC analysis. The analysis was performed on the lower half of segment 5 of core 147, the solid sample with the highest DSC measurement. No propagation was observed. The results are reported in Bechtold (1996).

Secondary analysis was also performed for the following cations: aluminum, bismuth, calcium, iron, phosphorus, and sodium. The analyses were performed by inductively coupled plasma (ICP) and are reported in Appendix B. The purpose of the analyses was to support the waste dryout analysis specified in the organic DQO. The waste dryout analysis will be performed later by the Organic Safety Project. This analysis must be performed before the tank can be categorized safe, conditionally safe, or unsafe.

2.3 VAPOR SCREENING

The data required to support vapor screening is documented in *Data Quality Objective for Tank Hazardous Vapor Safety Screening* (Osborne and Buckley 1995). The vapor screening DQO addresses three problems: 1) whether potential flammable levels of gases and vapors are generated or released in the tank headspace above the 25 percent LFL level, 2) whether an organic solvent pool exists in the waste that may cause an organic solvent pool fire or ignition of organic solvents entrained in waste solids, and 3) whether a potential exists for worker hazards, associated with the toxicity of constituents in fugitive vapor emissions, is no longer applicable for vapor screening (Hewitt 1996).

2.3.1 Flammable Gas

This is the same requirement as the safety screening flammability requirement (see Section 2.1.2).

2.3.2 Organic Solvents

The second function of the vapor screening DQO is to determine whether a solvent pool exists in the waste that could cause a solvent pool fire. Solvent pools are detected by analyzing for tributyl phosphate, dodecane, and tridecane in the headspace of the tank. Tributyl phosphate was not measured. Dodecane and tridecane were both detected, indicating a possibility of a solvent pool in the waste. A further requirement, total non-methane hydrocarbons, was requested in Cash (1996). Because this requirement was requested after the 1995 vapor sampling event, total non-methane hydrocarbons was not analyzed. Total non-methane hydrocarbons may be derived by subtracting methane from TOC, both of which were analyzed for in the 1995 sample. The Organic Safety Project has not reported the results of the evaluation to determine whether or not a solvent pool exists.

2.4 HISTORICAL MODEL EVALUATION

The purpose of the historical evaluation is to determine whether the model, based on process knowledge and historical information (Agnew et al. 1996), predicts tank inventories that agree with current tank inventories. If the historical model can accurately predict the waste characteristics observed through sample characterization, there is a possibility of reducing the amount of sampling and analysis in all tanks. Data requirements for this evaluation are documented in *Historical Model Evaluation Data Requirements* (Simpson and McCain 1996).

A large portion of the analysis performed in accordance with the historical DQO will be performed later and will be reported in a revision of this report. The first analysis of the data directed by the historical DQO was the "gateway" analysis. The gateway analysis provided a quick screening check of analytical data before a more thorough analysis was performed on the tank. If the gateway analysis failed, the remainder of the analyses directed by the historical DQO would not be performed. The historical gateway analysis consisted of two parts, which are described below. All data considered in this section are taken from the final laboratory data package for the 1996 core sampling event for tank 241-U-106 (Steen 1996) and are provided in Appendix B. Appendix C provides the numerical manipulation required for the gateway analysis.

The first part of the gateway analysis determined whether a set group of analytes (indicator analytes) were within 10 percent of the value predicted by the historical model (Agnew et al. 1996). The gateway analysis was performed on each solid sample from both cores. The historical model predicted that the major waste type in tank 241-U-106 was SMMS1 (saltcake from the 242-S Evaporator, as predicted by the supernatant mixing model). The indicator analytes for SMMS1 waste are aluminum, chromium, sodium, nitrate, sulfate, carbonate, and water. For a segment to pass the first part of the gateway analysis, each indicator analyte had to exceed 10 percent of the predicted value. The first part of the gateway analysis passed for all segments.

The second part of the gateway analysis was performed on segments that passed the first part of the gateway analysis. It was performed on all solid samples from tank 241-U-106. The second part of the gateway analysis determined whether indicator analytes accounted for 85 percent of the waste (by weight) for each segment. If the indicator analytes did not account for 85 percent of the segment by weight, the gateway failed for that segment. Some samples from each core failed the gateway analysis. Segment 2 failed in both core samples. One subsample from segment 3 failed in core 147, and one subsample from segment 5 failed in core 148. The composition of segment 4 in both cores most closely resembled SMMS1 waste as defined in Agnew et al. (1996).

2.5 COMPATIBILITY

To date, tank 241-U-106 has not been interim stabilized. Before pumping the supernatant and other drainable liquids from tank 241-U-106, a waste compatibility assessment must be performed by tank farm operations. The waste compatibility assessment will ensure that the waste in tank 241-U-106 is compatible with the waste in the double-shell receiver tank. The *Data Quality Objectives for Tank Farms Waste Compatibility Program* (Fowler 1995) directs the waste compatibility assessment. Sampling and analysis were performed to the requirements of the waste compatibility DQO for tank 241-U-106 as reported in Vogel (1994) and summarized in Appendix B.

The waste compatibility assessment has not been performed for tank 241-U-106. The assessment will be performed before the transfer is made, and when the double-shell tank for the waste has been identified. When the waste compatibility assessment has been performed, the results will be in a revision of this report.

2.6 SUMMARY

This section summarizes the results of sampling and analysis for issues applying to tank 241-U-106. To date, the sampling performed has met the needs of the DQOs that apply to the tank. Table 2-1 summarizes the results of characterization of tank 241-U-106 for the safety screening, organic, vapor screening, historical model evaluation, and compatibility issues.

Table 2-1. Summary of Safety Screening, Organic, Vapor Screening, Historical Model Evaluation, and Compatibility Evaluation Results.

Issue	Sub-issue	Results
Safety screening	Energetics	Exotherms were observed for in every sample. Every sample exceeded the threshold limit of 480 J/g except segment 5 of core 148.
	Flammable gas	Vapor measurement reported a maximum flammable gas reading of 6% of the LFL - well under the threshold limit of 25% of the LFL.
	Criticality	All samples were well below 1 g/L plutonium (within 95% confidence limit).
Organic	TOC	TOC was observed in every sample. Every sample exceeded the threshold limit of 3 wt% (dry basis) except segment 5 of cores 147 and 148 and the lower half of segment 3 of core 147.
	Moisture	All samples were above the threshold limit of 17 wt% water except segment 5 of core 148.
	Propagation	No propagation was observed.
Vapor screening	Flammability	See safety screening - flammable gas.
	Organic Solvents	Dodecane and tridecane were detected in the vapors. Evaluation to determine whether a solvent layer exists will be performed later.
Historical (gateway analysis)	Comparison of each indicator	Passed for all segments.
	Total mass of indicators	Failed for some segments in the top and bottom of the waste profile. Passed for most samples in segments 3 and 4.
Compatibility	Waste compatibility assessment	To date, compatibility assessment has not been performed.

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3.0 BEST-BASIS INVENTORY ESTIMATE

Information about chemical, radiological and/or physical properties is used to perform safety analyses, engineering evaluations, and risk assessment associated with waste management activities, as well as regulatory issues. These activities include overseeing tank farm operations and identifying, monitoring, and resolving safety issues associated with these operations and with the tank wastes. Disposal activities involve designing equipment, processes, and facilities for retrieving wastes and processing them into a suitable long-term storage form. Chemical and radiological inventory information is generally derived as follows: 1) component inventories are estimated using the results of sample analyses, 2) component inventories are predicted using the Hanford defined waste (HDW) model based on process knowledge and historical information, or 3) a tank-specific process estimate is made based on process flowsheets, reactor fuel data, essential material usage, and other operating data. The information derived from these approaches is often inconsistent.

An effort is underway to provide waste inventory estimates that will serve as the standard characterization for waste management activities. As part of this effort, an evaluation of available chemical information for tank 241-U-106 was performed, including the following:

- Data from two push mode 1996 core samples
- An inventory estimate generated by the HDW model (Agnew et al. 1996)
- Comparison with other tanks with SMMS1 saltcake.

Based on this evaluation, a best-basis inventory was developed for tank 241-U-106. For the following reasons, the sample-based inventory was chosen as the best basis for those analytes for which sample-based analytical values were available:

- The sample-based inventory analytical concentrations compared favorably to those of other tanks containing SMMS1 saltcake.
- Historical records and the results from core samples indicate the tank contains SMMS1 saltcake but little or no metal waste predicted by Agnew et al. (1996).
- For those few analytes where no values were available from the sampling-based inventory or the engineering assessment, the HDW model values were used with a note that they were of lower reliability.

Tables 3-1 and 3-2 shows the best-basis inventory for tank 241-U-106.

Table 3-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-U-106 (January 31, 1997). (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, or E)[1,2]	Comment
Al	15,650	S	This value is based on acid digest and may not represent all the aluminum present.
Bi	< 56.8	S	
Ca	510	S	
Cl	3,810	S	
CO_3	54,400	S	
Cr	3,520	S	
F	4,180	S	
Fe	4,050	S	
Hg	1.54	M	
K	1,860	S	
La	51.6	S	
Mn	1,530	S	
Na	2.58E+05	S	
Ni	389	S	
NO_2	68,670	S	
NO_3	2.86E+05	S	
OH	n/r		
Pb	424	S	
PO_4	12,650	S	Used phosphorous data from ICP to estimate.
Si	228	S	This value is based on acid digest and may not represent all the silicon present.
SO_4	13,090	S	Used sulfur data from ICP to estimate.
Sr	< 6.69	S	

Table 3-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-U-106 (January 31, 1997). (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, or E)[1,2]	Comment
TOC	28,980	S	
U	1,010	S	
Zr	132	S	

Notes:

n/r = not reported

[1]S = sample-based, M = HDW model-based, E = engineering assessment-based

[2]For more information about the origin and quality of the sample-based numbers, refer to Appendix B. For more information about the model-based numbers, refer to Agnew et al. (1996).

Table 3-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-U-106 (January 31, 1997). (Decayed to January 1, 1994) (3 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1,2]	Comment
^{3}H	n/r		
^{14}C	n/r		
^{59}Ni	n/r		
^{60}Co	182	S	
^{63}Ni	n/r		
^{79}Se	n/r		
^{90}Sr	1.06E+05	S	
^{90}Y	1.06E+05	E	Based on Sr
^{93}Zr	n/r		
^{93m}Nb	n/r		
^{99}Tc	n/r		
^{106}Ru	n/r		

Table 3-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-U-106 (January 31, 1997). (Decayed to January 1, 1994) (3 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1,2]	Comment
^{113m}Cd	n/r		
^{125}Sb	n/r		
^{126}Sn	n/r		
^{129}I	n/r		
^{134}Cs	n/r		
^{137}Cs	2.15E+05	S	
^{137m}Ba	2.00E+05	E	Based on Cs
^{151}Sm	n/r		
^{152}Eu	n/r		
^{154}Eu	1,990	S	
^{155}Eu	1,150	S	
^{226}Ra	n/r		
^{227}Ac	n/r		
^{228}Ra	n/r		
^{229}Th	n/r		
^{231}Pa	n/r		
^{232}Th	n/r		
^{232}U	n/r		
^{233}U	n/r		
^{234}U	n/r		
^{235}U	n/r		
^{236}U	n/r		
^{237}Np	n/r		
^{238}Pu	n/r		
^{238}U	n/r		

Table 3-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-U-106 (January 31, 1997). (Decayed to January 1, 1994) (3 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1,2]	Comment
^{239}Pu	n/r		
^{240}Pu	n/r		
^{241}Am	< 2,290	S	
^{241}Pu	n/r		
^{242}Cm	n/r		
^{242}Pu	n/r		
^{243}Am	n/r		
^{243}Cm	n/r		
^{244}Cm	n/r		

Notes:

[1]S = sample based, M = HDW model-based, E = engineering assessment-based

[2]For more information about the origin and quality of the sample-based numbers, refer to Appendix B. For more information about the model-based numbers, refer to Agnew et al. (1996).

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4.0 RECOMMENDATIONS

The August 25, 1994 and March 7, 1995 vapor sampling events provided sufficient information to address the needs of the vapor screening DQO (Osborne and Buckley 1995). No further vapor sampling efforts are necessary.

The September 14, 1994 grab sampling event provided the data required to perform the compatibility assessment specified in the compatibility DQO (Fowler 1995). To date the waste compatibility assessment has not been performed for this tank and the pumpable liquids in the tank have not been removed. No further grab sampling is necessary at this time.

The two core samples taken May 8 to 10, 1996 met the sampling and analytical needs of the safety screening (Dukelow et al. 1995), organic (Turner et al. 1995), and historical model evaluation (Simpson and McCain 1996) DQOs. Because a dryout analysis as specified by the organic DQO needs to be performed by the Organic Safety Project, the tank cannot be categorized as safe, conditionally safe, or unsafe at this time. The analytical results of the May 1996 core sampling events were also used to develop the best-basis inventory of the tank.

Table 4-1 summarizes the status of the Project Hanford Management Contractor (PHMC) TWRS Program Office review and acceptance of the sampling and analysis results reported in this TCR. Column 1 addresses all DQO issues required by sampling and analysis. Column 2 indicates whether the sampling and analysis performed met the requirements of the DQO. Column 3 indicates whether the responsible program in TWRS accepted or rejected the sampling and analysis results of the TCR. If the results/information have not been reviewed, "NR" is designated in the column. If the results/information have been reviewed, but acceptance or rejection has not been decided, "ND" is designated.

Table 4-1. Acceptance of Tank 241-U-106 Sampling and Analysis.

Issue	Sampling and Analysis Performed	TWRS[1] Program Acceptance
Safety screening DQO	Yes	Yes
Organic DQO	Yes	Yes
Vapor screening DQO	Yes	Yes
Historical evaluation DQO	Yes	Yes
Waste compatibility DQO	Yes	ND

Note:
[1]PHMC TWRS Program Office

Table 4-2 summarizes the status of PHMC TWRS Program Office review and acceptance of the evaluations and other characterization information contained in this report. The evaluations outlined in this report include the gateway analysis, the waste compatibility evaluation, and whether the tank is categorized safe, conditionally safe, or unsafe (safety evaluation). Column 1 lists the evaluations directed by the applicable DQO reports. Columns 2 and 3 are the same format as Table 4-1. The manner in which acceptance is summarized is also the same as in Table 4-1.

Table 4-2. Acceptance of Evaluation of Characterization Data and Information for Tank 241-U-106.

Evaluation	Evaluation Performed	TWRS[1] Program Acceptance
Safety categorization (safe, unsafe, or conditionally safe)	No	n/a[2]
Historical gateway analysis	Yes	Yes
Waste compatibility evaluation	No	n/a[2]

Notes:
[1]PHMC TWRS Program Office
[2]The Program cannot provide acceptance or disapproval of an evaluation that has not been performed.

The safety categorization evaluation is being performed by the Organic Safety Program. The waste compatibility evaluation will be performed at a later date by Tank Farm Operations before pumping liquids from the tank. When these evaluations are performed, they will be included in a revision of this report.

5.0 REFERENCES

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APPENDIX A

HISTORICAL TANK INFORMATION

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APPENDIX A

HISTORICAL TANK INFORMATION

Appendix A describes the historical information about tank 241-U-106. For this report, historical information includes information about the fill history, waste types, surveillance, or modeling data. This information is necessary to provide a balanced assessment of the sampling and analytical results.

Appendix A contains the following information:

- **Section A1**: Current tank status including the waste levels and the stabilization and isolation status.
- **Section A2**: Information about the tank design.
- **Section A3**: Process knowledge about the tank, that is, the waste transfer history and the estimated tank contents based on modeling data.
- **Section A4**: Surveillance data for tank 241-U-106, including surface-level readings, temperatures, and a description of the waste surface based on photographs.
- **Section A5**: References for Appendix A.

Appendix B contains historical sampling results (results from samples obtained before 1989).

A1.0 TANK STATUS

As of September 1996, tank 241-U-106 contained an estimated 855 kL (226 kgal) of waste classified as noncomplexed (Hanlon 1996). Liquid waste volume was estimated with a level measurement gauge. Solid waste volume was estimated using a combination of photographic evaluation and a sludge level measurement device. The solid waste volume was updated on June 30, 1996. Table A1-1 shows the waste phase amounts in the tank.

Table A1-1. Estimated Tank Contents.

Waste Form	Estimated Volume[1]	
	kL	kgal
Total waste	855	226
Supernatant liquid	57	15
Saltcake	700 (798)[2]	185 (211)[2]
Sludge	98 (0)[2]	26 (0)[2]
Drainable interstitial liquid	257	68
Drainable liquid remaining	314	83
Pumpable liquid remaining	322	85

Notes:

[1]For definitions and calculation methods, refer to Appendix C, Hanlon (1996).

[2]Although Hanlon (1996) indicates the presence of a sludge layer, the results of the 1996 core sampling indicate the waste is saltcake (unless there is a small amount of sludge in the dish bottom that would not have been sampled).

Tank 241-U-106 is out of service, categorized as sound, and partially interim isolated. The tank is on the Organics Watch List and is passively ventilated. All monitoring systems were in compliance with documented standards as of September 30, 1996 (Hanlon 1996).

A2.0 TANK DESIGN AND BACKGROUND

The 241-U Tank Farm was constructed during 1943 and 1944 in the 200 West Area of the Hanford Site. The farm contains twelve 100 series tanks and four 200 series tanks. The 100 series tanks have a capacity of 2,010 kL (530 kgal), a diameter of 23 m (75 ft), and an operating depth of 5.2 m (17 ft) (Leach and Stahl 1996). Built according to the first generation design, the 241-U Tank Farm was designed for nonboiling waste with a maximum fluid temperature of 104 °C (220 °F). A cascade overflow line 7.5 cm (3 in.) in diameter connects tank 241-U-106 as third in a cascade series of three tanks beginning with tanks 241-U-104 and 241-U-105. Each tank in the series is one foot lower in elevation than the preceding tank. The cascade overflow height is approximately 4.9 m (16 ft) from the tank bottom and 60 cm (2 ft) below the top of the steel liner.

The tank has a dished bottom with a 1.2-m (4-ft)-radius knuckle. Tank 241-U-106 was designed with a primary mild steel liner (ASTM[1] A283 Grade C) and a concrete dome with risers. The tank is on a reinforced concrete foundation. The tank and foundation were waterproofed by a coating of tar covered by a three-ply, asphalt-impregnated, waterproofing fabric. The waterproofing was protected by welded wire reinforced cement-like material. Two coats of primer were sprayed on all exposed interior tank surfaces (Rogers and Daniels 1944). The tank ceiling dome was covered with three applications of magnesium zinc fluorosilicate wash. Lead flashing was used to protect the joint where the steel liner meets the concrete dome. Asbestos gaskets were used to seal the risers in the tank dome. The tank was covered with approximately 2.1 m (7 ft) of overburden.

According to drawings, tank 241-U-106 has 13 risers. The risers range in diameter from 10 cm (4 in.) to 1.1 m (3.5 ft). Table A2-1 shows riser numbers, diameters, and descriptions and inlet, overflow, and spare nozzles. Figure A2-1 shows the riser configuration. Riser 19, 10 cm (4 in.) in diameter, and risers 2 and 7, 30 cm (12 in.) in diameter, are available for use (Lipnicki 1996). Figure A2-2 is a tank cross section that shows the approximate waste level and a schematic of the tank equipment.

[1]American Society for Testing and Materials

Figure A2-1. Riser Configuration for Tank 241-U-106.

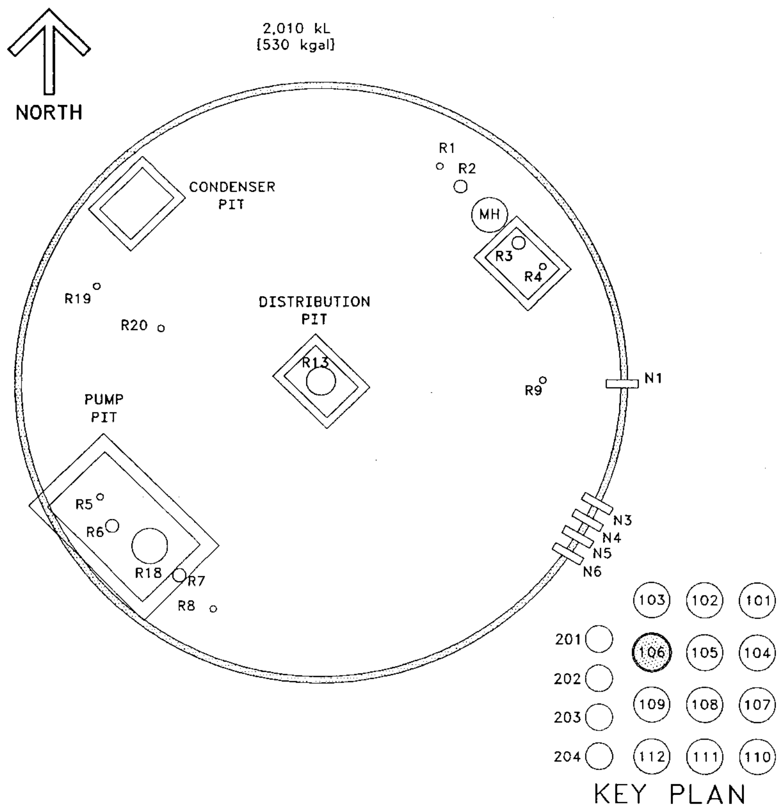


Figure A2-2. Tank 241-U-106 Configuration.

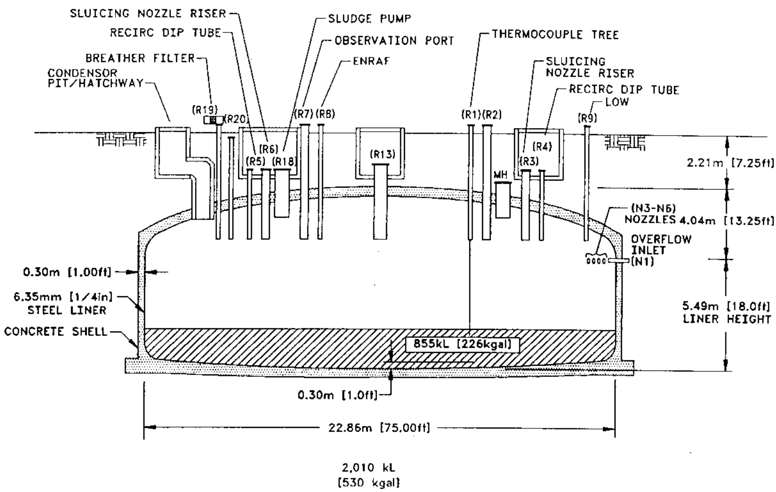


Table A2-1. Tank 241-U-106 Risers.[1]

Riser Number	Diameter (in.)	Description and Comments
1	4	Thermocouple tree [Benchmark CEO-37531 December 11, 1986]
2[2]	12	Flange
3	12	Sluice nozzle, weather covered
4	4	Recirculation line dip tubes, weather covered
5	4	Recirculation line dip tubes, weather covered
6	12	Sluicing nozzle, weather covered
7[2]	12	B-222 observation port
8	4	[ENRAF[3] 854 ECN-608148 July 12, 1994] Food Instrument Corporation level measurement gauge
9	4	B-436 liquid observation well [Benchmark CEO-37531 December 11, 1986]
13	36	Distributor jet, weather covered
18	42	Sludge pump, weather covered
19[2]	4	Breather filter
20	4	Below grade
Nozzle Number	**Diameter (in.)**	**Description and Comments**
N1	3	Inlet nozzle
N3	4	Spare
N4	4	Spare
N5	4	Spare
N6	4	Spare

Notes:

CEO = change engineering order
ECN = engineering change notice

[1]Riser information is compiled from Alstad 1993, Lipnicki 1996, Tran 1993, and Vitro Engineering Corporation 1988.

[2]Risers available for sampling.

[3]ENRAF is a registered trademark of the ENRAF Corporation, Houston, Texas.

A3.0 PROCESS KNOWLEDGE

The sections below: 1) provide information about the transfer history of tank 241-U-106, 2) describe the process wastes that make up the transfers, and 3) estimate the current tank contents based on transfer history.

A3.1 WASTE TRANSFER HISTORY

Table A3-1 summarizes the waste transfer history of tank 241-U-106 (Agnew et al. 1996c). Tank 241-U-106 began receiving metal waste through the cascade line from tank 241-U-105 in the second quarter of 1948. The tank continued to receive cascading metal waste from tank 241-U-105 until the third quarter of 1948. During the first quarter of 1953, the tank received supernatant from tank 241-TX-114, tributyl phosphate (uranium recovery waste) from tank 241-TX-115, and metal waste slurry, (probably as suspended solids) from tanks 241-U-104 and 241-U-105. During the first three quarters of 1953, the sludge waste was sent to 221-U Plant for uranium recovery operations, and the tank received flush water. In the fourth quarter of 1954, the tank received metal waste through the cascade line from tank 241-U-105. From the second quarter of 1955 through the fourth quarter of 1956, waste was sent to 221-U Plant for uranium recovery operations, and the tank received flush water.

In the third quarter of 1960, the tank received reduction oxidation (REDOX) high-level waste from tank 241-U-101. REDOX high-level waste was sent to tank 241-S-110 in the first quarter of 1974. The tank received supernatant (probably B Plant low-level waste) from tank 241-C-104 in the fourth quarter of 1975 and the first quarter of 1976. During the first quarter of 1976, waste was received from tank 241-U-111 and sent to tank 241-S-102. During the third and fourth quarters of 1976 and the first quarter of 1977, evaporator feed was sent to tank 241-S-102, and 242-S Evaporator bottoms waste was received from tank 241-S-102. In the second quarter of 1977, waste was sent to tank 241-SY-102.

Table A3-1. Summary of Tank 241-U-106 Waste Transfer History.[1,2] (2 sheets)

Transfer Source	Transfer Destination	Waste Type Received	Time Period	Estimated Waste Volume[1]	
				Kiloliters	Kilogallons
241-U-105		Metal waste	1948	2,010	530
241-TX-114		First-cycle supernatant	1953	1,270	336
241-TX-115		Tributyl phosphate waste	1953	167	44

Table A3-1. Summary of Tank 241-U-106 Waste Transfer History.[1,2] (2 sheets)

Transfer Source	Transfer Destination	Waste Type Received	Time Period	Estimated Waste Volume[3]	
				Kiloliters	Kilogallons
241-U-104 and 241-U-105		Metal waste sludge	1953	3,130	826
Misc.		Flush water	1953	3,570	942
	Uranium Recovery	Metal waste/flush water	1953	9,990	2639
241-U-105		Metal waste	1954	1,070	283
	Uranium Recovery	Metal waste/flush water	1955	882	233
Misc.		Flush water	1955-1956	1,780	469
	Uranium Recovery	Metal waste/flush water	1956	2,070	548
241-U-101		REDOX high-level waste	1960	1,830	483
	241-S-110	Supernatant	1974	1,610	424
241-C-104		Supernatant (probably B plant low-level waste)	1975 - 1976	1,520	402
	241-U-111	Supernatant	1976	1,800	475
241-S-102		242-S Evaporator bottoms	1976	1,480	390
	241-S-102	Supernatant	1976 - 1977	280	74
	241-SY-102	Supernatant	1977	397	105

Notes:
[1]Agnew et al. (1996c)
[2]Waste volumes and types are best estimates based on historical data.
[3]The above transfers add up to 785 kL (207 kgal) but the recorded tank volume is 855 kL (226 kgal). There is a discrepancy because the above listed transfers do not account for small or unrecorded transfers into or out of the tank.

A3.2 HISTORICAL ESTIMATION OF TANK CONTENTS

The historical transfer data used for this estimate are from the following sources:

- *Waste Status and Transaction Record summary for the Southwest Quadrant of the Hanford 200 East Area (WSTRS)* (Agnew et al. 1996a). WSTRS is a tank-by-tank quarterly summary spreadsheet of waste transactions.

- *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 3* (Agnew et al. 1996b). This document contains the Hanford defined waste (HDW) list, the supernatant mixing model (SMM), and the tank layer model (TLM).

- Historical Tank Content Estimate for the (Northeast, Northwest, Southeast, Southwest) Quadrant of the Hanford 200 (East and West) Area (HTCE). These four documents compile and summarize much of the process history, design, and technical information regarding the underground waste storage tanks in the 200 Areas.

- Tank layer model (TLM). The TLM defines the sludge and saltcake layers in each tank using waste composition and waste transfer information.

- Supernatant mixing model (SMM). This is a subroutine within the HDW model that calculates the volume and composition of certain supernatant blends and concentrates.

Using these records, the TLM defines the sludge and saltcake layers in each tank. The SMM uses information from both WSTRS and the TLM to describe the supernatants and concentrates in each tank. Together, the WSTRS, TLM and SMM determine each tank's inventory estimate. These model predictions are estimates that require further evaluation using analytical data.

Based on the HDW model, tank 241-U-106 contains two layers of solid waste and 57 kL (15 kgal) of supernatant. Listed from the bottom to the top of the waste, these solid layers are 98 kL (26 kgal) of metal waste and 700 kL (185 kgal) of 242-S Evaporator saltcake (SMMS1). The SMMS1 waste composition is calculated by the HDW model and is considered a concentrated supernatant. Figure A3-1 is a graphical representation of the estimated waste types and volumes for these layers. Table A3-2 provides the historical inventory estimate of the waste contents as predicted by the HDW model.

Figure A3-1. Tank Layer Model for Tank 241-U-106.

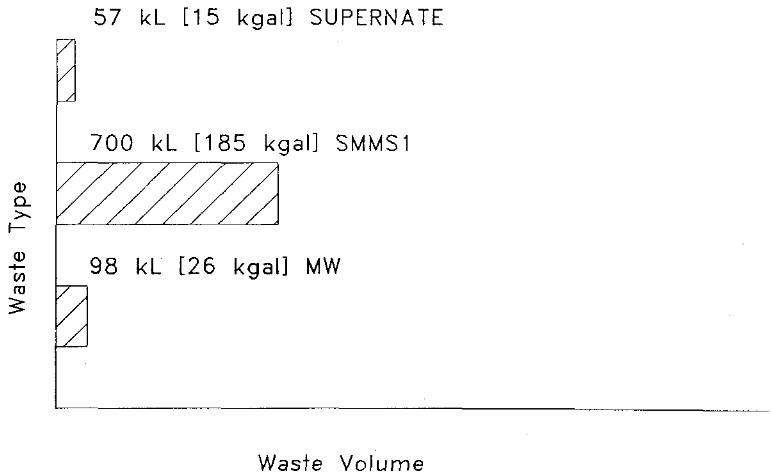


Table A3-2. Historical Tank Inventory Estimate[1,2] (2 sheets)

Total Inventory Estimate			
Physical Properties			
Total solid waste	1.43E+06 kg (226 kgal)		
Heat load	1.80 kW (6.15E+03 Btu/hr)		
Bulk density	1.67 g/cm^3		
Water wt%	31.2		
Total organic carbon[3] wt% carbon (wet)	1.00		
Chemical Constituents	*M*	µg/g	kg[4]
Na^+	13.1	1.80E+05	2.57E+05
Al^{3+}	1.68	2.72E+04	3.88E+04
Fe^{3+} (total Fe)	2.16E-02	723	1.03E+03
Cr^{3+}	6.15E-02	1.92E+03	2.73E+03
Bi^{3+}	1.23E-03	154	220
La^{3+}	5.24E-05	4.36	6.22
Hg^{2+}	8.98E-06	1.08	1.54
Zr (as $ZrO(OH)_2$)	8.22E-04	44.9	64.1
Pb^{2+}	1.04E-03	129	184
Ni^{2+}	6.86E-03	241	345
Sr^{2+}	1.75E-05	0.917	1.31
Mn^{4+}	4.37E-03	144	205
Ca^{2+}	4.59E-02	1.10E+03	1.57E+03
K^{1+}	5.96E-02	1.40E+03	1.99E+03
OH^-	8.81	8.98E+04	1.28E+05
NO_3^-	5.39	2.00E+05	2.86E+05
NO_2^-	2.48	6.83E+04	9.74E+04
CO_3^{2-}	0.725	2.61E+04	3.72E+04
PO_4^{3-}	0.141	8.01E+03	1.14E+04
SO_4^{2-}	0.276	1.59E+04	2.27E+04
Si (as SiO_3^{2-})	8.77E-02	1.48E+03	2.11E+03
F^-	6.94E-02	791	1.13E+03
Cl^-	0.221	4.68E+03	6.69E+03

Table A3-2. Historical Tank Inventory Estimate[1,2] (2 sheets)

Total Inventory Estimate			
Chemical Constituents	***M***	**μg/g**	**kg**[4]
$C_6H_5O_7^{3-}$	3.56E-02	4.04E+03	5.76E+03
$EDTA^{4-}$	2.19E-02	3.79E+03	5.40E+03
$HEDTA^{3-}$	4.08E-02	6.71E+03	9.57E+03
glycolate$^-$	0.130	5.84E+03	8.33E+03
acetate$^-$	9.67E-03	342	488
oxalate^{2-}	4.48E-05	2.36	3.37
DBP	2.23E-02	3.55E+03	5.07E+03
Butanol	2.23E-02	989	1.41E+03
NH_3	5.71E-02	581	830
$Fe(CN)_6^{4-}$	0	0	0
Radiological Constituents			
Pu		5.40E-02 (μCi/g)	1.30 (kg)
U	0.242 (*M*)	3.45E+04 (μg/g)	4.93E+04 (kg)
Cs	0.252 (Ci/L)	151 (μCi/g)	2.16E+05 (Ci)
Sr	0.137 (Ci/L)	82.1 (μCi/g)	1.17E+05 (Ci)

Notes:

[1]Agnew et al. (1996a)

[2]These historical tank content estimate (HTCE) predictions have not been validated and should be used with caution.

[3]Agnew et al. (1966b)

[4]Differences exist among the inventories in this column and the inventories calculated from the two sets of concentrations.

A4.0 SURVEILLANCE DATA

Tank 241-U-106 surveillance includes surface-level measurements (liquid and solid) and temperature monitoring inside the tank (waste and headspace). The data provide the basis for determining tank integrity.

Changes in liquid-level measurements may indicate whether there is a major leak from a tank. Solid surface-level measurements indicate physical changes and consistency of the solid layers. Tank 241-U-106 has a liquid observation well, located in riser 9, to measure interstitial liquid levels; and four drywells, located around the perimeter of the tank, to enable monitoring increased radiation caused by possible waste leaks. None of the drywells are considered active.

A4.1 SURFACE LEVEL

The surface level of the waste is monitored with an ENRAF® system through riser 8. On July 11, 1996, the surface-level reading from the automatic ENRAF® system was 2.29 m (7.51 ft). In February 1996, the reference point for the ENRAF® system was changed from the side wall of the tank to the bottom center of the dish, thereby accounting for the 30 cm (12 in.) increase in waste surface level. Figure A4-1 is a graphical representation of the tank volume history.

A4.2 INTERNAL TANK TEMPERATURES

Tank 241-U-106 has a thermocouple tree located in riser 1, with 11 thermocouples to monitor the waste temperature. Elevations are available for all thermocouples.
Tank 241-U-106 is on the Organic Watch List, and its temperature is monitored continuously by the Tank Monitor And Control System. Plots of individual thermocouple readings can be found in the U Tank Farm supporting document for the HTCE (Brevick et al. 1996).

Data for all 11 thermocouples recorded from July 1987 to present were available from the Surveillance Analysis Computer System. The mean temperature is 25 °C (77 °F) with a minimum of 17 °C (62 °F) and a maximum of 33 °C (92 °F). The mean temperature over the last year (July 1995 through July 1996) is 25 °C (78 °F) with a minimum of 21 °C (70 °F) and a maximum of 30 °C (87 °F). This average was calculated based on data from thermocouples 1 through 6 and 10 only. On June 23, 1996, the low temperature recorded was 23 °C (74 °F) on thermocouples 4 and 5 (located in the headspace). The high temperature recording was 26 °C (78 °F) on thermocouples 1 and 2 (located in the waste). Figure A4-2 is a graph of the weekly high temperatures.

Figure A4-1. Level History for Tank 241-U-106.

