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

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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-108. 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-108

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Project Hanford Management Contractor for the
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CONTENTS

CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Continued)

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF TABLES (Continued)

LIST OF TABLES (Continued)

LIST OF TABLES (Continued)

LIST OF TABLES (Continued)

LIST OF TABLES (Continued)

LIST OF TERMS

ANOVA	analysis of variance
BNW	Battelle Northwest Waste
Btu/hr	British thermal units per hour
CES	consensus exposure standard
Ci	curies
Ci/L	curies per liter
cm	centimeter
c/s	counts per second
CW	cladding waste
CWR	REDOX cladding waste
CWR2	cladding waste, REDOX, 1961-1972
df	degrees of freedom
DQO	data quality objective
DSC	differential scanning calorimetry
EB	evaporator bottoms
F	Fahrenheit
FIC	Food Instrument Corporation
ft	feet
g/mL	grams per milliliter
g	grams
g/kg	grams per kilogram
g/L	grams per liter
GC	gas chromatography
GEA	gamma energy analysis
HDRL	Hanford defense residual liquor
HDW	Hanford defined wastes
HTCE	historical tank content estimate
IC	ion chromatography
ICP	inductively coupled plasma spectroscopy
IDLH	immediately dangerous to life and health
in.	inches
J/g	joules per gram
kg^3	cubic kilograms
kg/L	kilograms per liter
kg	kilograms
kgal	kilogallon
kL	kiloliter
kW	kilowatt
L	liter
LANL	Los Alamos National Laboratory

LIST OF TERMS (Continued)

LFL	lower flammability limit
LL	lower limit
LMHC	Lockheed Martin Hanford Company
LOW	liquid observation well
M	molar
m	meter
MDL	method detection limit
mg/kg	milligrams per kilogram
mg/m^3	milligrams per cubic meter
mm	millimeter
MTU	metric tons uranium
MW	metal waste
N	N-Reactor waste
n/a	not applicable
NCPLX	non-complexed waste
nCi/g	nanocuries per gram
ND	not detected
N/D	not decided
n/r	not reported
NIOSH	National Institute for Occupational Safety and Health
ORNL	Oak Ridge National Laboratory
PHMC	Project Hanford Management Contract
PNF	partially neutralized waste feed
PNNL	Pacific Northwest National Laboratory
ppbv	parts per billion by volume
ppm	parts per million
ppmv	parts per million by volume
QC	quality control
REDOX	Reduction/Oxidation Plant
REML	restricted maximum likelihood
RPD	relative percent difference
SACS	Surveillance Analysis Computer System
SAP	sampling and analysis plan
SMM	supernatant mixing model
SMMS1	supernatant mixing model (SMM) wastes from 242-S Evaporator (S1)
SMMS2	supernatant mixing model (SMM) wastes from 242-S Evaporator (S2)
SU	supernatant
TBP	tributyl phosphate
TCD	tank characterization database
TCP	tank characterization plan

LIST OF TERMS (Continued)

TCR	tank characterization report
TGA	thermogravimetric analysis
TIC	total inorganic carbon
TID	tentatively identified compound
TLM	tank layer model
TOC	total organic carbon
TRU	transuranic
TWRS	Tank Waste Remediation System
UL	upper limit
UR	uranium recovery waste
VSS	Vapor Sampling System
W	watts
WHC	Westinghouse Hanford Company
WSTRS	Waste Status and Transaction Record Summary
wt%	weight percent
°C	degrees Celsius
°F	degrees Fahrenheit
μCi/g	microcuries per gram
μCi/L	microcuries per liter
μCi/mL	microcuries per milliliter
μeq/g	microequivalents per gram
μg/g	micrograms per gram
μg/mL	micrograms per milliliter
μm	microns

1.0 INTRODUCTION

One of the major functions 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 about a tank, 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-108. The objectives of this report are: 1) to use characterization data in response to technical issues associated with 241-U-108 waste; and 2) to provide a standard characterization of this waste in terms of a best-basis inventory estimate. The response to technical issues is summarized in Section 2.0, and the best-basis inventory estimate is presented in Section 3.0. Recommendations regarding safety status and additional sampling needs are provided in Section 4.0. Supporting data and information are contained in the appendixes. 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

Characterization information presented in this report originated from sample analyses and known historical sources. Only the results of recent sampling events will be used to fulfill the requirements of the data quality objectives (DQOs), but other information can be used to support (or question) conclusions derived from these results. Historical information for tank 241-U-108, provided in Appendix A, includes surveillance information, records pertaining to waste transfers and tank operations, and expected tank contents derived from a process knowledge model.

The recent sampling events listed in Table 1-1, as well as sample data obtained prior to 1989, are summarized in Appendix B along with the sampling results. The results of the 1995 and 1996 sampling events satisfied the data requirements specified in the tank characterization plan (TCP) for this tank (Winkelman 1996). The statistical analysis and numerical manipulation of data used in issue resolution are reported in Appendix C. Appendix D contains the evaluation to establish the best basis for the inventory estimate and the statistical analysis performed for the evaluation. A bibliography that resulted from an in-depth literature search of all known information sources applicable to tank 241-U-108 and its respective waste types is contained in Appendix E. The documents listed in Appendix E may be found in the Lockheed Martin Hanford Corporation Tank Characterization Resource Center.

1.2 TANK BACKGROUND

Tank 241-U-108 is located in the 200 West Area U Tank Farm on the Hanford Site, and is the second tank in a three-tank cascade series. In the mid 1950's, most of the metal waste (MW) was transferred out for uranium recovery. From the second quarter of 1959 until the fourth quarter of 1964, the tank received reduction-oxidation (REDOX) cladding waste. Numerous transfers from the tank took place during the 1960's. In the second quarter of 1964, the tank again received cladding waste from the REDOX plant. From the third quarter of 1968 until the first quarter of 1976, the tank received a combination of N Reactor, REDOX cladding, and evaporator bottoms waste. Some of these wastes were transferred out of tank 241-U-108 during the second quarter of 1972 and the fourth quarter of 1973. From the second quarter of 1975 through the first quarter of 1977, the tank exchanged evaporator bottoms waste with tank 241-S-102. This was the final major transfer of waste involving tank 241-U-108.

A description of tank 241-U-108 is summarized in Table 1-2. The tank has an operating capacity of 2,010 kL (530 kgal), and presently contains an estimated 1,771 kL (468 kgal) of non-complexed waste (Hanlon 1996). The tank is on the Flammable Gas Watch List (Public Law 101-510).

Table 1-1. Summary of Recent Sampling.

Sample/Date	Phase	Location	Segmentation	% Recovery	Mass (g)
Core samples 141, 145, 146 April 15 to May 6, 1996	Solids and drainable liquids	Risers 7, 2, and 9	Half segments	41 - 100%	See Tables B1-2 to B1-4
Vapor samples April 15 to May 8, 1996	Gas	Tank headspace, risers 7, 2, and 9; 6 m (19.7 ft) below top of riser	n/a	n/a	n/a
Grab samples U-108-1, U-108-2, U-108-3 May 31, 1995	Liquids	Riser 7	None	100%	Not determined
Vapor samples August 29, 1995	Gas	Tank headspace, riser 10; 6.1 m (20 ft) below top of riser	n/a	n/a	n/a

Note:
n/a = not applicable

Table 1-2. Description of Tank 241-U-108.

TANK DESCRIPTION	
Type	Single-shell
Constructed	1943-1944
In-service	1949
Diameter	22.9 m (75.0 ft)
Operating depth	5.2 m (17 ft)
Capacity	2,010 kL (530 kgal)
Bottom shape	Dish
Ventilation	Passive
TANK STATUS	
Waste classification	Non-complexed
Total waste volume[1]	1,771 kL (468 kgal)
Supernatant volume	91 kL (24 kgal)
Saltcake volume	1,570 kL (415 kgal)
Sludge volume	110 kL (29 kgal)
Drainable interstitial liquid volume	651 kL (172 kgal)
Waste surface level (July 8, 1996)	454 cm (179 in.)
Temperature (July 5, 1987 to October 13, 1996)	16.6 °C (61.8 °F) to 37 °C (98 °F)
Integrity	Sound
Watch List	Flammable Gas
SAMPLING DATE	
Core samples	April/May 1996
Vapor samples	June 1995 through May 1996
Grab samples	May 1995
SERVICE STATUS	
Declared inactive	1979
Interim stabilization	Not stabilized
Partial isolation	1982

Note:
[1]Waste volume was estimated from surface-level measurements (Hanlon 1996).

2.0 RESPONSE TO TECHNICAL ISSUES

The following five technical issues have been identified for tank 241-U-108 (Brown et al. 1996). They are:

- Safety screening: Does the waste pose or contribute to any 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: 1) Does the tank headspace exceed 25 percent of the lower flammability limit (LFL), and if so, what are the principal fuel components? 2) Is there an organic solvent pool in excess of 1 m^2 (10.76 ft^2) in area that may cause an organic solvent pool fire or ignition of organic solvents entrained in the waste?
- Historical model evaluation: Is the waste inventory generated by a model based on process knowledge and historical information (Agnew et al. 1996a) representative of the current tank waste inventory?
- Compatibility: Do safety or operational problems exist with waste in tank 241-U-108 that could inhibit the transfer of pumpable liquid from the tank into a double-shell receiver tank?

The tank 241-U-108 TCP (Winkelman 1996) provides the types of sampling and analysis used to address the above issues. Data from the recent analysis of three core samples, a grab sample, and tank headspace samples, as well as available historical information, provided the means to respond to these issues. This response is detailed in the following sections. See Appendix B for sample and analysis data for tank 241-U-108.

The 1996 core sampling events took place to satisfy sampling and analysis requirements of the safety screening, organic, and historical DQO documents, and the organic test plan. The 1995 grab samples were taken and analyzed to satisfy the requirements of the compatibility DQO. The 1995 grab samples were taken and analyzed to satisfy the requirements of the generic vapor and rotary core vapor DQOs. The 1996 and 1995 sampling events will be treated separately in the sections below.

The 1995 vapor samples were taken to address the issues listed in the first revision of the tank 241-U-108 TCP (Winkelman 1996). Since the 1995 vapor sampling, the generic vapor and rotary core vapor DQOs have been superseded by the health and safety vapor DQO listed in the latest revision of the tank 241-U-108 TCP (Hewitt 1996).

2.1 SAFETY SCREENING AND ORGANIC COMPLEXANT EVALUATION

The data needed to screen the waste in tank 241-U-108 for potential safety problems are documented in *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995). The potential safety problems are exothermic conditions in the waste, flammable gases in the waste and/or tank headspace, and criticality conditions in the waste. The safety screening DQO was not the only safety-related DQO associated with the sampling effort. Tank 241-U-108 is not on the Organic Watch List; however, reviews of waste transfer records indicate that it may contain greater than 3 percent total organic carbon (TOC) on a dry weight basis. The data needed to determine if the waste in tank 241-U-108 poses a potential safety concern with respect to a fuel (organic compounds) and oxidizer (nitrate or nitrite) propagating reaction are documented in *Data Quality Objective to Support Resolution of the Organic Complexant Safety Issue* (Turner et al. 1995), and *Test Plan for Samples From Hanford Waste Tanks 241-BY-103, BY-104, BY-105, BY-106, BY-108, BY-110, TY-103, U-105, U-107, U-108, and U-109* (Meacham 1995). In addition, organic solvent screening requirements as required in DOE (1996) have been added to all passively ventilated tanks per Cash (1996). Cash (1996) requires that tank 241-U-108 be vapor sampled for total non-methane hydrocarbons as part of the organic DQO (Turner et al. 1995).

2.1.1 Sampling and Analysis Requirements

Both the safety screening and organic DQO documents required that two vertical profiles of the waste in tank 241-U-108 be obtained and analyzed at the half-segment level. The upper and lower half subsegments from segment 2 were only obtained from core 146; therefore, the sampling requirements of the safety screening and organic DQO documents were not fully met. The analysis requirements of the safety screening DQO were also not fully met, because there was no bulk density determination on the upper half of segment 9 from core 141. Analysis for total non-methane hydrocarbons was performed on the 1995 vapor samples, satisfying the requirement in Cash (1996).

The organic test plan's sampling requirements are not clear. It appears that performing the analyses requested on one sample would meet the sampling requirement of the test plan. Most of the analytical requirements of the test plan were not met, including adiabatic calorimetry and tube propagation tests and analysis for diethylenediamine tetracacetic acid, hydroxyethylenediamine tetraacetic acid, nitrilotriacetic acid, citrate, acetate, formate, and dibutyl phosphate. The missing analyses may be performed on archived samples at a later date.

2.1.2 Exothermic Conditions (Energetics)

The first analytical requirement outlined in the safety screening and organic DQO documents and the organic test plan is to ensure that not enough exothermic constituents (organic compounds, ferrocyanide, or cyanide) are present in tank 241-U-108 to cause a safety hazard. Because of this requirement, energetics in the tank 241-U-108 waste were evaluated using differential scanning calorimetry (DSC). The safety screening and organic DQO documents required that the waste sample profile be tested for energetics every 24 cm (9.5 in.) to determine if the energetics exceed the DQO notification limit. The threshold for energetics in the DQO documents is 480 J/g on a dry-weight basis and 1,200 J/g (dry) for the test plan.

Results obtained using DSC indicated that exotherms were apparent in most samples. Analyses were performed on all subsegments and drainable liquids from tank 241-U-108. One sample from the upper half of segment 4 from core 141 had an average DSC result of 496 J/g on a dry-weight basis, thus exceeding the DSC notification limit specified in the core sampling and analysis plan (SAP) (Homi 1996). A re-run of a second sample did not exceed the notification limit at 82.6 J/g (dry). The mean water content of the sample was 32.8 percent. Two other samples exceeded the DSC notification limit at the one-sided 95 percent upper confidence limit of the mean, although the individual measurements did not exceed the 480 J/g notification limit. The one-sided 95 percent lower confidence limits of the means for the respective water content of these two samples were 39.75 and 33.42 percent. Hence, adequate moisture is present to mediate the exothermic reactions.

Waste in tank 241-U-108 was expected to contain organic complexants (Agnew et al. 1996b); therefore, it is reasonable to expect exothermic behavior in the liquid and solid tank waste. The energy equivalent conversion for TOC (based on a sodium acetate average energetics standard) is calculated by converting the analytical results from μg/g to weight percent (dividing by 10,000). The equation (Meacham 1995) is:

$$\left[\frac{-1{,}200\ \text{J/g}}{4.5\%\ \text{TOC}}\right] * \text{measured TOC (\% dry)} = \text{energetics (J/g dry)}.$$

The average tank TOC concentration is 0.63 percent (dry). According to the above equation, the TOC would be expected to yield an average exotherm of 168 J/g (dry). The actual average of the DSC results was 64.4 J/g (dry). The discrepancy may result from the assumption that the TOC is in the form of acetate. Radiolysis and chemical degradation convert higher-energy organic species to lower-energy organic species. The core composite data show that oxalate accounts for 28 percent of the carbon. The amount of TOC present as other low-energy species such as formate was not determined. The TOC measurement may also be low because all the TOC is not being oxidized. However, the data suggest that this is not the case (Section B3.3.5). A third possibility is that some of the TOC has been degraded through chemical or radiological decarboxylation (loss of carbon dioxide and, thus, measured organic carbon).

2.1.3 Flammable Gas

Tank vapor samples, taken in the tank headspace in August 1995 and vacuum pumped from the tank from June 1995 to May 1996, and tank headspace flammability measurements taken prior to and during core sampling in April/May 1996, indicated that little flammable gases were present (highest reading was 6 percent of the LFL). Data from these vapor phase measurements are presented in Appendix B, Section B2.7.

2.1.4 Criticality

The safety screening total alpha notification limit is 1 g/L. However, total alpha is measured in μCi/g rather than in g/L. To convert the notification limit for total alpha into a practical number, it was assumed that all alpha activity originated from Pu-239. Using the average measured tank bulk density of 1.74 g/mL (Table B3-7), 1 g/L of Pu-239 is equivalent to 35.3 μCi/g of alpha activity.

Each core subsegment and drainable liquid was analyzed for total alpha activity. The total alpha activity in all core samples was well below the notification limit; the highest activity found at the one-sided 95 percent upper confidence limit of the mean was 0.37 μCi/g. Therefore, no criticality concern exists for tank 241-U-108.

2.1.5 Total Organic Carbon Content

Total organic carbon is a primary analyte for the organic DQO, but not for the safety screening DQO. The TOC decision threshold is 3 percent TOC (dry weight). The highest TOC concentration found at the one-sided 95 percent upper confidence limit of the mean was 1.86 percent; thus, no samples exceeded the 3 percent threshold at the 95 percent confidence limit. The sampling requirements were not fully met; otherwise, the tank could be declared "safe" with respect to organic content according to the organic DQO's decision rule.

2.1.6 Moisture Content

Moisture content by thermogravimetric analysis (TGA) is another primary analyte for the organic DQO, but not for the safety screening DQO. The percent moisture decision threshold is $\leq$17 percent. One sample was below this threshold, and 18 samples were below the threshold at the lower 95 percent confidence limit of the mean (Table C1-3). This is not necessarily a safety concern according to the organic DQO, because none of the "dry" subsegments contained greater than 3 percent TOC. The fact that portions of the tank have been shown to be relatively dry is a concern, because the sampling requirements were not met and most samples showed exothermic behavior.

2.2 HISTORICAL EVALUATION

The purpose of the historical evaluation is to determine whether the model based on process knowledge and historical information (Brevick et al. 1996, Agnew et al. 1996b) predicts tank inventories that are in agreement with current tank inventories. If the historical model can be shown to accurately predict the waste characteristics as observed through sample characterization, then there is a possibility that the amount of total sampling and analysis needed may be reduced. Data requirements for this evaluation are documented in *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995). The historical DQO strives to quantify the errors associated with the tank waste composition predictions based on waste transaction history and waste type compositions. It also identifies key components for each waste type evaluated.

Tank 241-U-108 is classified as "spatially complex" in the historical DQO because historical information indicates that it received many waste types. The analytical results were evaluated against each of the waste types that historical modeling suggests make up the tank waste. The historical estimate of the tank waste is described in Appendix A. Results of the historical model evaluation DQO will be used to quantify the errors associated with the historical tank content estimate (HTCE).

The first step in the historical evaluation is to compare the analytical results with DQO-defined concentration levels for a selected number of analytes. The analytes of interest for each expected waste type are defined in the historical DQO. This comparison may lend strong evidence that the predicted waste type is in the tank and at the predicted location within the waste matrix. The historical DQO requires that two tests be performed for each waste type. The first test determines if the analytes of interest contribute to more than 85 percent of the total waste. The second test checks if the analytical results are $\geq$ 10 percent of the DQO levels for each analyte of interest. If a particular waste type passes these two tests, the waste type and layer identification are considered acceptable for further investigation (Simpson and McCain 1995).

Historical modeling estimates that the solid waste in tank 241-U-108 consists of four layers. From the volume of each historical waste layer, the number and identity of the core segments that make up each layer may be identified. Solids from segments 2 through 4 are expected to consist of supernatant mixing model (SMMS2), or S2 saltcake waste type from the 242-S Evaporator. Because of expected horizontal variability in the tank, and to account for possible errors in the waste volume predictions, the lower half of segment 4 was not included in the analysis. Segments 5 through 8 are expected to consist of SMMS1, or S1 saltcake from the 242-S Evaporator. The bottom 15 cm (6 in.) of waste is expected to be cladding waste generated from 1961 to 1972 (CWR2) from the REDOX facility. The tank layer model indicates that tank 241-U-108 contains 11 kL (3 kgal) of metal waste (MW). Even if a residual heel is present, it is unlikely that it was sampled, because it would be expected to reside in the tank's dished bottom, which has a volume of 47 kL (12.5 kgal), and all three core samples were removed from risers along the perimeter of the tank where the dish is inaccessible. Nevertheless, the waste in segment 9 was evaluated for MW. The waste recovered from segment 9 varied in color and texture considerably (see Tables B1-2 through B1-4). For this reason, the white material in the upper half of segment 9 from core 141 was treated separately from the black waste from segment 9 from core 145 and the upper half of segment 9 from core 146.

Table 2-1 presents the expected and actual concentrations of the analytes of interest for each waste type expected in tank 241-U-108. The data indicate that the material in segment 2 through the upper half of segment 4, and in segments 5 through 8, is consistent with SMMS1 and SMMS2 waste types, respectively, although there are distinct differences in the waste from each volume of the tank: segments 5 through 8 contain more aluminum and carbonate, but much less nitrate, than segments 2 through 4. The black material from segment 9 was expected to be CWR2 waste; it passes the 10 percent test for CWR2 waste and SMMS2 and SMMS1 waste, but fails the 85 percent mass test. On the other hand, the CWR2 and MW waste type analytes from the historical DQO do not add to 85 percent either. Because of the high sodium and low uranium content in the black segment 9 material, this waste seems to be a mixture of CWR2 and supernatant mixing model (SMM) waste types. The white material from segment 9 also appears to be a mixture of CWR2 and SMM waste types. None of the material from segment 9 is consistent with MW, because it lacks adequate uranium concentrations.

In summary, the waste in tank 241-U-108 appears to be "spatially complex" as labeled in the historical DQO, because four reasonably distinct regions were identified from inspection of the data. The data suggest that the tank contains several layers of waste with differing compositions. However, after comparison with the expected waste types, there is no strong evidence that the saltcake wastes are distinguishable from each other or from the expected waste composition. The sludges observed at the bottom of the tank did not agree with any expected waste composition, and appeared to be a mixture of wastes, but were much different in composition than the saltcake.

2.3 WASTE COMPATIBILITY EVALUATION

The compatibility DQO (Carothers 1994) involves two issues: 1) "Assurance that no safety problems are created as a result of commingling wastes under interim storage;" and 2) "Assurance of continued operability during waste transfer and waste concentration/minimization..." In accordance with the compatibility DQO and the waste compatibility SAP (Schreiber 1995), the 1995 grab sample U-108-1 from tank 241-U-108 was analyzed to assess the safety and operational implications of commingling the wastes in the tank and the double-shell tank systems. Safety considerations include criticality, flammable gas generation and accumulation, energetics, corrosion and leakage. Operational considerations include plugged pipelines and equipment, transuranic (TRU) segregation, complexant waste segregation, and heat load limits of the receiving tank. Not all of the safety and operational considerations were within the scope of this report, notably the potential chemical reactivity of the waste in a variety of different situations, and the tendency of the waste to plug piping and equipment. Table 2-2 presents the analyses used to evaluate

Table 2-1. Expected and Measured Concentrations for Tank 241-U-108 Waste Types.

	Expected Historical Waste Type Concentrations				Measured Concentrations[1]			
	Waste Type							
Analyte	SMMS2 (µg/g)	SMMS1 (µg/g)	CWR2 (µg/g)	MW (µg/g)	Seg. 2 - 4 (UH[3]) (µg/g)	Seg. 5 - 8 (µg/g)	Seg 9, Black (µg/g)	Seg 9, White (µg/g)
Al	44,000	24,300	95,200	n/a	10,840	16,490	14,870	78,950
Cr	1,300	n/a	n/a	n/a	3,000	4,270	7,362	927
Na	197,000	142,900	39,000	74,400	243,100	255,600	207,000	193,000
Water	27.0%	47.2%	51.2%	38.3%	29.8%	35.3%	38.9%	32.3%
NO_3^-	209,500	191,700	n/a	n/a	444,500	261,800	97,650	193,000
CO_3^{2-}	24,100	19,000	n/a	32,000	4,644	10,600	13,675	844
PO_4^{3-}	n/a	n/a	n/a	30,400	n/a	n/a	n/a	38,750
SO_4^{2-}	n/a	n/a	n/a	56,500	n/a	n/a	n/a	27,970
U	n/a	n/a	25,500	164,200	n/a	n/a	4,030[2]	2,940[2]
% of Mass	n/a	n/a	n/a	n/a	100.4	90.2	73.0	85.9

Notes:

[1]Concentrations were calculated from the data in Section B2.0 by averaging the results for each subsegment from each core for each waste type.

[2]Detected uranium concentrations were only found on the core 141, 145, and 146 composites. For the purposes of this evaluation, all uranium was attributed to the respective part of segment 9.

[3]Upper half (of segment 4)

Table 2-2. Decision Variables and Criteria for the Waste Compatibility Data Quality Objective. (2 Sheets)

Safety Issue	Primary Decision Variable	Decision Criteria Threshold	Mean Analytical Result
Criticality	[$^{239/240}$Pu]	$^{239/240}$Pu + 1.077E-10 * (U-gross) > 0.013 g/L (> 0.7995 μCi/mL)[1]	Less than 9.33E-05 μCi/mL
Flammable gas	Specific gravity	> 1.30	1.39[1]
Ferrocyanide/organics	Total fuel content	No exothermic reactions below 177 °C (350 °F), absolute value of exotherm/endotherm ≥ 1. No notification required.	No exothermic reactions below < 177 °C (350 °F), absolute value of exotherm/endotherm < 1.
Corrosion and leakage	[NO_3^-] [OH^-] [NO_2^-]	> 341,000 μg/mL[1] < 171 or > 135,000 μg/mL[1] < 506 or > 252,000 μg/mL[1]	1.74E+05 μg/mL 49,200 μg/mL 1.16E+05 μg/mL
Operations Issue			
TRU segregation	TRU elements	[$^{239/240}$Pu], [^{238}Pu], [^{241}Am], [U total], [$^{243/244}$Cm], [^{237}Np] total concentration > 0.1 μCi/g	[$^{239/240}$Pu] < 9.33E-05 [^{241}Am] = 2.39E-03 U, Np, and Cm not analyzed
Complexant segregation	Measured by selected analyte concentration, or by performing a boildown test in the laboratory.		

Table 2-2. Decision Variables and Criteria for the Waste Compatibility Data Quality Objective. (2 Sheets)

Safety Issue	Primary Decision Variable	Decision Criteria Threshold	Mean Analytical Result
Operations Issue			
Heat load	Heat generation rate from radioactive decay	≤ 20,000 W (70,000 Btu/hr)	2,140 W

Note:

[1]The SAP does not indicate any notification limit, although the DQO does specify the notification limit given. No notifications were made.

the waste in terms of the safety and operational considerations that are within the scope of this report. The primary decision variable, the notification limit, and the analytical results from the 1995 grab sampling event are listed for each safety or operational issue. All listed analyses and evaluations were well within the notification limits imposed by the waste compatibility DQO.

The analytical mean for $^{239/240}Pu$ was well below the notification limit. Flammable gases may accumulate in wastes with high specific gravity (>1.30). The mean specific gravity for the 1995 grab sample was 1.39. Transfers may be allowed with a specific gravity of the source > 1.3, provided that the specific gravity of the commingled wastes is ≤ 1.41. The limit for energetics is an exotherm/endotherm ratio < 1 for all reactions below 177 °C (350 °F). This limit was met. The limits for corrosion protection as stated in the compatibility DQO are based on the receiving tank temperature and the concentrations of the corrosion-inhibiting chemicals that are added to the waste. The limits as stated in Table 2-2 apply to tanks with operating temperatures of < 75 °C (167 °F).

Operations issues are based on the policy of segregating TRU and complexant wastes, avoiding excess heat in the tanks, and ensuring pumpability of the source waste to the receiving tank. The total concentration of TRU elements can be calculated by converting the values to a per-weight basis from the per-volume basis by dividing the analytical result for each radionuclide by the mean drainable liquid specific gravity, and summing the per-weight results. The total can then be compared to the 0.1-μCi/g [100-nCi/g] standard for segregating TRU waste from non-TRU. In the case of tank 241-U-108, all applicable results were less than the detection limit. The waste is non-TRU.

2.4 TANK VAPOR EVALUATION

The data needed to determine whether compounds present in the tank headspace were at levels such that the industrial hygiene group needed to be alerted to their presence were documented in *Data Quality Objectives for Generic In-Tank Health and Safety Vapor Issue Resolution* (Osborne et al. 1994) and *Rotary Core Vapor Sampling Data Quality Objective* (Price 1994). The sampling and analytical requirements of the two vapor DQOs were specified in the *Vapor Sampling and Analysis Plan* (Homi 1995). Tank vapors are no longer being addressed as a health concern (Hewitt 1996).

The sampling and analytical requirements of the vapor SAP were only partially met. No vapor samples were analyzed for three of the required organic species, and no vapor sample was sent to Oak Ridge National Laboratory (ORNL) for organic analysis as required in the SAP.

The vapor sampling system, sample device cleaning, sample preparations, and analyses are described in Mahon (1995). The analytical results and interpretation of those results are in Thomas et al. (1996) and are summarized below.

Of the measured analytes, two exceeded the respective notification limits specified in the vapor SAP: ammonia and N-nitrosodimethylamine. The ammonia concentration (692 ppmv) greatly exceeded the decision threshold of 150 ppmv. An "immediate" notification of the ammonia result was made to the proper personnel (Ligotke 1995). No evidence of a notification of the N-nitrosodimethylamine presence was found. Because the "immediately dangerous to life and health" (IDLH) exposure limit is not available for this compound (NIOSH 1994), and the notification limit is 50 percent of the IDLH value, one could argue that the notification limit was not exceeded. Another concern is that the toxicity decision rule in the vapor DQO (Osborne et al. 1994) requires that carcinogens, teratogens, mutagens, toxins, and irritants be in respective concentrations below one tenth, one half, and one half of the consensus exposure standard (CES). Except for two compounds, the notification limits for organic compounds in the vapor SAP are one half of the IDLH value, which varies greatly from the CES values published (Bratzel 1995) for 43 tanks that were vapor sampled earlier. Neither the SAP nor the analytical report mentions the CES for any analyte.

2.4.1 Permanent Gases

The vapor concentrations of the measured permanent gases, NH_3, NO_2, NO, and the vapor mass concentration (primarily H_2O), were determined. Two of the four average concentration results for ammonia and water exceeded the minimum of the expected ranges. An immediate notification (phone and electronic memo) was provided on September 9, 1995 after preliminary analytical results indicated the NH_3 concentration in tank 241-U-108 exceeded the notification level; notification levels and notification procedures are described in the SAP. The complete results of the permanent-gas analysis of tank 241-U-108 can be found in Thomas et al. (1996). In summary, hydrogen (522 ppmv) and nitrous oxide (612 ppmv) were observed above the method detection limit in the tank headspace samples, and carbon dioxide in the headspace samples was at a lower concentration than observed in the ambient air.

2.4.2 Total Non-Methane Hydrocarbons

The complete results of the total non-methane hydrocarbon analysis of tank 241-U-108 vapor samples can be found in Thomas et al. (1996). In summary, the average concentration in the three tank headspace samples was 11.99 mg/m^3. This compares to 6.08 mg/m^3 for the sum of all compounds identified in the target and tentatively identified compound (TID) analysis of the SUMMA[1] canisters.

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

2.4.3 Volatile Organic Analysis

The complete results of the volatile organic analysis of tank 241-U-108 vapor samples can be found in Thomas et al. (1996). In summary, 14 target analytes above the 5-ppbv reporting cutoff and 12 TIDs above the 10-ppbv reporting cutoff were detected. Thirteen target analytes and all TIDs were identified in two or more samples. The total concentration of the target analytes was found to be 3.47 mg/m^3. The total TID concentration was found to be 2.60 mg/m^3. The total concentration of all the compounds identified was 6.08 mg/m^3. The compound 2-butanone was the only target analyte observed in the upwind ambient air sample. Acetone was observed in the ambient air through the vapor sampling system sample. No TIDs were observed in the two ambient air samples.

2.4.4 Semi-Volatile Organic Analysis

The complete results of the sorbent trap analysis of tank 241-U-108 vapor samples can be found in Thomas et al. (1996). In summary, 19 target analytes above the 5-ppbv reporting cutoff and 13 TIDs above the 10-ppbv reporting cutoff were detected. Eighteen of 19 target analytes and 9 of 13 TIDs were observed in two or more sorbent traps. Two of 13 TIDs were designated as unknowns. The total concentration of the target analytes was found to be 4.49 mg/m^3, the total concentration of the TIDs was found to be 4.25 mg/m^3, and the total concentration of all the compounds identified was 8.74 mg/m^3.

2.5 OTHER TECHNICAL ISSUES

Heat generation and waste temperature are factors used in assessing tank safety. Heat is generated in the tanks from radioactive decay. An estimate of the tank heat load was calculated using the mean Cs-137, Sr-90, and total alpha data from the 1996 core sampling effort. Total alpha was assumed to be all Pu-239. Some of the total alpha is almost certainly due to Am-241; however, this radionuclide produces nearly the same heat per curie as Pu-239. The heat value calculated was 2,140 W (7,300 Btu/hr). The HTCE heat load estimate was 3,800 W (13,000 Btu/hr). Both these determinations are well below the limit of 11,700 W (40,000 Btu/hr) that separates high- and low-heat-load tanks (Smith 1986).

2.6 SUMMARY

The analytical results indicate that the tank is conditionally safe. However, the sampling requirements of the safety screening and organic DQO documents were not completely met because two complete vertical profiles were not acquired. Additional sampling may be necessary to satisfy the safety screening and organic DQOs. Three subsamples from tank 241-U-108 exceeded the DSC safety decision threshold limit of 480 J/g at the 95 percent upper confidence interval on the mean; however, in each case adequate moisture was present to mediate the exothermic behavior.

Nineteen samples were below the organic DQO moisture decision threshold of 17 percent at the lower 95 percent confidence limit on the mean, but the low moisture was mediated by the low TOC content of the samples. A summary of the DQOs and the test plan that applied to this tank is presented in Table 2-3.

Comparison of the waste transfer history and waste historical modeling of the tank with the analytical results suggests the waste does correspond with the predicted waste type compositions, and is "spatially complex" as described in the historical DQO. Also, the presence of MW could not be confirmed because no waste from the tank's dished bottom was sampled. The tank's process history suggests that little MW remains in the tank. The tank's second position in the cascade, and its sluicing history, substantially lower the likelihood of any residual MW.

Table 2-3. Summary of DQO and Test Plan Evaluations.

Issue	Sub-issue	Result
Safety screening	Energetics	Mean exotherm above 480 J/g observed in one sample; two additional samples exceeded 480 J/g at the 95 percent upper confidence interval on the mean. Exotherms were mediated by high (>17%) moisture in each case.
	Flammable gas	All vapor measurements reported <25 percent of LFL.
	Criticality	All analyses were well below 35.3 μCi/g total alpha.
Organic	TOC	All TOC results were well below the 3% threshold (dry) at the 95% upper confidence limit of the mean.
	Moisture	Nineteen samples were below the moisture decision threshold of 17% at the lower 95% confidence limit on the mean. Low moisture was mediated by the low TOC content of the samples.
Historical	Total mass of indicators	Failed for MW and CWR2 waste types. Other waste types passed.
	Comparison of each indicator	Passed for SMMS1, SMMS2, and CWR2 waste types.
Waste Compatibility	Criticality	Passed
	Flammable gas retention	Failed[1]
	Energetics	Passed
	Corrosion	Passed
Health and safety vapor	Flammability	Passed
	Carcinogens Teratogens Mutagens	Passed[2]
	Toxins	Passed
	Irritants	Failed. Ammonia concentration exceeded the notification limit.

Notes:

[1]Flammable gases may accumulate in wastes with high specific gravity (>1.30). The mean specific gravity for the 1995 grab sample was 1.39. Transfers may be allowed with a specific gravity of the source > 1.3, provided that the specific gravity of the commingled wastes is ≤ 1.41.

[2]Technically, the notification limit for N-nitrosodimethylamine was not exceeded; however, NIOSH (1994) recommends precautions if any amount is detected.

3.0 BEST-BASIS INVENTORY ESTIMATE

Information about the chemical and/or physical properties of tank wastes is used to perform safety analyses, engineering evaluations, and risk assessments associated with waste management activities, as well as to address regulatory issues. Waste management 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 the wastes into a form that is suitable for long-term storage. Chemical inventory information generally is derived using two approaches: 1) component inventories are estimated using the results of sample analyses; and 2) component inventories are predicted using a model based on process knowledge and historical information. The most recent model was developed by Los Alamos National Laboratory (LANL) (Agnew et al. 1996a). Not surprisingly, information derived from these two different approaches is often inconsistent.

An effort is underway to provide waste inventory estimates that will serve as standard characterization information for the various waste management activities (Hodgson and LeClair 1996). As part of this effort, an evaluation of available chemical information for tank 241-U-108 was performed that included:

- Data from recent analyses of three core samples collected in April/May 1996 (Bell 1996). See Appendix B, Section B2.0 for data.

- The solids composite inventory estimate for this tank generated from the Hanford defined waste (HDW) model (Agnew et al. 1996a), developed at Los Alamos National Laboratory.

The results from this evaluation support using the sampling data for tank 241-U-108 for the following reasons.

1. Core sample data were available from three risers at three widely spaced positions. Recovery of sample segments was good for most samples and consistent from core to core. Also, concentrations in each segment were consistent from core to core. Upon inspection of data collection and analysis protocols, no reasons were found to reject the laboratory data.

2. The sample-based inventory reconciles better with the position that the sludge layer in the tank is REDOX cladding waste (CW) rather than bismuth phosphate MW, and that sluicing of earlier MW was complete.

3. The evaporator concentrate wastes (SMMS1 and SMMS2) that make up the majority of the waste volume in tank 241-U-108 can be compared with no independent data source. The process of mixing and evaporating supernatants is sufficiently complex that comparison to process flowsheets or multicomponent chemical modeling is impractical.

Best-basis inventory estimates for tank 241-U-108 are presented in Tables 3-1 and 3-2. The projected inventories are based on a sample-derived waste density of 1.74 g/mL for segment sample data, 1.71 g/mL for core composite data, and 1.40 g/mL for the drainable liquid data.

Table 3-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-U-108. (2 sheets)

Analyte	Total inventory (kg)	Basis (S, M, or E)[1]	Comment
Al	51,190	S	Average segment sample data plus liquid data
Bi	437	E	Average based on S1 and S2 TCR saltcake data
Ca	447	S	Average based on acid digest of core composite data
Cl	10,914	S	Average segment sample data plus liquid data
TIC as CO_3	118,500	S	Average segment sample data plus liquid data
Cr	12,116	S	Average segment sample data plus liquid data
F	2,836	S	Average segment sample data plus liquid data
Fe	507	S	Core composite acid digest samples
K	4,800	S	Core composite samples
La	<117	S	Core composite samples below detection limit
Mn	185	S	Core composite acid digest samples
Na	726,100	S	Average segment sample data plus liquid data
Ni	150	S	Core composite acid digest samples
NO_2	157,800	S	Average segment sample data plus liquid data
NO_3	879,500	S	Average segment sample data plus liquid data
Pb	<234	S	Core composite samples below detection limit
P as PO_4	50,527	S	Average segment sample data plus liquid data
Si	830	S	Average core composite water wash sample plus liquid
S as SO_4	44,430	S	Average segment sample data plus liquid data
Sr	<23.4	S	Core composite below detection limit
TOC	12,850	S	Average segment sample data plus liquid data

Table 3-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-U-108. (2 sheets)

Analyte	Total inventory (kg)	Basis (S, M, or E)[1]	Comment
U_{TOTAL}	538	S	Laser phosphorescence data from core composite samples
Zr	<23.4	S	Core composite below detection limit

Notes:

TIC = Total inorganic carbon

[1]S = Sample-based
M = HDW model-based
E = Engineering assessment-based

Table 3-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-U-108.

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{60}Co	<61.5	S	Average solid segment data
^{90}Sr	29,400	S	Average solid segment data
^{137}Cs	411,000	S	Average core segment data
^{154}Eu	<241	S	Average core segment data
^{155}Eu	<884	S	Average core segment data
^{241}Am	<1,930	S	Average core segment data

Notes:

[1]S = Sample-based
M = HDW model-based
E = Engineering assessment-based

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4.0 RECOMMENDATIONS

Three subsamples from the 1996 core sampling of tank 241-U-108 exceeded the DSC safety decision threshold limit of 480 J/g at the 95 percent upper confidence interval on the mean; however, in each case adequate moisture was present to mediate the exothermic behavior. Nineteen samples were below the organic DQO moisture decision threshold of 17 percent at the lower 95 percent confidence limit on the mean, but the low moisture was mediated by the low TOC content of the samples. Despite high DSC and low moisture results on specific samples, the tank would ordinarily be classified as conditionally safe. However, the sampling requirements of the safety screening and organic DQO documents were not completely met.

Two complete vertical profiles of the waste were not acquired and additional sampling may be necessary to satisfy the safety screening and organic DQOs. Obtaining two complete vertical profiles is especially important for this tank because the data from the recent core samples show that: 1) the waste is heterogenous; 2) the waste is relatively dry (< 17 percent moisture) in specific locations; 3) that most half-segment subsamples exhibit exothermic behavior; and 4) that three samples were energetic enough to exceed the DSC notification limit at the one-sided 95 percent upper confidence limit on the mean.

The sampling and analysis requirements of the vapor DQO document were not met. Analyses for 1,3-butadiene, butanal, and tributyl phosphate were not performed, possibly because no sample was sent to ORNL for organic analysis. One vapor sample exceeded the notification limit for ammonia. Since the 1995 vapor sampling, tank vapors are no longer being evaluated as a health concern (Hewitt 1996).

The requirements of the historical DQO document were satisfied by the sampling and analysis of the three 1996 core samples. The requirements of the compatibility DQO document were satisfied by the 1995 liquid grab sample. Analysis of the core samples allowed for development of a characterization best-basis inventory.

Table 4-1 summarizes the status of the Project Hanford Management Contract (PHMC) TWRS Program review and acceptance of the sampling and analysis results reported in this tank characterization report. All DQO issues required to be addressed by sampling and analysis are listed in column one of Table 4-1. The second column indicates whether the requirements of the DQO were met by the sampling and analysis activities performed and is answered with "Yes," "No," or "Partially." The third column indicates concurrence and acceptance by the program in TWRS that is responsible for the DQO that the sampling and analysis activities performed adequately meet the needs of the DQO. A "Yes" or "No" in column three indicates acceptance or disapproval of the sampling and analysis information presented in the TCR. Because the waste at the bottom of the tank was not sampled (see Section B3.1) the safety screening DQO has been only partially completed. The upper part of the waste was sampled and analyzed in accordance with the safety screening DQO and accepted by the responsible TWRS program.

Table 4-2 summarizes the status of PHMC TWRS Program review and acceptance of the evaluations and other characterization information contained in this report. The evaluations specifically outlined in this report are the best-basis inventory evaluation, the historical evaluation, and the evaluation to determine whether the tank is safe, conditionally safe, or unsafe. Column one lists the different evaluations performed in this report. Columns two and three are in the same format as Table 4-1. The manner in which concurrence and acceptance are summarized is also the same as that in Table 4-1. The safety categorization of the tank is listed as "No" in Table 4-2 because the full depth of the waste was not sampled, the number of samples displaying exothermic behavior, and evidence of dry (less than 17 percent moisture) areas in the waste. However, none of the analyses performed on the 1996 core samples indicate any safety problems.

Table 4-1. Acceptance of Tank 241-U-108 Sampling and Analysis.

Issue	Sampling and Analysis Performed	PHMC TWRS Program Office Acceptance
Safety screening DQO	Partially	No
Organic complexant DQO	Partially	No
Organic solvent screening[1]	Yes	Yes
Historical evaluation DQO	Yes	Yes
Waste compatibility DQO	Yes	Yes
Generic in-tank health & safety DQO	Partially	Yes[2]
Organic test plan	Partially	No

Notes:

[1]Considered part of the Organic DQO (Cash 1996)

[2]Tank vapors are no longer being evaluated as a health concern (Hewitt 1996)

Table 4-2. Acceptance of Evaluation of Characterization Data and Information for Tank 241-U-108.

Issue	Evaluation Performed	PHMC TWRS Program Office Acceptance
Historical evaluation	Yes	Yes
Safety categorization (Tank is safe)	No	No

Resampling of tank 241-U-108 using push-mode core sampling is recommended in order to provide the two full-depth profiles required by the safety screening and organic DQO documents. Further evaluation of the information available on tank 241-U-108 is recommended to determine if additional samples are needed to categorize the tank as "safe." Analysis for total cyanide and adiabatic calorimetry of the samples that exceeded the DSC decision threshold is recommended in order to satisfy the safety screening analytical requirements. In addition, analysis of 1996 core material for adiabatic calorimetry, tube propagation, diethylenediamine tetracacetic acid, hydroxyethylenediamine tetraacetic acid, nitrilotriacetic acid, citrate, acetate, formate, and dibutyl phosphate is recommended to satisfy the analytical requirements of the organic test plan.

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APPENDIX A

HISTORICAL TANK INFORMATION

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APPENDIX A

HISTORICAL TANK INFORMATION

Appendix A describes tank 241-U-108 based on historical information. For this report, historical information includes any information about the fill history, waste types, surveillance, or modeling data about the tank. This information is necessary for providing a balanced assessment of the sampling and analytical results.

This appendix contains the following information:

- **Section A1**: Current status of the tank, including the current waste levels as well as the stabilization and isolation status of the tank.
- **Section A2**: Information about the design of the tank.
- **Section A3**: Process knowledge of the tank; that is, the waste transfer history and the estimated contents of the tank based on modeling data.
- **Section A4**: Surveillance data for tank 241-U-108, including surface-level readings, temperatures, and a description of the waste surface based on photographs.
- **Section A5**: References for Appendix A.

Historical sampling results (results from samples obtained prior to 1989) are included in Appendix B.

A1.0 CURRENT TANK STATUS

As of July 31, 1996, tank 241-U-108 contained an estimated 1,771 kL (468 kgal) of waste classified as non-complexed (Hanlon 1996). Liquid waste volumes are estimated using a level measurement gauge. The solid waste volumes are estimated using a sludge level measurement device. The solid waste volume was last updated on June 30, 1996. The amounts of various waste phases in the tank are presented in Table A1-1.

Tank 241-U-108 is out of service, as are all single-shell tanks. It is partially interim isolated, is categorized as sound, and has not been interim stabilized. The tank is on the Hydrogen/Flammable Gas Watch List and is passively ventilated. All monitoring systems were in compliance with documented standards as of September 30, 1996 (Hanlon 1996).

Table A1-1. Tank Contents Status Summary.

Waste Type	kL (kgal)
Total waste	1,771 (468)
Supernatant liquid	91 (24)
Sludge	110 (29)
Saltcake	1,570 (415)
Drainable interstitial liquid	651 (172)
Drainable liquid remaining	742 (196)
Pumpable liquid remaining	791 (209)

Note:
Hanlon (1996)

A2.0 TANK DESIGN AND BACKGROUND

The 241-U Tank Farm was constructed during 1943 and 1944 in the 200 West Area. It is one of twelve 2,010-kL (530-kgal) tanks in U Farm. 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 75 mm (3 in.) in diameter connects tank 241-U-108 as second in a cascade series of three tanks beginning with tank 241-U-107 and finishing with tank 241-U-109. Each tank in the cascade series is set 30 cm (1 ft) lower in elevation than the preceding tank.

Tank 241-U-108 has a dished bottom with a 1.2-m (4-ft) radius knuckle, a diameter of 23 m (75 ft), and an operating depth of 5.2 m (17 ft) (Leach and Stahl 1996). It was designed with a primary mild steel liner (ASTM A283 Grade C) and a concrete dome with 13 risers. The tank is set on a reinforced concrete foundation. The tank and foundation were waterproofed with a coating of tar covered by a three-ply, asphalt-impregnated waterproofing fabric. The waterproofing was protected by a welded-wire-reinforced mixture of cement, sand, and water. 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.

A plan view depicting riser configuration is shown as Figure A2-1. Risers 9 and 10, 100 mm (4 in.) in diameter, and 2 and 7, 300 mm (12 in.) in diameter, are available for sampling (Lipnicki 1996). Table A2-1 shows numbers, diameters, and descriptions of the risers and the nozzles. The tank's 13 risers range in diameter from 100 mm (4 in.) to 1.1 m (42 in.). A tank cross-section showing the approximate waste level and a schematic of the tank equipment is shown in Figure A2-2.

Figure A2-1. Riser Configuration for Tank 241-U-108.

