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Tank Characterization Report for Single-Shell Tank 241-BY-112

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U.S. Department of Energy Contract DE-AC06-87RL10930

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Abstract: This document summarizes the information on the historical uses, present status, and the sampling and analysis results of waste stored in Tank 241-BY-112. This report supports the requirements of the Tri-Party Agreement Milestone M-44-10.

Kara [signature] 8/22/97 AUG 25 1997

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Tank Characterization Report for Single-Shell Tank 241-BY-112

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LIST OF TERMS

ANOVA	analysis of variance
AT	alpha total
BNW	Battelle Northwest Laboratory waste
Btu/hr	British thermal units per hour
BYCOND	Liquid condensed by in-tank evaporators and sent to cribs
BYSltCk	BY saltcake
Ci	curie
CI	confidence interval
Ci/g	curies per gram
Ci/L	curies per liter
cm	centimeter
cm^3	cubic centimeter
CW	cladding waste
CWP2	cladding waste from PUREX
DQO	data quality objective
DSC	differential scanning calorimetry
EB	Evaporator bottoms
EB-ITS	Evaporator bottoms from in-tank solidification
EVAP	Evaporator feed waste
ft	feet
g	gram
g/L	grams per liter
g/cm^3	grams per cubic centimeter
g/mL	grams per milliliter
HDW	Hanford defined waste
IC	ion chromatography
ICP	inductively coupled plasma
in.	inch
$in.^3$	cubic inches
ITS	in-tank solidification
ITS1	first in-tank solidification unit
ITS2	second in-tank solidification unit
IX	ion-exchange waste
J/g	joules per gram
kg	kilogram
kgal	kilogallon
kL	kiloliter
kW	kilowatt

LIST OF TERMS (Continued)

L	liter
LEL	lower explosive limit
LFL	lower flammability limit
LL	lower limit
m	meter
mL	milliliter
mm	millimeter
m^2	square meter
M	molarity
mg/m^3	milligrams per cubic meter
MW	metal waste from the bismuth phosphate process
n/a	not applicable
NR	not reported
$PFeCN_2$	Ferrocyanide sludge produced by scavenging uranium recovery supernatant
PHMC	Project Hanford Management Contractor
ppmv	parts per million by volume
PUREX	plutonium-uranium extraction (plant)
REML	restricted maximum likelihood estimation
RPD	relative percent difference
SACS	Surveillance Analysis Computer System
SC	saltcake
SL	sludge
SMM	supernatant mixing model
SU	supernatant
TBP-F	Tributyl phosphate-ferrocyanide scavenged uranium recovery (TBP) supernatants (equivalent to PFeCN)
TCR	tank characterization report
TGA	thermogravimetric analysis
TIC	total inorganic carbon
TLM	tank layer model
TOC	total organic carbon
TWRS	Tank Waste Remediation System
UL	upper limit
W	watt
WSTRS	Waste Status and Transaction Record Summary

LIST OF TERMS (Continued)

wt%	weight percent
°C	Celsius
°F	Fahrenheit
%	percent
μCi/g	microcuries per gram
μCi/L	microcuries per liter
μCi/mL	microcuries per millimeter
μeg/g	microequivalents per gram
μg/g	micrograms per gram
μg/mL	micrograms per milliliter

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1.0 INTRODUCTION

One major function of the Tank Waste Remediation System (TWRS) is to characterize wastes in support of waste management and disposal activities at the Hanford Site. Analytical data from sampling and analysis and other available tank information are compiled and maintained in a tank characterization report (TCR). This report and its appendixes serve as the TCR for single-shell tank 241-BY-112.

The objectives of this report are: 1) to use characterization data in response to technical issues associated with tank 241-BY-112 waste and 2) to provide a standard characterization of this waste in terms of a best-basis inventory estimate. Section 2.0 summarizes the response to technical issues, Section 3.0 provides the best basis inventory estimate, and Section 4.0 makes recommendations regarding safety status and additional sampling needs. The appendices contain supporting data and information. This report also supports the requirements of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1996), Milestone M-44-10.

1.1 SCOPE

Characterization information in this report originated from sample analyses and known historical sources. Although only the results of recent sample events will be used to fulfill the requirements of the data quality objectives (DQOs), other information can be used to support (or question) conclusions derived from these results. Appendix A provides historical information for tank 241-BY-112 including surveillance information, records pertaining to waste transfers and tank operations, and expected tank contents derived from a process knowledge model.