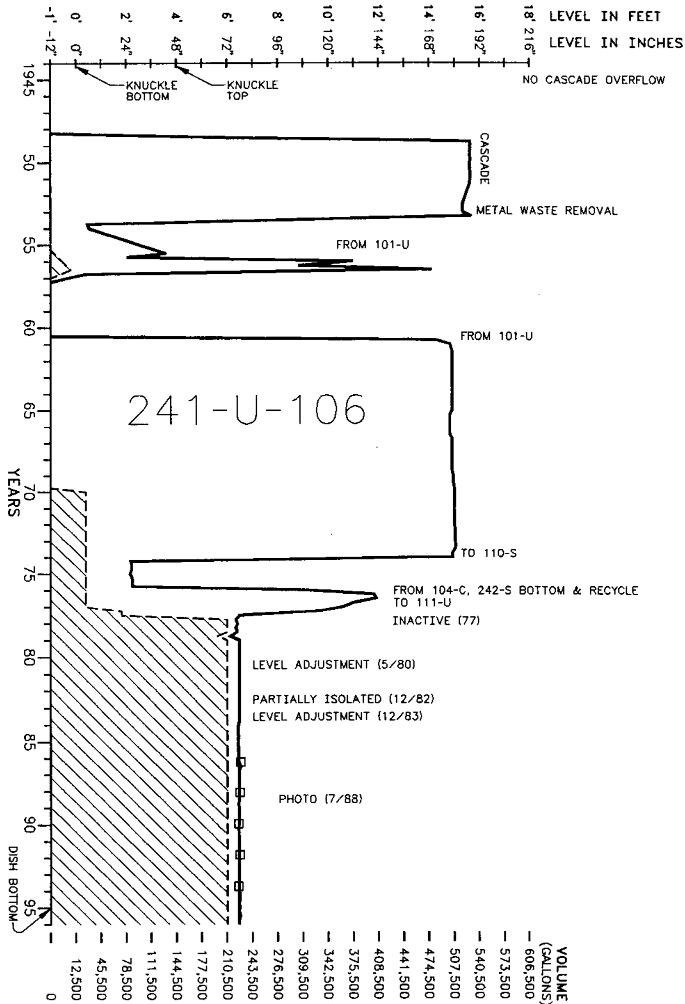
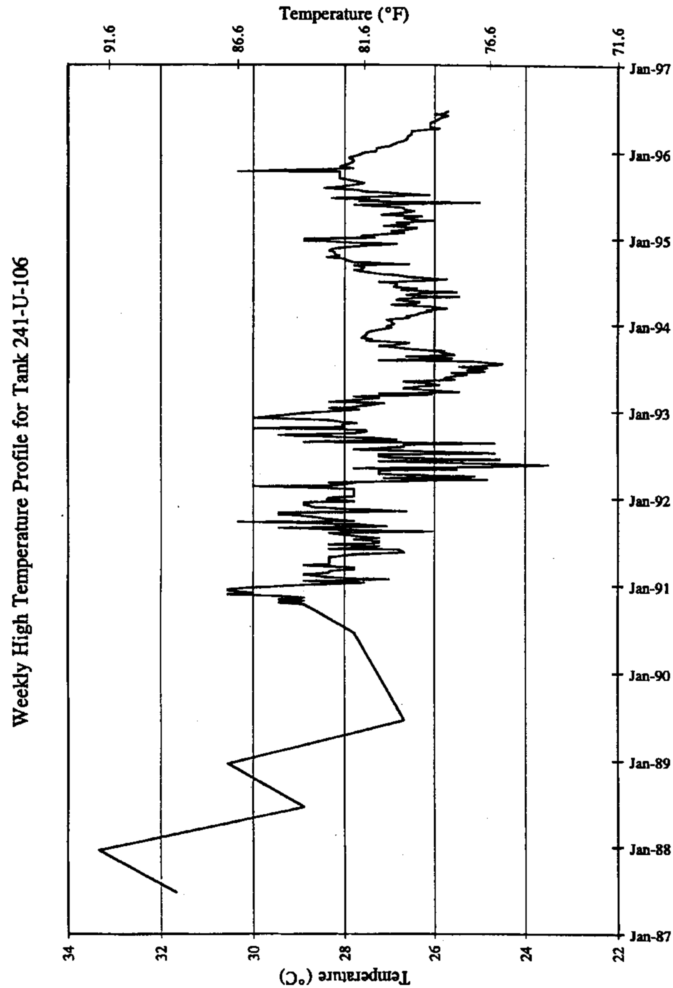


Figure A4-2. Weekly High Temperature Plot for Tank 241-U-106.



A4.3 INTERNAL TANK PHOTOGRAPHS

The July 1988 photographic montage of the tank 241-U-106 interior is not sufficiently clear to enable an accurate interpretation of the waste surface characteristics. In the foreground, a Food Instrument Corporation surface level probe can be seen contacting the supernatant. An old float is visible in the left center of the montage. A turbine pump, temperature probe, and liquid observation well are also visible. The volume of waste in the tank, 855 kL (226 kgal), has not changed since the photographs were taken; therefore, the photographic montage should accurately indicate the current appearance of the tank's waste. The photographic montage can be found in *Supporting Document for the Historical Tank Content Estimate for U Tank Farm* (Brevick et al. 1996).

A5.0 APPENDIX A REFERENCES

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APPENDIX B

SAMPLING OF TANK 241-U-106

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APPENDIX B

SAMPLING OF TANK 241-U-106

Appendix B provides sampling and analysis information for each known sampling event for tank 241-U-106. Each separate sampling and analysis event is discussed in chronological order in a separate section.

- **Section B1**: February 26, 1974 - Supernatant sample
- **Section B2**: June 29, 1977 - Sludge sample
- **Section B3**: August 25, 1994 - Vapor sample
- **Section B4**: September 14, 1994 - Grab sample
- **Section B5**: March 7, 1995 - Vapor sample
- **Section B6**: May 8 to 10, 1996 - Core sample

B1.0 FEBRUARY 26, 1974 - SUPERNATANT SAMPLE

A supernatant sample was analyzed, and the results were documented in an internal memorandum (Sant 1974). Details of the sampling and analysis event were not documented. Because the sample was labeled "evaporator feed samples," it is unlikely that the analysis represents the current tank supernatant. Table B1-1 summarizes the data (Sant 1974). The data have not been validated and should be used with caution.

B2.0 JUNE 29, 1977 - SLUDGE SAMPLE

A sludge sample was taken from tank 241-U-106, and the results were documented in an internal memorandum (Starr 1977). Although it is likely that chemical analysis of the sample was performed, analytical data with few exceptions were not reported in Starr. The memorandum indicated that 0.98 Ci/L of strontium-89/90 was present, and the sample contained 11 percent solids by volume after being centrifuged for one hour. The data have not been validated and should be used with caution.

Table B1-1. Supernatant Sample from Tank 241-U-106. Feed Samples for 242-S Evaporator (Sample Number T-1970).[1,2]

Category	Analyte (or Property)	Lab Value	Units
Physical or thermal	Visual description	Yellow liquid - no solids	n/a
	Specific gravity	1.3058	no unit
	Differential thermal analysis	No exotherms observed	n/a
	Water	61.91	Weight percent
	pH	12.4	no unit
Chemical	Sodium	5.73	*M*
	Aluminum	0.54	*M*
	Nitrate	4.09	*M*
	Nitrite	0.124	*M*
	Carbonate	6.93E-02	*M*
	Sulfate	2.10E-02	*M*
	Fluoride	1.45E-03	*M*
	Hydroxide	1.18	*M*
	Phosphate	1.24E-02	*M*
Radiological	Plutonium	<9.39E-07	g/L
	Cesium-137	1.29E+05	μCi/L

Notes:

[1]Sant (1974)

[2]Because of the lack of proper quality control procedures, historical data may not be reliable and should be used with caution.

B3.0 AUGUST 25, 1994 - VAPOR SAMPLE

B3.1 DESCRIPTION OF SAMPLING EVENT

Vapor sampling to support the vapor safety screening DQO (Osborne et al. 1994) was performed on August 25, 1994, using the in situ sampling method. Although the sampling and analysis of vapor samples was performed to meet the requirements of Revision 0 of the vapor safety screening DQO (Osborne et al. 1994), the current Revision 2 of the vapor screening DQO (Osborne and Buckley 1995) will be addressed in this report. Table B3-1 summarizes the sampling and analytical requirements for the vapor safety screening DQO.

Table B3-1. Sampling and Analytical Requirements for Tank 241-U-106 Vapor Samples.

Sampling Event	Applicable DQO[1]	Sampling Requirements	Applicable References and Analytical Requirements
Vapor sampling	Vapor safety screening	Vapor sample from a single point near the center of the headspace volume.	Tank headspace flammability, NH_3, CO_2, CO, NO, NO_2, N_2O, TOC, tributyl phosphate, n-dodecane, and n-tridecane.

Note:
[1]Osborne and Buckley (1995). Note that the sampling and analysis were actually performed to Osborne et al. (1994). However, this report will address the current requirements outlined in Osborne and Buckley (1995).

Sampling devices, including three sorbent trains (for inorganic analyses) and four SUMMA[1] canisters (for organic analyses), were supplied to the Westinghouse Hanford Company on August 16, and the samples were collected. Sampling media were prepared and analyzed by the Pacific Northwest Laboratory and the Oak Ridge National Laboratory. For detailed descriptions of the sampling and analysis for these vapor samples, refer to the *Vapor Space Characterization of Waste Tank 241-U-106 (In Situ): Results from Samples Collected on 8/25/94* (Ligotke et al. 1995).

Further vapor sampling was performed in March 1997 using the vapor sampling system (VSS). Appendix B5.0 describes the March 1997 vapor sampling.

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

B3.2 ANALYTICAL RESULTS

Table B3-2 summarizes the results of the vapor sampling event. This summary is taken from the executive summary of Ligotke et al. (1995). Further analyses were performed and are also reported in Ligotke et al.

Table B3-2. Summary Results of Vapor Samples Collected from the Headspace of Tank 241-U-106 on August 25, 1994.[1]

Category	Analyte	Vapor Concentration	Units
Inorganic	Hydrogen	not reported	
	NH_3	852	ppm (volumetric)
	NO_2	≤ 0.1	ppm (volumetric)
	NO	≤ 0.1	ppm (volumetric)
	H_2O	16	mg/L
Organic	Ethanol	1.47	mg/m^3
	1-Butanol	1.16	mg/m^3
	Acetone	1.16	mg/m^3
	Tridecane	0.68	mg/m^3
	Hexamethylcyclotrisiloxane	0.37	mg/m^3
	Pyridine	0.27	mg/m^3
	Isopropyl alcohol	0.27	mg/m^3
	Toluene	0.20	mg/m^3
	Butane	0.20	mg/m^3
	Propane	0.20	mg/m^3

Note:

[1]Ligotke et al. (1995)

B4.0 SEPTEMBER 14, 1994 - GRAB SAMPLE

B4.1 DESCRIPTION OF SAMPLING EVENT

Grab sampling to support the compatibility DQO (Carothers 1994) was performed on September 14, 1994. Although the sampling and analysis of the grab samples was performed to meet the requirements of Revision 0 of the compatibility DQO (Carothers 1994), the compatibility assessment will be performed to Revision 1 of the compatibility DQO (Fowler 1995). Three grab samples were taken from tank 241-U-106. The samples were received at the 222-S Laboratory on September 15, 1994. Table B4-1 summarizes the sampling and analytical requirements for the compatibility DQO.

Table B4-1. Sampling and Analytical Requirements for Tank 241-U-106 Grab Samples.

Sampling Event	Applicable DQO	Sampling Requirements	Applicable References and Analytical Requirements
Grab sampling	Compatibility[1]	Grab sample from a single location within the tank supernatant layer.	Aluminum, americium-241, carbonate, cesium-137, chloride, cooling curve, energetics, fluoride, hydroxide, nitrate, TOC, pH, phosphate, plutonium-239/240, volume percent solids, specific gravity, strontium-90, sulfate, uranium, viscosity.

Note:

[1]Fowler (1995). Note that the sampling and analysis were actually performed to Carothers (1994). However, the method outlined in Fowler (1995) will be used to perform the compatibility assessment.

B4.2 ANALYTICAL RESULTS

Only one grab sample was analyzed for the compatibility DQO (Carothers 1994). For analysis results, refer to Vogel (1994). Table B4-2 summarizes the results.

Table B4-2. Waste Compatibility Results for Tank 241-U-106 Grab Samples.[1] (2 sheets)

Analyte	Sample Result	Duplicate Result	Mean
METALS	µg/mL	µg/mL	µg/mL
Aluminum	1.47E+04	1.52E+04	1.50E+04
Iron	49.1	51.6	50.4
Sodium	2.66E+05	2.74E+05	2.70E+05
ANIONS	µg/mL	µg/mL	µg/mL
Fluoride	2.09E+03	2.00E+03	2.05E+03
Chloride	4.88E+03	4.87E+03	4.88E+03
Nitrite	8.76E+04	8.88E+04	8.82E+04
Nitrate	2.09E+05	2.07E+05	2.08E+05
Phosphate	5.55E+03	5.51E+03	5.53E+03
Hydroxide (liquid)	7.10E+03	7.49E+03	7.30E+03
Sulfate	8.49E+03	8.51E+03	8.50E+03
RADIONUCLIDES	µCi/mL	µCi/mL	µCi/mL
Cesium-137	4.50E+06	4.48E+06	4.49E+06
Strontium-90	51.1	51.5	51.3
Plutonium-239/240	7.50E-03	7.19E-03	7.35E-03
Plutonium-238	1.84E-03	1.93E-03	1.89E-03
Americium-241	0.197	0.282	0.240
PHYSICAL PROPERTIES			
Specific gravity	1.34	1.34	1.34
Weight percent solids	52.1	52.0	52.1
Percent water	48.1	48.3	48.2
pH	13.4	13.4	13.4

Table B4-2. Waste Compatibility Results for Tank 241-U-106 Grab Samples.[1] (2 sheets)

Analyte	Sample Result	Duplicate Result	Mean
THERMODYNAMIC PROPERTIES	J/g	J/g	J/g
Exothermic energy change	825 (at 304°C)	809 (at 304°C)	817
Endothermic energy change	893 (at 126°C)	872 (at 126°C)	882
CARBON	μg C/mL	μg C/mL	μg C/mL
TOC	3.79E+04	3.81E+04	3.80E+04
TIC	8.76E+03	8.75E+03	8.76E+03

Notes:
TIC = total inorganic carbon

[1]Vogel (1994)

B5.0 MARCH 7, 1995 - VAPOR SAMPLE

B5.1 DESCRIPTION OF SAMPLING EVENT

Vapor sampling to support the vapor safety screening DQO (Osborne et al. 1994) was performed on March 7, 1995, using the VSS method. Although the sampling and analysis of the vapor samples was performed to meet the requirements of Revision 0 of the vapor safety screening DQO (Osborne et al. 1994), the current revision (Revision 2) of the vapor safety screening DQO (Osborne and Buckley 1995) is addressed in this report (see Table B3-1).

B5.2 ANALYTICAL RESULTS

Headspace gas and vapor samples were collected from tank 241-U-106 using the VSS on March 7, 1995, by Westinghouse Hanford Company Sampling and Mobile Laboratories. For a detailed description of the sampling event, including a description of the VSS, refer to Caprio (1995). Table B5-1 summarizes the results of the vapor sampling event. The data is a summary of the extensive analytical results in Huckaby and Bratzel (1995).

Table B5-1. Summary Results of Vapor Samples Collected from the Headspace of Tank 241-U-106 on March 7, 1995.[1]

Category	Analyte	Vapor Concentration	Units
Inorganic	Hydrogen	210	ppm (volumetric)
	NH_3	988	ppm (volumetric)
	CO	< 12	ppm (volumetric)
	CO_2	46.5	ppm (volumetric)
	NO	≤ 0.04	ppm (volumetric)
	NO_2	≤ 0.04	ppm (volumetric)
	N_2O	559	ppm (volumetric)
	H_2O	12.9	mg/L
	H_2O	67	% relative humidity
Organic	Methane	< 61	ppm (volumetric)
	Tributyl phosphate	not reported	
	n-Dodecane	0.0022	ppm (volumetric)
	n-Tridecane	0.0046	ppm (volumetric)
	Total estimated organic vapor[2]	10.1	mg/m^3

Notes:

[1]Huckaby and Bratzel (1995). Only the analyses requested in the vapor safety screening DQO are reported.

[2]This value is the sum of quantitated and estimated organic vapor concentrations in samples analyzed at the Oak Ridge National Laboratory.

B6.0 MAY 8 to 10, 1996 - CORE SAMPLE

B6.1 DESCRIPTION OF SAMPLING EVENT

Two push-mode core samples, cores 147 and 148, were collected from tank 241-U-106 on May 8 through May 10, 1996. Each core was 5 segments deep. Core 147 was taken from riser 19, and core 148 was taken from riser 2. The samples were received at the 222-S Laboratory on May 14, 1996, except for segments 1 and 2 of core 147 which were received on May 16, 1996. A blank sample was not provided to the 222-S Laboratory as required in Brown (1996).

Before sampling, the work zone above the tank and in the tank headspace was screened for flammability issues.

B6.1.1 Sampling Requirements

Core sampling of tank 241-U-106 was performed to meet requirements of the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995), *Data Quality Objective to Support Resolution of the Organic Complexant Safety Issue* (Turner et al. 1995), and *Historical Model Evaluation Data Requirements* (Simpson and McCain 1996). Table B6-1 summarizes sampling and analytical requirements for the safety screening, organic, and historical DQOs.

B6.1.2 Sample Handling

The first sample was extruded on May 15, 1996, at the 222-S Laboratory, and the last samples were extruded on May 21, 1996. Table B6-2 summarizes the sample breakdown and sample descriptions from the sample extrusion events.

Table B6-1. Sampling and Analytical Requirements for Tank 241-U-106 Core Samples.

Sampling Event	Applicable DQOs	Sampling Requirements	Applicable References and Analytical Requirements
Push-mode core samples 147 and 148	Safety screening[1]	Core samples from two risers separated radially to the maximum extent possible.	Energetics, total alpha, bulk density, specific gravity, organic layer, headspace gas flammability
	Organic[2]	Two core samples	Energetics, moisture, total organic carbon, IC full suite, RSST[4]
	Historical[3]	Two core samples	Energetics, moisture, ICP full suite, IC full suite, bulk density, total uranium, total alpha, Cs-137, Np-237, Co-60, Eu-154, Sr-90

Notes:

IC = ion chromatography
RSST = reactive system screening tool

[1]Dukelow et al. (1995)
[2]Turner et al. (1995)
[3]Simpson and McCain (1996)
[4]Bechtold (1996)

Table B6-2. Tank 241-U-106 Subsampling Scheme and Sample Description. (2 sheets)

Seg.	Solids Length (in.)	Recovery (%)	Sample Description	Subsample Breakdown	Mass (g)
Core 147, Riser 19					
1	No solids	100	Drainable liquid - amber in color. No solids were observed.	Drainable liquid	314.5
2	8	87	Solids and drainable liquid were extruded. Solids were dark brown, and the texture resembled a slurry. The liquid was dark brown and opaque.	Drainable liquid	132.0
				Upper half solids	201.2
3	17	89	Solids were dark brown, and the texture resembled a slurry.	Upper half solids	178.7
				Lower half solids	200.8
4	19	100	Solids were dark brown, and the texture resembled a slurry. The sample appeared to be pitted with small holes.	Upper half solids	211.3
				Lower half solids	213.8
5	14	80	The upper portion of the solids (10 in.) was dark brown with the appearance of a moist sludge slurry. The lower portion of the solids (4 in.) was a wet, brown, salt.	Upper half solids	260.1
				Lower half solids	91.5

Table B6-2. Tank 241-U-106 Subsampling Scheme and Sample Description. (2 sheets)

Seg.	Solids Length (in.)	Recovery (%)	Sample Description	Subsample Breakdown	Mass (g)
Core 148, Riser 2					
1	No solids	100	The liquid was amber in color and opaque. No solids were observed.	Drainable liquid	116.5
2	9	73	The sample was dark brown with some gray portions.	Drainable liquid	124.1
				Upper half solids	104.3
				Lower half solids	120.8
3	18	95	The sample was dark brown and had the appearance of a moist sludge. The sample retained its shape and appeared to be pitted with holes.	Upper half solids	202.8
				Lower half solids	197.4
4	19	100	The sample was dark brown and had the appearance of a moist sludge. The sample was pitted with small holes.	Upper half solids	227.1
				Lower half solids	194.3
5	11	72	The sample was dark brown and had the the appearance of a moist sludge/slurry.	Upper half solids	188.0
				Lower half solids	134.3

B6.2 ANALYTICAL RESULTS

Core samples from tank 241-U-106 were analyzed in the 222-S Laboratory according to the requirements of the safety screening, organic, and historical DQOs. This section discusses the analysis of samples and the presentation of analytical data. Sample analysis was performed as specified in Brown (1996) and is reported in the data package (Steen 1996). Table B6-3 summarizes the sample analysis.

Table B6-3. Tank 241-U-106 Sample Analysis Summary (For Samples From Cores 147 and 148). (2 sheets)

Sample Portion	Analyses	Preparation Method
Drainable liquids (Segments 1 and 2 only)	ICP full suite[1]	Direct
	IC full suite[2]	Direct
	TIC/TOC	Direct
	TOC (furnace oxidation)	Direct
	DSC/TGA	Direct
	Specific gravity	Direct
	Total alpha	Direct
Solids (Segments 2 through 5, upper and lower half)[4]	ICP full suite[1]	Acid, fusion
	IC full suite[2]	Water
	Cyanide (water distillation)	Direct
	TIC/TOC	Direct
	DSC/TGA	Direct
	GEA full suite[3]	Fusion
Solids (Segments 2 through 5, lower half only)[4]	Density	Direct
	Total alpha	Fusion

Table B6-3. Tank 241-U-106 Sample Analysis Summary
(For Samples From Cores 147 and 148). (2 sheets)

Sample Portion	Analyses	Preparation Method
Solids (Core composite)	ICP full suite[1]	Acid, fusion, water
	IC full suite[2]	Water
	Uranium (phosphorescence)	Fusion
	TIC/TOC	Direct
	Density	Direct
	DSC/TGA	Direct
	Total alpha	Fusion
	Total beta	Fusion
	GEA full suite[3]	Fusion
	Strontium-90	Fusion

Notes:
GEA = gamma energy analysis
TGA = thermogravimetric analysis

[1]Full suite ICP includes the following: aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, calcium, cerium, chromium, cobalt, copper, iron, lanthanum, lead, lithium, magnesium, manganese, molybdenum, neodymium, nickel, phosphorus, potassium, samarium, selenium, silicon, silver, sodium, strontium, sulfer, thallium, titanium, total uranium, vanadium, zinc, and zirconium.

[2]Full suite IC includes the following: bromide, chloride, fluoride, nitrate, nitrite, phosphate, sulfate, and oxalate.

[3]Full suite GEA includes the following: americium-241, cesium-137, cobalt-60, europium-154, and europium-155.

[4]Segments 2 through 5 were subdivided into an upper half and lower half except for segment 2 of core 147 which was not subdivided.

The remainder of Section B6.2 provides the results of the core sample analysis. Table B6-4 summarizes the results.

Table B6-4. Analytical Presentation Tables.

Category	Analysis	Table Number
Physical and thermal	Density	B6-5
	Specific gravity	B6-6
	DSC	B6-7
	Water	B6-8
Radiochemical	Total alpha	B6-9
	Total beta	B6-10
	Strontium-90	B6-11
	GEA full suite	B6-12 to B6-16
Chemical	TOC	B6-17
	TOC (furnace oxidation)	B6-18
	TIC	B6-19
	Cyanide (water distillation)	B6-20
	ICP full suite	B6-21 to B6-57
	Uranium (phosphorescence)	B6-58
	IC full suite	B6-59 to B6-66

The four quality control (QC) parameters assessed in conjunction with the tank 241-U-106 samples were standard recoveries, spike recoveries, duplicate analyses (relative percent differences [RPDs]), and blanks. The QC criteria specified in Brown (1996) were applied to the data. The only QC parameter for which limits were not specified was blank contamination. The limits for blanks are in guidelines followed by the laboratory (DOE-RL 1996). All data results in this report meet those guidelines. Sample and duplicate pairs, in which the QC parameters are outside the limits specified in Brown (1996) are footnoted in the sample mean column of the data summary tables with an a, b, c, d, or e.

- "a" indicates the standard recovery was below the QC limit.
- "b" indicates the standard recovery was above the QC limit.
- "c" indicates the spike recovery was below the QC limit.
- "d" indicates the spike recovery was above the QC limit.
- "e" indicates the RPD was above the QC limit.

In the following data tables, sample number refers to the laboratory sample number assigned by the 222-S Laboratory. Sample location refers to the core and segment respectively. Sample portion refers to the subsampling of the segment (for example, upper half solids, lower half solids, or drainable liquid). The result and duplicate results are the measured results from the laboratory. The mean is the mean of the sample and the duplicate. Section B6.3 contains the mean of the total data set.

B6.2.1 Density

Density was measured on the core composites and on the lower half segments of each segment. Density was not measured on segment 1 of each core because segment 1 was liquid (supernatant) only. Density was not measured for segment 2 of core 147 because the segment was not subdivided into a lower half portion. Density was measured according to laboratory procedure LO-160-103. Table B6-5 shows the density measurements.

It was necessary to measure density to estimate the inventories of other tank analytes. For the purpose of estimating tank inventories for the solids portion of the waste, an average was used. The average density was estimated by the arithmetic mean of all available density numbers. The average bulk density of the tank was estimated to be 1.62 g/mL.

Table B6-5. Tank 241-U-106 Analytical Results: Bulk Density

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids			g/mL	g/mL	g/mL
S96T002949	147: 3	Lower half	1.49	n/a	1.49
S96T002987	147: 4	Lower half	1.51	n/a	1.51
S96T002970	147: 5	Lower half	1.87	n/a	1.87
S96T002971	148: 2	Lower half	1.58	n/a	1.58
S96T002974	148: 3	Lower half	1.68	n/a	1.68
S96T002976	148: 4	Lower half	1.64	n/a	1.64
S96T002990	148: 5	Lower half	1.57	n/a	1.57
S96T003875	Core composite	Whole	1.61	n/a	1.61
S96T003881		Whole	1.61	n/a	1.61

B6.2.2 Specific Gravity

Specific gravity was measured on the drainable liquid samples from segments 1 and 2. Specific gravity was measured according to laboratory procedure LA-510-112. Table B6-6 reports specific gravity.

It was necessary to measure specific gravity to estimate the inventory of other analytes in the The average specific gravity was estimated by the arithmetic mean of segment 1 of cores 147 and 148. The specific gravity of the supernatant was estimated to be 1.34. Segment 2 results were not used to calculate this average because at the uncertainty about whether the drainable liquid was from the supernatant layer or the interstitial liquid.

Table B6-6. Tank 241-U-106 Analytical Results: Specific Gravity.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			Unitless	Unitless	Unitless
S96T003063	147: 1	Drainable liquid	1.365	1.32	1.3425
S96T003064	147: 2	Drainable liquid	1.345	1.344	1.3445
S96T002860	148: 1	Drainable liquid	1.359	1.337	1.348
S96T003051	148: 2	Drainable liquid	1.326	1.346	1.336

B6.2.3 Differential Scanning Calorimetry

Differential scanning calorimetry was performed on the core composites and all subsegments (including drainable liquid samples). The DSC analyses for tank 241-U-106 were performed according to procedure LA-514-113 on a Mettler[2] DSC 20 instrument or procedure LA-514-114 on a Perkin-Elmer[3] DSC 7 instrument. Table B6-7 shows the DSC results.

Eighteen of 19 samples submitted for DSC analysis exceeded the notification limit of 480 J/g (dry weight basis) specified in the safety screening DQO (Dukelow et al. 1995). Both composite samples exceeded the notification limit. The average water value for each sample (by TGA) was used to estimate the dry weight basis exotherm. Section B6.2.4 shows the TGA results.

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

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

Table B6-7. Tank 241-U-106 Analytical Results:
Exotherm - Transition 1 (DSC - Dry Basis).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids			J/g	J/g	J/g
S96T003065	147: 2	Upper half	689	658	674
S96T003070	147: 3	Lower half	525	595	560
S96T003066		Upper half	584	579	581
S96T003068	147: 4	Lower half	619	554	587
S96T003067		Upper half	703	696	699
S96T003071	147: 5	Lower half	1020	848	936
S96T003069		Upper half	612	572	592
S96T003011	148: 2	Lower half	772	812	792
S96T003010		Upper half	785	801	793
S96T003013	148: 3	Lower half	839	916	877
S96T003012		Upper half	752	787	769
S96T003015	148: 4	Lower half	872	848	860
S96T003014		Upper half	545	449	497
S96T003017	148: 5	Lower half	55.8	59.0	57.4
S96T003016		Upper half	480	443	462
S96T003876	Core composite	Whole	606	520	563
S96T003882		Whole	532	535	533
Liquids			J/g	J/g	J/g
S96T003063	147: 1	Drainable liquid	965	967	966
S96T003064	147: 2	Drainable liquid	820	793	806
S96T002860	148: 1	Drainable liquid	815	875	845
S96T003051	148: 2	Drainable liquid	851	850	851

The sample that did not exceed the notification limit was the lower half of segment 5 of core 148 with an average exotherm of 57.4 g between the sample and the duplicate. This sample is at the tank bottom indicating the possibility of a different waste layer.

B6.2.4 Thermogravimetric Analysis

Thermogravimetric analysis was performed on core composites and all subsegment samples. The samples were analyzed by TGA according to procedure LA-514-114 on a Perkin-Elmer® TGA 7 instrument or procedure LA-560-112 on a Mettler® TG 50 instrument. Table B6-8 shows TGA analysis results.

One sample, the lower half of segment 5 of core 148, had a water content lower than 17 weight percent specified in the organic DQO (Turner et al. 1995). This sample was the same sample that had the low exotherm (see Section B6.2.3).

Table B6-8. Tank 241-U-106 Analytical Results: Percent Water (TGA). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids			%	%	%
S96T003065	147: 2	Upper half	40.85	42.63	41.74
S96T003070	147: 3	Lower half	40.43	40.13	40.28
S96T003066		Upper half	42.12	39.37	40.745
S96T003068	147: 4	Lower half	41.77	41.96	41.865
S96T003067		Upper half	46.39	44.21	45.3
S96T003071	147: 5	Lower half	46.27	42.87	44.57
S96T003069		Upper half	33.78	33.8	33.79
S96T003011	148: 2	Lower half	42.2	42.19	42.195
S96T003010		Upper half	43.8	40.33	42.065
S96T003013	148: 3	Lower half	46.92	47.63	47.275
S96T003012		Upper half	44.78	43.77	44.275

Table B6-8. Tank 241-U-106 Analytical Results: Percent Water (TGA). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids			%	%	%
S96T003015	148: 4	Lower half	45.08	43.88	44.48
S96T003014		Upper half	46.51	43.77	45.14
S96T003017	148: 5	Lower half	16.83	16.36	16.595
S96T003016		Upper half	25.2	28.49	26.845
S96T003876	Core composite	Whole	45.58	43.45	44.515
S96T003882		Whole	40.38	42.26	41.32
Liquids			%	%	%
S96T002860	148: 1	Drainable liquid	49.1	48.52	48.81
S96T003051	148: 2	Drainable liquid	48.11	47.68	47.895
S96T003063	147: 1	Drainable liquid	49.88	49.68	49.78
S96T003064	147: 2	Drainable liquid	47.59	48.2	47.895

B6.2.5 Total Alpha and Total Beta

Total alpha was performed on core composites and drainable liquid data. Total alpha was performed on the lower half of each solid segment. The solid segments and the composites were prepared by KOH fusion according to procedure LA-549-101. Total alpha was analyzed according to procedure LA-508-101. Table B6-9 shows total alpha results. No sample exceeded the total alpha limit defined in the safety screening DQO (Dukelow et al. 1995).

Total beta was performed on core composites only. The KOH fusion and analysis procedures used for total beta samples are the same as those used for total alpha samples. Table B6-10 shows total beta results.

Table B6-9. Tank 241-U-106 Analytical Results: Total Alpha (Alpha Radiation).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µCi/mL	µCi/mL	µCi/mL
S96T003063	147: 1	Drainable liquid	0.346	0.371	0.3585
S96T003064	147: 2	Drainable liquid	0.313	0.226	0.2695[QC:e]
S96T002860	148: 1	Drainable liquid	0.287	0.273	0.28
S96T003051	148: 2	Drainable liquid	0.307	0.265	0.286
Solids: fusion			µCi/g	µCi/g	µCi/g
S96T003083F	147: 3	Lower half	1.07	1.14	1.105
S96T003084F	147: 4	Lower half	1.26	1.33	1.295
S96T003085F	147: 5	Lower half	0.661	0.529	0.595[QC:e]
S96T003029F	148: 2	Lower half	1.19	1.17	1.18
S96T003031F	148: 3	Lower half	2.24	1.4	1.82[QC:e]
S96T003033F	148: 4	Lower half	1.67	1.72	1.695
S96T003035F	148: 5	Lower half	0.222	0.244	0.233
S96T003878F	Core composite	Whole	1.42	1.26	1.34
S96T003884F		Whole	1.29	0.839	1.0645[QC:e]

Table B6-10. Tank 241-U-106 Analytical Results: Total Beta (Alpha).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µCi/g	µCi/g	µCi/g
S96T003878F	Core composite	Whole	380	347	363.5[QC:b]
S96T003884F		Whole	339	251	295[QC:b,e]

B6.2.6 Strontium-90 and Gamma Energy Analysis

Strontium-90 was measured on core composite samples only. The samples were prepared according to procedure LA-549-141. The samples were analyzed according to procedure LA-220-101. Table B6-11 shows strontium results.

A GEA was performed on all solid and core composite samples. The solid segments and the composites were prepared by KOH fusion according to procedure LA-549-101. The analysis was performed according to procedure LA-548-121. The GEA reports results for americium-241, cesium-137, cobalt-60, europium-154, and europium-155. Tables B6-12 through B6-16 show GEA results.

B6.2.7 Total Organic Carbon

The TOC for tank 241-U-106 samples was measured by two methods. The persulfate method (procedure LA-342-100) was used to analyze all solid and liquid samples and composites. The furnace oxidation method (procedure LA-344-105) was used on the drainable liquid samples from segments 1 and 2 only.

Table B6-17 shows the results of the persulfate method TOC analyses. All samples exceeded the 3.0 weight percent TOC notification limit specified in the organic DQO (Turner et al. 1995) except for the lower half of segment 3 of core 147 and all samples from segment 5. The supernatant and drainable liquid samples in segments 1 and 2 had the highest quantities of TOC, over 6 weight percent. This indicates TOC is highest in the liquids at the tank top and lowest at the bottom of the waste.

Table B6-11. Tank 241-U-106 Analytical Results: Strontium-89/90.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µCi/g	µCi/g	µCi/g
S96T003878F	Core composite	Whole	91.1	87.7	89.4
S96T003884F		Whole	75.9	54.1	65

Table B6-12. Tank 241-U-106 Analytical Results: Americium-241 (GEA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µCi/g	µCi/g	µCi/g
S96T003079F	147: 2	Upper half	< 1.965	< 1.09	< 1.5275[QC:e]
S96T003083F	147: 3	Lower half	< 2.039	< 2.08	< 2.0595
S96T003080F		Upper half	< 2.036	< 2.64	< 2.338[QC:e]
S96T003084F	147: 4	Lower half	< 1.978	< 2	< 1.989
S96T003081F		Upper half	< 1.978	< 2	< 1.989
S96T003085F	147: 5	Lower half	< 0.7977	< 0.803	< 0.80035
S96T003082F		Upper half	< 1.376	< 0.943	< 1.1595[QC:e]
S96T003029F	148: 2	Lower half	1.604	1.81	1.707
S96T003026F		Upper half	< 1.186	< 1.16	< 1.173
S96T003031F	148: 3	Lower half	< 3.031	< 2.99	< 3.0105
S96T003030F		Upper half	< 1.173	< 1.1	< 1.1365
S96T003033F	148: 4	Lower half	< 2.375	< 2.36	< 2.3675
S96T003032F		Upper half	< 2.867	< 3.03	< 2.9485
S96T003035F	148: 5	Lower half	< 0.7316	< 0.736	< 0.7338
S96T003034F		Upper half	< 1.358	< 1.39	< 1.374
S96T003878F	Core composite	Whole	< 1.738	< 1.69	< 1.714
S96T003884F		Whole	< 1.964	< 1.67	< 1.817

Table B6-13. Tank 241-U-106 Analytical Results: Cesium-137 (GEA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µCi/g	µCi/g	µCi/g
S96T003079F	147: 2	Upper half	172.8	52.1	112.45[QC:e]
S96T003083F	147: 3	Lower half	180	184	182
S96T003080F		Upper half	188.9	186	187.45
S96T003084F	147: 4	Lower half	177.4	176	176.7
S96T003081F		Upper half	179	177	178
S96T003085F	147: 5	Lower half	67.58	67.4	67.49
S96T003082F		Upper half	113.4	102	107.7
S96T003029F	148: 2	Lower half	180.7	185	182.85
S96T003026F		Upper half	197.8	173	185.4
S96T003031F	148: 3	Lower half	178.2	181	179.6
S96T003030F		Upper half	189.7	184	186.85
S96T003033F	148: 4	Lower half	167.4	176	171.7
S96T003032F		Upper half	182.6	189	185.8
S96T003035F	148: 5	Lower half	61.1	65.9	63.5
S96T003034F		Upper half	95.18	104	99.59
S96T003878F	Core composite	Whole	174.6	166	170.3
S96T003884F		Whole	161.4	126	143.7[QC:e]

Table B6-14. Tank 241-U-106 Analytical Results: Cobalt-60 (GEA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µCi/g	µCi/g	µCi/g
S96T003079F	147: 2	Upper half	0.1616	< 0.0745	< 0.11805[QC:e]
S96T003083F	147: 3	Lower half	< 0.1021	0.184	< 0.14305[QC:e]
S96T003080F		Upper half	0.1879	0.169	0.17845
S96T003084F	147: 4	Lower half	0.1686	< 0.112	< 0.1403[QC:e]
S96T003081F		Upper half	0.1548	0.132	0.1434
S96T003085F	147: 5	Lower half	0.08158	0.0882	0.08489
S96T003082F		Upper half	0.1173	0.0873	0.1023[QC:e]
S96T003029F	148: 2	Lower half	0.1683	0.185	0.17665
S96T003026F		Upper half	0.1632	< 0.116	< 0.1396[QC:e]
S96T003031F	148: 3	Lower half	< 0.2371	< 0.209	< 0.22305
S96T003030F		Upper half	0.1779	0.164	0.17095
S96T003033F	148: 4	Lower half	< 0.1418	< 0.199	< 0.1704[QC:e]
S96T003032F		Upper half	< 0.2192	< 0.263	< 0.2411
S96T003035F	148: 5	Lower half	< 0.04325	0.0697	< 0.056475[QC:e]
S96T003034F		Upper half	< 0.09284	< 0.107	< 0.09992
S96T003878F	Core composite	Whole	0.1426	0.152	0.1473
S96T003884F		Whole	0.1541	< 0.115	< 0.13455[QC:e]

Table B6-15. Tank 241-U-106 Analytical Results: Europium-154 (GEA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µCi/g	µCi/g	µCi/g
S96T003079F	147: 2	Upper half	1.42	< 0.327	< 0.8735[QC:e]
S96T003083F	147: 3	Lower half	1.574	1.56	1.567
S96T003080F		Upper half	1.579	1.77	1.6745
S96T003084F	147: 4	Lower half	1.73	1.55	1.64
S96T003081F		Upper half	1.548	1.55	1.549
S96T003085F	147: 5	Lower half	0.6903	0.659	0.67465
S96T003082F		Upper half	1.066	0.863	0.9645[QC:e]
S96T003029F	148: 2	Lower half	1.435	1.56	1.4975
S96T003026F		Upper half	1.365	1.4	1.3825
S96T003031F	148: 3	Lower half	1.977	1.38	1.6785[QC:e]
S96T003030F		Upper half	1.695	1.67	1.6825
S96T003033F	148: 4	Lower half	1.362	1.27	1.316
S96T003032F		Upper half	1.657	1.64	1.6485
S96T003035F	148: 5	Lower half	0.3382	0.345	0.3416
S96T003034F		Upper half	0.6246	0.93	0.7773[QC:e]
S96T003878F	Core composite	Whole	1.426	1.23	1.328
S96T003884F		Whole	1.341	1.03	1.1855[QC:e]

Table B6-16. Tank 241-U-106 Analytical Results: Europium-155 (GEA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µCi/g	µCi/g	µCi/g
S96T003079F	147: 2	Upper half	1.366	< 0.459	< 0.9125[QC:e]
S96T003083F	147: 3	Lower half	< 1.104	< 1.23	< 1.167
S96T003080F		Upper half	< 0.9115	< 1.1	< 1.00575
S96T003084F	147: 4	Lower half	< 0.907	1.47	< 1.1885[QC:e]
S96T003081F		Upper half	< 1.014	< 0.564	< 0.789[QC:e]
S96T003085F	147: 5	Lower half	0.6179	< 0.284	< 0.45095[QC:e]
S96T003082F		Upper half	0.8763	0.757	0.81665
S96T003029F	148: 2	Lower half	0.9881	1.04	1.01405
S96T003026F		Upper half	0.9543	0.708	0.83115[QC:e]
S96T003031F	148: 3	Lower half	< 1.459	< 1.52	< 1.4895
S96T003030F		Upper half	1.306	0.938	1.122[QC:e]
S96T003033F	148: 4	Lower half	< 1.158	< 1.19	< 1.174
S96T003032F		Upper half	< 1.468	< 1.47	< 1.469
S96T003035F	148: 5	Lower half	< 0.3552	< 0.37	< 0.3626
S96T003034F		Upper half	< 0.6689	< 0.696	< 0.68245
S96T003878F	Core composite	Whole	< 0.867	1.06	< 0.9635
S96T003884F		Whole	< 0.8825	< 0.794	< 0.83825

Table B6-17. Tank 241-U-106 Analytical Results: Total Organic Carbon (TIC/TOC - Dry Basis).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids			μg/g	μg/g	μg/g
S96T003065	147: 2	Upper half	45,100	45,800	45,500
S96T003070	147: 3	Lower half	32,100	25,100	28,600[QC:e]
S96T003066		Upper half	44,700	44,000	44,400
S96T003068	147: 4	Lower half	42,000	44,400	43,200[QC:d]
S96T003067		Upper half	47,300	47,000	47,200
S96T003071	147: 5	Lower half	15,700	16,700	16,300
S96T003069		Upper half	24,600	22,100	23,200
S96T003011	148: 2	Lower half	43,900	42,400	43,300
S96T003010		Upper half	40,700	39,500	40,100
S96T003013	148: 3	Lower half	49,300	48,500	48,900
S96T003012		Upper half	46,100	45,800	45,900
S96T003015	148: 4	Lower half	45,900	45,000	45,400
S96T003014		Upper half	44,700	49,000	46,800
S96T003017	148: 5	Lower half	10,700	10,700	10,700
S96T003016		Upper half	22,800	19,700	21,300
S96T003876	Core composite	Whole	32,300	38,000	35,100
S96T003882		Whole	38,000	38,200	38,100
Liquids			μg/g	μg/g	μg/g
S96T003063	147: 1	Drainable liquid	50,900	50,500	50,700
S96T003064	147: 2	Drainable liquid	47,700	47,800	47,800
S96T002860	148: 1	Drainable liquid	48,100	50,700	48,200
S96T003051	148: 2	Drainable liquid	64,500	64,300	64,200

Table B6-18 shows the results of the furnace oxidation method TOC analyses for the liquid samples. The average TOC in the liquids by the furnace oxidation method is 8.3 weight percent whereas the average TOC of liquids by the persulfate method is 6.6 weight percent. The furnace oxidation method indicates about 2 percent more TOC (on average) in the supernatant than the persulfate method indicates.