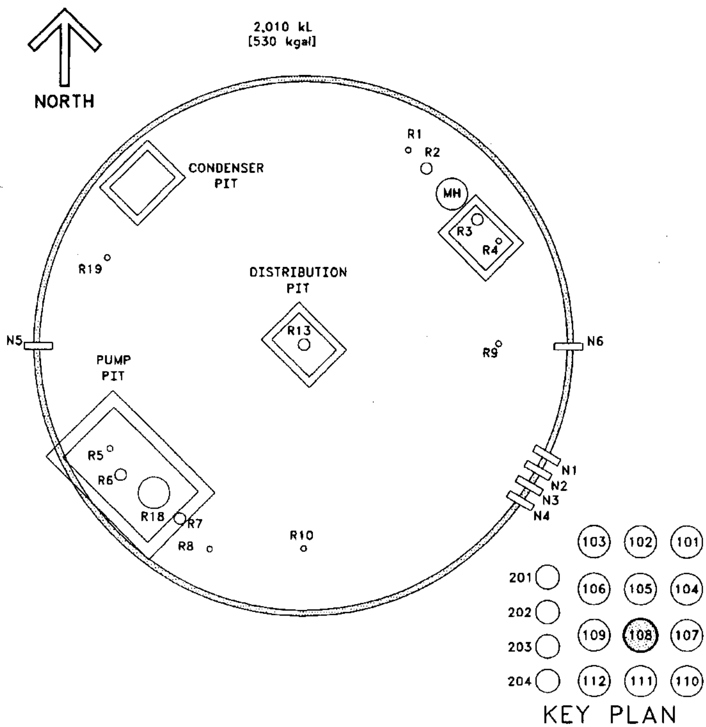


Table A2-1. Tank 241-U-108 Risers.[1,2]

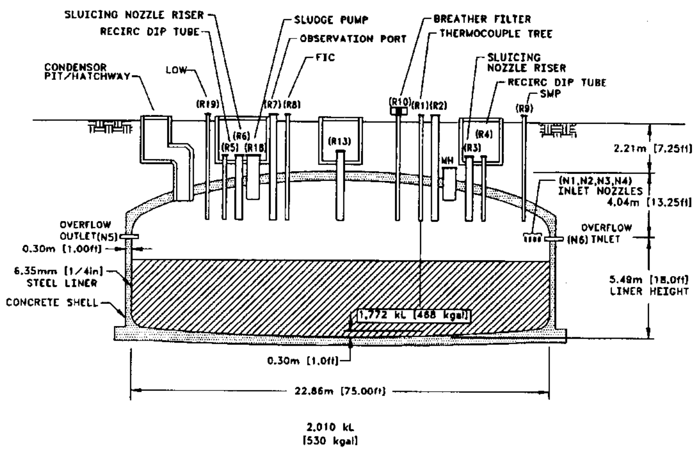
Number	Diameter (in.)	Description and Comments
R1	4	Thermocouple tree [Benchmark CEO-37531, December 11, 1986]
R2	12	Blind flange
R3	12	Sluice nozzle, weather covered
R4	4	Recirculation line dip legs, weather covered
R5	4	Recirculation line dip legs, weather covered
R6	12	Sluice nozzle, weather covered
R7	12	B-222 observation port
R8	4	ENRAF[3] 854, ECN-620751, February 27, 1995 [prior Food Instrument Corporation (FIC) gauge]
R9	4	Sludge measurement port [Benchmark CEO-37531, December 11, 1986]
R10	4	Breather filter [Standard Hydrogen Monitor System/breather filter, ECN-W369-021, January 13, 1995]
R13	12	Distributor Jet for saltwell pumping
R18	42	Sludge pump, weather covered
R19	4	B-436 liquid observation well (LOW)
N1	3	Spare, capped
N2	3	Spare, capped
N3	3	Spare, capped
N4	3	Spare, capped
N5	3	Outlet overflow
N6	3	Inlet overflow

Notes:

CEO = Change engineering order
ECN = Engineering change notice

[1]Alstad 1993
[2]Tran 1993
[3]Trademark of ENRAF Corporation, Houston, Texas.

Figure A2-2. Tank 241-U-108 Cross Section and Schematic.



A3.0 PROCESS KNOWLEDGE

The sections below: 1) provide information about the waste transfer history of tank 241-U-108; 2) describe the process wastes that were transferred; and 3) give an estimate of current tank contents based on waste transfer history.

A3.1 WASTE TRANSFER HISTORY

Table A3-1 summarizes the major (> 1,000 kL) waste transfers to and from tank 241-U-108 (Agnew et al. 1996a). Tank 241-U-108 began receiving MW in the first quarter of 1949 via the cascade line from tank 241-U-107. The tank was full and cascading to tank 241-U-109 by the end of the first quarter, and the cascade continued until the fourth quarter of 1954. The tank received flush water in the third quarter of 1953 and in the third and fourth quarters of 1954. In the fourth quarter of 1955, tank 241-U-108 again received flush water. Some of this waste was sluiced to tank 241-U-109. Most of the waste from the tank 241-U-108 was transferred out for the uranium recovery process by the first quarter of 1956.

From the second quarter of 1959 until the fourth quarter of 1964, tank 241-U-108 received REDOX cladding waste from tank 241-S-107. During the fourth quarter of 1961, the tank sent waste to tank 241-U-105. During the second quarter of 1963, the tank sent waste to tank 241-T-101. From the second through fourth quarters of 1968, the tank sent waste to tank 241-TX-118. In the second quarter of 1964 and the third quarter of 1968, the tank received cladding waste from the REDOX plant. The tank received supernatant waste from tank 241-U-107 from the fourth quarter of 1972 until the first quarter of 1976. During the second quarter of 1972 and the fourth quarter of 1973, the tank sent waste to tanks 241-TX-101 and 241-S-101, respectively. From the second quarter of 1975 through the first quarter of 1977, the tank received evaporator bottom waste from tank 241-S-102. During the same time period, supernatant waste was sent to tank 241-U-111, and evaporator feed waste was sent to 241-S-102.

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 Northwest Quadrant of the Hanford 200 West Area* (WSTRS) (Agnew et al. 1996b). The 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. 1996a). This document contains the Hanford defined waste (HDW) list, the supernatant mixing model (SMM), and the tank layer model (TLM).

Table A3-1. Tank 241-U-108 Major Transfers.[1,2]

Transfer Source	Transfer Destination	Waste Type	Time Period	Estimated Waste Volume	
				kL	kgal
241-U-107		MW	1949 - 1954	8 097	2 139
	241-U-109	MW	1949 - 1955	-7 908	-2 089
Miscellaneous		flush water	1953 - 1955	4 550	1 202
	241-U-109	MW	1955	-2 006	-530
241-S-107		CWR	1959 -1964	4 039	1 067
	241-U-105	CWR	1961	-1 220	-322
	241-T-101	CWR	1963	-1 640	-432
REDOX Plant		CWR	1964, 1968	3 590	948
	241-TX-118	CWR	1968	-7 366	-1 946
241-U-107		SU	1968 - 1972	5 913	1 562
	241-TX-101	SU	1972	-1 660	-439
	241-S-101	SU	1973	-1 270	-335
	241-U-111	SU	1975	-3 748	-990
241-U-107		SU	1975 - 1976	5 618	1 484
241-S-102		EB	1975 - 1977	1 242	328
	241-S-102	EB	1975 - 1977	-1 749	-462

Notes:

CWR = REDOX cladding waste
EB = Evaporator bottoms
SU = Supernatant

[1]Agnew et al. 1996a

[2]Because only major transfers are listed, the sum of these transfers will not equal the current tank waste volume.

- Historical Tank Content Estimate for the [Northeast, Northwest, Southeast, or Southwest] Quadrant of the Hanford 200 [East or West] Area. This set of four documents compiles and summarizes much of the process history, design, and technical information regarding the underground waste storage tanks in the 200 Areas.

- Tank Layer Model. The TLM defines the sludge and saltcake layers in each tank using waste composition and waste transfer information.

- Supernatant Mixing Model. This is a subroutine with 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 considered estimates that require further evaluation using analytical data.

Based on the TLM and the SMM, tank 241-U-108 contains 4 layers of waste, not including the supernatant, listed from last deposit into the tank to the first deposit; 697 kL (184 kgal) of 242-S Evaporator salt slurry (SMMS2), 874 kL (231 kgal) of 242-S Evaporator saltcake (SMMS1), 98 kL (26 kgal) of CWR2, and 11 kL (3 kgal) of metal waste (MW). A graphical representation of the estimated waste types and volumes for these layers can be seen in Figure A3-1.

The SMMS1 and SMMS2 waste compositions are calculated by the SMM on an individual tank basis and are considered concentrated supernatants. The MW layer should contain, from highest concentration above one weight percent, the following constituents: uranium, hydroxide, sodium, carbonate, and phosphate. Constituents contained in this layer above a tenth of a weight percent are sulfate, iron, nitrate, and calcium. The MW should have a relatively small activity because of the small quantities of cesium-137 (^{137}Cs) and strontium-90 (^{90}Sr). The REDOX cladding waste layer should contain, from highest concentration above one weight percent, the following constituents: hydroxide, aluminum, uranium, lead, nitrate, sodium, iron, and carbonate. Constituents contained in this layer above a tenth of a weight percent are calcium, nitrite, and mercury. REDOX cladding waste should have a relatively small activity due to the small quantities of ^{137}Cs and ^{90}Sr. Table A3-2 shows the historical estimate of the expected waste constituents and their concentrations.

Figure A3-1. Tank Layer Model.

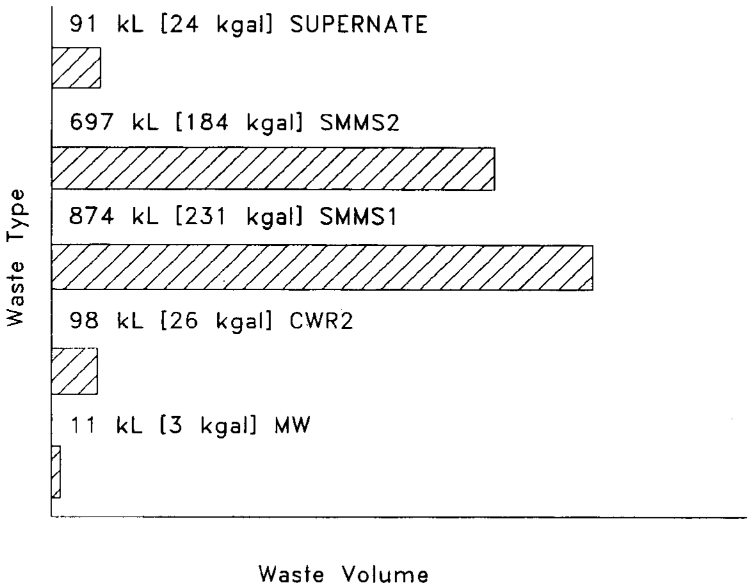


Table A3-2. Historical Tank Inventory Estimate.[1, 2] (2 sheets)

Total Inventory Estimate			
Physical Properties			
Total solid waste	2.88E+06 kg (468 kgal)		
Heat load	3.80 kW (1.30E+04 Btu/hr)		
Bulk density	1.62 (g/mL)		
Water wt%	33.0		
Total organic carbon wt% carbon (wet)	0.924		
Chemical Constituents	***M***	**µg/g**	**kg[3]**
Na^{+}	12.6	1.78E+05	5.13E+05
Al^{3+}	2.02	3.36E+04	9.68E+04
Fe^{3+} (total Fe)	3.43E-02	1.18E+03	3.39E+03
Cr^{3+}	6.50E-02	2.08E+03	5.98E+03
Bi^{3+}	1.18E-03	151	436
La^{3+}	4.22E-05	3.61	10.4
Hg^{2+}	6.21E-04	76.7	221
Zr (as $ZrO(OH)_2$)	7.96E-04	44.7	129
Pb^{2+}	1.91E-02	2.44E+03	7.02E+03
Ni^{2+}	7.06E-03	255	734
Sr^{2+}	1.41E-05	0.759	2.19
Mn^{4+}	4.47E-03	151	435
Ca^{2+}	5.54E-02	1.37E+03	3.94E+03
K^{1+}	5.91E-02	1.42E+03	4.10E+03
OH^{-}	8.82	9.23E+04	2.66E+05
NO_3^{-}	5.41	2.06E+05	5.94E+05
NO_2^{-}	2.58	7.31E+04	2.10E+05
CO_3^{2-}	0.516	1.91E+04	5.49E+04
PO_4^{3-}	9.99E-02	5.84E+03	1.68E+04
SO_4^{2-}	0.264	1.56E+04	4.50E+04
Si (as SiO_3^{2-})	8.71E-02	1.51E+03	4.33E+03
F^{-}	6.63E-02	775	2.23E+03
Cl^{-}	0.219	4.78E+03	1.38E+04
$C_6H_5O_7^{3-}$	3.54E-02	4.12E+03	1.19E+04

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

Chemical Constituents	*M*	ppm	kg[3]
$EDTA^{4-}$	1.86E-02	3.29E+03	9.47E+03
$HEDTA^{3-}$	3.41E-02	5.76E+03	1.66E+04
$glycolate^{-}$	0.110	5.08E+03	1.46E+04
$acetate^{-}$	9.55E-03	347	998
$oxalate^{2-}$	3.61E-05	1.96	5.63
DBP	2.25E-02	3.69E+03	1.06E+04
Butanol	2.25E-02	1.03E+03	2.95E+03
NH_3	5.96E-02	623	1.79E+03
$Fe(CN)_6^{4-}$	0	0	0
Radiological Constituents			
Pu		0.229 (μCi/g)	11.0 (kg)
U	5.30E-02 (M)	7.77E+03 (μg/g)	2.24E+04 (kg)
Cs	0.261 (Ci/L)	161 (μCi/g)	4.63E+05 (Ci)
Sr	0.137 (Ci/L)	84.3 (μCi/g)	2.43E+05 (Ci)

Notes:

DBP = Dibutyl phosphate

[1]Agnew et al. 1996b

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

[3]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-108 surveillance includes surface-level measurements (liquid and solid) and temperature monitoring inside the tank (waste and headspace). The data provide the basis for determining tank integrity.

Liquid-level measurement may indicate if a tank has a major leak. Solid surface-level measurements provide an indication of physical changes and consistency of the solid layers. Dry wells located around the tank perimeter may show increased radioactivity resulting from leaks.

A4.1 SURFACE-LEVEL READINGS

Tank 241-U-108 has a liquid observation well (LOW) located in riser 19. A gauge was used to monitor the waste surface level in tank 241-U-108 through riser 8 in the automatic mode until June 18, 1984, in the manual mode until January 16, 1995, and in the intrusion mode until May 3, 1995. A manual ENRAF™ system began recording on May 5, 1995. On July 8, 1996, the waste surface level was 4.53 m (178.5 in.), as measured by the manual ENRAF™ system. The surface level readings from the manual ENRAF™ system increased approximately 300 mm (12 in.) between the January 2, 1996 and April 2, 1996 readings, because of a change in the baseline for the ENRAF™ system from the top of the dish to the tank's bottom center. Tank 241-U-108 is not an assumed leaker. A graphical representation of the volume measurements is presented as a level history graph in Figure A4-1.

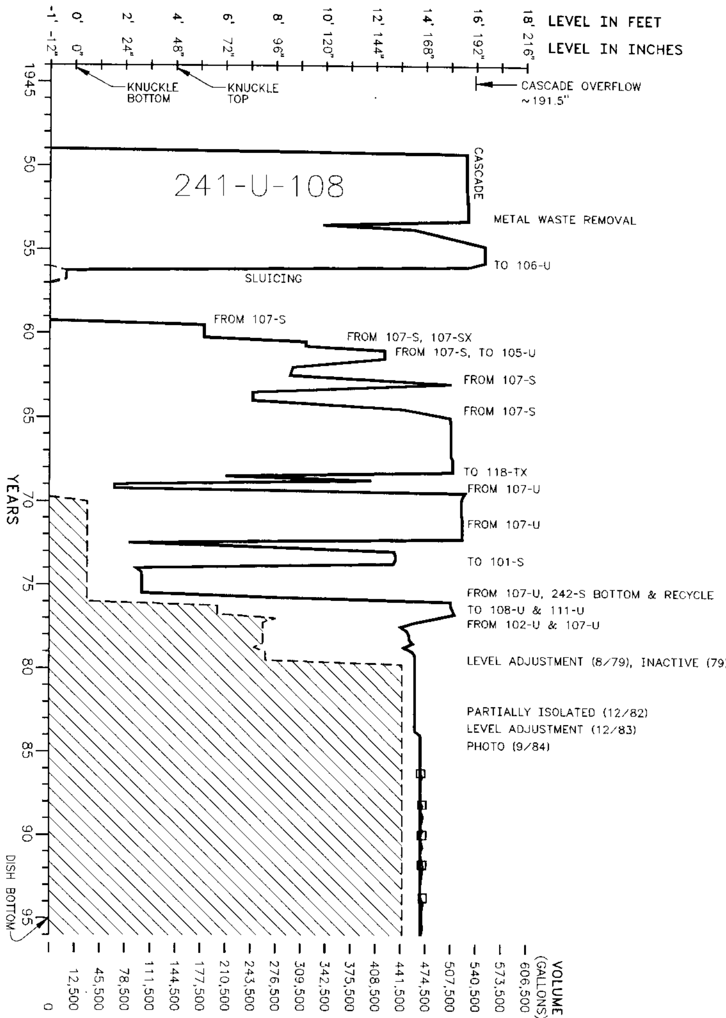
A4.2 DRYWELL READINGS

Tank 241-U-108 has four dry wells. Only dry well 60-08-04 (current readings <200 c/s) had readings greater than the 50 c/s background radiation.

A4.3 INTERNAL TANK TEMPERATURES

Tank 241-U-108 has a single thermocouple tree, located in riser 1, with 11 thermocouples to monitor the waste temperature. Elevations are available for all of the thermocouples. Temperature data recorded from July 5, 1987 through October 13, 1996 were obtained from the Surveillance Analysis Computer System (SACS) (LMHC 1996) for all 11 thermocouples. The average temperature of the SACS data was 28.1 °C (82.6 °F), the minimum was 16.6 °C (61.8 °F), and the maximum was 37 °C (98 °F). The average temperature of the SACS data over the last year (October 1995 through October 1996) was 28.3 °C (82.6 °F),

Figure A4-1. Level History for Tank 241-U-108.

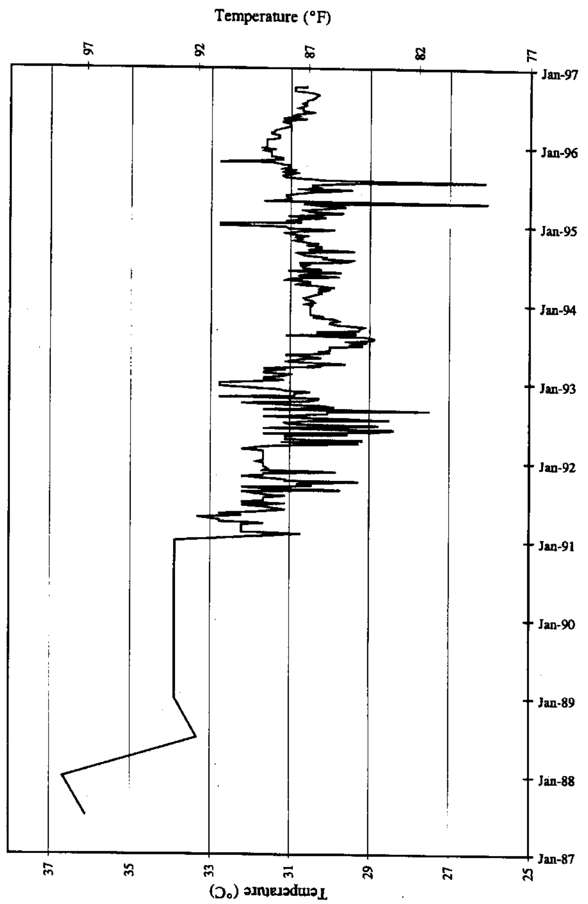


the minimum was 19.9 °C (67.8 °F), and the maximum was 33 °C (91 °F). A graph of the weekly high temperatures can be found in Figure A4-2. Plots of the individual thermocouple readings can be found in the *Supporting Document for the Historical Tank Content Estimate for U Tank Farm* (Brevick et al. 1994).

A4.4 TANK 241-U-108 PHOTOGRAPHS

The September 1984 photographic montage of tank 241-U-108's interior shows a dark surface of supernatant mixed with a tan-colored saltcake crust. In the foreground, a thermocouple tree has an accumulation of solids at the liquid surface. A recirculating dip tube and an overflow nozzle can be seen at the left. In the background, an FIC probe, a LOW, and a slurry pump can be observed. The bright white area near the temperature probe is the reflection from the camera light. The waste level has not changed since the photographs were taken; therefore, this photographic montage should accurately represent the tank waste's current appearance.

Figure A4-2. Weekly High Temperature Plot for Tank 241-U-108.



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APPENDIX B

SAMPLING OF TANK 241-U-108

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APPENDIX B

SAMPLING OF TANK 241-U-108

This appendix provides sampling and analysis information for each known sampling event for tank 241-U-108 and provides an assessment of the core, grab, and vapor sampling results.

- **Section B1**: Tank Sampling Overview
- **Section B2**: Analytical Results
- **Section B3**: Assessment of Characterization Results
- **Section B4**: References for Appendix B.

Future sampling of tank 241-U-108 will be appended to the above list.

B1.0 TANK SAMPLING OVERVIEW

This section focuses on the April/May 1996 core sampling and analysis events for tank 241-U-108. Three core samples were taken to satisfy the 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. 1996), *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995), and *Test Plan for Samples From Hanford Waste Tanks 241-BY-103, BY-104, BY-105, BY-106, BY-108, BY-110, TY-103, U-105, U-107, U-108, and U-109* (Meacham 1995). All three core samples were acquired and analyzed in accordance with the *Tank 241-U-108 Push-Mode Core Sampling and Analysis Plan* (SAP) (Homi 1996). Three liquid grab samples were taken in May/June 1995 to satisfy the requirements of *Data Quality Objectives for the Waste Compatibility Program* (Carothers 1994). Vapor samples were obtained in 1995 as required in *Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution* (Osborne et al. 1995). Additional sampling and analysis procedures can be found in the *Tank Characterization Reference Guide* (DeLorenzo et al. 1994).

Analytical results have also been reported for three "historical" sampling events: one in 1971, a liquid sample taken in late 1973 or early 1974, and a sludge sample taken in 1975. Because tank 241-U-108 was actively receiving waste until the first quarter of 1977, sampling events prior to this date no longer represent the current tank contents. Data from sampling and analysis events prior to 1989 may not be acceptable for some regulatory evaluations and decisions. None of the three pre-1995 analytical data were used to evaluate the present tank contents because of the age of the data and the lack of specifics concerning sample locations. The data are included in this report for historical comparison. Results from historical sampling events are compared with recent analytical results to corroborate data and to identify data trends.

B1.1 DESCRIPTION OF 1996 CORE AND 1995 GRAB SAMPLING EVENTS

Core samples 141, 145, and 146, containing 9 segments each, were respectively collected from risers 7, 9, and 2 of tank 241-U-108 between April 5, 1996 and May 6, 1996. A field blank of deionized water was created and delivered to the 222-S Laboratory with the core 146 samples. All segments were taken in the push mode and received, extruded, and analyzed at the 222-S Laboratories to support the requirements of the safety screening, organic, and historical DQO documents, and the organic test plan. Before taking each core sample, the flammability of tank vapors was checked using a flammable gas meter. This check was made to meet operational safety requirements and to fulfill the safety screening DQO requirement. To meet these requirements, the vapors in the tank headspace must be less than 25 percent of the lower flammability limit (LFL). This measurement was conducted in the field and was recorded in the work package (WHC 1996). The highest combustible gas meter reading observed from multiple readings in each of the three risers used for sampling was 8.6 percent of the LFL, observed in the headspace below riser 9 at 1115 hours on April 26, 1996.

Three liquid grab samples, U-108-1, U-108-2, and U-108-3, were removed from riser 7 of tank 241-U-108 on May 31, 1995 and received by the 222-S Laboratory on June 1, 1995. Sample U-108-1 was analyzed to support the waste compatibility safety issue. The remaining two samples were archived for possible future analysis.

The sampling and analytical requirements of the DQO documents covering the core, grab, and vapor samples are summarized in Table B1-1.

B1.2 SAMPLE HANDLING (1996 CORE AND 1995 GRAB SAMPLES)

Pertinent sampling information for the three core samples is provided in Tables B1-2, B1-3, and B1-4. Upon delivery to the 222-S Laboratory, cores 141, 145, and 146 were extruded and subsampled as prescribed in the SAP (Homi 1996). Video recordings and/or color photographs were taken of each segment immediately following extrusion and may be viewed by contacting the 222-S Laboratory.

The sampling and analysis schemes for the solids and liquids recovered from the three cores are provided in Homi (1996). When more than a 24-cm (9-in.) half segment was extruded, solid material from the extruded segments were divided into half segments labeled as upper and lower halves. The upper half is the material in the top half of the sampler; the material collected first by the sampler. Drainable liquids were identified as such. Core composites were created for all three cores in accordance with the historical DQO.

Table B1-1. Integrated Data Quality Objective Requirements for Tank 241-U-108.[1]

Sampling Event	Applicable DQO/Test Plan	Sampling Requirements	Primary Analytical Requirements
Core samples 141, 145, 146	Safety screening	Core samples from a minimum of three[2] risers separated radially to the maximum extent possible	Energetics, moisture content, total alpha, bulk density, flammable gas
Core samples 141, 145, 146	Organic	Core samples from three[2] risers	Energetics, moisture content, nickel, total organic carbon
Core samples 141, 145, 146	Historical	Core samples from three[2] risers	Energetics, moisture, total beta, anions, metals, uranium, Cs-137, Sr-90, bulk density
Core samples 141, 145, 146	Organic test plan	Core samples from three[2] risers	Energetics, moisture, TOC
1995 Grab samples	Waste compatibility	Liquid samples from one riser at three depths	Energetics, moisture content, total organic carbon, Cs-137, Sr-90, Al, Fe, Na, hydroxide, anions, carbonate, pH, Pu-239/240, Am-241, specific gravity, volume percent solids
Vapor samples	Generic in-tank health and safety	See Table B1-6	Organic vapors, hydrogen, nitrous oxide, carbon dioxide, carbon monoxide, ammonia, nitrogen dioxide, nitric oxide, water vapor
	Rotary core vapor		
	Organic solvent screening		

Notes:

[1]Winkelman (1996)

[2] No applicable DQOs required more than two core samples; however, *Tank Waste Characterization Basis* (Brown et al. 1995) required that three cores be taken.

One grab sample was broken down and subsampled for compatibility according to Schreiber (1995) following delivery to the 222-S Laboratory. Visual inspection of sample U-108-1 indicated that the sample contained less than 2 percent settled solids and that no organic layer was present. The remaining grab samples were archived.

Table B1-2. Sample Receipt and Extrusion Information for Tank 241-U-108, Core 141, Riser 7. (2 sheets)

Seg.	Date Sampled[1]	Date Received[1]	Date Extruded	Liner Liquid (g)	Drain. Liq. Recovered (g)	Solids Recovered (g)	Sample Description
1	4/5/96	4/16/96	4/23/96	0.0	152.5	84.1 (lower half)	Approximately 100 mL of drainable liquid were collected. The liquid was yellow but clear, and was placed into one jar. Approximately 10 cm (4 in.) of sludge, dark gray in color, were extruded. The sludge was subsampled in one jar.
2	4/8/96	4/16/96	4/22/96	0.0	0.0	195.0 (upper half)	About 19 cm (7.5 in.) of solids were extruded. The solids were collected in one jar and were gray in color. The texture resembled a mixture of sludge and saltcake.
3	4/8/96	4/16/96	4/22/96	0.0	0.0	129.5 (upper half)	About 10 cm (4 in.) of solids were extruded. The solids were medium gray in color and the texture resembled a mixture of sludge and saltcake.
3A	4/9/96	4/16/96	4/22/96	0.0	0.0	85.7 (upper half)	Approximately 10 cm (4 in.) of solids were collected in one jar. The solids were medium gray in color and the texture resembled a mixture of sludge and saltcake.
4	4/15/96	4/16/96	4/23/96	0.0	0.0	145.3 (upper half) 214.2 (lower half)	Roughly 38 cm (15 in.) of solids were recovered. The solids were blue gray in color and the texture resembled a mixture of sludge and saltcake. The solids were divided into upper and lower half subsegments.
4A	4/15/96	4/16/96	4/24/96	0.0	0.0	59.4 (upper half) 212.7 (lower half)	28 cm (11 in.) of solids, dark gray in color and resembling a sludge, were extruded. The solids were divided into upper and lower half subsegments.
5	4/15/96	4/23/96	4/29/96	0.0	0.0	242.7 (upper half) 237.7 (lower half)	48 cm (19 in.) of solids were collected. The solids were a damp, crystalline, bluish-gray saltcake, and were partitioned in upper and lower halves.

Table B1-2. Sample Receipt and Extrusion Information for Tank 241-U-108, Core 141, Riser 7. (2 sheets)

Seg.	Date Sampled[1]	Date Received[1]	Date Extruded	Liner Liquid (g)	Drain. Liq. Recovered (g)	Solids Recovered (g)	Sample Description
6	4/18/96	4/23/96	4/29/96	0.0	0.0	226.6 (upper half) 260.0 (lower half)	48 cm (19 in.) of solids were collected. The solids were medium bluish gray in color and were a damp, crystalline saltcake. They were divided into upper and lower half subsegments.
7	4/19/96	4/30/96	5/3/96	0.0	0.0	245.8 (upper half) 208.3 (lower half)	A full segment was collected as upper and lower half subsegments. The wet solids were medium gray in color and appeared as a sludge and saltcake mix.
8	4/19/96	4/30/96	5/3/96	0.0	0.0	186.5 (upper half) 230.8 (lower half)	A full segment (48 cm [19 in.]) was collected as upper and lower half subsegments. The solids were gray in color and appeared to be a mixture of wet sludge and saltcake.
9	4/19/96	4/23/96	5/6/96	0.0	0.0	193.5 (upper half)	Approximately 15 cm (6 in.) of solids were collected into one jar. The solids were gray/white in color and appeared to be a moist saltcake. Less than 5 mL of liner liquid was observed but it was not retained.

Note:

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

Table B1-3. Sample Receipt and Extrusion Information for Tank 241-U-108, Core 145, Riser 9. (2 sheets)

Seg.	Date Sampled	Date Received	Date Extruded	Liner Liquid (g)	Drain. Liq. Recovered (g)	Solids Recovered (g)	Sample Description
1	4/23/96	4/30/96	5/6/96	0.0	168.1	0.0	Approximately 120 mL of drainable liquid were collected. The liquid was dark gray in color and opaque. No solids were present.
2	4/23/96	4/30/96	5/7/96	0.0	0.0	194.2 (upper half)	Approximately 18 cm (7 in.) of solids were extruded. The solids were medium gray in color and the texture resembled a salt slurry. The solids were subsampled into one jar.
3	4/25/96	5/10/96	5/14/96	0.0	0.0	207.7 (upper half) 182.7 (lower half)	Approximately 14 in. of wet saltcake, light to dark gray in color, were extruded. The solids were partitioned into upper and lower halves.
4	4/25/96	5/10/96	5/14/96	0.0	0.0	212.9 (upper half) 184.8 (lower half)	Approximately 38 cm (15 in.) of medium gray, wet saltcake were collected as upper and lower half portions.
5	4/25/96	5/10/96	5/14/96	0.0	0.0	253.7 (upper half) 226.6 (lower half)	A full segment (48 cm [19 in.]) was collected as upper and lower half subsegments. The wet saltcake was dark gray in color and was subsampled as upper and lower halves.
6	4/25/96	4/30/96	5/7/96	0.0	0.0	249.0 (upper half) 248.3 (lower half)	A full segment (48 cm [19 in.]) was collected as upper and lower half subsegments. The moist saltcake was medium gray in color and was subsampled as upper and lower halves.

Table B1-3. Sample Receipt and Extrusion Information for Tank 241-U-108, Core 145, Riser 9. (2 sheets)

Seg.	Date Sampled	Date Received	Date Extruded	Liner Liquid (g)	Drain. Liq. Recovered (g)	Solids Recovered (g)	Sample Description
7	4/25/96	4/30/96	5/14/96	0.0	0.0	261.8 (upper half) 217.9 (lower half)	Approximately 48 cm (19 in.) of wet saltcake, medium gray in color, were extruded. The core was divided into upper and lower halves.
8	4/26/96	4/30/96	5/8/96	0.0	0.0	249.9 (upper half) 225.3 (lower half)	Approximately 48 cm (19 in.) of moist saltcake, medium gray in color, were extruded. The core was divided into upper and lower halves. Less than 5 mL of liner liquid were observed but not retained.
9	4/26/96	4/30/96	5/15/96	0.0	0.0	167.7 (upper half) 32.0 (lower half)	Roughly 23 cm (9 in.) of solids were collected. The upper portion was 20 cm (8 in.) of wet sludge and was dark gray in color. The lower 2.5-cm (1-in.) portion was moist saltcake that was medium gray in color. The two portions were placed in separate jars.

Table B1-4. Sample Receipt and Extrusion Information for Tank 241-U-108, Core 146, Riser 2. (2 sheets)

Seg.	Date Sampled	Date Received	Date Extruded	Liner Liquid (g)	Drain. Liq. Recovered (g)	Solids Recovered (g)	Sample Description
FB	4/30/96	5/3/96	5/7/96	0.0	233.8	0.0	Roughly 250 mL of clear, colorless drainable liquid were collected.
1	5/1/96	5/10/96	5/14/96	0.0	85.0	177.9 (upper half)	70 mL of dark gray, opaque drainable liquid were collected. In addition, approximately 18 cm (7 in.) of dark gray, wet saltcake were collected.
2	5/1/96	5/17/96	5/21/96	0.0	0.0	139.9 (upper half) 176.1 (lower half)	About 33 cm (13 in.) of light to dark gray, dry saltcake were collected. The sample was partitioned in upper and lower half portions.
3	5/1/96	5/16/96	5/22/96	0.0	0.0	80.2 (upper half) 104.4 (lower half)	About 16 cm (6.5 in.) of gray, moist saltcake were extruded. The sample was divided into upper and lower halves.
3A	5/3/96	5/3/96	5/7/96	0.0	0.0	249.4 (whole)	Approximately 23 cm (9 in.) of gray, moist saltcake were collected. All solids were placed into one jar.
4	5/3/96	5/3/96	5/7/96	0.0	0.0	141.8 (upper half) 162.9 (lower half)	Approximately 35 cm (14 in.) of medium gray, moist saltcake were collected as upper and lower halves.
5	5/3/96	5/3/96	5/7/96	0.0	0.0	241.0 (upper half) 216.8 (lower half)	Extruded approximately 46 cm (18 in.) of medium gray, wet saltcake were extruded, and partitioned into upper and lower half subsegments.
6	5/3/96	5/14/96	5/15/96	0.0	0.0	260.1 (upper half) 243.4 (lower half)	A full segment of medium gray, wet saltcake was extruded and divided into upper and lower half subsegments.

Table B1-4. Sample Receipt and Extrusion Information for Tank 241-U-108, Core 146, Riser 2. (2 sheets)

Seg.	Date Sampled	Date Received	Date Extruded	Liner Liquid (g)	Drain. Liq. Recovered (g)	Solids Recovered (g)	Sample Description
7	5/3/96	5/14/96	5/15/96	0.0	0.0	232.9 (upper half) 237.8 (lower half)	About 19 in. of gray, moist saltcake, was collected and divided in upper and lower half subsegments.
8	5/3/96	5/17/96	5/22/96	0.0	0.0	229.4 (upper half) 220.4 (lower half)	Approximately 46 cm (18 in.) of gray, wet saltcake was extruded. The sample was divided in upper and lower halves.
9	5/6/96	5/14/96	5/15/96	0.0	0.0	105.1 (qtr seg. A) 112.7 (lower half)	Roughly 23 cm (9 in.) of solids were extruded. The upper 10 cm (4 in.) were gray, wet, sludge collected as the upper quarter segment. The remaining 13 cm (5 in.) were light to medium gray, moist saltcake. They were collected as the lower half subsegment.

Note:
FB = field blank

B1.3 SAMPLE ANALYSIS (1996 CORE AND 1995 GRAB SAMPLES)

The analyses performed at the half segment level on solid samples, at the segment level on drainable liquid samples, and on the core composite samples from cores 141, 145, and 146 were not limited to those needed to satisfy the safety screening, organic, and historical DQO requirements. Additional analytical results for metals, anions, and radionuclides were obtained on an opportunistic basis (Kristofzski 1996) in the process of meeting the DQO requirements. The waste compatibility DQO requirements were performed on a 1995 liquid grab sample. The results of those analyses were limited to those necessary to satisfy the DQO document. Core and grab sample analyses results have been reported in Bell (1996a) and Esch (1995) respectively.

Depending on the analysis, solid subsamples were analyzed directly or after a fusion, acid, or water digestion. Drainable liquid core subsamples and liquid grab subsamples were analyzed directly or after dilution in water or acid. Analysis for percent of the LFL, bulk density, total organic carbon (TOC), and total inorganic carbon (TIC) was performed directly. Analysis by thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC) was performed directly under a nitrogen purge. One sample from core 141 exceeded the DSC notification limit specified in the core SAP and an immediate notification was made (Bell 1996b). No other notification limits were exceeded.

Total alpha activity, inductively coupled plasma (ICP), strontium-90 (Sr-90), cesium-137 (Cs-137), total beta, and total uranium measurements were performed on samples that had been fused with potassium hydroxide and then dissolved in acid. Ion chromatography (IC) and inductively coupled plasma spectroscopy (ICP) on the core composites were performed on samples that had been prepared by water digestion. Analysis by ICP was also performed on acid-digested core composite samples. Analysis of fusion-digested samples requires a high dilution, resulting in higher detection limits. Analysis of acid-digested samples allows quantification of some trace elements that are not quantified in the fusion digests.

The results of the analyses are presented and discussed in Section B2.0. The results of the quality control (QC) tests and the implications for data quality are discussed in Section B3.2. Table B1-5 is a summary of the cores, segments, segment portions, individual sample numbers, and the analyses performed on each sample. All reported analyses were performed in accordance with approved laboratory procedures. The procedure numbers are presented in the discussion in Section B2.0.

Table B1-5. Tank 241-U-103 Sample Analysis Summary. (8 sheets)

Core	Sample Portion	Sample Number	Analysis
141	Segment 1, drainable liq.	S96T002282	DSC, TGA, specific gravity, TOC, TIC, ICP, IC, total alpha
	Segment 1, lower half	S96T002270	IC
		S96T002230	Bulk density
		S96T002241	DSC, TGA, TOC, TIC
		S96T002257	ICP-fusion, GEA, total alpha
	Segment 2, upper half	S96T002231	Bulk density
		S96T002273	IC
		S96T002242	DSC, TGA, TOC, TIC
		S96T002258	ICP-fusion, GEA, total alpha
	Segment 3, upper half	S96T002232	Bulk density
		S96T002274	IC
		S96T002243	DSC, TGA, TOC, TIC
		S96T002259	ICP-fusion, GEA, total alpha
	Segment 3A, upper half	S96T002233	Bulk density
		S96T002275	IC
		S96T002244	DSC, TGA, TOC, TIC
		S96T002260	ICP-fusion, GEA, total alpha
	Segment 4, lower half	S96T002235	Bulk density
		S96T002277	IC
		S96T002246	DSC, TGA, TOC, TIC
		S96T002262	ICP-fusion, GEA, total alpha
	Segment 4, upper half	S96T002234	Bulk density
		S96T002276	IC
		S96T002245	DSC, TGA, TOC, TIC
		S96T002261	ICP-fusion, GEA, total alpha

Table B1-5. Tank 241-U-103 Sample Analysis Summary. (8 sheets)

Core	Sample Portion	Sample Number	Analysis
141 (Cont'd)	Segment 4A, lower half	S96T002237	Bulk density
		S96T002279	IC
		S96T002248	DSC, TGA, TOC, TIC
		S96T002264	ICP-fusion, GEA, total alpha
	Segment 4A, upper half	S96T002236	Bulk density
		S96T002278	IC
		S96T002247	DSC, TGA, TOC, TIC
		S96T002263	ICP-fusion, GEA, total alpha
	Segment 5, lower half	S96T002563	Bulk density
		S96T002586	DSC, TGA, TOC, TIC
		S96T002618	IC
		S96T002609	ICP-fusion, GEA, total alpha
	Segment 5, upper half	S96T002562	Bulk density
		S96T002617	IC
		S96T002585	DSC, TGA, TOC, TIC
		S96T002608	ICP-fusion, GEA, total alpha
	Segment 6, lower half	S96T002565	Bulk density
		S96T002620	IC
		S96T002588	DSC, TGA, TOC, TIC
		S96T002611	ICP-fusion, GEA, total alpha
	Segment 6, upper half	S96T002564	Bulk density
		S96T002619	IC
		S96T002587	DSC, TGA, TOC, TIC
		S96T002610	ICP-fusion, GEA, total alpha
	Segment 7, lower half	S96T002567	Bulk density
		S96T002622	IC
		S96T002590	DSC, TGA, TOC, TIC
		S96T002613	ICP-fusion, GEA, total alpha

Table B1-5. Tank 241-U-103 Sample Analysis Summary. (8 sheets)

Core	Sample Portion	Sample Number	Analysis
141	Segment 7, upper half	S96T002566	Bulk density
		S96T002621	IC
		S96T002589	DSC, TGA, TOC, TIC
		S96T002612	ICP-fusion, GEA, total alpha
	Segment 8, lower half	S96T002569	Bulk density
		S96T002624	IC
		S96T002592	DSC, TGA, TOC, TIC
		S96T002615	ICP-fusion, GEA, total alpha
	Segment 8, upper half	S96T002568	Bulk density
		S96T002623	IC
		S96T002591	DSC, TGA, TOC, TIC
		S96T002614	ICP-fusion, GEA, total alpha
	Segment 9, upper half	S96T002570	Bulk density
		S96T002625	IC
		S96T002593	DSC, TGA, TOC, TIC
		S96T002616	ICP-fusion, GEA, total alpha
	Solid core composite	S96T003448	Bulk density
		S96T003449	DSC, TGA, TOC, TIC
		S96T003452	IC
		S96T003451	ICP-Acid
		S96T003450	ICP-fusion, GEA, total uranium, total beta, Sr-90
		S96T003453	ICP-Water
145	Segment 1, drainable liq.	S96T002942	DSC, TGA, specific gravity, TOC, TIC, ICP, IC, total alpha
	Segment 2, upper half	S96T002864	Bulk density
		S96T002893	DSC, TGA, TOC, TIC
		S96T002924	IC
		S96T002909	ICP-fusion, GEA, total alpha
	Segment 3, lower half	S96T002866	Bulk density
		S96T002880	DSC, TGA, TOC, TIC
		S96T002926	IC
		S96T002911	ICP-fusion, GEA, total alpha

Table B1-5. Tank 241-U-103 Sample Analysis Summary. (8 sheets)

Core	Sample Portion	Sample Number	Analysis
145 (Cont'd)	Segment 3, upper half	S96T002865	Bulk density
		S96T002879	DSC, TGA, TOC, TIC
		S96T002925	IC
		S96T002910	ICP-fusion, GEA, total alpha
	Segment 4, lower half	S96T002868	Bulk density
		S96T002882	DSC, TGA, TOC, TIC
		S96T002928	IC
		S96T002913	ICP-fusion, GEA, total alpha
	Segment 4, upper half	S96T002867	Bulk density
		S96T002881	DSC, TGA, TOC, TIC
		S96T002927	IC
		S96T002912	ICP-fusion, GEA, total alpha
	Segment 5, lower half	S96T002870	Bulk density
		S96T002884	DSC, TGA, TOC, TIC
		S96T002930	IC
		S96T002915	ICP-fusion, GEA, total alpha
	Segment 5, upper half	S96T002869	Bulk density
		S96T002883	DSC, TGA, TOC, TIC
		S96T002929	IC
		S96T002914	ICP-fusion, GEA, total alpha
	Segment 6, lower half	S96T002872	Bulk density
		S96T002886	DSC, TGA, TOC, TIC
		S96T002932	IC
		S96T002917	ICP-fusion, GEA, total alpha
	Segment 6, upper half	S96T002871	Bulk density
		S96T002885	DSC, TGA, TOC, TIC
		S96T002931	IC
		S96T002916	ICP-fusion, GEA, total alpha
	Segment 7, lower half	S96T002874	Bulk density
		S96T002888	DSC, TGA, TOC, TIC
		S96T002934	IC
		S96T002919	ICP-fusion, GEA, total alpha

Table B1-5. Tank 241-U-103 Sample Analysis Summary. (8 sheets)

Core	Sample Portion	Sample Number	Analysis
145 (Cont'd)	Segment 7, upper half	S96T002873	Bulk density
		S96T002887	DSC, TGA, TOC, TIC
		S96T002933	IC
		S96T002918	ICP-fusion, GEA, total alpha
	Segment 8, lower half	S96T002876	Bulk density
		S96T002890	DSC, TGA, TOC, TIC
		S96T002936	IC
		S96T002921	ICP-fusion, GEA, total alpha
	Segment 8, upper half	S96T002875	Bulk density
		S96T002935	IC
		S96T002889	DSC, TGA, TOC, TIC
		S96T002920	ICP-fusion, GEA, total alpha
	Segment 9, lower half	S96T002892	DSC, TGA, TOC, TIC
		S96T002938	IC
		S96T002923	ICP-fusion, GEA, total alpha
	Segment 9, upper half	S96T002877	Bulk density
		S96T002891	DSC, TGA, TOC, TIC
		S96T002937	IC
		S96T002922	ICP-fusion, GEA, total alpha
	Solid core composite	S96T003454	Bulk density
		S96T003659	DSC, TGA, TOC, TIC
		S96T003661	IC
		S96T003457	ICP-Acid
		S96T003660	ICP-fusion, GEA, total uranium, total beta, Sr-90, total alpha
		S96T003662	ICP-Water
146	Segment 1, drainable liq.	S96T003163	DSC, TGA, specific gravity, TOC, TIC, ICP, IC, total alpha
	Segment 1, upper half	S96T003112	Bulk density
		S96T003151	IC
		S96T003121	DSC, TGA, TOC, TIC
		S96T003143	ICP-fusion, GEA, total alpha

Table B1-5. Tank 241-U-103 Sample Analysis Summary. (8 sheets)

Core	Sample Portion	Sample Number	Analysis
146 (Cont'd)	Segment 2, lower half	S96T003114	Bulk density
		S96T003124	DSC, TGA, TOC, TIC
		S96T003153	IC
		S96T003145	ICP-fusion, GEA, total alpha
	Segment 2, upper half	S96T003113	Bulk density
		S96T003152	IC
		S96T003123	DSC, TGA, TOC, TIC
		S96T003144	ICP-fusion, GEA, total alpha
	Segment 3, lower half	S96T003116	Bulk density
		S96T003126	DSC, TGA, TOC, TIC
		S96T003155	IC
		S96T003147	ICP-fusion, GEA, total alpha
	Segment 3, upper half	S96T003115	Bulk density
		S96T003154	IC
		S96T003125	DSC, TGA, TOC, TIC
		S96T003146	ICP-fusion, GEA, total alpha
	Segment 3A, upper half	S96T002950	Bulk density
		S96T002959	DSC, TGA, TOC, TIC
		S96T003052	IC
		S96T003001	ICP-fusion, GEA, total alpha
	Segment 4, lower half	S96T002952	Bulk density
		S96T003054	IC
		S96T002961	DSC, TGA, TOC, TIC
		S96T003003	ICP-fusion, GEA, total alpha
	Segment 4, upper half	S96T002951	Bulk density
		S96T003053	IC
		S96T002960	DSC, TGA, TOC, TIC
		S96T003002	ICP-fusion, GEA, total alpha
	Segment 5, lower half	S96T002954	Bulk density
		S96T002963	DSC, TGA, TOC, TIC
		S96T003056	IC
		S96T003005	ICP-fusion, GEA, total alpha

Table B1-5. Tank 241-U-103 Sample Analysis Summary. (8 sheets)

Core	Sample Portion	Sample Number	Analysis
146 (Cont'd)	Segment 5, upper half	S96T002953	Bulk density
		S96T003055	IC
		S96T002962	DSC, TGA, TOC, TIC
		S96T003004	ICP-fusion, GEA, total alpha
	Segment 6, lower half	S96T002956	Bulk density
		S96T002965	DSC, TGA, TOC, TIC
		S96T003058	IC
		S96T003007	ICP-fusion, GEA, total alpha
	Segment 6, upper half	S96T002955	Bulk density
		S96T003057	IC
		S96T002964	DSC, TGA, TOC, TIC
		S96T003006	ICP-fusion, GEA, total alpha
	Segment 7, lower half	S96T002958	Bulk density
		S96T002967	DSC, TGA, TOC, TIC
		S96T003060	IC
		S96T003009	ICP-fusion, GEA, total alpha
	Segment 7, upper half	S96T002957	Bulk density
		S96T003059	IC
		S96T002966	DSC, TGA, TOC, TIC
		S96T003008	ICP-fusion, GEA, total alpha
	Segment 8, lower half	S96T003118	Bulk density
		S96T003128	DSC, TGA, TOC, TIC
		S96T003157	IC
		S96T003149	ICP-fusion, GEA, total alpha
	Segment 8, upper half	S96T003117	Bulk density
		S96T003156	IC
		S96T003127	DSC, TGA, TOC, TIC
		S96T003148	ICP-fusion, GEA, total alpha
	Segment 9, lower half	S96T003120	Bulk density
		S96T004178	DSC, TGA, TOC, TIC
		S96T004181	IC
		S96T004180	ICP-fusion, GEA, total alpha

Table B1-5. Tank 241-U-103 Sample Analysis Summary. (8 sheets)

Core	Sample Portion	Sample Number	Analysis
146 (Cont'd)	Segment 9, upper half	S96T003119	Bulk density
		S96T003129	DSC, TGA, TOC, TIC
		S96T003158	IC
		S96T003150	ICP-fusion, GEA, total alpha
	Solid core composite	S96T004197	Bulk density
		S96T004198	DSC, TGA, TOC, TIC
		S96T004201	IC
		S96T004200	ICP-Acid
		S96T004199	ICP-fusion, GEA, total uranium, total beta, Sr-90, total alpha
		S96T004202	ICP-Water

Note:
GEA = Gamma energy analysis

B1.4 DESCRIPTION OF 1995 VAPOR SAMPLING

Tank 241-U-108 headspace gas and vapor samples were collected and analyzed to help determine the potential risks from fugitive emissions to tank farm workers. Analysis of these samples also satisfies the organic solvent screening requirements (Cash 1996). The drivers and objectives of waste tank headspace sampling and analysis are discussed in *Program Plan for the Resolution of Tank Vapor Issues* (Osborne and Huckaby 1994). Tank 241-U-108 was vapor sampled in accordance with *Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution* (Osborne et al. 1995).