Appendix B summarizes information on the recent sampling events (see Table 1-1), sample data obtained before 1989, and sampling results. The results of the 1996 sampling events, also reported in the laboratory data package (Nuzum 1997), satisfied the data requirements specified in the tank characterization plan for this tank (Baldwin and Winkelman 1996). Appendix C reports on the statistical analysis and numerical manipulation of data used in issue resolution. Appendix D contains the evaluation to establish the best basis for the inventory estimate and the statistical analysis performed for this evaluation. Appendix E is a bibliography that resulted from an in-depth literature search of all known information sources applicable to tank 241-BY-112 and its respective waste types. The reports listed in Appendix E are available in the Tank Characterization and Safety Resource Center.

Table 1-1. Summary of Recent Sampling.

Sample/Date[1]	Phase	Location	Segmentation	Percent Recovery
Combustible gas test (10/2/96 and 10/7/96)	Gas	Tank headspace, risers 18 and 21 6.1 m (20 ft) below top of riser	n/a	n/a
Push mode sampling (10/2/96 to 10/3/96) Core 174	Solid	Riser 18	6 segments	Segment recovery varied from 26 to 95%.
	Liquid		Recovered only in segment 5	n/a
Push mode sampling (10/7/96) Core 177	Solid	Riser 21	6 segments	Segment recovery varied from 21 to 74%.
	Liquid		Recovered only in segment 5	n/a
Vapor sample (11/18/94)	Gas	Tank headspace	n/a	n/a

Notes:

n/a = not applicable

[1]Dates are given in the month/day/year format.

1.2 TANK BACKGROUND

Tank 241-BY-112 is located in the 200 East Area BY Tank Farm on the Hanford Site. It is the last tank in a three-tank cascade series. Tank 241-BY-112 began receiving metal waste from B Plant during the second quarter of 1951. During the first and fourth quarters of 1952, the tank received metal waste through the cascade from tank 241-BY-111. During the second, third, and fourth quarters of 1952, tank 241-BY-112 again received metal waste from B Plant.

During the first quarter of 1955, metal waste sludge was sent to tank 241-BY-111. In the second quarter of 1955, the tank received metal waste from B Plant. During 1956, tank 241-BY-112 received supernatant from tanks 241-BY-106, 241-BY-107, and

241-BY-108. During the second quarter of 1957, ferrocyanide sludge was received, and supernatant was sent to the B-028 and B-029 cribs. During the third and fourth quarters of 1957, tank 241-BY-112 received supernatant from tank 241-C-105.

The tank remained static until 1965 when supernatant was sent to tanks 241-BY-109, 241-BY-101, and 241-BY-103. Tank 241-BY-112 received supernatant from tanks 241-C-102 and 241-BY-111 from the third quarter of 1965 to the third quarter of 1996. During the fourth quarter of 1967, tank 241-BY-112 received cladding waste from PUREX.

In 1966, a heater was placed in the tank to cause evaporation (ITS2). During late 1967 and early 1968, tank 241-BY-112 received waste from cell 23 at B Plant. Cell 23 was used to evaporate tank waste. From the first quarter of 1968 to the second quarter of 1976, the tank received waste from the first in-tank solidification unit (ITS1) tank 241-BY-102 as well as other single-shell tanks in the 200 East Area. During this same time, waste was transferred from tank 241-BY-112 to other single-shell tanks in the 200 East Area.

For additional information on the amount of liquid evaporated during the ITS process from 1968 to 1976, see Appendix A.

Interstitial liquor was salt well pumped to tank 241-AW-102 in the third quarter of 1982.

Table 1-2 summarizes the description of tank 241-BY-112. The tank has an operating capacity of 2,870 kL (758 kgal) and contains an estimated 1,101 kL (291 kgal) of noncomplexed waste (Hanlon 1997). The tank is not on the Watch List (Public Law 101-510).

Table 1-2. Description of Tank 241-BY-112.

TANK DESCRIPTION	
Type	Single-shell
Constructed	1948 to 1949
In-service	1951
Diameter	23 m (75 ft)
Operating depth	7.2 m (23.67 ft)
Capacity	2,870 kL (758 kgal)
Bottom Shape	Dish
Ventilation	Passive
TANK STATUS	
Waste classification	Noncomplexed
Total waste volume[1]	1,101 kL (291 kgal)
Supernatant volume	0 kL (0 kgal)
Saltcake volume	1,080 kL (286 kgal)
Sludge volume	20 kL (5 kgal)
Drainable interstitial liquid volume	30 kL (8 kgal)
Waste surface level (October 3, 1996)	2.87 m (113 in.)
Temperature (August 1974 to December 1996)	5°C (41 °F) to 62.2 °C (144 °F)
Integrity	Sound
Watch List	None
SAMPLING DATE	
Vapor sample	November 1994
Push mode core samples	October 1996
SERVICE STATUS	
Declared inactive	1977
Interim stabilization	1984
Intrusion prevention	1991

Note:

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

2.0 RESPONSE TO TECHNICAL ISSUES

The following technical issues have been identified for tank 241-BY-112.