Table B6-18. Tank 241-U-106 Analytical Results: Total Organic Carbon (Furnace Oxidation - Dry Basis).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/g	μg/g	μg/g
S96T003063	147: 1	Drainable liquid	70,400	68,800	69,600
S96T003064	147: 2	Drainable liquid	59,400	58,700	59,000
S96T002860	148: 1	Drainable liquid	60,200	58,900	59,600
S96T003051	148: 2	Drainable liquid	61,200	58,800	60,000

B6.2.8 Total Inorganic Carbon

Total inorganic carbon was analyzed for all solid, liquid, and composite samples. The method used was the same used to measure TOC by persulfate (see Section B.2.7). Table B6-19 shows TIC analyses.

B6.2.9 Cyanide

Cyanide analysis was performed to meet requirements of the safety screening DQO (Dukelow et al. 1995). It was triggered by the high DSC measurements. Cyanide analysis was performed on all subsegments samples for segments 2 through 5. The procedures used to perform cyanide analysis were LA-695-102 and LA-695-103. No cyanide analysis was over the limit specified in the safety screening DQO. Table B6-20 shows cyanide results.

Table B6-19. Tank 241-U-106 Analytical Results: Total Inorganic Carbon (TIC/TOC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids			µg/g	µg/g	µg/g
S96T003065	147: 2	Upper half	11,300	11,600	11,450
S96T003070	147: 3	Lower half	12,600	14,800	13,700
S96T003066		Upper half	12,800	13,000	12,900
S96T003068	147: 4	Lower half	13,600	13,400	13,500[QC:d]
S96T003067		Upper half	13,000	13,500	13,250
S96T003071	147: 5	Lower half	3,360	2,980	3,170
S96T003069		Upper half	6,350	6,230	6,290[QC:d]
S96T003011	148: 2	Lower half	14,700	15,000	14,850
S96T003010		Upper half	14,400	15,400	14,900
S96T003013	148: 3	Lower half	14,500	14,800	14,650
S96T003012		Upper half	15,200	14,300	14,750
S96T003015	148: 4	Lower half	14,100	13,700	13,900
S96T003014		Upper half	12,100	12,900	12,500
S96T003017	148: 5	Lower half	2,010	2,020	2,015
S96T003016		Upper half	4,980	4,170	4,575
S96T003876	Core composite	Whole	4,340	4,960	4,650
S96T003882		Whole	11,400	11,300	11,350
Liquids			µg/mL	µg/mL	µg/mL
S96T003063	147: 1	Drainable liquid	9,360	9,490	9,425
S96T003064	147: 2	Drainable liquid	9,790	9,780	9,785
S96T002860	148: 1	Drainable liquid	8,980	9,380	9,180
S96T003051	148: 2	Drainable liquid	9,290	9,710	9,500

Table B6-20. Tank 241-U-106 Analytical Results: Cyanide (Spec (CN)).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids			µg/g	µg/g	µg/g
S96T003065	147: 2	Upper half	29.2	27.3	28.25
S96T003070	147: 3	Lower half	22.1	19.6	20.85
S96T003066		Upper half	41.3	41.4	41.35[QC:c]
S96T003068	147: 4	Lower half	21.3	23	22.15
S96T003067		Upper half	42	42	42
S96T003071	147: 5	Lower half	17.3	18.2	17.75
S96T003069		Upper half	< 8.49	7.48	7.48
S96T003011	148: 2	Lower half	32.1	35.1	33.6[QC:c]
S96T003010		Upper half	30.1	30.1	30.1
S96T003013	148: 3	Lower half	< 8.25	< 4.23	< 6.24
S96T003012		Upper half	< 5.78	4.49	4.49
S96T003015	148: 4	Lower half	27.2	25.9	26.55
S96T003014		Upper half	29.2	26.4	27.8
S96T003016	148: 5	Upper half	20.6	23.6	22.1

B6.2.10 Inductively Coupled Plasma

Inductively coupled plasma was used to analyze for aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, calcium, cerium, chromium, cobalt, copper, iron, lanthanum, lead, lithium, magnesium, manganese, molybdenum, neodymium, nickel, phosphorus, potassium, samarium, selenium, silicon, silver, sodium, strontium, sulfer, thallium, titanium, total uranium, vanadium, zinc, and zirconium. Inductively coupled plasma was used to analyze all liquid, solid, and the core composite samples. The segment data was prepared using acid dissolution and fusion digestion methods. The composite data was prepared using acid, fusion, and water dissolution methods. Liquid samples were analyzed directly. The procedures used to prepare samples for ICP analysis are LA-505-159, LA-549-101, and LA-504-101. The ICP analysis was performed using procedures LA-505-151, and LA-505-161. Table B6-21 through B6-57 show all available results.

Because the fusion preparation was performed using potassium hydroxide fusion in a nickel crucible, potassium and nickel fusion numbers are not shown.

Table B6-21. Tank 241-U-106 Analytical Results: Aluminum (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	12,100	12,000	12,050
S96T003088A	147: 3	Lower half	11,500	11,500	11,500[QC:c]
S96T003087A		Upper half	10,800	11,100	10,950
S96T003090A	147: 4	Lower half	12,300	12,000	12,150
S96T003089A		Upper half	11,600	11,800	11,700
S96T003092A	147: 5	Lower half	6,210	5,970	6,090[QC:c]
S96T003091A		Upper half	7,460	7,640	7,550
S96T003036A	148: 2	Lower half	11,200	11,200	11,200[QC:c]
S96T003027A		Upper half	32,000	31,800	31,900[QC:c]
S96T003038A	148: 3	Lower half	11,000	10,900	10,950
S96T003037A		Upper half	10,800	10,800	10,800
S96T003040A	148: 4	Lower half	12,900	12,400	12,650
S96T003039A		Upper half	13,400	16,300	14,850
S96T003042A	148: 5	Lower half	5,590	4,280	4,935[QC:e]
S96T003041A		Upper half	6,390	7,650	7,020[QC:c]
S96T003887A	Core composite	Whole	11,200	12,000	11,600[QC:d]
S96T003888A		Whole	11,900	11,200	11,550[QC:c]
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	12,600	3,840	8,220[QC:e]
S96T003083F	147: 3	Lower half	11,800	12,000	11,900
S96T003080F		Upper half	11,900	22,600	17,250[QC:e]
S96T003084F	147: 4	Lower half	13,000	12,900	12,950
S96T003081F		Upper half	12,400	12,300	12,350

Table B6-21. Tank 241-U-106 Analytical Results: Aluminum (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S96T003085F	147: 5	Lower half	6,460	6,370	6,415
S96T003082F		Upper half	9,020	7,900	8,460
S96T003029F	148: 2	Lower half	11,700	30,800	21,250[QC:e]
S96T003026F		Upper half	31,800	30,700	31,250
S96T003031F	148: 3	Lower half	11,600	11,500	11,550
S96T003030F		Upper half	31,700	11,200	21,450[QC:e]
S96T003033F	148: 4	Lower half	11,900	12,400	12,150
S96T003032F		Upper half	12,700	12,700	12,700
S96T003035F	148: 5	Lower half	4,580	4,840	4,710
S96T003034F		Upper half	7,040	7,530	7,285
S96T003878F	Core composite	Whole	11,500	10,900	11,200
S96T003884F		Whole	12,600	8,880	10,740[QC:e]
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S96T003880I	Core composite	Whole	8,130	7,370	7,750[QC:c]
S96T003886I		Whole	7,270	7,010	7,140
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S96T003063D	147: 1	Drainable liquid	10,700	12,000	11,350[QC:c]
S96T003064D	147: 2	Drainable liquid	13,900	12,600	13,250[QC:c]
S96T002860D	148: 1	Drainable liquid	11,100	11,300	11,200[QC:d]
S96T003051D	148: 2	Drainable liquid	13,200	11,400	12,300[QC:c]

Table B6-22. Tank 241-U-106 Analytical Results: Antimony (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	< 23.9	< 24	< 23.95
S96T003088A	147: 3	Lower half	< 23.1	< 23.8	< 23.45
S96T003087A		Upper half	< 23.9	< 23.9	< 23.9
S96T003090A	147: 4	Lower half	< 23.7	< 23.5	< 23.6
S96T003089A		Upper half	< 23.5	< 24	< 23.75
S96T003092A	147: 5	Lower half	< 23.8	< 24	< 23.9
S96T003091A		Upper half	< 23.3	< 23.7	< 23.5
S96T003036A	148: 2	Lower half	< 28.4	< 29.3	< 28.85
S96T003027A		Upper half	< 27.6	< 27.9	< 27.75
S96T003038A	148: 3	Lower half	< 28.9	< 29.5	< 29.2
S96T003037A		Upper half	< 26.6	< 27.4	< 27
S96T003040A	148: 4	Lower half	< 24.2	< 23.2	< 23.7
S96T003039A		Upper half	< 24.1	< 29.7	< 26.9
S96T003042A	148: 5	Lower half	< 29.4	< 26.1	< 27.75
S96T003041A		Upper half	< 25.7	< 27.8	< 26.75
S96T003887A	Core composite	Whole	< 29.4	< 27.4	< 28.4
S96T003888A		Whole	< 29.4	< 27.5	< 28.45
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 1,200	< 1,220	< 1,210
S96T003083F	147: 3	Lower half	< 1,240	< 1,220	< 1,230
S96T003080F		Upper half	< 1,230	< 1,200	< 1,215
S96T003084F	147: 4	Lower half	< 1,200	< 1,190	< 1,195
S96T003081F		Upper half	< 1,210	< 1,210	< 1,210
S96T003085F	147: 5	Lower half	< 1,190	< 1,220	< 1,205
S96T003082F		Upper half	< 1,200	< 1,190	< 1,195

Table B6-22. Tank 241-U-106 Analytical Results: Antimony (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003029F	148: 2	Lower half	< 1,220	< 1,210	< 1,215
S96T003026F		Upper half	< 1,220	< 1,200	< 1,210
S96T003031F	148: 3	Lower half	< 1,200	< 1,220	< 1,210
S96T003030F		Upper half	< 1,210	< 1,200	< 1,205
S96T003033F	148: 4	Lower half	< 1,240	< 1,220	< 1,230
S96T003032F		Upper half	< 1,190	< 1,180	< 1,185
S96T003035F	148: 5	Lower half	< 1,150	< 1,180	< 1,165
S96T003034F		Upper half	< 1,220	< 1,200	< 1,210
S96T003878F	Core composite	Whole	< 1,190	< 1,180	< 1,185
S96T003884F		Whole	< 1,200	< 1,080	< 1,140
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	< 23.2	< 24.5	< 23.85
S96T003886I		Whole	< 23.3	< 23.8	< 23.55
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	< 60.1	< 60.1	< 60.1
S96T003064D	147: 2	Drainable liquid	< 60.1	< 60.1	< 60.1
S96T002860D	148: 1	Drainable liquid	< 60.1	< 60.1	< 60.1
S96T003051D	148: 2	Drainable liquid	< 60.1	< 60.1	< 60.1

Table B6-23. Tank 241-U-106 Analytical Results: Arsenic (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	< 39.8	< 40	< 39.9
S96T003088A	147: 3	Lower half	< 38.6	< 39.6	< 39.1
S96T003087A		Upper half	< 39.8	< 39.8	< 39.8
S96T003090A	147: 4	Lower half	< 39.5	< 39.2	< 39.35
S96T003089A		Upper half	< 39.1	< 40.1	< 39.6
S96T003092A	147: 5	Lower half	< 39.7	< 40	< 39.85
S96T003091A		Upper half	< 38.9	< 39.5	< 39.2
S96T003036A	148: 2	Lower half	< 47.3	< 48.8	< 48.05
S96T003027A		Upper half	< 46	< 46.5	< 46.25
S96T003038A	148: 3	Lower half	< 48.1	< 49.2	< 48.65
S96T003037A		Upper half	< 44.4	< 45.7	< 45.05
S96T003040A	148: 4	Lower half	< 40.4	< 38.7	< 39.55
S96T003039A		Upper half	< 40.2	< 49.6	< 44.9
S96T003042A	148: 5	Lower half	< 49	< 43.5	< 46.25
S96T003041A		Upper half	< 42.8	< 46.3	< 44.55
S96T003887A	Core composite	Whole	< 49	< 45.7	< 47.35
S96T003888A		Whole	< 48.9	< 45.8	< 47.35
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 2,010	< 2,030	< 2,020
S96T003083F	147: 3	Lower half	< 2,060	< 2,030	< 2,045
S96T003080F		Upper half	< 2,050	< 2,000	< 2,025
S96T003084F	147: 4	Lower half	< 2,000	< 1,990	< 1,995
S96T003081F		Upper half	< 2,020	< 2,010	< 2,015

Table B6-23. Tank 241-U-106 Analytical Results: Arsenic (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 1,980	< 2,030	< 2,005
S96T003082F		Upper half	< 2,000	< 1,990	< 1,995
S96T003029F	148: 2	Lower half	< 2,040	< 2,020	< 2,030
S96T003026F		Upper half	< 2,030	< 2,000	< 2,015
S96T003031F	148: 3	Lower half	< 2,000	< 2,030	< 2,015
S96T003030F		Upper half	< 2,020	< 2,000	< 2,010
S96T003033F	148: 4	Lower half	< 2,060	< 2,040	< 2,050
S96T003032F		Upper half	< 1,990	< 1,970	< 1,980
S96T003035F	148: 5	Lower half	< 1,910	< 1,960	< 1,935
S96T003034F		Upper half	< 2,030	< 2,000	< 2,015
S96T003878F	Core composite	Whole	< 1,980	< 1,960	< 1,970
S96T003884F		Whole	< 2,000	< 1,790	< 1,895
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	< 38.7	< 40.8	< 39.75
S96T003886I		Whole	< 38.9	< 39.6	< 39.25
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	< 100	< 100	< 100
S96T003064D	147: 2	Drainable liquid	< 100	< 100	< 100
S96T002860D	148: 1	Drainable liquid	< 100	< 100	< 100
S96T003051D	148: 2	Drainable liquid	< 100	< 100	< 100

Table B6-24. Tank 241-U-106 Analytical Results: Barium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S96T003086A	147: 2	Upper half	< 19.9	< 20	< 19.95
S96T003088A	147: 3	Lower half	< 19.3	< 19.8	< 19.55
S96T003087A		Upper half	< 19.9	< 19.9	< 19.9
S96T003090A	147: 4	Lower half	< 19.7	< 19.6	< 19.65
S96T003089A		Upper half	< 19.6	< 20	< 19.8
S96T003092A	147: 5	Lower half	24.9	24.5	24.7
S96T003091A		Upper half	< 19.4	< 19.8	< 19.6
S96T003036A	148: 2	Lower half	< 23.7	< 24.4	< 24.05
S96T003027A		Upper half	< 23	< 23.2	< 23.1
S96T003038A	148: 3	Lower half	< 24.1	< 24.6	< 24.35
S96T003037A		Upper half	< 22.2	< 22.8	< 22.5
S96T003040A	148: 4	Lower half	< 20.2	< 19.4	< 19.8
S96T003039A		Upper half	< 20.1	< 24.8	< 22.45
S96T003042A	148: 5	Lower half	< 24.5	< 21.8	< 23.15
S96T003041A		Upper half	< 21.4	< 23.1	< 22.25
S96T003887A	Core composite	Whole	< 24.5	< 22.9	< 23.7
S96T003888A		Whole	< 24.5	< 22.9	< 23.7
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S96T003079F	147: 2	Upper half	< 1,000	< 1,020	< 1,010
S96T003083F	147: 3	Lower half	< 1,030	< 1,020	< 1,025
S96T003080F		Upper half	< 1,020	< 999	< 1,009.5
S96T003084F	147: 4	Lower half	< 1,000	< 993	< 996.5
S96T003081F		Upper half	< 1,010	< 1,010	< 1,010

Table B6-24. Tank 241-U-106 Analytical Results: Barium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 990	< 1,020	< 1,005
S96T003082F		Upper half	< 998	< 994	< 996
S96T003029F	148: 2	Lower half	< 1,020	< 1,010	< 1,015
S96T003026F		Upper half	< 1,010	< 1,000	< 1,005
S96T003031F	148: 3	Lower half	< 1,000	< 1,020	< 1,010
S96T003030F		Upper half	< 1,010	< 1,000	< 1,005
S96T003033F	148: 4	Lower half	< 1,030	< 1,020	< 1,025
S96T003032F		Upper half	< 993	< 984	< 988.5
S96T003035F	148: 5	Lower half	< 956	< 979	< 967.5
S96T003034F		Upper half	< 1,020	< 998	< 1,009
S96T003878F	Core composite	Whole	< 991	< 980	< 985.5
S96T003884F		Whole	< 1,000	< 897	< 948.5
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	< 19.4	< 20.4	< 19.9
S96T003886I		Whole	< 19.4	< 19.8	< 19.6
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	< 50.1	< 50.1	< 50.1
S96T003064D	147: 2	Drainable liquid	< 50.1	< 50.1	< 50.1
S96T002860D	148: 1	Drainable liquid	< 50.1	< 50.1	< 50.1
S96T003051D	148: 2	Drainable liquid	< 50.1	< 50.1	< 50.1

Table B6-25. Tank 241-U-106 Analytical Results: Beryllium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	< 1.99	< 2	< 1.995
S96T003088A	147: 3	Lower half	< 1.93	< 1.98	< 1.955
S96T003087A		Upper half	< 1.99	< 1.99	< 1.99
S96T003090A	147: 4	Lower half	< 1.97	< 1.96	< 1.965
S96T003089A		Upper half	< 1.96	< 2	< 1.98
S96T003092A	147: 5	Lower half	< 1.99	< 2	< 1.995
S96T003091A		Upper half	< 1.94	< 1.98	< 1.96
S96T003036A	148: 2	Lower half	< 2.37	< 2.44	< 2.405
S96T003027A		Upper half	< 2.3	< 2.32	< 2.31
S96T003038A	148: 3	Lower half	< 2.41	< 2.46	< 2.435
S96T003037A		Upper half	< 2.22	< 2.28	< 2.25
S96T003040A	148: 4	Lower half	< 2.02	< 1.94	< 1.98
S96T003039A		Upper half	< 2.01	< 2.48	< 2.245
S96T003042A	148: 5	Lower half	< 2.45	< 2.18	< 2.315
S96T003041A		Upper half	< 2.14	< 2.31	< 2.225
S96T003887A	Core composite	Whole	< 2.45	< 2.29	< 2.37
S96T003888A		Whole	< 2.45	< 2.29	< 2.37
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 100	< 102	< 101
S96T003083F	147: 3	Lower half	< 103	< 102	< 102.5
S96T003080F		Upper half	< 102	< 99.9	< 100.95
S96T003084F	147: 4	Lower half	< 100	< 99.3	< 99.65
S96T003081F		Upper half	< 101	< 101	< 101

Table B6-25. Tank 241-U-106 Analytical Results: Beryllium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 99	< 102	< 100.5
S96T003082F		Upper half	< 99.8	< 99.4	< 99.6
S96T003029F	148: 2	Lower half	< 102	< 101	< 101.5
S96T003026F		Upper half	< 101	< 100	< 100.5
S96T003031F	148: 3	Lower half	< 100	< 102	< 101
S96T003030F		Upper half	< 101	< 100	< 100.5
S96T003033F	148: 4	Lower half	< 103	< 102	< 102.5
S96T003032F		Upper half	< 99.3	< 98.4	< 98.85
S96T003035F	148: 5	Lower half	< 95.6	< 97.9	< 96.75
S96T003034F		Upper half	< 102	< 99.8	< 100.9
S96T003878F	Core composite	Whole	< 99.1	< 98	< 98.55
S96T003884F		Whole	< 100	< 89.7	< 94.85
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	< 1.94	< 2.04	< 1.99
S96T003886I		Whole	< 1.94	< 1.98	< 1.96
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	< 5	< 5	< 5
S96T003064D	147: 2	Drainable liquid	< 5	< 5	< 5
S96T002860D	148: 1	Drainable liquid	< 5	< 5	< 5
S96T003051D	148: 2	Drainable liquid	< 5	< 5	< 5

Table B6-26. Tank 241-U-106 Analytical Results: Bismuth (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	< 39.8	< 40	< 39.9
S96T003088A	147: 3	Lower half	< 38.6	< 39.6	< 39.1
S96T003087A		Upper half	< 39.8	< 39.8	< 39.8
S96T003090A	147: 4	Lower half	< 39.5	< 39.2	< 39.35
S96T003089A		Upper half	< 39.1	< 40.1	< 39.6
S96T003092A	147: 5	Lower half	< 39.7	< 40	< 39.85
S96T003091A		Upper half	< 38.9	< 39.5	< 39.2
S96T003036A	148: 2	Lower half	< 47.3	< 48.8	< 48.05
S96T003027A		Upper half	< 46	< 46.5	< 46.25
S96T003038A	148: 3	Lower half	< 48.1	< 49.2	< 48.65
S96T003037A		Upper half	< 44.4	< 45.7	< 45.05
S96T003040A	148: 4	Lower half	< 40.4	< 38.7	< 39.55
S96T003039A		Upper half	< 40.2	< 49.6	< 44.9
S96T003042A	148: 5	Lower half	< 49	< 43.5	< 46.25
S96T003041A		Upper half	< 42.8	< 46.3	< 44.55
S96T003887A	Core composite	Whole	< 49	< 45.7	< 47.35
S96T003888A		Whole	< 48.9	< 45.8	< 47.35
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 2,010	< 2,030	< 2,020
S96T003083F	147: 3	Lower half	< 2,060	< 2,030	< 2,045
S96T003080F		Upper half	< 2,050	< 2,000	< 2,025
S96T003084F	147: 4	Lower half	< 2,000	< 1,990	< 1,995
S96T003081F		Upper half	< 2,020	< 2,010	< 2,015

Table B6-26. Tank 241-U-106 Analytical Results: Bismuth (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μg/g	μg/g	μg/g
S96T003085F	147: 5	Lower half	< 1,980	< 2,030	< 2,005
S96T003082F		Upper half	< 2,000	< 1,990	< 1,995
S96T003029F	148: 2	Lower half	< 2,040	< 2,020	< 2,030
S96T003026F		Upper half	< 2,030	< 2,000	< 2,015
S96T003031F	148: 3	Lower half	< 2,000	< 2,030	< 2,015
S96T003030F		Upper half	< 2,020	< 2,000	< 2,010
S96T003033F	148: 4	Lower half	< 2,060	< 2,040	< 2,050
S96T003032F		Upper half	< 1,990	< 1,970	< 1,980
S96T003035F	148: 5	Lower half	< 1,910	< 1,960	< 1,935
S96T003034F		Upper half	< 2,030	< 2,000	< 2,015
S96T003878F	Core composite	Whole	< 1,980	< 1,960	< 1,970
S96T003884F		Whole	< 2,000	< 1,790	< 1,895
Solids: water digest			μg/g	μg/g	μg/g
S96T003880I	Core composite	Whole	< 38.7	< 40.8	< 39.75
S96T003886I		Whole	< 38.9	< 39.6	< 39.25
Liquids			μg/mL	μg/mL	μg/mL
S96T003063D	147: 1	Drainable liquid	< 100	< 100	< 100
S96T003064D	147: 2	Drainable liquid	< 100	< 100	< 100
S96T002860D	148: 1	Drainable liquid	< 100	< 100	< 100
S96T003051D	148: 2	Drainable liquid	< 100	< 100	< 100

Table B6-27. Tank 241-U-106 Analytical Results: Boron (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	113	91.2	102.1[QC:e]
S96T003088A	147: 3	Lower half	81.1	79	80.05
S96T003087A		Upper half	67.7	97.6	82.65[QC:e]
S96T003090A	147: 4	Lower half	75.6	60.7	68.15[QC:e]
S96T003089A		Upper half	90.7	88.9	89.8
S96T003092A	147: 5	Lower half	41.7	37.5	39.6
S96T003091A		Upper half	42.9	48	45.45
S96T003036A	148: 2	Lower half	102	68.2	85.1[QC:e]
S96T003027A		Upper half	87.5	119	103.25[QC:e]
S96T003038A	148: 3	Lower half	59.7	92.6	76.15[QC:e]
S96T003037A		Upper half	74	68.6	71.3
S96T003040A	148: 4	Lower half	59.7	60.8	60.25[QC:b]
S96T003039A		Upper half	49.4	72.4	60.9[QC:b,e]
S96T003042A	148: 5	Lower half	44	36.5	40.25[QC:b]
S96T003041A		Upper half	51.3	60.6	55.95[QC:b]
S96T003887A	Core composite	Whole	72	68	70
S96T003888A		Whole	67.9	50.2	59.05[QC:e]
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 1,000	< 1,020	< 1,010
S96T003083F	147: 3	Lower half	< 1,030	< 1,020	< 1,025
S96T003080F		Upper half	< 1,020	< 999	< 1,009.5
S96T003084F	147: 4	Lower half	< 1,000	< 993	< 996.5
S96T003081F		Upper half	< 1,010	< 1,010	< 1,010

Table B6-27. Tank 241-U-106 Analytical Results: Boron (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 990	< 1,020	< 1,005
S96T003082F		Upper half	< 998	< 994	< 996
S96T003029F	148: 2	Lower half	< 1,020	< 1,010	< 1,015
S96T003026F		Upper half	< 1,010	< 1,000	< 1,005
S96T003031F	148: 3	Lower half	< 1,000	< 1,020	< 1,010
S96T003030F		Upper half	< 1,010	< 1,000	< 1,005
S96T003033F	148: 4	Lower half	< 1,030	< 1,020	< 1,025
S96T003032F		Upper half	< 993	< 984	< 988.5
S96T003035F	148: 5	Lower half	< 956	< 979	< 967.5
S96T003034F		Upper half	< 1,020	< 998	< 1,009
S96T003878F	Core composite	Whole	< 991	< 980	< 985.5
S96T003884F		Whole	< 1,000	< 897	< 948.5
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	471	648	559.5[QC:e]
S96T003886I		Whole	558	482	520
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	< 50.1	52.1	< 51.1
S96T003064D	147: 2	Drainable liquid	51.9	52.3	52.1
S96T002860D	148: 1	Drainable liquid	< 50.1	< 50.1	< 50.1
S96T003051D	148: 2	Drainable liquid	51.6	< 50.1	< 50.85

Table B6-28. Tank 241-U-106 Analytical Results: Cadmium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	59.5	58.6	59.05
S96T003088A	147: 3	Lower half	56.6	56	56.3
S96T003087A		Upper half	56.7	57.3	57
S96T003090A	147: 4	Lower half	56.6	55.2	55.9
S96T003089A		Upper half	54.1	55.5	54.8
S96T003092A	147: 5	Lower half	21.6	20.8	21.2
S96T003091A		Upper half	31.6	32.7	32.15
S96T003036A	148: 2	Lower half	55.1	54.9	55
S96T003027A		Upper half	54.4	50.6	52.5
S96T003038A	148: 3	Lower half	54.8	55.8	55.3
S96T003037A		Upper half	57.2	56.8	57
S96T003040A	148: 4	Lower half	58.4	56.5	57.45
S96T003039A		Upper half	60.5	73.9	67.2
S96T003042A	148: 5	Lower half	23.3	18	20.65[QC:e]
S96T003041A		Upper half	28.6	34	31.3
S96T003887A	Core composite	Whole	53	49.4	51.2
S96T003888A		Whole	49.9	52.8	51.35
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 100	< 102	< 101
S96T003083F	147: 3	Lower half	< 103	< 102	< 102.5
S96T003080F		Upper half	< 102	106	< 104
S96T003084F	147: 4	Lower half	< 100	< 99.3	< 99.65
S96T003081F		Upper half	< 101	< 101	< 101

Table B6-28. Tank 241-U-106 Analytical Results: Cadmium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 99	< 102	< 100.5
S96T003082F		Upper half	< 99.8	< 99.4	< 99.6
S96T003029F	148: 2	Lower half	< 102	< 101	< 101.5
S96T003026F		Upper half	< 101	< 100	< 100.5
S96T003031F	148: 3	Lower half	< 100	< 102	< 101
S96T003030F		Upper half	< 101	< 100	< 100.5
S96T003033F	148: 4	Lower half	< 103	< 102	< 102.5
S96T003032F		Upper half	< 99.3	< 98.4	< 98.85
S96T003035F	148: 5	Lower half	< 95.6	< 97.9	< 96.75
S96T003034F		Upper half	< 102	< 99.8	< 100.9
S96T003878F	Core composite	Whole	< 99.1	< 98	< 98.55
S96T003884F		Whole	< 100	< 89.7	< 94.85
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	49.8	45.4	47.6
S96T003886I		Whole	47.4	45.9	46.65
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	82.6	93	87.8
S96T003064D	147: 2	Drainable liquid	93.9	93.1	93.5
S96T002860D	148: 1	Drainable liquid	84.2	86.2	85.2
S96T003051D	148: 2	Drainable liquid	102	86.1	94.05

Table B6-29. Tank 241-U-106 Analytical Results: Calcium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	345	336	340.5
S96T003088A	147: 3	Lower half	356	342	349
S96T003087A		Upper half	338	334	336
S96T003090A	147: 4	Lower half	339	330	334.5
S96T003089A		Upper half	327	330	328.5
S96T003092A	147: 5	Lower half	472	461	466.5
S96T003091A		Upper half	303	360	331.5
S96T003036A	148: 2	Lower half	318	315	316.5
S96T003027A		Upper half	289	274	281.5
S96T003038A	148: 3	Lower half	323	331	327
S96T003037A		Upper half	349	334	341.5
S96T003040A	148: 4	Lower half	355	344	349.5
S96T003039A		Upper half	357	419	388
S96T003042A	148: 5	Lower half	121	98.8	109.9
S96T003041A		Upper half	157	192	174.5
S96T003887A	Core composite	Whole	411	319	365[QC:e]
S96T003888A		Whole	360	423	391.5
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 2,010	< 2,030	< 2,020
S96T003083F	147: 3	Lower half	< 2,060	< 2,030	< 2,045
S96T003080F		Upper half	< 2,050	< 2,000	< 2,025
S96T003084F	147: 4	Lower half	< 2,000	< 1,990	< 1,995
S96T003081F		Upper half	< 2,020	< 2,010	< 2,015

Table B6-29. Tank 241-U-106 Analytical Results: Calcium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 1,980	< 2,030	< 2,005
S96T003082F		Upper half	< 2,000	< 1,990	< 1,995
S96T003029F	148: 2	Lower half	< 2,040	< 2,020	< 2,030
S96T003026F		Upper half	< 2,030	< 2,000	< 2,015
S96T003031F	148: 3	Lower half	< 2,000	< 2,030	< 2,015
S96T003030F		Upper half	< 2,020	< 2,000	< 2,010
S96T003033F	148: 4	Lower half	< 2,060	< 2,040	< 2,050
S96T003032F		Upper half	< 1,990	< 1,970	< 1,980
S96T003035F	148: 5	Lower half	< 1,910	< 1,960	< 1,935
S96T003034F		Upper half	< 2,030	< 2,000	< 2,015
S96T003878F	Core composite	Whole	< 1,980	< 1,960	< 1,970
S96T003884F		Whole	< 2,000	< 1,790	< 1,895
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	332	304	318
S96T003886I		Whole	269	257	263
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	351	383	367
S96T003064D	147: 2	Drainable liquid	425	399	412
S96T002860D	148: 1	Drainable liquid	354	356	355
S96T003051D	148: 2	Drainable liquid	442	371	406.5

Table B6-30. Tank 241-U-106 Analytical Results: Cerium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	95.4	102	98.7
S96T003088A	147: 3	Lower half	78.7	77.8	78.25
S96T003087A		Upper half	75.2	76.6	75.9
S96T003090A	147: 4	Lower half	77.9	77.9	77.9
S96T003089A		Upper half	76.2	79.7	77.95
S96T003092A	147: 5	Lower half	59.8	57	58.4
S96T003091A		Upper half	58.2	63.2	60.7
S96T003036A	148: 2	Lower half	77.2	74.2	75.7
S96T003027A		Upper half	61.4	64.7	63.05
S96T003038A	148: 3	Lower half	78.1	76.1	77.1
S96T003037A		Upper half	77.1	82.9	80
S96T003040A	148: 4	Lower half	78	74.8	76.4
S96T003039A		Upper half	78.1	95	86.55
S96T003042A	148: 5	Lower half	< 49	< 43.5	< 46.25
S96T003041A		Upper half	< 42.8	< 46.3	< 44.55
S96T003887A	Core composite	Whole	75.9	62.3	69.1
S96T003888A		Whole	57.2	79.9	68.55[QC:e]
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 2,010	< 2,030	< 2,020
S96T003083F	147: 3	Lower half	< 2,060	< 2,030	< 2,045
S96T003080F		Upper half	< 2,050	< 2,000	< 2,025
S96T003084F	147: 4	Lower half	< 2,000	< 1,990	< 1,995
S96T003081F		Upper half	< 2,020	< 2,010	< 2,015