Headspace gas and vapor samples were collected from tank 241-U-108 using the Vapor Sampling System (VSS) on August 29, 1995 by Westinghouse Hanford Company (WHC) Sampling and Mobile Laboratories. Sample collection and analyses were performed as directed by the vapor sampling and analysis plan (Homi 1995). Air from the tank 241-U-108 headspace was withdrawn via a heated sampling probe mounted in riser 10, and transferred via heated tubing to the VSS sampling manifold. All heated zones of the VSS were maintained at approximately 60 °C (140 °F). Further discussion of the methods used for collection and analysis of the vapor samples can be found in Mahon (1995).

B1.5 SAMPLE HANDLING AND ANALYSIS (1995 VAPOR SAMPLES)

Tank 241-U-108 headspace samples were analyzed at Pacific Northwest National Laboratory (PNNL) for inorganic and organic analytes. The analytical work was performed by the PNNL Vapor Analytical Laboratory in the 300 Area of the Hanford Site. Analytical results were reported in Thomas et al. (1996). Sampling devices, sample volumes, analytes, and number of samples are shown in Table B1-6.

Table B1-6. Tank 241-U-108 Gas and Vapor Sample Type and Number for the 1995 Tank 241-U-108 Vapor Samples.[1]

Sampling Device	Nominal Sample Volume (L)	Target Analytes	Number of Samples
SUMMA[2] canister	6.0	Hydrogen, nitrous oxide, carbon dioxide, carbon monoxide	3 tank air samples, 2 ambient air blanks, 3 field blanks
Acidified carbon sorbent trap	3.0	Ammonia	6 tank air samples, 2 trip blanks
Triethanolamine sorbent trap	3.0	Nitrogen dioxide	6 tank air samples, 2 trip blanks
Oxidation bed plus triethanolamine sorbent trap	3.0	Nitric oxide	6 tank air samples, 2 trip blanks
Silica gel sorbent trap	3.0	Water vapor	8 tank air samples, 2 trip blanks
SUMMA™ canister	6.0	Organic vapors (including total non-methane hydrocarbons)	3 tank air samples, 2 ambient air samples, 3 field blanks
Triple sorbent trap	1.0	Semi-volatile organic vapors	6 tank air samples, 6 field blanks, 2 trip blanks

Notes:

[1]Thomas et al. (1996)

[2]SUMMA is a trademark of Molectrics, Inc., Cleveland, Ohio.

Sorbent traps for inorganic analytes were either weighed (for water analysis) or weighed and desorbed with the appropriate aqueous solutions for analyzing inorganic analytes by either ion-selective electrode or ion chromatography. Triple sorbent traps were used for semi-volatile organic analytes by gas chromatography/mass spectroscopy. Tank headspace samples were also analyzed for permanent gases (hydrogen, nitrous oxide, carbon dioxide, and carbon monoxide) by gas chromatography (GC), total non-methane hydrocarbons using cryogenic preconcentration followed by GC, and volatile organic analysis using cryogenic preconcentration followed by GC.

B1.6 HISTORICAL SAMPLING EVENTS

Historical analytical data are available for tank 241-U-108's sampling events. Data from waste samples obtained from the tank in 1971, 1973 or 1974, and 1975 were taken from Atlantic Richfield Hanford Company internal memoranda. The analytical results are presented in Section B2.0. Because of the uncertainty in sampling locations and analytical procedures, and the age of some of these data, these historical data were not used to assess the current contents or the status of the tank with respect to safety. Furthermore, pre-1989 analytical data have not been validated and should be used with caution.

B1.6.1 Description of Historical Sampling Events

Samples were removed from tank 241-U-108 in 1971 (Puryear 1971) and in late 1973 or early 1974 (Sant 1974) in order to identify feed material for the 242-S Evaporator. It is not clear whether the 1971 sample was solid or liquid. The 1973 or 1974 sample was identified as clear and yellow with no solids. A sludge sample was taken and analyzed in 1975 because tank 241-U-108 was being considered as a slurry receiving tank for 242-S Evaporator waste at that time (Horton 1975). Sampling dates and locations were not provided for any of the three sampling events. It appears the analyses were performed at the 222-S Laboratory, although the above references are not clear in that regard.

B2.0 ANALYTICAL RESULTS

B2.1 OVERVIEW

This section summarizes the sampling and analytical results associated with the 1996 core, and the 1995 grab and vapor samples from tank 241-U-108. The location of the analytical results associated with this tank are presented in Table B2-1. The core sampling results were documented in Bell (1996a), the grab sampling results were documented in Esch (1995), and the vapor results are reported in Thomas et al. (1996).

Table B2-1. Analytical Presentation Tables.

Analysis	Table Number
Percent water by TGA	B2-2, B2-3
DSC	B2-4, B2-5
Bulk density	B2-6
Specific gravity	B2-7, B2-8
pH	B2-9
TOC	B2-10, B2-11
TIC	B2-12, B2-13
Hydroxide	B2-14
Summary data for metals by ICP	B2-16 through B2-37
Anions by IC	B2-38 through B2-50
Total alpha activity	B2-51
Sr-90	B2-52, B2-53
Total beta	B2-54
Total uranium	B2-55
Pu-239/240	B2-56
Am-241	B2-57
Radionuclides by GEA	B2-58 through B2-64
1995 vapor results summary	B2-65
Flammable gas monitoring	B2-66

The four QC parameters assessed in conjunction with the tank 241-U-108 samples were standard recoveries, spike recoveries, duplicate analyses (relative percent difference [RPDs]), and blanks. The QC criteria specified in the core SAP (Homi 1996) were either 80 to 120 or 90 to 110 percent recovery for standards and spikes, and $\leq$20 or $\leq$10 percent for RPDs, depending on the analyte. The QC criteria specified in the grab SAP (Schreiber 1995) were 80 to 120 percent recovery for standards and spikes and $\leq$20 percent for RPDs. The only QC parameter for which limits are not specified in the core and grab SAPs is blank contamination. The limits for blanks are set forth in guidelines followed by the laboratory, and all data results presented in this report have met those guidelines. The QC criteria for the 1995 vapor samples are discussed in Section B2.5.

Sample and duplicate pairs in which any of the QC parameters were outside of these limits are footnoted in the sample mean column of the following data summary tables with an a, b, c, d, or e as follows:

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

In the analytical tables in this section, the "Mean" column is the average of the result and duplicate values. All values, including those below the detection level (denoted by the less-than symbol, "<"), were averaged. If both sample and duplicate values were non-detected, the mean is expressed as a non-detected value. If one value was detected while the other was not, the mean is expressed as a detected value. If both values were detected, the mean is expressed as a detected value.

B2.2 THERMODYNAMIC ANALYSES

As required by the safety screening, organic, historical, and compatibility DQOs, and the organic test plan, analysis by TGA and DSC was performed on all samples. Other physical tests required were bulk density (Section B2.3.1), specific gravity (Section B2.3.2), and pH (Section B2.3.3).

B2.2.1 Thermogravimetric Analysis

Thermogravimetric analysis measures the mass of a sample while its temperature is increased at a constant rate. Nitrogen is passed over the sample during heating to remove any released gases. Any decrease in the weight of a sample during TGA represents a loss of gaseous matter from the sample, either through evaporation or through a reaction that forms gas phase products. The moisture content is estimated by assuming all TGA sample weight loss up to a certain temperature (typically 150 to 200 °C [300 to 390 °F) is caused by water evaporation. The temperature limit for moisture loss is chosen by the operator at an inflection point on the TGA plot. Other volatile matter fractions can often be differentiated by inflection points as well.

Analyses for percent water by TGA were performed on the core samples using procedures LA-560-112, Rev. B-1 (Mettler[1] instrument) and LA-514-114, Rev. C-1 (Perkin-Elmer[2] instrument). Grab sample U-108-1 was analyzed by procedure LA-560-112, Rev. A-2. All samples were run under a nitrogen atmosphere. The TGA results for the tank 241-U-108 samples are summarized in Tables B2-2 and B2-3.

Although the core SAP (Homi 1996) indicates that there is no notification limit for moisture by TGA, the organic DQO does have a notification limit of < 17 percent. Only the sample from the lower half of segment 2 of core 146 had an average moisture value below 17 percent (12.27 percent). However, the TOC content of that sample was far below 3 percent (0.174 percent) and the sample had a small exotherm (69 J/g).

Table B2-2. Tank 241-U-108 Core Sample Analytical Results: Percent Water (TGA). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Triplicate	Mean
Solids			%	%	%	%
S96T002241	141: 1	Lower 1/2	45.92	45.08		45.5
S96T002242	141: 2	Upper 1/2	23.05	24.43		23.74
S96T002243	141: 3	Upper 1/2	33.54	26.98		30.26[QC:e]
S96T002244	141: 3A	Upper 1/2	19.44	32.04		25.74[QC:e]
S96T002245	141: 4	Upper 1/2	33.04	32.57		32.805
S96T002246		Lower 1/2	28.59	31.19		29.89
S96T002247	141: 4A	Upper 1/2	0.986	44.42	44.53	29.979[QC:e]
S96T002248		Lower 1/2	39.46	38.73		39.095
S96T002585	141: 5	Upper 1/2	24.85	29.17		27.01[QC:e]
S96T002586		Lower 1/2	28.40	35.74		32.07[QC:e]
S96T002587	141: 6	Upper 1/2	23.06	21.32		22.19
S96T002588		Lower 1/2	21.21	15.68		18.445[QC:e]
S96T002589	141: 7	Upper 1/2	39.52	38.20		38.86
S96T002590		Lower 1/2	40.30	40.15		40.225
S96T002591	141: 8	Upper 1/2	38.04	42.06	42.04	40.7133[QC:e]
S96T002592		Lower 1/2	41.31	37.90		39.605

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

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

Table B2-2. Tank 241-U-108 Core Sample Analytical Results: Percent Water (TGA). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Triplicate	Mean
Solids			%	%	%	%
S96T002593	141: 9	Upper 1/2	30.76	33.88		32.32
S96T002893	145: 2	Upper 1/2	34.42	31.90		33.16
S96T002879	145: 3	Upper 1/2	69.61	47.71	39.27	52.1967[QC:e]
S96T002880		Lower 1/2	45.56	45.98		45.77
S96T002881	145: 4	Upper 1/2	41.97	39.96		40.965
S96T002882		Lower 1/2	25.88	25.56		25.72
S96T002883	145: 5	Upper 1/2	18.15	17.30		17.725
S96T002884		Lower 1/2	28.41	33.46		30.935[QC:e]
S96T002885	145: 6	Upper 1/2	28.67	27.50		28.085
S96T002886		Lower 1/2	29.39	38.89		34.14[QC:e]
S96T002887	145: 7	Upper 1/2	45.85	42.45		44.15
S96T002888		Lower 1/2	42.33	42.24		42.285
S96T002889	145: 8	Upper 1/2	41.50	42.92		42.21
S96T002890		Lower 1/2	41.17	40.04		40.605
S96T002891	145: 9	Upper 1/2	40.10	38.34		39.22
S96T002892		Lower 1/2	48.86	49.67		49.265
S96T003121	146: 1	Upper 1/2	41.79	37.70		39.745[QC:e]
S96T003123	146: 2	Upper 1/2	29.51	23.66		26.585[QC:e]
S96T003124		Lower 1/2	9.59	14.94		12.265[QC:e]
S96T003125	146: 3	Upper 1/2	29.49	41.56		35.525[QC:e]
S96T003126		Lower 1/2	19.20	21.63		20.415[QC:e]
S96T002959	146: 3A	Upper 1/2	17.24	23.12		20.18[QC:e]
S96T002960	146: 4	Upper 1/2	17.89	17.21		17.55
S96T002962	146: 5	Upper 1/2	41.13	36.72		38.925[QC:e]
S96T002963		Lower 1/2	38.38	31.17		34.775[QC:e]
S96T002964	146: 6	Upper 1/2	29.48	35.35		32.415[QC:e]
S96T002965		Lower 1/2	44.30	45.61		44.955
S96T002966	146: 7	Upper 1/2	33.55	33.30		33.425
S96T002967		Lower 1/2	41.14	40.96		41.05
S96T003127	146: 8	Upper 1/2	41.25	41.28		41.265
S96T003128		Lower 1/2	40.39	40.07		40.23

Table B2-2. Tank 241-U-108 Core Sample Analytical Results: Percent Water (TGA). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Triplicate	Mean
Solids			%	%	%	%
S96T004178	146: 9	Lower 1/2	48.59	47.83		48.21
S96T003129		Upper 1/2	38.62	38.46		38.54
S96T003449	Core 141	Solid composite	30.82	40.19		35.505[QC:e]
S96T003659	Core 145	Solid composite	32.60	29.12		30.86[QC:e]
S96T004198	Core 146	Solid composite	28.00	28.35		28.175
Liquids			%	%	%	%
S96T002282	141: 1	Drainable liquid	51.08	47.33		49.205
S96T002942	145: 1	Drainable liquid	49.25	49.66		49.455
S96T003163	146: 1	Drainable liquid	51.15	51.11		51.13

Table B2-3. Tank 241-U-108 Grab Sample Analytical Results: Percent Water (TGA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			%	%	%
S95T000978	Riser 7	Grab sample	50.20	50.35	50.275

B2.2.2 Differential Scanning Calorimetry

In a DSC analysis, heat absorbed or emitted by a sample is measured while the temperature of the sample is heated at a constant rate. Nitrogen is passed over the sample material to remove any gases being released. The onset temperature for an endothermic or exothermic event is determined graphically.

Analyses by DSC were performed on all 1996 core subsegments and drainable liquids, and the 1995 grab sample from tank 241-U-108. The core sample analyses were performed under a nitrogen purge using procedures LA-514-113, Rev. C-1 (Mettler™ instrument) and LA-514-114, Rev. C-1 (Perkin-Elmer™ instrument). The grab sample was analyzed per procedure LA-514-113, Rev. B-1. Because two instruments were used during the DSC analyses, it must be noted that each instrument produces raw data scans that present exotherms differently. On the Mettler™ instrument, an exotherm is represented by a peak, while the Perkin-Elmer™ instrument shows an exotherm as a valley. Results are presented in Tables B2-4 and B2-5. Only samples that showed or had exotherms were included in the tables. Most core samples displayed exothermic behavior, and one sample from the upper half of segment 4 from core 141 had an average DSC result of 496 J/g on a dry-weight basis, thus exceeding the DSC notification limit specified in the SAP. Two other samples exceeded the DSC notification limit at the one-sided 95 percent upper confidence limit of the mean, although the individual measurements did not exceed the 480-J/g notification limit. The upper limits are provided in Table C1-2.

Table B2-4. Tank 241-U-108 Core Sample Analytical Results: Exotherm - Transition 1 (DSC). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Triplicate	Mean
Solids			J/g	J/g	J/g	J/g
S96T002241	141: 1	Lower 1/2	85.2	110.9		98.1QC:e
S96T002242	141: 2	Upper 1/2	47.8	45.4		46.6
S96T002245	141: 4	Upper 1/2	408.9	257.3		333.1QC:e
S96T002245		Upper 1/2	67.0	44.0		55.5QC:e
S96T002246		Lower 1/2	232.3	74.4	159.7	155.5QC:e
S96T002589	141: 7	Upper 1/2	76.4	36.5		56.5QC:e
S96T002590		Lower 1/2	184.4	68.6		126.5QC:e
S96T002591	141: 8	Upper 1/2	77.4	89.2	96.7	87.8QC:e
S96T002592		Lower 1/2	71.9	81.9		76.9QC:e
S96T002879	145: 3	Upper 1/2	86.7	99.8		93.2QC:e
S96T002880		Lower 1/2	88.5	89.6		89.1
S96T002881	145: 4	Upper 1/2	90.1	58.2	84.1	77.5QC:e
S96T002884	145: 5	Lower 1/2	21.4	18.1		19.7QC:e
S96T002885	145: 6	Upper 1/2	26.2	80.3		53.3QC:e
S96T002886		Lower 1/2	153.5	0.0		76.7QC:e
S96T002887	145: 7	Upper 1/2	141.3	72.8		107.1QC:e
S96T002888		Lower 1/2	97.2	98.7		97.9
S96T002891	145: 9	Upper 1/2	67.8	63.6		65.7
S96T002892		Lower 1/2	52.7	22.5		37.6QC:e
S96T003121	146: 1	Upper 1/2	65.6	71.5		68.6
S96T003124	146: 2	Lower 1/2	77.4	60.6		69.0QC:e

Table B2-4. Tank 241-U-108 Core Sample Analytical Results: Exotherm - Transition 1 (DSC). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Triplicate	Mean
Solids			**J/g**	**J/g**	**J/g**	**J/g**
S96T003125	146: 3	Upper 1/2	45.9	11.1		28.5[QC:e]
S96T003126		Lower 1/2	3.70	0.0		3.70
S96T002959	146: 3A	Upper 1/2	0.0	0.0	22.9	7.63[QC:e]
S96T002960	146: 4	Upper 1/2	34.1	0		17.1[QC:e]
S96T002961	146: 4	Lower 1/2	62.4	60.5		61.5
S96T002962	146: 5	Upper 1/2	96.9	92.1		94.5
S96T002963		Lower 1/2	101.6	87.5		94.6[QC:e]
S96T002964	146: 6	Upper 1/2	30.3	18.5		24.4[QC:e]
S96T002967	146: 7	Lower 1/2	64.5	73.3		68.9[QC:e]
S96T004178	146: 9	Lower 1/2	26.1	37.42		31.8[QC:e]
S96T003129		Upper 1/2	55.6	57.6		56.6
S96T003449	Core 141	Solid composite	76.8	110.4		93.6[QC:e]
Liquids			**J/g**	**J/g**	**J/g**	**J/g**
S96T002942	145: 1	Drainable liquid	78.3	79.5		78.9
S96T003163	146: 1	Drainable liquid	77.9	88.8		83.3[QC:e]

Table B2-5. Tank 241-U-108 Grab Sample Analytical Results: Exotherm - Transition 1.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			**J/g**	**J/g**	**J/g**
S95T000978	Riser 7	Grab sample	64.2	66.7	65.45

B2.3 PHYSICAL MEASUREMENTS

B2.3.1 Bulk Density

Bulk density was determined on all solid subsamples from cores 141, 145, and 146 except the upper half of segment 9 from core 141, according to procedure LO-160-103, Rev. B-0. The sample from segment 9 of core 141 was a dry, clay-like material. An accurate volume measurement could not be made using the bulk density procedure.

Results shown in Table B2-6 were consistent from core to core and segment to segment. The highest measured bulk density was 2.1 g/mL (upper half of segment 2, core 145) and the lowest result was 1.57 g/mL (lower half of segment 1, core 141). No duplicate analyses were performed as part of the bulk density measurements.

Table B2-6. Tank 241-U-108 Core Sample Analytical Results: Bulk Density. (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Mean
Solids			g/mL	g/mL
S96T002230	141: 1	Lower 1/2	1.57	1.57
S96T002231	141: 2	Upper 1/2	1.75	1.75
S96T002232	141: 3	Upper 1/2	1.74	1.74
S96T002233	141: 3A	Upper 1/2	1.77	1.77
S96T002234	141: 4	Upper 1/2	1.69	1.69
S96T002235		Lower 1/2	1.68	1.68
S96T002236	141: 4A	Upper 1/2	1.67	1.67
S96T002237		Lower 1/2	1.69	1.69
S96T002562	141: 5	Upper 1/2	1.66	1.66
S96T002563		Lower 1/2	1.71	1.71
S96T002564	141: 6	Upper 1/2	1.75	1.75
S96T002565		Lower 1/2	1.76	1.76
S96T002566	141: 7	Upper 1/2	1.66	1.66
S96T002567		Lower 1/2	1.63	1.63
S96T002568	141: 8	Upper 1/2	1.61	1.61
S96T002569		Lower 1/2	1.63	1.63
S96T002864	145: 2	Upper 1/2	2.1	2.1
S96T002865	145: 3	Upper 1/2	1.85	1.85
S96T002866		Lower 1/2	1.85	1.85
S96T002867	145: 4	Upper 1/2	1.7	1.7
S96T002868		Lower 1/2	1.71	1.71

Table B2-6. Tank 241-U-108 Core Sample Analytical Results: Bulk Density. (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Mean
Solids			g/mL	g/mL
S96T002869	145: 5	Upper 1/2	1.87	1.87
S96T002870		Lower 1/2	1.88	1.88
S96T002871	145: 6	Upper 1/2	1.79	1.79
S96T002872		Lower 1/2	1.72	1.72
S96T002873	145: 7	Upper 1/2	1.75	1.75
S96T002874		Lower 1/2	1.74	1.74
S96T002875	145: 8	Upper 1/2	1.8	1.8
S96T002876		Lower 1/2	1.82	1.82
S96T002877	145: 9	Upper 1/2	1.73	1.73
S96T003112	146: 1	Upper 1/2	1.67	1.67
S96T003113	146: 2	Upper 1/2	1.8	1.8
S96T003114		Lower 1/2	1.84	1.84
S96T003115	146: 3	Upper 1/2	1.71	1.71
S96T003116		Lower 1/2	1.66	1.66
S96T002950	146: 3A	Upper 1/2	1.67	1.67
S96T002951	146: 4	Upper 1/2	1.58	1.58
S96T002952		Lower 1/2	1.74	1.74
S96T002953	146: 5	Upper 1/2	1.71	1.71
S96T002954		Lower 1/2	1.68	1.68
S96T002955	146: 6	Upper 1/2	1.76	1.76
S96T002956		Lower 1/2	1.77	1.77
S96T002957	146: 7	Upper 1/2	1.75	1.75
S96T002958		Lower 1/2	1.77	1.77
S96T003117	146: 8	Upper 1/2	1.62	1.62
S96T003118		Lower 1/2	1.62	1.62
S96T003120	146: 9	Lower 1/2	1.58	1.58
S96T003119		Upper 1/2	1.75	1.75
S96T003448	Core 141	Solid composite	1.66	1.66
S96T003454	Core 145	Solid composite	1.79	1.79
S96T004197	Core 146	Solid Composite	1.69	1.69

B2.3.2 Specific Gravity

Specific gravity was determined on the segment 1 drainable liquid from each 1996 core sample, according to procedure LA-510-112, Rev. C-3, and on the one 1995 grab sample per procedure LA-510-112, Rev. C-3. Sample results are shown in Tables B2-7 and B2-8 and varied from 1.38 (core 146) to 1.67 (core 141).

Table B2-7. Tank 241-U-108 Analytical Results: Specific Gravity.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			unitless	unitless	unitless
S96T002282	141: 1	Drainable liquid	1.448	1.424	1.436
S96T002942	145: 1	Drainable liquid	1.384	1.388	1.386
S96T003163	146: 1	Drainable liquid	1.371	1.397	1.384

Table B2-8. Tank 241-U-108 Grab Sample Analytical Results: Specific Gravity.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			unitless	unitless	unitless
S95T000978	Riser 7	Grab sample	1.39	1.39	1.39

B2.3.3 pH

The pH of grab sample U-108-1 was measured directly by glass electrode according to procedure LA-212-102, Rev. C-5. As shown in Table B2-9, the liquid was quite alkaline.

Table B2-9. Tank 241-U-108 Grab Sample Analytical Results: pH Measurement.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			unitless	unitless	unitless
S95T000978	Riser 7	Grab sample	13.73	13.70	13.72

B2.4 INORGANIC ANALYSES

B2.4.1 Total Organic Carbon

Analyses for TOC were performed by direct persulfate oxidation on all 1996 core subsamples per procedure LA-342-100, Rev. D-0 and by furnace oxidation per procedure LA-344-105, Rev. B-2 on the 1995 grab sample. The TOC results from all cores are shown in Tables B2-10 and B2-11.

The lower half of segment 2 from core 146 had the lowest TOC (wet weight) concentration at 1,745 μg/g. The highest concentration was 11,200 μg/g found in segment 9 of the same core. Even after conversion to a dry-weight basis, these values are below the programmatic dry weight notification limit of 30,000 μg/g.

Table B2-10. Tank 241-U-108 Core Sample Analytical Results: Total Organic Carbon (Persulfate). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Triplicate	Mean
Solids			μg/g	μg/g	μg/g	μg/g
S96T002241	141: 1	Lower 1/2	6,000	6,560		6,280
S96T002242	141: 2	Upper 1/2	3,470	3,060		3,265[QC:c]
S96T002243	141: 3	Upper 1/2	2,660	2,680		2,670[QC:d]
S96T002244	141: 3A	Upper 1/2	2,980	2,950		2,965
S96T002245	141: 4	Upper 1/2	2,750	4,430	4,600	3,927
S96T002246		Lower 1/2	4,950	4,750		4,850[QC:c]
S96T002247	141: 4A	Upper 1/2	4,440	4,560		4,500
S96T002248		Lower 1/2	4,350	4,570		4,460
S96T002585	141: 5	Upper 1/2	4,380	4,900		4,640
S96T002586		Lower 1/2	3,850	3,830		3,840
S96T002587	141: 6	Upper 1/2	3,380	3,280		3,330
S96T002588		Lower 1/2	3,030	2,600		2,815
S96T002589	141: 7	Upper 1/2	6,550	6,080		6,315
S96T002590		Lower 1/2	5,260	5,270		5,265
S96T002591	141: 8	Upper 1/2	5,480	6,170		5,825
S96T002592		Lower 1/2	5,650	3,660	4,380	4,563
S96T002593	141: 9	Upper 1/2	2,290	2,630		2,460
S96T002893	145: 2	Upper 1/2	2,610	2,760		2,685

Table B2-10. Tank 241-U-108 Core Sample Analytical Results: Total Organic Carbon (Persulfate). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Triplicate	Mean
Solids			µg/g	µg/g	µg/g	µg/g
S96T002879	145: 3	Upper 1/2	3,190	3,170		3,180
S96T002880		Lower 1/2	3,460	3,060		3,260
S96T002881	145: 4	Upper 1/2	2,920	2,950		2,935
S96T002882		Lower 1/2	3,870	3,860		3,865
S96T002883	145: 5	Upper 1/2	3,720	3,700		3,710
S96T002884		Lower 1/2	5,580	5,530		5,555
S96T002885	145: 6	Upper 1/2	4,850	4,920		4,885
S96T002886		Lower 1/2	3,980	4,230		4,105
S96T002887	145: 7	Upper 1/2	4,500	4,710		4,605
S96T002888		Lower 1/2	5,240	5,360		5,300
S96T002889	145: 8	Upper 1/2	2,900	2,880		2,890
S96T002890		Lower 1/2	4,530	4,650		4,590
S96T002891	145: 9	Upper 1/2	5,350	5,090		5,220
S96T002892		Lower 1/2	2,730	2,860		2,795
S96T003121	146: 1	Upper 1/2	3,920	4,000		3,960
S96T003123	146: 2	Upper 1/2	2,820	2,790		2,805
S96T003124		Lower 1/2	1,780	1,710		1,745
S96T003125	146: 3	Upper 1/2	2,960	2,740	2,600	2,767
S96T003126		Lower 1/2	2,250	2,630	2,140	2,340
S96T002959	146: 3A	Upper 1/2	2,620	2,730	3,930	3,093
S96T002960	146: 4	Upper 1/2	2,640	2,600		2,620
S96T002961		Lower 1/2	4,270	4,150		4,210
S96T002962	146: 5	Upper 1/2	4,650	5,080		4,865
S96T002963		Lower 1/2	4,330	3,850		4,090
S96T002964	146: 6	Upper 1/2	4,180	4,220		4,200
S96T002965		Lower 1/2	4,430	4,440		4,435
S96T002966	146: 7	Upper 1/2	4,960	5,750		5,355
S96T002967		Lower 1/2	7,430	6,310		6,870[QC:c]
S96T003127	146: 8	Upper 1/2	6,010	5,980	5,200	5,730
S96T003128		Lower 1/2	3,350	3,230		3,290
S96T004178	146: 9	Lower 1/2	5,540	5,180		5,360[QC:d]
S96T003129		Upper 1/2	11,100	11,200		11,150

Table B2-10. Tank 241-U-108 Core Sample Analytical Results: Total Organic Carbon (Persulfate). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Triplicate	Mean
Solids			μg/g	μg/g	μg/g	μg/g
S96T003449	Core 141	Solid composite	5,100	5,080		5,090
S96T003659	Core 145	Solid composite	4,520	4,770		4,645
S96T004198	Core 146	Solid composite	3,510	3,850		3,680
Liquids			μg/mL	μg/mL	μg/mL	μg/mL
S96T002282	141: 1	Drainable liquid	7,030	7,150		7,090[QC:f]
S96T002942	145: 1	Drainable liquid	6,990	7,040		7,015
S96T003163	146: 1	drainable liquid	7,240	6,970		7,105[QC:f]

Table B2-11. Tank 241-U-108 Grab Sample Analytical Results: Total Organic Carbon (Furnace Oxidation).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S95T000978	Riser 7	Grab sample	7,490	7,390	7,440

B2.4.2 Total Inorganic Carbon

Analyses for TIC were performed directly on all solid and drainable liquid samples from all cores using procedure LA-342-100, Rev. D-0, and on the 1995 grab sample using procedure LA-622-102, Rev. B-2. Carbonate was determined by the TIC method instead of IC as specified in the core SAP. Most of the TIC levels from all solid and drainable liquid samples were consistent. Results (Tables B2-12 and B2-13) varied from a high of 16,400 μg/g in the lower half of segment 7 from core 146, to 844.5 μg/g in the upper half of segment 9 from core 141.

Table B2-12. Tank 241-U-108 Core Sample Analytical Results: Total Inorganic Carbon. (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Triplicate	Mean
Solids			µg/g	µg/g	µg/g	µg/g
S96T002241	141: 1	Lower 1/2	6,880	6,920		6,900
S96T002242	141: 2	Upper 1/2	6,360	5,700		6,030
S96T002243	141: 3	Upper 1/2	5,230	5,410		5,320
S96T002244	141: 3A	Upper 1/2	3,420	3,290		3,355
S96T002245	141: 4	Upper 1/2	6,880	6,930	6,910	6,907
S96T002246		Lower 1/2	7,660	7,860		7,760
S96T002247	141: 4A	Upper 1/2	6,720	7,080		6,900
S96T002248		Lower 1/2	7,190	7,290		7,240
S96T002585	141: 5	Upper 1/2	7,270	7,980		7,625
S96T002586		Lower 1/2	6,790	6,740		6,765
S96T002587	141: 6	Upper 1/2	6,870	6,710		6,790
S96T002588		Lower 1/2	6,570	6,390		6,480
S96T002589	141: 7	Upper 1/2	13,100	14,100		13,600
S96T002590		Lower 1/2	12,400	13,100		12,750
S96T002591	141: 8	Upper 1/2	13,700	11,800		12,750
S96T002592		Lower 1/2	11,800	11,900	11,500	11,733
S96T002593	141: 9	Upper 1/2	892	797		844.5
S96T002893	145: 2	Upper 1/2	3,040	3,360		3,200
S96T002879	145: 3	Upper 1/2	4,620	4,800		4,710
S96T002880		Lower 1/2	4,810	4,630		4,720
S96T002881	145: 4	Upper 1/2	4,850	5,020		4,935
S96T002882		Lower 1/2	5,680	5,740		5,710
S96T002883	145: 5	Upper 1/2	5,940	6,080		6,010
S96T002884		Lower 1/2	11,000	10,800		10,900
S96T002885	145: 6	Upper 1/2	11,300	11,200		11,250
S96T002886		Lower 1/2	10,200	10,300		10,250
S96T002887	145: 7	Upper 1/2	12,300	10,500		11,400
S96T002888		Lower 1/2	13,100	12,900		13,000
S96T002889	145: 8	Upper 1/2	8,350	7,930		8,140
S96T002890		Lower 1/2	13,000	13,200		13,100
S96T002891	145: 9	Upper 1/2	11,700	13,300		12,500
S96T002892		Lower 1/2	1,320	1,430		1,375

Table B2-12. Tank 241-U-108 Core Sample Analytical Results: Total Inorganic Carbon. (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Triplicate	Mean
Solids			µg/g	µg/g	µg/g	µg/g
S96T003121	146: 1	Upper 1/2	10,300	9,070		9,685
S96T003123	146: 2	Upper 1/2	6,440	5,590		6,015
S96T003124		Lower 1/2	1,400	1,400		1,400
S96T003125	146: 3	Upper 1/2	7,190	7,680	7,620	7,497
S96T003126		Lower 1/2	2,080	2,440		2,260
S96T002959	146: 3A	Upper 1/2	4,210	5,760	3,910	4,627
S96T002960	146: 4	Upper 1/2	4,060	4,020		4,040
S96T002961		Lower 1/2	9,470	9,410		9,440
S96T002962	146: 5	Upper 1/2	11,500	11,900		11,700
S96T002963		Lower 1/2	9,750	8,830		9,290
S96T002964	146: 6	Upper 1/2	10,500	10,700		10,600
S96T002965		Lower 1/2	11,700	11,600		11,650
S96T002966	146: 7	Upper 1/2	12,200	12,000		12,100
S96T002967		Lower 1/2	16,200	16,600		16,400
S96T003127	146: 8	Upper 1/2	10,500	12,800	13,800	12,370
S96T003128		Lower 1/2	7,680	8,060		7,870
S96T004178	146: 9	Lower 1/2	1,220	1,220		1,220
S96T003129		Upper 1/2	14,600	15,100		14,850
S96T003449	Core 141	Solid composite	7,590	7,800		7,695
S96T003659	Core 145	Solid composite	10,000	10,000		10,000
S96T004198	Core 146	Solid composite	7,080	8,100		7,590
Liquids			µg/mL	µg/mL	µg/mL	µg/mL
S96T002282	141: 1	Drainable liquid	4,220	4,750		4,485
S96T002942	145: 1	Drainable liquid	4,070	4,490		4,280
S96T003163	146: 1	Drainable liquid	4,340	4,510		4,425

Table B2-13. Tank 241-U-108 Grab Sample Analytical Results: Total Inorganic Carbon.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S95T000978	Riser 7	Grab sample	3,200	3,220	3,210

B2.4.3 Hydroxide

Analysis for hydroxide was performed directly by titration on the 1995 grab sample U-108-1 per procedure LA-211-102, Rev. C-2. Results are shown in Table B2-14.

Table B2-14. Tank 241-U-108 Grab Sample Analytical Results: Hydroxide.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S95T000978	Riser 7	Grab sample	48,400	48,900	49,200

B2.4.4 Inductively Coupled Plasma

Samples were analyzed directly following acid dilution or were prepared by either fusion, acid, or water digests. The ICP analyses on core samples were performed per procedures LA-505-161, Rev. D-3 (per the data package), or LA-505-151, Rev. D-3, depending on the ICP instrument used. The ICP analyses on the 1995 grab sample were performed per procedure LA-505-161, Rev. A-1. Although a full suite of analytes were reported on the acid- and water-digested 1996 core samples, the analytes of interest were Al, Bi, Ca, Cr, Fe, Li, Mn, Na, Ni, P, Si, and U. The ICP analytes Al, Fe, Cr, Bi, Na, Ni, Si, and U were required for historical waste modeling per the historical DQO. The metals Al, Fe, and Na were required by the compatibility DQO. Lithium was required to evaluate contamination by hydrostatic head fluid and/or wash water used during sampling. The analytes Al, Bi, Ca, Fe, P, Na, and Mn are required by the organic DQO as secondary analytes if the TOC exceeds 30,000 μg/g. Because no TOC values exceeded that value, Mn was not a required analyte. The potassium and zirconium results for the ICP fusion analyses should be disregarded, because the samples were prepared in a zirconium crucible by fusion using potassium hydroxide. For the core samples, additional ICP data were collected on an opportunistic basis (Kristofzski 1996) and are reported here. Because these data were not identified in any DQO document, there were no programmatic QC requirements with respect to these data, and the QC information associated with them were not evaluated for this report.

The ICP results are shown in Tables B2-16 through B2-37 for the 1996 core sample solids and drainable liquids, and on the 1995 liquid grab sample. Many ICP analytes were not detected at all for a given sample (digestate). These analytes are listed in Table B2-15 along with the respective digest and the highest detection limit. The solid core composite samples were prepared by fusion, water and acid digestion prior to analysis, the solid core samples were prepared by fusion digestion, and liquids were analyzed directly following acid dilution.

Table B2-15. Non-Detected ICP Analytes for Tank 241-U-108 Core Samples. (2 sheets)

Analyte	Digest	Highest Detection Limit Observed (μg/g)
Arsenic	acid	98.9
Arsenic	water	103
Arsenic	none	40.1
Barium	acid	49.5
Barium	water	51.3
Barium	none	20.1
Beryllium	acid	4.95
Beryllium	water	5.13
Beryllium	none	2
Bismuth	acid	98.9
Bismuth	fusion	2,270
Bismuth	water	103
Bismuth	none	40.1
Calcium	fusion	2,270
Cerium	acid	98.9
Cerium	water	103
Cerium	none	40.1
Cobalt	acid	19.8
Cobalt	water	20.5
Cobalt	none	8.02
Lanthanum	acid	49.5
Lanthanum	water	51.3
Lanthanum	none	20.1
Lead	acid	98.9
Lead	water	103
Lead	none	40.1
Lithium	acid	9.89

Table B2-15. Non-Detected ICP Analytes for Tank 241-U-108 Core Samples. (2 sheets)

Analyte	Digest	Highest Detection Limit Observed (μg/g)
Lithium	fusion	227
Lithium	water	10.3
Magnesium	acid	98.9
Magnesium	water	103
Magnesium	none	40.1
Neodymium	acid	98.9
Neodymium	water	103
Neodymium	none	40.1
Samarium	acid	98.9
Samarium	water	103
Samarium	none	40.1
Selenium	acid	98.9
Selenium	water	103
Selenium	none	40.1
Strontium	acid	9.89
Strontium	water	10.3
Strontium	none	4.01
Thallium	acid	198
Thallium	water	205
Thallium	none	80.2
Titanium	acid	9.89
Titanium	water	10.3
Tantalum	none	4.01
Uranium	acid	495
Uranium	fusion	11,400
Uranium	water	513
Uranium	none	200
Vanadium	acid	49.5
Vanadium	water	51.3
Vanadium	none	20.1
Zirconium	acid	9.89
Zirconium	water	10.3
Zirconium	none	4.01

Table B2-16. Tank 241-U-108 Core Sample Analytical Results: Aluminum (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003451	Core 141	Solid composite	26,400	25,500	25,950[QC:b]
S96T003457	Core 145	Solid composite	15,000	14,500	14,750[QC:b]
S96T004200	Core 146	Solid composite	12,900	16,200	14,550[QC:c,e]
Solids: fusion			µg/g	µg/g	µg/g
S96T002257	141: 1	Lower 1/2	23,700	22,600	23,150
S96T002258	141: 2	Upper 1/2	11,900	12,500	12,200
S96T002259	141: 3	Upper 1/2	12,200	11,900	12,050
S96T002260	141: 3A	Upper 1/2	11,200	10,600	10,900
S96T002261	141: 4	Upper 1/2	15,400	16,500	15,950
S96T002262		Lower 1/2	18,800	18,000	18,400
S96T002263	141: 4A	Upper 1/2	17,100	17,300	17,200
S96T002264		Lower 1/2	15,600	17,500	16,550[QC:e]
S96T002608	141: 5	Upper 1/2	16,800	16,400	16,600
S96T002609		Lower 1/2	13,500	14,600	14,050
S96T002610	141: 6	Upper 1/2	14,000	13,300	13,650
S96T002611		Lower 1/2	13,300	13,200	13,250
S96T002612	141: 7	Upper 1/2	21,400	20,900	21,150
S96T002613		Lower 1/2	17,900	16,500	17,200
S96T002614	141: 8	Upper 1/2	20,300	20,900	20,600
S96T002615		Lower 1/2	15,000	15,700	15,350
S96T002616	141: 9	Upper 1/2	83,500	74,400	78,950[QC:e]
S96T002909	145: 2	Upper 1/2	9,690	10,500	10,095
S96T002910	145: 3	Upper 1/2	12,500	12,400	12,450
S96T002911		Lower 1/2	12,600	12,100	12,350
S96T002912	145: 4	Upper 1/2	11,500	11,200	11,350
S96T002913		Lower 1/2	15,100	14,200	14,650
S96T002914	145: 5	Upper 1/2	13,600	14,400	14,000
S96T002915		Lower 1/2	21,500	20,800	21,150
S96T002916	145: 6	Upper 1/2	16,100	15,000	15,550
S96T002917		Lower 1/2	13,900	14,100	14,000

Table B2-16. Tank 241-U-108 Core Sample Analytical Results: Aluminum (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T002918	145: 7	Upper 1/2	15,200	14,700	14,950
S96T002919		Lower 1/2	17,400	17,200	17,300
S96T002920	145: 8	Upper 1/2	10,300	10,400	10,350
S96T002921		Lower 1/2	12,700	13,300	13,000
S96T002922	145: 9	Upper 1/2	13,500	13,400	13,450
S96T002923		Lower 1/2	7,530	8,030	7,780
S96T003143	146: 1	Upper 1/2	14,200	15,400	14,800
S96T003144	146: 2	Upper 1/2	10,100	10,700	10,400
S96T003145		Lower 1/2	6,900	7,320	7,110
S96T003146	146: 3	Upper 1/2	10,000	9,130	9,565
S96T003147		Lower 1/2	8,410	8,210	8,310
S96T003001	146: 3A	Upper 1/2	9,340	8,660	9,000
S96T003002	146: 4	Upper 1/2	9,990	10,100	10,045
S96T003003		Lower 1/2	15,900	15,400	15,650
S96T003004	146: 5	Upper 1/2	19,300	19,600	19,450
S96T003005		Lower 1/2	14,200	13,900	14,050
S96T003006	146: 6	Upper 1/2	14,700	14,100	14,400
S96T003007		Lower 1/2	16,200	16,200	16,200
S96T003008	146: 7	Upper 1/2	17,000	18,200	17,600
S96T003009		Lower 1/2	20,800	20,900	20,850
S96T003148	146: 8	Upper 1/2	21,300	20,500	20,900
S96T003149		Lower 1/2	19,700	20,600	20,150
S96T004180	146: 9	Lower 1/2	9,470	9,320	9,395
S96T003150		Upper 1/2	16,200	16,400	16,300
S96T003450	Core 141	Solid composite	27,300	23,000	25,150[QC:e]
S96T003660	Core 145	Solid composite	19,700	12,300	16,000[QC:e]
S96T004199	Core 146	Solid composite	15,200	15,400	15,300

Table B2-16. Tank 241-U-108 Core Sample Analytical Results: Aluminum (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T003453	Core 141	Solid composite	21,700	21,300	21,500
S96T003662	Core 145	Solid composite	14,500	13,900	14,200
S96T004202	Core 146	Solid composite	13,800	13,800	13,800
Liquids			µg/mL	µg/mL	µg/mL
S96T002282	141: 1	Drainable liquid	29,900	30,200	30,050
S96T002942	145: 1	Drainable liquid	31,100	31,100	31,100
S96T003163	146: 1	Drainable liquid	30,900	29,600	30,250

Table B2-17. Tank 241-U-108 Grab Sample Analytical Results: Aluminum (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S95T000978	Riser 7	Grab sample	42,900	37,440	40,170

Table B2-18. Tank 241-U-108 Core Sample Analytical Results: Antimony (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S96T003451	Core 141	Solid composite	77.1	< 57.8	< 67.45[QC:e]
S96T003457	Core 145	Solid composite	< 59.4	< 58	< 58.7
S96T004200	Core 146	Solid composite	< 28.9	< 31.5	< 30.2[QC:a]
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S96T003453	Core 141	Solid composite	< 61.6	< 61.5	< 61.55
S96T003662	Core 145	Solid composite	< 56.5	< 43.7	< 50.1[QC:e]
S96T004202	Core 146	Solid composite	< 37	< 33	< 35[QC:e]
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S96T002282	141: 1	Drainable liquid	< 24.1	< 24.1	< 24.1
S96T002942	145: 1	Drainable liquid	< 24.1	< 24.1	< 24.1
S96T003163	146: 1	Drainable liquid	< 24.1	< 24.1	< 24.1

Table B2-19. Tank 241-U-108 Core Sample Analytical Results: Boron (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003451	Core 141	Solid composite	106	117	111.5
S96T003457	Core 145	Solid composite	71.2	64.5	67.85
S96T004200	Core 146	Solid composite	57.6	66.2	61.9[QC:e]
Solids: water digest			µg/g	µg/g	µg/g
S96T003453	Core 141	Solid composite	530	604	567[QC:e]
S96T003662	Core 145	Solid composite	538	454	496[QC:e]
S96T004202	Core 146	Solid composite	589	431	510[QC:e]
Liquids			µg/mL	µg/mL	µg/mL
S96T002282	141: 1	Drainable liquid	96.7	96.5	96.6
S96T002942	145: 1	Drainable liquid	89.2	91.3	90.25
S96T003163	146: 1	Drainable liquid	89.4	84.2	86.8