Safety screening:

- Does the waste pose or contribute to any recognized potential safety problems?

Hazardous vapor safety screening:

- Does a potential exist for worker hazards associated with the toxicity of constituents in tank fugitive vapor emissions.

Organic Solvents:

- Does an organic solvent pool exist that may cause an organic solvent pool fire or ignition of organic solvents entrained in waste solids?

The tank characterization plan (Baldwin and Winkelman 1996) identifies the types of sampling and analysis that were used to address the above issues. Data from the recent analysis of two core samples, tank vapor space flammability measurements, and historical information are the means to respond to the issues. This response is detailed below. Appendix B contains the sample and analysis data for tank 241-BY-112.

2.1 SAFETY SCREENING

The data needed to screen the waste in tank 241-BY-112 for potential safety problems are documented in the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995). These potential safety problems are exothermic conditions in the waste, flammable gases in the waste and/or tank headspace, and criticality conditions in the waste. Each condition is addressed separately. Because tank 241-BY-112 is not a Watch List tank, the safety screening DQO was the only safety-related DQO associated with the sampling effort.

2.1.1 Exothermic Conditions (Energetics)

The first requirement outlined in the safety screening DQO (Dukelow et al. 1995) is to ensure there is not enough fuel in tank 241-BY-112 to cause a safety hazard. Because of this requirement, energetics in tank 241-BY-112 waste were evaluated. The safety screening DQO required that the waste sample profile be tested for energetics every 24 cm (9.5 in.) to determine whether the energetics exceeded the safety threshold limit. Because of poor recovery, only four of 12 segments met this condition.

The threshold limit for energetics is 480 J/g on a dry weight basis. Results obtained using differential scanning calorimetry (DSC) indicated no exotherms exceeded the threshold limit. (Nuzum 1996). However, because of sample heterogeneity, three samples exceeded the limit of 480 J/g at the upper 95 percent confidence level of the mean on a dry basis (see Appendix C). The percent water for these same samples exceeded 25 percent (see Appendix C), and the total organic carbon (TOC) for these samples was less than the limit of 30,000 μg/g; therefore, no DSC safety concern exists for tank 241-BY-112.

Historically, any exothermic agent in tank BY-112 should be low. Waste transfer records indicate that the major waste type expected to be in the tank is BY saltcake. An ITS system was operated in tank 241-BY-112. The ITS used electric emersion heaters and an airlift recirculator to concentrate nonboiling aqueous (or supernatant) waste directly inside the tank. The heat from the ITS would drive off organics in the waste and degrade ferrocyanide. Ferrocyanide and organics are the primary sources of exotherms in Hanford Site waste tanks.

2.1.2 Flammable Gas

Vapor phase measurements, which were taken in the tank headspace before the push mode samples in October 1996, indicated flammable gas was detected at 1.0 percent of the lower flammability limit (LFL). Appendix B provides data from these vapor phase measurements.

2.1.3 Criticality

The safety threshold limit is 1 g ^{239}Pu per liter of waste. Assuming that all alpha is from ^{239}Pu and with a measured density of 1.46 g/mL, 1 g/L of ^{239}Pu is equivalent to 42 μCi/g of alpha activity. Alpha activity in all samples was less than 0.2 μCi/g, well below this limit. Additionally, as required by the DQO, the upper limit of the one-sided 95 percent confidence interval on the mean for these results was less than 42 μCi/g. Appendix C provides the method used to calculate confidence limits. Criticality is not a concern for this tank.

2.1.4 Total Organic Carbon

The dry weight notification limit for TOC is 30,000 μg/g. Three samples exceeded the notification limit at the upper 95 percent confidence level of the mean (see Appendix C). The percent water measured for these samples exceeds 23 percent (see Appendix C). The DSC measured for these samples is less than the limit of 480 J/g. The low results associated with the relatively high TOC values indicates a majority of the measured carbon is no longer associated with hydrogen-containing compounds; therefore, it is not reactive. No safety concern exists for tank 241-BY-112.