Table B6-30. Tank 241-U-106 Analytical Results: Cerium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 1,980	< 2,030	< 2,005
S96T003082F		Upper half	< 2,000	< 1,990	< 1,995
S96T003029F	148: 2	Lower half	< 2,040	< 2,020	< 2,030
S96T003026F		Upper half	< 2,030	< 2,000	< 2,015
S96T003031F	148: 3	Lower half	< 2,000	< 2,030	< 2,015
S96T003030F		Upper half	< 2,020	< 2,000	< 2,010
S96T003033F	148: 4	Lower half	< 2,060	< 2,040	< 2,050
S96T003032F		Upper half	< 1,990	< 1,970	< 1,980
S96T003035F	148: 5	Lower half	< 1,910	< 1,960	< 1,935
S96T003034F		Upper half	< 2,030	< 2,000	< 2,015
S96T003878F	Core composite	Whole	< 1,980	< 1,960	< 1,970
S96T003884F		Whole	< 2,000	< 1,790	< 1,895
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	< 38.7	< 40.8	< 39.75
S96T003886I		Whole	< 38.9	< 39.6	< 39.25
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	< 100	< 100	< 100
S96T003064D	147: 2	Drainable liquid	< 100	< 100	< 100
S96T002860D	148: 1	Drainable liquid	< 100	< 100	< 100
S96T003051D	148: 2	Drainable liquid	< 100	< 100	< 100

Table B6-31. Tank 241-U-106 Analytical Results: Chromium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	3,380	3,430	3,405
S96T003088A	147: 3	Lower half	3,090	3,080	3,085
S96T003087A		Upper half	2,930	2,970	2,950
S96T003090A	147: 4	Lower half	3,150	3,080	3,115
S96T003089A		Upper half	3,040	3,090	3,065
S96T003092A	147: 5	Lower half	1,260	1,210	1,235
S96T003091A		Upper half	1,650	1,730	1,690
S96T003036A	148: 2	Lower half	2,960	2,880	2,920
S96T003027A		Upper half	3,320	3,490	3,405[QC:c]
S96T003038A	148: 3	Lower half	3,160	2,850	3,005
S96T003037A		Upper half	3,080	3,260	3,170
S96T003040A	148: 4	Lower half	3,150	3,080	3,115
S96T003039A		Upper half	3,310	4,060	3,685
S96T003042A	148: 5	Lower half	761	585	673[QC:e]
S96T003041A		Upper half	1,310	1,570	1,440[QC:c]
S96T003887A	Core composite	Whole	2,750	2,610	2,680
S96T003888A		Whole	2,520	2,910	2,715
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	3,090	970	2,030[QC:e]
S96T003083F	147: 3	Lower half	2,970	3,030	3,000
S96T003080F		Upper half	3,100	5,960	4,530[QC:e]
S96T003084F	147: 4	Lower half	3,240	3,210	3,225
S96T003081F		Upper half	3,260	3,220	3,240

Table B6-31. Tank 241-U-106 Analytical Results: Chromium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	1,270	1,280	1,275
S96T003082F		Upper half	1,850	1,670	1,760
S96T003029F	148: 2	Lower half	3,100	3,140	3,120
S96T003026F		Upper half	3,310	3,120	3,215
S96T003031F	148: 3	Lower half	3,550	3,230	3,390
S96T003030F		Upper half	3,310	2,930	3,120
S96T003033F	148: 4	Lower half	3,080	3,020	3,050
S96T003032F		Upper half	3,050	3,100	3,075
S96T003035F	148: 5	Lower half	586	610	598
S96T003034F		Upper half	1,450	1,490	1,470
S96T003878F	Core composite	Whole	2,760	2,670	2,715
S96T003884F		Whole	2,700	1,730	2,215[QC:e]
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	244	221	232.5
S96T003886I		Whole	221	210	215.5
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	381	420	400.5
S96T003064D	147: 2	Drainable liquid	1,130	456	793[QC:c,e]
S96T002860D	148: 1	Drainable liquid	379	392	385.5
S96T003051D	148: 2	Drainable liquid	438	373	405.5

Table B6-32. Tank 241-U-106 Analytical Results: Cobalt (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	< 7.97	< 7.99	< 7.98
S96T003088A	147: 3	Lower half	< 7.71	< 7.92	< 7.815
S96T003087A		Upper half	< 7.96	< 7.96	< 7.96
S96T003090A	147: 4	Lower half	< 7.89	< 7.84	< 7.865
S96T003089A		Upper half	< 7.83	< 8.01	< 7.92
S96T003092A	147: 5	Lower half	< 7.95	< 8	< 7.975
S96T003091A		Upper half	< 7.77	< 7.91	< 7.84
S96T003036A	148: 2	Lower half	< 9.47	< 9.77	< 9.62
S96T003027A		Upper half	< 9.2	< 9.29	< 9.245
S96T003038A	148: 3	Lower half	< 9.62	< 9.84	< 9.73
S96T003037A		Upper half	< 8.87	< 9.14	< 9.005
S96T003040A	148: 4	Lower half	< 8.08	< 7.75	< 7.915
S96T003039A		Upper half	< 8.04	< 9.91	< 8.975
S96T003042A	148: 5	Lower half	< 9.81	< 8.71	< 9.26
S96T003041A		Upper half	< 8.57	< 9.25	< 8.91
S96T003887A	Core composite	Whole	< 9.8	< 9.15	< 9.475
S96T003888A		Whole	< 9.78	< 9.16	< 9.47
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 401	< 407	< 404
S96T003083F	147: 3	Lower half	< 412	< 406	< 409
S96T003080F		Upper half	< 410	< 400	< 405
S96T003084F	147: 4	Lower half	< 401	< 397	< 399
S96T003081F		Upper half	< 404	< 403	< 403.5

Table B6-32. Tank 241-U-106 Analytical Results: Cobalt (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 396	< 406	< 401
S96T003082F		Upper half	< 399	< 398	< 398.5
S96T003029F	148: 2	Lower half	< 407	< 404	< 405.5
S96T003026F		Upper half	< 405	< 400	< 402.5
S96T003031F	148: 3	Lower half	< 400	< 407	< 403.5
S96T003030F		Upper half	< 404	< 401	< 402.5
S96T003033F	148: 4	Lower half	< 412	< 408	< 410
S96T003032F		Upper half	< 397	< 394	< 395.5
S96T003035F	148: 5	Lower half	< 382	< 392	< 387
S96T003034F		Upper half	< 407	< 399	< 403
S96T003878F	Core composite	Whole	< 397	< 392	< 394.5
S96T003884F		Whole	< 400	< 359	< 379.5
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	< 7.75	< 8.16	< 7.955
S96T003886I		Whole	< 7.78	< 7.92	< 7.85
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	< 20	< 20	< 20
S96T003064D	147: 2	Drainable liquid	< 20	< 20	< 20
S96T002860D	148: 1	Drainable liquid	< 20	< 20	< 20
S96T003051D	148: 2	Drainable liquid	< 20	< 20	< 20

Table B6-33. Tank 241-U-106 Analytical Results: Copper (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			μg/g	μg/g	μg/g
S96T003086A	147: 2	Upper half	20	19.3	19.65
S96T003088A	147: 3	Lower half	19.5	19	19.25
S96T003087A		Upper half	19.1	21.1	20.1
S96T003090A	147: 4	Lower half	19.7	19	19.35
S96T003089A		Upper half	19	19.3	19.15
S96T003092A	147: 5	Lower half	8.55	8.21	8.38
S96T003091A		Upper half	12.3	12.6	12.45
S96T003036A	148: 2	Lower half	19.4	20.1	19.75
S96T003027A		Upper half	19.6	17.8	18.7
S96T003038A	148: 3	Lower half	19.3	20.7	20
S96T003037A		Upper half	20.9	22.4	21.65
S96T003040A	148: 4	Lower half	20.5	20.4	20.45
S96T003039A		Upper half	20.6	25.2	22.9
S96T003042A	148: 5	Lower half	9.44	6.67	8.055[QC:e]
S96T003041A		Upper half	10.1	11.3	10.7
S96T003887A	Core composite	Whole	24.7	17.7	21.2[QC:e]
S96T003888A		Whole	18	19.8	18.9
Solids: fusion			μg/g	μg/g	μg/g
S96T003079F	147: 2	Upper half	< 201	< 203	< 202
S96T003083F	147: 3	Lower half	< 206	< 203	< 204.5
S96T003080F		Upper half	< 205	< 200	< 202.5
S96T003084F	147: 4	Lower half	< 200	< 199	< 199.5
S96T003081F		Upper half	< 202	< 201	< 201.5

Table B6-33. Tank 241-U-106 Analytical Results: Copper (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 198	< 203	< 200.5
S96T003082F		Upper half	< 200	< 199	< 199.5
S96T003029F	148: 2	Lower half	< 204	< 202	< 203
S96T003026F		Upper half	< 203	< 200	< 201.5
S96T003031F	148: 3	Lower half	< 200	< 203	< 201.5
S96T003030F		Upper half	< 202	< 200	< 201
S96T003033F	148: 4	Lower half	< 206	< 204	< 205
S96T003032F		Upper half	< 199	< 197	< 198
S96T003035F	148: 5	Lower half	< 191	< 196	< 193.5
S96T003034F		Upper half	< 203	< 200	< 201.5
S96T003878F	Core composite	Whole	< 198	< 196	< 197
S96T003884F		Whole	< 200	< 179	< 189.5
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	18.8	17.8	18.3
S96T003886I		Whole	17.9	17.2	17.55
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	28.3	30.7	29.5
S96T003064D	147: 2	Drainable liquid	32.4	33.2	32.8
S96T002860D	148: 1	Drainable liquid	29.8	29.8	29.8
S96T003051D	148: 2	Drainable liquid	34.9	29.9	32.4

Table B6-34. Tank 241-U-106 Analytical Results: Iron (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	2,960	3,060	3,010
S96T003088A	147: 3	Lower half	3,280	3,270	3,275
S96T003087A		Upper half	3,000	3,050	3,025
S96T003090A	147: 4	Lower half	3,270	3,200	3,235
S96T003089A		Upper half	3,090	3,140	3,115
S96T003092A	147: 5	Lower half	6,320	6,060	6,190[QC:c]
S96T003091A		Upper half	4,110	4,290	4,200
S96T003036A	148: 2	Lower half	3,020	2,930	2,975
S96T003027A		Upper half	2,080	2,070	2,075
S96T003038A	148: 3	Lower half	3,140	2,810	2,975
S96T003037A		Upper half	3,230	3,400	3,315
S96T003040A	148: 4	Lower half	3,170	3,140	3,155
S96T003039A		Upper half	3,520	4,210	3,865
S96T003042A	148: 5	Lower half	1,470	1,130	1,300[QC:e]
S96T003041A		Upper half	1,630	1,970	1,800[QC:c]
S96T003887A	Core composite	Whole	3,590	2,610	3,100[QC:c,e]
S96T003888A		Whole	2,510	3,800	3,155[QC:d,e]
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	2,440	< 1,020	< 1,730[QC:e]
S96T003083F	147: 3	Lower half	2,940	2,970	2,955
S96T003080F		Upper half	2,970	5,650	4,310[QC:e]
S96T003084F	147: 4	Lower half	3,300	3,290	3,295
S96T003081F		Upper half	3,170	3,130	3,150

Table B6-34. Tank 241-U-106 Analytical Results: Iron (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	6,470	6,290	6,380
S96T003082F		Upper half	4,690	4,090	4,390
S96T003029F	148: 2	Lower half	3,110	1,820	2,465[QC:e]
S96T003026F		Upper half	1,950	1,650	1,800
S96T003031F	148: 3	Lower half	3,400	2,860	3,130
S96T003030F		Upper half	2,110	2,930	2,520[QC:e]
S96T003033F	148: 4	Lower half	2,960	2,910	2,935
S96T003032F		Upper half	3,040	3,030	3,035
S96T003035F	148: 5	Lower half	1,030	1,010	1,020
S96T003034F		Upper half	1,560	1,650	1,605
S96T003878F	Core composite	Whole	3,370	3,180	3,275
S96T003884F		Whole	2,410	1,500	1,955[QC:e]
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	159	149	154
S96T003886I		Whole	114	110	112
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	< 50.1	< 50.1	< 50.1
S96T003064D	147: 2	Drainable liquid	848	107	477.5[QC:c,e]
S96T002860D	148: 1	Drainable liquid	< 50.1	< 50.1	< 50.1
S96T003051D	148: 2	Drainable liquid	< 50.1	< 50.1	< 50.1

Table B6-35. Tank 241-U-106 Analytical Results: Lanthanum (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	42.4	42.9	42.65
S96T003088A	147: 3	Lower half	43.7	43.5	43.6
S96T003087A		Upper half	41.4	42	41.7
S96T003090A	147: 4	Lower half	43.5	42.6	43.05
S96T003089A		Upper half	42.3	43.3	42.8
S96T003092A	147: 5	Lower half	26.7	25.8	26.25
S96T003091A		Upper half	28.5	29.4	28.95
S96T003036A	148: 2	Lower half	41.7	40.8	41.25
S96T003027A		Upper half	34.7	34.6	34.65
S96T003038A	148: 3	Lower half	44.2	41.1	42.65
S96T003037A		Upper half	44	46.5	45.25
S96T003040A	148: 4	Lower half	44.5	43.7	44.1
S96T003039A		Upper half	45.8	56.2	51
S96T003042A	148: 5	Lower half	< 24.5	< 21.8	< 23.15
S96T003041A		Upper half	< 21.4	23.3	< 22.35
S96T003887A	Core composite	Whole	39.4	35.6	37.5
S96T003888A		Whole	34.3	41.6	37.95
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 1,000	< 1,020	< 1,010
S96T003083F	147: 3	Lower half	< 1,030	< 1,020	< 1,025
S96T003080F		Upper half	< 1,020	< 999	< 1,009.5
S96T003084F	147: 4	Lower half	< 1,000	< 993	< 996.5
S96T003081F		Upper half	< 1,010	< 1,010	< 1,010

Table B6-35. Tank 241-U-106 Analytical Results: Lanthanum (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μg/g	μg/g	μg/g
S96T003085F	147: 5	Lower half	< 990	< 1,020	< 1,005
S96T003082F		Upper half	< 998	< 994	< 996
S96T003029F	148: 2	Lower half	< 1,020	< 1,010	< 1,015
S96T003026F		Upper half	< 1,010	< 1,000	< 1,005
S96T003031F	148: 3	Lower half	< 1,000	< 1,020	< 1,010
S96T003030F		Upper half	< 1,010	< 1,000	< 1,005
S96T003033F	148: 4	Lower half	< 1,030	< 1,020	< 1,025
S96T003032F		Upper half	< 993	< 984	< 988.5
S96T003035F	148: 5	Lower half	< 956	< 979	< 967.5
S96T003034F		Upper half	< 1,020	< 998	< 1,009
S96T003878F	Core composite	Whole	< 991	< 980	< 985.5
S96T003884F		Whole	< 1,000	< 897	< 948.5
Solids: water digest			μg/g	μg/g	μg/g
S96T003880I	Core composite	Whole	< 19.4	< 20.4	< 19.9
S96T003886I		Whole	< 19.4	< 19.8	< 19.6
Liquids			μg/mL	μg/mL	μg/mL
S96T003063D	147: 1	Drainable liquid	< 50.1	< 50.1	< 50.1
S96T003064D	147: 2	Drainable liquid	< 50.1	< 50.1	< 50.1
S96T002860D	148: 1	Drainable liquid	< 50.1	< 50.1	< 50.1
S96T003051D	148: 2	Drainable liquid	< 50.1	< 50.1	< 50.1

Table B6-36. Tank 241-U-106 Analytical Results: Lead (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	371	379	375
S96T003088A	147: 3	Lower half	367	360	363.5
S96T003087A		Upper half	347	343	345
S96T003090A	147: 4	Lower half	365	360	362.5
S96T003089A		Upper half	355	359	357
S96T003092A	147: 5	Lower half	327	317	322
S96T003091A		Upper half	276	291	283.5
S96T003036A	148: 2	Lower half	338	345	341.5
S96T003027A		Upper half	268	260	264
S96T003038A	148: 3	Lower half	360	339	349.5
S96T003037A		Upper half	366	385	375.5
S96T003040A	148: 4	Lower half	367	361	364
S96T003039A		Upper half	382	470	426
S96T003042A	148: 5	Lower half	128	97.8	112.9[QC:e]
S96T003041A		Upper half	178	210	194
S96T003887A	Core composite	Whole	349	289	319
S96T003888A		Whole	287	357	322[QC:e]
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 2,010	< 2,030	< 2,020
S96T003083F	147: 3	Lower half	< 2,060	< 2,030	< 2,045
S96T003080F		Upper half	< 2,050	< 2,000	< 2,025
S96T003084F	147: 4	Lower half	< 2,000	< 1,990	< 1,995
S96T003081F		Upper half	< 2,020	< 2,010	< 2,015

Table B6-36. Tank 241-U-106 Analytical Results: Lead (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 1,980	< 2,030	< 2,005
S96T003082F		Upper half	< 2,000	< 1,990	< 1,995
S96T003029F	148: 2	Lower half	< 2,040	< 2,020	< 2,030
S96T003026F		Upper half	< 2,030	< 2,000	< 2,015
S96T003031F	148: 3	Lower half	< 2,000	< 2,030	< 2,015
S96T003030F		Upper half	< 2,020	< 2,000	< 2,010
S96T003033F	148: 4	Lower half	< 2,060	< 2,040	< 2,050
S96T003032F		Upper half	< 1,990	< 1,970	< 1,980
S96T003035F	148: 5	Lower half	< 1,910	< 1,960	< 1,935
S96T003034F		Upper half	< 2,030	< 2,000	< 2,015
S96T003878F	Core composite	Whole	< 1,980	< 1,960	< 1,970
S96T003884F		Whole	< 2,000	< 1,790	< 1,895
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	167	177	172
S96T003886I		Whole	159	145	152
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	185	187	186
S96T003064D	147: 2	Drainable liquid	256	209	232.5
S96T002860D	148: 1	Drainable liquid	196	168	182
S96T003051D	148: 2	Drainable liquid	214	184	199

Table B6-37. Tank 241-U-106 Analytical Results: Lithium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	< 3.98	< 4	< 3.99
S96T003088A	147: 3	Lower half	< 3.86	< 3.96	< 3.91
S96T003087A		Upper half	< 3.98	< 3.98	< 3.98
S96T003090A	147: 4	Lower half	< 3.95	< 3.92	< 3.935
S96T003089A		Upper half	< 3.91	< 4.01	< 3.96
S96T003092A	147: 5	Lower half	< 3.97	< 4	< 3.985
S96T003091A		Upper half	< 3.89	< 3.95	< 3.92
S96T003036A	148: 2	Lower half	< 4.73	< 4.88	< 4.805
S96T003027A		Upper half	< 4.6	< 4.65	< 4.625
S96T003038A	148: 3	Lower half	< 4.81	< 4.92	< 4.865
S96T003037A		Upper half	< 4.44	< 4.57	< 4.505
S96T003040A	148: 4	Lower half	< 4.04	< 3.87	< 3.955
S96T003039A		Upper half	< 4.02	< 4.96	< 4.49
S96T003042A	148: 5	Lower half	< 4.9	< 4.35	< 4.625
S96T003041A		Upper half	< 4.28	< 4.63	< 4.455
S96T003887A	Core composite	Whole	< 4.9	< 4.57	< 4.735
S96T003888A		Whole	< 4.89	< 4.58	< 4.735
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 201	< 203	< 202
S96T003083F	147: 3	Lower half	< 206	< 203	< 204.5
S96T003080F		Upper half	< 205	< 200	< 202.5
S96T003084F	147: 4	Lower half	< 200	< 199	< 199.5
S96T003081F		Upper half	< 202	< 201	< 201.5

Table B6-37. Tank 241-U-106 Analytical Results: Lithium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 198	< 203	< 200.5
S96T003082F		Upper half	< 200	< 199	< 199.5
S96T003029F	148: 2	Lower half	< 204	< 202	< 203
S96T003026F		Upper half	< 203	< 200	< 201.5
S96T003031F	148: 3	Lower half	< 200	< 203	< 201.5
S96T003030F		Upper half	< 202	< 200	< 201
S96T003033F	148: 4	Lower half	< 206	< 204	< 205
S96T003032F		Upper half	< 199	< 197	< 198
S96T003035F	148: 5	Lower half	< 191	< 196	< 193.5
S96T003034F		Upper half	< 203	< 200	< 201.5
S96T003878F	Core composite	Whole	< 198	< 196	< 197
S96T003884F		Whole	< 200	< 179	< 189.5
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	< 3.87	< 4.08	< 3.975
S96T003886I		Whole	< 3.89	< 3.96	< 3.925
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	< 10	< 10	< 10
S96T003064D	147: 2	Drainable liquid	< 10	< 10	< 10
S96T002860D	148: 1	Drainable liquid	< 10	< 10	< 10
S96T003051D	148: 2	Drainable liquid	< 10	< 10	< 10

Table B6-38. Tank 241-U-106 Analytical Results: Magnesium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	< 39.8	< 40	< 39.9
S96T003088A	147: 3	Lower half	< 38.6	< 39.6	< 39.1
S96T003087A		Upper half	< 39.8	< 39.8	< 39.8
S96T003090A	147: 4	Lower half	< 39.5	< 39.2	< 39.35
S96T003089A		Upper half	< 39.1	< 40.1	< 39.6
S96T003092A	147: 5	Lower half	50	44.7	47.35
S96T003091A		Upper half	< 38.9	< 39.5	< 39.2
S96T003036A	148: 2	Lower half	< 47.3	< 48.8	< 48.05
S96T003027A		Upper half	< 46	< 46.5	< 46.25
S96T003038A	148: 3	Lower half	< 48.1	< 49.2	< 48.65
S96T003037A		Upper half	< 44.4	< 45.7	< 45.05
S96T003040A	148: 4	Lower half	< 40.4	< 38.7	< 39.55
S96T003039A		Upper half	< 40.2	< 49.6	< 44.9
S96T003042A	148: 5	Lower half	< 49	< 43.5	< 46.25
S96T003041A		Upper half	< 42.8	< 46.3	< 44.55
S96T003887A	Core composite	Whole	< 49	< 45.7	< 47.35
S96T003888A		Whole	< 48.9	< 45.8	< 47.35
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 2,010	< 2,030	< 2,020
S96T003083F	147: 3	Lower half	< 2,060	< 2,030	< 2,045
S96T003080F		Upper half	< 2,050	< 2,000	< 2,025
S96T003084F	147: 4	Lower half	< 2,000	< 1,990	< 1,995
S96T003081F		Upper half	< 2,020	< 2,010	< 2,015

Table B6-38. Tank 241-U-106 Analytical Results: Magnesium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 1,980	< 2,030	< 2,005
S96T003082F		Upper half	< 2,000	< 1,990	< 1,995
S96T003029F	148: 2	Lower half	< 2,040	< 2,020	< 2,030
S96T003026F		Upper half	< 2,030	< 2,000	< 2,015
S96T003031F	148: 3	Lower half	< 2,000	< 2,030	< 2,015
S96T003030F		Upper half	< 2,020	< 2,000	< 2,010
S96T003033F	148: 4	Lower half	< 2,060	< 2,040	< 2,050
S96T003032F		Upper half	< 1,990	< 1,970	< 1,980
S96T003035F	148: 5	Lower half	< 1,910	< 1,960	< 1,935
S96T003034F		Upper half	< 2,030	< 2,000	< 2,015
S96T003878F	Core composite	Whole	< 1,980	< 1,960	< 1,970
S96T003884F		Whole	< 2,000	< 1,790	< 1,895
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	< 38.7	< 40.8	< 39.75
S96T003886I		Whole	< 38.9	< 39.6	< 39.25
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	< 100	< 100	< 100
S96T003064D	147: 2	Drainable liquid	< 100	< 100	< 100
S96T002860D	148: 1	Drainable liquid	< 100	< 100	< 100
S96T003051D	148: 2	Drainable liquid	< 100	< 100	< 100

Table B6-39. Tank 241-U-106 Analytical Results: Manganese (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	3,460	3,570	3,515
S96T003088A	147: 3	Lower half	952	950	951
S96T003087A		Upper half	880	897	888.5
S96T003090A	147: 4	Lower half	950	928	939
S96T003089A		Upper half	899	918	908.5
S96T003092A	147: 5	Lower half	862	826	844
S96T003091A		Upper half	697	731	714
S96T003036A	148: 2	Lower half	1,020	982	1,001
S96T003027A		Upper half	1,840	1,860	1,850
S96T003038A	148: 3	Lower half	913	823	868
S96T003037A		Upper half	925	984	954.5
S96T003040A	148: 4	Lower half	937	916	926.5
S96T003039A		Upper half	996	1,220	1,108
S96T003042A	148: 5	Lower half	317	242	279.5[QC:e]
S96T003041A		Upper half	490	592	541[QC:c]
S96T003887A	Core composite	Whole	1,440	896	1,168[QC:c,e]
S96T003888A		Whole	862	1,540	1,201[QC:d,e]
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	3,040	948	1,994[QC:e]
S96T003083F	147: 3	Lower half	906	925	915.5
S96T003080F		Upper half	902	1,750	1,326[QC:e]
S96T003084F	147: 4	Lower half	953	965	959
S96T003081F		Upper half	943	924	933.5

Table B6-39. Tank 241-U-106 Analytical Results: Manganese (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	859	882	870.5
S96T003082F		Upper half	795	691	743
S96T003029F	148: 2	Lower half	1,020	1,740	1,380[QC:e]
S96T003026F		Upper half	1,740	1,710	1,725
S96T003031F	148: 3	Lower half	996	890	943
S96T003030F		Upper half	1,790	985	1,387.5[QC:e]
S96T003033F	148: 4	Lower half	880	856	868
S96T003032F		Upper half	871	876	873.5
S96T003035F	148: 5	Lower half	249	257	253
S96T003034F		Upper half	534	548	541
S96T003878F	Core composite	Whole	1,490	1,430	1,460
S96T003884F		Whole	928	578	753[QC:e]
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	89.5	86.8	88.15
S96T003886I		Whole	64.6	65.2	64.9
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	13.9	17	15.45
S96T003064D	147: 2	Drainable liquid	747	79.5	413.25[QC:c,e]
S96T002860D	148: 1	Drainable liquid	22.4	18.1	20.25[QC:e]
S96T003051D	148: 2	Drainable liquid	67.9	46	56.95[QC:e]

Table B6-40. Tank 241-U-106 Analytical Results: Molybdenum (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	37.9	36.8	37.35
S96T003088A	147: 3	Lower half	36.5	35.9	36.2
S96T003087A		Upper half	36.8	36.8	36.8
S96T003090A	147: 4	Lower half	34.7	34.9	34.8
S96T003089A		Upper half	34.1	36.3	35.2
S96T003092A	147: 5	Lower half	< 19.9	< 20	< 19.95
S96T003091A		Upper half	19.9	21.1	20.5
S96T003036A	148: 2	Lower half	34.9	35.7	35.3
S96T003027A		Upper half	37.8	34.7	36.25
S96T003038A	148: 3	Lower half	35.9	37.2	36.55
S96T003037A		Upper half	38	36.7	37.35
S96T003040A	148: 4	Lower half	36.1	36.6	36.35
S96T003039A		Upper half	39	47.2	43.1
S96T003042A	148: 5	Lower half	< 24.5	< 21.8	< 23.15
S96T003041A		Upper half	< 21.4	< 23.1	< 22.25
S96T003887A	Core composite	Whole	33.6	30.7	32.15
S96T003888A		Whole	32.5	33.4	32.95
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 1,000	< 1,020	< 1,010
S96T003083F	147: 3	Lower half	< 1,030	< 1,020	< 1,025
S96T003080F		Upper half	< 1,020	< 999	< 1,009.5
S96T003084F	147: 4	Lower half	< 1,000	< 993	< 996.5
S96T003081F		Upper half	< 1,010	< 1,010	< 1,010

Table B6-40. Tank 241-U-106 Analytical Results: Molybdenum (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 990	< 1,020	< 1,005
S96T003082F		Upper half	< 998	< 994	< 996
S96T003029F	148: 2	Lower half	< 1,020	< 1,010	< 1,015
S96T003026F		Upper half	< 1,010	< 1,000	< 1,005
S96T003031F	148: 3	Lower half	< 1,000	< 1,020	< 1,010
S96T003030F		Upper half	< 1,010	< 1,000	< 1,005
S96T003033F	148: 4	Lower half	< 1,030	< 1,020	< 1,025
S96T003032F		Upper half	< 993	< 984	< 988.5
S96T003035F	148: 5	Lower half	< 956	< 979	< 967.5
S96T003034F		Upper half	< 1,020	< 998	< 1,009
S96T003878F	Core composite	Whole	< 991	< 980	< 985.5
S96T003884F		Whole	< 1,000	< 897	< 948.5
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	34.5	31.7	33.1
S96T003886I		Whole	33	30.3	31.65
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	57	63.9	60.45
S96T003064D	147: 2	Drainable liquid	62.6	65	63.8
S96T002860D	148: 1	Drainable liquid	56.4	59.9	58.15
S96T003051D	148: 2	Drainable liquid	70.3	58.1	64.2

Table B6-41. Tank 241-U-106 Analytical Results: Neodymium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	127	129	128
S96T003088A	147: 3	Lower half	122	121	121.5
S96T003087A		Upper half	117	118	117.5
S96T003090A	147: 4	Lower half	122	121	121.5
S96T003089A		Upper half	120	121	120.5
S96T003092A	147: 5	Lower half	67.2	65	66.1
S96T003091A		Upper half	76.5	79.2	77.85
S96T003036A	148: 2	Lower half	123	122	122.5
S96T003027A		Upper half	110	109	109.5
S96T003038A	148: 3	Lower half	129	118	123.5
S96T003037A		Upper half	130	138	134
S96T003040A	148: 4	Lower half	128	126	127
S96T003039A		Upper half	132	163	147.5[QC:e]
S96T003042A	148: 5	Lower half	< 49	< 43.5	< 46.25
S96T003041A		Upper half	55.9	67.8	61.85
S96T003887A	Core composite	Whole	111	101	106
S96T003888A		Whole	97.8	117	107.4
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 2,010	< 2,030	< 2,020
S96T003083F	147: 3	Lower half	< 2,060	< 2,030	< 2,045
S96T003080F		Upper half	< 2,050	< 2,000	< 2,025
S96T003084F	147: 4	Lower half	< 2,000	< 1,990	< 1,995
S96T003081F		Upper half	< 2,020	< 2,010	< 2,015

Table B6-41. Tank 241-U-106 Analytical Results: Neodymium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S96T003085F	147: 5	Lower half	< 1,980	< 2,030	< 2,005
S96T003082F		Upper half	< 2,000	< 1,990	< 1,995
S96T003029F	148: 2	Lower half	< 2,040	< 2,020	< 2,030
S96T003026F		Upper half	< 2,030	< 2,000	< 2,015
S96T003031F	148: 3	Lower half	< 2,000	< 2,030	< 2,015
S96T003030F		Upper half	< 2,020	< 2,000	< 2,010
S96T003033F	148: 4	Lower half	< 2,060	< 2,040	< 2,050
S96T003032F		Upper half	< 1,990	< 1,970	< 1,980
S96T003035F	148: 5	Lower half	< 1,910	< 1,960	< 1,935
S96T003034F		Upper half	< 2,030	< 2,000	< 2,015
S96T003878F	Core composite	Whole	< 1,980	< 1,960	< 1,970
S96T003884F		Whole	< 2,000	< 1,790	< 1,895
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S96T003880I	Core composite	Whole	< 38.7	< 40.8	< 39.75
S96T003886I		Whole	< 38.9	< 39.6	< 39.25
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S96T003063D	147: 1	Drainable liquid	< 100	< 100	< 100
S96T003064D	147: 2	Drainable liquid	< 100	< 100	< 100
S96T002860D	148: 1	Drainable liquid	< 100	< 100	< 100
S96T003051D	148: 2	Drainable liquid	< 100	< 100	< 100

Table B6-42. Tank 241-U-106 Analytical Results: Nickel (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	311	307	309
S96T003088A	147: 3	Lower half	297	298	297.5
S96T003087A		Upper half	300	301	300.5
S96T003090A	147: 4	Lower half	297	293	295
S96T003089A		Upper half	284	291	287.5
S96T003092A	147: 5	Lower half	146	134	140
S96T003091A		Upper half	177	183	180
S96T003036A	148: 2	Lower half	293	291	292
S96T003027A		Upper half	298	277	287.5
S96T003038A	148: 3	Lower half	294	300	297
S96T003037A		Upper half	313	308	310.5
S96T003040A	148: 4	Lower half	312	301	306.5
S96T003039A		Upper half	330	391	360.5
S96T003042A	148: 5	Lower half	134	99.9	116.95[QC:e]
S96T003041A		Upper half	157	187	172
S96T003887A	Core composite	Whole	292	271	281.5
S96T003888A		Whole	268	286	277
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	282	251	266.5
S96T003886I		Whole	259	250	254.5
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	476	532	504
S96T003064D	147: 2	Drainable liquid	547	543	545
S96T002860D	148: 1	Drainable liquid	481	497	489
S96T003051D	148: 2	Drainable liquid	594	503	548.5

Table B6-43. Tank 241-U-106 Analytical Results: Phosphorus (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	1,360	1,650	1,505
S96T003088A	147: 3	Lower half	3,430	3,550	3,490
S96T003087A		Upper half	1,980	2,070	2,025
S96T003090A	147: 4	Lower half	2,170	2,030	2,100
S96T003089A		Upper half	2,090	2,130	2,110
S96T003092A	147: 5	Lower half	6,490	6,360	6,425
S96T003091A		Upper half	12,000	12,300	12,150
S96T003036A	148: 2	Lower half	1,690	1,370	1,530[QC:c]
S96T003027A		Upper half	1,320	1,540	1,430
S96T003038A	148: 3	Lower half	1,550	1,890	1,720
S96T003037A		Upper half	1,650	1,760	1,705
S96T003040A	148: 4	Lower half	3,070	2,820	2,945
S96T003039A		Upper half	2,520	3,190	2,855[QC:d,e]
S96T003042A	148: 5	Lower half	2,460	2,250	2,355
S96T003041A		Upper half	1,770	2,200	1,985[QC:d,e]
S96T003887A	Core composite	Whole	3,460	2,280	2,870[QC:c,e]
S96T003888A		Whole	2,540	4,270	3,405[QC:d,e]
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 4,010	< 4,070	< 4,040
S96T003083F	147: 3	Lower half	< 4,120	4,230	< 4,175
S96T003080F		Upper half	< 4,100	4,060	< 4,080
S96T003084F	147: 4	Lower half	< 4,010	< 3,970	< 3,990
S96T003081F		Upper half	< 4,040	< 4,030	< 4,035

Table B6-43. Tank 241-U-106 Analytical Results: Phosphorus (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	6,750	7,150	6,950
S96T003082F		Upper half	13,500	12,100	12,800
S96T003029F	148: 2	Lower half	< 4,070	< 4,040	< 4,055
S96T003026F		Upper half	< 4,050	< 4,000	< 4,025
S96T003031F	148: 3	Lower half	< 4,000	< 4,070	< 4,035
S96T003030F		Upper half	< 4,040	< 4,010	< 4,025
S96T003033F	148: 4	Lower half	< 4,120	< 4,080	< 4,100
S96T003032F		Upper half	< 3,970	< 3,940	< 3,955
S96T003035F	148: 5	Lower half	< 3,820	< 3,920	< 3,870
S96T003034F		Upper half	< 4,070	< 3,990	< 4,030
S96T003878F	Core composite	Whole	4,270	4,440	4,355
S96T003884F		Whole	< 4,000	< 3,590	< 3,795
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	4,400	4,160	4,280
S96T003886I		Whole	2,290	2,350	2,320
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	1,160	1,320	1,240
S96T003064D	147: 2	Drainable liquid	1,230	1,300	1,265
S96T002860D	148: 1	Drainable liquid	1,150	1,220	1,185
S96T003051D	148: 2	Drainable liquid	1,440	1,180	1,310

Table B6-44. Tank 241-U-106 Analytical Results: Potassium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			μg/g	μg/g	μg/g
S96T003086A	147: 2	Upper half	1,320	1,310	1,315
S96T003088A	147: 3	Lower half	1,230	1,160	1,195
S96T003087A		Upper half	1,340	1,300	1,320
S96T003090A	147: 4	Lower half	1,120	1,280	1,200
S96T003089A		Upper half	1,210	1,210	1,210
S96T003092A	147: 5	Lower half	687	507	597[QC:e]
S96T003091A		Upper half	744	749	746.5
S96T003036A	148: 2	Lower half	1,360	1,350	1,355
S96T003027A		Upper half	1,340	1,140	1,240
S96T003038A	148: 3	Lower half	1,350	1,330	1,340
S96T003037A		Upper half	1,410	1,440	1,425
S96T003040A	148: 4	Lower half	1,310	1,340	1,325
S96T003039A		Upper half	1,380	1,680	1,530
S96T003042A	148: 5	Lower half	585	427	506[QC:e]
S96T003041A		Upper half	630	836	733[QC:e]
S96T003887A	Core composite	Whole	1,410	1,280	1,345
S96T003888A		Whole	1,310	1,430	1,370
Solids: water digest			μg/g	μg/g	μg/g
S96T003880I	Core composite	Whole	1,330	1,270	1,300
S96T003886I		Whole	1,230	1,200	1,215
Liquids			μg/mL	μg/mL	μg/mL
S96T003063D	147: 1	Drainable liquid	1,770	1,980	1,875
S96T003064D	147: 2	Drainable liquid	1,960	2,040	2,000
S96T002860D	148: 1	Drainable liquid	1,670	1,810	1,740[QC:d]
S96T003051D	148: 2	Drainable liquid	2,140	1,760	1,950[QC:e]