Table B2-20. Tank 241-U-108 Core Sample Analytical Results: Cadmium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S96T003451	Core 141	Solid composite	< 4.8	5.14	< 4.97
S96T003457	Core 145	Solid composite	< 4.95	< 4.84	< 4.895
S96T004200	Core 146	Solid composite	2.95	4.06	3.505[QC:a,e]
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S96T003453	Core 141	Solid composite	< 5.13	< 5.12	< 5.125
S96T003662	Core 145	Solid composite	< 4.71	< 3.64	< 4.175[QC:e]
S96T004202	Core 146	Solid composite	< 3.08	< 2.75	< 2.915[QC:e]
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S96T002282	141: 1	Drainable liquid	< 2	< 2	< 2
S96T002942	145: 1	Drainable liquid	< 2	< 2	< 2
S96T003163	146: 1	Drainable liquid	< 2	< 2	< 2

Table B2-21. Tank 241-U-108 Core Sample Analytical Results: Calcium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S96T003451	Core 141	Solid composite	178	137	157.5[QC:b,e]
S96T003457	Core 145	Solid composite	199	173	186[QC:b,e]
S96T004200	Core 146	Solid composite	109	137	123[QC:e]
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S96T003453	Core 141	Solid composite	151	128	139.5[QC:e]
S96T003662	Core 145	Solid composite	127	114	120.5[QC:e]
S96T004202	Core 146	Solid composite	88.5	82.6	85.55
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S96T002282	141: 1	Drainable liquid	41.9	< 40.1	< 41
S96T002942	145: 1	Drainable liquid	< 40.1	< 40.1	< 40.1
S96T003163	146: 1	Drainable liquid	41	< 40.1	< 40.55

Table B2-22. Tank 241-U-108 Core Sample Analytical Results: Chromium (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003451	Core 141	Solid composite	4,060	3,930	3,995
S96T003457	Core 145	Solid composite	3,630	3,610	3,620
S96T004200	Core 146	Solid composite	3,430	4,300	3,865[QC:c,e]
Solids: fusion			µg/g	µg/g	µg/g
S96T002257	141: 1	Lower 1/2	12,600	9,310	10,960[QC:e]
S96T002258	141: 2	Upper 1/2	3,630	3,650	3,640
S96T002259	141: 3	Upper 1/2	2,900	3,000	2,950
S96T002260	141: 3A	Upper 1/2	2,500	2,660	2,580
S96T002261	141: 4	Upper 1/2	4,810	4,430	4,620
S96T002262		Lower 1/2	5,100	5,300	5,200
S96T002263	141: 4A	Upper 1/2	5,390	5,420	5,405
S96T002264		Lower 1/2	4,380	4,230	4,305
S96T002608	141: 5	Upper 1/2	4,670	4,490	4,580
S96T002609		Lower 1/2	3,320	3,210	3,265
S96T002610	141: 6	Upper 1/2	2,920	2,830	2,875
S96T002611		Lower 1/2	2,360	2,530	2,445
S96T002612	141: 7	Upper 1/2	5,300	5,770	5,535
S96T002613		Lower 1/2	4,600	4,470	4,535
S96T002614	141: 8	Upper 1/2	6,300	6,080	6,190
S96T002615		Lower 1/2	5,650	5,740	5,695
S96T002616	141: 9	Upper 1/2	937	918	927.5
S96T002909	145: 2	Upper 1/2	2,390	3,000	2,695[QC:e]
S96T002910	145: 3	Upper 1/2	3,700	3,160	3,430[QC:e]
S96T002911		Lower 1/2	3,370	3,230	3,300
S96T002912	145: 4	Upper 1/2	2,770	2,900	2,835
S96T002913		Lower 1/2	3,790	3,660	3,725
S96T002914	145: 5	Upper 1/2	3,070	3,320	3,195
S96T002915		Lower 1/2	5,940	6,490	6,215
S96T002916	145: 6	Upper 1/2	3,950	3,720	3,835
S96T002917		Lower 1/2	3,340	3,310	3,325

Table B2-22. Tank 241-U-108 Core Sample Analytical Results: Chromium (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T002918	145: 7	Upper 1/2	3,960	3,980	3,970
S96T002919		Lower 1/2	5,060	5,200	5,130
S96T002920	145: 8	Upper 1/2	2,820	2,850	2,835
S96T002921		Lower 1/2	3,940	3,820	3,880
S96T002922	145: 9	Upper 1/2	7,890	7,960	7,925
S96T002923		Lower 1/2	2,390	2,480	2,435
S96T003143	146: 1	Upper 1/2	3,520	3,870	3,695
S96T003144	146: 2	Upper 1/2	3,380	3,500	3,440
S96T003145		Lower 1/2	1,680	1,540	1,610
S96T003146	146: 3	Upper 1/2	3,200	3,360	3,280
S96T003147		Lower 1/2	1,290	1,330	1,310
S96T003001	146: 3A	Upper 1/2	2,940	2,900	2,920
S96T003002	146: 4	Upper 1/2	3,400	3,390	3,395
S96T003003		Lower 1/2	4,890	4,940	4,915
S96T003004	146: 5	Upper 1/2	5,100	4,810	4,955
S96T003005		Lower 1/2	3,650	3,280	3,465[QC:e]
S96T003006	146: 6	Upper 1/2	3,520	3,990	3,755[QC:e]
S96T003007		Lower 1/2	3,970	3,850	3,910
S96T003008	146: 7	Upper 1/2	3,990	4,350	4,170
S96T003009		Lower 1/2	5,350	5,140	5,245
S96T003148	146: 8	Upper 1/2	4,200	4,790	4,495[QC:e]
S96T003149		Lower 1/2	4,890	5,070	4,980
S96T004180	146: 9	Lower 1/2	6,300	6,510	6,405
S96T003150		Upper 1/2	6,590	7,010	6,800
S96T003450	Core 141	Solid composite	4,310	3,810	4,060[QC:e]
S96T003660	Core 145	Solid composite	5,050	3,150	4,100[QC:e]
S96T004199	Core 146	Solid composite	4,090	3,950	4,020

Table B2-22. Tank 241-U-108 Core Sample Analytical Results: Chromium (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			**μg/g**	**μg/g**	**μg/g**
S96T003453	Core 141	Solid composite	321	317	319
S96T003662	Core 145	Solid composite	287	273	280
S96T004202	Core 146	Solid composite	462	474	468
Liquids			**μg/mL**	**μg/mL**	**μg/mL**
S96T002282	141: 1	Drainable liquid	1,230	1,250	1,240
S96T002942	145: 1	Drainable liquid	1,130	1,130	1,130
S96T003163	146: 1	Drainable liquid	1,500	1,420	1,460

Table B2-23. Tank 241-U-108 Core Sample Analytical Results: Copper (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003451	Core 141	Solid composite	< 9.6	< 9.63	< 9.615
S96T003457	Core 145	Solid composite	< 9.89	< 9.67	< 9.78
S96T004200	Core 146	Solid composite	5.77	< 5.25	< 5.51
Solids: water digest			µg/g	µg/g	µg/g
S96T003453	Core 141	Solid composite	< 10.3	< 10.2	< 10.25
S96T003662	Core 145	Solid composite	< 9.42	< 7.28	< 8.35[QC:e]
S96T004202	Core 146	Solid composite	< 6.17	< 5.5	< 5.835[QC:e]
Liquids			µg/mL	µg/mL	µg/mL
S96T002282	141: 1	Drainable liquid	< 4.01	< 4.01	< 4.01
S96T002942	145: 1	Drainable liquid	< 4.01	< 4.01	< 4.01
S96T003163	146: 1	Drainable liquid	< 4.01	< 4.01	< 4.01

Table B2-24. Tank 241-U-108 Core Sample Analytical Results: Iron (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003451	Core 141	Solid composite	176	147	161.5[QC:e]
S96T003457	Core 145	Solid composite	235	179	207[QC:e]
S96T004200	Core 146	Solid composite	144	171	157.5[QC:e]
Solids: fusion			µg/g	µg/g	µg/g
S96T002257	141: 1	Lower 1/2	< 893	< 895	< 894
S96T002258	141: 2	Upper 1/2	< 929	< 967	< 948
S96T002259	141: 3	Upper 1/2	< 878	< 864	< 871
S96T002260	141: 3A	Upper 1/2	< 978	< 941	< 959.5
S96T002261	141: 4	Upper 1/2	< 913	< 907	< 910
S96T002262		Lower 1/2	< 991	< 945	< 968
S96T002263	141: 4A	Upper 1/2	< 904	< 925	< 914.5
S96T002264		Lower 1/2	< 904	< 893	< 898.5
S96T002608	141: 5	Upper 1/2	< 944	< 954	< 949
S96T002609		Lower 1/2	< 1,100	< 1,020	< 1,060
S96T002610	141: 6	Upper 1/2	< 1,060	< 963	< 1,011
S96T002611		Lower 1/2	< 1,100	< 1,120	< 1,110
S96T002612	141: 7	Upper 1/2	< 947	< 968	< 957.5
S96T002613		Lower 1/2	< 1,100	< 1,060	< 1,080
S96T002614	141: 8	Upper 1/2	< 1,030	< 934	< 982
S96T002615		Lower 1/2	< 1,080	< 973	< 1,026[QC:e]
S96T002616	141: 9	Upper 1/2	< 1,080	< 1,060	< 1,070
S96T002909	145: 2	Upper 1/2	1,070	< 970	< 1,020
S96T002910	145: 3	Upper 1/2	< 1,010	< 1,010	< 1,010
S96T002911		Lower 1/2	< 1,010	< 1,020	< 1,015
S96T002912	145: 4	Upper 1/2	< 1,110	< 1,120	< 1,115
S96T002913		Lower 1/2	< 1,050	< 1,090	< 1,070
S96T002914	145: 5	Upper 1/2	< 1,110	< 1,090	< 1,100
S96T002915		Lower 1/2	< 1,100	< 1,110	< 1,105
S96T002916	145: 6	Upper 1/2	< 1,040	< 1,050	< 1,045
S96T002917		Lower 1/2	< 1,000	< 990	< 995

Table B2-24. Tank 241-U-108 Core Sample Analytical Results: Iron (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
S96T002918	145: 7	Upper 1/2	< 1,040	< 1,030	< 1,035
S96T002919		Lower 1/2	< 1,050	< 1,040	< 1,045
S96T002920	145: 8	Upper 1/2	< 983	< 967	< 975
S96T002921		Lower 1/2	< 1,020	< 1,020	< 1,020
S96T002922	145: 9	Upper 1/2	1,310	1,440	1,375
S96T002923		Lower 1/2	< 982	< 984	< 983
S96T003143	146: 1	Upper 1/2	< 1,120	< 1,130	< 1,125
S96T003144	146: 2	Upper 1/2	< 1,090	< 1,050	< 1,070
S96T003145		Lower 1/2	< 934	< 1,130	< 1,032[QC:e]
S96T003146	146: 3	Upper 1/2	< 1,110	< 1,130	< 1,120
S96T003147		Lower 1/2	< 961	< 1,020	< 990.5
S96T003001	146: 3A	Upper 1/2	< 1,060	< 1,080	< 1,070
S96T003002	146: 4	Upper 1/2	< 1,010	< 1,060	< 1,035
S96T003003		Lower 1/2	< 976	< 1,060	< 1,018
S96T003004	146: 5	Upper 1/2	< 1,100	< 969	< 1,034[QC:e]
S96T003005		Lower 1/2	< 1,050	< 990	< 1,020
S96T003006	146: 6	Upper 1/2	< 1,130	< 954	< 1,042[QC:e]
S96T003007		Lower 1/2	< 1,020	< 1,030	< 1,025
S96T003008	146: 7	Upper 1/2	< 978	< 1,020	< 999
S96T003009		Lower 1/2	< 932	< 1,110	< 1,021[QC:e]
S96T003148	146: 8	Upper 1/2	< 965	< 982	< 973.5
S96T003149		Lower 1/2	< 982	< 946	< 964
S96T004180	146: 9	Lower 1/2	1,360	1,400	1,380
S96T003150		Upper 1/2	< 1,140	< 1,070	< 1,105
S96T003450	Core 141	Solid composite	< 987	< 1,010	< 998.5
S96T003660	Core 145	Solid composite	< 987	< 781	< 884[QC:e]
S96T004199	Core 146	Solid composite	< 1,010	< 981	< 995.5

Table B2-24. Tank 241-U-108 Core Sample Analytical Results: Iron (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			μg/g	μg/g	μg/g
S96T003453	Core 141	Solid composite	< 51.3	< 51.2	< 51.25
S96T003662	Core 145	Solid composite	< 47.1	< 36.4	< 41.75[QC:e]
S96T004202	Core 146	Solid composite	< 30.8	< 27.5	< 29.15[QC:e]
Liquids			μg/mL	μg/mL	μg/mL
S96T002282	141: 1	Drainable liquid	29.2	29.2	29.2
S96T002942	145: 1	Drainable liquid	28.9	29.1	29
S96T003163	146: 1	Drainable liquid	35.7	34.4	35.05

Table B2-25. Tank 241-U-108 Grab Sample Analytical Results: Iron (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S95T000978	Riser 7	Grab sample	43.24	36.95	40.10

Table B2-26. Tank 241-U-108 Core Sample Analytical Results: Lithium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S96T002282	141: 1	Drainable liquid	< 4.01	< 4.01	< 4.01
S96T002942	145: 1	Drainable liquid	< 4.01	< 4.01	< 4.01
S96T003163	146: 1	Drainable liquid	4.09	< 4.01	< 4.05

Table B2-27. Tank 241-U-108 Core Sample Analytical Results: Manganese (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003451	Core 141	Solid composite	45.3	45.3	45.3
S96T003457	Core 145	Solid composite	77.7	77	77.35
S96T004200	Core 146	Solid composite	68.4	73.6	71[QC:a]
Solids: fusion			µg/g	µg/g	µg/g
S96T002257	141: 1	Lower 1/2	< 179	< 179	< 179
S96T002258	141: 2	Upper 1/2	< 186	< 193	< 189.5
S96T002259	141: 3	Upper 1/2	< 176	< 173	< 174.5
S96T002260	141: 3A	Upper 1/2	< 196	< 188	< 192
S96T002261	141: 4	Upper 1/2	< 183	< 181	< 182
S96T002262		Lower 1/2	< 198	< 189	< 193.5
S96T002263	141: 4A	Upper 1/2	< 181	< 185	< 183
S96T002264		Lower 1/2	< 181	< 179	< 180
S96T002608	141: 5	Upper 1/2	< 189	< 191	< 190
S96T002609		Lower 1/2	< 221	< 205	< 213
S96T002610	141: 6	Upper 1/2	< 212	< 193	< 202.5
S96T002611		Lower 1/2	< 219	< 224	< 221.5
S96T002612	141: 7	Upper 1/2	< 189	< 194	< 191.5
S96T002613		Lower 1/2	< 221	< 212	< 216.5
S96T002614	141: 8	Upper 1/2	< 205	< 187	< 196
S96T002615		Lower 1/2	< 215	198	< 206.5
S96T002616	141: 9	Upper 1/2	< 216	< 212	< 214
S96T002909	145: 2	Upper 1/2	< 196	< 194	< 195
S96T002910	145: 3	Upper 1/2	< 202	< 202	< 202
S96T002911		Lower 1/2	< 202	< 203	< 202.5
S96T002912	145: 4	Upper 1/2	< 223	< 223	< 223
S96T002913		Lower 1/2	< 211	< 218	< 214.5
S96T002914	145: 5	Upper 1/2	< 221	< 219	< 220
S96T002915		Lower 1/2	< 220	< 221	< 220.5
S96T002916	145: 6	Upper 1/2	< 209	< 210	< 209.5
S96T002917		Lower 1/2	< 201	< 198	< 199.5

Table B2-27. Tank 241-U-108 Core Sample Analytical Results: Manganese (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
96T002918	145: 7	Upper 1/2	< 207	< 206	< 206.5
S96T002919		Lower 1/2	< 211	< 207	< 209
S96T002920	145: 8	Upper 1/2	< 197	< 193	< 195
S96T002921		Lower 1/2	< 204	< 205	< 204.5
S96T002922	145: 9	Upper 1/2	671	712	691.5
S96T002923		Lower 1/2	< 196	< 197	< 196.5
S96T003143	146: 1	Upper 1/2	< 224	< 225	< 224.5
S96T003144	146: 2	Upper 1/2	< 218	< 210	< 214
S96T003145		Lower 1/2	< 187	< 227	< 207[QC:e]
S96T003146	146: 3	Upper 1/2	< 222	< 226	< 224
S96T003147		Lower 1/2	< 192	< 203	< 197.5
S96T003001	146: 3A	Upper 1/2	< 211	< 216	< 213.5
S96T003002	146: 4	Upper 1/2	< 202	< 213	< 207.5
S96T003003		Lower 1/2	< 195	< 212	< 203.5
S96T003004	146: 5	Upper 1/2	< 219	< 194	< 206.5[QC:e]
S96T003005		Lower 1/2	< 209	< 198	< 203.5
S96T003006	146: 6	Upper 1/2	< 226	< 191	< 208.5[QC:e]
S96T003007		Lower 1/2	< 204	< 206	< 205
S96T003008	146: 7	Upper 1/2	< 196	< 203	< 199.5
S96T003009		Lower 1/2	< 186	< 223	< 204.5[QC:e]
S96T003148	146: 8	Upper 1/2	< 193	< 196	< 194.5
S96T003149		Lower 1/2	< 196	< 189	< 192.5
S96T004180	146: 9	Lower 1/2	785	823	804
S96T003150		Upper 1/2	455	474	464.5
S96T003450	Core 141	Solid composite	< 197	< 202	< 199.5
S96T003660	Core 145	Solid composite	< 197	< 156	< 176.5[QC:e]
S96T004199	Core 146	Solid composite	< 202	< 196	< 199

Table B2-27. Tank 241-U-108 Core Sample Analytical Results: Manganese (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S96T003453	Core 141	Solid composite	< 10.3	< 10.2	< 10.25
S96T003662	Core 145	Solid composite	< 9.42	< 7.28	< 8.35[QC:e]
S96T004202	Core 146	Solid composite	< 6.17	< 5.5	< 5.84[QC:e]
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S96T002282	141: 1	Drainable liquid	< 4.01	< 4.01	< 4.01
S96T002942	145: 1	Drainable liquid	< 4.01	< 4.01	< 4.01
S96T003163	146: 1	Drainable liquid	< 4.01	< 4.01	< 4.01

Table B2-28. Tank 241-U-108 Core Sample Analytical Results: Molybdenum (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S96T003451	Core 141	Solid composite	66.6	66	66.3
S96T003457	Core 145	Solid composite	< 49.5	< 48.4	< 48.95
S96T004200	Core 146	Solid composite	45.3	55.7	50.5[QC:e]
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S96T003453	Core 141	Solid composite	74	72.4	73.2
S96T003662	Core 145	Solid composite	48.5	47.9	48.2
S96T004202	Core 146	Solid composite	51.8	51.8	51.8
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S96T002282	141: 1	Drainable liquid	119	122	120.5
S96T002942	145: 1	Drainable liquid	125	126	125.5
S96T003163	146: 1	Drainable liquid	125	119	122

Table B2-29. Tank 241-U-108 Core Sample Analytical Results: Nickel (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003451	Core 141	Solid composite	53.6	52.5	53.05
S96T003457	Core 145	Solid composite	50.8	51.6	51.2
S96T004200	Core 146	Solid composite	43.5	54.3	48.9[QC:e]
Solids: fusion			µg/g	µg/g	µg/g
S96T002257	141: 1	Lower 1/2	< 357	< 358	< 357.5
S96T002258	141: 2	Upper 1/2	< 372	< 387	< 379.5
S96T002259	141: 3	Upper 1/2	< 351	< 345	< 348
S96T002260	141: 3A	Upper 1/2	< 391	< 376	< 383.5
S96T002261	141: 4	Upper 1/2	< 365	< 363	< 364
S96T002262		Lower 1/2	< 397	< 378	< 387.5
S96T002263	141: 4A	Upper 1/2	< 362	< 370	< 366
S96T002264		Lower 1/2	< 361	< 357	< 359
S96T002608	141: 5	Upper 1/2	< 377	< 382	< 379.5
S96T002609		Lower 1/2	< 441	< 409	< 425
S96T002610	141: 6	Upper 1/2	< 424	< 385	< 404.5
S96T002611		Lower 1/2	< 438	< 447	< 442.5
S96T002612	141: 7	Upper 1/2	< 379	< 387	< 383
S96T002613		Lower 1/2	< 441	< 424	< 432.5
S96T002614	141: 8	Upper 1/2	< 411	< 373	< 392
S96T002615		Lower 1/2	< 431	< 389	< 410[QC:e]
S96T002616	141: 9	Upper 1/2	< 432	< 423	< 427.5
S96T002909	145: 2	Upper 1/2	< 393	< 388	< 390.5
S96T002910	145: 3	Upper 1/2	< 404	< 404	< 404
S96T002911		Lower 1/2	< 404	< 407	< 405.5
S96T002912	145: 4	Upper 1/2	< 446	< 447	< 446.5
S96T002913		Lower 1/2	< 422	< 436	< 429
S96T002914	145: 5	Upper 1/2	< 442	< 438	< 440
S96T002915		Lower 1/2	< 441	< 442	< 441.5
S96T002916	145: 6	Upper 1/2	< 418	< 419	< 418.5
S96T002917		Lower 1/2	< 401	< 396	< 398.5

Table B2-29. Tank 241-U-108 Core Sample Analytical Results: Nickel (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T002918	145: 7	Upper 1/2	< 414	< 412	< 413
S96T002919		Lower 1/2	< 422	< 414	< 418
S96T002920	145: 8	Upper 1/2	< 393	< 387	< 390
S96T002921		Lower 1/2	< 409	< 410	< 409.5
S96T002922	145: 9	Upper 1/2	< 393	< 399	< 396
S96T002923		Lower 1/2	< 393	< 393	< 393
S96T003143	146: 1	Upper 1/2	< 447	< 451	< 449
S96T003144	146: 2	Upper 1/2	< 437	< 421	< 429
S96T003145		Lower 1/2	< 373	< 454	< 413.5[QC:e]
S96T003146	146: 3	Upper 1/2	< 444	< 451	< 447.5
S96T003147		Lower 1/2	< 384	< 407	< 395.5
S96T003001	146: 3A	Upper 1/2	< 423	< 432	< 427.5
S96T003002	146: 4	Upper 1/2	< 404	< 426	< 415
S96T003003		Lower 1/2	< 390	< 425	< 407.5
S96T003004	146: 5	Upper 1/2	< 438	< 388	< 413[QC:e]
S96T003005		Lower 1/2	< 418	< 396	< 407
S96T003006	146: 6	Upper 1/2	< 452	< 382	< 417[QC:e]
S96T003007		Lower 1/2	< 408	< 413	< 410.5
S96T003008	146: 7	Upper 1/2	< 391	< 407	< 399
S96T003009		Lower 1/2	< 373	< 446	< 409.5[QC:e]
S96T003148	146: 8	Upper 1/2	< 386	< 393	< 389.5
S96T003149		Lower 1/2	< 393	< 378	< 385.5
S96T004180	146: 9	Lower 1/2	< 395	< 398	< 396.5
S96T003150		Upper 1/2	< 455	< 429	< 442
S96T003450	Core 141	Solid composite	< 395	< 404	< 399.5
S96T003660	Core 145	Solid composite	< 395	< 312	< 353.5[QC:e]
S96T004199	Core 146	Solid composite	2,280	1,920	2,100[QC:e]

Table B2-29. Tank 241-U-108 Core Sample Analytical Results: Nickel (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S96T003453	Core 141	Solid composite	< 20.5	< 20.5	< 20.5
S96T003662	Core 145	Solid composite	< 18.8	< 14.6	< 16.7[QC:e]
S96T004202	Core 146	Solid composite	16.5	14.7	15.6[QC:e]
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S96T002282	141: 1	Drainable liquid	27.3	30.3	28.8
S96T002942	145: 1	Drainable liquid	30.6	30.7	30.65
S96T003163	146: 1	Drainable liquid	35.2	33.4	34.3

Table B2-30. Tank 241-U-108 Core Sample Analytical Results: Phosphorus (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003451	Core 141	Solid composite	4,500	3,310	3,905[QC:e]
S96T003457	Core 145	Solid composite	2,840	2,860	2,850
S96T004200	Core 146	Solid composite	3,660	4,510	4,085[QC:c,e]
Solids: fusion			µg/g	µg/g	µg/g
S96T002257	141: 1	Lower 1/2	7,880	4,190	6,035[QC:e]
S96T002258	141: 2	Upper 1/2	< 3,720	< 3,870	< 3,795
S96T002259	141: 3	Upper 1/2	< 3,510	< 3,450	< 3,480
S96T002260	141: 3A	Upper 1/2	< 3,910	< 3,760	< 3,835
S96T002261	141: 4	Upper 1/2	< 3,650	< 3,630	< 3,640
S96T002262		Lower 1/2	< 3,970	< 3,780	< 3,875
S96T002263	141: 4A	Upper 1/2	< 3,620	< 3,700	< 3,660
S96T002264		Lower 1/2	< 3,610	< 3,570	< 3,590
S96T002608	141: 5	Upper 1/2	< 3,770	< 3,820	< 3,795
S96T002609		Lower 1/2	< 4,410	< 4,090	< 4,250
S96T002610	141: 6	Upper 1/2	< 4,240	< 3,850	< 4,045
S96T002611		Lower 1/2	< 4,380	< 4,470	< 4,425
S96T002612	141: 7	Upper 1/2	< 3,790	< 3,870	< 3,830
S96T002613		Lower 1/2	< 4,410	< 4,240	< 4,325
S96T002614	141: 8	Upper 1/2	< 4,110	< 3,730	< 3,920
S96T002615		Lower 1/2	11,200	11,000	11,100
S96T002616	141: 9	Upper 1/2	45,800	44,400	45,100
S96T002909	145: 2	Upper 1/2	< 3,930	< 3,880	< 3,905
S96T002910	145: 3	Upper 1/2	< 4,040	< 4,040	< 4,040
S96T002911		Lower 1/2	< 4,040	< 4,070	< 4,055
S96T002912	145: 4	Upper 1/2	< 4,460	< 4,470	< 4,465
S96T002913		Lower 1/2	< 4,220	< 4,360	< 4,290
S96T002914	145: 5	Upper 1/2	< 4,420	< 4,380	< 4,400
S96T002915		Lower 1/2	< 4,410	< 4,420	< 4,415
S96T002916	145: 6	Upper 1/2	< 4,180	< 4,190	< 4,185
S96T002917		Lower 1/2	< 4,010	< 3,960	< 3,985

Table B2-30. Tank 241-U-108 Core Sample Analytical Results: Phosphorus (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T002918	145: 7	Upper 1/2	< 4,140	< 4,120	< 4,130
S96T002919		Lower 1/2	< 4,220	< 4,140	< 4,180
S96T002920	145: 8	Upper 1/2	< 3,930	< 3,870	< 3,900
S96T002921		Lower 1/2	< 4,090	< 4,100	< 4,095
S96T002922	145: 9	Upper 1/2	15,400	20,000	17,700[QC:e]
S96T002923		Lower 1/2	47,000	48,100	47,550
S96T003143	146: 1	Upper 1/2	< 4,470	< 4,510	< 4,490
S96T003144	146: 2	Upper 1/2	< 4,370	< 4,210	< 4,290
S96T003145		Lower 1/2	< 3,730	< 4,540	< 4,135[QC:e]
S96T003146	146: 3	Upper 1/2	< 4,440	< 4,510	< 4,475
S96T003147		Lower 1/2	< 3,840	< 4,070	< 3,955
S96T003001	146: 3A	Upper 1/2	< 4,230	< 4,320	< 4,275
S96T003002	146: 4	Upper 1/2	< 4,040	< 4,260	< 4,150
S96T003003		Lower 1/2	< 3,900	< 4,250	< 4,075
S96T003004	146: 5	Upper 1/2	< 4,380	< 3,880	< 4,130[QC:e]
S96T003005		Lower 1/2	< 4,180	< 3,960	< 4,070
S96T003006	146: 6	Upper 1/2	< 4,520	< 3,820	< 4,170[QC:e]
S96T003007		Lower 1/2	< 4,080	< 4,130	< 4,105
S96T003008	146: 7	Upper 1/2	< 3,910	< 4,070	< 3,990
S96T003009		Lower 1/2	< 3,730	< 4,460	< 4,095[QC:e]
S96T003148	146: 8	Upper 1/2	< 3,860	< 3,930	< 3,895
S96T003149		Lower 1/2	< 3,930	< 3,780	< 3,855
S96T004180	146: 9	Lower 1/2	43,300	46,800	45,050
S96T003150		Upper 1/2	< 4,550	4,690	< 4,620
S96T003450	Core 141	Solid composite	< 3,950	< 4,040	< 3,995
S96T003660	Core 145	Solid composite	< 3,950	< 3,120	< 3,535[QC:e]
S96T004199	Core 146	Solid composite	4,090	< 3,930	< 4,010

Table B2-30. Tank 241-U-108 Core Sample Analytical Results: Phosphorus (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T003453	Core 141	Solid composite	4,380	5,190	4,785[QC:e]
S96T003662	Core 145	Solid composite	3,290	3,020	3,155
S96T004202	Core 146	Solid composite	4,040	4,050	4,045
Liquids			µg/mL	µg/mL	µg/mL
S96T002282	141: 1	Drainable liquid	967	957	962
S96T002942	145: 1	Drainable liquid	1,030	1,040	1,035
S96T003163	146: 1	Drainable liquid	1,070	1,030	1,050

Table B2-31. Tank 241-U-108 Core Sample Analytical Results: Potassium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			**μg/g**	**μg/g**	**μg/g**
S96T003451	Core 141	Solid composite	1,980	1,830	1,905
S96T003457	Core 145	Solid composite	1,300	1,220	1,260
S96T004200	Core 146	Solid composite	1,470	1,680	1,575[QC:c,e]
Solids: water digest			**μg/g**	**μg/g**	**μg/g**
S96T003453	Core 141	Solid composite	2,050	2,070	2,060
S96T003662	Core 145	Solid composite	1,420	1,430	1,425
S96T004202	Core 146	Solid composite	1,520	1,530	1,525
Liquids			**μg/mL**	**μg/mL**	**μg/mL**
S96T002282	141: 1	Drainable liquid	3,900	4,040	3,970
S96T002942	145: 1	Drainable liquid	4,160	4,120	4,140
S96T003163	146: 1	Drainable liquid	3,970	3,870	3,920

Table B2-32. Tank 241-U-108 Core Sample Analytical Results: Silicon (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			μg/g	μg/g	μg/g
S96T003451	Core 141	Solid composite	147	161	154
S96T003457	Core 145	Solid composite	108	92.6	100.3[QC:e]
S96T004200	Core 146	Solid composite	95.3	110	102.7[QC:b,e]
Solids: fusion			μg/g	μg/g	μg/g
S96T002257	141: 1	Lower 1/2	< 893	< 895	< 894
S96T002258	141: 2	Upper 1/2	< 929	< 967	< 948
S96T002259	141: 3	Upper 1/2	< 878	< 864	< 871
S96T002260	141: 3A	Upper 1/2	< 978	1,180	< 1,080[QC:e]
S96T002261	141: 4	Upper 1/2	< 913	< 907	< 910
S96T002262		Lower 1/2	< 991	< 945	< 968
S96T002263	141: 4A	Upper 1/2	< 904	< 925	< 914.5
S96T002264		Lower 1/2	< 904	932	< 918
S96T002608	141: 5	Upper 1/2	< 944	< 954	< 949
S96T002609		Lower 1/2	< 1,100	1,590	< 1,340[QC:e]
S96T002610	141: 6	Upper 1/2	< 1,060	< 963	< 1,011
S96T002611		Lower 1/2	< 1,100	< 1,120	< 1,110
S96T002612	141: 7	Upper 1/2	< 947	< 968	< 957.5
S96T002613		Lower 1/2	2,450	< 1,060	< 1,755[QC:e]
S96T002614	141: 8	Upper 1/2	< 1,030	< 934	< 982
S96T002615		Lower 1/2	< 1,080	< 973	< 1,026[QC:e]
S96T002616	141: 9	Upper 1/2	1,930	2,390	2,160[QC:e]
S96T002909	145: 2	Upper 1/2	984	< 970	< 977
S96T002910	145: 3	Upper 1/2	< 1,010	< 1,010	< 1,010
S96T002911		Lower 1/2	< 1,010	< 1,020	< 1,015
S96T002912	145: 4	Upper 1/2	< 1,110	< 1,120	< 1,115
S96T002913		Lower 1/2	< 1,050	< 1,090	< 1,070
S96T002914	145: 5	Upper 1/2	< 1,110	< 1,090	< 1,100
S96T002915		Lower 1/2	< 1,100	< 1,110	< 1,105
S96T002916	145: 6	Upper 1/2	< 1,040	< 1,050	< 1,045
S96T002917		Lower 1/2	< 1,000	< 990	< 995

Table B2-32. Tank 241-U-108 Core Sample Analytical Results: Silicon (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T002918	145: 7	Upper 1/2	< 1,040	< 1,030	< 1,035
S96T002919		Lower 1/2	< 1,050	< 1,040	< 1,045
S96T002920	145: 8	Upper 1/2	< 983	< 967	< 975
S96T002921		Lower 1/2	< 1,020	< 1,020	< 1,020
S96T002922	145: 9	Upper 1/2	< 982	< 998	< 990
S96T002923		Lower 1/2	< 982	< 984	< 983
S96T003143	146: 1	Upper 1/2	< 1,120	< 1,130	< 1,125
S96T003144	146: 2	Upper 1/2	< 1,090	< 1,050	< 1,070
S96T003145		Lower 1/2	< 934	< 1,130	< 1,032[QC:e]
S96T003146	146: 3	Upper 1/2	< 1,110	< 1,130	< 1,120
S96T003147		Lower 1/2	< 961	< 1,020	< 990.5
S96T003001	146: 3A	Upper 1/2	< 1,060	< 1,080	< 1,070
S96T003002	146: 4	Upper 1/2	< 1,010	< 1,060	< 1,035
S96T003003		Lower 1/2	< 976	< 1,060	< 1,018
S96T003004	146: 5	Upper 1/2	< 1,100	< 969	< 1,034[QC:e]
S96T003005		Lower 1/2	< 1,050	< 990	< 1,020
S96T003006	146: 6	Upper 1/2	< 1,130	< 954	< 1,042[QC:e]
S96T003007		Lower 1/2	< 1,020	< 1,030	< 1,025
S96T003008	146: 7	Upper 1/2	< 978	< 1,020	< 999
S96T003009		Lower 1/2	< 932	< 1,110	< 1,021[QC:e]
S96T003148	146: 8	Upper 1/2	2,980	< 982	< 1,981[QC:e]
S96T003149		Lower 1/2	< 982	< 946	< 964
S96T004180	146: 9	Lower 1/2	< 987	< 994	< 990.5
S96T003150		Upper 1/2	< 1,140	< 1,070	< 1,105
S96T003450	Core 141	Solid composite	< 987	< 1,010	< 998.5
S96T003660	Core 145	Solid composite	< 987	< 781	< 884[QC:e]
S96T004199	Core 146	Solid composite	< 1,010	< 981	< 995.5

Table B2-32. Tank 241-U-108 Core Sample Analytical Results: Silicon (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			**μg/g**	**μg/g**	**μg/g**
S96T003453	Core 141	Solid composite	308	351	329.5[QC:e]
S96T003662	Core 145	Solid composite	271	202	236.5[QC:e]
S96T004202	Core 146	Solid composite	304	259	281.5[QC:e]
Liquids			**μg/mL**	**μg/mL**	**μg/mL**
S96T002282	141: 1	Drainable liquid	201	205	203
S96T002942	145: 1	Drainable liquid	185	186	185.5
S96T003163	146: 1	Drainable liquid	202	190	196

Table B2-33. Tank 241-U-108 Core Sample Analytical Results: Silver (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S96T003451	Core 141	Solid composite	< 9.6	< 9.63	< 9.615[QC:a]
S96T003457	Core 145	Solid composite	< 9.89	< 9.67	< 9.78[QC:a]
S96T004200	Core 146	Solid composite	15.1	17.3	16.2[QC:a,e]
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S96T003453	Core 141	Solid composite	< 10.3	< 10.2	< 10.25
S96T003662	Core 145	Solid composite	< 9.42	< 7.28	< 8.35[QC:e]
S96T004202	Core 146	Solid composite	15.7	15.2	15.45
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S96T002282	141: 1	Drainable liquid	15.8	15.8	15.8
S96T002942	145: 1	Drainable liquid	17.3	16.8	17.05
S96T003163	146: 1	Drainable liquid	16.2	15.9	16.05

Table B2-34. Tank 241-U-108 Core Sample Analytical Results: Sodium (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003451	Core 141	Solid composite	1.930E+05	1.900E+05	1.915E+05 QC:b,d
S96T003457	Core 145	Solid composite	2.080E+05	2.180E+05	2.130E+05 QC:b
S96T004200	Core 146	Solid composite	1.930E+05	2.320E+05	2.125E+05 QC:b,c
Solids: fusion			µg/g	µg/g	µg/g
S96T002257	141: 1	Lower 1/2	1.850E+05	1.800E+05	1.825E+05
S96T002258	141: 2	Upper 1/2	2.220E+05	2.220E+05	2.220E+05
S96T002259	141: 3	Upper 1/2	2.240E+05	2.210E+05	2.225E+05
S96T002260	141: 3A	Upper 1/2	2.250E+05	2.250E+05	2.250E+05
S96T002261	141: 4	Upper 1/2	2.150E+05	2.080E+05	2.115E+05
S96T002262		Lower 1/2	2.150E+05	2.090E+05	2.120E+05
S96T002263	141: 4A	Upper 1/2	2.180E+05	2.200E+05	2.190E+05
S96T002264		Lower 1/2	2.130E+05	2.160E+05	2.145E+05
S96T002608	141: 5	Upper 1/2	2.610E+05	2.690E+05	2.650E+05
S96T002609		Lower 1/2	2.830E+05	2.760E+05	2.795E+05
S96T002610	141: 6	Upper 1/2	2.860E+05	2.710E+05	2.785E+05
S96T002611		Lower 1/2	2.850E+05	2.770E+05	2.810E+05
S96T002612	141: 7	Upper 1/2	2.550E+05	2.480E+05	2.515E+05
S96T002613		Lower 1/2	2.650E+05	2.610E+05	2.630E+05
S96T002614	141: 8	Upper 1/2	2.400E+05	2.470E+05	2.435E+05
S96T002615		Lower 1/2	2.630E+05	2.530E+05	2.580E+05
S96T002616	141: 9	Upper 1/2	1.900E+05	1.960E+05	1.930E+05
S96T002909	145: 2	Upper 1/2	2.570E+05	2.570E+05	2.570E+05
S96T002910	145: 3	Upper 1/2	2.590E+05	2.450E+05	2.520E+05
S96T002911		Lower 1/2	2.690E+05	2.670E+05	2.680E+05
S96T002912	145: 4	Upper 1/2	2.740E+05	2.680E+05	2.710E+05
S96T002913		Lower 1/2	2.770E+05	2.820E+05	2.795E+05
S96T002914	145: 5	Upper 1/2	2.880E+05	2.790E+05	2.835E+05
S96T002915		Lower 1/2	2.630E+05	2.580E+05	2.605E+05
S96T002916	145: 6	Upper 1/2	2.700E+05	2.660E+05	2.680E+05
S96T002917		Lower 1/2	2.670E+05	2.710E+05	2.690E+05

Table B2-34. Tank 241-U-108 Core Sample Analytical Results: Sodium (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S96T002918	145: 7	Upper 1/2	2.610E+05	2.590E+05	2.600E+05
S96T002919		Lower 1/2	2.170E+05	2.120E+05	2.145E+05
S96T002920	145: 8	Upper 1/2	2.370E+05	2.320E+05	2.345E+05
S96T002921		Lower 1/2	2.460E+05	2.280E+05	2.370E+05
S96T002922	145: 9	Upper 1/2	2.090E+05	2.110E+05	2.100E+05
S96T002923		Lower 1/2	1.810E+05	1.830E+05	1.820E+05
S96T003143	146: 1	Upper 1/2	2.220E+05	2.200E+05	2.210E+05
S96T003144	146: 2	Upper 1/2	2.340E+05	2.360E+05	2.350E+05
S96T003145		Lower 1/2	2.390E+05	2.360E+05	2.375E+05
S96T003146	146: 3	Upper 1/2	2.290E+05	2.360E+05	2.325E+05
S96T003147		Lower 1/2	2.340E+05	2.330E+05	2.335E+05
S96T003001	146: 3A	Upper 1/2	2.330E+05	2.330E+05	2.330E+05
S96T003002	146: 4	Upper 1/2	3.040E+05	3.030E+05	3.035E+05
S96T003003		Lower 1/2	2.890E+05	2.930E+05	2.910E+05
S96T003004	146: 5	Upper 1/2	2.930E+05	2.660E+05	2.795E+05
S96T003005		Lower 1/2	2.320E+05	2.270E+05	2.295E+05
S96T003006	146: 6	Upper 1/2	2.240E+05	2.230E+05	2.235E+05
S96T003007		Lower 1/2	2.180E+05	2.260E+05	2.220E+05
S96T003008	146: 7	Upper 1/2	2.790E+05	2.740E+05	2.765E+05
S96T003009		Lower 1/2	2.620E+05	2.760E+05	2.690E+05
S96T003148	146: 8	Upper 1/2	2.780E+05	2.790E+05	2.785E+05
S96T003149		Lower 1/2	2.030E+05	2.150E+05	2.090E+05
S96T004180	146: 9	Lower 1/2	2.090E+05	2.040E+05	2.065E+05
S96T003150		Upper 1/2	1.970E+05	2.100E+05	2.035E+05
S96T003450	Core 141	Solid composite	3.060E+05	2.730E+05	2.895E+05[QC:e]
S96T003660	Core 145	Solid composite	3.680E+05	2.480E+05	3.080E+05[QC:e]
S96T004199	Core 146	Solid composite	2.440E+05	2.500E+05	2.470E+05

Table B2-34. Tank 241-U-108 Core Sample Analytical Results: Sodium (ICP). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			μg/g	μg/g	μg/g
S96T003453	Core 141	Solid composite	2.050E+05	2.000E+05	2.025E+05
S96T003662	Core 145	Solid composite	2.270E+05	2.260E+05	2.265E+05
S96T004202	Core 146	Solid composite	2.190E+05	2.180E+05	2.185E+05
Liquids			μg/mL	μg/mL	μg/mL
S96T002282	141: 1	Drainable liquid	2.220E+05	2.240E+05	2.230E+05[QC:d]
S96T002942	145: 1	Drainable liquid	2.320E+05	2.320E+05	2.320E+05
S96T003163	146: 1	Drainable liquid	2.330E+05	2.230E+05	2.280E+05

Table B2-35. Tank 241-U-108 Grab Sample Analytical Results: Sodium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S95T000978	Riser 7	Grab sample	3.064E+05	2.698E+05	2.881E+05

Table B2-36. Tank 241-U-108 Core Sample Analytical Results: Sulfur (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			µg/g	µg/g	µg/g
S96T003451	Core 141	Solid composite	4,770	4,530	4,650
S96T003457	Core 145	Solid composite	4,670	4,790	4,730
S96T004200	Core 146	Solid composite	5,150	6,410	5,780[QC:a,c,e]
Solids: water digest			µg/g	µg/g	µg/g
S96T003453	Core 141	Solid composite	5,410	5,160	5,285
S96T003662	Core 145	Solid composite	5,620	5,170	5,395
S96T004202	Core 146	Solid composite	5,840	5,960	5,900
Liquids			µg/mL	µg/mL	µg/mL
S96T002282	141: 1	Drainable liquid	1,390	1,410	1,400
S96T002942	145: 1	Drainable liquid	1,410	1,410	1,410
S96T003163	146: 1	Drainable liquid	1,450	1,390	1,420

Table B2-37. Tank 241-U-108 Core Sample Analytical Results: Zinc (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S96T003451	Core 141	Solid composite	74.5	81.8	78.15
S96T003457	Core 145	Solid composite	40.9	41.2	41.05
S96T004200	Core 146	Solid composite	16	19.2	17.6[QC:a,e]
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S96T003453	Core 141	Solid composite	22.7	31.3	27[QC:e]
S96T003662	Core 145	Solid composite	40.9	24.3	32.6[QC:e]
S96T004202	Core 146	Solid composite	10.9	10.4	10.65
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S96T002282	141: 1	Drainable liquid	32.9	34.8	33.85
S96T002942	145: 1	Drainable liquid	56.9	60.2	58.55
S96T003163	146: 1	Drainable liquid	40.7	45.7	43.2

B2.4.5 Ion Chromatography

Solid core samples and the core composites were analyzed by IC following water digestion per procedure LA-533-105, Rev. D-1. Liquid core samples and the 1995 grab sample were analyzed directly following dilution per procedure LA-533-105, Rev. C-2.

The analytes of bromide, carbonate, and nitrate were required by the core SAP for solid and core composite samples. Only bromide was required on the drainable liquid samples. Bromide was measured to evaluate intrusion and contamination of the sample by hydrostatic head fluid or wash water containing LiBr. Carbonate was determined by TIC methodology and not IC (as specified in the core SAP) because the IC eluent is a carbonate buffer. The analytes of chloride, fluoride, phosphate, sulfate, nitrate, and nitrite were required by the grab SAP. The concentrations of anions except bromide by IC are shown in Tables B2-38 through B2-50. Bromide was not detected in the water-digested solid samples or the drainable liquids. The highest detection limit of the water-digested samples was 1,411 μg/g, and the highest detection limit of the drainable liquid samples was 649 μg/mL.

For the core samples, additional IC data were collected on an opportunistic basis and are reported here. Because these data were not identified in any DQO document, there were no programmatic QC requirements with respect to these data and the QC information associated with them were not evaluated for this report.