2.2 HAZARDOUS VAPOR SAFETY SCREENING

The data required to support vapor screening are documented in *Data Quality Objective for Tank Hazardous Vapor Safety Screening* (Osborne and Buckley 1995). Does the vapor headspace exceed 25 percent of the LFL? If so, what are the principal fuel components? Are compounds of toxicological significance present in the tank vapor at such a level that the industrial hygiene group shall be alerted to their presence so adequate breathing zone monitoring can be accomplished and future activities in and around the tank can be performed in a safe manner?

2.2.1 Flammable Gas

This is the same requirement as the safety screening flammability requirement. See Section 2.1.2 for a treatment of the flammability issue.

2.2.2 Toxicity

The vapor screening DQO (Osborne and Buckley 1995) requires the analysis of tank vapor samples for ammonia (NH_3), carbon dioxide (CO_2), carbon monoxide (CO), nitric oxide (NO), nitrous oxide (N_2O), and nitrogen dioxide (NO_2). The vapor screening DQO specifies a threshold limit for each above listed compound. All components were well below the threshold limit. The worker toxicity issue has been resolved, and the resolution is documented in Hewitt (1996).

2.3 ORGANIC SOLVENTS

A new DQO is being developed to address the organic solvent issue. In the interim, tanks are to be sampled for total nonmethane hydrocarbon to determine whether an organic solvent pool with an area greater than 1 m^2 exists (Cash 1996). The purpose of this assessment is to ensure that any organic solvent pool is sufficiently small that an organic solvent pool fire or ignition of organic solvents cannot occur. The size of the organic solvent pool will be determined by the organic program based on the vapor data, tank headspace temperature, and the tank ventilation rate.

2.4 OTHER TECHNICAL ISSUES

A factor in assessing tank safety is the heat generation and temperature of the waste. Heat is generated in the tanks primarily from radioactive decay. The heat load estimate based on the tank process history is 2,020 W (6,900 Btu/hr) (Agnew et al. 1997b). The heat load estimate based on the tank headspace temperature is 1,786 W (6,100 Btu/hr) (Kummerer

1995). Both estimates are well below the limit of 11,700 W (40,000 Btu/hr) that separates high- and low-heat-load tanks (Smith 1986).

2.5 SUMMARY

The results from all analyses performed to address potential safety issues show TOC exceeded the safety threshold limit for two samples. The DSC for these samples were low indicating the carbon is not associated with reactive compounds.

These samples exceeded the DSC threshold at the upper 95 percent confidence interval on the mean because of sample heterogeneity. Although recovery was not adequate to provide DSC results for every 24 cm (9.5 in.) of the core, the history of the tank suggests the fuel content in the tank is not a concern. The analyses do not indicate a safety concern for tank 241-BY-112. Table 2-1 summarizes the results of the analyses results.

Table 2-1. Summary of Technical Issues.

Issue	Sub-issue	Result
Safety	Energetics	Three samples exceeded 480 J/g at the upper 95% confidence level of the mean. However, this is a result of sample heterogeneity and does not indicate a safety concern.
	Flammable gas	Vapor measurement reported 1.0 percent of LFL. (Combustible gas meter).
	Criticality	All analyses were well below 42 μCi/g total alpha (within 95 percent confidence limit on each sample).
	TOC	Three samples exceeded 30,000 μg/g. However, the carbon measured is not associated with reactive compounds and does not indicate a safety concern.
Hazardous vapor	Toxicity	This issue has been resolved.
Organic solvents	Solvent pool size	Total nonmethane hydrocarbon was not measured. The size of the organic solvent pool will be estimated from vapor results obtained.

3.0 BEST-BASIS STANDARD 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 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 (Agnew et al. 1997a). 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 source terms for the various waste management activities (Hodgson and LeClair 1996). As part of this effort, an evaluation of available chemical information for tank 241-BY-112 was performed including the following.

- Data from recent analyses of two push-mode core samples collected in October 1996 (see Appendix B)
- An inventory estimate generated by the Hanford Defined Waste (HDW) model (Agnew et al. 1997a)
- Evaluation of BY saltcake data from other BY Tank Farm tanks

Based on this evaluation, a best-basis inventory was developed for tank 241-BY-112. For the following reasons, the sampling-based inventory was chosen as the best basis for those analytes for which sampling-based analytical values were available:

- The sample-based inventory analytical concentrations compared favorably to those of other BY evaporator tanks with the ITS1 unit or direct outsource tanks. Except for noted exceptions, there were good comparisons to all BY farm tanks.
- No methodology is available to fully predict BY saltcake from process flowsheet or historical records.
- Waste transfer records are not complete and not always accurate.