Table B6-45. Tank 241-U-106 Analytical Results: Samarium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	< 39.8	< 40	< 39.9
S96T003088A	147: 3	Lower half	< 38.6	< 39.6	< 39.1
S96T003087A		Upper half	< 39.8	< 39.8	< 39.8
S96T003090A	147: 4	Lower half	< 39.5	< 39.2	< 39.35
S96T003089A		Upper half	< 39.1	< 40.1	< 39.6
S96T003092A	147: 5	Lower half	< 39.7	< 40	< 39.85
S96T003091A		Upper half	< 38.9	< 39.5	< 39.2
S96T003036A	148: 2	Lower half	< 47.3	< 48.8	< 48.05
S96T003027A		Upper half	< 46	< 46.5	< 46.25
S96T003038A	148: 3	Lower half	< 48.1	< 49.2	< 48.65
S96T003037A		Upper half	< 44.4	< 45.7	< 45.05
S96T003040A	148: 4	Lower half	< 40.4	< 38.7	< 39.55
S96T003039A		Upper half	< 40.2	< 49.6	< 44.9
S96T003042A	148: 5	Lower half	< 49	< 43.5	< 46.25
S96T003041A		Upper half	< 42.8	< 46.3	< 44.55
S96T003887A	Core composite	Whole	< 49	< 45.7	< 47.35
S96T003888A		Whole	< 48.9	< 45.8	< 47.35
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 2,010	< 2,030	< 2,020
S96T003083F	147: 3	Lower half	< 2,060	< 2,030	< 2,045
S96T003080F		Upper half	< 2,050	< 2,000	< 2,025
S96T003084F	147: 4	Lower half	< 2,000	< 1,990	< 1,995
S96T003081F		Upper half	< 2,020	< 2,010	< 2,015

Table B6-45. Tank 241-U-106 Analytical Results: Samarium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 1,980	< 2,030	< 2,005
S96T003082F		Upper half	< 2,000	< 1,990	< 1,995
S96T003029F	148: 2	Lower half	< 2,040	< 2,020	< 2,030
S96T003026F		Upper half	< 2,030	< 2,000	< 2,015
S96T003031F	148: 3	Lower half	< 2,000	< 2,030	< 2,015
S96T003030F		Upper half	< 2,020	< 2,000	< 2,010
S96T003033F	148: 4	Lower half	< 2,060	< 2,040	< 2,050
S96T003032F		Upper half	< 1,990	< 1,970	< 1,980
S96T003035F	148: 5	Lower half	< 1,910	< 1,960	< 1,935
S96T003034F		Upper half	< 2,030	< 2,000	< 2,015
S96T003878F	Core composite	Whole	< 1,980	< 1,960	< 1,970
S96T003884F		Whole	< 2,000	< 1,790	< 1,895
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	< 38.7	< 40.8	< 39.75
S96T003886I		Whole	< 38.9	< 39.6	< 39.25
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	< 100	< 100	< 100
S96T003064D	147: 2	Drainable liquid	< 100	< 100	< 100
S96T002860D	148: 1	Drainable liquid	< 100	< 100	< 100
S96T003051D	148: 2	Drainable liquid	< 100	< 100	< 100

Table B6-46. Tank 241-U-106 Analytical Results: Selenium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	< 39.8	< 40	< 39.9
S96T003088A	147: 3	Lower half	< 38.6	< 39.6	< 39.1
S96T003087A		Upper half	< 39.8	< 39.8	< 39.8
S96T003090A	147: 4	Lower half	< 39.5	< 39.2	< 39.35
S96T003089A		Upper half	< 39.1	< 40.1	< 39.6
S96T003092A	147: 5	Lower half	< 39.7	< 40	< 39.85
S96T003091A		Upper half	< 38.9	< 39.5	< 39.2
S96T003036A	148: 2	Lower half	< 47.3	< 48.8	< 48.05
S96T003027A		Upper half	< 46	< 46.5	< 46.25
S96T003038A	148: 3	Lower half	< 48.1	< 49.2	< 48.65
S96T003037A		Upper half	< 44.4	< 45.7	< 45.05
S96T003040A	148: 4	Lower half	< 40.4	< 38.7	< 39.55
S96T003039A		Upper half	< 40.2	< 49.6	< 44.9
S96T003042A	148: 5	Lower half	< 49	< 43.5	< 46.25
S96T003041A		Upper half	< 42.8	< 46.3	< 44.55
S96T003887A	Core composite	Whole	< 49	< 45.7	< 47.35
S96T003888A		Whole	< 48.9	< 45.8	< 47.35
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 2,010	< 2,030	< 2,020
S96T003083F	147: 3	Lower half	< 2,060	< 2,030	< 2,045
S96T003080F		Upper half	< 2,050	< 2,000	< 2,025
S96T003084F	147: 4	Lower half	< 2,000	< 1,990	< 1,995
S96T003081F		Upper half	< 2,020	< 2,010	< 2,015

Table B6-46. Tank 241-U-106 Analytical Results: Selenium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 1,980	< 2,030	< 2,005
S96T003082F		Upper half	< 2,000	< 1,990	< 1,995
S96T003029F	148: 2	Lower half	< 2,040	< 2,020	< 2,030
S96T003026F		Upper half	< 2,030	< 2,000	< 2,015
S96T003031F	148: 3	Lower half	< 2,000	< 2,030	< 2,015
S96T003030F		Upper half	< 2,020	< 2,000	< 2,010
S96T003033F	148: 4	Lower half	< 2,060	< 2,040	< 2,050
S96T003032F		Upper half	< 1,990	< 1,970	< 1,980
S96T003035F	148: 5	Lower half	< 1,910	< 1,960	< 1,935
S96T003034F		Upper half	< 2,030	< 2,000	< 2,015
S96T003878F	Core composite	Whole	< 1,980	< 1,960	< 1,970
S96T003884F		Whole	< 2,000	< 1,790	< 1,895
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	< 38.7	< 40.8	< 39.75
S96T003886I		Whole	< 38.9	< 39.6	< 39.25
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	140	< 100	< 120[QC:e]
S96T003064D	147: 2	Drainable liquid	133	157	145
S96T002860D	148: 1	Drainable liquid	180	200	190
S96T003051D	148: 2	Drainable liquid	162	193	177.5

Table B6-47. Tank 241-U-106 Analytical Results: Silicon (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	165	207	186[QC:b,d,e]
S96T003088A	147: 3	Lower half	226	184	205[QC:b,d]
S96T003087A		Upper half	178	190	184[QC:b]
S96T003090A	147: 4	Lower half	210	226	218[QC:b]
S96T003089A		Upper half	212	182	197[QC:b]
S96T003092A	147: 5	Lower half	926	971	948.5[QC:b,d]
S96T003091A		Upper half	561	586	573.5[QC:b]
S96T003036A	148: 2	Lower half	138	152	145[QC:b,d]
S96T003027A		Upper half	130	118	124[QC:b,d]
S96T003038A	148: 3	Lower half	151	147	149[QC:b]
S96T003037A		Upper half	168	164	166[QC:b]
S96T003040A	148: 4	Lower half	168	156	162[QC:b,d]
S96T003039A		Upper half	154	195	174.5[QC:b,d,e]
S96T003042A	148: 5	Lower half	484	322	403[QC:b,e]
S96T003041A		Upper half	119	149	134[QC:b,d,e]
S96T003887A	Core composite	Whole	256	129	192.5[QC:e]
S96T003888A		Whole	113	197	155[QC:e]
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper 1/2	2,440	< 1,020	< 1,730[QC:e]
S96T003083F	147: 3	Lower half	< 1,030	< 1,020	< 1,025
S96T003080F		Upper half	< 1,020	< 999	< 1,009.5
S96T003084F	147: 4	Lower half	< 1,000	< 993	< 996.5
S96T003081F		Upper half	< 1,010	< 1,010	< 1,010

Table B6-47. Tank 241-U-106 Analytical Results: Silicon (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	1,190	1,230	1,210
S96T003082F		Upper half	< 998	< 994	< 996
S96T003029F	148: 2	Lower half	< 1,020	< 1,010	< 1,015
S96T003026F		Upper half	< 1,010	< 1,000	< 1,005
S96T003031F	148: 3	Lower half	< 1,000	< 1,020	< 1,010
S96T003030F		Upper half	< 1,010	< 1,000	< 1,005
S96T003033F	148: 4	Lower half	< 1,030	< 1,020	< 1,025
S96T003032F		Upper half	< 993	< 984	< 988.5
S96T003035F	148: 5	Lower half	< 956	1,320	< 1,138[QC:e]
S96T003034F		Upper half	< 1,020	< 998	< 1,009
S96T003878F	Core composite	Whole	< 991	< 980	< 985.5
S96T003884F		Whole	< 1,000	< 897	< 948.5
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	161	210	185.5[QC:e]
S96T003886I		Whole	169	141	155
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	< 50.1	< 50.1	< 50.1
S96T003064D	147: 2	Drainable liquid	129	< 50.1	< 89.55[QC:e]
S96T002860D	148: 1	Drainable liquid	< 50.1	< 50.1	< 50.1
S96T003051D	148: 2	Drainable liquid	< 50.1	< 50.1	< 50.1

Table B6-48. Tank 241-U-106 Analytical Results: Silver (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	15.2	15.3	15.25
S96T003088A	147: 3	Lower half	17	16.8	16.9
S96T003087A		Upper half	16	16.1	16.05
S96T003090A	147: 4	Lower half	18.6	16.7	17.65
S96T003089A		Upper half	16.3	16.4	16.35
S96T003092A	147: 5	Lower half	107	102	104.5
S96T003091A		Upper half	58.5	60.7	59.6
S96T003036A	148: 2	Lower half	16	15.4	15.7[QC:a]
S96T003027A		Upper half	14.1	13.4	13.75[QC:a]
S96T003038A	148: 3	Lower half	15.8	15.5	15.65[QC:a]
S96T003037A		Upper half	16.5	16.9	16.7[QC:a]
S96T003040A	148: 4	Lower half	17.7	17.2	17.45
S96T003039A		Upper half	17.4	21.5	19.45[QC:e]
S96T003042A	148: 5	Lower half	30.9	25.5	28.2
S96T003041A		Upper half	17	21.1	19.05[QC:e]
S96T003887A	Core composite	Whole	31.9	17	24.45[QC:e]
S96T003888A		Whole	17.1	33	25.05[QC:c,e]
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 201	< 203	< 202
S96T003083F	147: 3	Lower half	< 206	< 203	< 204.5
S96T003080F		Upper half	< 205	< 200	< 202.5
S96T003084F	147: 4	Lower half	< 200	< 199	< 199.5[QC:c]
S96T003081F		Upper half	< 202	< 201	< 201.5[QC:c]

Table B6-48. Tank 241-U-106 Analytical Results: Silver (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 198	< 203	< 200.5[QC:c]
S96T003082F		Upper half	< 200	< 199	< 199.5[QC:c]
S96T003029F	148: 2	Lower half	< 204	< 202	< 203[QC:c]
S96T003026F		Upper half	< 203	< 200	< 201.5
S96T003031F	148: 3	Lower half	< 200	< 203	< 201.5[QC:c]
S96T003030F		Upper half	< 202	< 200	< 201[QC:c]
S96T003033F	148: 4	Lower half	< 206	< 204	< 205[QC:c]
S96T003032F		Upper half	< 199	< 197	< 198[QC:c]
S96T003035F	148: 5	Lower half	< 191	< 196	< 193.5[QC:c]
S96T003034F		Upper half	< 203	< 200	< 201.5[QC:c]
S96T003878F	Core composite	Whole	< 198	< 196	< 197
S96T003884F		Whole	< 200	< 179	< 189.5
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	14.8	14.4	14.6
S96T003886I		Whole	14.4	13.6	14
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	< 10	< 10	< 10
S96T003064D	147: 2	Drainable liquid	< 10	< 10	< 10
S96T002860D	148: 1	Drainable liquid	< 10	< 10	< 10
S96T003051D	148: 2	Drainable liquid	< 10	< 10	< 10

Table B6-49. Tank 241-U-106 Analytical Results: Sodium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	1.630E+05	1.620E+05	1.62E+05[QC:c]
S96T003088A	147: 3	Lower half	1.760E+05	1.730E+05	1.74E+05[QC:c]
S96T003087A		Upper half	1.670E+05	1.660E+05	1.66E+05
S96T003090A	147: 4	Lower half	1.660E+05	1.620E+05	1.64E+05
S96T003089A		Upper half	1.710E+05	1.670E+05	1.69E+05
S96T003092A	147: 5	Lower half	1.970E+05	2.030E+05	2.00E+05[QC:d]
S96T003091A		Upper half	1.890E+05	1.910E+05	1.90E+05
S96T003036A	148: 2	Lower half	1.650E+05	1.640E+05	1.6E+05[QC:b,c]
S96T003027A		Upper half	1.640E+05	1.590E+05	1.6E+05[QC:b,c]
S96T003038A	148: 3	Lower half	1.740E+05	1.710E+05	1.72E+05[QC:b]
S96T003037A		Upper half	1.730E+05	1.740E+05	1.73E+05[QC:b]
S96T003040A	148: 4	Lower half	1.840E+05	1.770E+05	1.8E+05[QC:b,c]
S96T003039A		Upper half	1.740E+05	2.170E+05	1.9E+05[QC:b,d]
S96T003042A	148: 5	Lower half	2.470E+05	2.130E+05	2.30E+05[QC:b]
S96T003041A		Upper half	1.810E+05	2.220E+05	2.0E+05[QC:b,d]
S96T003887A	Core composite	Whole	1.680E+05	1.710E+05	1.69E+05[QC:d]
S96T003888A		Whole	1.770E+05	1.740E+05	1.75E+05
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	1.540E+05	47,400	1.01E+05[QC:e]
S96T003083F	147: 3	Lower half	1.840E+05	1.860E+05	1.85E+05[QC:d]
S96T003080F		Upper half	1.800E+05	3.480E+05	2.64E+05[QC:e]
S96T003084F	147: 4	Lower half	2.250E+05	2.110E+05	2.18E+05
S96T003081F		Upper half	2.130E+05	2.220E+05	2.17E+05

Table B6-49. Tank 241-U-106 Analytical Results: Sodium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	2.680E+05	2.740E+05	2.71E+05
S96T003082F		Upper half	2.530E+05	2.200E+05	2.36E+05
S96T003029F	148: 2	Lower half	1.770E+05	1.670E+05	1.72E+05
S96T003026F		Upper half	1.650E+05	1.600E+05	1.62E+05
S96T003031F	148: 3	Lower half	1.810E+05	1.830E+05	1.82E+05
S96T003030F		Upper half	1.710E+05	1.780E+05	1.74E+05
S96T003033F	148: 4	Lower half	1.900E+05	1.830E+05	1.86E+05
S96T003032F		Upper half	1.830E+05	1.760E+05	1.79E+05
S96T003035F	148: 5	Lower half	2.300E+05	2.230E+05	2.26E+05[QC:c]
S96T003034F		Upper half	2.220E+05	2.110E+05	2.16E+05[QC:c]
S96T003878F	Core composite	Whole	2.020E+05	2.070E+05	2.04E+05
S96T003884F		Whole	2.050E+05	1.460E+05	1.75E+05[QC:e]
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	1.780E+05	1.780E+05	1.78E+05[QC:c]
S96T003886I		Whole	1.870E+05	1.800E+05	1.83E+05[QC:c]
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	1.970E+05	2.200E+05	2.08E+05[QC:c]
S96T003064D	147: 2	Drainable liquid	2.350E+05	2.300E+05	2.32E+05[QC:c]
S96T002860D	148: 1	Drainable liquid	2.110E+05	2.140E+05	2.12E+05[QC:d]
S96T003051D	148: 2	Drainable liquid	2.530E+05	2.240E+05	2.38E+05[QC:c]

Table B6-50. Tank 241-U-106 Analytical Results: Strontium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	4.1	4.17	4.135
S96T003088A	147: 3	Lower half	< 3.86	< 3.96	< 3.91
S96T003087A		Upper half	< 3.98	< 3.98	< 3.98
S96T003090A	147: 4	Lower half	< 3.95	< 3.92	< 3.935
S96T003089A		Upper half	< 3.91	< 4.01	< 3.96
S96T003092A	147: 5	Lower half	4.18	4.13	4.155
S96T003091A		Upper half	< 3.89	< 3.95	< 3.92
S96T003036A	148: 2	Lower half	< 4.73	< 4.88	< 4.805
S96T003027A		Upper half	< 4.6	< 4.65	< 4.625
S96T003038A	148: 3	Lower half	< 4.81	< 4.92	< 4.865
S96T003037A		Upper half	< 4.44	< 4.57	< 4.505
S96T003040A	148: 4	Lower half	< 4.04	< 3.87	< 3.955
S96T003039A		Upper half	< 4.02	< 4.96	< 4.49
S96T003042A	148: 5	Lower half	< 4.9	< 4.35	< 4.625
S96T003041A		Upper half	< 4.28	< 4.63	< 4.455
S96T003887A	Core composite	Whole	< 4.9	< 4.57	< 4.735
S96T003888A		Whole	< 4.89	< 4.58	< 4.735
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 201	< 203	< 202
S96T003083F	147: 3	Lower half	< 206	< 203	< 204.5
S96T003080F		Upper half	< 205	< 200	< 202.5
S96T003084F	147: 4	Lower half	< 200	< 199	< 199.5
S96T003081F		Upper half	< 202	< 201	< 201.5

Table B6-50. Tank 241-U-106 Analytical Results: Strontium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 198	< 203	< 200.5
S96T003082F		Upper half	< 200	< 199	< 199.5
S96T003029F	148: 2	Lower half	< 204	< 202	< 203
S96T003026F		Upper half	< 203	< 200	< 201.5
S96T003031F	148: 3	Lower half	< 200	< 203	< 201.5
S96T003030F		Upper half	< 202	< 200	< 201
S96T003033F	148: 4	Lower half	< 206	< 204	< 205
S96T003032F		Upper half	< 199	< 197	< 198
S96T003035F	148: 5	Lower half	< 191	< 196	< 193.5
S96T003034F		Upper half	< 203	< 200	< 201.5
S96T003878F	Core composite	Whole	< 198	< 196	< 197
S96T003884F		Whole	< 200	< 179	< 189.5
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	< 3.87	< 4.08	< 3.975
S96T003886I		Whole	< 3.89	< 3.96	< 3.925
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	< 10	< 10	< 10
S96T003064D	147: 2	Drainable liquid	< 10	< 10	< 10
S96T002860D	148: 1	Drainable liquid	< 10	< 10	< 10
S96T003051D	148: 2	Drainable liquid	< 10	< 10	< 10

Table B6-51. Tank 241-U-106 Analytical Results: Sulfur (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	3,220	3,200	3,210
S96T003088A	147: 3	Lower half	4,080	4,100	4,090
S96T003087A		Upper half	4,050	4,070	4,060
S96T003090A	147: 4	Lower half	4,020	3,870	3,945
S96T003089A		Upper half	4,000	4,130	4,065
S96T003092A	147: 5	Lower half	753	694	723.5
S96T003091A		Upper half	2,580	2,730	2,655
S96T003036A	148: 2	Lower half	3,710	3,670	3,690
S96T003027A		Upper half	2,340	2,130	2,235[QC:e]
S96T003038A	148: 3	Lower half	4,270	4,150	4,210
S96T003037A		Upper half	4,090	4,200	4,145
S96T003040A	148: 4	Lower half	4,760	4,590	4,675
S96T003039A		Upper half	3,960	4,710	4,335
S96T003042A	148: 5	Lower half	829	629	729[QC:e]
S96T003041A		Upper half	1,520	1,880	1,700[QC:c,e]
S96T003887A	Core composite	Whole	3,380	3,120	3,250
S96T003888A		Whole	3,110	3,480	3,295
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	2,820	< 2,030	< 2,425[QC:e]
S96T003083F	147: 3	Lower half	4,220	4,320	4,270
S96T003080F		Upper half	4,390	8,350	6,370[QC:e]
S96T003084F	147: 4	Lower half	3,870	4,060	3,965
S96T003081F		Upper half	4,390	4,030	4,210

Table B6-51. Tank 241-U-106 Analytical Results: Sulfur (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 1,980	< 2,030	< 2,005
S96T003082F		Upper half	2,700	2,460	2,580
S96T003029F	148: 2	Lower half	3,920	2,340	3,130[QC:e]
S96T003026F		Upper half	2,590	2,410	2,500
S96T003031F	148: 3	Lower half	4,960	4,070	4,515
S96T003030F		Upper half	2,460	3,950	3,205[QC:e]
S96T003033F	148: 4	Lower half	4,230	4,700	4,465
S96T003032F		Upper half	3,620	3,570	3,595
S96T003035F	148: 5	Lower half	< 1,910	< 1,960	< 1,935
S96T003034F		Upper half	< 2,030	< 2,000	< 2,015
S96T003878F	Core composite	Whole	3,370	3,500	3,435
S96T003884F		Whole	3,350	2,170	2,760[QC:e]
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	3,600	3,230	3,415
S96T003886I		Whole	3,370	3,110	3,240
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	2,590	2,900	2,745
S96T003064D	147: 2	Drainable liquid	3,180	3,050	3,115[QC:c]
S96T002860D	148: 1	Drainable liquid	2,610	2,740	2,675[QC:d]
S96T003051D	148: 2	Drainable liquid	3,220	2,720	2,970[QC:e]

Table B6-52. Tank 241-U-106 Analytical Results: Thallium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			μg/g	μg/g	μg/g
S96T003086A	147: 2	Upper half	< 79.7	< 79.9	< 79.8
S96T003088A	147: 3	Lower half	< 77.1	< 79.2	< 78.15
S96T003087A		Upper half	< 79.6	< 79.6	< 79.6
S96T003090A	147: 4	Lower half	< 78.9	< 78.4	< 78.65
S96T003089A		Upper half	< 78.3	< 80.1	< 79.2
S96T003092A	147: 5	Lower half	< 79.5	< 80	< 79.75
S96T003091A		Upper half	< 77.7	< 79.1	< 78.4
S96T003036A	148: 2	Lower half	< 94.7	< 97.7	< 96.2
S96T003027A		Upper half	< 92	< 92.9	< 92.45
S96T003038A	148: 3	Lower half	< 96.2	< 98.4	< 97.3
S96T003037A		Upper half	< 88.7	< 91.4	< 90.05
S96T003040A	148: 4	Lower half	< 80.8	< 77.5	< 79.15
S96T003039A		Upper half	< 80.4	< 99.1	< 89.75
S96T003042A	148: 5	Lower half	< 98.1	< 87.1	< 92.6
S96T003041A		Upper half	< 85.7	< 92.5	< 89.1
S96T003887A	Core composite	Whole	< 98	< 91.5	< 94.75
S96T003888A		Whole	< 97.8	< 91.6	< 94.7
Solids: fusion			μg/g	μg/g	μg/g
S96T003079F	147: 2	Upper half	< 4,010	< 4,070	< 4,040
S96T003083F	147: 3	Lower half	< 4,120	< 4,060	< 4,090
S96T003080F		Upper half	< 4,100	< 4,000	< 4,050
S96T003084F	147: 4	Lower half	< 4,010	< 3,970	< 3,990
S96T003081F		Upper half	< 4,040	< 4,030	< 4,035

Table B6-52. Tank 241-U-106 Analytical Results: Thallium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 3,960	< 4,060	< 4,010
S96T003082F		Upper half	< 3,990	< 3,980	< 3,985
S96T003029F	148: 2	Lower half	< 4,070	< 4,040	< 4,055
S96T003026F		Upper half	< 4,050	< 4,000	< 4,025
S96T003031F	148: 3	Lower half	< 4,000	< 4,070	< 4,035
S96T003030F		Upper half	< 4,040	< 4,010	< 4,025
S96T003033F	148: 4	Lower half	< 4,120	< 4,080	< 4,100
S96T003032F		Upper half	< 3,970	< 3,940	< 3,955
S96T003035F	148: 5	Lower half	< 3,820	< 3,920	< 3,870
S96T003034F		Upper half	< 4,070	< 3,990	< 4,030
S96T003878F	Core composite	Whole	< 3,970	< 3,920	< 3,945
S96T003884F		Whole	< 4,000	< 3,590	< 3,795
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	< 77.5	< 81.6	< 79.55
S96T003886I		Whole	< 77.8	< 79.2	< 78.5
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	< 200	< 200	< 200
S96T003064D	147: 2	Drainable liquid	< 200	< 200	< 200
S96T002860D	148: 1	Drainable liquid	< 200	< 200	< 200
S96T003051D	148: 2	Drainable liquid	< 200	< 200	< 200

Table B6-53. Tank 241-U-106 Analytical Results: Titanium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	< 3.98	< 4	< 3.99
S96T003088A	147: 3	Lower half	< 3.86	< 3.96	< 3.91
S96T003087A		Upper half	< 3.98	< 3.98	< 3.98
S96T003090A	147: 4	Lower half	< 3.95	< 3.92	< 3.935
S96T003089A		Upper half	< 3.91	< 4.01	< 3.96
S96T003092A	147: 5	Lower half	13.4	13.8	13.6
S96T003091A		Upper half	6.66	6.97	6.815
S96T003036A	148: 2	Lower half	< 4.73	< 4.88	< 4.805
S96T003027A		Upper half	< 4.6	< 4.65	< 4.625
S96T003038A	148: 3	Lower half	< 4.81	< 4.92	< 4.865
S96T003037A		Upper half	< 4.44	< 4.57	< 4.505
S96T003040A	148: 4	Lower half	< 4.04	< 3.87	< 3.955
S96T003039A		Upper half	< 4.02	< 4.96	< 4.49
S96T003042A	148: 5	Lower half	< 4.9	< 4.35	< 4.625
S96T003041A		Upper half	< 4.28	< 4.63	< 4.455
S96T003887A	Core composite	Whole	< 4.9	< 4.57	< 4.735
S96T003888A		Whole	< 4.89	< 4.58	< 4.735
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 201	< 203	< 202
S96T003083F	147: 3	Lower half	< 206	< 203	< 204.5
S96T003080F		Upper half	< 205	< 200	< 202.5
S96T003084F	147: 4	Lower half	< 200	< 199	< 199.5
S96T003081F		Upper half	< 202	< 201	< 201.5

Table B6-53. Tank 241-U-106 Analytical Results: Titanium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 198	< 203	< 200.5
S96T003082F		Upper half	< 200	< 199	< 199.5
S96T003029F	148: 2	Lower half	< 204	< 202	< 203
S96T003026F		Upper half	< 203	< 200	< 201.5
S96T003031F	148: 3	Lower half	< 200	< 203	< 201.5
S96T003030F		Upper half	< 202	< 200	< 201
S96T003033F	148: 4	Lower half	< 206	< 204	< 205
S96T003032F		Upper half	< 199	< 197	< 198
S96T003035F	148: 5	Lower half	< 191	< 196	< 193.5
S96T003034F		Upper half	< 203	< 200	< 201.5
S96T003878F	Core composite	Whole	< 198	< 196	< 197
S96T003884F		Whole	< 200	< 179	< 189.5
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	< 3.87	< 4.08	< 3.975
S96T003886I		Whole	< 3.89	< 3.96	< 3.925
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	< 10	< 10	< 10
S96T003064D	147: 2	Drainable liquid	< 10	< 10	< 10
S96T002860D	148: 1	Drainable liquid	< 10	< 10	< 10
S96T003051D	148: 2	Drainable liquid	< 10	< 10	< 10

Table B6-54. Tank 241-U-106 Analytical Results: Total Uranium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	631	636	633.5
S96T003088A	147: 3	Lower half	848	847	847.5
S96T003087A		Upper half	724	729	726.5
S96T003090A	147: 4	Lower half	844	810	827
S96T003089A		Upper half	788	798	793
S96T003092A	147: 5	Lower half	680	642	661
S96T003091A		Upper half	604	637	620.5
S96T003036A	148: 2	Lower half	806	772	789
S96T003027A		Upper half	410	381	395.5
S96T003038A	148: 3	Lower half	810	726	768
S96T003037A		Upper half	827	877	852
S96T003040A	148: 4	Lower half	895	881	888
S96T003039A		Upper half	984	1,180	1,082
S96T003042A	148: 5	Lower half	< 245	< 218	< 231.5
S96T003041A		Upper half	408	503	455.5
S96T003887A	Core composite	Whole	719	642	680.5
S96T003888A		Whole	625	762	693.5
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 10,000	< 10,200	< 10,100
S96T003083F	147: 3	Lower half	< 10,300	< 10,200	< 10,250
S96T003080F		Upper half	< 10,200	< 9,990	< 10,095
S96T003084F	147: 4	Lower half	< 10,000	< 9,930	< 9,965
S96T003081F		Upper half	< 10,100	< 10,100	< 10,100

Table B6-54. Tank 241-U-106 Analytical Results: Total Uranium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 9,900	< 10,200	< 10,050
S96T003082F		Upper half	< 9,980	< 9,940	< 9,960
S96T003029F	148: 2	Lower half	< 10,200	< 10,100	< 10,150
S96T003026F		Upper half	< 10,100	< 10,000	< 10,050
S96T003031F	148: 3	Lower half	< 10,000	< 10,200	< 10,100
S96T003030F		Upper half	< 10,100	< 10,000	< 10,050
S96T003033F	148: 4	Lower half	< 10,300	< 10,200	< 10,250
S96T003032F		Upper half	< 9,930	< 9,840	< 9,885
S96T003035F	148: 5	Lower half	< 9,560	< 9,790	< 9,675
S96T003034F		Upper half	< 10,200	< 9,980	< 10,090
S96T003878F	Core composite	Whole	< 9,910	< 9,800	< 9,855
S96T003884F		Whole	< 10,000	< 8,970	< 9,485
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	< 194	< 204	< 199
S96T003886I		Whole	< 194	< 198	< 196
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	< 500	< 500	< 500
S96T003064D	147: 2	Drainable liquid	< 500	< 500	< 500
S96T002860D	148: 1	Drainable liquid	< 500	< 500	< 500
S96T003051D	148: 2	Drainable liquid	< 500	< 500	< 500

Table B6-55. Tank 241-U-106 Analytical Results: Vanadium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	< 19.9	< 20	< 19.95
S96T003088A	147: 3	Lower half	< 19.3	< 19.8	< 19.55
S96T003087A		Upper half	< 19.9	< 19.9	< 19.9
S96T003090A	147: 4	Lower half	< 19.7	< 19.6	< 19.65
S96T003089A		Upper half	< 19.6	< 20	< 19.8
S96T003092A	147: 5	Lower half	< 19.9	< 20	< 19.95
S96T003091A		Upper half	< 19.4	< 19.8	< 19.6
S96T003036A	148: 2	Lower half	< 23.7	< 24.4	< 24.05
S96T003027A		Upper half	< 23	< 23.2	< 23.1
S96T003038A	148: 3	Lower half	< 24.1	< 24.6	< 24.35
S96T003037A		Upper half	< 22.2	< 22.8	< 22.5
S96T003040A	148: 4	Lower half	< 20.2	< 19.4	< 19.8
S96T003039A		Upper half	< 20.1	< 24.8	< 22.45
S96T003042A	148: 5	Lower half	< 24.5	< 21.8	< 23.15
S96T003041A		Upper half	< 21.4	< 23.1	< 22.25
S96T003887A	Core composite	Whole	< 24.5	< 22.9	< 23.7
S96T003888A		Whole	< 24.5	< 22.9	< 23.7
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 1,000	< 1,020	< 1,010
S96T003083F	147: 3	Lower half	< 1,030	< 1,020	< 1,025
S96T003080F		Upper half	< 1,020	< 999	< 1,009.5
S96T003084F	147: 4	Lower half	< 1,000	< 993	< 996.5
S96T003081F		Upper half	< 1,010	< 1,010	< 1,010

Table B6-55. Tank 241-U-106 Analytical Results: Vanadium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	< 990	< 1,020	< 1,005
S96T003082F		Upper half	< 998	< 994	< 996
S96T003029F	148: 2	Lower half	< 1,020	< 1,010	< 1,015
S96T003026F		Upper half	< 1,010	< 1,000	< 1,005
S96T003031F	148: 3	Lower half	< 1,000	< 1,020	< 1,010
S96T003030F		Upper half	< 1,010	< 1,000	< 1,005
S96T003033F	148: 4	Lower half	< 1,030	< 1,020	< 1,025
S96T003032F		Upper half	< 993	< 984	< 988.5
S96T003035F	148: 5	Lower half	< 956	< 979	< 967.5
S96T003034F		Upper half	< 1,020	< 998	< 1,009
S96T003878F	Core composite	Whole	< 991	< 980	< 985.5
S96T003884F		Whole	< 1,000	< 897	< 948.5
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	< 19.4	< 20.4	< 19.9
S96T003886I		Whole	< 19.4	< 19.8	< 19.6
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	< 50.1	< 50.1	< 50.1
S96T003064D	147: 2	Drainable liquid	< 50.1	< 50.1	< 50.1
S96T002860D	148: 1	Drainable liquid	< 50.1	< 50.1	< 50.1
S96T003051D	148: 2	Drainable liquid	< 50.1	< 50.1	< 50.1

Table B6-56. Tank 241-U-106 Analytical Results: Zinc (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	63.1	67.7	65.4
S96T003088A	147: 3	Lower half	60.8	58.6	59.7
S96T003087A		Upper half	54.6	58.5	56.55
S96T003090A	147: 4	Lower half	59.3	56.3	57.8
S96T003089A		Upper half	64.8	57.3	61.05
S96T003092A	147: 5	Lower half	51.4	43.5	47.45
S96T003091A		Upper half	42.9	35.4	39.15
S96T003036A	148: 2	Lower half	43.3	41.9	42.6
S96T003027A		Upper half	46.2	50	48.1
S96T003038A	148: 3	Lower half	44.7	42.5	43.6
S96T003037A		Upper half	50	49.9	49.95
S96T003040A	148: 4	Lower half	46.1	46.6	46.35
S96T003039A		Upper half	52.5	60.1	56.3
S96T003042A	148: 5	Lower half	25.6	21.1	23.35
S96T003041A		Upper half	28.4	34.2	31.3
S96T003887A	Core composite	Whole	43.7	41.4	42.55
S96T003888A		Whole	34.7	41	37.85
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 201	< 203	< 202
S96T003083F	147: 3	Lower half	< 206	< 203	< 204.5
S96T003080F		Upper half	< 205	< 200	< 202.5
S96T003084F	147: 4	Lower half	801	989	895[QC:e]
S96T003081F		Upper half	924	897	910.5

Table B6-56. Tank 241-U-106 Analytical Results: Zinc (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	479	< 203	< 341[QC:e]
S96T003082F		Upper half	892	< 199	< 545.5[QC:e]
S96T003029F	148: 2	Lower half	964	1,020	992
S96T003026F		Upper half	364	< 200	< 282[QC:e]
S96T003031F	148: 3	Lower half	1,060	871	965.5
S96T003030F		Upper half	819	1,110	964.5[QC:e]
S96T003033F	148: 4	Lower half	1,000	1,090	1,045
S96T003032F		Upper half	1,340	798	1,069[QC:e]
S96T003035F	148: 5	Lower half	787	584	685.5[QC:e]
S96T003034F		Upper half	751	662	706.5
S96T003878F	Core composite	Whole	< 198	< 196	< 197
S96T003884F		Whole	< 200	< 179	< 189.5
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	8.76	8.92	8.84
S96T003886I		Whole	9.21	8.73	8.97
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	15.3	17.6	16.45
S96T003064D	147: 2	Drainable liquid	39.4	20.8	30.1[QC:e]
S96T002860D	148: 1	Drainable liquid	15	15.2	15.1
S96T003051D	148: 2	Drainable liquid	15.5	11.9	13.7[QC:e]

Table B6-57. Tank 241-U-106 Analytical Results: Zirconium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003086A	147: 2	Upper half	81.8	83.7	82.75
S96T003088A	147: 3	Lower half	76.5	80.3	78.4
S96T003087A		Upper half	89.7	90.2	89.95
S96T003090A	147: 4	Lower half	95.9	95.2	95.55
S96T003089A		Upper half	90.9	91.8	91.35
S96T003092A	147: 5	Lower half	321	501	411[QC:e]
S96T003091A		Upper half	280	269	274.5
S96T003036A	148: 2	Lower half	87.7	85.3	86.5
S96T003027A		Upper half	57.7	57.1	57.4
S96T003038A	148: 3	Lower half	93.3	84.7	89
S96T003037A		Upper half	94.4	99.1	96.75
S96T003040A	148: 4	Lower half	93.2	88.9	91.05
S96T003039A		Upper half	101	120	110.5
S96T003042A	148: 5	Lower half	108	83.1	95.55[QC:e]
S96T003041A		Upper half	54.7	65.4	60.05
S96T003887A	Core composite	Whole	150	83.9	116.95[QC:e]
S96T003888A		Whole	79.9	93.6	86.75
Solids: fusion			µg/g	µg/g	µg/g
S96T003079F	147: 2	Upper half	< 201	< 203	< 202
S96T003083F	147: 3	Lower half	< 206	< 203	< 204.5
S96T003080F		Upper half	< 205	< 200	< 202.5
S96T003084F	147: 4	Lower half	< 200	< 199	< 199.5
S96T003081F		Upper half	< 202	< 201	< 201.5

Table B6-57. Tank 241-U-106 Analytical Results: Zirconium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003085F	147: 5	Lower half	206	264	235[QC:e]
S96T003082F		Upper half	261	< 199	< 230[QC:e]
S96T003029F	148: 2	Lower half	< 204	< 202	< 203
S96T003026F		Upper half	< 203	< 200	< 201.5
S96T003031F	148: 3	Lower half	< 200	< 203	< 201.5
S96T003030F		Upper half	< 202	< 200	< 201
S96T003033F	148: 4	Lower half	< 206	< 204	< 205
S96T003032F		Upper half	< 199	< 197	< 198
S96T003035F	148: 5	Lower half	< 191	< 196	< 193.5
S96T003034F		Upper half	< 203	< 200	< 201.5
S96T003878F	Core composite	Whole	< 198	< 196	< 197
S96T003884F		Whole	< 200	< 179	< 189.5
Solids: water digest			µg/g	µg/g	µg/g
S96T003880I	Core composite	Whole	6.93	6.41	6.67
S96T003886I		Whole	< 3.89	4.14	< 4.015
Liquids			µg/mL	µg/mL	µg/mL
S96T003063D	147: 1	Drainable liquid	< 10	< 10	< 10
S96T003064D	147: 2	Drainable liquid	28.4	< 10	< 19.2[QC:e]
S96T002860D	148: 1	Drainable liquid	< 10	< 10	< 10
S96T003051D	148: 2	Drainable liquid	< 10	< 10	< 10

B6.2.11 Uranium by Phosphorescence

Uranium was measured by two methods: phosphorescence and ICP (see Section B6.2.10). The phosphorescence method, which is considered to be more accurate, was used on core composite samples. The composites samples were prepared by KOH fusion according to procedure LA-549-101. The analysis was performed using method LA-925-009. Table B6-58 shows the uranium by phosphorescence results.