Table B2-38. Tank 241-U-108 Core Sample Analytical Results: Chloride (IC). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			μg/g	μg/g	μg/g
S96T002270	141: 1	Lower 1/2	4,214	4,150	4,182
S96T002273	141: 2	Upper 1/2	2,946	3,250	3,098
S96T002274	141: 3	Upper 1/2	3,178	3,420	3,299
S96T002275	141: 3A	Upper 1/2	2,936	3,100	3,018
S96T002276	141: 4	Upper 1/2	4,625	5,330	4,977[QC:e]
S96T002277		Lower 1/2	5,478	4,760	5,119[QC:e]
S96T002278	141: 4A	Upper 1/2	4,790	5,290	5,040
S96T002279		Lower 1/2	4,731	4,580	4,655
S96T002617	141: 5	Upper 1/2	3,398	4,110	3,754[QC:e]
S96T002618		Lower 1/2	3,093	3,050	3,071
S96T002619	141: 6	Upper 1/2	4,009	4,120	4,064
S96T002620		Lower 1/2	3,165	3,030	3,097
S96T002621	141: 7	Upper 1/2	4,806	4,740	4,773
S96T002622		Lower 1/2	3,967	4,180	4,073
S96T002623	141: 8	Upper 1/2	4,650	4,730	4,690
S96T002624		Lower 1/2	1,050	1,040	1,045
S96T002625	141: 9	Upper 1/2	3,922	4,040	3,981
S96T002924	145: 2	Upper 1/2	2,546	2,350	2,448
S96T002925	145: 3	Upper 1/2	3,461	3,370	3,415
S96T002926		Lower 1/2	3,064	3,820	3,442[QC:e]
S96T002927	145: 4	Upper 1/2	3,717	2,710	3,213[QC:e]
S96T002928		Lower 1/2	4,011	4,050	4,030
S96T002929	145: 5	Upper 1/2	3,912	4,360	4,136[QC:e]
S96T002930		Lower 1/2	5,278	5,560	5,419

Table B2-38. Tank 241-U-108 Core Sample Analytical Results: Chloride (IC). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T002931	145: 6	Upper 1/2	3,974	4,140	4,057
S96T002932		Lower 1/2	3,317	3,690	3,503[QC:e]
S96T002933	145: 7	Upper 1/2	3,023	2,970	2,996
S96T002934		Lower 1/2	2,174	2,850	2,512[QC:e]
S96T002935	145: 8	Upper 1/2	2,031	5,310	3,670[QC:e]
S96T002936		Lower 1/2	2,905	2,650	2,777
S96T002937	145: 9	Upper 1/2	3,386	2,190	2,788[QC:e]
S96T002938		Lower 1/2	3,673	1,720	2,696[QC:e]
S96T003151	146: 1	Upper 1/2	3,714	3,750	3,732
S96T003152	146: 2	Upper 1/2	1,907	1,760	1,833
S96T003153		Lower 1/2	2,416	1,680	2,048[QC:e]
S96T003154	146: 3	Upper 1/2	2,131	2,070	2,100
S96T003155		Lower 1/2	1,761	1,980	1,870[QC:e]
S96T003052	146: 3A	Upper 1/2	2,032	2,010	2,021
S96T003053	146: 4	Upper 1/2	2,308	2,190	2,249
S96T003054		Lower 1/2	3,894	3,940	3,917
S96T003055	146: 5	Upper 1/2	4,407	4,490	4,448
S96T003056		Lower 1/2	3,261	3,280	3,270
S96T003057	146: 6	Upper 1/2	3,620	3,460	3,540
S96T003058		Lower 1/2	2,662	10,000	6,331[QC:e]
S96T004322		Lower 1/2	3,621	3,420	3,520
S96T003059	146: 7	Upper 1/2	3,470	3,490	3,480
S96T003060		Lower 1/2	3,753	3,880	3,816
S96T003156	146: 8	Upper 1/2	3,514	3,540	3,527
S96T003157		Lower 1/2	3,523	3,590	3,556
S96T004181	146: 9	Lower 1/2	2,228	1,880	2,054[QC:e]
S96T003158		Upper 1/2	3,044	3,130	3,087
S96T003452	Core 141	Solid composite	5,707	5,700	5,703
S96T003661	Core 145	Solid composite	3,865	3,940	3,902
S96T004201	Core 146	Solid composite	3,540	3,510	3,525

Table B2-38. Tank 241-U-108 Core Sample Analytical Results: Chloride (IC). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T002282	141: 1	Drainable liquid	8,598	8,800	8,699
S96T002942	145: 1	Drainable liquid	9,141	9,140	9,140
S96T003163	146: 1	Drainable liquid	9,551	9,490	9,520

Table B2-39. Tank 241-U-108 Grab Sample Analytical Results: Chloride (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S95T000978	Riser 7	Grab sample	8,270	8,560	8,415

Table B2-40. Tank 241-U-108 Core Sample Analytical Results: Fluoride (IC). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T002270	141: 1	Lower 1/2	1,525	1,510	1,517
S96T002273	141: 2	Upper 1/2	548.8	600	574.4
S96T002274	141: 3	Upper 1/2	< 122.1	< 120	< 121.1
S96T002275	141: 3A	Upper 1/2	< 123.7	< 123	< 123.4
S96T002276	141: 4	Upper 1/2	< 123.1	< 126	< 124.6
S96T002277		Lower 1/2	< 117.2	< 114	< 115.6
S96T002278	141: 4A	Upper 1/2	< 116.8	< 118	< 117.4
S96T002279		Lower 1/2	< 113.5	< 113	< 113.3
S96T002617	141: 5	Upper 1/2	558.1	576	567.1
S96T002618		Lower 1/2	499.7	469	484.4
S96T002619	141: 6	Upper 1/2	< 115.6	< 105	< 110.3
S96T002620		Lower 1/2	535.9	549	542.4
S96T002621	141: 7	Upper 1/2	878.2	886	882.1
S96T002622		Lower 1/2	448.4	< 114	< 281.2[QC:e]
S96T002623	141: 8	Upper 1/2	< 104.6	< 110	< 107.3
S96T002624		Lower 1/2	632.4	4,020	2,326[QC:e]
S96T002625	141: 9	Upper 1/2	2,904	2,760	2,832
S96T002924	145: 2	Upper 1/2	576.3	571	573.6
S96T002925	145: 3	Upper 1/2	770.9	719	744.9
S96T002926		Lower 1/2	587.5	< 141	< 364.2[QC:e]
S96T002927	145: 4	Upper 1/2	< 130.8	< 129	< 129.9
S96T002928		Lower 1/2	< 105.6	< 104	< 104.8
S96T002929	145: 5	Upper 1/2	< 105.8	< 108	< 106.9
S96T002930		Lower 1/2	882.8	954	918.4
S96T002931	145: 6	Upper 1/2	1,063	1,070	1,066
S96T002932		Lower 1/2	868.7	839	853.8
S96T002933	145: 7	Upper 1/2	938.6	937	937.8
S96T002934		Lower 1/2	740.6	839	789.8[QC:e]
S96T002935	145: 8	Upper 1/2	859.8	835	847.4
S96T002936		Lower 1/2	< 104	< 104	< 104
S96T002937	145: 9	Upper 1/2	3,159	2,310	2,734[QC:e]
S96T002938		Lower 1/2	2,728	2,620	2,674

Table B2-40. Tank 241-U-108 Core Sample Analytical Results: Fluoride (IC). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T003151	146: 1	Upper 1/2	< 104	< 101	< 102.5
S96T003152	146: 2	Upper 1/2	< 101.3	< 106	< 103.6
S96T003153		Lower 1/2	819.3	818	818.6
S96T003154	146: 3	Upper 1/2	583.7	554	568.8
S96T003155		Lower 1/2	< 167.4	802	< 484.7[QC:e]
S96T003052	146: 3A	Upper 1/2	865.5	957	911.2[QC:e]
S96T003053	146: 4	Upper 1/2	1,131	1,070	1,100
S96T003054		Lower 1/2	1,534	1,590	1,562
S96T003055	146: 5	Upper 1/2	1,685	1,770	1,727
S96T003056		Lower 1/2	1,344	1,260	1,302
S96T003057	146: 6	Upper 1/2	1,557	1,350	1,453[QC:e]
S96T003058		Lower 1/2	1,205	1,580	1,392[QC:e]
S96T004322		Lower 1/2	645.2	609	627.1
S96T003059	146: 7	Upper 1/2	1,615	1,640	1,627
S96T003060		Lower 1/2	2,213	2,300	2,256
S96T003156	146: 8	Upper 1/2	1,715	1,680	1,697
S96T003157		Lower 1/2	2,027	2,060	2,043
S96T004181	146: 9	Lower 1/2	2,074	2,410	2,242[QC:e]
S96T003158		Upper 1/2	3,512	3,540	3,526
S96T003452	Core 141	Solid composite	< 54.59	< 54.5	< 54.55
S96T003661	Core 145	Solid composite	< 97.76	< 75.6	< 86.68[QC:e]
S96T004201	Core 146	Solid composite	570.4	577	573.7
Liquids			µg/mL	µg/mL	µg/mL
S96T002282	141: 1	Drainable liquid	< 53.83	< 53.8	< 53.82
S96T002942	145: 1	Drainable liquid	< 53.83	< 53.8	< 53.82
S96T003163	146: 1	Drainable liquid	804.2	776	790.1

Table B2-41. Tank 241-U-108 Grab Sample Analytical Results: Fluoride (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S95T000978	Riser 7	Grab sample	1,130	1,110	1,120

Table B2-42. Tank 241-U-108 Core Sample Analytical Results: Nitrate (IC). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			μg/g	μg/g	μg/g
S96T002270	141: 1	Lower 1/2	94,880	96,100	95,490
S96T002273	141: 2	Upper 1/2	3.451E+05	3.440E+05	3.446E+05
S96T002274	141: 3	Upper 1/2	4.273E+05	4.490E+05	4.382E+05
S96T002275	141: 3A	Upper 1/2	4.571E+05	4.320E+05	4.446E+05
S96T002276	141: 4	Upper 1/2	3.498E+05	2.950E+05	3.224E+05[QC:e]
S96T002277		Lower 1/2	2.813E+05	3.120E+05	2.967E+05[QC:e]
S96T002278	141: 4A	Upper 1/2	3.386E+05	2.990E+05	3.188E+05[QC:e]
S96T002279		Lower 1/2	3.482E+05	3.460E+05	3.471E+05
S96T002617	141: 5	Upper 1/2	2.475E+05	2.370E+05	2.423E+05
S96T002618		Lower 1/2	2.901E+05	2.990E+05	2.946E+05
S96T002619	141: 6	Upper 1/2	4.070E+05	3.930E+05	4.000E+05
S96T002620		Lower 1/2	3.987E+05	4.100E+05	4.044E+05
S96T002621	141: 7	Upper 1/2	1.316E+05	1.320E+05	1.318E+05
S96T002622		Lower 1/2	2.407E+05	2.260E+05	2.334E+05
S96T002623	141: 8	Upper 1/2	1.137E+05	1.160E+05	1.149E+05
S96T002624		Lower 1/2	26,920	29,900	28,410[QC:e]
S96T002625	141: 9	Upper 1/2	1.722E+05	1.580E+05	1.651E+05
S96T002924	145: 2	Upper 1/2	4.511E+05	4.770E+05	4.641E+05
S96T002925	145: 3	Upper 1/2	4.045E+05	4.100E+05	4.073E+05
S96T002926		Lower 1/2	4.079E+05	4.010E+05	4.045E+05
S96T002927	145: 4	Upper 1/2	4.339E+05	4.520E+05	4.430E+05
S96T002928		Lower 1/2	3.389E+05	3.380E+05	3.385E+05
S96T002929	145: 5	Upper 1/2	3.593E+05	3.540E+05	3.567E+05
S96T002930		Lower 1/2	2.012E+05	1.910E+05	1.961E+05

Table B2-42. Tank 241-U-108 Core Sample Analytical Results: Nitrate (IC). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T002931	145: 6	Upper 1/2	2.753E+05	2.550E+05	2.652E+05
S96T002932		Lower 1/2	3.094E+05	3.150E+05	3.122E+05
S96T002933	145: 7	Upper 1/2	2.669E+05	2.700E+05	2.685E+05
S96T002934		Lower 1/2	1.452E+05	1.700E+05	1.576E+05[QC:e]
S96T002935	145: 8	Upper 1/2	4.106E+05	3.580E+05	3.843E+05[QC:e]
S96T002936		Lower 1/2	2.810E+05	3.050E+05	2.930E+05
S96T002937	145: 9	Upper 1/2	1.153E+05	73,100	94,200[QC:e]
S96T002938		Lower 1/2	59,620	56,400	58,010
S96T003151	146: 1	Upper 1/2	2.418E+05	2.870E+05	2.644E+05[QC:e]
S96T003152	146: 2	Upper 1/2	4.545E+05	4.750E+05	4.648E+05
S96T003153		Lower 1/2	5.549E+05	5.420E+05	5.485E+05
S96T003154	146: 3	Upper 1/2	4.192E+05	4.430E+05	4.311E+05
S96T003155		Lower 1/2	5.212E+05	5.220E+05	5.216E+05
S96T003052	146: 3A	Upper 1/2	4.680E+05	4.860E+05	4.770E+05
S96T003053	146: 4	Upper 1/2	4.530E+05	4.590E+05	4.560E+05
S96T003054		Lower 1/2	2.985E+05	3.030E+05	3.008E+05
S96T003055	146: 5	Upper 1/2	2.400E+05	2.450E+05	2.425E+05
S96T003056		Lower 1/2	3.549E+05	3.610E+05	3.580E+05
S96T003057	146: 6	Upper 1/2	3.189E+05	3.110E+05	3.150E+05
S96T003058		Lower 1/2	2.108E+05	2.760E+05	2.434E+05[QC:e]
S96T004322		Lower 1/2	3.350E+05	3.150E+05	3.250E+05
S96T003059	146: 7	Upper 1/2	2.243E+05	2.230E+05	2.237E+05
S96T003060		Lower 1/2	1.110E+05	1.090E+05	1.100E+05
S96T003156	146: 8	Upper 1/2	1.654E+05	1.630E+05	1.642E+05
S96T003157		Lower 1/2	1.089E+05	1.020E+05	1.055E+05
S96T004181	146: 9	Lower 1/2	61,370	52,500	56,935[QC:e]
S96T003158		Upper 1/2	1.022E+05	99,900	1.011E+05
S96T003452	Core 141	Solid composite	1.504E+05	1.420E+05	1.462E+05
S96T003661	Core 145	Solid composite	3.232E+05	3.240E+05	3.236E+05
S96T004201	Core 146	Solid composite	3.002E+05	2.980E+05	2.991E+05

Table B2-42. Tank 241-U-108 Core Sample Analytical Results: Nitrate (IC). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S96T002282	141: 1	Drainable liquid	1.738E+05	1.740E+05	1.739E+05[QC:e]
S96T002942	145: 1	Drainable liquid	1.825E+05	1.830E+05	1.828E+05[QC:e]
S96T003163	146: 1	Drainable liquid	1.951E+05	1.950E+05	1.951E+05

Table B2-43. Tank 241-U-108 Grab Sample Analytical Results: Nitrate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S95T000978	Riser 7	Grab sample	1.730E+05	1.740E+05	1.735E+05

Table B2-44. Tank 241-U-108 Core Sample Analytical Results: Nitrite (IC). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			μg/g	μg/g	μg/g
S96T002270	141: 1	Lower 1/2	63,020	62,700	62,860
S96T002273	141: 2	Upper 1/2	44,920	49,000	46,960
S96T002274	141: 3	Upper 1/2	42,760	45,200	43,980
S96T002275	141: 3A	Upper 1/2	38,340	41,000	39,670
S96T002276	141: 4	Upper 1/2	61,530	69,100	65,310[QC:e]
S96T002277		Lower 1/2	72,650	63,300	67,970[QC:e]
S96T002278	141: 4A	Upper 1/2	59,750	69,400	64,570[QC:e]
S96T002279		Lower 1/2	62,070	61,200	61,630
S96T002617	141: 5	Upper 1/2	48,820	49,200	49,010
S96T002618		Lower 1/2	41,550	39,600	40,570
S96T002619	141: 6	Upper 1/2	45,570	46,800	46,180
S96T002620		Lower 1/2	41,760	40,000	40,880
S96T002621	141: 7	Upper 1/2	72,490	71,700	72,090
S96T002622		Lower 1/2	59,750	62,700	61,220
S96T002623	141: 8	Upper 1/2	74,360	76,100	75,230
S96T002624		Lower 1/2	14,440	14,900	14,670
S96T002625	141: 9	Upper 1/2	60,030	63,800	61,910
S96T002924	145: 2	Upper 1/2	37,520	34,000	35,760
S96T002925	145: 3	Upper 1/2	48,070	45,600	46,830
S96T002926		Lower 1/2	42,530	49,800	46,160[QC:e]
S96T002927	145: 4	Upper 1/2	44,820	40,400	42,610[QC:e]
S96T002928		Lower 1/2	56,530	56,300	56,410
S96T002929	145: 5	Upper 1/2	49,700	52,000	50,850
S96T002930		Lower 1/2	66,950	70,000	68,470
S96T002931	145: 6	Upper 1/2	53,460	57,100	55,280
S96T002932		Lower 1/2	49,930	49,100	49,510
S96T002933	145: 7	Upper 1/2	53,620	53,200	53,410
S96T002934		Lower 1/2	39,220	51,600	45,410[QC:e]
S96T002935	145: 8	Upper 1/2	37,790	35,200	36,490
S96T002936		Lower 1/2	48,640	44,200	46,420
S96T002937	145: 9	Upper 1/2	56,020	35,900	45,960[QC:e]
S96T002938		Lower 1/2	32,840	31,600	32,220

Table B2-44. Tank 241-U-108 Core Sample Analytical Results: Nitrite (IC). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T003151	146: 1	Upper 1/2	53,140	53,300	53,220
S96T003152	146: 2	Upper 1/2	32,760	29,900	31,330
S96T003153		Lower 1/2	25,800	27,100	26,450
S96T003154	146: 3	Upper 1/2	32,590	33,300	32,940
S96T003155		Lower 1/2	31,320	33,200	32,260
S96T003052	146: 3A	Upper 1/2	34,790	32,500	33,640
S96T003053	146: 4	Upper 1/2	39,250	37,900	38,570
S96T003054		Lower 1/2	54,410	56,000	55,200
S96T003055	146: 5	Upper 1/2	57,440	58,600	58,020
S96T003056		Lower 1/2	45,070	46,800	45,930
S96T003057	146: 6	Upper 1/2	51,400	50,700	51,050
S96T003058		Lower 1/2	44,910	55,200	50,050[QC:e]
S96T004322		Lower 1/2	55,270	55,900	55,580
S96T003059	146: 7	Upper 1/2	64,590	64,300	64,440
S96T003060		Lower 1/2	72,400	72,600	72,500
S96T003156	146: 8	Upper 1/2	67,810	69,300	68,550
S96T003157		Lower 1/2	69,580	71,700	70,640
S96T004181	146: 9	Lower 1/2	36,330	30,800	33,560[QC:e]
S96T003158		Upper 1/2	58,460	59,600	59,030
S96T003452	Core 141	Solid composite	82,370	83,000	82,680
S96T003661	Core 145	Solid composite	55,920	53,000	54,460
S96T004201	Core 146	Solid composite	54,110	53,900	54,000
Liquids			µg/mL	µg/mL	µg/mL
S96T002282	141: 1	Drainable liquid	1.311E+05	1.310E+05	1.311E+05[QC:c]
S96T002942	145: 1	Drainable liquid	1.345E+05	1.360E+05	1.353E+05[QC:c]
S96T003163	146: 1	Drainable liquid	1.359E+05	1.370E+05	1.365E+05

Table B2-45. Tank 241-U-108 Grab Sample Analytical Results: Nitrite (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S95T000978	Riser 7	Grab sample	1.160E+05	1.150E+05	1.155E+05

Table B2-46. Tank 241-U-108 Core Sample Analytical Results: Phosphate (IC). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T002270	141: 1	Lower 1/2	40,710	40,600	40,650
S96T002273	141: 2	Upper 1/2	7,911	8,250	8,080
S96T002274	141: 3	Upper 1/2	3,677	4,030	3,853
S96T002275	141: 3A	Upper 1/2	3,640	2,640	3,140[QC:e]
S96T002276	141: 4	Upper 1/2	6,919	6,590	6,754
S96T002277		Lower 1/2	4,613	4,440	4,526
S96T002278	141: 4A	Upper 1/2	4,997	4,000	4,498[QC:e]
S96T002279		Lower 1/2	6,007	6,180	6,093
S96T002617	141: 5	Upper 1/2	5,884	6,180	6,032
S96T002618		Lower 1/2	4,875	5,580	5,227[QC:e]
S96T002619	141: 6	Upper 1/2	6,072	7,740	6,906[QC:e]
S96T002620		Lower 1/2	6,155	5,840	5,997
S96T002621	141: 7	Upper 1/2	9,486	10,000	9,743
S96T002622		Lower 1/2	10,290	8,850	9,570[QC:e]
S96T002623	141: 8	Upper 1/2	10,420	9,680	10,050
S96T002624		Lower 1/2	1.139E+05	1.190E+05	1.165E+05
S96T002625	141: 9	Upper 1/2	40,400	37,100	38,750
S96T002924	145: 2	Upper 1/2	3,537	5,880	4,708[QC:e]
S96T002925	145: 3	Upper 1/2	5,522	4,880	5,201[QC:e]
S96T002926		Lower 1/2	3,648	4,130	3,889[QC:e]
S96T002927	145: 4	Upper 1/2	6,849	6,550	6,699
S96T002928		Lower 1/2	5,496	6,470	5,983[QC:e]
S96T002929	145: 5	Upper 1/2	4,403	4,620	4,511
S96T002930		Lower 1/2	11,270	12,700	11,980[QC:e]

Table B2-46. Tank 241-U-108 Core Sample Analytical Results: Phosphate (IC). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T002931	145: 6	Upper 1/2	13,720	14,500	14,110
S96T002932		Lower 1/2	8,284	8,230	8,257
S96T002933	145: 7	Upper 1/2	8,099	8,490	8,294
S96T002934		Lower 1/2	5,737	7,130	6,433[QC:e]
S96T002935	145: 8	Upper 1/2	7,207	6,620	6,913
S96T002936		Lower 1/2	7,026	8,680	7,853[QC:e]
S96T002937	145: 9	Upper 1/2	39,760	40,100	39,930
S96T002938		Lower 1/2	1.479E+05	1.500E+05	1.490E+05
S96T003151	146: 1	Upper 1/2	5,552	7,960	6,756[QC:e]
S96T003152	146: 2	Upper 1/2	6,977	7,770	7,373[QC:e]
S96T003153		Lower 1/2	4,362	4,040	4,201
S96T003154	146: 3	Upper 1/2	9,199	8,660	8,929
S96T003155		Lower 1/2	2,098	1,770	1,934[QC:e]
S96T003052	146: 3A	Upper 1/2	4,261	4,300	4,280
S96T003053	146: 4	Upper 1/2	7,488	7,770	7,629
S96T003054		Lower 1/2	11,110	8,690	9,900[QC:e]
S96T003055	146: 5	Upper 1/2	9,139	10,600	9,869[QC:e]
S96T003056		Lower 1/2	7,657	7,360	7,508
S96T003057	146: 6	Upper 1/2	10,770	9,400	10,090[QC:e]
S96T003058		Lower 1/2	7,239	9,020	8,129[QC:e]
S96T004322		Lower 1/2	9,165	9,530	9,347
S96T003059	146: 7	Upper 1/2	8,497	8,660	8,578
S96T003060		Lower 1/2	15,290	15,600	15,440
S96T003156	146: 8	Upper 1/2	6,367	6,380	6,373
S96T003157		Lower 1/2	8,097	7,620	7,858
S96T004181	146: 9	Lower 1/2	1.474E+05	1.320E+05	1.397E+05[QC:e]
S96T003158		Upper 1/2	32,820	30,600	31,710
S96T003452	Core 141	Solid composite	14,350	17,500	15,920[QC:e]
S96T003661	Core 145	Solid composite	10,480	10,600	10,540
S96T004201	Core 146	Solid composite	10,500	11,000	10,750

Table B2-46. Tank 241-U-108 Core Sample Analytical Results: Phosphate (IC). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S96T002282	141: 1	Drainable liquid	2,266	2,480	2,373
S96T002942	145: 1	Drainable liquid	2,690	2,690	2,690
S96T003163	146: 1	Drainable liquid	2,529	2,470	2,499

Table B2-47. Tank 241-U-108 Grab Sample Analytical Results: Phosphate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S95T000978	Riser 7	Grab sample	3,700	< 1,160	< 2,430[QC:e]

Table B2-48. Tank 241-U-108 Core Sample Analytical Results: Sulfate (IC). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T002270	141: 1	Lower 1/2	16,860	17,000	16,930
S96T002273	141: 2	Upper 1/2	13,550	15,900	14,720[QC:e]
S96T002274	141: 3	Upper 1/2	11,290	10,600	10,940
S96T002275	141: 3A	Upper 1/2	10,860	9,000	9,930[QC:e]
S96T002276	141: 4	Upper 1/2	18,860	18,100	18,480
S96T002277		Lower 1/2	14,310	14,700	14,500
S96T002278	141: 4A	Upper 1/2	14,220	12,900	13,560
S96T002279		Lower 1/2	15,650	16,600	16,120
S96T002617	141: 5	Upper 1/2	12,070	12,300	12,180
S96T002618		Lower 1/2	9,603	9,550	9,576
S96T002619	141: 6	Upper 1/2	12,600	12,900	12,750
S96T002620		Lower 1/2	10,960	10,500	10,730
S96T002621	141: 7	Upper 1/2	20,100	20,100	20,100
S96T002622		Lower 1/2	17,940	17,400	17,670
S96T002623	141: 8	Upper 1/2	21,420	19,700	20,560
S96T002624		Lower 1/2	< 1,278	< 1,290	< 1,284
S96T002625	141: 9	Upper 1/2	28,440	27,500	27,970
S96T002924	145: 2	Upper 1/2	6,813	6,560	6,686
S96T002925	145: 3	Upper 1/2	10,670	10,200	10,430
S96T002926		Lower 1/2	12,570	13,900	13,230[QC:e]
S96T002927	145: 4	Upper 1/2	8,652	7,950	8,301
S96T002928		Lower 1/2	11,430	11,900	11,660
S96T002929	145: 5	Upper 1/2	15,390	15,900	15,640
S96T002930		Lower 1/2	13,720	14,600	14,160
S96T002931	145: 6	Upper 1/2	15,560	16,700	16,130
S96T002932		Lower 1/2	16,240	16,600	16,420
S96T002933	145: 7	Upper 1/2	17,880	18,000	17,940
S96T002934		Lower 1/2	12,500	16,000	14,250[QC:e]
S96T002935	145: 8	Upper 1/2	12,440	12,800	12,620
S96T002936		Lower 1/2	28,540	26,900	27,720
S96T002937	145: 9	Upper 1/2	29,590	21,200	25,390[QC:e]
S96T002938		Lower 1/2	1,917	1,620	1,768[QC:e]

Table B2-48. Tank 241-U-108 Core Sample Analytical Results: Sulfate (IC). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			μg/g	μg/g	μg/g
S96T003151	146: 1	Upper 1/2	22,100	22,600	22,350
S96T003152	146: 2	Upper 1/2	15,850	16,800	16,320
S96T003153		Lower 1/2	3,853	3,860	3,856
S96T003154	146: 3	Upper 1/2	23,870	24,200	24,030
S96T003155		Lower 1/2	< 1,750	1,990	< 1,870[QC:e]
S96T003052	146: 3A	Upper 1/2	12,230	12,300	12,260
S96T003053	146: 4	Upper 1/2	9,000	9,070	9,035
S96T003054		Lower 1/2	15,640	17,100	16,370
S96T003055	146: 5	Upper 1/2	18,280	18,600	18,440
S96T003056		Lower 1/2	13,580	13,500	13,540
S96T003057	146: 6	Upper 1/2	16,240	16,200	16,220
S96T003058		Lower 1/2	13,640	18,300	15,970[QC:e]
S96T004322		Lower 1/2	19,210	19,100	19,150
S96T003059	146: 7	Upper 1/2	17,380	17,400	17,390
S96T003060		Lower 1/2	20,080	20,000	20,040
S96T003156	146: 8	Upper 1/2	19,420	19,400	19,410
S96T003157		Lower 1/2	31,980	31,000	31,490
S96T004181	146: 9	Lower 1/2	1,125	996	1,060[QC:e]
S96T003158		Upper 1/2	33,110	33,700	33,450
S96T003452	Core 141	Solid composite	17,290	16,900	17,090
S96T003661	Core 145	Solid composite	17,940	17,000	17,470
S96T004201	Core 146	Solid composite	18,490	17,900	18,190
Liquids			μg/mL	μg/mL	μg/mL
S96T002282	141: 1	Drainable liquid	3,058	2,920	2,989
S96T002942	145: 1	Drainable liquid	2,958	2,950	2,954
S96T003163	146: 1	Drainable liquid	3,630	4,320	3,975[QC:e]

Table B2-49. Tank 241-U-108 Grab Sample Analytical Results: Sulfate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S95T000978	Riser 7	Grab sample	4,390	4,800	4,595

Table B2-50. Tank 241-U-108 Core Sample Analytical Results: Oxalate (IC). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T002270	141: 1	Lower 1/2	12,480	12,600	12,540
S96T002273	141: 2	Upper 1/2	3,090	4,310	3,700[QC:e]
S96T002274	141: 3	Upper 1/2	3,014	3,160	3,087
S96T002275	141: 3A	Upper 1/2	1,364	1,410	1,387
S96T002276	141: 4	Upper 1/2	3,245	2,950	3,097
S96T002277		Lower 1/2	3,155	3,790	3,472[QC:e]
S96T002278	141: 4A	Upper 1/2	3,086	2,880	2,983
S96T002279		Lower 1/2	2,887	3,200	3,043[QC:e]
S96T002617	141: 5	Upper 1/2	3,474	3,380	3,427
S96T002618		Lower 1/2	2,931	2,750	2,840
S96T002619	141: 6	Upper 1/2	< 934	2,670	< 1,802[QC:e]
S96T002620		Lower 1/2	2,655	2,840	2,747
S96T002621	141: 7	Upper 1/2	5,043	5,360	5,201
S96T002622		Lower 1/2	4,085	3,410	3,747[QC:e]
S96T002623	141: 8	Upper 1/2	4,764	4,520	4,642
S96T002624		Lower 1/2	4,248	3,440	3,844[QC:e]
S96T002625	141: 9	Upper 1/2	8,378	7,950	8,164
S96T002924	145: 2	Upper 1/2	2,270	2,420	2,345
S96T002925	145: 3	Upper 1/2	2,984	2,950	2,967
S96T002926		Lower 1/2	2,361	2,670	2,515[QC:e]
S96T002927	145: 4	Upper 1/2	2,696	2,030	2,363[QC:e]
S96T002928		Lower 1/2	2,933	3,250	3,091[QC:e]
S96T002929	145: 5	Upper 1/2	3,238	3,470	3,354
S96T002930		Lower 1/2	5,302	5,410	5,356

Table B2-50. Tank 241-U-108 Core Sample Analytical Results: Oxalate (IC). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T002931	145: 6	Upper 1/2	4,547	4,770	4,658
S96T002932		Lower 1/2	3,645	3,740	3,692
S96T002933	145: 7	Upper 1/2	4,068	3,960	4,014
S96T002934		Lower 1/2	3,363	4,400	3,881[QC:e]
S96T002935	145: 8	Upper 1/2	2,585	2,870	2,727[QC:e]
S96T002936		Lower 1/2	4,737	4,590	4,663
S96T002937	145: 9	Upper 1/2	18,440	12,700	15,570[QC:e]
S96T002938		Lower 1/2	2,747	2,780	2,763
S96T003151	146: 1	Upper 1/2	2,595	2,830	2,712
S96T003152	146: 2	Upper 1/2	2,179	2,630	2,404[QC:e]
S96T003153		Lower 1/2	< 2,025	< 2,230	< 2,127
S96T003154	146: 3	Upper 1/2	2,913	2,930	2,921
S96T003155		Lower 1/2	< 1,352	< 1,470	< 1,411
S96T003052	146: 3A	Upper 1/2	1,850	2,130	1,990[QC:e]
S96T003053	146: 4	Upper 1/2	2,532	2,670	2,601
S96T003054		Lower 1/2	4,230	4,210	4,220
S96T003055	146: 5	Upper 1/2	4,588	4,600	4,594
S96T003056		Lower 1/2	3,917	3,790	3,853
S96T003057	146: 6	Upper 1/2	3,905	4,450	4,177[QC:e]
S96T003058		Lower 1/2	2,944	3,960	3,452[QC:e]
S96T004322		Lower 1/2	4,208	3,750	3,979[QC:e]
S96T003059	146: 7	Upper 1/2	3,717	3,960	3,838
S96T003060		Lower 1/2	5,001	5,190	5,095
S96T003156	146: 8	Upper 1/2	4,478	4,470	4,474
S96T003157		Lower 1/2	6,418	6,320	6,369
S96T004181	146: 9	Lower 1/2	6,532	6,740	6,636
S96T003158		Upper 1/2	20,100	20,600	20,350
S96T003452	Core 141	Solid composite	4,625	4,520	4,572
S96T003661	Core 145	Solid composite	4,900	5,010	4,955
S96T004201	Core 146	Solid composite	4,407	4,350	4,378

Table B2-50. Tank 241-U-108 Core Sample Analytical Results: Oxalate (IC). (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T002282	141: 1	Drainable liquid	< 434.8	< 435	< 434.9
S96T002942	145: 1	Drainable liquid	< 434.8	736	< 585.4[QC:e]
S96T003163	146: 1	Drainable liquid	< 540.9	< 541	< 540.95

B2.5 RADIOCHEMICAL ANALYSES

B2.5.1 Total Alpha Activity

Analyses for total alpha activity were performed on core samples recovered from tank 241-U-108. The samples were prepared by potassium hydroxide fusion digestion according to procedure LA-549-141, Rev. F-0 and analyzed according to procedure LA-508-101, Rev. D-2. Two fusions were prepared per sample (for duplicate results). Each fused dilution was analyzed twice, the results were averaged and reported as one value. The highest result returned was 0.364 µCi/g. The sample results for total alpha are given in Table B2-51.

Table B2-51. Tank 241-U-108 Core Sample Analytical Results: Total Alpha. (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µCi/g	µCi/g	µCi/g
S96T002257	141: 1	Lower 1/2	0.0932	0.0669	0.08005[QC:e]
S96T002258	141: 2	Upper 1/2	0.0352	0.0282	0.0317[QC:e]
S96T002259	141: 3	Upper 1/2	0.0276	0.0313	0.02945[QC:e]
S96T002260	141: 3A	Upper 1/2	0.029	0.0232	0.0261[QC:e,f]
S96T002261	141: 4	Upper 1/2	0.056	0.0456	0.0508[QC:e,f]
S96T002262		Lower 1/2	0.0433	0.0374	0.04035[QC:e,f]
S96T002263	141: 4A	Upper 1/2	0.0538	0.0528	0.0533
S96T002264		Lower 1/2	0.0291	0.0327	0.0309[QC:e]
S96T002608	141: 5	Upper 1/2	0.0521	0.0604	0.05625[QC:e]
S96T002609		Lower 1/2	0.0505	0.0452	0.04785[QC:e]

Table B2-51. Tank 241-U-108 Core Sample Analytical Results: Total Alpha. (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μCi/g	μCi/g	μCi/g
S96T002610	141: 6	Upper 1/2	0.0365	0.0279	0.0322[QC:e]
S96T002611		Lower 1/2	0.0123	0.0198	0.01605[QC:e]
S96T002612	141: 7	Upper 1/2	0.0314	0.0383	0.03485[QC:b,e]
S96T002613		Lower 1/2	0.0296	0.0289	0.02925[QC:b]
S96T002614	141: 8	Upper 1/2	0.0714	< 0.00429	< 0.03784[QC:b]
S96T002615		Lower 1/2	0.109	0.11	0.1095[QC:b]
S96T002616	141: 9	Upper 1/2	0.0486	0.0368	0.0427[QC:b,e]
S96T002909	145: 2	Upper 1/2	0.0269	0.0272	0.02705
S96T002910	145: 3	Upper 1/2	0.0407	0.0423	0.0415
S96T002911		Lower 1/2	0.0423	0.0369	0.0396[QC:e]
S96T002912	145: 4	Upper 1/2	0.0352	0.0317	0.03345[QC:a,e,f]
S96T002913		Lower 1/2	0.0464	0.0472	0.0468[QC:a,f]
S96T002914	145: 5	Upper 1/2	0.0353	0.0396	0.03745[QC:a,e,f]
S96T002915		Lower 1/2	0.0302	0.0329	0.03155
S96T002916	145: 6	Upper 1/2	0.0195	0.0145	0.017[QC:e]
S96T002917		Lower 1/2	0.0151	0.0135	0.0143[QC:e]
S96T002918	145: 7	Upper 1/2	0.0158	0.0177	0.01675[QC:b,e]
S96T002919		Lower 1/2	0.0213	0.0214	0.02135[QC:b]
S96T002920	145: 8	Upper 1/2	0.0126	0.0127	0.01265[QC:b]
S96T002921		Lower 1/2	0.0313	0.0308	0.03105[QC:b]
S96T002922	145: 9	Upper 1/2	0.262	0.245	0.2535[QC:b]
S96T002923		Lower 1/2	0.0718	0.055	0.0634[QC:b,e]
S96T003143	146: 1	Upper 1/2	0.0387	0.0394	0.03905[QC:a]
S96T003144	146: 2	Upper 1/2	0.0255	0.0274	0.02645[QC:a]
S96T003145		Lower 1/2	0.0129	0.0117	0.0123[QC:a]
S96T003146	146: 3	Upper 1/2	0.033	0.0332	0.0331
S96T003147		Lower 1/2	0.0104	0.0111	0.01075
S96T003001	146: 3A	Upper 1/2	0.0289	0.0285	0.0287
S96T003002	146: 4	Upper 1/2	0.0396	0.0388	0.0392[QC:b]
S96T003003		Lower 1/2	0.112	0.0913	0.10165[QC:b,e]
S96T003004	146: 5	Upper 1/2	0.0816	0.0975	0.08955[QC:b,e]
S96T003005		Lower 1/2	0.0461	< 0.0602	< 0.05315[QC:e]

Table B2-51. Tank 241-U-108 Core Sample Analytical Results: Total Alpha. (3 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µCi/g	µCi/g	µCi/g
S96T003006	146: 6	Upper 1/2	< 0.0324	< 0.0581	< 0.04525[QC:e]
S96T003007		Lower 1/2	< 0.0925	< 0.126	< 0.10925[QC:e]
S96T003008	146: 7	Upper 1/2	0.0178	0.0196	0.0187
S96T003009		Lower 1/2	0.0307	0.0249	0.0278[QC:e]
S96T003148	146: 8	Upper 1/2	0.0223	0.026	0.02415[QC:e]
S96T003149		Lower 1/2	0.0389	0.0514	0.04515[QC:e]
S96T004180	146: 9	Lower 1/2	0.363	0.365	0.364
S96T003150		Upper 1/2	0.182	0.171	0.1765
S96T003450	Core 141	Solid composite	0.0312	0.0359	0.03355[QC:a,e]
S96T003660	Core 145	Solid composite	0.0549	0.0338	0.04435[QC:a,e]
S96T004199	Core 146	Solid composite	0.0539	0.0541	0.054[QC:f]

B2.5.2 Strontium-90

The activity of Sr-90 was determined on solid core samples by chemical separation of fusion digests followed by beta counting according to procedure LA-220-101, Rev. D-1. Analysis for the 1995 grab sample was by beta counting following chemical separation according to procedure LA-220-101, Rev. D-1. Activities of Sr-90 ranged from 0.345 µCi/g (grab sample U-108-1) to 64.5 µCi/g (upper half of segment 9, core 145). All results are shown in Tables B2-52 and B2-53.

Table B2-52. Tank 241-U-108 Core Sample Analytical Results: Strontium-89/90. (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μCi/g	μCi/g	μCi/g
S96T002257	141: 1	Lower 1/2	15	10.9	12.95
S96T002258	141: 2	Upper 1/2	5.96	6.42	6.19
S96T002259	141: 3	Upper 1/2	5.5	5.67	5.585
S96T002260	141: 3A	Upper 1/2	3.79	4.03	3.91
S96T002261	141: 4	Upper 1/2	8.12	7.8	7.96
S96T002262		Lower 1/2	6.84	7.66	7.25
S96T002263	141: 4A	Upper 1/2	7.19	7.19	7.19
S96T002264		Lower 1/2	5.68	5.67	5.675
S96T002608	141: 5	Upper 1/2	6.29	6.49	6.39
S96T002609		Lower 1/2	5.16	5.08	5.12
S96T002610	141: 6	Upper 1/2	4.92	4.92	4.92
S96T002611		Lower 1/2	4.22	4.41	4.315
S96T002612	141: 7	Upper 1/2	10.2	10.6	10.4
S96T002613		Lower 1/2	9.6	8.95	9.275
S96T002614	141: 8	Upper 1/2	12.6	12.1	12.35
S96T002615		Lower 1/2	21.2	21.1	21.15
S96T002616	141: 9	Upper 1/2	3.9	3.29	3.595
S96T002909	145: 2	Upper 1/2	3.19	4.08	3.635
S96T002910	145: 3	Upper 1/2	6.01	5.05	5.53
S96T002911		Lower 1/2	5.22	4.98	5.10
S96T002912	145: 4	Upper 1/2	4.31	4.42	4.365
S96T002913		Lower 1/2	6.26	5.99	6.125
S96T002914	145: 5	Upper 1/2	6.08	6.5	6.29
S96T002915		Lower 1/2	11.5	11.4	11.45
S96T002916	145: 6	Upper 1/2	9.25	8.83	9.04
S96T002917		Lower 1/2	7.05	7.45	7.25
S96T002918	145: 7	Upper 1/2	8.25	8.59	8.42
S96T002919		Lower 1/2	10	10.1	10.05
S96T002920	145: 8	Upper 1/2	5.92	5.7	5.81
S96T002921		Lower 1/2	13.2	12.7	12.95
S96T002922	145: 9	Upper 1/2	63.1	65.9	64.5
S96T002923		Lower 1/2	11.4	11.9	11.65

Table B2-52. Tank 241-U-108 Core Sample Analytical Results: Strontium-89/90. (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µCi/g	µCi/g	µCi/g
S96T003143	146: 1	Upper 1/2	5.79	6.32	6.055
S96T003144	146: 2	Upper 1/2	5.89	6.34	6.115
S96T003145		Lower 1/2	1.81	1.73	1.77
S96T003146	146: 3	Upper 1/2	6.07	6.36	6.215
S96T003147		Lower 1/2	1.86	2.01	1.935
S96T003001	146: 3A	Upper 1/2	4.85	4.75	4.80
S96T003002	146: 4	Upper 1/2	3.94	3.93	3.935
S96T003003		Lower 1/2	8.38	8.34	8.36
S96T003004	146: 5	Upper 1/2	4.98	4.76	4.87
S96T003005		Lower 1/2	7.19	7.15	7.17
S96T003006	146: 6	Upper 1/2	7.06	7.5	7.28
S96T003007		Lower 1/2	7.6	7.65	7.625
S96T003008	146: 7	Upper 1/2	8.27	8.74	8.505
S96T003009		Lower 1/2	11.1	11.2	11.15
S96T003148	146: 8	Upper 1/2	10.5	11.6	11.05
S96T003149		Lower 1/2	17.1	17.2	17.15
S96T004180	146: 9	Lower 1/2	51.8	56.7	54.25
S96T003150		Upper 1/2	45.5	46.3	45.90
S96T003450	Core 141	Solid composite	7.35	6.43	6.89
S96T003660	Core 145	Solid composite	13.8	8.56	11.18
S96T004199	Core 146	Solid composite	9.65	10.1	9.875

Table B2-53. Tank 241-U-108 Grab Sample Analytical Results: Strontium-89/90.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µCi/mL	µCi/mL	µCi/mL
S95T000978	Riser 7	Grab sample	0.356	0.333	0.3445[QC:f]

B2.5.3 Total Beta

Total beta activity was measured on the fusion digest of all core composite samples according to procedure LA-508-101, Rev. D-2 in support of the historical DQO. The results are shown in Table B2-54. Total beta activity ranged from 158.5 to 180.5 μCi/g.

Table B2-54. Tank 241-U-108 Core Sample Analytical Results: Total Beta.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μCi/g	μCi/g	μCi/g
S96T003450	Core 141	Solid composite	191	170	180.5
S96T003660	Core 145	Solid composite	194	123	158.5[QC:e]
S96T004199	Core 146	Solid composite	165	157	161

B2.5.4 Total Uranium

The concentration of uranium was determined by laser phosphorescence on fusion digests of the three core composite samples according to procedure LA-925-009, Rev. A-1. Results ranged from 140 (core 145) to 245 μg/g (core 146) and are shown in Table B2-55.

Table B2-55. Tank 241-U-108 Core Sample Analytical Results: Total Uranium.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μg/g	μg/g	μg/g
S96T003450	Core 141	Solid composite	192	162	177[QC:e]
S96T003660	Core 145	Solid composite	134	146	140
S96T004199	Core 146	Solid composite	230	260	245[QC:e]

B2.5.5 Plutonium-239/240

The activities of Pu-239 and Pu-240 were determined simultaneously by chemical separation followed by alpha counting. Only the grab sample was analyzed for Pu-239/240 using procedure LA-943-127, Rev. A-0. Results were below the detection limit of 6.8 E-05 and are shown in Table B2-56.

Table B2-56. Tank 241-U-108 Grab Sample Analytical Results: Plutonium-239/40.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µCi/mL	µCi/mL	µCi/mL
S95T000978	Riser 7	Grab sample	<6.840E-05	<9.330E-05	< 8.085E-05

B2.5.6 Americium-241

The Am-241 activity of grab sample U-108-1 was determined by chemical separation followed by alpha counting per procedure LA-953-103, Rev. A-3. Core samples were analyzed for Am-241 by GEA on an opportunistic basis (Kristofzski 1996) as discussed in Section B2.6. Results are shown in Table B2-57.

Table B2-57. Tank 241-U-108 Grab Sample Analytical Results: Americium-241.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µCi/mL	µCi/mL	µCi/mL
S95T000978	Riser 7	Grab sample	0.00235	0.00244	0.002395

B2.6 GAMMA ENERGY ANALYSIS

Although the activities of selected gamma-emitting radionuclides on solid core samples were determined by GEA, only the analyte Cs-137 was required by the core SAP. All analyses on the core samples were performed on fusion digests. Additional GEA data were collected on an opportunistic basis and are reported here. All GEA results are presented in Tables B2-58 through B2-63. Because data other than Cs-137 were not identified in any DQO document, there were no programmatic QC requirements with respect to these data, and the QC information associated with them were not evaluated for this report.

B2.6.1 Cesium-137

The Cs-137 activity of the liquid grab sample was determined using procedure LA-548-121, Rev. D-1. At 416 μCi/mL, the grab sample analyzed had roughly twice the Cs-137 activity as any core sample. The Cs-137 activities of the 1996 core samples were determined using procedure LA-548-121, Rev. E-0 and were comparable from segment to segment and core to core except for one sample (upper half of segment 9, core 141) that had an unusually low activity. With the exception of that sample, activities ranged from a low of 75 μCi/g (lower half of segment 2, core 146) to a high of 206 μCi/g (upper half of segment 8, core 141).