For those few analytes for which no values could be calculated from the sample-based inventory, the engineering evaluation data or the HDW model values were used. These values are less reliable than the values for which sample data are available.

Based on this evaluation, a best-basis inventory was developed for tank 241-BY-112. When the sample-based inventory had a high less-than value or was not measured, the engineering assessment-based values were used (if applicable). Some high less than values are reported because all three tanks used in the engineering assessment had high less than values. Results for radionuclides were not available for the sample-based inventory. The best basis radionuclide values were either engineering assessment values based on the heat load of tank 241-BY-112 from Kummerer (1995) or HDW values. The HDW model was used only where no other data were available. Tables 3-1 and 3-2 show the best-basis inventory for tank 241-BY-112.

Once the best-basis inventories were determined, the hydroxide inventory was calculated by performing a charge balance with the valences of other analytes. In some cases, this approach required that other analyte (for example, sodium or nitrate) inventories be adjusted to achieve the charge balance. During such adjustments, significant figures are retained. No such adjustments were necessary in this tank. This charge balance approach is consistent with that used by (Agnew et al. 1997a).

Best-basis tank inventory values were derived for 46 key radionuclides (defined in Kupfer et al. 1997). The radionuclides were decayed to a common report date of January 1, 1994. Often, waste sample analyses reported only ^{90}Sr, ^{137}Cs, $^{239/40}$Pu, and total uranium, or (total beta and total alpha) while other key radionuclides such as ^{60}Co, ^{99}Tc, ^{129}I, ^{154}Eu, ^{155}Eu, and ^{241}Am were reported infrequently. For this reason, it was necessary to derive most of the 46 key radionuclides by computer models. These models estimated radionuclide activity in batches of reactor fuel, accounted for the split of radionuclides to various separations plant waste streams, and tracked their movement with tank waste transactions. (These computer models are described in Kupfer et al. 1997 (Section 6.1) and Watrous and Wootan 1997.) Model generated values for radionuclides in any of 177 tanks were reported in Agnew et al. 1997. The best-basis value for any one analyte may be either a model result or a sample or engineering assessment-based result if available. (No attempt was made to ratio or normalize model results for all 46 radionuclides when values for measured nuclides disagreed with the model.) For a discussion of typical error between model derived values and sample derived values, see Kupfer et al. (1997).

Table 3-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-BY-112 (Effective May 31, 1997). (2 sheets)

Analyte	Total inventory (kg)	Basis (S, M, E, or C)[1]	Comment
Al	31,000	S	---
Bi	<3,270	S	---
Ca	<3,270	S	---
Cl	2,110	S	---
TIC as CO_3	326,000	S	---
Cr	28,400	S	High throughout tank
F	15,100	S	---
Fe	4,760	S	---
Hg	7.79	M	---
K	2,740	E	Used average concentration from other tanks in BY Farm
La	0.304	M	---
Mn	<469	S	---
Na	543,000	S	---
Ni	7,750	E	Used average concentration from other tanks in BY Farm. May be too high as no actual data for ITS tanks.
NO_2	37,000	S	---
NO_3	124,000	S	---
OH_{TOTAL}	209,000	C	Calculated from charge balance
Pb	<3,270	S	---
PO_4	26,700	S	---
Si	3,910	S	---
SO_4	40,400	S	---
Sr	<327	S	---

Table 3-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-BY-112 (Effective May 31, 1997). (2 sheets)

Analyte	Total inventory (kg)	Basis (S, M, E, or C)[1]	Comment
TOC	13,600	S	---
U_{TOTAL}	<16,500	S	---
Zr	<327	S	---

Notes:

TIC = total inorganic carbon

[1]S = sample-based, M = HDW model-based, and E = engineering assessment-based, C = calculated by charge balance; includes oxides as hydroxides, not including CO_3, NO_3, NO_2, PO_4, SO_4 and SiO_3

Table 3-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-BY-112 Decayed to January 1, 1994 (Effective May 31, 1997). (3 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	140	M	
^{14}C	36.4	M	
^{59}Ni	3.97	M	
^{60}Co	34.1	M	
^{63}Ni	394	M	
^{79}Se	3.06	M	
^{90}Sr	133,000	E	HDW estimate was 144,000
^{90}Y	133,000	E	Based on ^{90}Sr
^{93}Zr	14.7	M	
^{93m}Nb	10.7	M	
^{99}Tc	203	M	
^{106}Ru	0.00680	M	
^{113m}Cd	78.1	M	