B6.2.12 Ion Chromatography

Ion chromatography was used to analyze for bromide, chloride, fluoride, nitrate, nitrite, oxalate, phosphate, and sulfate. Ion chromatography was performed on all liquid and solid samples and core composites. Solid samples were prepared using water digestion. Liquid samples were analyzed directly. The procedure used to prepare samples for ICP analysis is LA-504-101. The analysis was performed according to procedure LA-533-105. Tables B6-59 through B6-66 show the results of IC analysis.

B6.2.13 Vapor Phase Measurements

As directed in Brown (1996), the headspace of tank 241-U-106 was sampled and analyzed for the presence of flammable gases before core sampling by a combustible gas monitor (CGM) and during core sampling by the standard hydrogen monitoring system (SHMS). The maximum recorded flammability was six percent of the LFL. This is less than the safety screening decision criteria threshold for flammable gas concentration, which is 25 percent of the LFL (Dukelow et al. 1995). Vapor phase measurements were performed many times before and during the core sampling event. Table B6-67 summarizes the range of headspace flammability screening results before and during the sampling event from both CGM and SHMS measurement methods.

Table B6-58. Tank 241-U-106 Analytical Results: Total Uranium (U).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T003878F	Core composite	Whole	890	884	887
S96T003884F		Whole	692	573	632.5

Table B6-59. Tank 241-U-106 Analytical Results: Bromide (IC). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T003093W	147: 2	Upper half	1,004	1,010	1,007
S96T003095W	147: 3	Lower half	< 517.9	< 518	< 517.95
S96T003094W		Upper half	1,192	1,120	1,156
S96T003097W	147: 4	Lower half	< 516.4	< 520	< 518.2
S96T003096W		Upper half	< 519	< 521	< 520
S96T003099W	147: 5	Lower half	< 1,676	< 1,640	< 1,658
S96T003098W		Upper half	< 1,279	< 1,280	< 1,279.5
S96T003043W	148: 2	Lower half	918.3	1,000	959.15
S96T003028W		Upper half	633.5	636	634.75
S96T003045W	148: 3	Lower half	< 525	< 528	< 526.5
S96T003044W		Upper half	< 520.9	< 517	< 518.95
S96T003047W	148: 4	Lower half	< 534.8	< 524	< 529.4
S96T003046W		Upper half	< 526.9	< 521	< 523.95
S96T003049W	148: 5	Lower half	< 1,229	< 1,250	< 1,239.5
S96T003048W		Upper half	< 1,204	< 1,250	< 1,227
S96T003879W	Core composite	Whole	< 499.2	< 526	< 512.6
S96T003885W		Whole	1,304	1,310	1,307

Table B6-59. Tank 241-U-106 Analytical Results: Bromide (IC). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T003063	147: 1	Drainable liquid	1,496	1,500	1,498
S96T003064	147: 2	Drainable liquid	2,299	2,170	2,234.5
S96T002860	148: 1	Drainable liquid	609.1	< 522	< 565.55
S96T003051	148: 2	Drainable liquid	< 521.8	< 522	< 521.9

Table B6-60. Tank 241-U-106 Analytical Results: Chloride (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T003093W	147: 2	Upper half	2,698	2,630	2,664
S96T003095W	147: 3	Lower half	3,024	3,040	3,032
S96T003094W		Upper half	2,882	2,660	2,771
S96T003097W	147: 4	Lower half	2,852	2,900	2,876
S96T003096W		Upper half	3,032	2,960	2,996
S96T003099W	147: 5	Lower half	1,235	1,260	1,247.5
S96T003098W		Upper half	1,658	1,810	1,734
S96T003043W	148: 2	Lower half	2,588	2,630	2,609
S96T003028W		Upper half	2,516	2,410	2,463
S96T003045W	148: 3	Lower half	3,047	3,090	3,068.5
S96T003044W		Upper half	3,921	2,970	3,445.5[QC:c,e]
S96T003047W	148: 4	Lower half	3,040	2,980	3,010
S96T003046W		Upper half	3,167	3,030	3,098.5
S96T003049W	148: 5	Lower half	940	801	870.5
S96T003048W		Upper half	1,480	1,900	1,690[QC:e]
S96T003879W	Core composite	Whole	2,624	2,890	2,757
S96T003885W		Whole	2,785	2,600	2,692.5[QC:d]
Liquids			µg/mL	µg/mL	µg/mL
S96T003063	147: 1	Drainable liquid	4,942	5,050	4,996
S96T003064	147: 2	Drainable liquid	5,770	5,860	5,815
S96T002860	148: 1	Drainable liquid	5,255	5,020	5,137.5
S96T003051	148: 2	Drainable liquid	5,896	5,920	5,908

Table B6-61. Tank 241-U-106 Analytical Results: Fluoride (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T003093W	147: 2	Upper half	< 53.62	< 53.4	< 53.51
S96T003095W	147: 3	Lower half	< 53.44	< 53.4	< 53.42
S96T003094W		Upper half	< 53.02	< 54.4	< 53.71
S96T003097W	147: 4	Lower half	4,689	4,650	4,669.5
S96T003096W		Upper half	< 53.55	< 53.8	< 53.675[QC:d]
S96T003099W	147: 5	Lower half	3,466	3,200	3,333
S96T003098W		Upper half	6,096	6,120	6,108
S96T003043W	148: 2	Lower half	< 53.75	< 54.3	< 54.025
S96T003028W		Upper half	< 54.58	< 54.3	< 54.44
S96T003045W	148: 3	Lower half	< 54.17	< 54.5	< 54.335
S96T003044W		Upper half	< 53.74	< 53.4	< 53.57[QC:d]
S96T003047W	148: 4	Lower half	< 55.17	< 54.1	< 54.635
S96T003046W		Upper half	< 54.36	< 53.8	< 54.08[QC:d]
S96T003049W	148: 5	Lower half	946.5	735	840.75[QC:e]
S96T003048W		Upper half	1,102	1,460	1,281[QC:e]
S96T003879W	Core composite	Whole	4,901	5,290	5,095.5
S96T003885W		Whole	1,061	1,650	1,355.5[QC:e]
Liquids			µg/mL	µg/mL	µg/mL
S96T003063	147: 1	Drainable liquid	< 66.96	< 67	< 66.98
S96T003064	147: 2	Drainable liquid	< 132.6	< 133	< 132.8
S96T002860	148: 1	Drainable liquid	< 53.83	< 53.8	< 53.815
S96T003051	148: 2	Drainable liquid	< 53.83	< 53.8	< 53.815

Table B6-62. Tank 241-U-106 Analytical Results: Nitrate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T003093W	147: 2	Upper half	1.532E+05	1.530E+05	1.531E+05
S96T003095W	147: 3	Lower half	1.440E+05	1.490E+05	1.465E+05
S96T003094W		Upper half	1.512E+05	1.490E+05	1.501E+05
S96T003097W	147: 4	Lower half	1.459E+05	1.410E+05	1.435E+05
S96T003096W		Upper half	1.677E+05	1.500E+05	1.589E+05
S96T003099W	147: 5	Lower half	4.671E+05	4.680E+05	4.676E+05[QC:c]
S96T003098W		Upper half	2.936E+05	3.050E+05	2.993E+05
S96T003043W	148: 2	Lower half	1.474E+05	1.490E+05	1.482E+05
S96T003028W		Upper half	1.414E+05	1.360E+05	1.387E+05
S96T003045W	148: 3	Lower half	1.396E+05	1.480E+05	1.438E+05
S96T003044W		Upper half	1.453E+05	1.450E+05	1.452E+05[QC:c]
S96T003047W	148: 4	Lower half	1.473E+05	1.520E+05	1.496E+05
S96T003046W		Upper half	1.399E+05	1.360E+05	1.379E+05
S96T003049W	148: 5	Lower half	4.693E+05	3.970E+05	4.332E+05
S96T003048W		Upper half	3.681E+05	4.380E+05	4.030E+05
S96T003879W	Core composite	Whole	1.843E+05	2.120E+05	1.982E+05
S96T003885W		Whole	2.263E+05	2.230E+05	2.247E+05[QC:c]
Liquids			µg/mL	µg/mL	µg/mL
S96T003063	147: 1	Drainable liquid	2.328E+05	2.350E+05	2.339E+05
S96T003064	147: 2	Drainable liquid	2.623E+05	2.620E+05	2.622E+05
S96T002860	148: 1	Drainable liquid	2.356E+05	2.300E+05	2.328E+05
S96T003051	148: 2	Drainable liquid	2.660E+05	2.670E+05	2.665E+05

Table B6-63. Tank 241-U-106 Analytical Results: Nitrite (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			μg/g	μg/g	μg/g
S96T003093W	147: 2	Upper half	56,390	57,400	56,895
S96T003095W	147: 3	Lower half	57,470	57,300	57,385
S96T003094W		Upper half	59,070	56,800	57,935
S96T003097W	147: 4	Lower half	53,390	54,100	53,745
S96T003096W		Upper half	56,170	56,300	56,235
S96T003099W	147: 5	Lower half	19,490	17,900	18,695
S96T003098W		Upper half	28,420	29,600	29,010
S96T003043W	148: 2	Lower half	55,400	56,700	56,050
S96T003028W		Upper half	53,010	51,000	52,005
S96T003045W	148: 3	Lower half	57,850	53,900	55,875
S96T003044W		Upper half	56,940	56,100	56,520
S96T003047W	148: 4	Lower half	54,800	55,100	54,950
S96T003046W		Upper half	58,510	58,100	58,305
S96T003049W	148: 5	Lower half	15,220	12,600	13,910
S96T003048W		Upper half	24,520	30,200	27,360
S96T003879W	Core composite	Whole	49,380	54,200	51,790
S96T003885W		Whole	47,480	44,800	46,140
Liquids			μg/mL	μg/mL	μg/mL
S96T003063	147: 1	Drainable liquid	89,140	89,800	89,470
S96T003064	147: 2	Drainable liquid	98,990	97,700	98,345
S96T002860	148: 1	Drainable liquid	97,450	94,700	96,075
S96T003051	148: 2	Drainable liquid	1.113E+05	1.130E+05	1.121E+05

Table B6-64. Tank 241-U-106 Analytical Results: Phosphate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			μg/g	μg/g	μg/g
S96T003093W	147: 2	Upper half	5,084	3,020	4,052[QC:e]
S96T003095W	147: 3	Lower half	9,830	10,200	10,015
S96T003094W		Upper half	4,544	5,420	4,982
S96T003097W	147: 4	Lower half	5,512	5,690	5,601
S96T003096W		Upper half	6,072	6,330	6,201
S96T003099W	147: 5	Lower half	18,660	16,900	17,780
S96T003098W		Upper half	33,470	33,600	33,535
S96T003043W	148: 2	Lower half	4,576	4,100	4,338
S96T003028W		Upper half	3,548	3,520	3,534
S96T003045W	148: 3	Lower half	4,595	4,800	4,697.5
S96T003044W		Upper half	5,811	6,010	5,910.5
S96T003047W	148: 4	Lower half	7,106	8,330	7,718
S96T003046W		Upper half	7,157	7,720	7,438.5
S96T003049W	148: 5	Lower half	5,039	3,830	4,434.5[QC:e]
S96T003048W		Upper half	3,774	5,220	4,497[QC:e]
S96T003879W	Core composite	Whole	11,250	12,400	11,825
S96T003885W		Whole	6,547	7,130	6,838.5
Liquids			μg/mL	μg/mL	μg/mL
S96T003063	147: 1	Drainable liquid	2,985	2,920	2,952.5
S96T003064	147: 2	Drainable liquid	3,004	3,470	3,237
S96T002860	148: 1	Drainable liquid	5,134	3,340	4,237[QC:e]
S96T003051	148: 2	Drainable liquid	3,890	3,750	3,820

Table B6-65. Tank 241-U-106 Analytical Results: Sulfate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T003093W	147: 2	Upper half	9,077	8,650	8,863.5
S96T003095W	147: 3	Lower half	11,870	11,800	11,835
S96T003094W		Upper half	12,040	11,600	11,820
S96T003097W	147: 4	Lower half	10,730	10,900	10,815
S96T003096W		Upper half	11,940	11,700	11,820
S96T003099W	147: 5	Lower half	2,678	2,490	2,584
S96T003098W		Upper half	7,352	7,910	7,631
S96T003043W	148: 2	Lower half	10,850	10,800	10,825
S96T003028W		Upper half	6,186	6,040	6,113
S96T003045W	148: 3	Lower half	12,580	11,900	12,240
S96T003044W		Upper half	11,470	11,200	11,335
S96T003047W	148: 4	Lower half	12,670	12,500	12,585
S96T003046W		Upper half	10,020	10,000	10,010
S96T003049W	148: 5	Lower half	1,992	1,700	1,846
S96T003048W		Upper half	4,312	5,230	4,771
S96T003879W	Core composite	Whole	9,249	10,100	9,674.5
S96T003885W		Whole	9,751	9,250	9,500.5
Liquids			µg/mL	µg/mL	µg/mL
S96T003063	147: 1	Drainable liquid	6,796	6,760	6,778
S96T003064	147: 2	Drainable liquid	9,564	9,560	9,562
S96T002860	148: 1	Drainable liquid	7,646	7,070	7,358
S96T003051	148: 2	Drainable liquid	8,701	8,640	8,670.5

Table B6-66. Tank 241-U-106 Analytical Results: Oxalate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T003093W	147: 2	Upper half	9,605	9,080	9,342.5
S96T003095W	147: 3	Lower half	11,030	11,000	11,015
S96T003094W		Upper half	9,493	9,150	9,321.5
S96T003097W	147: 4	Lower half	10,510	10,700	10,605
S96T003096W		Upper half	10,560	10,500	10,530
S96T003099W	147: 5	Lower half	10,990	9,570	10,280
S96T003098W		Upper half	7,162	7,810	7,486
S96T003043W	148: 2	Lower half	9,127	9,180	9,153.5
S96T003028W		Upper half	7,252	6,970	7,111
S96T003045W	148: 3	Lower half	10,780	9,910	10,345
S96T003044W		Upper half	9,822	9,850	9,836
S96T003047W	148: 4	Lower half	10,510	10,500	10,505
S96T003046W		Upper half	10,700	10,600	10,650
S96T003049W	148: 5	Lower half	2,375	2,050	2,212.5
S96T003048W		Upper half	5,333	6,910	6,121.5[QC:e]
S96T003879W	Core composite	Whole	10,370	11,100	10,735
S96T003885W		Whole	9,295	8,060	8,677.5
Liquids			µg/mL	µg/mL	µg/mL
S96T003063	147: 1	Drainable liquid	< 540.9	< 541	< 540.95
S96T003064	147: 2	Drainable liquid	9,758	10,300	10,029
S96T002860	148: 1	Drainable liquid	1,208	667	937.5[QC:e]
S96T003051	148: 2	Drainable liquid	557.7	660	608.85

Table B6-67. Combustible Gas Monitoring of Tank 241-U-106.

Measurement	Method	Units	Observations	Range		Mean
				Minimum	Maximum	
LFL	SHMS	% of LFL	16	2.0	6.0	4.4
	CGM	% of LFL	3	0.0	6.0	3.3
TOC	CGM	ppm	3	37.0	77.9	61.4
Oxygen	CGM	Total volume %	3	20.7	21.0	20.9
Ammonia	CGM	ppm	3	> 700	> 700	> 700

B6.3 ASSESSMENT OF CHARACTERIZATION RESULTS

This section discusses the overall quality and consistency of the current sampling results for tank 241-U-106 and shows the results of the calculation of an analytical-based inventory.

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

B6.3.1 Field Observations

The sample recovery from the May 1996 core sampling of tank 241-U-106 was good. Sample material was retrieved in all segments. The first segment of each core was liquid. Because a supernatant layer rests on the top of the waste, the first segment was expected to be all liquid. The second segment was expected to be mostly solids with a small amount of supernatant. Solids and drainable liquids were recovered from segment 2 from both cores. Segments 3 through 5 were all solids and contained enough sample to be divided into half segments.

The recovery of the cores is adequate to meet the needs of the safety screening DQO (Dukelow et al. 1995), the organic DQO (Turner et al. 1995), and the historical DQO (Simpson and McCain 1996).

B6.3.2 Quality Control Assessment

The usual QC assessment includes an evaluation of the appropriate standard recoveries, spike recoveries, duplicate analyses, and blanks that are performed in conjunction with the chemical analyses. All pertinent QC tests were conducted on the 1995 auger samples, enabling a full assessment of the accuracy and precision of the data. Brown (1996) established the specific criteria for all analytes. Sample and duplicate pairs with one or more QC results outside the specified criteria were identified by footnotes in the data summary tables.

Only one analyte, silver, experienced low standard recoveries in the acid preparation. Both total beta measurements on the fusion preparation for the composite samples experienced high standard recoveries. Boron, silicon, and sodium experienced high standard recoveries in the acid preparation. Silicon experienced high standard recoveries in every sample. Silicon data should be considered suspect for acid preparation data.

The following analytes demonstrated spike recoveries below the QC limit for one or more preparation methods: aluminum, chloride, chromium, cyanide, iron, manganese, nitrate, phosphorus, potassium, silver, sodium, and sulfer. Among these analytes, only a small number of the total measurements had low spike recoveries. No particular sample (segment or composite) or preparation method experienced more consistently low spike recoveries than any other sample or preparation method.

The following analytes demonstrated spike recoveries above the QC limit for one or more preparation methods: aluminum, chloride, fluoride, iron, manganese, phosphorus, potassium, silicon, sodium, sulfer, TOC, and TIC. Except for silicon, only a small number of the total measurements had high spike recoveries. Over half of the silicon measurements exhibited high spike recoveries (for the acid preparation). No particular sample or preparation method experienced more consistently high spike recoveries than any other sample or preparation method.

The following analytes demonstrated RPDs in one or more preparation methods: aluminum, boron, cadmium, calcium, cerium, chromium, copper, iron, lead, manganese, neodymium, nickel, phosphorus, potassium, silicon, silver, sodium, sulfer, zinc, zirconium, chloride, fluoride, phosphate, oxalate, TOC, total alpha, total beta, americium-241, cesium-137, cobalt-60, europium-154, and europium-155. Most analytes experienced high RPDs for only a limited number of samples. Some samples consistently experienced higher RPDs than others. The lower half of segment 5 of core 148 experienced high RPDs for most analytes. This indicates a high degree of heterogeneity in this sample, probably caused by a different type of saltcake waste in the tank bottom. The core composites also experienced high RPDs for several analytes. This is probably indicates incomplete homogenization of the segment samples when the composite was being prepared. Finally, the drainable liquid samples exhibited high RPDs more often than would be expected. (Liquid samples should be more evenly mixed than the solid samples.)

Contamination of the blank sample was not observed for any analyte measured.

In summary, most QC results for primary analytes were within the boundaries specified by Brown (1996). With few exceptions, the discrepancies should not impact data validity or use. Silicon measurements from the acid preparation should be used with caution. The lower half of segment 5 of core 148 appears to be very heterogeneous. Finally, core composite data appears to show some heterogeneity, although not enough to discredit use of the composite data.

B6.3.3 Data Consistency Checks

Comparing different analytical methods can help to assess data consistency and quality. In addition, mass and charge balances were calculated to help assess the overall data consistency.

B6.3.3.1 Comparison of Results from Different Analytical Methods. The following data consistency checks compare the results from two analytical methods. A close agreement between the methods strengthens the credibility of both results, but poor agreement may cause data reliability questions. All analytical mean results are from the statistical results provided in Section B6.3.4.

The first data consistency check is to compare the ICP results for sulfer and phosphorus to the IC results for sulfate and phosphate. The average sulfate in the solids, measured by IC, is 9,590 μg/g. This compares to the estimated average solids sulfate (assuming all sulfer is sulfate), measured by ICP, of 9,790 μg/g. The average sulfate in the supernatant is 7,070 μg/mL by IC compared to the ICP sulfer equivalent result of 8,180 μg/mL. Although the supernatant results do not compare as well as the solid average results, they are still acceptable.

The average phosphate in the solids, measured by IC, is 9,330 μg/g compared to the ICP phosphorus equivalent result of 9,630 μg/g. The average phosphate result in the liquids, measured by IC, is 3,590 μg/mL compared to the ICP phosphorus equivalent result of 3,710 μg/mL. In the solid and supernatant phosphate results, the IC measurement is 97 percent of the ICP result. The close comparison of IC and ICP phosphorus indicates that phosphate in the tank is in a soluble form. This generally indicates saltcake waste rather than sludge.

Another data consistency check compares uranium by ICP to uranium by phosphorescence. The ICP acid preparation uranium is 687 μg/g, and the uranium analyzed by phosphorescence (fusion preparation) is 760 μg/g. Although phosphorescence is the recommended method for uranium analysis, the ICP value was close (10 percent difference).

B6.3.3.2 Mass and Charge Balances. The primary objective in performing mass and charge balances is to determine whether measurements are consistent. In calculating the balances, only cations and anions with a concentration greater than 1,000 μg/g in the solid phase of the waste were considered.

To perform mass and charge balances, the following assumptions were made about the chemical species in the tank.

- Aluminum: ICP analysis indicates approximately 65 percent of the aluminum was observed by the water preparation method compared to the total aluminum by the fusion method. Therefore, to perform a mass balance, it is assumed that aluminum is in the soluble form of the aluminate ion $[Al(OH)_4]^-$.

- Sodium and potassium: ICP analysis indicates more than 90 percent of sodium and potassium were recovered by the water preparation method. All sodium and potassium are assumed to be the soluble ionic form.

- Insoluble metals: Chromium, iron, and manganese were very insoluble. The assumed species for chromium, iron, and manganese are $[Cr(OH)_3]$, $[Fe_2(OH)_3]$, and $[Mn(OH)_3]$, respectively.

- Anions: Chloride, fluoride, nitrate, nitrite, oxalate, phosphate, and sulfate are assumed to be in their ionic form.

- Acetate: TOC is assumed to be in the form of acetate. Because some organic carbon was measured as oxalate, the acetate will be estimated by subtracting the carbon from oxalate from the TOC.

- Carbonate: All TIC is assumed to be in the form of carbonate.

The mass balance was calculated from the formula below. The conversion factor from μg/g to weight percent is 0.0001. Table B6-68 shows the results of the mass balance.

As shown in Table B6-68, the sum of all assumed chemical species is 105 percent.

Table B6-68. Mass and Charge Balances.

Analyte	Average Solids Concentration µg/g	Assumed Species	Weight% of Assumed Species	Charge[1] µeq/g
Water		Water	42.9	0
Sodium	190,000	Na^+	19.0	8,260
Potassium	1,360	K^+	0.14	35
Aluminum	11,600	$Al(OH)_4^-$	4.08	[429]
Chloride	2,720	Cl^-	0.27	[76]
Fluoride	3,230	F^-	0.32	[168]
Nitrate	211,000	NO_3^-	21.1	[3,403]
Nitrite	49,000	NO_3^-	4.9	[1,065]
Oxalate	9,710	$(COO)_2^{2-}$	0.97	[220]
Phosphate	9,330	PO_4^{3-}	0.93	[293]
Sulfate	9,590	SO_4^{2-}	0.96	[200]
TOC (acetate)[2]	18,300	$C_2H_3O_2^-$	4.49	[761]
TIC (carbonate)	8,000	CO_3^{2-}	4.0	[1,333]
Chromium	2,700	$Cr(OH)_3$	0.53	0
Iron	3,130	$Fe_2(OH)_3$	0.46	0
Manganese	1,180	$Mn(OH)_3$	0.23	0
Total mass balance (%)			105	n/a
Total positive charge			n/a	8,295
Total negative charge			n/a	7,948
Ratio (positive charge/negative charge)			n/a	1.04

Notes:

[1]Negative charge is indicated in square brackets [].

[2]Acetate was estimated using TOC minus the organic carbon in oxalate.

Mass balance = % water + 0.0001 X {Total Analyte Concentration}

= % water + 0.0001 X $\{Na^+ + K^+ + Al(OH)_4^- + Cl^- + F^- + NO_3^- + NO_2^- + (COO)_2^{2-} + PO_4^{3-} + SO_4^{2-} + C_2H_3O_2^- + CO_3^{2-} + Cr(OH)_3 + Fe_2(OH)_3 + Mn(OH)_3\}$

The charge balance was calculated from the following formulas.

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

Total anions (μeq/g) = $[Al(OH)_4^-]/95 + [Cl^-]/35.5 + [F^-]/19 + [NO_3^-]/62 + [NO_2^-]/46 + [(COO)_2^{2-}] X 2/88 + [PO_4^-] X 3/95 + [SO_4^-] X 2/96 + [C_2H_3O_2^-]/59 + [CO_3^-]/60$

The charge of each assumed chemical species is shown in Table B6-68. At the bottom of the table the charge is summed for all cations and anions. Finally, the ratio of positive charges to negative charges is calculated. The ideal ratio is 1.0. The ratio calculated based upon the assumed species was 1.04, close to the ideal ratio.

B6.3.4 Mean Concentrations and Confidence Intervals

B6.3.4.1 Composite, Solid Segment, and Supernatant Means. The following statistical evaluation was performed on the May 1996 core sample analytical data from tank 241-U-106. The evaluation is used to support the characterization best-basis inventory in Appendix D.

Two-sided 95 percent confidence intervals on the mean were computed. This was done with composite-level and segment-level data. With segment-level data, the supernatant and solid data were analyzed separately. Only the drainable liquid from segment 1 was used for computing supernatant statistics.

The lower limit (LL) to a two-sided 95 percent confidence interval for the mean is:

$$LL = \hat{\mu} - t_{(df,0.975)} \times \hat{\sigma}_{\hat{\mu}}$$

The upper limit (UL) to a two-sided 95 percent confidence interval for the mean is:

$$UL = \hat{\mu} + t_{(df,0.975)} \times \hat{\sigma}_{\hat{\mu}}$$

In these equations, $\hat{\mu}$ is the estimate of the mean concentration, $\hat{\sigma}_{\hat{\mu}}$ is the estimate of the standard deviation of the mean concentration, and $t_{(df,0.025)}$ is the quantile from Student's t distribution with *df* degrees of freedom for a two-sided 95 percent confidence interval.

The mean, $\hat{\mu}$, and the standard deviation, $\hat{\sigma}_{\hat{\mu}}$, were estimated using restricted maximum likelihood estimation (REML) methods. The degrees of freedom (*df*), for tank 241-U-106, is the number of risers sampled minus one. In this case df = 1 and t(1,0.25) = 12.706.

Table B6-69 gives the UL and LL to the 95 percent confidence intervals on the mean for composite data. Table B6-70 gives the UL and LL to the 95 percent confidence intervals on the mean for solid segment data. Table B6-71 gives the UL and LL to the 95 percent confidence intervals on the mean for supernatant segment data. Some analytes had a computed LL less than 0. Because an inventory estimate less than 0 is not possible, the LL was recorded as 0 whenever the LL was negative. If more than 50 percent of the analytical results were "less-than-values" a confidence interval was not computed. The detection limit was used as the analytical value and provided 50 percent or less of the "less-than-value" results.

Table B6-69. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Composite Data. (6 sheets)

Analyte	Method	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	*df*	95% Lower Limit	95% Upper Limit
Aluminum	ICP:A	μg/g	11,600	217	1	8,810	14,300
Aluminum	ICP:F	μg/g	11,000	781	1	1,050	20,900
Aluminum	ICP:W	μg/g	7,440	305	1	3,570	11,300
Am-241[1]	GEA:F	μCi/g	< 1.77	n/a	n/a	n/a	n/a
Antimony[1]	ICP:A	μg/g	< 28.43	n/a	n/a	n/a	n/a
Antimony[1]	ICP:F	μg/g	< 1,162.5	n/a	n/a	n/a	n/a
Antimony[1]	ICP:W	μg/g	< 23.7	n/a	n/a	n/a	n/a
Arsenic[1]	ICP:A	μg/g	< 47.35	n/a	n/a	n/a	n/a
Arsenic[1]	ICP:F	μg/g	< 1,932.5	n/a	n/a	n/a	n/a
Arsenic[1]	ICP:W	μg/g	< 39.5	n/a	n/a	n/a	n/a
Barium[1]	ICP:A	μg/g	< 23.7	n/a	n/a	n/a	n/a
Barium[1]	ICP:F	μg/g	< 96.7	n/a	n/a	n/a	n/a
Barium[1]	ICP:W	μg/g	< 19.75	n/a	n/a	n/a	n/a
Beryllium[1]	ICP:A	μg/g	< 2.37	n/a	n/a	n/a	n/a
Beryllium[1]	ICP:F	μg/g	< 96.7	n/a	n/a	n/a	n/a
Beryllium[1]	ICP:W	μg/g	< 1.98	n/a	n/a	n/a	n/a
Bismuth[1]	ICP:A	μg/g	< 47.35	n/a	n/a	n/a	n/a
Bismuth[1]	ICP:F	μg/g	< 1,932.5	n/a	n/a	n/a	n/a

Table B6-69. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Composite Data. (6 sheets)

Analyte	Method	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	95% Lower Limit	95% Upper Limit
Bismuth[1]	ICP:W	µg/g	< 39.5	n/a	n/a	n/a	n/a
Boron	ICP:A	µg/g	64.5	5.47	1	0	134
Boron[1]	ICP:F	µg/g	< 967	n/a	n/a	n/a	n/a
Boron	ICP:W	µg/g	540	40.9	1	19.6	1,060
Bromide[2]	IC:W	µg/g	910	397	1	0	5,960
Cadmium	ICP:A	µg/g	51.3	0.945	1	39.3	63.3
Cadmium[1]	ICP:F	µg/g	< 96.7	n/a	n/a	n/a	n/a
Cadmium	ICP:W	µg/g	47.1	0.988	1	34.6	59.7
Calcium	ICP:A	µg/g	378	24	1	73.2	683
Calcium[1]	ICP:F	µg/g	< 1,932.5	n/a	n/a	n/a	n/a
Calcium	ICP:W	µg/g	291	27.5	1	0	640
Cerium	ICP:A	µg/g	68.8	5.4	1	0.162	137
Cerium[1]	ICP:F	µg/g	< 1,932.5	n/a	n/a	n/a	n/a
Cerium[1]	ICP:W	µg/g	< 39.5	n/a	n/a	n/a	n/a
Cs-137	GEA:F	µCi/g	157	13.3	1	0	326
Chloride	IC:W	µg/g	2,720	68.7	1	1,850	3,600
Chromium	ICP:A	µg/g	2,700	85.2	1	1,620	3,780
Chromium	ICP:F	µg/g	2,470	250	1	0	5,640
Chromium	ICP:W	µg/g	224	8.5	1	116	332
Cobalt[1]	ICP:A	µg/g	< 9.47	n/a	n/a	n/a	n/a
Cobalt[1]	ICP:F	µg/g	< 387	n/a	n/a	n/a	n/a
Cobalt[1]	ICP:W	µg/g	< 7.90	n/a	n/a	n/a	n/a
Co-60[2]	GEA:F	µCi/g	0.14	0.009	1	0.027	0.255
Copper	ICP:A	µg/g	20.1	1.62	1	0	40.6
Copper[1]	ICP:F	µg/g	< 193.25	n/a	n/a	n/a	n/a
Copper	ICP:W	µg/g	17.9	0.38	1	13.2	22.7

Table B6-69. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Composite Data. (6 sheets)

Analyte	Method	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	95% Lower Limit	95% Upper Limit
Eu-154	GEA:F	µCi/g	1.26	0.09	1	0.17	2.34
Eu-155[1]	GEA:F	µCi/g	< 0.90	n/a	n/a	n/a	n/a
Fluoride	IC:W	µg/g	3,230	1,870	1	0	27,000
Gross alpha	Alpha:F	µCi/g	1.2	0.14	1	0	2.95
Gross beta	Alpha:F	µCi/g	329	34.2	1	0	764
Iron	ICP:A	µg/g	3,130	331	1	0	7,330
Iron	ICP:F	µg/g	2,620	660	1	0	11,000
Iron	ICP:W	µg/g	133	21	1	0	400
Lanthanum	ICP:A	µg/g	37.7	1.68	1	16.3	59.1
Lanthanum[1]	ICP:F	µg/g	< 967	n/a	n/a	n/a	n/a
Lanthanum[1]	ICP:W	µg/g	< 19.75	n/a	n/a	n/a	n/a
Lead	ICP:A	µg/g	320	18.8	1	81.1	560
Lead[1]	ICP:F	µg/g	< 1,932.5	n/a	n/a	n/a	n/a
Lead	ICP:W	µg/g	162	10	1	34.9	289
Lithium[1]	ICP:A	µg/g	< 4.735	n/a	n/a	n/a	n/a
Lithium[1]	ICP:F	µg/g	< 193.25	n/a	n/a	n/a	n/a
Lithium[1]	ICP:W	µg/g	< 3.95	n/a	n/a	n/a	n/a
Magnesium[1]	ICP:A	µg/g	< 47.35	n/a	n/a	n/a	n/a
Magnesium[1]	ICP:F	µg/g	< 1,932.5	n/a	n/a	n/a	n/a
Magnesium[1]	ICP:W	µg/g	< 39.5	n/a	n/a	n/a	n/a
Manganese	ICP:A	µg/g	1,180	178	1	0	3,440
Manganese	ICP:F	µg/g	1,110	354	1	0	5,600
Manganese	ICP:W	µg/g	76.5	11.6	1	0	224
Molybdenum	ICP:A	µg/g	32.6	0.66	1	24.1	41
Molybdenum[1]	ICP:F	µg/g	< 967	n/a	n/a	n/a	n/a
Molybdenum	ICP:W	µg/g	32.4	0.90	1	21	43.8

Table B6-69. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Composite Data. (6 sheets)

Analyte	Method	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	*df*	95% Lower Limit	95% Upper Limit
Neodymium	ICP:A	μg/g	107	4.44	1	50.3	163
Neodymium[1]	ICP:F	μg/g	< 1,932.5	n/a	n/a	n/a	n/a
Neodymium[1]	ICP:W	μg/g	< 39.5	n/a	n/a	n/a	n/a
Nickel	ICP:A	μg/g	279	5.79	1	206	353
Nickel	ICP:F	μg/g	1,110	130	1	0	2,760
Nickel	ICP:W	μg/g	260	7.44	1	166	355
Nitrate	IC:W	μg/g	21,1000	13,300	1	43,000	380,000
Nitrite	IC:W	μg/g	49,000	2,830	1	13,100	84,900
Oxalate	IC:W	μg/g	9,710	1,030	1	0	22,800
Phosphate	IC:W	μg/g	9,330	2,490	1	0	41,000
Phosphorus	ICP:A	μg/g	3,140	455	1	0	8,910
Phosphorus[2]	ICP:F	μg/g	4,080	280	1	517	7,630
Phosphorus	ICP:W	μg/g	3,300	980	1	0	15,800
Potassium	ICP:A	μg/g	1,360	36.8	1	890	1,830
Potassium	ICP:W	μg/g	1,260	42.5	1	717	1,800
Samarium[1]	ICP:A	μg/g	< 47.35	n/a	n/a	n/a	n/a
Samarium[1]	ICP:F	μg/g	< 1,932.5	n/a	n/a	n/a	n/a
Samarium[1]	ICP:W	μg/g	< 39.5	n/a	n/a	n/a	n/a
Selenium[1]	ICP:A	μg/g	< 47.35	n/a	n/a	n/a	n/a
Selenium[1]	ICP:F	μg/g	< 1,932.5	n/a	n/a	n/a	n/a
Selenium[1]	ICP:W	μg/g	< 39.5	n/a	n/a	n/a	n/a
Silicon	ICP:A	μg/g	174	32.9	1	0	592
Silicon[1]	ICP:F	μg/g	< 967	n/a	n/a	n/a	n/a
Silicon	ICP:W	μg/g	170	15.3	1	0	364
Silver	ICP:A	μg/g	24.8	4.45	1	0	81.3

Table B6-69. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Composite Data. (6 sheets)

Analyte	Method	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	*df*	95% Lower Limit	95% Upper Limit
Silver[1]	ICP:F	μg/g	< 193.25	n/a	n/a	n/a	n/a
Silver	ICP:W	μg/g	14.3	0.3	1	10.5	18.1
Sodium	ICP:A	μg/g	173,000	3,000	1	134,000	211,000
Sodium	ICP:F	μg/g	190,000	14,700	1	3,190	377,000
Sodium	ICP:W	μg/g	181,000	2,750	1	146,000	216,000
Strontium[1]	ICP:A	μg/g	< 4.74	n/a	n/a	n/a	n/a
Strontium[1]	ICP:F	μg/g	< 193.25	n/a	n/a	n/a	n/a
Strontium[1]	ICP:W	μg/g	< 3.95	n/a	n/a	n/a	n/a
Sr-89/90	Sr:F	μCi/g	77.2	12.2	1	0	232
Sulfate	IC:W	μg/g	9,590	208	1	6,950	12,200
Sulfur	ICP:A	μg/g	3,270	93.2	1	2,090	4,460
Sulfur	ICP:F	μg/g	3,100	338	1	0	7,390
Sulfur	ICP:W	μg/g	3,330	105	1	1,990	4,660
Thallium[1]	ICP:A	μg/g	< 94.73	n/a	n/a	n/a	n/a
Thallium[1]	ICP:F	μg/g	< 3,870	n/a	n/a	n/a	n/a
Thallium[1]	ICP:W	μg/g	< 79.03	n/a	n/a	n/a	n/a
Titanium[1]	ICP:A	μg/g	< 4.74	n/a	n/a	n/a	n/a
Titanium[1]	ICP:F	μg/g	< 193.25	n/a	n/a	n/a	n/a
Titanium[1]	ICP:W	μg/g	< 3.95	n/a	n/a	n/a	n/a
TIC	TIC/TOC	μg/g	8,000	3,350	1	0	50,600
TOC #	TIC/TOC	μg/g	20,900	1,420	1	2,820	39,000
Uranium	ICP:A	μg/g	687	32.3	1	277	1,100
Uranium[1]	ICP:F	μg/g	< 9,670	n/a	n/a	n/a	n/a
Uranium[1]	ICP:W	μg/g	< 197.5	n/a	n/a	n/a	n/a
Uranium	U:F	μg/g	760	127	1	0	2,380
Vanadium[1]	ICP:A	μg/g	< 23.7	n/a	n/a	n/a	n/a

Table B6-69. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Composite Data. (6 sheets)

Analyte	Method	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	*df*	95% Lower Limit	95% Upper Limit
Vanadium[1]	ICP:F	μg/g	< 967	n/a	n/a	n/a	n/a
Vanadium[1]	ICP:W	μg/g	< 19.75	n/a	n/a	n/a	n/a
Zinc	ICP:A	μg/g	40.2	2.35	1	10.3	70.1
Zinc[1]	ICP:F	μg/g	< 193.25	n/a	n/a	n/a	n/a
Zinc	ICP:W	μg/g	8.91	0.11	1	7.51	10.3
Zirconium	ICP:A	μg/g	102	16.3	1	0	309
Zirconium[1]	ICP:F	μg/g	< 193.25	n/a	n/a	n/a	n/a
Zirconium[2]	ICP:W	μg/g	5.34	1.33	1	0	22.2
Percent water	DSC/TGA	%	42.90	1.60	1	22.60	63.20
DSC*	DSC	J/g	548.40	19.39	1	301.97	794.83

Notes:

= wet basis
* = dry basis

[1]More than 50 percent of the analytical results were less than values; therefore, confidence intervals were not computed.