Table B2-58. Tank 241-U-108 Core Sample Analytical Results: Cesium-137 (GEA). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μCi/g	μCi/g	μCi/g
S96T002257	141: 1	Lower 1/2	180	205	192.5
S96T002258	141: 2	Upper 1/2	130.6	135	132.8
S96T002259	141: 3	Upper 1/2	129.7	128	128.85
S96T002260	141: 3A	Upper 1/2	119.7	113	116.35
S96T002261	141: 4	Upper 1/2	166.5	182	174.25
S96T002262		Lower 1/2	196.4	194	195.2
S96T002263	141: 4A	Upper 1/2	184.3	187	185.65
S96T002264		Lower 1/2	167.5	191	179.25
S96T002608	141: 5	Upper 1/2	168.9	171	169.95
S96T002609		Lower 1/2	135.6	143	139.3
S96T002610	141: 6	Upper 1/2	132.9	127	129.95
S96T002611		Lower 1/2	130.4	127	128.7
S96T002612	141: 7	Upper 1/2	204.6	182	193.3
S96T002613		Lower 1/2	173.2	150	161.6
S96T002614	141: 8	Upper 1/2	200.4	212	206.2
S96T002615		Lower 1/2	149.2	156	152.6
S96T002616	141: 9	Upper 1/2	43.96	44.1	44.03
S96T002909	145: 2	Upper 1/2	97.18	99.8	98.49
S96T002910	145: 3	Upper 1/2	124.1	126	125.05
S96T002911		Lower 1/2	126.6	122	124.3
S96T002912	145: 4	Upper 1/2	123.4	118	120.7
S96T002913		Lower 1/2	153.2	151	152.1

Table B2-58. Tank 241-U-108 Core Sample Analytical Results: Cesium-137 (GEA). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µCi/g	µCi/g	µCi/g
S96T002914	145: 5	Upper 1/2	133.7	139	136.35
S96T002915		Lower 1/2	199	196	197.5
S96T002916	145: 6	Upper 1/2	157.4	147	152.2
S96T002917		Lower 1/2	141	144	142.5
S96T002918	145: 7	Upper 1/2	152.1	149	150.55
S96T002919		Lower 1/2	167.1	167	167.05
S96T002920	145: 8	Upper 1/2	98.75	97.2	97.97
S96T002921		Lower 1/2	114.7	129	121.85
S96T002922	145: 9	Upper 1/2	130.8	128	129.4
S96T002923		Lower 1/2	80.92	87.3	84.11
S96T003143	146: 1	Upper 1/2	152.1	163	157.55
S96T003144	146: 2	Upper 1/2	103.3	109	106.15
S96T003145		Lower 1/2	73.32	76.9	75.11
S96T003146	146: 3	Upper 1/2	105.1	97.4	101.25
S96T003147		Lower 1/2	89.54	89.8	89.67
S96T003001	146: 3A	Upper 1/2	98.49	93.2	95.84
S96T003002	146: 4	Upper 1/2	100	100	100
S96T003003		Lower 1/2	151.8	147	149.4
S96T003004	146: 5	Upper 1/2	175.3	180	177.65
S96T003005		Lower 1/2	137.2	139	138.1
S96T003006	146: 6	Upper 1/2	150.6	142	146.3
S96T003007		Lower 1/2	163.2	157	160.1
S96T003008	146: 7	Upper 1/2	170.9	175	172.95
S96T003009		Lower 1/2	188.8	197	192.9
S96T003148	146: 8	Upper 1/2	183.2	188	185.6
S96T003149		Lower 1/2	184.5	192	188.25
S96T004180	146: 9	Lower 1/2	96.75	94.5	95.63
S96T003150		Upper 1/2	166.4	161	163.7
S96T003450	Core 141	Solid composite	207.1	173	190.05
S96T003660	Core 145	Solid composite	180	116	148[QC:e]
S96T004199	Core 146	Solid composite	149	149	149

Table B2-59. Tank 241-U-108 Grab Sample Analytical Results: Cesium-137 (GEA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μCi/mL	μCi/mL	μCi/mL
S95T000978	Riser 7	Grab sample	418	414	416

Table B2-60. Tank 241-U-108 Core Sample Analytical Results: Americium-241 (GEA). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μCi/g	μCi/g	μCi/g
S96T002257	141: 1	Lower 1/2	< 1.111	< 1.18	< 1.146
S96T002258	141: 2	Upper 1/2	< 0.9717	< 0.995	< 0.9834
S96T002259	141: 3	Upper 1/2	< 0.6591	< 0.651	< 0.6550
S96T002260	141: 3A	Upper 1/2	< 0.09824	< 0.0944	< 0.0963
S96T002261	141: 4	Upper 1/2	< 0.1118	< 0.115	< 0.1134
S96T002262		Lower 1/2	< 0.1253	< 0.121	< 0.1232
S96T002263	141: 4A	Upper 1/2	< 1.115	< 1.14	< 1.1275
S96T002264		Lower 1/2	< 1.062	< 1.13	< 1.096
S96T002608	141: 5	Upper 1/2	< 0.4211	< 0.427	< 0.4241
S96T002609		Lower 1/2	< 0.4119	< 0.405	< 0.4084
S96T002610	141: 6	Upper 1/2	< 0.3983	< 0.375	< 0.3866
S96T002611		Lower 1/2	< 0.4007	< 0.4	< 0.4003
S96T002612	141: 7	Upper 1/2	< 1.268	< 1.2	< 1.234
S96T002613		Lower 1/2	< 1.242	< 1.13	< 1.186
S96T002614	141: 8	Upper 1/2	< 1.302	< 1.26	< 1.281
S96T002615		Lower 1/2	< 1.144	< 1.08	< 1.112
S96T002616	141: 9	Upper 1/2	< 0.6329	< 0.622	< 0.6275
S96T002909	145: 2	Upper 1/2	< 0.7227	< 0.72	< 0.7214
S96T002910	145: 3	Upper 1/2	< 0.8062	< 0.829	< 0.8176
S96T002911		Lower 1/2	< 0.822	< 0.836	< 0.829
S96T002912	145: 4	Upper 1/2	< 0.7187	< 0.699	< 0.7088
S96T002913		Lower 1/2	< 0.8876	< 0.911	< 0.8993
S96T002914	145: 5	Upper 1/2	< 0.8668	< 0.886	< 0.8764
S96T002915		Lower 1/2	< 0.352	< 0.348	< 0.3500

Table B2-60. Tank 241-U-108 Core Sample Analytical Results: Americium-241 (GEA). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μCi/g	μCi/g	μCi/g
S96T002916	145: 6	Upper 1/2	< 0.3038	< 0.295	< 0.2994
S96T002917		Lower 1/2	< 0.2804	< 0.283	< 0.2817
S96T002918	145: 7	Upper 1/2	< 0.7944	< 0.786	< 0.7902
S96T002919		Lower 1/2	< 0.8498	< 0.822	< 0.8359
S96T002920	145: 8	Upper 1/2	< 0.6337	< 0.608	< 0.6208
S96T002921		Lower 1/2	< 0.2579	< 0.272	< 0.2649
S96T002922	145: 9	Upper 1/2	< 0.3226	< 0.32	< 0.3213
S96T002923		Lower 1/2	< 0.2151	< 0.222	< 0.2185
S96T003143	146: 1	Upper 1/2	< 0.3575	< 0.376	< 0.3667
S96T003144	146: 2	Upper 1/2	< 0.2749	< 0.26	< 0.2674
S96T003145		Lower 1/2	< 0.1957	< 0.226	< 0.2108
S96T003146	146: 3	Upper 1/2	< 0.6593	< 0.65	< 0.6546
S96T003147		Lower 1/2	< 0.5748	< 0.581	< 0.5779
S96T003001	146: 3A	Upper 1/2	< 0.6375	< 0.613	< 0.6253
S96T003002	146: 4	Upper 1/2	< 0.2443	< 0.25	< 0.2471
S96T003003		Lower 1/2	< 0.344	< 0.343	< 0.3435
S96T003004	146: 5	Upper 1/2	< 0.3912	< 0.369	< 0.3801
S96T003005		Lower 1/2	< 0.8673	< 0.852	< 0.8596
S96T003006	146: 6	Upper 1/2	< 0.9512	< 0.845	< 0.8981
S96T003007		Lower 1/2	< 0.9484	< 0.932	< 0.9402
S96T003008	146: 7	Upper 1/2	< 0.9464	< 0.972	< 0.9592
S96T003009		Lower 1/2	< 0.9729	< 1.09	< 1.0314
S96T003148	146: 8	Upper 1/2	< 0.9722	< 0.999	< 0.9856
S96T003149		Lower 1/2	< 0.9528	< 0.967	< 0.9599
S96T004180	146: 9	Lower 1/2	< 0.584	< 0.505	< 0.5445
S96T003150		Upper 1/2	< 0.979	< 0.941	< 0.9600
S96T003450	Core 141	Solid composite	< 0.8692	< 0.808	< 0.8386
S96T003660	Core 145	Solid composite	< 0.843	< 0.602	< 0.7225
S96T004199	Core 146	Solid composite	< 0.9072	< 0.885	< 0.8961

Table B2-61. Tank 241-U-108 Core Sample Analytical Results: Cobalt-60 (GEA). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µCi/g	µCi/g	µCi/g
S96T002257	141: 1	Lower 1/2	< 0.03376	< 0.0326	< 0.03318
S96T002258	141: 2	Upper 1/2	< 0.02556	< 0.0315	< 0.02853
S96T002259	141: 3	Upper 1/2	< 0.01436	< 0.0139	< 0.01413
S96T002260	141: 3A	Upper 1/2	< 0.02614	< 0.0236	< 0.02487
S96T002261	141: 4	Upper 1/2	< 0.02212	< 0.0219	< 0.02201
S96T002262		Lower 1/2	< 0.02719	< 0.0253	< 0.02624
S96T002263	141: 4A	Upper 1/2	< 0.02928	< 0.0273	< 0.02829
S96T002264		Lower 1/2	< 0.03441	< 0.0289	< 0.03165
S96T002608	141: 5	Upper 1/2	< 0.01565	< 0.0187	< 0.01717
S96T002609		Lower 1/2	< 0.02093	< 0.0178	< 0.01936
S96T002610	141: 6	Upper 1/2	< 0.01802	< 0.0168	< 0.01741
S96T002611		Lower 1/2	< 0.01752	< 0.0177	< 0.01761
S96T002612	141: 7	Upper 1/2	< 0.02473	< 0.0308	< 0.02776
S96T002613		Lower 1/2	< 0.04274	< 0.0314	< 0.03707
S96T002614	141: 8	Upper 1/2	< 0.03513	< 0.0373	< 0.03621
S96T002615		Lower 1/2	< 0.04125	< 0.0352	< 0.03822
S96T002616	141: 9	Upper 1/2	< 0.03695	< 0.0277	< 0.03232
S96T002909	145: 2	Upper 1/2	< 0.02819	< 0.0203	< 0.02424
S96T002910	145: 3	Upper 1/2	< 0.02214	< 0.0321	< 0.02712
S96T002911		Lower 1/2	< 0.02971	< 0.0235	< 0.02660
S96T002912	145: 4	Upper 1/2	< 0.01854	< 0.0175	< 0.01802
S96T002913		Lower 1/2	< 0.02807	< 0.0208	< 0.02443
S96T002914	145: 5	Upper 1/2	< 0.02181	< 0.0238	< 0.02280
S96T002915		Lower 1/2	< 0.0106	< 0.0114	< 0.01100
S96T002916	145: 6	Upper 1/2	< 0.009969	< 0.0101	< 0.01003
S96T002917		Lower 1/2	< 0.008876	< 0.00933	< 0.009103
S96T002918	145: 7	Upper 1/2	< 0.01912	< 0.0186	< 0.01886
S96T002919		Lower 1/2	< 0.01675	< 0.0191	< 0.01793
S96T002920	145: 8	Upper 1/2	< 0.01612	< 0.0151	< 0.01561
S96T002921		Lower 1/2	< 0.01043	< 0.0106	< 0.01051
S96T002922	145: 9	Upper 1/2	0.01897	0.0229	0.020935
S96T002923		Lower 1/2	< 0.009559	< 0.00829	< 0.008924
S96T003143	146: 1	Upper 1/2	< 0.01338	< 0.0125	< 0.01294

Table B2-61. Tank 241-U-108 Core Sample Analytical Results: Cobalt-60 (GEA). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µCi/g	µCi/g	µCi/g
S96T003144	146: 2	Upper 1/2	< 0.008736	< 0.00916	< 0.008948
S96T003145		Lower 1/2	< 0.008127	< 0.0102	< 0.009163
S96T003146	146: 3	Upper 1/2	< 0.01998	< 0.0204	< 0.02019
S96T003147		Lower 1/2	< 0.01697	< 0.0144	< 0.01568
S96T003001	146: 3A	Upper 1/2	< 0.01673	< 0.0171	< 0.01691
S96T003002	146: 4	Upper 1/2	< 0.009459	< 0.00977	< 0.009614
S96T003003		Lower 1/2	< 0.01328	< 0.0135	< 0.01339
S96T003004	146: 5	Upper 1/2	< 0.01252	< 0.0111	< 0.01181
S96T003005		Lower 1/2	< 0.02485	< 0.0271	< 0.02597
S96T003006	146: 6	Upper 1/2	< 0.01731	< 0.0154	< 0.01635
S96T003007		Lower 1/2	< 0.02745	< 0.0198	< 0.02362
S96T003008	146: 7	Upper 1/2	< 0.02409	< 0.0223	< 0.02319
S96T003009		Lower 1/2	< 0.02213	< 0.0272	< 0.02466
S96T003148	146: 8	Upper 1/2	< 0.01837	< 0.0172	< 0.01778
S96T003149		Lower 1/2	< 0.02254	< 0.0159	< 0.01922
S96T004180	146: 9	Lower 1/2	< 0.0446	< 0.038	< 0.04130
S96T003150		Upper 1/2	< 0.02381	< 0.0225	< 0.02315
S96T003450	Core 141	Solid composite	< 0.01568	< 0.0186	< 0.01714
S96T003660	Core 145	Solid composite	< 0.02667	< 0.0102	< 0.01843
S96T004199	Core 146	Solid composite	< 0.02152	< 0.0296	< 0.02556

Table B2-62. Tank 241-U-108 Core Sample Analytical Results: Europium-154 (GEA). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µCi/g	µCi/g	µCi/g
S96T002257	141: 1	Lower 1/2	< 0.1333	< 0.118	< 0.12565
S96T002258	141: 2	Upper 1/2	< 0.1031	< 0.0962	< 0.09965
S96T002259	141: 3	Upper 1/2	< 0.06633	< 0.0693	< 0.06781
S96T002260	141: 3A	Upper 1/2	< 0.08558	< 0.0791	< 0.08234
S96T002261	141: 4	Upper 1/2	< 0.08931	< 0.0991	< 0.09420
S96T002262		Lower 1/2	< 0.1042	< 0.098	< 0.10110
S96T002263	141: 4A	Upper 1/2	< 0.1175	< 0.117	< 0.11725
S96T002264		Lower 1/2	< 0.0853	< 0.108	< 0.09665
S96T002608	141: 5	Upper 1/2	< 0.0605	< 0.0655	< 0.06300
S96T002609		Lower 1/2	< 0.06897	< 0.0606	< 0.06478
S96T002610	141: 6	Upper 1/2	< 0.05389	< 0.0546	< 0.05424
S96T002611		Lower 1/2	< 0.05852	< 0.061	< 0.05976
S96T002612	141: 7	Upper 1/2	< 0.09173	< 0.0975	< 0.09461
S96T002613		Lower 1/2	< 0.123	< 0.137	< 0.1300
S96T002614	141: 8	Upper 1/2	< 0.1247	< 0.115	< 0.1198
S96T002615		Lower 1/2	< 0.1788	< 0.124	< 0.1514
S96T002616	141: 9	Upper 1/2	< 0.09579	< 0.0983	< 0.09705
S96T002909	145: 2	Upper 1/2	< 0.07418	< 0.0876	< 0.08089
S96T002910	145: 3	Upper 1/2	< 0.1008	< 0.0853	< 0.09305
S96T002911		Lower 1/2	< 0.09677	< 0.106	< 0.10138
S96T002912	145: 4	Upper 1/2	< 0.07392	< 0.064	< 0.06896
S96T002913		Lower 1/2	< 0.08475	< 0.102	< 0.09337
S96T002914	145: 5	Upper 1/2	< 0.08122	< 0.0958	< 0.08851
S96T002915		Lower 1/2	< 0.04459	< 0.0431	< 0.04384
S96T002916	145: 6	Upper 1/2	< 0.03425	< 0.0345	< 0.03437
S96T002917		Lower 1/2	< 0.03012	< 0.0323	< 0.03121
S96T002918	145: 7	Upper 1/2	< 0.06448	< 0.063	< 0.06374
S96T002919		Lower 1/2	< 0.06277	< 0.0758	< 0.06928
S96T002920	145: 8	Upper 1/2	< 0.04999	< 0.0551	< 0.05254
S96T002921		Lower 1/2	< 0.03427	< 0.0374	< 0.03583
S96T002922	145: 9	Upper 1/2	0.1998	0.213	0.2064
S96T002923		Lower 1/2	0.05363	< 0.0328	< 0.04321

Table B2-62. Tank 241-U-108 Core Sample Analytical Results: Europium-154 (GEA). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µCi/g	µCi/g	µCi/g
S96T003143	146: 1	Upper 1/2	< 0.04867	< 0.0571	< 0.05288
S96T003144	146: 2	Upper 1/2	0.06233	< 0.0382	< 0.05026
S96T003145		Lower 1/2	< 0.02782	< 0.0307	< 0.02926
S96T003146	146: 3	Upper 1/2	< 0.06112	< 0.0797	< 0.07041
S96T003147		Lower 1/2	< 0.04996	< 0.0523	< 0.05113
S96T003001	146: 3A	Upper 1/2	< 0.07431	< 0.0664	< 0.07035
S96T003002	146: 4	Upper 1/2	< 0.03901	< 0.0408	< 0.03990
S96T003003		Lower 1/2	< 0.04918	< 0.0512	< 0.05019
S96T003004	146: 5	Upper 1/2	< 0.04898	< 0.0465	< 0.04774
S96T003005		Lower 1/2	< 0.08836	< 0.0866	< 0.08748
S96T003006	146: 6	Upper 1/2	< 0.09557	< 0.0699	< 0.08273
S96T003007		Lower 1/2	< 0.06238	< 0.0831	< 0.07274
S96T003008	146: 7	Upper 1/2	< 0.08322	< 0.0622	< 0.07271
S96T003009		Lower 1/2	< 0.0735	< 0.0997	< 0.0866
S96T003148	146: 8	Upper 1/2	< 0.08311	< 0.085	< 0.08405
S96T003149		Lower 1/2	< 0.07069	< 0.0868	< 0.07874
S96T004180	146: 9	Lower 1/2	0.3369	< 0.145	< 0.24095
S96T003150		Upper 1/2	< 0.1232	< 0.123	< 0.1231
S96T003450	Core 141	Solid composite	< 0.07773	< 0.0678	< 0.07276
S96T003660	Core 145	Solid composite	< 0.07935	< 0.0513	< 0.06532
S96T004199	Core 146	Solid composite	< 0.09139	< 0.0659	< 0.07864

Table B2-63. Tank 241-U-108 Core Sample Analytical Results: Europium-155 (GEA). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µCi/g	µCi/g	µCi/g
S96T002257	141: 1	Lower 1/2	< 0.425	< 0.453	< 0.4390
S96T002258	141: 2	Upper 1/2	< 0.3674	< 0.387	< 0.3772
S96T002259	141: 3	Upper 1/2	< 0.2494	< 0.246	< 0.2477
S96T002260	141: 3A	Upper 1/2	< 0.1804	< 0.172	< 0.1762
S96T002261	141: 4	Upper 1/2	< 0.2043	< 0.213	< 0.2086
S96T002262		Lower 1/2	< 0.2279	< 0.222	< 0.2249
S96T002263	141: 4A	Upper 1/2	< 0.4257	< 0.435	< 0.4303
S96T002264		Lower 1/2	< 0.4094	< 0.434	< 0.4217
S96T002608	141: 5	Upper 1/2	< 0.1961	< 0.2	< 0.1980
S96T002609		Lower 1/2	< 0.191	< 0.19	< 0.1905
S96T002610	141: 6	Upper 1/2	< 0.1862	< 0.173	< 0.1796
S96T002611		Lower 1/2	< 0.1848	< 0.184	< 0.1844
S96T002612	141: 7	Upper 1/2	< 0.5999	< 0.575	< 0.5874
S96T002613		Lower 1/2	< 0.5979	< 0.535	< 0.5664
S96T002614	141: 8	Upper 1/2	< 0.6146	< 0.601	< 0.6078
S96T002615		Lower 1/2	< 0.5449	< 0.523	< 0.5339
S96T002616	141: 9	Upper 1/2	< 0.3024	< 0.305	< 0.3037
S96T002909	145: 2	Upper 1/2	< 0.3462	< 0.352	< 0.3491
S96T002910	145: 3	Upper 1/2	< 0.3989	< 0.397	< 0.3979
S96T002911		Lower 1/2	< 0.3958	< 0.391	< 0.3934
S96T002912	145: 4	Upper 1/2	< 0.2811	< 0.27	< 0.2755
S96T002913		Lower 1/2	< 0.3468	< 0.345	< 0.3459
S96T002914	145: 5	Upper 1/2	< 0.3291	< 0.335	< 0.3320
S96T002915		Lower 1/2	< 0.1635	< 0.163	< 0.1632
S96T002916	145: 6	Upper 1/2	< 0.1414	< 0.136	< 0.1387
S96T002917		Lower 1/2	< 0.1298	< 0.131	< 0.1304
S96T002918	145: 7	Upper 1/2	< 0.3812	< 0.374	< 0.3776
S96T002919		Lower 1/2	< 0.4044	< 0.397	< 0.4007
S96T002920	145: 8	Upper 1/2	< 0.2989	< 0.294	< 0.2964
S96T002921		Lower 1/2	< 0.12	< 0.125	< 0.1225
S96T002922	145: 9	Upper 1/2	0.2204	< 0.15	< 0.1852
S96T002923		Lower 1/2	< 0.1006	< 0.103	< 0.1018

Table B2-63. Tank 241-U-108 Core Sample Analytical Results: Europium-155 (GEA). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µCi/g	µCi/g	µCi/g
S96T003143	146: 1	Upper 1/2	< 0.1656	< 0.174	< 0.1698
S96T003144	146: 2	Upper 1/2	< 0.1175	< 0.118	< 0.1177
S96T003145		Lower 1/2	< 0.09056	< 0.102	< 0.09628
S96T003146	146: 3	Upper 1/2	< 0.2538	< 0.246	< 0.2499
S96T003147		Lower 1/2	< 0.2176	< 0.222	< 0.2198
S96T003001	146: 3A	Upper 1/2	< 0.2381	< 0.236	< 0.2370
S96T003002	146: 4	Upper 1/2	< 0.111	< 0.114	< 0.1125
S96T003003		Lower 1/2	< 0.1557	< 0.161	< 0.1583
S96T003004	146: 5	Upper 1/2	< 0.1778	< 0.168	< 0.1729
S96T003005		Lower 1/2	< 0.4228	< 0.408	< 0.4154
S96T003006	146: 6	Upper 1/2	< 0.4551	< 0.41	< 0.4325
S96T003007		Lower 1/2	< 0.4433	< 0.443	< 0.4431
S96T003008	146: 7	Upper 1/2	< 0.4566	< 0.465	< 0.4608
S96T003009		Lower 1/2	< 0.4654	< 0.52	< 0.4927
S96T003148	146: 8	Upper 1/2	< 0.4664	< 0.476	< 0.4712
S96T003149		Lower 1/2	< 0.3615	< 0.364	< 0.3627
S96T004180	146: 9	Lower 1/2	< 0.2691	< 0.236	< 0.2525
S96T003150		Upper 1/2	< 0.3816	< 0.367	< 0.3743
S96T003450	Core 141	Solid composite	< 0.3341	< 0.309	< 0.3215
S96T003660	Core 145	Solid composite	< 0.4058	< 0.29	< 0.3479
S96T004199	Core 146	Solid composite	< 0.4305	< 0.429	< 0.4297

B2.7 VAPOR PHASE MEASUREMENTS

B2.7.1 Safety Screening

Before and during the April/May core sampling of tank 241-U-108, vapor phase measurements were made in support of the safety screening DQO. The vapor phase measurements reported here were taken in the tank headspace below a riser. Results were obtained in the field (i.e., no gas sample was sent to the laboratory for analysis). Multiple measurements were taken for each riser used for core sampling. The results in Table B2-64 are those with the highest LFL value for found for each riser. All data were reported in WHC (1996).

Table B2-64. Results of Vapor Phase Measurements of Tank 241-U-108.

Measurement	Results		
	Riser 2; May 1, 1996	Riser 7; April 19, 1996	Riser 9; April 26, 1996
LFL	4% of LFL	3% of LFL	6% of LFL
TOC	15 ppm	28 ppm	14 ppm
Oxygen	20.8%	20.8%	21.0%
Ammonia	500 ppm	500 ppm	450 ppm

B2.7.2 1995 Tank Vapor Samples

Data from the 1995 tank 241-U-108 vapor samples are shown in Table B2-65. Vapor samples were obtained in 1995 as required in *Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution* (Osborne et al. 1995). Since the 1995 vapor samples were taken, tank vapors are no longer being evaluated as a health concern (Hewitt 1996).

B2.7.2.1 Inorganic Analytes. The vapor concentrations of selected inorganic analytes, NH_3, NO_2, NO, and vapor mass concentration (primarily H_2O), were determined. The average and one standard deviation of concentration results from inorganic sorbent sample trains used to sample headspace vapors were 692 $\pm$ 7 ppmv (NH_3), $\leq$ 0.02 ppmv (NO_2), $\leq$ 0.06 ppmv (NO), and 15.5 $\pm$ 0.1 mg/L (primarily H_2O). The vapor concentration results were based on six samples for each compound (eight samples for mass concentration). The NO_2 and NO samples included four samples trailing (downstream of) NH_3 sorbent traps and two samples unprotected by NH_3 sorbent traps. All samples were successfully analyzed and used in the averages. Representative field blanks were also analyzed and used to correct data.

Two of the four average concentration results, NH_3 and H_2O, exceeded the minimum of the expected ranges. The precision of results, based on one standard deviation of all samples, was $\leq$ 1 percent (within the target level of $\pm$ 25 percent) for analytes exceeding expected ranges. The estimated accuracies of vapor concentrations, assuming negligible sample volume uncertainty, were 90 to 110 percent (within the target range of 70 to 130 percent) for analytes exceeding the expected ranges. These uncertainties were confirmed by evaluation of spikes and continuing calibration standards (NH_3) and evaluation of the variability of field blanks (H_2O). No procedural deviations were noted. Data and additional information on samples, analyses, and results are described in Thomas et al. (1996).

B2.7.2.2 Permanent Gases. The complete results of the permanent-gas analysis of tank 241-U-108 can be found in Thomas et at. (1996). In summary, hydrogen (522 ppmv) and nitrous oxide (612 ppmv) were observed above the method detection limit (MDL) in the tank headspace samples, and carbon dioxide in the headspace samples was at a lower concentration than observed in the ambient air.

B2.7.2.3 Total Non-Methane Hydrocarbons. The complete results of the total non-methane hydrocarbons analysis of tank 241-U-108 can be found in Thomas et al. (1996). In summary, the average concentration in the three tank headspace samples was 11.99 mg/m^3. This compares to 6.08 mg/m^3 for the sum of all compounds identified in the target and tentatively identified compound (TID) analysis of the SUMMA™ canisters.

B2.7.2.4 Volatile Organic Analytes. The complete results of the volatile organic analysis of tank 241-U-108 can be also be found in Thomas et al. (1996). In summary, 14 target analytes above the 5-ppbv reporting cutoff and 12 tentatively identified compounds (TIDs) above the 10-ppbv reporting cutoff were detected in the tank headspace samples. Thirteen target analytes and all TIDs were identified in two or more tank headspace samples. The total concentration of the target analytes was found to be 3.47 mg/m^3. The total TID concentration was found to be 2.60 mg/m^3. The total concentration of all the compounds identified was 6.08 mg/m^3. SUMMA™ canister PNL 48 was analyzed in replicate for target analytes and TIDs to determine analytical precision. Eight of 13 target analytes and 7 of 12 TIDs had RPDs of less than 10 percent. The compound 2-butanone was the only target analyte observed in the upwind ambient air sample. Acetone was observed in the ambient air through the VSS sample. No TIDs were observed in the two ambient air samples.

B2.7.2.5 Semi-Volatile Organic Analytes. The complete results of the sorbent trap analysis of tank 241-U-108 can be found in Thomas et al. (1996). In summary, 19 target analytes above the 5-ppbv reporting cutoff and 13 TIDs above the 10-ppbv reporting cutoff were detected in the tank headspace samples. Eighteen of 19 target analytes and 9 of 13 TIDs were observed in two or more sorbent traps. Two of 13 TIDs were identified as unknowns. The total concentration of the target analytes was found to be 4.49 mg/m^3. The total concentration of the TIDs was found to be 4.25 mg/m^3. The total concentration of all the compounds identified was 8.74 mg/m^3. Triple sorbent trap sample PNL 635 was analyzed in replicate for target analytes and TIDs to determine analytical precision. Fifteen of 18 target analytes and 1 of 9 TIDs had RPDs of less than 10 percent.

Table B2-65. Vapor Analytical Summary for Tank 241-U-108.

Safety Issue[1]	Target Analyte[2]	Mean Concentration[3] (ppmv)	Decision Threshold[2]
Flammability	Hydrogen	522	20% of LFL
	Methane	<25	20% of LFL
	Carbon monoxide	<25	20% of LFL
Carcinogen Teratogen Mutagen	Acetonitrile	0.029	250
	Benzene	0.019	250
	1,3-Butadiene	Not measured[4]	1000
	Hexane	0.012	550
	Nitric oxide	<0.06	50
	Nitrogen dioxide	<0.02	10
	N-Nitrosodimethyl amine	0.051[5]	Any detectable amount[6]
	Nitrous oxide	612	Not provided in SAP
Toxin	Dodecane	Not detected	---
	Tridecane	Not detected	---
	Propane nitrile	Not detected	---
	Carbon monoxide	<25	20% of LFL
Irritant	Ammonia	692	150
	Tributyl phosphate	Not measured[4]	15
	Carbon dioxide	<25	Not provided in SAP
	Butanol	0.296	700
	Butanol	Not measured[4]	44,610 mg/m^3 [7]
	Acetone	0.25	1,250

Notes:

[1]Mahlum et al. (1994)

[2]Homi (1995)

[3]Average of triple sorbent tube and SUMMA™ results

[4]Samples sent to PNNL for organic analysis were not analyzed for this compound. No sample was sent to Oak Ridge National Laboratory for organic analysis as required in the SAP.

[5]Tentatively identified compound; concentration is estimated.

[6]The "immediately dangerous to life and health" concentration is not available for this compound. The National Institute for Occupational Safety and Health (NIOSH) recommends specific safeguards for any detectable amount of this carcinogen (NIOSH 1994).

[7]The "immediately dangerous to life and health" concentration is not available for this compound. The LD_{50} mouse inhalation value (Izmerov 1982) value was used.

B2.7.3 Flammable Gas Monitoring

From June 1995 to May 1996, 14 headspace samples were removed from tank 241-U-108 using the Standard Hydrogen Monitoring System. The samples were analyzed for hydrogen, methane, and nitrous oxide. The samples were taken to support resolution of the flammable gas safety issue and to meet the requirements of Tri-Party Agreement (Ecology et al. 1996) milestone M-40-10.

A description of the sampling methods and requirements is available in Wilkins et al. (1997). The analytical data are presented in Table B2-66. The results are consistent with the August 1995 and April/May 1996 vapor samples described in sections B2.7.1 and B2.7.2. The hydrogen concentrations reported in Wilkins et al. (1997) are well below 25 percent of the LFL, and the methane and nitrous oxide results compare well with the results from the August 1995 headspace samples.

Table B2-66. Tank 241-U-108 Flammable Gas Monitoring Vapor Sample Results.

Sample Date	H_2 (ppm)	CH_4 (ppm)	N_2O (ppm)
June 27, 1995	430	11	330
June 30, 1995	410	8	310
July 7, 1995	500	10	360
July 11, 1995	470	10	530
July 14, 1995	450	8	510
July 17, 1995	430	18	450
September 11, 1995	490	7	530
September 11, 1995	480	8	550
September 18, 1995	n/r	2[1]	n/r
September 18, 1995	8	1	n/r
February 7, 1996	296	n/r	370
February 7, 1996	145	n/r	120
May 9, 1996	520	10	600
May 9, 1996	530	20	600

Notes:

n/r = not reported

[1]The samples taken on September 18, 1995 are unusually low. A problem with the sample cylinder is suspected.

B2.8 HISTORICAL SAMPLE RESULTS

The results of the 1971, 1973 or 1974, and 1975 samples are shown in Tables B2-67, B2-68, and B2-69. In the early to mid 1970s, the contents of tank 241-U-108 were scheduled to be used as feed to the 242-S Evaporator. The 1971 sample was probably sludge since values for specific gravity and viscosity were not provided as with most other sample data given in Puryear (1971). None of the samples probably represent the present tank contents. These data have not been validated and should be used with caution.

Table B2-67. 1971 Sample.[1,2]

Waste Tank 241-U-108 Sample Date: not given		
Sample Number: not given		
COMPONENT	LAB VALUE	LAB UNIT
Physical Data		
Sample description	not provided	
Chemical Analysis		
Al	0.25	*M*[3]
Na	4.59	*M*[3]
NO_2	0.231	*M*[3]
CO_3	0.086	*M*[3]

Notes:

[1]Pre-1989 analytical data have not been validated and should be used with caution.
[2]Puryear (1971)
[3]Units were not provided in reference and are assumed to be molar.

Table B2-68. 1973 or 1974 Supernatant Sample.[1,2] (2 sheets)

Waste Tank 241-U-108 Sample Date: not given		
Sample Number: T-151		
COMPONENT	LAB VALUE	LAB UNIT
Physical Data		
Sample description	Clear, yellow, no solids. 50 mR/hr.	
pH	11.6	n/a
Specific gravity	1.0056	n/a
Water	96.38	%
Energetics	no exotherm	J/g
Chemical Analysis		
OH	<0.01	*M*
Al	<7.60E-03	*M*
Na	0.515	*M*
NO_2	3.17E-03	*M*

Table B2-68. 1973 or 1974 Supernatant Sample.[1,2] (2 sheets)

Waste Tank 241-U-108 Sample Date: not given Sample Number: T-151		
COMPONENT	**LAB VALUE**	**LAB UNIT**
NO_3	0.381	*M*
SO_4	4.93E-03	*M*
PO_4	0.137	*M*
F	1.27E-02	*M*
CO_3	0.024	*M*
Radiological Analysis		
^{134}Cs	43.37	μCi/L
^{137}Cs	1,690	μCi/L
Pu	1.04E-06	g/L
$^{89/90}Sr$	4.54	μCi/L

Notes:

[1]Pre-1989 analytical data have not been validated and should be used with caution.

[2]Sant (1974)

Table B2-69. 1975 Sludge Sample.[1,2]

Waste Tank 241-U-108 Sample Receipt Date: August 14, 1975		
Sample Number: not given		
COMPONENT	**LAB VALUE**	**LAB UNIT**
Physical Data		
Sample description	**Large, yellow crystals.**	
Particle density	2.30	not given
Bulk density	0.898	g/mL[3]
Water	51.2	%
Chemical Analysis		
SiO_2	3.9	%
Al_2O_3	15.5	%
FeOOH	1.4	%
Mn	<0.01	%
Mg	<0.01	%
Ca	<0.01	%
$NaNO_2$	0.2	%
$NaNO_3$	1.8	%
SO_4	4.93E-03	%
Na_3PO_4	15.6	%
NaOH	0.01	%
Na_2CO_3	0.7	%
Radiological Analysis		
^{134}Cs	8.8	μCi/g
^{137}Cs	144.5	μCi/g
^{239}Pu	1.04E-06	g/g
$^{89/90}Sr$	8.4	μCi/g

Notes:

[1]Pre-1989 analytical data have not been validated and should be used with caution.

[2]Horton (1975)

[3]Units were not provided in reference and are assumed to be g/mL.

B3.0 ASSESSMENT OF CHARACTERIZATION RESULTS

The purpose of this chapter is to discuss the overall quality and consistency of the current sampling results for tank 241-U-108, and to present the results of the calculation of an analytical-based inventory.

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

B3.1 FIELD OBSERVATIONS

The safety screening, historical, and organic DQO requirements on the 1996 core samples that vertical profiles from at least two widely spaced risers be obtained was not completely fulfilled. Sample from the lower half of segment 2 was only recovered from core sample 146. A sample from each half segment was recovered from at least two of the three cores for all other segments. The sampling requirements of the waste compatibility and vapor DQOs were met. Water with a lithium bromide tracer was used to acquire most of the core samples. There was no evidence of contamination from hydrostatic head fluid or wash water. In addition, all analyses were performed in accordance with the required procedures, with the exception of carbonate which was determined by the TIC method rather than by IC. Carbonate cannot be determined by the IC method prescribed in the core SAP (Homi 1996).

B3.2 QUALITY CONTROL ASSESSMENT

The usual quality control assessment includes an evaluation of the appropriate standard recoveries, spike recoveries, duplicate analyses, and blanks that are performed in conjunction with the chemical analyses. All the pertinent quality control tests were conducted on the 1996 core and the 1995 grab and vapor samples, allowing a full assessment regarding the accuracy and precision of the data. The respective SAPs (Homi 1996, Schreiber 1995, and Homi 1995) established the specific criteria for all analytes. For the core and grab samples, sample and duplicate pairs that had one or more QC results outside the specified criteria were identified by footnotes in the data summary tables.

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

B3.2.1 1996 Core Samples

Occasional fusion preparation blanks showed results above the detection level for some ICP analytes. The level of the respective analyte in a preparation blank was inconsequential when compared to the result for the sample; therefore, the contamination did not impact the sample data quality. Most fusion preparation blanks showed results above the detection level for Sr-90 activity;, however, the contamination was low enough that it did not impact sample data quality.

Tank 241-U-108 core samples were affected by an incorrect spike recovery calculation for the TOC and TIC analyses (Rice 1996). Corrections were made to the TOC and TIC data summary tables (Tables B2-10 and B2-12). However, selected spike recovery data in the tank 241-U-108 data report (Bell 1996a) are not correct. Corrections to Bell (1996a) are due October 30, 1997.

B3.2.1.1 Direct Analyses. The core sample data show that many samples were heterogeneous at the 15- to 30-mg level as evidenced by the sample descriptions provided in Section B1.2 and the numerous DSC and TGA RPD values that exceeded the 10 percent core SAP criterion. The sample that exceeded the DSC notification limit was rerun due to the large RPD (45.6) between sample and duplicate results with little improvement (41.4). Triplicate runs were performed on several DSC, TGA, and TOC analyses with poor RPD values between the sample and duplicate results.

The data indicate that the fluctuation of TOC and TIC results from subsegment to subsegment was most likely due to heterogeneity in the samples rather than any analytical problems. Spike recovery and RPD TOC data were within the core SAP limits (80 to 120 percent spike recovery and ≤ 20 percent RPD) for 51 of 57 subsamples. No re-runs were initiated because the results were far below the 30,000-μg/g notification limit; however, triplicate runs were performed and reported on six samples. For the TIC analyses, the QC criteria of RPD (≤ 10 percent) and spike recovery (90 to 110 percent) were tighter and were not always met. The highest RPD value was 31.1 (upper half of segment 3A, core 146) and the poorest spike recovery was 142 percent (upper half of segment 4A, core 141).

B3.2.1.2 Inductively Coupled Plasma Analyses. At least three analyses for each of the elements Al, Cr, Fe, Na, Ni, P and Si had RPD values and/or spike recoveries outside of the core SAP limit of < =10 percent for the RPD and 90 to 110 percent for the spike recovery. Because of the high concentrations of sodium in all samples and aluminum in the drainable liquid and water-digested samples, the poor spike recoveries associated with these samples were reported, but not evaluated. The acid-digested core composite samples analyzed for Si had low spike recoveries. This was most likely caused by the sample result being biased high because of Si leaching from the laboratory glassware.

As with the TOC and TIC results, the poor RPD values and spike recoveries were attributed to sample heterogeneity. Two fusion digests were re-run because of poor precision between the sample and duplicate results.

B3.2.1.3 Ion Chromatography Analyses. Quality control issues are discussed for the bromide and nitrate determinations. Additional IC data were collected on an opportunistic basis and are reported here. Because these data were not identified in any DQO document, there were no programmatic QC requirements with respect to these data and the QC information associated with them were not evaluated for this report.

Bromide was only detected in the field blank; therefore, there were no exceptions to the QC parameters stated in the SAP for the samples analyzed for bromide. For nitrate, however, eight of 51 samples had RPD values in excess of the required 10 percent, and ten of the samples had spike recoveries outside the SAP 90-110 percent limit. The poor RPD values nd spike recoveries were attributed to sample heterogeneity.

B3.2.1.4 Radiochemical Analyses. Quality control issues are discussed for the total alpha, Cs-137 (by GEA), Sr-90, total uranium, and total beta determinations. Additional GEA data were collected on an opportunistic basis and are reported here. Because these data were not identified in any DQO document, there were no programmatic QC requirements with respect to these data and the QC information associated with them were not evaluated for this report.

For the total alpha activity analyses, the core SAP criterion for RPD between sample and duplicate results ($\leq$10 percent) was exceeded in 27 samples, and the core SAP criterion for spike recovery (90-110 percent) was exceeded on 18 samples. The samples that exceeded the RPD and/or spike recovery criteria probably did so due to sample heterogeneity and a high solids content.

One sample measured for Cs-137 activity (core 146 composite) had an RPD value of 43.2, which exceeded the core SAP limit of 20 percent. Six of 53 fusion digest samples measured for Sr-90 activity had RPD values greater than 10 percent as specified in the core SAP. These RPD values ranged from 11.3 to 46.9 percent. The sample with the RPD value of 46.9 (core 145 composite) had been re-run, as had three other samples.

The initial total uranium sample and duplicate results from core 145 had an RPD that exceeded the SAP criterion of $<$20 percent. The sample was re-run with a satisfactory RPD result, but with a low spike recovery (48.3 percent).

The initial sample and duplicate total beta activity results from core 145 had an RPD which exceeded the core SAP criterion of $<$20 percent. At 44.8, the rerun RPD results still did not meet the SAP RPD criterion.

B3.2.2 1995 Grab Samples

All QC criteria were met for the 1995 grab sample analyses on sample U-108-1.

In summary, the vast majority of the QC results were within the boundaries specified in the core and grab SAPs. The discrepancies mentioned here and footnoted in the data summary tables in Appendix B should not impact the validity or use of the data.

B3.3 DATA CONSISTENCY CHECKS

Comparisons of different analytical methods can help to assess the consistency and quality of the data. Several comparisons were possible with the data set provided by the three core samples. These include a comparison of phosphorous and sulfur as analyzed by ICP with phosphate and sulfate as analyzed by IC, and a comparison of TOC concentration as determined by the persulfate and furnace oxidation methods. In addition, mass and charge balances were calculated and a comparison of calculated total beta activity and measured total beta activity was made. A comparison of 1996 core drainable liquid and 1995 grab sample results helped assess the overall data consistency.

B3.3.1 Comparison of Results from Different Analytical Methods

The following data consistency checks compare the results from two different analytical methods. Agreement between the two methods strengthens the credibility of both results, whereas poor agreement brings the reliability of the data into question. All analytical mean results were taken from Table B3.6.

B3.3.1.1 Solid Core Samples. Phosphate and sulfate data were measured by IC, and phosphorous and sulfur were measured by ICP, which allows a comparison of the IC and ICP results. The mean phosphorous core composite result on the water-digested sample was 4,000 μg/g. Surprisingly, this result was higher than the results on the acid-digested and fusion-digested samples and was the one used for comparison to the (water-digested) IC phosphate result. The concentration of phosphorous found converts to 12,264 μg/g of phosphate, and compares very well with the IC result of 12,400 μg/g.

The mean sulfur core composite result on the water-digested sample was 5,530 μg/g. This result was slightly higher than the acid-digested result and was the one used for comparison to the (water-digested) IC sulfate result. The concentration of sulfur found converts to 16,570 μg/g of sulfate, which compares very well with the IC result of 17,600 μg/g.

B3.3.1.2 Drainable Liquid Samples. Phosphate and phosphorous, and sulfate and sulfur concentrations were also measured on the drainable liquid samples from segment 1 of cores 141, 145, and 146. The mean ICP phosphorous result was 1,020 μg/mL, which converts to 3,130 μg/mL of phosphate. The phosphate result was 2,500 μg/mL, which accounts for approximately 80 percent of the phosphorous. The sulfur/sulfate comparison on the drainable liquids was more favorable. The mean ICP sulfur result was 1,410 μg/mL, which converts to 4,220 μg/mL of sulfate. The observed IC sulfate value was 3,630 μg/mL; accounting for 86 percent of the sulfur.

B3.3.2 Mass and Charge Balance

The principle objective in performing mass and charge balances is to determine if the measurements are self-consistent. In calculating the balances, only analytes listed in Table B3-2 detected at a concentration of 1,000 μg/g or greater were considered.

Except for sodium, all cations listed in Table B3-1 were assumed to be in their most common oxide form, and the concentrations of the assumed species were calculated stoichiometrically. The aluminum concentration was assumed to be present as the aluminate ion because of the high concentration of aluminum found in the drainable liquid and water-digested samples. Because precipitates are neutral species, all positive charge was attributed to the sodium cation. The anions listed in Table B3-2 were assumed to be present as sodium salts and were expected to balance the positive charge exhibited by the cations. Phosphate, as determined by IC, is assumed to be completely water soluble and appears only in the anion mass and charge calculations. The concentrations of cationic species in Table B3-1, the anionic species in Table B3-2, and the percent water were ultimately used to calculate the mass balance.

Table B3-1. Cation Mass and Charge Data.

Analyte	Concentration (μg/g)	Assumed Species	Concentration of Assumed Species (μg/g)	Charge (μeq/g)
Sodium	241,000	Na^+	241,000	10,480

Table B3-2. Anion and Neutral Species Mass and Charge Data.

Analyte	Concentration µg/g	Species or Assumed Species	Concentration of Assumed Species µg/g	Charge µeq/g
Aluminum	16,500	AlO_2^-	36,100	612
TOC	4,160	$C_2O_4^{2-}$	15,300	347
TIC	7,970	CO_3^{2-}	39,800	1,330
Chromium	4,120	$Cr(OH)_3$	8,160	n/a
Chloride	3,450	Cl^-	3,450	97
Nitrate	295,000	NO_3^-	295,000	4,760
Nitrite	50,000	NO_2^-	50,000	1,090
Phosphate	17,200	PO_4^{3-}	17,200	542
Sulfate	15,100	SO_4^{2-}	15,100	314
Total			480,100	9,090

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

Mass balance = % Water + 0.0001 x {Total Analyte Concentration}

= % water + 0.0001 x $\{[Na^+] + [AlO_2^-] + [C_2O_4^{2-}] + [CO_3^{2-}] + Cr(OH)_3 + [Cl^-] + [NO_3^-] + [NO_2^-] + [PO_4^{3-}] + [SO_4^{2-}]\}$

The mass balance resulting from adding the percent water to the total analyte concentration is 108.3 percent as shown in Table B3-3.

Table B3-3. Mass Balance Totals.

Totals	Concentrations (µg/g)
Total from Table B3-1	241,000
Total from Table B3-2	480,100
Water %	364,000
Grand total	1,085,100

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

Total cations (μeq/g) = $[Na^{+}]/23.0$ = 10,480 μeq/g

Total anions (μeq/g) = $[AlO_2^-]/59.0 + [C_2O_4^{2-}]/44.0 + [CO_3^{2-}]/30.0 + [Cl^-]/35.5 + [NO_3^-]/62.0 + [NO_2^-]/46.0 + [PO_4^{3-}]/31.7 + [SO_4^{2-}]/48.1$ = 9,090 μeq/g

The charge balance obtained by dividing the sum of the positive charge by the sum of the negative charge was 1.15.

B3.3.3 Total Beta Results

The mean total beta result obtained from the core composite data was compared with the measured beta emitters ^{137}Cs and $^{89/90}Sr$. For consistency, all results used were the mean core composite data shown in Table B3-4.

Total beta (calculated) = $[^{137}Cs] + (2)([^{89/90}Sr])$ = 162 μCi/g + (2)(9.32) = 181 μCi/g.

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

The measured mean total beta activity on the core composites was 167 μCi/g.

In summary, the above calculations yield results $<=$ 15 percent of the theoretical values, indicating that the analytical results are generally self-consistent.

B3.3.4 Comparison of 1996 Core Drainable Liquid and 1995 Grab Sample Results

Because no waste transfers were made in or out of tank 241-U-108 between the collection of the 1995 grab samples and the 1996 core samples, the analytical results for the (liquid) grab samples and the drainable liquids should be similar. Recall that all drainable liquid was collected from the first segment of the three core samples. The results are taken from the tables in Section B2.0.

B3.3.5 Comparison of TOC by Persulfate and TOC by Furnace Oxidation

As shown in Table B3-4, there is generally good agreement between the 1995 liquid grab samples and what is expected to be the same liquid obtained from the 1996 core sampling. This agreement allows for a comparison between the two TOC methods available at the 222-S Laboratory: furnace oxidation and persulfate oxidation. The furnace oxidation method has been shown (Baldwin et al. 1994) to be effective at oxidizing hydrocarbons such as dodecane, while the persulfate method is not. The TOC content of the 1995 liquid grab sample was measured at 7,440 μg/mL by furnace oxidation. The TOC content of the 1996 drainable liquid samples averaged 7,160 μg/mL, indicating that there is little or no organic carbon that was not oxidized by the persulfate method.

B3.3.6 Comparison of Transfer History and Analytical Results

The HTCE of selected tank 241-U-108 analytes appears in Table B3-5 along with the concentration estimates from the core sample analytical results. This comparison is presented for information purposes only. The HTCE values are generated from a combination of inputs: transfer history, estimated compositions of various Hanford Site waste types, and modeled waste layering (see Agnew et al. 1996a). Each of the three inputs contains assumptions and/or other factors (such as transfers of an unknown waste type into the tank) that may impact HTCE data. Because of uncertainty of waste volumes and the fact that the HTCE values have not been validated, they should be used with caution.

Comparing the HTCE with the most recent analytical values produced varied results, yet some analytes such as bulk density, water, potassium, and nitrate compared quite favorably. The largest disparity was found with oxalate values. The HTCE value does not consider the TOC degradation that is probably responsible for the observed oxalate concentration. The discrepancy in the uranium numbers most likely results from the fact that MW was not recovered from the tank, although the HTCE model considers there to be metal waste in the tank. Agnew et al. (1996a) is believed to have overestimated the amount of cladding waste in the tank, which would account for the overestimation of aluminum, carbonate, and uranium. The reasons for the overestimation of the sulfate and strontium concentrations may be related to inaccurate source term assumptions about the waste composition.