Table 3-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-BY-112 Decayed to January 1, 1994 (Effective May 31, 1997). (3 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{125}Sb	153	M	
^{126}Sn	4.57	M	
^{129}I	0.393	M	
^{134}Cs	1.66	M	
^{137}Cs	189,000	E	HDW estimate was 170,000
^{137m}Ba	179,000	E	From ^{137}Cs
^{151}Sm	10,600	M	
^{152}Eu	4.81	M	
^{154}Eu	575	M	
^{155}Eu	291	M	
^{226}Ra	1.48E-04	M	
^{227}Ac	0.00208	M	
^{228}Ra	1.82	M	
^{229}Th	0.0420	M	
^{231}Pa	0.0107	M	
^{232}Th	0.0673	M	
^{232}U	10.2	M	
^{233}U	38.9	M	
^{234}U	3.79	M	
^{235}U	0.149	M	
^{236}U	0.0983	M	
^{237}Np	0.680	M	
^{238}Pu	2.71	M	
^{238}U	6.82	M	
^{239}Pu	97.2	M	

Table 3-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-BY-112 Decayed to January 1, 1994 (Effective May 31, 1997). (3 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{240}Pu	16.7	M	
^{241}Am	47.7	M	
^{241}Pu	196	M	
^{242}Cm	8.81E-04	M	
^{242}Pu	9.42E-04	M	
^{243}Am	0.00165	M	
^{243}Cm	1.80E-05	M	
^{244}Cm	2.21E-04	M	

Note:

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

4.0 RECOMMENDATIONS

The TOC and DSC exceeded safety notification limits. However, the carbon is not associated with reactive compounds, and the DSC results were an artifact of the heterogeneity of the material. Headspace flammable gas measurements were less than 1 percent of the LFL. Therefore, the tank can be classified as "safe." Vapor samples were analyzed in accordance with the hazardous screening DQO. All analytes were below toxicity threshold limits. Vapor measurement also showed that the organic pool size is well below levels of concern for the organic solvents issue. The sampling and analysis activities performed for tank 241-BY-112 have met all requirements for the applicable DQOs.

Table 4-1 summarizes the status of the Project Hanford Management Contract (PHMC) TWRS Program Office review and acceptance of the sampling and analysis results reported in this tank characterization report. Column 1 lists all DQO issues required to be addressed by sampling and analysis. Column 2 indicates whether the requirements of the DQO were met by the sampling and analysis activities performed and is answered with a "yes" or a "no." Column 3 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 3 indicates acceptance or disapproval of the sampling and analysis information in the TCR.

Table 4-1. Acceptance of Tank 241-BY-112 Sampling and Analysis.

Issue	Evaluation Performed	Program[1] Acceptance
Safety screening DQO	Yes	Yes
Hazardous vapor screening DQO	Yes	Issue Resolved
Organic solvents	Yes	Yes

Note:

[1]PHMC TWRS Program Office

Table 4-2 summarizes the status of PHMC TWRS Program review and acceptance of the evaluations and other characterization information in this report. The evaluations specifically outlined in this report are the best-basis inventory evaluation and the evaluation to determine whether the tank is safe, conditionally safe, or unsafe. Column 1 lists the different evaluations performed in this report. Columns 2 and 3 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.

Table 4-2. Acceptance of Evaluation of Characterization Data and Information for Tank 241-BY-112.

Issue	Evaluation Performed	TWRS[1] Program Acceptance
Safety categorization - Safe	Yes	Yes
Hazardous vapor screening DQO	Yes	Issue resolved
Organic solvents	No	Not decided

Note:

[1]PHMC TWRS Program Office

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APPENDIX A

HISTORICAL TANK INFORMATION

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APPENDIX A

HISTORICAL TANK INFORMATION

Appendix A describes tank 241-BY-112 based on historical information. Historical information includes any information about the fill history, waste types, surveillance, or modeling data about the tank. This information is necessary to provide a balanced assessment of the sampling and analytical results.

This appendix contains the following information:

- **Section A1.0**: Current status of the tank, including the current waste levels, and the stabilization and isolation status of the tank.
- **Section A2.0**: Information about the tank design.
- **Section A3.0**: Process knowledge about the tank, that is, the waste transfer history and the estimated contents of the tank based on modeling data.
- **Section A4.0**: Surveillance data for tank 241-BY-112, including surface-level readings, temperatures, and a description of the waste surface based on photographs.
- **Section A5.0**: References for Appendix A.