[2]Some "less-than" values are in the analytical results.

Table B6-70. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Solid Segment Data. (4 sheets)

Analyte	Method	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	Lower Limit	Upper Limit
Am-241[1]	GEA:F	μCi/g	< 1.75	n/a	n/a	n/a	n/a
Cs-137	GEA:F	μCi/g	149	16.40	1	0	358
Co-60[2]	GEA:F	μCi/g	0.15	0.02	1	0	0.35
Eu-154	GEA:F	μCi/g	1.26	0.16	1	0	3.23
Eu-155[1]	GEA:F	μCi/g	< 0.97	n/a	n/a	n/a	n/a
Gross alpha	Alpha:F	μCi/g	1.13	0.21	1	0	3.85
Aluminum	ICP:F	μg/g	13,100	2,310	1	0	42,500
Aluminum	ICP:A	μg/g	11,800	1,770	1	0	34,300
Antimony[1]	ICP:F	μg/g	< 1,206	n/a	n/a	n/a	n/a
Antimony[1]	ICP:A	μg/g	< 25.60	n/a	n/a	n/a	n/a
Arsenic[1]	ICP:F	μg/g	< 2,010	n/a	n/a	n/a	n/a
Arsenic[1]	ICP:A	μg/g	< 42.67	n/a	n/a	n/a	n/a
Barium[1]	ICP:A	μg/g	< 21.65	n/a	n/a	n/a	n/a
Barium[1]	ICP:F	μg/g	< 1,005.13	n/a	n/a	n/a	n/a
Beryllium[1]	ICP:F	μg/g	< 100.51	n/a	n/a	n/a	n/a
Beryllium[1]	ICP:A	μg/g	< 2.13	n/a	n/a	n/a	n/a
Bismuth[1]	ICP:A	μg/g	< 42.67	n/a	n/a	n/a	n/a
Bismuth[1]	ICP:F	μg/g	< 2,010	n/a	n/a	n/a	n/a
Boron[1]	ICP:F	μg/g	< 1,005.13	n/a	n/a	n/a	n/a
Boron	ICP:A	μg/g	72.30	7.34	1	0	166
Bromide[1]	IC:W	μg/g	< 854.39	n/a	n/a	n/a	n/a
Cadmium[1]	ICP:F	μg/g	< 100.72	n/a	n/a	n/a	n/a
Cadmium	ICP:A	μg/g	49.40	5.15	1	0	115
Calcium	ICP:A	μg/g	320	33.90	1	0	750
Calcium[1]	ICP:F	μg/g	< 2,010	n/a	n/a	n/a	n/a
Cerium[1]	ICP:F	μg/g	< 2,010	n/a	n/a	n/a	n/a

Table B6-70. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Solid Segment Data. (4 sheets)

Analyte	Method	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	*df*	Lower Limit	Upper Limit
Cerium[2]	ICP:A	μg/g	73.40	5.55	1	2.87	144
Chloride	IC:W	μg/g	2,510	261	1	0	5,840
Chromium	ICP:F	μg/g	2,640	348	1	0	7,060
Chromium	ICP:A	μg/g	2,710	324	1	0	6,820
Cobalt[1]	ICP:A	μg/g	< 8.53	n/a	n/a	n/a	n/a
Cobalt[1]	ICP:F	μg/g	< 401.97	n/a	n/a	n/a	n/a
Copper[1]	ICP:F	μg/g	< 201	n/a	n/a	n/a	n/a
Copper	ICP:A	μg/g	17.50	1.70	1	0	39.10
Cyanide[2]	Spec (CN)	μg/g	23.60	3.80	1	0	71.90
Fluoride[1]	IC:W	μg/g	< 1,118.11	n/a	n/a	n/a	n/a
Iron[2]	ICP:F	μg/g	2,930	627	1	0	10,900
Iron	ICP:A	μg/g	3,170	490	1	0	9,390
Lanthanum[1]	ICP:F	μg/g	< 1,005.13	n/a	n/a	n/a	n/a
Lanthanum[2]	ICP:A	μg/g	38.50	3.10	1	0	77.80
Lead[1]	ICP:F	μg/g	< 2,010	n/a	n/a	n/a	n/a
Lead	ICP:A	μg/g	325	27.30	1	0	672
Lithium[1]	ICP:F	μg/g	< 201	n/a	n/a	n/a	n/a
Lithium[1]	ICP:A	μg/g	< 4.27	n/a	n/a	n/a	n/a
Magnesium[1]	ICP:A	μg/g	< 43.17	n/a	n/a	n/a	n/a
Magnesium[1]	ICP:F	μg/g	< 2,010	n/a	n/a	n/a	n/a
Manganese	ICP:F	μg/g	1,090	162	1	0	3,150
Manganese	ICP:A	μg/g	1,230	332	1	0	5,450
Molybdenum[1]	ICP:F	μg/g	< 1,005.13	n/a	n/a	n/a	n/a
Molybdenum[2]	ICP:A	μg/g	33	2.59	1	0.14	65.90
Neodymium[1]	ICP:F	μg/g	< 2,010	n/a	n/a	n/a	n/a

Table B6-70. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Solid Segment Data. (4 sheets)

Analyte	Method	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	*df*	Lower Limit	Upper Limit
Neodymium[2]	ICP:A	μg/g	109	10.60	1	0	244
Nickel	ICP:A	μg/g	266	25.50	1	0	590
Nickel	ICP:F	μg/g	3,110	811	1	0	13,400
Nitrate	IC:W	μg/g	211,000	41,900	1	0	743,000
Nitrite	IC:W	μg/g	47,600	5,580	1	0	118,000
Oxalate	IC:W	μg/g	8,980	770	1	0	18,800
Phosphate	IC:W	μg/g	8,140	2,870	1	0	44,600
Phosphorus	ICP:A	μg/g	3,020	973	1	0	15,400
Phosphorus[1]	ICP:F	μg/g	< 4,811	n/a	n/a	n/a	n/a
Potassium	ICP:A	μg/g	1,150	113	1	0	2,580
Samarium[1]	ICP:A	μg/g	< 42.67	n/a	n/a	n/a	n/a
Samarium[1]	ICP:F	μg/g	< 2,010	n/a	n/a	n/a	n/a
Selenium[1]	ICP:F	μg/g	< 2,010	n/a	n/a	n/a	n/a
Selenium[1]	ICP:A	μg/g	< 42.67	n/a	n/a	n/a	n/a
Silicon[1]	ICP:F	μg/g	< 1,078.17	n/a	n/a	n/a	n/a
Silicon	ICP:A	μg/g	261	80.50	1	0	1,280
Silver[1]	ICP:F	μg/g	< 201	n/a	n/a	n/a	n/a
Silver	ICP:A	μg/g	25.60	8.24	1	0	130
Sodium	ICP:F	μg/g	195,000	15,700	1	0	394,000
Sodium	ICP:A	μg/g	180,000	6,670	1	94800	264,000
Strontium[1]	ICP:A	μg/g	< 4.29	n/a	n/a	n/a	n/a
Strontium[1]	ICP:F	μg/g	< 201	n/a	n/a	n/a	n/a
Sulfate	IC:W	μg/g	9,000	1,180	1	0	24,000
Sulfur[2]	ICP:F	μg/g	3,370	410	1	0	8,580
Sulfur	ICP:A	μg/g	3,230	437	1	0	8,790
Thallium[1]	ICP:A	μg/g	< 85.34	n/a	n/a	n/a	n/a

Table B6-70. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Solid Segment Data. (4 sheets)

Analyte	Method	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	*df*	Lower Limit	Upper Limit
Thallium[1]	ICP:F	μg/g	< 4,019.67	n/a	n/a	n/a	n/a
Titanium[1]	ICP:F	μg/g	< 201	n/a	n/a	n/a	n/a
Titanium[1]	ICP:A	μg/g	< 5.10	n/a	n/a	n/a	n/a
TIC	TIC/TOC	μg/g	11,100	1,610	1	0	31,600
TOC #	TIC/TOC	μg/g	21,400	2,130	1	0	48,500
Uranium[1]	ICP:F	μg/g	< 10,051.33	n/a	n/a	n/a	n/a
Uranium[2]	ICP:A	μg/g	702	69.60	1	0	1,590
Vanadium[1]	ICP:F	μg/g	< 1,005.13	n/a	n/a	n/a	n/a
Vanadium[1]	ICP:A	μg/g	< 21.34	n/a	n/a	n/a	n/a
Zinc[2]	ICP:F	μg/g	646	194	1	0	3,110
Zinc	ICP:A	μg/g	49.50	6.81	1	0	136
Zirconium[1]	ICP:F	μg/g	< 205.33	n/a	n/a	n/a	n/a
Zirconium	ICP:A	μg/g	119	33.20	1	0	540
Specific gravity	Specific gravity	unitless	1.34	0.01	1	1.27	1.41
Percent water	DSC/TGA	%	39.90	2.75	1	4.92	74.88
DSC *	DSC	J/g	649.76	65.73	1	0	1,484.98

Notes:

= wet basis
* = dry basis

[1]More than 50 percent of the analytical results were less than values; therefore, confidence intervals were not computed.

[2]Some "less-than" values are in the analytical results.

Table B6-71. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Supernatant Segment Data. (3 sheets)

Analyte	Method	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	95% Lower Limit	95% Upper Lower
Aluminum	ICP	μg/mL	11,300	272	1	7,820	14,700
Antimony[1]	ICP	μg/mL	< 60.1	n/a	n/a	n/a	n/a
Arsenic[1]	ICP	μg/mL	< 100	n/a	n/a	n/a	n/a
Barium[1]	ICP	μg/mL	< 50.1	n/a	n/a	n/a	n/a
Beryllium[1]	ICP	μg/mL	< 5	n/a	n/a	n/a	n/a
Bismuth[1]	ICP	μg/mL	< 100	n/a	n/a	n/a	n/a
Boron[1]	ICP	μg/mL	< 50.6	n/a	n/a	n/a	n/a
Bromide[2]	IC	μg/mL	1,030	466	1	0	6,960
Cadmium	ICP	μg/mL	86.5	2.29	1	57.4	116
Calcium	ICP	μg/mL	361	7.4	1	267	455
Cerium[1]	ICP	μg/mL	< 100	n/a	n/a	n/a	n/a
Chloride	IC	μg/mL	5,070	70.8	1	4,170	5,970
Chromium	ICP	μg/mL	393	9.44	1	273	513
Cobalt[1]	ICP	μg/mL	< 20	n/a	n/a	n/a	n/a
Copper	ICP	μg/mL	29.6	0.5	1	23.3	36
Fluoride[1]	IC	μg/mL	< 60.4	n/a	n/a	n/a	n/a
Gross alpha	Alpha radiation	μCi/mL	0.32	0.04	1	0	0.82
Iron[1]	ICP	μg/mL	< 50.1	n/a	n/a	n/a	n/a
Lanthanum[1]	ICP	μg/mL	< 50.1	n/a	n/a	n/a	n/a
Lead	ICP	μg/mL	184	5.85	1	110	258
Lithium[1]	ICP	μg/mL	< 10	n/a	n/a	n/a	n/a
Magnesium[1]	ICP	μg/mL	< 100	n/a	n/a	n/a	n/a
Manganese	ICP	μg/mL	17.9	2.4	1	0	48.3
Molybdenum	ICP	μg/mL	59.3	1.71	1	37.5	81.1
Neodymium[1]	ICP	μg/mL	< 100	n/a	n/a	n/a	n/a
Nickel	ICP	μg/mL	496	12.7	1	336	657

Table B6-71. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Supernatant Segment Data. (3 sheets)

Analyte	Method	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	95% Lower Limit	95% Upper Lower
Nitrate	IC	µg/mL	233,000	1,270	1	217,000	249,000
Nitrite	IC	µg/mL	92,800	3,300	1	50,800	135,000
Oxalate[2]	IC	µg/mL	739	198	1	0	3,260
Phosphate	IC	µg/mL	3,590	642	1	0	11,800
Phosphorus	ICP	µg/mL	1,210	39	1	717	1,710
Potassium	ICP	µg/mL	1,810	67.5	1	950	2,670
Samarium[1]	ICP	µg/mL	< 100	n/a	n/a	n/a	n/a
Selenium[2]	ICP	µg/mL	155	35	1	0	600
Silicon[1]	ICP	µg/mL	< 50.1	n/a	n/a	n/a	n/a
Silver[1]	ICP	µg/mL	< 10	n/a	n/a	n/a	n/a
Sodium	ICP	µg/mL	210,000	4,870	1	149,000	272,000
Specific gravity	Specific gravity	unitless	1.35	0.0103	1	1.21	1.48
Strontium[1]	ICP	µg/mL	< 10	n/a	n/a	n/a	n/a
Sulfate	IC	µg/mL	7,070	290	1	3,380	10,800
Sulfur	ICP	µg/mL	2,710	71.5	1	1,800	3,620
Thallium[1]	ICP	µg/mL	< 200	n/a	n/a	n/a	n/a
Titanium[1]	ICP	µg/mL	< 10	n/a	n/a	n/a	n/a
TIC	TIC/TOC	µg/mL	9,300	123	1	7,750	10,900
TOC #	Furnace Oxidation	µg/mL	44,100	3,750	1	0	91,700
TOC #	TIC/TOC	µg/mL	34,200	700	1	25,300	43,000
Uranium[1]	ICP	µg/mL	< 500	n/a	n/a	n/a	n/a
Vanadium[1]	ICP	µg/mL	< 50.1	n/a	n/a	n/a	n/a
Zinc	ICP	µg/mL	15.8	0.675	1	7.2	24.4

Table B6-71. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Supernatant Segment Data. (3 sheets)

Analyte	Method	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	95% Lower Limit	95% Upper Lower
Zirconium[1]	ICP	μg/mL	< 10	n/a	n/a	n/a	n/a
DSC*	DSC	J/g	905.73	60.53	1	136.69	1,674.76
TGA	TGA	%	49.30	0.49	1	43.13	55.46

Notes:

* = dry basis
\# = wet basis

[1]More than 50 percent of the analytical results were less than values; therefore, confidence intervals were not computed.

[2]Some "less-than" values are in the analytical results.

B6.3.4.2 Statistical Models. A statistical model is needed to account for the spatial and measurement variability in $\hat{\mu}$. This cannot be done using an ordinary standard deviation of the data (Snedecor and Cochran 1980).

The statistical model used to describe the structure of composite data and supernatant data is as follows:

$$Y_{ijk} = \mu + R_i + A_{ij},\ i=1,\ldots,a,\ j= 1,\ldots,n_i,$$

where

- Y_{ij} = laboratory results from the k^{th} duplicate from the i^{th} location in the tank
- μ = the grand mean
- R_i = the effect of the i^{th} riser
- A_{ij} = the effect of the j^{th} analytical result from the i^{th} location
- a = the number of risers
- n_i = the number of analytical results from the i^{th} location.

The variable R_i is assumed to be a random effect. This variable and A_{ij} are uncorrelated and normally distributed with means 0 and variances $\sigma^2(R)$ and $\sigma^2(A)$, respectively. Estimates of $\sigma^2(R)$ and $\sigma^2(A)$ were obtained using REML techniques. This method applied to variance component estimation is described in Harville (1977). The results using the REML techniques were obtained using the statistical analysis package S-PLUS[4] (Statistical Sciences, Inc. 1993).

The statistical model used to describe the structure of solid segment data is as follows:

$$Y_{ijkm} = \mu + R_i + S_{ij} + L_{ijk} + A_{ijkm},\ i=1,\ldots,a,\ j= 1,\ldots,b_i,\ k=1,\ldots,c_{ij},\ m=1,\ldots,n_{ijk}$$

where

Y_{ijkm}	=	laboratory results from the l^{th} duplicate from the k^{th} location from the j^{th} segment in the i^{th} riser in the tank
μ	=	the grand mean
R_i	=	the effect of the i^{th} riser
S_{ij}	=	the effect of the j^{th} segment from the i^{th} riser
S_{ijk}	=	the effect of the k^{th} location from j^{th} segment in the i^{th} riser
A_{ijkm}	=	the effect of the m^{th} analytical result from the k^{th} location in the j^{th} segment in the i^{th} riser
a	=	the number of risers
b_i	=	the number of segments in the i^{th} riser
c_{ij}	=	the number of locations from the j^{th} segment in the i^{th} riser
n_{ijk}	=	the number of analytical results from the k^{th} location from the j^{th} segment in the i^{th} riser

The variable R_i, S_{ij}, and, L_{ijk} are assumed to be random effects. These variable and A_{ij} are uncorrelated and normally distributed with means 0 and variances $\sigma^2(R)$, $\sigma^2(S)$, $\sigma^2(L)$, and $\sigma^2(A)$, respectively. Estimates of $\sigma^2(R)$, $\sigma^2(S)$, $\sigma^2(L)$, and $\sigma^2(A)$ were obtained using REML) techniques. This method applied to variance component estimation is described in *Maximum Likelihood Approaches to Variance Component Estimation and to Related Problems* (Harville 1977). The results using the REML techniques were obtained using the statistical analysis package S-PLUS®.

[4]S-PLUS is a registered trademark of Statistical Sciences, Seattle, Washington.

B6.3.4.3 Analytical Based Inventory Estimate. An inventory estimate of each analyte can be derived from analytical data. This analytical inventory of the tank contents is not the same as the best-basis inventory of the tank provided in Appendix D. The best-basis inventory uses the analytical inventory and information obtained from historical records and process flowsheets to estimate tank contents. The analytical based inventory discussed in this section is is an estimate based only on the May 8 to 10, 1996, core sample events. Only the method used to generate the analytical inventory is discussed in this section, not the inventory itself.

The tank volume used to generate an analytical based inventory is 855 kL (226 kgal) (Hanlon 1996). This volume is estimated from surface level measurements. The solids volume used to generate a solids inventory is 798 kL (211 kgal), and the supernatant volume is 57 kL (15 kgal) (Hanlon 1996). The density used to generate an analytical based inventory is 1.62 g/mL, the average of all segment level density measurements. This density agrees with the composite density measurement of 1.61 g/mL for both segments.

The tank solids inventory for each analyte may be estimated by multiplying the concentration of the analyte in the solids by the tank solids volume and the density. The tank supernatant inventory for each analyte may be estimated by multiplying the concentration of the analyte in the tank supernatant by the supernatant volume. The total tank inventory is estimated by adding the solids and supernatant inventory for each analyte.

The best estimate of the solids inventory is made by using the analytical results of the core composite samples that were created by combining solid material from segments 2 through 5. Composite samples provide better inventory estimates because they do not have the vertical variability component; therefore, there is less variability in the data. Drainable liquids from segments 1 or 2 are not included in the solids inventory estimates because the drainable liquids are probably tank supernatant. Acid digestion data is recommended for all cations except sodium (for which fusion data is recommended) and uranium (for which phosphorescence is the preferred method). Although fusion digestion often provides better results for aluminum, iron, and phosphorus, the acid digestion results for these analytes were generally higher with less variability than the fusion results. ICP results are preferred for estimating the phosphate and sulphate than IC results.

The best estimate of the supernatant inventory is made by using drainable liquid samples from segment 1. Segment 2 drainable liquid samples are not recommended for the supernatant inventory because it is uncertain whether they are liquids from the supernatant or interstitial liquids from the solids layer.

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APPENDIX C

STATISTICAL ANALYSIS FOR ISSUE RESOLUTION

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APPENDIX C

STATISTICAL ANALYSIS FOR ISSUE RESOLUTION

Appendix C discusses the analyses required for the applicable DQO reports for tank 241-U-106. The three analyses required for tank 241-U-106 are documented in the following sections:

- **Section C1**: Statistical analysis supporting the safety screening DQO (Dukelow et al. 1995). Specifically, confidence intervals were needed to support the energetics and plutonium (criticality) threshold limits.

- **Section C2**: Statistical analysis supporting the Organic DQO (Turner et al. 1995). Specifically, confidence intervals were needed to support the TOC and moisture threshold limits.

- **Section C3**: Gateway analysis supporting the historical model evaluation data requirements DQO (Simpson and McCain 1995).

C1.0 STATISTICS FOR SAFETY SCREENING DATA QUALITY OBJECTIVE

The safety screening DQO (Dukelow et al. 1995) defines acceptable decision confidence limits in terms of one-sided 95 percent confidence intervals. This appendix calculates one-sided confidence limits supporting the safety screening DQO for tank 241-U-106. All data considered are taken from the final laboratory data package for the 1996 core sampling event for tank 241-U-106 (Steen 1996).

Confidence intervals were computed for each sample number from tank 241-U-106 analytical data. Tables C1-1 and C1-2 provide the sample numbers and confidence intervals for DSC and total alpha, respectively.

The upper limit (UL) of a one-sided 95 percent confidence interval for the mean is

$$\hat{\mu} + t_{(n-1,0.05)} * \hat{\sigma}_{\hat{\mu}}.$$

In this equation, $\hat{\mu}$ is the arithmetic mean of the data, n is the number of observations, $\hat{\sigma}_{\hat{\mu}}$ is the estimate of the standard deviation of the mean, and $t_{(n-1,0.05)}$ is a quantile from Student's t distribution with $n-1$ degrees of freedom (df) for a one-sided 95 percent confidence interval. In this case, n is 2 and t(1,0.05) is 6.314.

Table C1-1. 95 Percent Confidence Interval Upper Limits for Total Alpha for Tank 241-U-106 (Units are g/L).

Sample Number	Sample Description	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	UL
S96T003063	Core 147, segment 1, drainable liquid	0.006	2.02E-04	0.037
S96T003064	Core 147, segment 2, drainable liquid	0.004	7.02E-04	0.009
S96T003083	Core 147, segment 3, lower half	0.027	8.41E-04	0.032
S96T003084	Core 147, segment 4, lower half	0.032	8.52E-04	0.037
S96T003085	Core 147, segment 5, lower half	0.018	0.002	0.031
S96T002860	Core 148, segment 1, drainable liquid	0.005	1.13E-04	0.005
S96T003051	Core 148, segment 2, drainable liquid	0.005	3.39E-04	0.007
S96T003029	Core 148, segment 2, lower half	0.030	2.55E-04	0.032
S96T003031	Core 148, segment 3, lower half	0.049	0.011	0.121
S96T003033	Core 148, segment 4, lower half	0.045	6.61E-04	0.049
S96T003035	Core 148, segment 5, lower half	0.006	2.02E-04	0.008

Table C1-2. 95 Percent Confidence Interval Upper Limits for Differential Scanning Calorimetry for Tank 241-U-106 (Units are J/g-Dry).

Sample Number	Sample Description	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	UL
S96T003063	Core 147, segment 1, drainable liquid	966.25	1.05	972.88
S96T003064	Core 147, segment 2, drainable liquid	806.45	13.75	893.26
S96T003065	Core 147, segment 2, upper half	673.45	15.15	769.10
S96T003066	Core 147, segment 3, upper half	581.60	2.70	598.65
S96T003070	Core 147, segment 3, lower half	560.10	35.20	782.34
S96T003067	Core 147, segment 4, upper half	699.45	3.45	721.23
S96T003068	Core 147, segment 4, lower half	586.70	32.30	790.63
S96T003069	Core 147, segment 5, upper half	592.15	19.85	717.48
S96T003071	Core 147, segment 5, lower half	936.05	87.95	1491.34
S96T002860	Core 148, segment 1, drainable liquid	845.20	30.60	1038.40
S96T003051	Core 148, segment 2, drainable liquid	850.75	0.45	853.59
S96T003010	Core 148, segment 2, upper half	793.05	7.95	843.24
S96T003011	Core 148, segment 2, lower half	791.70	20.20	919.24
S96T003012	Core 148, segment 3, upper half	769.30	17.50	879.79
S96T003013	Core 148, segment 3, lower half	877.40	38.80	1122.37
S96T003014	Core 148, segment 4, upper half	497.00	48.00	800.06
S96T003015	Core 148, segment 4, lower half	860.20	11.70	934.07
S96T003016	Core 148, segment 5, upper half	461.85	18.35	577.71
S96T003017	Core 148, segment 5, lower half	57.44	1.56	67.25

Table C1-1 lists the UL of the 95 percent confidence interval for each sample number based on total alpha data. Each confidence interval can be used to make the following statement: if the UL is less than 1 g/L, reject the null hypothesis that the total alpha is greater than or equal to 1 g/L at the 0.05 level of significance. Because total alpha was reported in units of μCi/g or μCi/mL, total alpha was converted to g/L by using the measured density for each sample and by assuming that all alpha was from ^{239}Pu.

Table C1-2 lists the UL of the 95 percent confidence interval for each sample number based on DSC data. Each confidence interval can be used to make the following statement: if the UL is less than 480 J/g, reject the null hypothesis that DSC is greater than or equal to 480 J/g at the 0.05 level of significance.

Confidence intervals were constructed for the overall tank mean for DSC and total alpha. For a description of the model used for these confidence intervals see Section B6.3.4.2. The confidence intervals for safety screening are one-sided confidence intervals, and the confidence intervals for mean concentration are two-sided confidence intervals. Table C1-3 provides the confidence intervals for the overall tank means for safety screening.

Table C1-3. 95 Percent Confidence Interval Upper Limits for Overall Tank Mean for Safety Screening.

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	UL
Total alpha	g/L	0.03	0.006	0.07
DSC[1]	J/g	649.76	65.73	1,064.80

Note:
[1]Dry basis

C2.0 STATISTICS FOR THE ORGANIC DATA QUALITY OBJECTIVE

The organic DQO (Turner et al. 1995) defines acceptable decision confidence limits in terms of one-sided 95 percent confidence intervals. This appendix calculates one-sided confidence limits supporting the organic DQO for tank 241-U-106. All data considered are taken from the final laboratory data package for the 1996 core sampling event for tank 241-U-106 (Steen 1996).

Confidence intervals were computed for each sample number from tank 241-U-106 analytical data. Tables C2-1 and C2-2 provide the sample numbers and confidence intervals for percent water and TOC, respectively.

For percent water, the lower limit (LL) of a one-sided 95 percent confidence interval for the mean is

$$\hat{\mu} - t_{(n-1,0.95)} * \hat{\sigma}_{\hat{\mu}}$$

and for TOC, the UL of a one-sided 95 percent confidence interval for the mean is

$$\hat{\mu} + t_{(n-1,0.95)} * \hat{\sigma}_{\hat{\mu}}.$$

For these equations, $\hat{\mu}$ is the arithmetic mean of the data, $\hat{\sigma}_{\hat{\mu}}$ is the estimate of the standard deviation of the mean, and $t_{(n-1,0.95)}$ is a quantile from Student's t distribution with *df* degrees of freedom for a one-sided confidence interval. In this case, n-1 = 1 and t)1,0.05) = 6.314.

Table C2-1 lists the LL of the 95 percent confidence interval for each sample number based on percent water data. Each confidence interval can be used to make the following statement: if the LL is greater than 17 percent, reject the null hypothesis that the percent water is less than or equal to 17 percent at the 0.05 level of significance.

Table C2-2 lists the UL of the 95 percent confidence interval for each sample number based on TOC data. Each confidence interval can be used to make the following statement: if the upper limit is less than 30,000 μg/g, reject the null hypothesis that TOC is greater than or equal to 30,000 μg/g at the 0.05 level of significance.

Table C2-1. 95 Percent Confidence Interval Lower Limits for Percent Water for Tank 241-U-106 (Units Are in Percents).

Sample Number	Sample Description	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	LL
S96T003063	Core 147, segment 1, drainable liquid	49.78	0.10	49.15
S96T003064	Core 147, segment 2, drainable liquid	47.90	0.31	45.97
S96T003065	Core 147, segment 2, upper half	41.74	0.89	36.12
S96T003066	Core 147, segment 3, upper half	40.75	1.38	32.06
S96T003070	Core 147, segment 3, lower half	40.28	0.15	39.33
S96T003067	Core 147, segment 4, upper half	45.30	1.09	38.42
S96T003068	Core 147, segment 4, lower half	41.87	0.10	41.27
S96T003069	Core 147, segment 5, upper half	33.79	0.01	33.73
S96T003071	Core 147, segment 5, lower half	44.57	1.70	33.84
S96T002860	Core 148, segment 1, drainable liquid	48.81	0.29	46.98
S96T003051	Core 148, segment 2, drainable liquid	47.90	0.22	46.54
S96T003010	Core 148, segment 2, upper half	42.07	1.74	31.11
S96T003011	Core 148, segment 2, lower half	42.20	0.01	42.16
S96T003012	Core 148, segment 3, upper half	44.28	0.51	41.09
S96T003013	Core 148, segment 3, lower half	47.28	0.36	45.03
S96T003014	Core 148, segment 4, upper half	45.14	1.37	36.49
S96T003015	Core 148, segment 4, lower half	44.48	0.60	40.69
S96T003016	Core 148, segment 5, upper half	26.85	1.65	16.46
S96T003017	Core 148, segment 5, lower half	16.60	0.24	15.11

Table C2-2. 95 Percent Confidence Interval Upper Limits for Total Organic Carbon for Tank 241-U-106 (Units Are in $\mu g/g$-Dry or $\mu g/mL$-Dry).

Sample Number	Sample Description	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	95% UL
S96T003063	Core 147, segment 1, drainable liquid	69395	299	71280
S96T003064	Core 147, segment 2, drainable liquid	64197	96	64803
S96T003065	Core 147, segment 2, upper half	45486	343	47653
S96T003066	Core 147, segment 3, upper half	44384	338	46515
S96T003070	Core 147, segment 3, lower half	25843	3451	35920
S96T003067	Core 147, segment 4, upper half	47166	183	48321
S96T003068	Core 147, segment 4, lower half	43175	1204	50778
S96T003069	Core 147, segment 5, upper half	23335	1284	31440
S96T003071	Core 147, segment 5, lower half	16318	622	20248
S96T002860	Core 148, segment 1, drainable liquid	65345	1660	75829
S96T003051	Core 148, segment 2, drainable liquid	64389	96	64995
S96T003010	Core 148, segment 2, upper half	40131	604	43945
S96T003011	Core 148, segment 2, lower half	43162	778	48077
S96T003012	Core 148, segment 3, upper half	45940	179	47073
S96T003013	Core 148, segment 3, lower half	48933	379	51328
S96T003014	Core 148, segment 4, upper half	46847	2187	60657
S96T003015	Core 148, segment 4, lower half	45479	450	48322
S96T003016	Core 148, segment 5, upper half	21256	1572	31181
S96T003017	Core 148, segment 5, lower half	10719	12	10794

Confidence intervals were constructed for the overall tank mean for percent water and TOC. For a description of the model used for these confidence intervals, see Section B6.3.4.2. The confidence intervals for the organic DQO are one-sided confidence intervals, and the confidence intervals for inventory are two-sided confidence intervals. Table C2-3 provides the confidence intervals for the overall tank means for the organic DQO.

Table C2-3. 95 Percent Confidence Interval Lower Limit (Percent Water) and Upper Limit (Total Organic Carbon) for the Overall Tank Mean for the Organic Data Quality Objective.

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	LL	UL
Percent water	%	39.90	2.75	22.52	n/a
TOC[1]	$\mu g/g$	36,970.43	4,449.82	n/a	65,066.60

Notes:

n/a = not applicable

[1]Dry basis

C3.0 GATEWAY ANALYSIS FOR HISTORICAL MODEL DATA QUALITY OBJECTIVE

The *Historical Model Evaluation Data Requirements* (Simpson and McCain 1996) requires that a gateway analysis be performed on the analytical data from tank 241-U-106. The purpose of the gateway analysis was to provide a quick screening check of the analytical data before a more thorough set of analyses were performed. If the gateway analysis fails, then the remainder of the analyses in the historical DQO would not be performed. The historical gateway analysis consists of two parts, described below. All data considered were taken from the final laboratory data package for the 1996 core sampling event for tank 241-U-106 (Steen 1996).

The first part of the gateway analysis determines whether a set group of analytes (indicator analytes) are within 10 percent of the value predicted by the historical model (Agnew et al. 1996). The gateway analysis was tested on each solid sample from both cores. The historical model predicted that the major waste type in tank 241-U-106 was SMMS1 (saltcake from the 242-S Evaporator). The indicator analytes for SMMS1 waste are aluminum, chromium, sodium, nitrate, sulfate, carbonate, and water. For a segment to pass the first part of the gateway analysis, each indicator analyte must be over 10 percent of the predicted value. Tables C3-1 and C3-2 summarize the results of the gateway analysis for core 147 and core 148, respectively. The first part of the gateway analysis passed for all segments.

The second part of the gateway analysis was performed on all segments that passed the first part of the gateway analysis and were performed on all solid samples from tank 241-U-106. The second part of the gateway analysis determined whether the indicator analytes account for 85 percent of the waste (by weight) for each segment. If the indicator analytes did not account for 85 percent of the segment by weight, the gateway failed for that segment. Tables C3-1 and C3-2 summarize the results of the second part of the gateway analysis.

Table C3-1. Results of Gateway Analysis for Samples from Core 147.

Gateway Analyte	Units	Historical Predicted Value	Location (Segment/Subsegment)						
			2	3	3	4	4	5	5
			Top	Bottom	Top	Bottom	Top	Bottom	Top
Aluminum	μg/g	31,000	12,000	11,500	10,900	12,100	11,700	6,090	7,550
Chromium	μg/g	3,000	3,400	3,080	2,950	3,110	3,060	1,230	1,690
Sodium	μg/g	195,400	101,000	185,000	264,000	218,000	217,000	271,000	236,000
Nitrate	μg/g	274,000	153,000	146,000	150,000	143,000	159,000	468,000	299,000
Sulfate	μg/g	13,000	8,860	11,800	11,800	10,800	11,800	2,580	7,630
Carbonate	μg/g	17,000	57,200	68,500	64,500	67,500	66,200	15,800	31,400
Water	wt%	32.1	41.7	40.3	40.7	41.9	45.3	44.6	33.8
Pass/Fail Part 1			Pass	Pass	Pass	Pass	Pass	Pass	Pass
Sum (%)			75	83	91	87	92	121	92
Pass/Fail Part 2			Fail	Fail	Pass	Pass	Pass	Pass	Pass

Table C3-2. Results of Gateway Analysis for Samples from Core 148.

Gateway Analyte	Units	Historical Predicted Value	Location (Segment/Subsegment)							
			2	2	3	3	4	4	5	5
			Bottom	Top	Bottom	Top	Bottom	Top	Bottom	Top
Aluminum	μg/g	31,000	11,200	31,900	10,900	10,800	12,600	14,800	4,930	7,020
Chromium	μg/g	3,000	2,920	3,400	3,000	3,170	3,110	3,680	673	1,440
Sodium	μg/g	195,000	172,000	162,000	182,000	174,000	186,000	179,000	226,000	216,000
Nitrate	μg/g	274,000	148,000	139,000	144,000	145,000	150,000	138000	433,000	403,000
Sulfate	μg/g	13,000	10,800	6,110	12,200	11,300	12,600	10,000	1,850	4,770
Carbonate	μg/g	17,000	74,200	74,500	73,200	73,700	69,500	62,500	10,100	22,900
Water	wt%	32.1	42.2	42.1	47.2	44.2	44.5	45.1	16.6	26.8
Pass/Fail Part 1			Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Sum (%)			84	84	90	86	88	86	84	92
Pass/Fail Part 2			Fail	Fail	Pass	Pass	Pass	Pass	Fail	Pass

Some samples from each core failed the gateway analysis. Segment 2 failed in both core samples. One subsample from segment 3 failed in core 147. Likewise, one subsample from segment 5 failed in core 148. Segment 4 in both cores most resembled the concentration of SMMS2 waste.