B3.4 MEAN CONCENTRATIONS AND CONFIDENCE INTERVALS

The following evaluation was performed on the analytical data from the April/May 1995 core samples for tank 241-U-108. Analysis of variance (ANOVA) models were fit to the 1996 core samples from tank 241-U-108. These models were used to compute an estimate of mean concentration, the variance of the mean, and 95 percent confidence intervals on the mean for each detected analyte.

Table B3-4. Comparison of 1995 Grab and 1996 Drainable Liquid Analytical Results.

Analyte	1995 Result (µg/mL)	1996 Result (µg/mL)
Al	40,170	40,700
Fe	40.1	33.3
Na	288,100	243,000
Chloride	8,415	8,940
Fluoride	1,120	790[1]
Nitrate	173,500	197,000
Nitrite	115,500	145,000
Phosphate	3,700[2]	2,500
Sulfate	4,595	3,630
Water	50.27 %	49.93 %
TIC	3,210	4,400

Notes:

[1]Fluoride was only detected in the core 146 drainable liquid.

[2]The duplicate result was a less-than value.

Table B3-5. Comparison of Historical Tank Content Estimate[1] with 1996 Core Sample Analytical Results from Tank 241-U-108. (2 sheets)

Analyte	1996 Solid Core Mean[2]	HTCE Estimate
PHYSICAL PROPERTIES		
Percent water (TGA)	31.5%	33.0%
Bulk density	1.71 g/mL	1.62 g/mL
METALS	µg/g	µg/g
Aluminum	16,500	33,600
Chromium	4,120	2,080
Potassium	1,580[3]	1,420
Sodium	2.41E+05	1.78E+05
ANIONS	µg/g	µg/g
Carbonate (TIC)	4,400	19,100
Chloride	8,940	4,780
Nitrate	1.81E+05	2.06E+05
Nitrite	1.30E+05	73,100
Oxalate	4,640[3]	1.96
Phosphate	2,500	5,840
Sulfate	3,630	15,600
TOTAL CARBON	µg/g	µg/g
Total organic carbon	7,160	9,240

Table B3-5. Comparison of Historical Tank Content Estimate[1] with 1996 Core Sample Analytical Results from Tank 241-U-108. (2 sheets)

Analyte	1996 Solid Core Mean[2]	HTCE Estimate
RADIONUCLIDES	**μCi/g**	**μCi/g**
^{137}Cs	166	117
Total uranium	187[3] (μg/g)	7,770 (μg/g)
^{90}Sr	10.1	84.3

Notes:

[1]Agnew et al. (1996b)
[2]From Table B3-5
[3]From Table B3-4

Because an inventory estimate is needed without comparing it to a threshold value, two-sided 95 percent confidence intervals on the mean inventory are computed. These confidence intervals were done with both the composite-level and segment-level data. With segment-level data, the supernatant sample data and solid sample data were analyzed separately. Supernatant samples were only present in segment 1 of both cores.

The upper and lower limits (UL and LL) to a two-sided 95 percent confidence interval for the mean are

$$\hat{\mu} \pm t_{(df,0.025)} \times \hat{\sigma}_{\hat{\mu}}.$$

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 degrees of freedom (df) 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-108, is the number of cores sampled minus one.

B3.4.1 Composite, Solid Segment, and Liquid Segment Means

The statistics in this section were based on analytical data from the most recent sampling event of tank 241-U-108. ANOVA techniques were used to estimate the mean, and calculate confidence limits on the mean, for all analytes that had at least 50 percent of reported values above the detection limit. If at least 50 percent of the reported values were above the detection limit, all of the data were used in the computations. The detection limit was used as the value for nondetected results. No ANOVA estimates were computed for analytes with less than 50 percent detected values. Only arithmetic means were computed for these analytes.

The results given below are ANOVA estimates based on the core composite data from cores 141, 145, and 146 of tank 241-U-108. Estimates of the mean concentration, the standard deviation of the mean, the degrees of freedom, and confidence interval on the mean concentration, are given in Table B3-6. The LL to a 95 percent confidence interval can be negative. Because an actual concentration of less than zero is not possible, the lower limit is reported as zero, whenever this occurred.

Table B3-6. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Composite Sample Data. (4 sheets)

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	LL	UL
ICP.a.Al	µg/g	1.84E+04	3.77E+03	2	2.21E+03	3.46E+04
ICP.f.Al	µg/g	1.88E+04	3.17E+03	2	5.16E+03	3.25E+04
ICP.w.Al	µg/g	1.65E+04	2.50E+03	2	5.73E+03	2.73E+04
Am-241[1]	µCi/g	8.19E-01	n/a	n/a	n/a	n/a
ICP.a.Sb[1]	µg/g	5.21E+01	n/a	n/a	n/a	n/a
ICP.w.Sb[1]	µg/g	4.89E+01	n/a	n/a	n/a	n/a
ICP.a.As[1]	µg/g	8.14E+01	n/a	n/a	n/a	n/a
ICP.w.As[1]	µg/g	8.15E+01	n/a	n/a	n/a	n/a
ICP.a.Ba[1]	µg/g	4.07E+01	n/a	n/a	n/a	n/a
ICP.w.Ba[1]	µg/g	4.07E+01	n/a	n/a	n/a	n/a
ICP.a.Be[1]	µg/g	4.07E+00	n/a	n/a	n/a	n/a
ICP.w.Be[1]	µg/g	4.07E+00	n/a	n/a	n/a	n/a
ICP.a.Bi[1]	µg/g	8.14E+01	n/a	n/a	n/a	n/a
ICP.f.Bi[1]	µg/g	1.92E+03	n/a	n/a	n/a	n/a
ICP.w.Bi[1]	µg/g	8.15E+01	n/a	n/a	n/a	n/a
ICP.a.B	µg/g	8.04E+01	1.56E+01	2	1.31E+01	1.48E+02
ICP.w.B	µg/g	5.24E+02	2.85E+01	2	4.02E+02	6.47E+02
Bromide[1]	µg/g	6.23E+02	n/a	n/a	n/a	n/a
Bulk density	g/mL	1.71E+00	3.93E-02	2	1.54E+00	1.88E+00
ICP.a.Cd[2]	µg/g	4.46E+00	4.76E-01	2	2.41E+00	6.51E+00
ICP.w.Cd[1]	µg/g	4.07E+00	n/a	n/a	n/a	n/a
ICP.a.Ca	µg/g	1.56E+02	1.82E+01	2	7.71E+01	2.34E+02
ICP.f.Ca[1]	µg/g	1.92E+03	n/a	n/a	n/a	n/a
ICP.w.Ca	µg/g	1.15E+02	1.58E+01	2	4.72E+01	1.83E+02
ICP.a.Ce[1]	µg/g	8.14E+01	n/a	n/a	n/a	n/a
ICP.w.Ce[1]	µg/g	8.15E+01	n/a	n/a	n/a	n/a
Cs-137	µCi/g	1.62E+02	1.39E+01	2	1.03E+02	2.22E+02
Chloride	µg/g	4.38E+03	6.72E+02	2	1.49E+03	7.27E+03

Table B3-6. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Composite Sample Data. (4 sheets)

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	LL	UL
ICP.a.Cr	μg/g	3.83E+03	1.33E+02	2	3.25E+03	4.40E+03
ICP.f.Cr	μg/g	4.06E+03	2.55E+02	2	2.96E+03	5.16E+03
ICP.w.Cr	μg/g	3.56E+02	5.73E+01	2	1.09E+02	6.02E+02
ICP.a.Co[1]	μg/g	1.63E+01	n/a	n/a	n/a	n/a
ICP.w.Co[1]	μg/g	1.63E+01	n/a	n/a	n/a	n/a
Co-60[1]	μCi/g	2.04E-02	n/a	n/a	n/a	n/a
ICP.a.Cu[1]	μg/g	8.30E+00	n/a	n/a	n/a	n/a
ICP.w.Cu[1]	μg/g	8.15E+00	n/a	n/a	n/a	n/a
Eu-154[1]	μCi/g	7.22E-02	n/a	n/a	n/a	n/a
Eu-155[1]	μCi/g	3.66E-01	n/a	n/a	n/a	n/a
Fluoride[1]	μg/g	2.38E+02	n/a	n/a	n/a	n/a
Alpha	μCi/g	4.40E-02	5.91E-03	2	1.86E-02	6.94E-02
Beta	μCi/g	1.67E+02	1.06E+01	2	1.21E+02	2.12E+02
ICP.a.Fe	μg/g	1.75E+02	1.59E+01	2	1.07E+02	2.44E+02
ICP.f.Fe[1]	μg/g	9.59E+02	n/a	n/a	n/a	n/a
ICP.w.Fe[1]	μg/g	4.07E+01	n/a	n/a	n/a	n/a
ICP.a.La[1]	μg/g	4.07E+01	n/a	n/a	n/a	n/a
ICP.w.La[1]	μg/g	4.07E+01	n/a	n/a	n/a	n/a
ICP.a.Pb[1]	μg/g	8.14E+01	n/a	n/a	n/a	n/a
ICP.w.Pb[1]	μg/g	8.15E+01	n/a	n/a	n/a	n/a
ICP.a.Li[1]	μg/g	8.14E+00	n/a	n/a	n/a	n/a
ICP.f.Li[1]	μg/g	1.92E+02	n/a	n/a	n/a	n/a
ICP.w.Li[1]	μg/g	8.15E+00	n/a	n/a	n/a	n/a
ICP.a.Mg[1]	μg/g	8.14E+01	n/a	n/a	n/a	n/a
ICP.w.Mg[1]	μg/g	8.15E+01	n/a	n/a	n/a	n/a
ICP.a.Mn	μg/g	6.46E+01	9.80E+00	2	2.24E+01	1.07E+02
ICP.f.Mn[1]	μg/g	1.92E+02	n/a	n/a	n/a	n/a
ICP.w.Mn[1]	μg/g	8.15E+00	n/a	n/a	n/a	n/a
ICP.a.Mo[2]	μg/g	5.53E+01	5.54E+00	2	3.14E+01	7.91E+01
ICP.w.Mo	μg/g	5.77E+01	7.80E+00	2	2.42E+01	9.13E+01
ICP.a.Nd[1]	μg/g	8.14E+01	n/a	n/a	n/a	n/a
ICP.w.Nd[1]	μg/g	8.15E+01	n/a	n/a	n/a	n/a

Table B3-6. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Composite Sample Data. (4 sheets)

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	LL	UL
ICP.a.Ni	μg/g	5.11E+01	1.60E+00	2	4.42E+01	5.79E+01
ICP.f.Ni[1]	μg/g	9.51E+02	n/a	n/a	n/a	n/a
ICP.w.Ni[1]	μg/g	1.76E+01	n/a	n/a	n/a	n/a
Nitrate	μg/g	2.56E+05	5.55E+04	2	1.75E+04	4.95E+05
Nitrite	μg/g	6.37E+04	9.49E+03	2	2.29E+04	1.05E+05
Oxalate	μg/g	4.64E+03	1.69E+02	2	3.91E+03	5.36E+03
Phosphate	μg/g	1.24E+04	1.76E+03	2	4.83E+03	2.00E+04
ICP.a.P	μg/g	3.61E+03	3.85E+02	2	1.96E+03	5.27E+03
ICP.f.P[1]	μg/g	3.85E+03	n/a	n/a	n/a	n/a
ICP.w.P	μg/g	4.00E+03	4.71E+02	2	1.97E+03	6.02E+03
ICP.a.K	μg/g	1.58E+03	1.86E+02	2	7.79E+02	2.38E+03
ICP.w.K	μg/g	1.67E+03	1.97E+02	2	8.22E+02	2.52E+03
ICP.a.Sm[1]	μg/g	8.14E+01	n/a	n/a	n/a	n/a
ICP.w.Sm[1]	μg/g	8.15E+01	n/a	n/a	n/a	n/a
ICP.a.Se[1]	μg/g	8.14E+01	n/a	n/a	n/a	n/a
ICP.w.Se[1]	μg/g	8.15E+01	n/a	n/a	n/a	n/a
ICP.a.Si	μg/g	1.19E+02	1.75E+01	2	4.36E+01	1.94E+02
ICP.f.Si[1]	μg/g	9.59E+02	n/a	n/a	n/a	n/a
ICP.w.Si	μg/g	2.83E+02	2.69E+01	2	1.67E+02	3.98E+02
ICP.a.Ag[1]	μg/g	1.19E+01	n/a	n/a	n/a	n/a
ICP.w.Ag[1]	μg/g	1.14E+01	n/a	n/a	n/a	n/a
ICP.a.Na	μg/g	2.06E+05	7.08E+03	2	1.75E+05	2.36E+05
ICP.f.Na	μg/g	2.82E+05	1.97E+04	2	1.97E+05	3.66E+05
ICP.w.Na	μg/g	2.16E+05	7.06E+03	2	1.86E+05	2.46E+05
ICP.a.Sr[1]	μg/g	8.14E+00	n/a	n/a	n/a	n/a
ICP.w.Sr[1]	μg/g	8.15E+00	n/a	n/a	n/a	n/a
Sr-89/90	μCi/g	9.32E+00	1.27E+00	2	3.85E+00	1.48E+01
Sulfate	μg/g	1.76E+04	3.23E+02	2	1.62E+04	1.90E+04
ICP.a.S	μg/g	5.05E+03	3.64E+02	2	3.49E+03	6.62E+03
ICP.w.S	μg/g	5.53E+03	1.89E+02	2	4.71E+03	6.34E+03
ICP.a.Tl[1]	μg/g	1.63E+02	n/a	n/a	n/a	n/a
ICP.w.Tl[1]	μg/g	1.63E+02	n/a	n/a	n/a	n/a

Table B3-6. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Composite Sample Data. (4 sheets)

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	LL	UL
ICP.a.Ti[1]	μg/g	8.14E+00	n/a	n/a	n/a	n/a
ICP.w.Ti[1]	μg/g	8.15E+00	n/a	n/a	n/a	n/a
TIC	μg/g	8.43E+03	7.86E+02	2	5.05E+03	1.18E+04
TOC	μg/g	4.47E+03	4.16E+02	2	2.68E+03	6.26E+03
ICP.a.U[1]	μg/g	4.07E+02	n/a	n/a	n/a	n/a
ICP.f.U[1]	μg/g	9.59E+03	n/a	n/a	n/a	n/a
ICP.w.U[1]	μg/g	4.07E+02	n/a	n/a	n/a	n/a
Uranium	μg/g	1.87E+02	3.07E+01	2	5.50E+01	3.20E+02
ICP.a.V[1]	μg/g	4.07E+01	n/a	n/a	n/a	n/a
ICP.w.V[1]	μg/g	4.07E+01	n/a	n/a	n/a	n/a
ICP.a.Zn	μg/g	4.56E+01	1.76E+01	2	0.00E+00	1.21E+02
ICP.w.Zn	μg/g	2.34E+01	6.58E+00	2	0.00E+00	5.18E+01
ICP.a.Zr[1]	μg/g	8.14E+00	n/a	n/a	n/a	n/a
ICP.w.Zr[1]	μg/g	8.15E+00	n/a	n/a	n/a	n/a
% Water	%	3.15E+01	2.14E+00	2	2.23E+01	4.07E+01
DSC	Joules/g	3.12E+01	3.12E+01	2	0.00E+00	1.65E+02

Notes:

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

[2]Fewer than 50 percent, but some of the results, were less-than values.

In addition to core composite data, segment level data from tank 241-U-108 was also available. The supernatant sample data and solid sample data were analyzed separately. Supernatant samples were present only in segment 1 of both cores. Mean concentration estimates, along with 95 percent confidence intervals on the mean, are given in Table B3-6 for the solid segment sample data and Table B3-7 for the supernatant segment sample data.

Table B3-7. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Solid Segment Sample Data. (3 sheets)

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	LL	UL
ICP.f.Al	μg/g	1.65E+04	2.74E+03	2	4.70E+03	2.83E+04
Am-241[1]	μCi/g	6.61E-01	n/a	n/a	n/a	n/a
ICP.f.Bi[1]	μg/g	2.03E+03	n/a	n/a	n/a	n/a

Table B3-7. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Solid Segment Sample Data. (3 sheets)

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	LL	UL
Bromide[1]	μg/g	1.04E+03	n/a	n/a	n/a	n/a
Bulk density	---	1.74E+00	4.06E-02	2	1.56E+00	1.91E+00
ICP.f.Ca[1]	μg/g	2.03E+03	n/a	n/a	n/a	n/a
Cs-137	μCi/g	1.41E+02	6.48E+00	2	1.13E+02	1.69E+02
Chloride	μg/g	3.45E+03	2.23E+02	2	2.49E+03	4.41E+03
ICP.f.Cr	μg/g	4.12E+03	2.88E+02	2	2.88E+03	5.36E+03
Co-60[1]	μCi/g	2.10E-02	n/a	n/a	n/a	n/a
Eu-154[1]	μCi/g	8.23E-02	n/a	n/a	n/a	n/a
Eu-155[1]	μCi/g	3.03E-01	n/a	n/a	n/a	n/a
Fluoride[2]	μg/g	9.56E+02	1.86E+02	2	1.55E+02	1.76E+03
Alpha[2]	μCi/g	5.25E-02	1.01E-02	2	9.11E-03	9.59E-02
ICP.f.Fe[1]	μg/g	1.03E+03	n/a	n/a	n/a	n/a
ICP.f.Li[1]	μg/g	2.03E+02	n/a	n/a	n/a	n/a
ICP.f.Mn[1]	μg/g	2.30E+02	n/a	n/a	n/a	n/a
ICP.f.Ni[1]	μg/g	4.06E+02	n/a	n/a	n/a	n/a
Nitrate	μg/g	2.95E+05	2.45E+04	2	1.90E+05	4.01E+05
Nitrite	μg/g	5.00E+04	2.14E+03	2	4.08E+04	5.92E+04
Oxalate[2]	μg/g	4.35E+03	5.15E+02	2	2.13E+03	6.56E+03
Phosphate	μg/g	1.72E+04	4.85E+03	2	0.00E+00	3.81E+04
ICP.f.P[1]	μg/g	7.04E+03	n/a	n/a	n/a	n/a
ICP.f.Si[1]	μg/g	1.08E+03	n/a	n/a	n/a	n/a
ICP.f.Na	μg/g	2.41E+05	5.31E+03	2	2.18E+05	2.64E+05
Sr-89/90	μCi/g	1.01E+01	1.99E+00	2	1.50E+00	1.86E+01
Sulfate[2]	μg/g	1.51E+04	1.01E+03	2	1.08E+04	1.95E+04
TIC	μg/g	7.97E+03	6.03E+02	2	5.37E+03	1.06E+04
TOC	μg/g	4.16E+03	2.50E+02	2	3.09E+03	5.24E+03
ICP.f.U[1]	μg/g	1.01E+04	n/a	n/a	n/a	n/a

Table B3-7. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Solid Segment Sample Data. (3 sheets)

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	LL	UL
% Water	%	3.43E+01	1.57E+00	2	2.75E+01	4.10E+01
DSC	Joules/g	4.23E+01	8.63E+00	2	5.18E+00	7.95E+01

Notes:

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

[2]Fewer than 50 percent, but some of the results, were less-than values.

B3.4.2 Analysis of Variance Models

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

The statistical model fit to the composite sample data and supernatant segment sample data is

$$Y_{ij} = \mu + C_i + A_{ij},$$

$$i=1,\ldots,a,\ j= 1,\ldots,n_i,$$

where

Y_{ij}	=	laboratory results from the j^{th} duplicate from the i^{th} core in the tank
μ	=	the grand mean
C_i	=	the effect of the i^{th} core
A_{ij}	=	the effect of the j^{th} analytical result from the i^{th} core
a	=	the number of cores
n_i	=	the number of analytical results from the i^{th} location.

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

The statistical model fit to the solid segment sample data is

$$Y_{ijkmn} = \mu + C_i + S_{ij} + L_{ijk} + A_{ijkm},$$

$$i=1,\ldots,a,\ j=1,\ldots,b_i,\ k=1,\ldots,c_{ij},\ m=1,\ldots,n_{ijk},$$

where

Y_{ijkm}	=	laboratory results from the m^th^ duplicate from the k^th^ location in the j^th^ segment in the i^th^ core in the tank,
μ	=	the grand mean
C_i	=	the effect of the i^th^ core
S_{ij}	=	the effect of the j^th^ segment from the i^th^ core
L_{ijk}	=	the effect of the k^th^ location from the j^th^ segment in the i^th^ core
A_{ijkm}	=	the effect of the m^th^ analytical result from the k^th^ location in the j^th^ segment in the i^th^ core
a	=	the number of cores
b_i	=	the number of segments in the i^th^ core
c_{ij}	=	the number of locations from the j^th^ segment in the i^th^ core
n_{ijk}	=	the number of analytical results from the k^th^ location in j^th^ segment in the i^th^ core.

The variable C_i, S_{ij}, and, L_{ijk} are assumed to be random effects. These variables and A_{ijkm} are assumed to be uncorrelated and normally distributed with means zero and variances $\sigma^2(C)$, $\sigma^2(S)$, $\sigma^2(L)$, and $\sigma^2(A)$, respectively. Estimates of $\sigma^2(C)$, $\sigma^2(S)$, $\sigma^2(L)$, and $\sigma^2(A)$ were obtained using REML techniques. This method, applied to variance component estimation, is described in Reference 2. The statistical results were obtained using statistical analysis package S-PLUS (Statistical Sciences 1993).

B3.4.3 Inventory

After the sample means are calculated for the tank for each analyte, the sampling based inventory may be calculated. Because the analyte concentrations above are presented in terms of a mass basis concentration, the total mass of waste in the tank is needed to estimate inventories. The total mass of waste is derived from the tank volume (from surveillance) and the tank solids density. The tank volume for solids is 1,680 kL and the tank volume for liquids is 91 kL (Hanlon 1996). The densities used for these estimates are 1.74 g/mL for segment sample data, 1.71 g/mL for composite sample data, and 1.40 g/mL for liquid sample data (Bell 1996a). The inventory (and 95 percent confidence interval on the inventory) of each of the analytes is presented in Table B3-8 for composite sample data, Table B3-9 for solid segment sample data, and Table B3-10 for liquid segment sample data. No analytical-based inventories were calculated for analytes where more than 50 percent of the results were below the detection limit.

Table B3-8. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Supernatant Segment Sample Data. (2 sheets)

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	LL	UL
ICP.d.Al	μg/mL	3.29E+04	2.44E+03	3	2.51E+04	4.07E+04
ICP.d.Sb[1]	μg/mL	2.41E+01	n/a	n/a	n/a	n/a
ICP.d.As[1]	μg/mL	4.01E+01	n/a	n/a	n/a	n/a
ICP.d.Ba[1]	μg/mL	2.01E+01	n/a	n/a	n/a	n/a
ICP.d.Be[1]	μg/mL	2.00E+00	n/a	n/a	n/a	n/a
ICP.d.Bi[1]	μg/mL	4.01E+01	n/a	n/a	n/a	n/a
ICP.d.B	μg/mL	9.12E+01	2.87E+00	2	7.89E+01	1.04E+02
Bromide[1]	μg/mL	5.64E+02	n/a	n/a	n/a	n/a
ICP.d.Cd[1]	μg/mL	2.00E+00	n/a	n/a	n/a	n/a
ICP.d.Ca[1]	μg/mL	4.06E+01	n/a	n/a	n/a	n/a
ICP.d.Ce[1]	μg/mL	4.01E+01	n/a	n/a	n/a	n/a
Chloride	μg/mL	8.94E+03	2.43E+02	3	8.17E+03	9.72E+03
ICP.d.Cr	μg/mL	1.28E+03	9.70E+01	2	8.59E+02	1.69E+03
ICP.d.Co[1]	μg/mL	8.02E+00	n/a	n/a	n/a	n/a
ICP.d.Cu[1]	μg/mL	4.01E+00	n/a	n/a	n/a	n/a
Fluoride[2]	μg/mL	7.90E+02	2.69E+02	3	0.00E+00	1.36E+03
Alpha[1]	μCi/mL	9.79E-03	n/a	n/a	n/a	n/a
ICP.d.Fe	μg/mL	3.33E+01	2.65E+00	3	2.49E+01	4.18E+01
ICP.d.La[1]	μg/mL	2.01E+01	n/a	n/a	n/a	n/a
ICP.d.Pb[1]	μg/mL	4.01E+01	n/a	n/a	n/a	n/a

Table B3-8. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Supernatant Segment Sample Data. (2 sheets)

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	LL	UL
ICP.d.Li[1]	μg/mL	4.02E+00	n/a	n/a	n/a	n/a
ICP.d.Mg[1]	μg/mL	4.01E+01	n/a	n/a	n/a	n/a
ICP.d.Mn[1]	μg/mL	4.01E+00	n/a	n/a	n/a	n/a
ICP.d.Mo	μg/mL	1.23E+02	1.48E+00	2	1.16E+02	1.29E+02
ICP.d.Nd[1]	μg/mL	4.01E+01	n/a	n/a	n/a	n/a
ICP.d.Ni	μg/mL	3.13E+01	1.62E+00	2	2.43E+01	3.82E+01
Nitrate	μg/mL	1.81E+05	5.06E+03	3	1.65E+05	1.97E+05
Nitrite	μg/mL	1.30E+05	4.83E+03	3	1.14E+05	1.45E+05
Oxalate[1]	μg/mL	5.20E+02	n/a	n/a	n/a	n/a
Phosphate	μg/mL	2.50E+03	2.45E+02	3	1.72E+03	3.28E+03
ICP.d.P	μg/mL	1.02E+03	2.72E+01	2	8.99E+02	1.13E+03
Pu-239/240[1]	μCi/mL	8.09E-05	n/a	n/a	n/a	n/a
ICP.d.K	μg/mL	4.01E+03	6.66E+01	2	3.72E+03	4.30E+03
ICP.d.Sm[1]	μg/mL	4.01E+01	n/a	n/a	n/a	n/a
ICP.d.Se[1]	μg/mL	4.01E+01	n/a	n/a	n/a	n/a
ICP.d.Si	μg/mL	1.95E+02	5.09E+00	2	1.73E+02	2.17E+02
ICP.d.Ag	μg/mL	1.63E+01	3.82E-01	2	1.47E+01	1.79E+01
ICP.d.Na	μg/mL	2.43E+05	1.52E+04	3	1.94E+05	2.91E+05
SpG	none	1.40E+00	1.24E-02	3	1.36E+00	1.44E+00
ICP.d.Sr[1]	μg/mL	4.01E+00	n/a	n/a	n/a	n/a
Sulfate	μg/mL	3.63E+03	4.00E+02	3	2.36E+03	4.90E+03
ICP.d.S	μg/mL	1.41E+03	8.94E+00	2	1.37E+03	1.45E+03
ICP.d.Tl[1]	μg/mL	8.02E+01	n/a	n/a	n/a	n/a
ICP.d.Ti[1]	μg/mL	4.01E+00	n/a	n/a	n/a	n/a
TIC	μg/mL	4.40E+03	9.79E+01	2	3.98E+03	4.82E+03
TOC	μg/mL	7.16E+03	9.46E+01	3	6.86E+03	7.46E+03
ICP.d.U[1]	μg/mL	2.00E+02	n/a	n/a	n/a	n/a
ICP.d.V[1]	μg/mL	2.01E+01	n/a	n/a	n/a	n/a
ICP.d.Zn	μg/mL	4.52E+01	7.20E+00	2	1.42E+01	7.62E+01
ICP.d.Zr[1]	μg/mL	4.01E+00	n/a	n/a	n/a	n/a
% Water	%	5.02E+01	4.57E-01	3	4.86E+01	5.15E+01
DSC	Joules/g	5.69E+01	1.94E+01	3	0.00E+00	1.19E+02

Notes:

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

[2]Fewer than 50 percent, but some of the results, were less-than values.

Table B3-9. Analytical-Based Inventory for Composite Sample Data for Tank 241-U-108. (2 sheets)

Analyte	Inventory (kg or Ci)	LL	UL
ICP.a.Al	5.29E+04	6.34E+03	9.95E+04
ICP.f.Al	5.41E+04	1.48E+04	9.33E+04
ICP.w.Al	4.74E+04	1.65E+04	7.83E+04
ICP.a.B	2.31E+02	3.77E+01	4.24E+02
ICP.w.B	1.51E+03	1.15E+03	1.86E+03
ICP.a.Cd	1.28E+01	6.91E+00	1.87E+01
ICP.a.Ca	4.47E+02	2.22E+02	6.72E+02
ICP.w.Ca	3.31E+02	1.36E+02	5.26E+02
Cs-137	4.66E+05	2.95E+05	6.38E+05
Chloride	1.26E+04	4.27E+03	2.09E+04
ICP.a.Cr	1.10E+04	9.35E+03	1.26E+04
ICP.f.Cr	1.17E+04	8.51E+03	1.48E+04
ICP.w.Cr	1.02E+03	3.14E+02	1.73E+03
Alpha	1.26E+02	5.33E+01	1.99E+02
Beta	4.79E+05	3.48E+05	6.10E+05
ICP.a.Fe	5.04E+02	3.07E+02	7.00E+02
ICP.a.Mn	1.85E+02	6.43E+01	3.07E+02
ICP.a.Mo	1.59E+02	9.02E+01	2.27E+02
ICP.w.Mo	1.66E+02	6.94E+01	2.62E+02
ICP.a.Ni	1.47E+02	1.27E+02	1.66E+02
Nitrate	7.36E+05	5.02E+04	1.42E+06
Nitrite	1.83E+05	6.58E+04	3.00E+05
Oxalate	1.33E+04	1.12E+04	1.54E+04
Phosphate	3.56E+04	1.39E+04	5.74E+04
ICP.a.P	1.04E+04	5.62E+03	1.51E+04
ICP.w.P	1.15E+04	5.65E+03	1.73E+04
ICP.a.K	4.54E+03	2.24E+03	6.84E+03
ICP.w.K	4.80E+03	2.36E+03	7.23E+03
ICP.a.Si	3.42E+02	1.25E+02	5.58E+02
ICP.w.Si	8.12E+02	4.80E+02	1.14E+03
ICP.a.Na	5.91E+05	5.03E+05	6.79E+05
ICP.f.Na	8.09E+05	5.65E+05	1.05E+06
ICP.w.Na	6.20E+05	5.33E+05	7.07E+05
Sr-89/90	2.68E+04	1.11E+04	4.25E+04

Table B3-9. Analytical-Based Inventory for Composite Sample Data for Tank 241-U-108. (2 sheets)

Analyte	Inventory (kg or Ci)	LL	UL
Sulfate	5.05E+04	4.65E+04	5.45E+04
ICP.a.S	1.45E+04	1.00E+04	1.90E+04
ICP.w.S	1.59E+04	1.35E+04	1.82E+04
TIC	2.42E+04	1.45E+04	3.39E+04
TOC	1.28E+04	7.70E+03	1.80E+04
Uranium	5.38E+02	1.58E+02	9.18E+02
ICP.a.Zn	1.31E+02	0.00E+00	3.49E+02
ICP.w.Zn	6.73E+01	0.00E+00	1.49E+02
% Water	9.05E+05	6.41E+05	1.17E+06

Table B3-10. Analytical-Based Inventory for Solid Segment Sample Data for Tank 241-U-108.

Analyte	Inventory (kg or Ci)	LL	UL
% Water	1.00E+06	8.04E+05	1.20E+06
Cs-137	4.11E+05	3.30E+05	4.93E+05
Alpha	1.54E+02	2.66E+01	2.80E+02
Sr-89/90	2.94E+04	4.38E+03	5.45E+04
ICP.f.Al	4.82E+04	1.37E+04	8.26E+04
Chloride	1.01E+04	7.28E+03	1.29E+04
ICP.f.Cr	1.20E+04	8.42E+03	1.57E+04
Fluoride	2.79E+03	4.54E+02	5.13E+03
Nitrate	8.63E+05	5.54E+05	1.17E+06
Nitrite	1.46E+05	1.19E+05	1.73E+05
Oxalate	1.27E+04	6.23E+03	1.92E+04
Phosphate	5.03E+04	0.00	1.11E+05
ICP.f.Na	7.04E+05	6.37E+05	7.71E+05
Sulfate	4.41E+04	3.14E+04	5.69E+04
TIC	2.33E+04	1.57E+04	3.09E+04
TOC	1.22E+04	9.03E+03	1.53E+04

Table B3-11. Analytical-Based Inventory for Liquid Segment Sample Data for Tank 241-U-108.

Analyte	Inventory (kg or Ci)	LL	UL
Water	1.46E+06	1.42E+06	1.50E+06
ICP.d.Al	2.99E+03	2.29E+03	3.70E+03
ICP.d.B	8.30E+00	7.18E+00	9.43E+00
Chloride	8.14E+02	7.43E+02	8.84E+02
ICP.d.Cr	1.16E+02	7.82E+01	1.54E+02
Fluoride	4.59E+01	0.00E+00	1.24E+02
ICP.d.Fe	3.03E+00	2.26E+00	3.80E+00
ICP.d.Mo	1.12E+01	1.06E+01	1.17E+01
ICP.d.Ni	2.84E+00	2.21E+00	3.48E+00
Nitrate	1.65E+04	1.50E+04	1.80E+04
Nitrite	1.18E+04	1.04E+04	1.32E+04
Phosphate	2.27E+02	1.56E+02	2.98E+02
ICP.d.P	9.25E+01	8.18E+01	1.03E+02
ICP.d.K	3.65E+02	3.39E+02	3.91E+02
ICP.d.Si	1.77E+01	1.57E+01	1.97E+01
ICP.d.Ag	1.48E+00	1.33E+00	1.63E+00
ICP.d.Na	2.21E+04	1.77E+04	2.65E+04
Sulfate	3.30E+02	2.14E+02	4.46E+02
ICP.d.S	1.28E+02	1.25E+02	1.32E+02
TIC	4.00E+02	3.62E+02	4.38E+02
TOC	6.52E+02	6.24E+02	6.79E+02
ICP.d.Zn	4.11E+00	1.29E+00	6.93E+00

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APPENDIX C

STATISTICAL ANALYSIS FOR ISSUE RESOLUTION

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APPENDIX C

STATISTICAL ANALYSIS FOR ISSUE RESOLUTION

C1.0 STATISTICS FOR SAFETY SCREENING AND ORGANIC DQOS

The safety screening (Dukelow et al. 1995) and organic (Turner et al. 1996) DQOs define acceptable decision confidence limits in terms of one-sided 95 percent confidence intervals. In this appendix, one-sided confidence limits supporting the safety screening and organic DQOs are calculated for tank 241-U-108. All data in this section are from the final laboratory data package for the 1996 core sampling event for tank 241-U-108 (Bell 1996).

Confidence intervals were computed for each sample number from tank 241-U-108 analytical data. The sample numbers and confidence intervals are provided in Table C1-1 for alpha and Table C1-2 for DSC.

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

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

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

For the tank 241-U-108 data (per sample number), df equals the number of observations minus one; i.e., df = 1.

The upper limit of the 95 percent confidence interval for each sample number based on alpha data is listed in Table C1-1. Each confidence interval can be used to make the following statement. If the upper limit is less than 41 μCi/g (61.5 μCi/mL for drainable liquid), then one would reject the null hypothesis that the alpha is greater than or equal to 41 μCi/g (61.5 μCi/mL for drainable liquid) at the 0.05 level of significance.

The upper limit of the 95 percent confidence interval for each sample number based on DSC data is listed in Table C1-2. Each confidence interval can be used to make the following statement. If the upper limit is less than 480 J/g, then one would reject the null hypothesis that DSC is greater than or equal to 480 J/g at the 0.05 level of significance.

Table C1-1. 95 Percent Confidence Interval Upper Limits for Alpha for Tank 241-U-108 (Units are μCi/g or μCi/mL). (2 sheets)

Sample Number	Sample Description	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	UL
S96T002257	Core 141, segment 1, lower half	0.080	0.013	0.163
S96T002258	Core 141, segment 2, upper half	0.032	0.004	0.054
S96T002259	Core 141, segment 3, upper half	0.029	0.002	0.041
S96T002260	Core 141, segment 3A, upper half	0.026	0.003	0.044
S96T002261	Core 141, segment 4, upper half	0.051	0.005	0.084
S96T002262	Core 141, segment 4, lower half	0.040	0.003	0.059
S96T002263	Core 141, segment 4A, upper half	0.053	0.001	0.056
S96T002264	Core 141, segment 4A, lower half	0.031	0.002	0.042
S96T002282[1]	Core 141, segment 1, drainable liquid	0.008	0.001	0.012
S96T002608	Core 141, segment 5, upper half	0.056	0.004	0.082
S96T002609	Core 141, segment 5, lower half	0.048	0.003	0.065
S96T002610	Core 141, segment 6, upper half	0.032	0.004	0.059
S96T002611	Core 141, segment 6, lower half	0.016	0.004	0.040
S96T002612	Core 141, segment 7, upper half	0.035	0.003	0.057
S96T002613	Core 141, segment 7, lower half	0.029	3.50E-04	0.031
S96T002614[2]	Core 141, segment 8, upper half	0.038	0.034	0.250
S96T002615	Core 141, segment 8, lower half	0.110	0.001	0.113
S96T002616	Core 141, segment 9, upper half	0.043	0.006	0.080
S96T002909	Core 145, segment 2, upper half	0.027	0.000	0.028
S96T002910	Core 145, segment 3, upper half	0.042	0.001	0.047
S96T002911	Core 145, segment 3, lower half	0.040	0.003	0.057
S96T002912	Core 145, segment 4, upper half	0.033	0.002	0.044
S96T002913	Core 145, segment 4, lower half	0.047	4.00E-04	0.049
S96T002914	Core 145, segment 5, upper half	0.037	0.002	0.051
S96T002915	Core 145, segment 5, lower half	0.032	0.001	0.040
S96T002916	Core 145, segment 6, upper half	0.017	0.003	0.033
S96T002917	Core 145, segment 6, lower half	0.014	0.001	0.019
S96T002918	Core 145, segment 7, upper half	0.017	0.001	0.023
S96T002919	Core 145, segment 7, lower half	0.021	5.00E-05	0.022
S96T002920	Core 145, segment 8, upper half	0.013	5.00E-05	0.013
S96T002921	Core 145, segment 8, lower half	0.031	2.50E-04	0.033
S96T002922	Core 145, segment 9, upper half	0.254	0.009	0.307
S96T002923	Core 145, segment 9, lower half	0.063	0.008	0.116

Table C1-1. 95 Percent Confidence Interval Upper Limits for Alpha for Tank 241-U-108 (Units are μCi/g or μCi/mL). (2 sheets)

Sample Number	Sample Description	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	UL
S96T002942[1,2]	Core 145, segment 1, drainable liquid	0.011	4.50E-04	0.014
S96T003001	Core 146, segment 3A, upper half	0.029	2.00E-04	0.030
S96T003002	Core 146, segment 4, upper half	0.039	4.00E-04	0.042
S96T003003	Core 146, segment 4, lower half	0.102	0.010	0.167
S96T003004	Core 146, segment 5, upper half	0.090	0.008	0.140
S96T003005[2]	Core 146, segment 5, lower half	0.053	0.007	0.098
S96T003006[1,2]	Core 146, segment 6, upper half	0.045	0.013	0.126
S96T003007[1,2]	Core 146, segment 6, lower half	0.109	0.017	0.215
S96T003008	Core 146, segment 7, upper half	0.019	0.001	0.024
S96T003009	Core 146, segment 7, lower half	0.028	0.003	0.046
S96T003143	Core 146, segment 1, upper half	0.039	3.50E-04	0.041
S96T003144	Core 146, segment 2, upper half	0.026	0.001	0.032
S96T003145	Core 146, segment 2, lower half	0.012	0.001	0.016
S96T003146	Core 146, segment 3, upper half	0.033	1.00E-04	0.034
S96T003147	Core 146, segment 3, lower half	0.011	3.50E-04	0.013
S96T003148	Core 146, segment 8, upper half	0.024	0.002	0.036
S96T003149	Core 146, segment 8, lower half	0.045	0.006	0.085
S96T003150	Core 146, segment 9, First Quarter	0.177	0.006	0.211
S96T003163[1,2]	Core 146, segment 1, drainable liquid	0.010	0.000	0.010
S96T004180	Core 146, segment 9, lower half	0.364	0.001	0.370

Notes:

[1]Sample result is below the detection limit.

[2]Duplicate result is below the detection limit.

Table C1-2. 95 Percent Confidence Interval Upper Limits for DSC for Tank 241-U-108 (Units are J/g Dry).

Sample Number	Sample Description	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	UL
S96T002241	Core 141, segment 1, lower half	180.0	24.0	331.5
S96T002242	Core 141, segment 2, upper half	61.1	1.6	71.2
S96T002245	Core 141, segment 4, upper half	289.3	128.1	590.8
S96T002246	Core 141, segment 4, lower half	221.7	65.0	411.6
S96T002589	Core 141, segment 7, upper half	92.4	32.7	298.5
S96T002590	Core 141, segment 7, lower half	211.5	96.5	820.8
S96T002591	Core 141, segment 8, upper half	148.0	9.3	175.1
S96T002592	Core 141, segment 8, lower half	127.5	8.5	181.2
S96T002879	Core 145, segment 3, upper half	195.0	14.0	283.4
S96T002880	Core 145, segment 3, lower half	164.0	1.0	170.3
S96T002881	Core 145, segment 4, upper half	131.5	16.7	180.3
S96T002884	Core 145, segment 5, lower half	28.6	2.4	43.4
S96T002885	Core 145, segment 6, upper half	49.5	33.0	145.8
S96T002886	Core 145, segment 6, lower half	77.7	77.7	304.5
S96T002887	Core 145, segment 7, upper half	191.5	61.5	579.8
S96T002888	Core 145, segment 7, lower half	169.5	1.5	179.0
S96T002891	Core 145, segment 9, upper half	108.5	3.5	130.6
S96T002892	Core 145, segment 9, lower half	74.0	30.0	263.4
S96T002942	Core 145, segment 1, drainable liquid	156.0	1.0	162.3
S96T002960	Core 146, segment 4, upper half	20.7	20.7	151.4
S96T002961	Core 146, segment 4, lower half	104.0	2.0	116.6
S96T002962	Core 146, segment 5, upper half	155.0	4.0	180.3
S96T002963	Core 146, segment 5, lower half	145.0	11.0	214.5
S96T002964	Core 146, segment 6, upper half	36.2	8.8	91.4
S96T002967	Core 146, segment 7, lower half	116.5	7.5	163.9
S96T003121	Core 146, segment 1, upper half	114.0	5.0	145.6
S96T003124	Core 146, segment 2, lower half	78.7	9.6	138.9
S96T003125	Core 146, segment 3, upper half	44.2	27.0	214.7
S96T003126	Core 146, segment 3, lower half	2.4	2.4	17.3
S96T003129	Core 146, segment 9, First Quarter	92.1	1.6	102.2
S96T003163	Core 146, segment 1, drainable liquid	170.0	11.0	239.5

C1.1 STATISTICS FOR THE ORGANIC DQO

The organic DQO (Turner et al. 1996) defines acceptable decision confidence limits in terms of one-sided 95 percent confidence intervals. In this appendix, one-sided confidence limits supporting the organic DQO are calculated for tank 241-U-108. All data considered in this section are taken from the final laboratory data package for the 1996 core sampling event for tank 241-U-108 (Bell 1996).

Confidence intervals were computed for each sample number from tank 241-U-108 analytical data. The sample numbers and confidence intervals are provided in Table C1-3 for percent water and table C1-4 for TOC.

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

$$\hat{\mu} - t_{(df,0.05)} * \hat{\sigma}_{\hat{\mu}}$$

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

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

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 $t_{(df,0.05)}$ is the quantile from Student's t distribution with df (the number of observations minus one) degrees of freedom for a one-sided 95% confidence interval. In this case, df = 1.

The lower limit of the 95 percent confidence interval for each sample number based on percent water data is listed in Table C1-3. Each confidence interval can be used to make the following statement. If the lower limit is greater than 17 percent, then one would reject the null hypothesis that the percent water is less than or equal to 17 percent at the 0.05 level of significance.

The upper limit of the 95 percent confidence interval for each sample number based on TOC data is listed in Table C1-4. Each confidence interval can be used to make the following statement: "If the upper limit is less than 30,000 μg/g, then one would reject the null hypothesis that TOC is greater than or equal to 30,000 μg/g at the 0.05 level of significance."