A1.0 CURRENT TANK STATUS

As of April 30, 1997, tank 241-BY-112 contained an estimated 1,100 kL (291 kgal) of waste classified as noncomplexed (Hanlon 1997). The solid waste volumes were estimated using a manual tape. The solid waste volume was last updated on April 28, 1982. Table A1-1 shows the amounts of various waste phases in the tank.

Tank 241-BY-112 is out of service as are all single-shell tanks. The tank was removed from the Ferrocyanide Watch List in September 1996. This tank is categorized as sound with interim stabilization and intrusion prevention completed (Hanlon 1997). The tank is passively ventilated. All monitoring systems were in compliance with documented standards as of April 30, 1997 (Hanlon 1997).

Table A1-1. Tank Contents Status Summary[1].

Waste Type	kL (kgal)
Total waste	1,100 (291)
Supernatant liquid	0 (0)
Sludge	20 (5)
Saltcake	1,080 (286)
Drainable interstitial liquid	30 (8)
Drainable liquid remaining	30 (8)
Pumpable liquid remaining	0 (0)

Note:

[1]Hanlon (1997)

A2.0 TANK DESIGN AND BACKGROUND

The 241-BY Tank Farm was constructed from 1948 to 1949 in the 200 East Area of the Hanford Site. The tank farm contains twelve 100 series tanks. These tanks have a capacity of 2,870 kL (758 kgal) and a diameter of 23 m (75 ft). Built according to the second generation design, the 241-BY Tank Farm was designed for nonboiling waste with a maximum fluid temperature of 104 °C (220 °F) (Leach and Stahl 1993). A cascade line 75 mm (3 in.) in diameter connects 241-BY-112 as last in a cascade series of three tanks beginning with tank 241-BY-110 (Hanlon 1997). Each tank in the cascade series is set 1 ft lower in elevation than the preceding tank.

The tank has a dished bottom with a 1.2-m (4-ft) radius knuckle. Tank 241-BY-112 was designed with a primary mild steel liner (ASTM A283 Grade C) and a concrete dome with a number of risers. The tank is set on a reinforced concrete foundation. Three-ply asphalt waterproofing was applied over the foundation and steel tank. Two coats of primer were sprayed on all exposed interior tank surfaces. The tank ceiling dome was covered with three applications of magnesium zinc fluorosilicate wash. Lead flashing was used to protect the joint where the steel liner meets the concrete dome. Asbestos gaskets were used to seal the risers in the tank dome. The tank was waterproofed on the sides and top with tar and welded wire reinforced gunite (Rutherford 1948).

Tank 241-BY-112 has 24 risers according to the drawings and engineering change notices. The risers range in diameter from 100 mm (4 in.) to 1.1 m (42 in.). Table A2-1 shows numbers, diameters, and descriptions of the risers and the inlet and spare nozzles.

Table A2-1. Tank 241-BY-112 Risers.[1,2,3,4] (2 sheets)

Number	Diameter (in.)	Description and Comments
1	4	Breather filter, G1 housing
2	4	Thermocouple tree
3	4	Pit drain, weather covered
4	4	Flange, below grade
5	4	Flange, spare
6	12	Not usable, weather covered
7	12	Salt well pump and screen, weather covered
8	12	Not usable, weather covered
9	42	Cover plate, weather covered
10	42	Adapter plate
10A[4]	12[5]	Observation port
10B[4]	4[5]	Flange
11	42	Condenser, weather covered
12	42	Adapter plate, weather covered
12A	4	Blind flange
13	42	Electric heater and air circulator, weather covered
14	6	Flange, weather covered
15	6	B-436 Liquid observation well
16	6	Blind flange and 24 in. I.D. caisson cover
17	4	Spare
18[4]	4	Flange, spare [bench marked CEO-36923, December 12, 1986]
19	4	Liquid-level reel
20[4]	4	Flange
21[4]	4	Spare
N1	3	Spare
N2	3	Spare

Table A2-1. Tank 241-BY-112 Risers.[1, 2, 3, 4] (2 sheets)

Number	Diameter (in.)	Description and Comments
N3	3	Spare
N4	3	Spare
N5	3	Inlet

Notes:

[1]Alstad (1993)

[2]Tran (1993)