Further evaluations will be made for the historical DQO for the samples that passed the gateway analysis. Such evaluations will not be performed in this report but may be reported in a later revision.

C4.0 APPENDIX C REFERENCES

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-U-106

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-U-106

An effort is underway to provide waste inventory estimates that will serve as standard characterization source terms for the waste management activities (Hodgson and LeClair 1996). As part of this effort, an evaluation of information for tank 241-U-106 was performed, and a best-basis inventory was established. This work follows the methodology that was established by the standard inventory task.

D1.0 CHEMICAL INFORMATION SOURCES

Chemical waste information for tank 241-U-106 included:

- Data from two push mode cores samples collected in 1996
- Data from pre-1989 analyses used only for informational purposes
- The inventory estimate for this tank generated from the HDW (Agnew et al. 1996)
- The TCR data from other tanks that have the same saltcake waste types.

D2.0 COMPARISON OF COMPONENT INVENTORY VALUES

Tables D2-1 and D2-2 compare sample-based inventories derived from the analytical concentration data from the core samples and the HDW model inventories. Table D2-1 compares nonradioactive components on a kilogram basis, and Table D2-2 compares the radioactive components on a total curie basis. The sample-based inventory in Tables D2-1 and D2-2 were calculated according to the method outlined in Appendix B. A density of 1.62 g/mL was used for the analytical inventory. The HDW inventory estimate in Tables D2-1 and D2-2 was calculated by the method outlined in Agnew et al. (1996). Both the sample-based inventory estimate and the HDW inventory estimate assigned a supernatant layer of 57 kL (15 kgal). The sample-based estimate assumes the entire solids portion of the waste is saltcake, and the HDW estimate assumes the bottom 98 kL (26 kgal) of solid waste is metal waste (MW) and the top 700 kL (185 kgal) of the solid waste is saltcake. Both estimates assume a total waste volume of 855 kL (226 kgal).

Table D2-1. Sample-Based and Hanford Defined Waste-Based Inventory Estimates for Nonradioactive Components in Tank 241-U-106. (2 sheets)

Analyte	Sampling[1] Inventory Estimate (kg)	HDW[2] Inventory Estimate (kg)	Analyte	Sampling[1] Inventory Estimate (kg)	HDW[2] Inventory Estimate (kg)
Al	15,650	38,800	NH_4	n/r	830
Ag	23.7	n/r	Ni	390	345
As	< 67	n/r	NO_2	68,700	97,400
Ba	< 33.5	n/r	NO_3	2.86E+05	2.86E+05
Be	< 3.35	n/r	OH	n/r	1.28E+05
Bi	< 56.8	220	oxalate	12,700	3.37
Ca	510	1,570	Pb	425	184
Ce	94.7	n/r	Pd	n/r	n/r
Cd	71.3	n/r	P as PO_4	12,300	11,400
Cl	3,810	6,690	Pt	n/r	n/r
Co	< 13.4	n/r	Rh	n/r	n/r
Cr	3,520	n/r	Ru	n/r	n/r
Cr^{+3}	n/r	2,730	Sb	< 40.2	n/r
Cr^{+6}	n/r	n/r	Se	< 61.3	n/r
Cu	27.7	n/r	Si	228	2,110
F	4,180	1,130	S as SO_4	12,810	22,700
Fe	4,050	1,030	Sr	6.13	1.31
Hg	n/r	1.54	TIC as CO_3	54,400	37,200
K	1,860	1,990	TOC	28,980	14,300
La	51.6	6.22	U_{TOTAL}	1,010	49,300
Mg	66.9	n/r	V	33.5	n/r
Mn	1,520	205	Zn	52.9	n/r

Table D2-1. Sample-Based and Hanford Defined Waste-Based Inventory Estimates for Nonradioactive Components in Tank 241-U-106. (2 sheets)

Analyte	Sampling[1] Inventory Estimate (kg)	HDW[2] Inventory Estimate (kg)	Analyte	Sampling[1] Inventory Estimate (kg)	HDW[2] Inventory Estimate (kg)
Mo	45.5	n/r	Zr	133	64.1
Na	2.45E+05	2.57E+05	H_2O (wt%)	42.9	31.2
Nd	144	n/r	density (g/mL)	1.62	1.67

Notes:
[1]Appendix B
[2]Agnew et al. (1996)
[3]Fluoride is based on water soluble portion only.

Table D2-2. Sampling and Hanford Defined Waste Predicted Inventory Estimates for Radioactive Components in Tank 241-U-106 (Decayed to January 1, 1994).

Analyte	Sampling[1] Inventory Estimate (Ci)	HDW[2] Inventory Estimate (Ci)	Analyte	Sampling[1] Inventory Estimate (Ci)	HDW[2] Inventory Estimate (Ci)
^{90}Sr	1.06E+05	1.17E+05	^{241}Am	<2,290	n/r
^{137}Cs	2.15E+05	2.16E+05	Total α	1,570	n/r
^{154}Eu	1,990	n/r	Total β	4.3E+05	n/r
$^{239/240}Pu$	n/r	77.2			

Notes:
[1]Appendix B
[2]Agnew et al. (1996)

D3.0 COMPONENT INVENTORY EVALUATION

The following evaluation of tank contents identifies potential errors and/or missing information that could influence the sample-based and HDW model component inventories.

D3.1 CONTRIBUTING WASTE TYPES

Agnew et al. (1996) provided information about MW (98 kL [26 kgal]) and supernatant mixing model 242-S Evaporator period one waste (SMMS1) from 1974 to 1976. Hill et al. (1995) provided information about high-level REDOX waste, evaporator bottoms (same as SMMS1), B plant low-level waste, and PUREX low-level waste.

According to Rodenhizer (1987), tank 241-U-106 had been sluiced of MW waste and was empty by January 1957. If sludge is in the tank, it was deposited after that date, but the analytical results do not support the presence of a sludge layer. The composition based on Hill et al. (1995), assumes there is high-level REDOX sludge waste present, but recent sampling analytical data do not agree; therefore, the assumption of a sludge layer is not supported.

The other tank waste identified by Hill et al. (1995) includes evaporator bottoms (saltcake), B Plant low-level waste, and PUREX low-level waste. Hill et al. provides process flowsheet molarity values for some analytes for B Plant and PUREX low-level waste. The high molarities for some analytes in B Plant low-level waste indicates little of this waste type in the tank based on analytical results. There is no flowsheet for SMMS1 and evaporator bottoms because it is a mixture of concentrate supernatants from several tanks.

D3.2 ASSUMPTIONS USED

The following evaluation provides an engineering evaluation of tank 241-U-106 contents. For this evaluation, the following assumptions and observations are made:

- Total waste mass is calculated using the sampling-based measured density and the tank volume in Hanlon (1996). The analytical-based HDW model and the engineering evaluation inventories are derived using this volume. The actual waste types contributing to the total volume are different in each case. As a result, inventory comparisons are not made on the same mass or waste type basis.

- Only the SMMS1 waste stream contributed to solids formation.

- No radiolysis of NO_3 to NO_2 and no additions of NO_2 to the waste for corrosion purposes are factored into this evaluation.

D3.3 BASIS FOR CALCULATIONS USED IN THIS EVALUATION

In this evaluation, Table D3-1 provides the method used of determining the inventory estimates of the supernatant and solids layers.

Table D3-1. Assessment Methodologies Used on Tank 241-U-106.

Waste Type	How Calculated	Check Method
Supernatant Volume = 57 kL (15 kgal)	Used sample-based values	None. There is no clear method of evaluating the supernatant layer because it is a blend of many waste supernatants. This portion of the waste is a small percent of the total waste. Its contribution to the total inventory is minimal.
Saltcake SMMS1 Volume = 798.6 kL (211 kgal) Density = 1.62 g/mL (sample-based) Density = 1.63 g/mL (Comparison tanks)	Used sample-based concentrations for tank 241-U-106 multiplied by saltcake total mass. The great majority of waste in this tank appears to be represented by this waste type.	Used sample-based concentrations for three comparison tanks containing SMMS1 saltcake to determine an average composition. Multiplied by saltcake total mass in tank 241-U-106. The density used was the average density of the tanks for which the concentrations were derived.
Sludge (No sludge)	No sludge layer is observed in this tank by comparison to segment analytical data. The engineering assessment makes the same assumption.	Analytes characteristic of sludges such as iron, manganese, bismuth, and uranium were not observed in significant quantities (> 5,000 μg/g) in the samples analyzed. The core samples were essentially complete and provided a full length profile of the tank.

D3.3.1 Basis for Saltcake Calculations Used In This Evaluation

Tables D3-2 and D3-3 summarize sample-based characterization data for three tanks (241-S-101, 241-S-102, and 241-U-109) that contain the same SMMS1 saltcake waste type as tank 241-U-106. The analytical results for this tank were evaluated at the core segment level, and the SMMS1 saltcake was identified. The SMMS1 component concentrations for these tanks and for tank 241-U-106 were averaged to provide a generalized composition for SMMS1 saltcake. Tables D3-2 and D3-3 also show the SMMS1 saltcake composition predicted by Agnew et al. (1996) for tank 241-U-106 for comparison.

As shown in Table D3-2, the concentrations of major waste components (for example, Na, Al, NO_3, NO_2, and SO_4) for the four tanks containing SMMS1 saltcake vary between tanks by no more than an approximate factor of three. An exception is phosphate which exhibits exceptionally high concentrations for tank 241-S-102 waste, thereby skewing the average concentration high for phosphate for the SMMS1 tanks used in this assessment. The variation between several minor components for the four tanks is quite high. Except for phosphate and silicon, the analyte concentrations for tank 241-U-106 are close to the average concentrations for the four tanks.

The analyte concentrations for tank 241-U-106 saltcake compare within approximately a factor of three for most major components with the predicted SMMS1 composition from the HDW model. However, significant differences occur for several components including F, Fe, Mn, Si, and oxalate. Except for silicon, the concentrations of these components for the other three saltcake tanks are closer to those for tank 241-U-106 than to the HDW model estimate. It is concluded that the concentrations of these components are best represented by the analytical results for tank 241-U-106.

Table D3-2. Chemical Composition of SMMS1 Saltcakes (μg/g). (2 sheets)

Analyte	Tank 241-S-101	Tank 241-S-102	Tank 241-U-106	Tank 241-U-109	Average SMMS1[1]	HDW SMMS1[2]
Al	18,000	15,085	13,620	13,625	15,083	30,900
Bi	71	76	n/r	n/r	74	175
Ca	273	237	336	n/r	282	989
Cl	4,500	4,099	2,926	3,560	3,771	5,320
Cr	10,000	4,359	3,170	4,233	5,441	2,170
F	500	13,596	4,669	298	4,766	899
Fe	508	1,298	3,096	n/r	1,634	303
K	1,109	898	1,309	n/r	1,105	1,590
La	n/r	37	43	n/r	40	4.96

Table D3-2. Chemical Composition of SMMS1 Saltcakes ($\mu g/g$). (2 sheets)

Analyte	Tank 241-S-101	Tank 241-S-102	Tank 241-U-106	Tank 241-U-109	Average SMMS1[1]	HDW SMMS1[2]
Mn	266	597	1,189	n/r	684	164
Na	150,000	189,500	170,500	218,333	182,083	196,000
Ni	114	49	304	n/r	155	272
NO_2	91,000	40,078	56,029	42,900	57,502	77,600
NO_3	110,000	99,152	147,200	296,667	163,255	227,000
Pb	91	137	348	n/r	192	147
PO_4	9,500	114,500	5,888	5,970	33,965	6,140
P	2,290	33,984	1,949	n/r	12,741	n/r
S	5,940	2,683	3,878	n/r	4,167	n/r
Si	5,269	517	176	n/r	1,987	1,680
SO_4	20,700	12,500	10,774	11,100	13,768	17,400
Sr	7	n/r	n/r	n/r	7	1.04
TOC	1,900	5,340	24,626	3,920	8,947	11,300
U	560	1,403	781	n/r	914	2,150
Zr	14	39	88	n/r	47	51.1
Oxalate	15,400	15,674	9,881	n/r	13,652	2.69
wt% H_2O		25	43	24	30.6	29.5
Density	1.58	1.69	1.57	1.67	1.63	1.66

Notes:

[1]Average concentrations for tanks 241-S-101, 241-S-102, 241-U-106, and 241-U-109

[2]Agnew et al. (1996)

Table D3-3 shows the concentrations for the radioactive components for SMMS1 saltcakes.

Table D3-3. Radionuclide Composition of SMMS1 Saltcakes (μCi/g).

Analyte	Tank 241-S-101	Tank 241-S-102	Tank 241-U-106	Tank 241-U-109	Average SMMS1[1]	HDW SMMS1[2]
^{90}Sr	252	23	77	9	90	92.8
^{137}Cs	175	121	175	142	153	172
^{241}Am		0	2		1.026	n/r
$^{239/240}Pu$	n/r	n/r	n/r	n/r	n/r	n/r

D3.4 ESTIMATED COMPONENT INVENTORIES

Table D3-4 summarizes estimated chemical inventories for tank 241-U-106. The 241-U-106 sample-based inventory and the inventory estimated by the HDW model are shown. As shown in Table D3-1, the supernatant inventory for tank 241-U-106 was calculated from the tank 241-U-106 supernatant samples and was added to the saltcake inventory. The predicted (engineering evaluation) inventory based on the average analytical values for the four SMMS1 tanks is also shown. Comments and observations regarding these inventories are provided by component in the text below.

Table D3-4. Comparison of Selected Component Inventory Estimates for Tank 241-U-106 Waste. (2 sheets)

Component	Predicted (kg)[1]	241-U-106 Sample-Based (kg)	HDW Estimated (kg)
Bi	209	< 56.8	220
Ca	332	510	1,570
K	1,440	1,860	1,990
La	52	51.6	6.22
Ni	202	390	345
NO_3	2.1E+05	2.86E+05	2.86E+05
NO_2	74,900	68,700	97,400
Mn	890	1,520	205
SO_4	17,900	12,810	22,700

Table D3-4. Comparison of Selected Component Inventory Estimates for Tank 241-U-106 Waste. (2 sheets)

Component	Predicted (kg)[1]	241-U-106 Sample-Based (kg)	HDW Estimated (kg)
Cr	7,080	3,520	2,730
Sr	9	< 6.13	1.31
Pb	250	425	184
PO_4	44,200	12,300	11,400
F	8,140	4,180	1,130
Al	19,600	15,700	38,800
Fe	2,130	4,050	1,030
Cl	5,000	3,810	6,690
Si	2,590	228	2,110
TOC	32,100	29,000	14,300
U	1,190	1,010	49,300
Oxalate	17,770	12,700	3.37
Zr	61	133	64.1
Na	2.37E+05	2.45E+05	2.57E+05
H_2O (percent)	n/r	42.9	31.2

Note:
[1]Based on average analyte concentrations for tanks known to contain SMMS1 saltcake.

Nitrate. The HDW estimated inventory is the same as the tank 241-U-106 sample-based inventory. This is reasonable because this evaluation and the HDW model predicts predominantly saltcake waste for this tank, which consists primarily of $NaNO_3$.

Sulfate. The HDW model estimate is approximately twice that of the tank 241-U-106 sample-based value. However, the data for the two core samples for tank 241-U-106 were consistent and were used as the best basis for this tank.

Chromium. The HDW estimated inventory is approximately 25 percent lower than the sample-based inventory. The Cr concentration in the four SMMS1 comparison samples was consistently higher than the HDW SMMS1. This indicates that the Cr^{+6} solubility in REDOX waste may be higher than predicted by Agnew et al. (1996).

Phosphate. The sample-based inventory estimate was used as the best basis inventory. The HDW model agreed with this value. The average phosphate inventory for the four SMMS1 saltcakes is more than three times higher than the tank 241-U-106 and HDW model estimates. This is attributed to tank 241-S-102 that received high levels of phosphate which substantially raised the average.

Fluoride. The sample-based estimate for tank 241-U-106 was used as the best basis and was almost four times higher than the HDW model estimate. The average fluoride inventory for the four SMMS1 saltcakes is much higher than the tank 241-U-106 estimate because the fluoride concentration in the tank is much higher for the other SMMS1 comparison tanks.

Sodium. The HDW model estimate is approximately 5 percent higher than the sample-based estimate which was used as the best basis. All estimates were reasonably close.

TOC. The HDW model predicts approximately half the TOC that is estimated for tank 241-U-106 samples. The data for the two core samples for tank 241-U-106 were consistent and were used as the best basis for this tank.

Manganese. The sampling-based estimate, which was used as the best basis, shows approximately 7.5 times as much as the HDW model estimate. All tanks analyzed as containing SMMS1 saltcake contain significantly higher concentrations of Mn than predicted by the HDW model for SMMS1.

Aluminum. The HDW model predicted an inventory almost 2.5 times higher than the sample-based best estimate. The other three tanks with SMMS1 agree with the tank 241-U-106 sample-based inventory. Because the acid preparation method was used, caution should be exercised when using this number.

Iron. The sample-based inventory is used as the best basis. It is approximately four times higher than predicted by the HDW model. However, the SMMS1 tanks consistently contain higher iron concentrations than predicted by the HDW model.

Silicon. The sample-based inventory is used for the best basis and is more than nine times lower than that predicted by the HDW model; however, the average for the four sampled tanks is approximately the same as the HDW model. Because the acid preparation method was used, caution should be exercised when using this number.

Uranium. The sample-based value is used as the best basis. The HDW model predicts approximately 49 times as much uranium as does the analytical data. The model predicts that MW (which contains uranium) is in the tank, but no sludge is evident in the sample.

Oxalate. The sample-based inventory is used as the best basis. This value is significantly higher than that predicted by the HDW model. No explanation has been found to explain the vast difference, except that oxalate is produced as a product of organic degradation, which is not specifically accounted for by the model.

D4.0 DEFINE THE BEST-BASIS AND ESTABLISH COMPONENT INVENTORIES

An evaluation of available chemical information for tank 241-U-106 was performed, including the following:

- Data from two push mode 1996 core samples
- An inventory estimate generated by the HDW model (Agnew et al. 1996)
- Comparison with other tanks with SMMS1 saltcake.

Based on this evaluation, a best-basis inventory was developed for tank 241-U-106 for which sampling information was available. The sample-based inventory was chosen as the best basis for those analytes for which sample-based analytical values were available for the following reasons:

- The sample-based inventory analytical concentrations compared favorably to those of other tanks containing SMMS1 saltcake.
- Historical records and the results from core samples indicate the tank contains SMMS1 saltcake but little or no metal waste predicted by Agnew et al. (1996).
- For those few analytes where no values were available from the sampling-based inventory or the engineering assessment, the HDW model values were used with a note that they were of lower reliability.

Tables D4-1 and D4-2 shows the best-basis inventory for tank 241-U-106.

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-U-106 (January 31, 1997). (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, or E)[1,2]	Comment
Al	15,650	S	This value is based on acid digest and may not represent all the aluminum present.
Bi	< 56.8	S	
Ca	510	S	
Cl	3,810	S	
CO_3	54,400	S	
Cr	3,520	S	

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-U-106 (January 31, 1997). (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, or E)[1,2]	Comment
F	4,180	S	
Fe	4,050	S	
Hg	1.54	M	
K	1,860	S	
La	51.6	S	
Mn	1,530	S	
Na	2.58E+05	S	
Ni	389	S	
NO_2	68,670	S	
NO_3	2.86E+05	S	
OH	n/r		
Pb	424	S	
PO_4	12,650	S	Used phosphorous data from ICP to estimate.
Si	228	S	This value is based on acid digest and may not represent all the silicon present.
SO_4	13,090	S	Used sulfur data from ICP to estimate.
Sr	< 6.69	S	
TOC	28,980	S	
U	1,010	S	
Zr	132	S	

Notes:

[1]S = sample-based, M = HDW model-based, E = engineering assessment-based

[2]For more information about the origin and quality of the sample-based numbers, refer to Appendix B. For more information about the model-based numbers, refer to Agnew et al. (1996).

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-U-106 (January 31, 1997). (Decayed to January 1, 1994) (2 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1,2]	Comment
^{3}H	n/r		
^{14}C	n/r		
^{59}Ni	n/r		
^{60}Co	182	S	
^{63}Ni	n/r		
^{79}Se	n/r		
^{90}Sr	1.06E+05	S	
^{90}Y	1.06E+05	E	Based on Sr
^{93}Zr	n/r		
^{93m}Nb	n/r		
^{99}Tc	n/r		
^{106}Ru	n/r		
^{113m}Cd	n/r		
^{125}Sb	n/r		
^{126}Sn	n/r		
^{129}I	n/r		
^{134}Cs	n/r		
^{137}Cs	2.15E+05	S	
^{137m}Ba	2.00E+05	E	Based on Cs
^{151}Sm	n/r		
^{152}Eu	n/r		
^{154}Eu	1,990	S	
^{155}Eu	1,150	S	
^{226}Ra	n/r		
^{227}Ac	n/r		

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-U-106 (January 31, 1997). (Decayed to January 1, 1994) (2 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1,2]	Comment
^{228}Ra	n/r		
^{229}Th	n/r		
^{231}Pa	n/r		
^{232}Th	n/r		
^{232}U	n/r		
^{233}U	n/r		
^{234}U	n/r		
^{235}U	n/r		
^{236}U	n/r		
^{237}Np	n/r		
^{238}Pu	n/r		
^{238}U	n/r		
^{239}Pu	n/r		
^{240}Pu	n/r		
^{241}Am	< 2,290	S	
^{241}Pu	n/r		
^{242}Cm	n/r		
^{242}Pu	n/r		
^{243}Am	n/r		
^{243}Cm	n/r		
^{244}Cm	n/r		

Notes:

[1]S = sample based, M = HDW model-based, E = engineering assessment-based

[2]For more information about the origin and quality of the sample-based numbers, refer to Appendix B. For more information about the model-based numbers, refer to Agnew et al. (1996).

D5.0 APPENDIX D REFERENCES

Agnew, S. F., J. Boyer, R. Corbin, T. Duran, J. FitzPatrick, K. Jurgensen, T. Ortiz, and B. Young, 1996, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 3*,, Los Alamos National Laboratory, Los Alamos, New Mexico.

Hanlon, B. M., 1996, *Waste Tank Summary Report for Month Ending June 30, 1996*, WHC-EP-0182-99, Westinghouse Hanford Company, Richland, Washington.

Hill, J. G., G. S. Anderson, and B. C. Simpson, 1995, *The Sort On Radioactive Waste Type Model: A Method to Sort Single-Shell Tanks into Characteristic Groups*, PNL-9814, Rev. 2 , Pacific Northwest Laboratory, Richland, Washington.

Hodgson, K. M., and M. D. LeClair, 1996, *Work Plan for Defining a Standard Inventory Estimate for Wastes Stored in Hanford Site Underground Tanks*, WHC-SD-WM-WP-311, Rev. 1, Lockheed Martin Hanford Corporation, Richland, Washington.

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APPENDIX E

BIBLIOGRAPHY FOR TANK 241-U-106

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APPENDIX E

BIBLIOGRAPHY FOR TANK 241-U-106

Appendix E is a bibliography of information that supports the characterization of tank 241-U-106. This bibliography represents an in-depth literature search of all known information sources that provide sampling, analysis, surveillance, and modeling information, and processing occurrences associated with tank 241-U-106 and its respective waste types.

The references in this bibliography are separated into three categories with references broken into subgroups. These categories and subgroups are listed below.

I. NON-ANALYTICAL DATA

Ia. Models/Waste Type Inventories/Campaign Information
Ib. Fill History/Waste Transfer Records
Ic. Surveillance/Tank Configuration
Id. Sample Planning/Tank Prioritization
Ie. Data Quality Objectives/Customers of Characterization Data

II. ANALYTICAL DATA - SAMPLING OF TANK WASTE AND WASTE TYPES

IIa. Sampling of Tank 241-U-106
IIb. Sampling of 242-S Evaporator Streams
IIc. Sampling of Other Tanks with SMMS1 Saltcake

III. COMBINED ANALYTICAL/NON-ANALYTICAL DATA

IIIa. Inventories using both Campaign and Analytical Information
IIIb. Compendium of Existing Physical and Chemical Documented Data Sources

This bibliography is divided into the appropriate sections with an annotation at the end of each reference describing the information source. A majority of the information can be found in the Lockheed Martin Hanford Corporation Tank Characterization Resource Center.

I. NON-ANALYTICAL DATA

Ia. Models/Waste Type Inventories/Campaign Information

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

- Predicts volumes of waste type layers in single-shell tanks.

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

- Contains single-shell tank fill history and primary campaign/waste type information up to 1981.

Jungfleisch, F. M., and B. C. Simpson, 1993, *Preliminary Estimation of the Waste Inventories in Hanford Tanks Through 1980*, WHC-SD-WM-TI-057 Rev. 0A, Westinghouse Hanford Company, Richland, Washington.

- Provides a model based on process knowledge and radioactive decay estimations for different compositions of process waste streams assembled for total, solution, and solids compositions per tank. Provides assumptions about waste/waste types and solubility parameters/constraints.

Schneider, K. J., 1951, *Flow Sheet and Flow Diagrams of Precipitation Separations Process*, HW-23043, General Electric Company, Richland, Washington.

- Contains compositions of metal waste before transfer to 200E Tank Farms waste tanks.

Ib. Fill History/Waste Transfer Records

Agnew, S. F., R. A. Corbin, T. B. Duran, K. A. Jurgensen, T. P. Ortiz, and B. L. Young, 1996, *Waste Status and Transaction Record Summary for the Southwest Quadrant of the Hanford 200 East Area*, WHC-SD-WM-TI-614, Rev. 1, Los Alamos National Laboratory, Los Alamos, New Mexico.

- Contains spreadsheets showing all available data on tank additions/transfers.

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

- Contains single-shell tank fill history and primary campaign/waste type information up to 1981.

Ic. Surveillance/Tank Configuration

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

- Shows tank riser locations in relation to tank aerial view and provides a description of risers and their contents.

Lipnicki, J., 1995, *Waste Tank Risers Available for Sampling*, WHC-SD-WM-TI-710, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

- Provides an assessment of riser locations for each tank; however, not all tanks are included/completed. Also includes an estimate of the risers that are available for sampling.

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

- Contains thermocouple trees locations and elevations for each tank.

Id. Sample Planning/Tank Prioritization

Brown, T. M., S. J. Eberlein, J. W. Hunt, and T. J. Kunthara, 1996, *Tank Waste Characterization Basis*, WHC-SD-WM-TA-164, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

- Summarizes the technical basis for characterizing tank waste and assigns a priority number to each tank.

Brown, T. M. and W. D. Winkelman, 1996, *Tank 241-U-106 Tank Characterization Plan*, WHC-SD-WM-TP-245, Rev. 3, Westinghouse Hanford Company, Richland, Washington.

- Discusses all relevant DQOs and how they will be met for tank 241-U-106.

Brown, T. M., 1996, *Tank 241-U-106 Push Mode Core Sampling and Analysis Plan*, WHC-SD-WM-TSAP-093, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Provides specific guidelines for the sampling and analysis of the 1996 core samples.

Schreiber, R. D., 1994, *Tank 241-U-106 Tank Characterization Plan*, WHC-SD-WM-TP-245, Rev. 0A, Westinghouse Hanford Company, Richland, Washington.

- Contains sampling and analysis requirements for the 1994 grab sampling event.

Grimes, G. W., 1977, *Hanford Long-Term Defense High-Level Waste Management Program Waste Sampling and Characterization Plan*, RHO-CD-137, Rockwell Hanford Operations, Richland, Washington.

- Early characterization planning document.

Winkelman, W. D., J. W. Hunt, and L. J. Fergestrom, 1996, *Fiscal Year 1997 Tank Waste Analysis Plan*, WHC-SD-WM-PLN-120, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

- Contains Tri-Party Agreement requirement-driven TWRS Characterization Program information and a list of tanks to be characterized in fiscal year 1997.

Ie. Data Quality Objectives/Customers of Characterization Data

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

- Determines whether tanks are under safe operating conditions.

Fowler, K. D., 1995, *Data Quality Objectives for Tank Farms Waste Compatibility Program*, WHC-SD-WM-DQO-001, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

- Provides the data requirements needed to perform compatibility study before pumping liquids from a tank.

Osborne, J. W., and L. L. Buckley, 1995, *Data Quality Objectives for Tank Hazardous Vapor Safety Screening*, WHC-SD-WM-DQO-002, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

- Specifies requirements for screening tank vapors for flammable gases, organic solvents, and toxic gases.

Simpson, B. C., and D. J. McCain, 1996, *Historical Model Evaluation Data Requirements*, WHC-SD-WM-DQO-018, Rev. 1, Westinghouse, Hanford Company, Richland, Washington.

- Provides data needs for evaluating the Los Alamos National Laboratory model for estimating tank waste compositions.

Turner, D. A., H. Babad, L. L. Buckley, and J. E. Meacham, 1995, *Data Quality Objective to Support Resolution of the Organic Complexant Safety Issue*, WHC-SD-WM-DQO-006, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

- Specifies data requirement needs for determining the safety status of a tank with respect to organic fuels in the solid or liquid waste.

II. ANALYTICAL DATA - SAMPLING OF TANK WASTE AND WASTE TYPES

IIa. Sampling of Tank 241-U-106

Buckingham, J. S., 1976, *Analyses of Liquids From 242-S Slurry Receiving Tanks 105-U and 106-U While Processing High Strontium Alkaline Waste*, (internal memorandum to R. E. VanderCook, March 16), Atlantic Richfield Hanford Company, Richland, Washington.

- Contains some sample results from tank 241-U-106. Results should be used with caution.

Buckingham, J. S., 1976, *Evaporator Support and Tank Farm Assistance*, (internal memorandum [number unknown] to D. C. Lini, April [day unknown]), Atlantic Richfield Hanford Company, Richland, Washington.

- Contains some sample results from tank 241-U-106. Results should be used with caution.

Huckaby, J. L., and D. R. Bratzel, 1995, *Tank 241-U-106 Headspace Gas and Vapor Characterization Results for Samples Collected in March 1995*, WHC-SD-WM-ER-450, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

- Analytical results of the 1995 vapor sampling event.

Ligotke, M. W., K. H. Pool, G. S. Klinger, J. S. Young, J. S. Fruchter, R. B. Lucke, B. D. McVeety, T. W. Clauss, M. McCulloch, S. C. Goheen, 1995, *Vapor Space Characterization of Waste Tank 241-U-106 (In Situ): Results from Samples Collected on 8/25/94*, PNL-10730, Pacific Northwest National Laboratory, Richland, Washington.

- Analytical results of the 1994 vapor sampling event.

Sant, W. H., 1974, *242-S Feed Samples, Number T-1970, 106-U Sample Point*, (internal memorandum [number unknown] to R. L. Walser, February 26), Atlantic Richfield Hanford Company, Richland, Washington.

- Analytical results of 1974 supernatant sample. Results should be used with caution.

Starr, J. L., 1977, *Sludge Sample from 106-U, Sample # 4859*, (internal memorandum [number unknown] to W. R. Christensen, June 29), Atlantic Richfield Hanford Company, Richland, Washington.

- Sludge sample results. Few results were reported. Results should be used with caution.

Steen, F. H., 1996, *Tank 241-U-106, cores 147 and 148 Analytical Results for the Final Report,* WHC-SD-WM-DP-191, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

- Analytical results of the 1996 core sampling event. Two core samples were taken from the tank.

Vogel, R. E., 1994, *Results for Tank 241-U-106*, (internal memorandum #8E480-94-109 to M. J. Sutey, October 18), Westinghouse Hanford Company, Richland, Washington.

- Analytical results of the 1994 grab sample. Sample was taken to support the compatibility DQO for future pumping of the liquid waste in the tank.

Wheeler, R. E., 1975, *Analysis of Tank Farm Samples: T 6861, Tank 106-U*, (internal memorandum [number unknown] to R. L. Walser, October 20), Atlantic Richfield Hanford Company, Richland, Washington.

- Analytical results of 1975 supernatant sample. Results should be used with caution.

IIb. Sampling of 242-S Evaporator Waste Streams

The following analyses may provide insight as to the composition of SltCk waste type expected to be in tank 241-U-106.

Brown, G. E., 1978, *Operating Parameters for Evaporator Crystallizers*, (internal memorandum [number unknown] to K. G. Carothers, July 5), Rockwell Hanford Operations, Richland, Washington.

Campbell, G. D., 1975, *242-S Evaporator-Crystallizer Material Balance*, (internal memorandum [number unknown] to R. L. Walker, August 5), Atlantic Richfield Hanford Company Operations, Richland, Washington.

Puryear, D. A. and J. S. Buckingham, 1971, *Status Report on Waste Solidification Studies and Separations Chemistry Laboratory*, (internal memorandum to M. H. Campbell and Distribution, Process Aids #00362, July 23), Atlantic Richfield Hanford Company Operations, Richland, Washington.

IIc. Sampling of Other Tanks with SMMS1 Saltcake

- The following tank characterization reports contain information about other tanks that contain SMMSI saltcake waste.

Brown, T. M., and J. Franklin, 1996, *Tank Characterization Report for Single-Shell Tank 241-U-105*, WHC-SD-WM-ER-617, Rev. O, Westinghouse Hanford Company, Richland, Washington.

Eggers, R. F., R. H. Stephens, and T. T. Tran, 1996, *Tank Characterization Report for Single-Shell Tank 241-S-102*, WHC-SD-WM-ER-611, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Jo, J., B. J. Morris, and T. T. Tran, 1996, *Tank Characterization Report for Single-Shell Tank 241-U-107*, WHC-SD-WM-ER-614, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

III. COMBINED ANALYTICAL/NON-ANALYTICAL DATA

IIIa. Inventories from Campaign and Analytical Information

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

- Contains waste type summaries and primary chemical compound/analyte and radionuclide estimates for sludge, supernatant, and solids.

Allen, G. K., 1976, *Estimated Inventory of Chemicals Added to Underground Waste Tanks, 1944 - 1975*, ARH-CD-601B, Atlantic Richfield Hanford Company, Richland, Washington.

- Contains major components for waste types and some assumptions. Purchase records are used to estimate chemical inventories.

Allen, G. K., 1975, *Hanford Liquid Waste Inventory as of September 30, 1974*, ARH-CD-229, Atlantic Richfield Hanford Company, Richland, Washington.

- Contains major components for waste types and some assumptions.

Brevick, C. H., L. A. Gaddis, and W. W. Pickett, 1994, *Historical Tank Content Estimate for the Southwest Quadrant of the Hanford 200 West Area*, WHC-SD-WM-ER-352, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Contains summary information from the supporting document and in-tank photo collages and composite inventory estimates.

Brevick, C. H., L. A. Gaddis, and E. D. Johnson, 1996, *Supporting Document for the Historical Tank Content Estimate for U Tank Farm*, WHC-SD-WM-ER-325, Rev. 0B, Westinghouse Hanford Company, Richland, Washington.

- Contains summary tank farm and tank write-ups on historical data and solid inventory estimates and data appendixes. The appendixes contain the following information: Appendix C - Level History AutoCAD sketch; Appendix D - Temperature Graphs; Appendix E - Surface Level Graph; Appendix F, pg F-1 - Cascade/Drywell Chart; Appendix G - Riser Configuration Drawing and Table; Appendix I - In-Tank Photos; and Appendix K - Tank Layer Model Bar Chart and Spreadsheet.

IIIb. Compendium of data from other physcial and chemical sources

Agnew, S. F., and J. G. Watkin, 1994, *Estimation of Limiting Solubilities for Ionic Species in Hanford Waste Tank Supernates*, LAUR-94-3590, Los Alamos National Laboratory, Los Alamos, New Mexico.

- Provides solubility ranges used for key chemical and radionuclide components based on supernatant sample analyses.

Brevick, C. H., L. A. Gaddis, and E. D. Johnson, 1995, *Tank Waste Source Term Inventory Validation, Vols. I & II*, WHC-SD-WM-ER-400, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Contains a quick reference to sampling information in spreadsheet or graphical form for 23 chemicals and 11 radionuclides for all tanks.

Hanlon, B. M., 1996, *Waste Tank Summary Report for Month Ending September 30, 1996*, WHC-EP-0182-102, Westinghouse Hanford Company, Richland, Washington.

- Contain a monthly summary of the following: fill volumes, Watch List tanks, occurrences, integrity information, equipment readings, equipment status, tank location, and other miscellaneous tank information.

Husa, E. I., 1993, *Hanford Site Waste Storage Tank Information Notebook*, WHC-EP-0625, Westinghouse Hanford Company, Richland, Washington.

- Contains in-tank photos and summaries on the tank descriptions, leak detection systems, and tank status.

Husa, E. I., 1995, *Hanford Waste Tank Preliminary Dryness Evaluation*, WHC-SD-WM-TI-703, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Provides assessment of relative dryness between tanks.

Shelton. L. W., 1995, *Chemical and Radionuclide Inventory for Single and Double Shell Tanks*, (internal memorandum #75520-95-007 to R. M. Orme, August 8), Westinghouse Hanford Company, Richland, Washington.

- Memorandum contains a tank inventory estimate based on analytical information.

Shelton, L. W., 1995, *Radionuclide Inventories for Single and Double Shell Tanks*, (internal memorandum #71320-95-002 to R. M. Cooney, February 14), Westinghouse Hanford Company, Richland, Washington.

- Memorandum contains a tank inventory estimate based on analytical information.

Shelton, L. W., 1996, *Chemical and Radionuclide Inventory for Single and Double Shell Tanks*, (internal memorandum 74A20-96-30 to D. J. Washenfelder, February 28), Westinghouse Hanford Company, Richland, Washington.

- Memorandum contains a tank inventory estimate based on analytical information.

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