Table C1-3. 95 Percent Confidence Interval Lower Limits for Percent Water for Tank 241-U-108 (Units are in %). (2 sheets)

Sample Number	Sample Description	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	LL
S95T000978	Riser 7, Grab Sample	50.28	0.07	49.80
S96T002241	Core 141, segment 1, lower half	45.50	0.42	42.85
S96T002242	Core 141, segment 2, upper half	23.74	0.69	19.38
S96T002243	Core 141, segment 3, upper half	30.26	3.28	9.55
S96T002244	Core 141, segment 3A, upper half	25.74	6.30	0.00
S96T002245	Core 141, segment 4, upper half	32.81	0.24	31.32
S96T002246	Core 141, segment 4, lower half	29.89	1.30	21.68
S96T002247	Core 141, segment 4A, upper half	29.98	14.50	0.00
S96T002248	Core 141, segment 4A, lower half	39.10	0.37	36.79
S96T002282	Core 141, segment 1, drainable liquid	49.21	1.88	37.37
S96T002585	Core 141, segment 5, upper half	27.01	2.16	13.37
S96T002586	Core 141, segment 5, lower half	32.07	3.67	8.90
S96T002587	Core 141, segment 6, upper half	22.19	0.87	16.70
S96T002588	Core 141, segment 6, lower half	18.45	2.77	0.99
S96T002589	Core 141, segment 7, upper half	38.86	0.66	34.69
S96T002590	Core 141, segment 7, lower half	40.23	0.08	39.75
S96T002591	Core 141, segment 8, upper half	40.71	1.34	36.81
S96T002592	Core 141, segment 8, lower half	39.61	1.71	28.84
S96T002593	Core 141, segment 9, upper half	32.32	1.56	22.47
S96T002879	Core 145, segment 3, upper half	52.20	9.04	25.80
S96T002880	Core 145, segment 3, lower half	45.77	0.21	44.44
S96T002881	Core 145, segment 4, upper half	40.97	1.01	34.62
S96T002882	Core 145, segment 4, lower half	25.72	0.16	24.71
S96T002883	Core 145, segment 5, upper half	17.73	0.43	15.04
S96T002884	Core 145, segment 5, lower half	30.94	2.53	14.99
S96T002885	Core 145, segment 6, upper half	28.09	0.59	24.39
S96T002886	Core 145, segment 6, lower half	34.14	4.75	4.15
S96T002887	Core 145, segment 7, upper half	44.15	1.70	33.42
S96T002888	Core 145, segment 7, lower half	42.29	0.05	42.00
S96T002889	Core 145, segment 8, upper half	42.21	0.71	37.73
S96T002890	Core 145, segment 8, lower half	40.61	0.57	37.04
S96T002891	Core 145, segment 9, upper half	39.22	0.88	33.66
S96T002892	Core 145, segment 9, lower half	49.27	0.41	46.71

Table C1-3. 95 Percent Confidence Interval Lower Limits for Percent Water for Tank 241-U-108 (Units are in %). (2 sheets)

Sample Number	Sample Description	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	LL
S96T002893	Core 145, segment 2, upper half	33.16	1.26	25.20
S96T002942	Core 145, segment 1, drainable liquid	49.46	0.21	48.16
S96T002959	Core 146, segment 3A, upper half	20.18	2.94	1.62
S96T002960	Core 146, segment 4, upper half	17.55	0.34	15.40
S96T002961	Core 146, segment 4, lower half	40.83	0.51	37.61
S96T002962	Core 146, segment 5, upper half	38.93	2.21	25.00
S96T002963	Core 146, segment 5, lower half	34.78	3.61	12.01
S96T002964	Core 146, segment 6, upper half	32.42	2.94	13.88
S96T002965	Core 146, segment 6, lower half	44.96	0.66	40.82
S96T002966	Core 146, segment 7, upper half	33.43	0.13	32.64
S96T002967	Core 146, segment 7, lower half	41.05	0.09	40.48
S96T003121	Core 146, segment 1, upper half	39.75	2.05	26.83
S96T003123	Core 146, segment 2, upper half	26.59	2.93	8.12
S96T003124	Core 146, segment 2, lower half	12.27	2.68	0.00
S96T003125	Core 146, segment 3, upper half	35.53	6.04	0.00
S96T003126	Core 146, segment 3, lower half	20.42	1.22	12.74
S96T003127	Core 146, segment 8, upper half	41.27	0.02	41.17
S96T003128	Core 146, segment 8, lower half	40.23	0.16	39.22
S96T003129	Core 146, segment 9, First Quarter	38.54	0.08	38.03
S96T003163	Core 146, segment 1, drainable liquid	51.13	0.02	51.00
S96T004178	Core 146, segment 9, lower half	48.21	0.38	45.81

Table C1-4. 95 Percent Confidence Interval Upper Limits for TOC for Tank 241-U-108 (Units are in μg/g Dry). (2 sheets)

Sample Number	Sample Description	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	UL
S96T002241	Core 141, segment 1, lower half	11523	514	14767
S96T002242	Core 141, segment 2, upper half	4281	269	5979
S96T002243	Core 141, segment 3, upper half	3829	14	3919
S96T002244	Core 141, segment 3A, upper half	3993	20	4120
S96T002245	Core 141, segment 4, upper half	5844	879	8409
S96T002246	Core 141, segment 4, lower half	6918	143	7818
S96T002247	Core 141, segment 4A, upper half	6427	86	6968
S96T002248	Core 141, segment 4A, lower half	7323	181	8463
S96T002282	Core 141, segment 1, drainable liquid	9720	82	10240
S96T002585	Core 141, segment 5, upper half	6357	356	8606
S96T002586	Core 141, segment 5, lower half	5653	15	5746
S96T002587	Core 141, segment 6, upper half	4280	64	4685
S96T002588	Core 141, segment 6, lower half	3452	264	5116
S96T002589	Core 141, segment 7, upper half	10329	384	12756
S96T002590	Core 141, segment 7, lower half	8808	8	8861
S96T002591	Core 141, segment 8, upper half	9825	582	13499
S96T002592	Core 141, segment 8, lower half	7556	963	10368
S96T002593	Core 141, segment 9, upper half	3635	251	5221
S96T002879	Core 145, segment 3, upper half	6652	21	6784
S96T002880	Core 145, segment 3, lower half	6011	369	8340
S96T002881	Core 145, segment 4, upper half	4972	25	5132
S96T002882	Core 145, segment 4, lower half	5203	7	5246
S96T002883	Core 145, segment 5, upper half	4509	12	4586
S96T002884	Core 145, segment 5, lower half	8043	36	8272
S96T002885	Core 145, segment 6, upper half	6793	49	7100
S96T002886	Core 145, segment 6, lower half	6233	190	7431
S96T002887	Core 145, segment 7, upper half	8245	188	9432
S96T002888	Core 145, segment 7, lower half	9183	104	9839
S96T002889	Core 145, segment 8, upper half	5001	17	5110
S96T002890	Core 145, segment 8, lower half	7728	101	8366
S96T002891	Core 145, segment 9, upper half	8588	214	9939
S96T002892	Core 145, segment 9, lower half	5509	128	6318
S96T002893	Core 145, segment 2, upper half	4017	112	4726

Table C1-4. 95 Percent Confidence Interval Upper Limits for TOC for Tank 241-U-108 (Units are in μg/g Dry). (2 sheets)

Sample Number	Sample Description	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	UL
S96T002893	Core 145, segment 2, upper half	4017	112	4726
S96T002942	Core 145, segment 1, drainable liquid	10014	35	10239
S96T002959	Core 146, segment 3A, upper half	3875	526	5410
S96T002960	Core 146, segment 4, upper half	3178	24	3331
S96T002961	Core 146, segment 4, lower half	7115	101	7755
S96T002962	Core 146, segment 5, upper half	7966	352	10188
S96T002963	Core 146, segment 5, lower half	6271	368	8594
S96T002964	Core 146, segment 6, upper half	6214	30	6401
S96T002965	Core 146, segment 6, lower half	8057	9	8114
S96T002966	Core 146, segment 7, upper half	8044	593	11790
S96T002967	Core 146, segment 7, lower half	11654	950	17652
S96T003121	Core 146, segment 1, upper half	6572	66	6991
S96T003123	Core 146, segment 2, upper half	3821	20	3950
S96T003124	Core 146, segment 2, lower half	1989	40	2241
S96T003125	Core 146, segment 3, upper half	4291	163	4766
S96T003126	Core 146, segment 3, lower half	2940	187	3485
S96T003127	Core 146, segment 8, upper half	9756	451	11074
S96T003128	Core 146, segment 8, lower half	5504	100	6138
S96T003129	Core 146, segment 9, upper half	18142	81	18656
S96T003163	Core 146, segment 1, drainable liquid	10505	199	11765
S96T004178	Core 146, segment 9, lower half	10349	348	12544

C2.0 APPENDIX C REFERENCES

Bell, K. E., 1996, *Final Report for Tank 241-U-108, Push-Mode Core Samples 141, 145, and 146*, WHC-SD-WM-DP-198, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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

Turner, D. A., H. Babad, L. L. Buckley, J. E. Meacham, 1996, *Data Quality Objective to Support Resolution of the Organic Complexant Safety Issue*, WHC-SD-WM-DQO-006, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR TANK 241-U-108

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR TANK 241-U-108

An effort is underway to provide waste inventory estimates that will serve as standard characterization information for the various waste management activities (Kupfer et al. 1995). As part of this effort, an evaluation of available chemical information for tank 241-U-108 was performed, and a best-basis inventory was established. This work, detailed in the following sections, follows the methodology that was established by the standard inventory task.

D1.0 CHEMICAL INFORMATION SOURCES

Available chemical information for tank 241-U-108 included:

- Data from recent analyses of three core samples collected in April/May 1996 (Bell 1996). See Appendix B, Section B2.0 for data.
- The solids composite inventory estimate for this tank generated from the Hanford Defined Waste (HDW) model (Agnew et al. 1996a), developed at Los Alamos National Laboratory.

A list of references used in this evaluation is provided at the end of this Appendix.

D2.0 COMPARISON OF COMPONENT INVENTORY VALUES

The sample-based inventory estimate (Section B3.2), derived from the analytical concentration data from the three 1996 core samples, and the inventory estimate from the HDW (Section A3.2), are compared in Tables D2-1 and D2-2. The HDW provides tank content estimates derived from process flowsheets and waste volume records. The waste volume used to generate both estimates is 1,771 kL (468 kgal). However, the sample- and HDW-based estimates use different waste densities. The sample-based inventory was generated using a measured bulk density of 1.74 g/mL for segment sample data and 1.40 g/mL for drainable liquid samples, and a density of 1.71 g/mL for core composites. The current HDW shows a lower waste density of 1.62 g/mL. The differences attributable to density result in a relative percent difference of 7.1 for analytes with roughly the same concentration.

The sample-based values in Table D2-1 were obtained either from the mass-weighted average of the solid segment data (Table B3-9) plus the drainable liquid data (Table B3-10), or from the core composite results (Table B3-8) as indicated. The segment/drainable liquid data were used preferentially because they provided a more comprehensive description of the tank. The component inventories were calculated by multiplying the mean analyte concentration value by the current tank waste volume and the appropriate density of the waste.

There are several differences between the sample-based and HDW inventories for some analytes. Analyte inventories that vary by about a factor of two between the two bases are Al, phosphate, Cr, and carbonate. Analytes that vary by an order of magnitude or more are La and U. Of the radionuclides, Sr-90 is reported to be about an order of magnitude less in the sampling inventory than in the HDW.

Table D2-1. Sampling and HDW-Based Inventory Estimates for Nonradioactive Components in Tank 241-U-108. (2 sheets)

Analyte	Sampling Inventory Estimate (kg)	HDW Inventory Estimate (kg)	Analyte	Sampling Inventory Estimate (kg)	HDW Inventory Estimate (kg)
Al	51,190[1]	96,800	NH_3	n/r	1,790
Ag	34.1[2]	n/r	Ni	150	734
As	<234	n/r	NO_2^-	157,800[1]	210,000
B	239	n/r	NO_3^-	879,500[1]	594,000
Ba	<117	n/r	oxalate	12,700[1]	5.63
Be	<11.7	n/r	Pb	<234	7,020
Bi	<5,930[1]	436	P as PO_4^{3-}	50,527[1]	16,800
Ca	447[3]	3,940	Sb	<152	n/r
Cr	12,116[1]	5,980	Se	<234	n/r
Ce	<234	n/r	S as SO_4^{2-}	44,430[1]	45,000
Co	<46.8	n/r	Si	830	4330
Cl	10,914[1]	13,800	Sr	<23.4	2.19
Cd	12.8	n/r	TIC as CO_3^{2-}	118,500[1]	54,900
Cu	<23.8	n/r	Te	n/r	n/r
F	2,836[1]	2,230	Ti	<23.4	n/r

Table D2-1. Sampling and HDW-Based Inventory Estimates for Nonradioactive Components in Tank 241-U-108. (2 sheets)

Analyte	Sampling Inventory Estimate (kg)	HDW Inventory Estimate (kg)	Analyte	Sampling Inventory Estimate (kg)	HDW Inventory Estimate (kg)
Fe	507	3,390	TOC	12,850[1]	n/r
Hg	n/r	221	U_{TOTAL}	538[4]	22,400
K	4,800	4,100	V	<117	n/r
La	<117	10.4	W	n/r	n/r
Mg	<234	n/r	Zn	131	n/r
Mn	185	435	Zr	<23.4	129
Mo	177	n/r	H_2O(Wt%)	34.3	33.0
Na	726,100[1]	513,000	Density (kg/L)	1.71	1.62
Nd	<234	n/r			

Notes:

[1]Average of solid segment data plus liquid segment data.
[2]From liquid sample only.
[3]Acid digest value from core composite data.
[4]Total uranium value based on the three core composite averages using the laser phosphorescence analysis method on fusion digestions.

< = "less than" values are average detection limits for analytical method used.

Table D2-2. Sampling and HDW Model-Based Inventory Estimates for Radioactive Components in Tank 241-U-108. (2 sheets)

Analyte	Sampling Inventory Estimate (Ci)	HDW Inventory Estimate (Ci)	Analyte	Sampling Inventory Estimate (Ci)	HDW Inventory Estimate (Ci)
^{14}C	n/r	n/r	^{155}Eu	<884	n/r
^{60}Co	<61.5	n/r	^{237}Np	n/r	n/r
^{90}Sr	29,400[1]	243,000	$^{239/240}Pu$	n/r	11.0

Table D2-2. Sampling and HDW Model-Based Inventory Estimates for Radioactive Components in Tank 241-U-108. (2 sheets)

Analyte	Sampling Inventory Estimate (Ci)	HDW Inventory Estimate (Ci)	Analyte	Sampling Inventory Estimate (Ci)	HDW Inventory Estimate (Ci)
^{99}Tc	n/r	n/r	^{241}Am	<1930	n/r
^{129}I	n/r	n/r	Total α	154	n/r
^{137}Cs	411,000[1]	463,000	Total β	479,000[2]	n/r
^{154}Eu	<241	n/r			

Notes:
[1]Average of solid segment data plus liquid segment data.
[2]Fusion digest value from core composite data.

D3.0 COMPONENT INVENTORY EVALUATION

The following evaluation of tank contents was performed in order to identify potential errors and/or missing information that could influence the sampling and/or the HDW-based component inventories.

D3.1 CONTRIBUTING WASTE TYPES

Tank 241-U-108 was the second tank in the 241-U-107, 241-U-108, and 241-U-109 cascade and it began receiving metal waste (MW) in the first quarter of 1949. In the mid 1950's, most of the MW was transferred out for uranium recovery.

From the second quarter of 1959 until the fourth quarter of 1964, the tank received REDOX cladding waste. Numerous transfers out of the tank took place during the 1960's. In the second quarter of 1964, the tank again received cladding waste from the REDOX plant. It received a combination of N-Reactor, REDOX cladding, and evaporator bottoms waste from the third quarter of 1968 until the first quarter of 1976. Some of these wastes were transferred out of tank 241-U-108 during the second quarter of 1972 and the fourth quarter of 1973. From the second quarter of 1975 through the first quarter of 1977, the tank exchanged evaporator bottoms waste with tank 241-S-102. This was the final major transfer of waste involving tank 241-U-108.

Refer to Appendix A, Section A3.1 for a more detailed summary of the waste transfer history of tank 241-U-108.

The types of solids accumulated in tank 241-U-108 during its history, as reported by various authors, are compiled in tables D3-1 and D3-2.

Table D3-1. Expected Solids for Tank 241-U-108.

Reference	Waste Type
(Anderson 1990)	MW, REDOX CW, EB, N, BNW, DW, HDRL, PNF, NCPLX
SORWT Model (Hill et al. 1995)	EB and CW mixture
WSTRS (Agnew et al. 1996b)	MW, CW, EB, N, BNW, PNF, HDRL, NCPLX
HDW Model (Agnew et al. 1996a)	MW, CWR2, SMMS1, SMMS2

Notes:

MW	=	[Bismuth phosphate process U] metal waste
DW	=	Dilute waste
N	=	N-Reactor Waste
BNW	=	Battelle Northwest Laboratory Waste
HDRL	=	Hanford Defense Residual Liquor
NCPLX	=	Non-Complexed Waste
PNF	=	Partially Neutralized Waste
SMMS1 and SMMS2	=	Supernatant mixing model 242-S Evaporator waste. WSTRS Waste Status and Transaction Record Summary (Agnew et al. 1996b).
SORWT	=	Sort on radioactive waste type

The WSTRS document (Agnew et al. 1996b) as well as Anderson (1990) support the position that metal waste was removed from tank 241-U-108 before receipt of REDOX cladding wastes and evaporator bottoms. However, Appendix C and Appendix D of Agnew et al. (1996b) assign the sludge heel as $BiPO_4$ metal waste.

D3.2 EVALUATION OF PROCESS FLOWSHEET INFORMATION

Detailed review of Agnew et al. (1996b) indicates that a considerable amount of transfer activity occurred with 241-U-108, but the dominant waste type currently is saltcake derived primarily from REDOX cladding wastes and evaporator bottoms. Essentially all the MW was removed during sluicing, but some traces of residual MW occur in the lower core sample segments.

Table D3-2. HDW Solids for Tank 241-U-108.

Tank Layer Model Solids Layer	kL	kgal
MW	11.3	3
CWR2	98.4	26
SMMS1	874.3	231
SMMS2	696.4	184

[1]From Agnew et al (1996a)

D3.2.1 Metal Wastes

Although very little MW is estimated to be in tank 241-U-108 (3 kgal) there is a significant discrepancy in the uranium inventory between the HDW (22,400 kg) and the sample data (538 kg). Tank 241-U-108 has a dished bottom, and all cores were taken from the outer edges of the tank. Thus, a heel of MW would not have been sampled. Nevertheless, all cores exhibited an increase in phosphorous concentration in segment 9. Because of sampling location and an increase in phosphorous concentration in the lower segments, there is a possibility that undetected uranium inventory could be in the dished bottom. The uranium recovery manual and declassified sluicing records, as well as Agnew et al. (1996b) data, were used in an attempt to evaluate this discrepancy.

The uranium recovery waste (UR) manual lists approximate sludge levels (1.2 m [4 ft], 0.6 m [1.9 ft], 0 m [0 ft], respectively) expected to develop for a three-tank cascade after transfer of uranium effluent from the bismuth phosphate process. For a dish-bottomed tank with a 23-m (75-ft) diameter and the approximate sludge levels, it is estimated that 70 volume percent of the sludge was in the first tank and 30 volume percent was in the second. Declassified sluicing records for the 241-U-107, -U-108, -U-109 cascade indicate a total of 74 short tons of uranium remained in the total cascade after sluicing (Rodenhizer 1987). Assuming 30 percent of this inventory may have been left in tank 241-U-108 yields a value of 20,140 kg of uranium, which is comparable to the HDW value of 22,400 kg. However, neither of these values are compatible with a uranium inventory of 4,957 kg obtained as a product of the HDW MW2 sludge concentration of 269.5 g/kg and 11.4 kL (3 kgal) of waste at a HDW sludge density of 1.62 kg/L.

A uranium inventory of <29,700 kg from average segment ICP-fusion data where all segments were below detection limits and uranium inventories varying from <1,117 kg (acid digestion ICP) to <27,600 kg (fusion digestion ICP) from core composite data also does not provide a basis for comparison because all results were below analytical detection limits. The laser phosphorescence data from core composite samples were all above detection limits and are considered the more reliable data. Because of the uncertainty associated with the sludge level estimates and remaining inventory after sluicing, as well as the inconsistency of the HDW estimates, and the relatively small amount of estimated MW, the sampling values for uranium in tank 241-U-108 obtained by laser-phosphorescence analytical methods were adopted.

D3.2.2 REDOX Cladding Waste

The WSTRS document (Agnew 1996b) indicates 749 kL (198 kgal) of CWR was received by tank 241-U-108 in 1964 and 2,839 kL (750 kgal) was received in 1968. This latter transfer in 1968 occurred about a year after REDOX ceased operations, and may have represented supernatant from REDOX cladding waste. In 1964, tank 241-S-107 received about 1,366 kL (361 kgal) of CWR which, when combined with 198 kgal of tank 241-U-108 waste in 1964, yields a total of 2,115 kL (559 kgal). The fraction of this total volume in tank 241-U-108 is 0.35. REDOX fuel processed in 1964 was 1,693 metric tons of uranium (MTU) (Kupfer et al. 1995), so the fraction received by tank 241-U-108 is 0.35 x 1,693 MTU or 599.8 MTU. This waste contained about 47 kg Al/MTU, 0.47 kg Ni/MTU and 1.31 kg Si/MTU. If the 1964 volume of REDOX cladding waste in 241-U-108, represented by the 599.8 MTU, was the main source of Al, Ni, and Si, the inventories of these constituents would be 28,193 kg Al, 282 kg Ni, and 785 kg Si. The sample-based inventories for these elements are 51,190 kg Al, 150 kg Ni, and 830 kg Si. This comparison suggests that the latter 1968 transfers of 2,840 kL (750 kgal) may have been supernatant that contributed additional Al, but the earlier transfers in 1964 may have contributed much of the Ni and Si.

D3.2.3 Saltcake

Over 90 percent of the waste in tank 241-U-108 is saltcake derived from REDOX cladding waste and 242-S evaporator bottoms. Of these saltcake wastes, cladding waste was the first type received, followed by evaporator bottoms. The HDW model separates saltcake into S1 and S2 categories based on feed source and process period with S1 assigned to the 242-S Evaporator campaign of 1973 to 1976. For some of the major elements, such as aluminum and sulfate, the core sample analysis indicates a subtle increase in concentration in the core segments in approximately the lower tank half, suggesting these lower segments may be dominated by cladding waste.

In general, complete sample recovery was obtained from the lower segments and the composition of the segments, particularly segments 5, 6, 7, and 8, was similar from core to core for all three cores. These observations suggest that the waste volume represented by these segments is relatively homogeneous and may be representative of the earlier evaporator campaigns used for the SMMS1 HDW model. In addition, average sample-derived concentrations from TCRs for several other tanks containing wastes designated as SMMS1 saltcake have been prepared as part of the best-basis effort. This sample-based S1 saltcake concentration average is obtained from TCR's for tanks 241-S-101, 241-S-102, 241-U-106, and 241-U-109. These three data sets, the core segment data, the SMMS1 HDW model results for tank 241-U-108, and the average S1 saltcake tank data, were compared with inventories of S1 saltcake. This comparison is used to show how well tank 241-U-108 saltcake inventories compare with similar tanks.

Core segments 5, 6, 7, and 8 from tank 241-U-108 were used, and only those saltcake components reported above detection limits were used. Table D3-3 compares concentrations of 241-U-108 analytes with the average SMMS1 composition from the HDW model and an average sample-based concentrations from TCRs for saltcake dominant tanks (241-S-101, -S-102, -U-109, and -U-106). The sample concentration data for tank 241-U-108 is an average of 12 core segment analyses from 3 cores for segments 5, 6, 7, and 8. Except for phosphate and fluoride, the U-108 concentrations are in general agreement with the average sample-based tank concentrations for S1 saltcake. Except for Al, there is general consistency between tank 241-U-108 concentrations and the SMMS1 HDW model results.

Table D3-3. Comparisons of Concentrations in Segments 5, 6, 7, 8 Sample Analysis Average With S1 Saltcake Type.

Analyte	Tank 241-U-108 Segment Sample Ave. (μg/g)	Tank 241-U-108 SMMS1 HDW Model (μg/g)	SMMS1 Average from TCR's (μg/g)
Na	2.55E+05	1.98E+05	1.82E+05
Al	16,489	32,089	15,083
Cr	4,270	3,166	5,441
PO_4	8,863	6,015	33,965
SO_4	17,962	14,249	13,768
F	1,043	806	6,255
Cl	3,880	2,580	3,842
NO_3	2.67E+05	2.69E+05	1.63E+05

The sample-based inventory of the components in Table D3-3 is based on the volume of tank 241-U-108 represented by the core segments. The sample-based inventory is compared to the HDW-based inventory of the tank 241-U-108 SMMS1 saltcake. A measured average density of 1.71 kg/L was used for the sample segment data and an estimated density of 1.62 kg/L was used for the SMMS1 HDW model data for tank 241-U-108.

The estimated inventories in Table D3-4 for the presumed S1 saltcake volume of tank 241-U-108 assumed to be dominated by REDOX cladding waste are somewhat higher, except for Al, than those derived from SMMS1 HDW model results. Except for Al, the inventories differ by less than a factor of 2 and are often within 30 percent.

Table D3-4. Inventory Comparisons of Tank Volume Based on Tank 241-U-108 Selected Core Segment Analysis With HDW Model SMMS1 Saltcake Inventory.

Analyte	Tank 241-U-108 Sample Ave. Conc. (μg/g)	Tank 241-U-108 S1 Sample Inventory (kg)	Tank 241-U-108 HDW SMMS1 Conc. (μg/g)	Tank 241-U-108 HDW SMMS1 Inventory (kg)
Na	255,000	343,100	198,000	280,400
Al	16,489	22,200	32,089	45,400
Cr	4,270	5,740	3,166	4,480
PO_4	8,863	11,900	6,015	8,520
SO_4	17,962	24,200	14,249	20,200
F	1,043	1,900	806	1,140
Cl	3,880	5,200	2,580	3,650
NO_3	267,000	359,300	269,000	381,000
Density, kg/L	1.71		1.62	
Sample Mass, kg	1.345E+06		1.416E+06	

D3.3 DOCUMENT ELEMENT BASIS

Significant differences between sample-based and HDW inventories were apparent for Al, Cr, phosphate and carbonate, which vary by a factor of two, and Bi, Ca, and U which differ by an order of magnitude. A discussion of the two inventory estimates for selected analytes is given below. Only those analytes present in core samples at concentrations greater than detection limits were considered.

D3.3.1 Aluminum

The sample-based and HDW inventories for aluminum are 51,190 kg and 96,800 kg, respectively. The comparison of S1 saltcake type inventories suggests 22,200 kg and 45,400 kg, respectively, which varies by a factor of two. However, Al concentrations of 16,500 μg/g from segments 5, 6, 7, and 8 closely agree with the HDW saltcake average of 15,083 μg/g.

D3.3.2 Bismuth

The sample-based and HDW inventories for bismuth are <5,930 kg, (based on samples below detection limits) and 436 kg, respectively. Because the Bi values for core samples were below detection limits and the detection limits were high, an alternate approach was used as a basis for a best Bi estimate. Average sample-based Bi concentrations for SMMS1 saltcake based on TCRs for tanks 241-S-101, -S-102, -U-106, and -U-109 yield a Bi concentration of 161 mg/kg. The HDW model estimate for SMMS1 volume in tank 241-U-108 is 874 kL (Table D-6) and the average measured core sample density for tank 241-U-108 is 1.71 kg/L (Table D-1). The product of these values yields an estimate of 241 kg Bi for the S1 saltcake. For S2 saltcake, the average sample-derived Bi concentration from tanks 241-S-101, -S-102, -U-102, -U-107, and -U-109 is also 161 mg/kg. Using the same measured density of 1.71 kg/L and an HDW model SMMS2 volume of 696 kL (Table D-6) yields an S2 saltcake estimate of 192 kg for Bi. The sum of the S1 (241 kg) and S2 (192 kg) saltcake estimate for Bi plus a measured liquid sample value of 4 kg yields a total Bi estimate for tank 241-U-108 of 437 kg. Furthermore, process chemistry suggests that Bi concentrations will be low. Bismuth is not soluble, and thus will not be a substantial component of saltcake. Bismuth is absent from the REDOX process entirely.

D3.3.3 Calcium

The sample-based and HDW inventories for calcium are <5,930 (where all samples were below detection limits by the fusion method) and 3,940 kg, respectively. An acid digest value of 447 kg from core composite data was well above detection limits and is considered the best estimate. The source of Ca in the HDW would appear to be due to the hard water and supernatant mixing assumptions made for the SMMS1 and/or SMMS2 models.

D3.3.4 Chromium

The sample-based and HDW inventories for chromium are 12,116 kg and 5,980 kg, respectively. The comparison of S1 saltcake types based on sample data and HDW data suggest partial inventories of 5,740 kg and 4,480 kg, respectively. The HDW model indicates that 5,980 kg of chromium is introduced to tank 241-U-108 in the SMMS1 and SMMS2 models. The solubility assumptions in these models, especially regarding REDOX waste, have not been verified.

D3.3.5 Sulfate

The sample-based and HDW inventories for sulfate are 44,430 kg and 45,000 kg, respectively. Estimates for the S1 saltcake portion are 24,200 kg for sample-based inventory and 20,200 kg from HDW data. The HDW model indicates that 45,000 kg of sulfate are introduced to tank 241-U-108 in the SMMS1 and SMMS2 models. This number is consistent with the sample-based inventory, indicating that model assumptions about sulfate are reasonable. However, good sample recovery and consistency among cores taken from 241-U-108 suggest sample-based inventories are more reliable.

D3.3.6 Phosphate

The sample-based and HDW inventories for phosphate are 50,527 kg and 16,800 kg, respectively. Estimates for the S1 saltcake portion are 11,900 kg from sample data and 8,520 kg from HDW data, respectively. Comparison of these values suggests that the HDW model estimates are too low because the phosphate solubility assumed is too high for this waste.

D4.0 ESTABLISH THE BEST BASIS AND ESTABLISH COMPONENT INVENTORIES

The results from this evaluation support using the sampling data for tank 241-U-108 for the following reasons.

1. Core sample data were available from three risers at three widely spaced positions. Recovery of sample segments was good for most samples and consistent from core to core. Also, concentrations in each segment were consistent from core to core. Upon inspection of data collection and analysis protocols, no reasons were found to reject the laboratory data.

2. The sample-based inventory reconciles better with the position that the sludge layer in the tank is REDOX CW rather than bismuth phosphate MW and that sluicing of earlier metal waste was complete.

3. The evaporator concentrate waste (SMMS1 and SMMS2) that make up the majority of the waste volume in tank 241-U-108 have no independent data source with which to they may be compared. The process of mixing and evaporating supernatants is sufficiently complex that comparison to process flowsheets or multicomponent chemical modeling is impractical.

Best-basis inventory estimates for tank 241-U-108 are presented in Tables D4-1 and D4-2. The sample-based inventory values were generated using a measured density of 1.74 g/mL for segment sample data, 1.40 g/mL for drainable liquid samples, and 1.71 g/mL for core composites.

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-U-108. (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, or E)[1]	Comment
Al	51,190	S	Average segment sample data plus liquid data
Bi	437	E	Average based on S1 and S2 TCR saltcake data
Ca	447	S	Average based on acid digest of core composite data
Cl	10,914	S	Average segment sample data plus liquid data
TIC as CO_3	118,500	S	Average segment sample data plus liquid data
Cr	12,116	S	Average segment sample data plus liquid data
F	2,836	S	Average segment sample data plus liquid data
Fe	507	S	Core composite acid digest samples
Hg	n/r		
K	4,800	S	Core composite samples
La	<117	S	Core composite samples below detection limit
Mn	185	S	Core composite acid digest samples
Na	726,100	S	Average segment sample data plus liquid data
Ni	150	S	Core composite acid digest samples
NO_2	157,800	S	Average segment sample data plus liquid data
NO_3	879,500	S	Average segment sample data plus liquid data
OH	n/r		
Pb	<234	S	Core composite samples below detection limit
P as PO_4	50,527	S	Average segment sample data plus liquid data

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-U-108. (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, or E)[1]	Comment
Si	830	S	Average core composite water wash sample plus liquid
S as SO_4	44,430	S	Average segment sample data plus liquid data
Sr	<23.4	S	Core composite below detection limit
TOC	12,850	S	Average segment sample data plus liquid data
U_{TOTAL}	538	S	Laser phosphorescence data from core composite samples
Zr	<23.4	S	Core composite below detection limit

Notes:
[1]S = Sample-based (see Appendix B)
M = Hanford Defined Waste model-based
E = Engineering assessment-based

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-U-108. (3 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	n/r		
^{14}C	n/r		
^{59}Ni	n/r		
^{60}Co	<61.5	S	Average solid segment data
^{63}Ni	n/r		
^{79}Se	n/r		
^{90}Sr	29,400	S	Average solid segment data
^{90}Y	n/r		
^{93}Zr	n/r		
^{93m}Nb	n/r		
^{99}Tc	n/r		

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-U-108. (3 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{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	411,000	S	Average core segment data
^{137m}Ba	n/r		
^{151}Sm	n/r		
^{152}Eu	n/r		
^{154}Eu	<241	S	Average core segment data
^{155}Eu	<884	S	Average core segment data
^{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		
^{239}Pu	n/r		

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-U-108. (3 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{240}Pu	n/r		
^{241}Am	<1,930	S	Average core segment data
^{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 = Hanford Defined Waste model-based

E = Engineering assessment-based

D5.0 APPENDIX D REFERENCES

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

Agnew, S. F., R. A. Corbin, T. B. Duran, K. A. Jurgensen, T. P. Ortiz, and B. L. Young, 1996b, *Waste Status and Transaction Record Summary for the Southwest Quadrant of the Hanford 200 East Area*, WHC-SD-WM-TI-614, Rev. 2, Los Alamos National Laboratory, Los Alamos, New Mexico.

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

Bell, K. E., 1996, *Final Report for Tank 241-U-108, Push-Mode Core Samples 141, 145, and 146 Analytical Results for the Final Report*, WHC-SD-WM-DP-198, Rev. 0, 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.

Kupfer, M. J., M. D. LeClair, W. W. Schulz, and L. W. Shelton, 1995, *Work Plan for Defining a Standard Inventory Estimate for Wastes Stored in Hanford Site Underground Tanks,* WHC-SD-WM-WP-311, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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APPENDIX E

BIBLIOGRAPHY FOR TANK 241-U-108

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APPENDIX E

BIBLIOGRAPHY FOR TANK 241-U-108

Appendix E provides a bibliography of information that supports the characterization of tank 241-U-108. This bibliography represents an in-depth literature search of all known information sources that provide sampling, analysis, surveillance, and modeling information, as well as processing occurrences associated with tank 241-U-108 and its respective waste types.

The references in this bibliography are separated into three broad categories containing references broken down into subgroups. These categories and their 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-108
- IIb. Sampling of 242-S Evaporator Waste Streams

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 broken down into the appropriate sections of material to use, with an annotation at the end of each reference describing the information source. Where possible, a reference is provided for information sources. A majority of the information listed below may 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. Corbin, T. Duran, J. FitzPatrick, K. Jurgensen, T. Ortiz, and B. Young, 1996, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 3*, LA-UR-96-858, Los Alamos National Laboratory, Los Alamos, New Mexico.

- Document contains tank layer and supernatant mixing models and the historical tank content estimate for Hanford Site 200 East and 200 West underground waste storage tanks, as well as a list of Hanford Site waste types and their respective major analyte concentrations.

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

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

Boldt, A. L., 1966, *REDOX Chemical Flowsheet HW No. 9*, ISO-335, Isochem, Inc., Richland, Washington.

- Document contains compositions of material balance for REDOX process as well as a separations plan denoting process stream waste before transfer to 200 Area waste tanks.

Crawley, D. T., 1960, *REDOX Chemical Flowsheet HW-No. 6*, HW-66203, Hanford Atomic Products Operation, General Electric Company, Richland, Washington.

- Document contains compositions of material balance for REDOX process as well as a separations plan denoting process stream waste before transfer to 200 Area waste tanks.

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

- A model based on process knowledge and radioactive decay estimations using ORIGEN for different compositions of process waste streams assembled for total, solution, and solids compositions per tank. Assumptions about waste/waste types and solubility parameters/constraints are also given.

Merrill, E. T., and R. L. Stevenson, 1955, *REDOX Chemical Flowsheet HW No. 5*, HW-38684, Hanford Atomic Products Operation, Richland, Washington.

- Document contains compositions of material balance for REDOX process as well as a separations plan denoting process stream waste before transfer to 200 Area waste tanks.

Schneider, K.J., 1951, *Flowsheets and Flow Diagrams of Precipitation Separations Process*, HW-23043, Hanford Atomic Products Operation, Richland, Washington.

- Document contains compositions of process stream waste before transfer to 200 Area 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*, WHC-SD-WM-TI-614, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

- Document contains spreadsheets depicting all available data on tank additions/transfers for SW quadrant.

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

- Document 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.

- Document shows tank riser locations in relation to tank aerial view as well as a description of riser and its contents.

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

- Document contains safety analysis report on isolation of single-shell tanks.

Lipnicki, J., 1996, *Waste Tank Risers Available for Sampling*, WHC-SD-WM-TI-710, Rev. 3, Westinghouse Hanford Company, Richland, Washington.

- Document gives an assessment of all risers per tank, however not all tanks are included/completed.

Rogers, R. D., and H. T. Daniels, 1944, *Specifications for Construction of Composite Storage Tanks Bldg. #241 at Hanford Engineer Works*, CVI-73550, E. I. Du Pont de Nemours & Co., Richland, Washington.

- Vendor information contains a compilation of drawings for Hanford 200 East and 200 West Area tanks.

Swaney, S. L., 1994, *Single-Shell Stabilization Record*, WHC-SD-RE-TI-178, Rev. 4, Westinghouse Hanford Company, Richland, Washington.

- Document contains information about the stabilization of single-shell tanks.

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

- Document contains thermocouple data for each tank including some history and riser information.

Vitro Engineering Corporation, 1988, *Piping Waste Tank Isolation TK 241-U-108*, H-2-73156, Rev. 4, Vitro Engineering Corporation, Richland, Washington.

- Drawing shows riser layout for tank 241-U-108.

Id. Sample Planning/Tank Prioritization

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

- Document that summarizes the technical basis for characterizing the waste in the tanks and assigns a priority number to each tank.

Christensen, W. R., 1976, *Tank Farm Sludge Samples*, (internal memorandum to J. A. Teal, February 19), Atlantic Richfield Hanford Company, Richland, Washington.

- Memorandum requests salt samples from tank 241-U-108.

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.

- Document contains plan for characterizing waste, short and long term goals, tank priority, analysis needs, estimates of analyte concentrations per waste type, and a characterization flowsheet.

Homi, C. S., 1996, *Tank 241-U-108 Push Mode Core Sampling and Analysis Plan*, WHC-SD-WM-TSAP-049, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Document contains detailed sampling and analysis scheme for core samples to be taken from tank 241-U-108 to address applicable DQOs.

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

- Document contains vapor sampling and analysis scheme for tank 241-U-108.

Osborne, J. W., and J. L. Huckaby, 1994, *Program Plan for the Resolution of Tank Vapor Issues*, WHC-EP-0562, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

- Document presents plan/approach to resolving Hanford Site waste tank vapor concerns.

Puryear, D. A., 1971, *Waste Tank Characterization*, (internal memorandum to D. A. Dodd, August 2), Atlantic Richfield Hanford Company, Richland, Washington.

- Memorandum contains analytes desired from tank sampled in support of 242-S Evaporator startup.

Schreiber, R. D., 1995, *Compatibility Grab Sampling and Analysis Plan*, WHC-SD-WM-TP-330, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Document contains compatibility sampling needs for tank 241-U-108.

Walser, R. L., 1975, *Sludge Samples Required From July 21 to December 31, 1975*, (internal memorandum to J. A. Teal, July 17), Atlantic Richfield Hanford Company, Richland, Washington.

- Memorandum requests sludge samples from tank 241-U-108.

Westinghouse Hanford Company, 1996, *Tank U-108 Core Sampling Work Package*, WS-95-00250, Westinghouse Hanford Company, Richland, Washington.

- Document contains sampling procedures for tank 241-U-108.

Winkelman, W. D., 1996, *Tank 241-U-108 Tank Characterization Plan*, WHC-SD-WM-TP-315, Rev. 3, Westinghouse Hanford Company, Richland, Washington.

- Document discusses all relevant DQOs and how their requirements will be met for tank 241-U-108.

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- Document contains Tri-Party Agreement requirement-driven TWRS Characterization program information and a list of tanks addressed in fiscal year 1997.

Ie. Data Quality Objectives/Customers of Characterization Data

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- Document contains objectives to sample all tanks for safety concerns (ferrocyanide, organic, flammable gas, and criticality) as well as decision thresholds for energetics, criticality and flammability.

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- Document provides test preparation and conduct of cesium removal test using single-shell tank saltcake, including tank 241-U-108.

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.

- Document contains waste transfer compatibility program data needs, list of tanks to be evaluated, decision thresholds, and decision logic flow diagram.

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 Company, Richland, Washington.

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Osborne, J. W., J. L. Huckaby, T. P. Rudolph, E. R. Hewitt, D. D. Mahlum, J. Y. Young, and C. M. Anderson, 1995, *Data Quality Objectives for Generic In-Tank Health and Safety Issue Resolution*, WHC-SD-WM-DQO-002, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

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- Document identifies analytical parameters to characterize waste into one of five waste types.

Turner, D.A., H. Babad, L. L. Buckley, J. E. Meacham, 1996, *Data Quality Objective to Support Resolution of the Organic Complexant Safety Issue*, WHC-SD-WM-DQO-006, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

- Document contains organic program data needs, list of tanks to be evaluated, decision thresholds, and decision logic flow diagram.

II. Analytical Data

IIa. Sampling of tank 241-U-108

Bell, K. E., 1996, *Final Report for Tank 241-U-108, Push-Mode Core Samples 141, 145, and 146*, WHC-SD-WM-DP-198, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Document contains analytical results from March-May 1996 push mode core sampling event.

Bell, K. E., 1996, *Safety Screening/Immediate Notification for Tank 241-U-108*, (internal memorandum #79400-96-161 to J. N. Appel, H. Babad, D. C. Hetzer, J. E. Hyatt, T. J. Kelley, N. W. Kirch, M. J. Kupfer, J. E. Meacham, K. L. Powell, J. B. Schaffer, L. W. Shelton, and J. A. Voogd, August 8), Westinghouse Hanford Company, Richland, Washington.

- Memorandum contains notification of any analytical results exceeding DQO limits from March-May 1996 push mode core sampling event.

Caprio, G. S., 1995, *Vapor and Gas Sampling of Single-Shell Tank 241-U-108 Using the Vapor Sampling System*, WHC-SD-WM-RPT-181, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Document presents sampling data from August 1995 vapor sampling event.

Esch, R. A., 1995, *Waste Compatibility Results for 241-U-108 Grab Samples*, (internal memorandum #75970-95-043 Rev. 1 to M. J. Sutey, R. D. Schreiber, S. D. Estey, and N. W. Kirch, July 24), Westinghouse Hanford Company, Richland, Washington.

- Document contains analytical results from May 1995 grab sampling event.

Geier, R. G., 1976, *Estimated Hanford Liquid Wastes Chemical Inventory as of June 30, 1976*, ARH-CD-768, Atlantic Richfield Hanford Company, Richland, Washington.

- Document contains historical sample analytical results for tank 241-U-108 as well as many other tanks.

Horton, J. E., 1975, *Analyses of Sludge Sample From Tank 108-U*, (internal memorandum to W. R. Christensen, September 29), Atlantic Richfield Hanford Company, Richland, Washington.

- Memorandum contains historical sample analytical results for tank 241-U-108.

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Puryear D. A., 1971, *Characterization of S, U, and SX Waste Tanks*, (internal memorandum to J. O. Skolrud, September 21), Atlantic Richfield Hanford Company, Richland, Washington.

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Rice, A. D., 1996, *Correction of Spike Recovery for Persulfate TIC/TOC Analyses on Tank Samples*, (external letter #9655794 to K. M. Hall, Lockheed Martin Hanford Company, November 20), Rust Federal Services of Hanford, Inc., Richland, Washington.

- Memorandum contains corrections to analytical results from March-May 1996 push mode core sampling event.

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Thomas, B. L., T. W. Clauss, J. C. Evana, B. D. McVeety, K. H. Pool, K. B. Olsen, J. S. Fruchter, and M. W. Ligotke, 1996, *Headspace Vapor Characterization of Hanford Waste Tank 241-U-108: Results from Samples Collected on 08/29/95*, PNNL-10961, Pacific Northwest National Laboratory, Richland, Washington.

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Wheeler, R. E., 1976, *Analysis of Tank Farm Samples, Sample: T-376, Tank: 108-U, Received: December 12, 1975*, (internal memorandum to R. L. Walker, February 2), Atlantic Richfield Hanford Company, Richland, Washington.

- Memorandum contains historical sample analytical results for tank 241-U-108.

Wheeler, R. E., 1975, *Analysis of Tank Farm Samples, Sample: T-6142, Tank: 108-U, Received: July 15, 1975*, (internal memorandum to R. L. Walker, October 21), Atlantic Richfield Hanford Company, Richland, Washington.

- Memorandum contains historical sample analytical results for tank 241-U-108.

Wheeler, R. E., 1975, *Analysis of Tank Farm Samples, Sample: T-6352, Tank: 108-U, Received: July 22, 1975*, (internal memorandum to R. L. Walker, October 24), Atlantic Richfield Hanford Company, Richland, Washington.

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Wheeler, R. E., 1975, *Analysis of Tank Farm Samples, Sample: T-6709, Tank: 108-U, Received: August 4, 1975*, (internal memorandum to R. L. Walker, October 21), Atlantic Richfield Hanford Company, Richland, Washington.

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Wheeler, R. E., 1975, *Analysis of Tank Farm Samples, Sample: T-7019, Tank: 108-U, Received: August 12, 1975*, (internal memorandum to R. L. Walker, October 21), Atlantic Richfield Hanford Company, Richland, Washington.

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Wheeler, R. E., 1975, *Analysis of Tank Farm Samples, Sample: T-7443, Tank: 108-U, Received: August 26, 1975*, (internal memorandum to R. L. Walker, December 2), Atlantic Richfield Hanford Company, Richland, Washington.

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Wheeler, R. E., 1975, *Analysis of Tank Farm Samples, Sample: T-7822, Tank: 108-U, Received: September 8, 1975*, (internal memorandum to R. L. Walker, October 20), Atlantic Richfield Hanford Company, Richland, Washington.

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IIb. Sampling of 242-S Evaporator Waste Streams

- The following analyses may provide insight as to the composition of saltcake waste type expected to be in tank 241-U-108.

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Campbell, G. D., 1975, *242-S Evaporator-Crystallizer Material Balance*, (internal memorandum 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.

III. Combined Analytical/Non-Analytical Data

IIIa. Inventories from Campaign and Analytical Information

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

- Document contains waste type summaries, primary chemical compound/analyte and radionuclide estimates for sludge, supernatant, and solids, as well as SMM, TLM, and individual tank inventory estimates.

Agnew, S. F., 1995, *Letter Report: Strategy for Analytical Data Comparisons to HDW Model*, (external letter #CST-4:95-sfa272 to S. J. Eberlein, Westinghouse Hanford Company, September 28), Los Alamos National Laboratory, Los Alamos, New Mexico.

- Document contains proposed tank groups based on TLM, and statistical method for comparing analytical information to HDW predictions.

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

- Document contains major components for waste types, and some assumptions

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

- Document contains major components for waste types, and some assumptions

Brevick, C. H., L. A. Gaddis, and W. W. Pickett, 1996, *Historical Tank Content Estimate for the Southwest Quadrant of the Hanford 200 Areas*, WHC-SD-WM-ER-352, Rev 0B, Westinghouse Hanford Company, Richland, Washington.

- Document contains summary information from the supporting document for Tank Farms S, SX, and U as well as in-tank photo collages and the solid (including the interstitial liquid) composite inventory estimates.

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.

- Document statistically groups Hanford 200 Area Tanks by waste type and provides nominal compositions for the waste types.

Kupfer, M. J., 1996, *Interim Report: Best Basis Total Chemical and Radionuclide Inventories in Hanford Site Tank Waste*, WHC-SD-WM-TI-740, Rev. B-Draft, Westinghouse Hanford Company, Richland, Washington.

- Document contains a global component inventory for 200 Area waste tanks, currently inventoried are 14 chemical and 2 radionuclide components.

Schmittroth, F. A., 1995, *Inventories for Low-Level Tank Waste*, WHC-SD-WM-RPT-164, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Document contains a global inventory based on process knowledge and radioactive decay estimations using ORIGEN2. Pu and U waste contributions are taken at 1% of the amount used in processes. Also compares information on Tc-99 from both ORIGEN2 and analytical data.

IIIb. Compendium of data from other sources physical and chemical

Agnew, S.F., John 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.

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

Baldwin, D. L., Stromatt, R. W., and Winters, W. I., 1994, *Comparative Study of Total Organic Carbon Methods for High-Level Mixed Waste*, PNL-SA-23718, Pacific Northwest National Laboratory, Richland, Washington.

- Document contains comparison of hot persulfate oxidation, furnace combustion, and UV-catalyzed persulfate oxidation TOC method analyses using numerous tank samples.

Bratzel, D. R., 1995, *Headspace Gas and Vapor Characterization Summary for the 43 Vapor Program Suspect Tanks*, WHC-SD-WM-ER-514, Rev. 1A, Westinghouse Hanford Company, Richland, Washington.

- Document summarizes vapor sampling analytical results for 43 single-shell tanks for safety and worker breathing considerations.

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

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

Brevick, C. H., L. A. Gaddis, and E. D. Johnson, 1994, *Supporting Document for the Historical Tank Content Estimate for U Tank Farm*, WHC-SD-WM-ER-325, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Document contains summary tank farm and tank write-ups on historical data and solid inventory estimates as well as appendices for the data. The appendices contain the following information: level history, temperature graphs, surface level graphs, a cascade/dry well chart, riser configuration drawings and tables, in-tank photos, and tank layer model information.

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

- Document summarizes issues surrounding the characterization of nuclear wastes stored in Hanford Site waste tanks.

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

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

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

- Document gives assessment of relative dryness between tanks.

Husa, E. I., R. E. Raymond, R. K. Welty, S. M. Griffith, B. M. Hanlon, R. R. Rios, and N. J. Vermeulen, 1993, *Hanford Site Waste Storage Tank Information Notebook*, WHC-EP-0625, Westinghouse Hanford Company, Richland, Washington.

- Document contains in-tank photos as well as summaries on the tank description, leak detection system, and tank status.

Leach, C. E., and S. M. Stahl, 1993, *Hanford Site Tank Farm Facilities Interim Safety Basis*, WHC-SD-WM-ISB-001, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Document provides ready reference to the tank farms safety envelope.

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.

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 F. M. Cooney, February 14), Westinghouse Hanford Company, Richland, Washington.

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

Van Vleet, R. J., 1993, *Radionuclide and Chemical Inventories for the Single Shell Tanks*, WHC-SD-WM-TI-565, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

- Document contains selected sample analysis tables prior to 1993 for single-shell tanks.

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D. Powers		X			
Nuclear Consulting Services Inc. P. O. Box 29151 Columbus, OH 43229-01051					
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T. T. Tran	B1-44	X			
<u>Tank Advisory Panel</u> 102 Windham Road Oak Ridge, TN 37830					
D. O. Campbell		X			
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<u>Department of Energy - Richland Operations</u>					
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