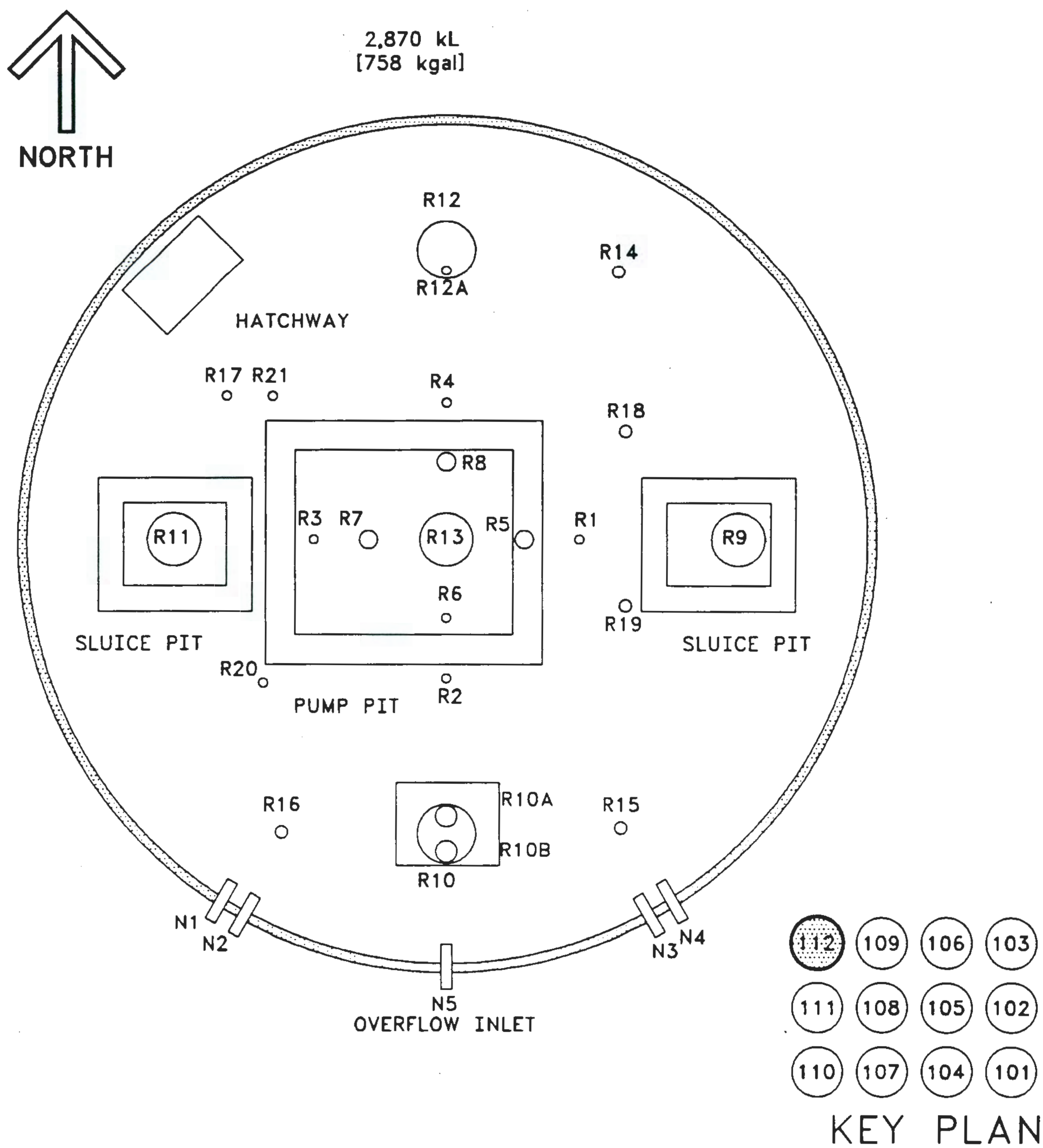
[3]Drawing H-2-73256 (Vitro 1986)

[4]Denotes risers tentatively available for sampling (Lipnicki 1997)

[5]Risers 10A and 10B are on opposite sides of riser 10 than is listed on the drawing; also both were listed as 12 in. diameter in Lipnicki (1997) and Alstad (1993).

Figure A2-1 shows the riser and nozzle configuration. Risers 18, 20, and 21 (100 mm [4 in.] in diameter), and riser 10A (300 mm [12 in.] in diameter) are available for sampling (Lipnicki 1997). Figure A2-2 is a cross section showing the approximate waste level and a schematic of the tank equipment.

Figure A2-1. Riser Configuration for Tank 241-BY-112.



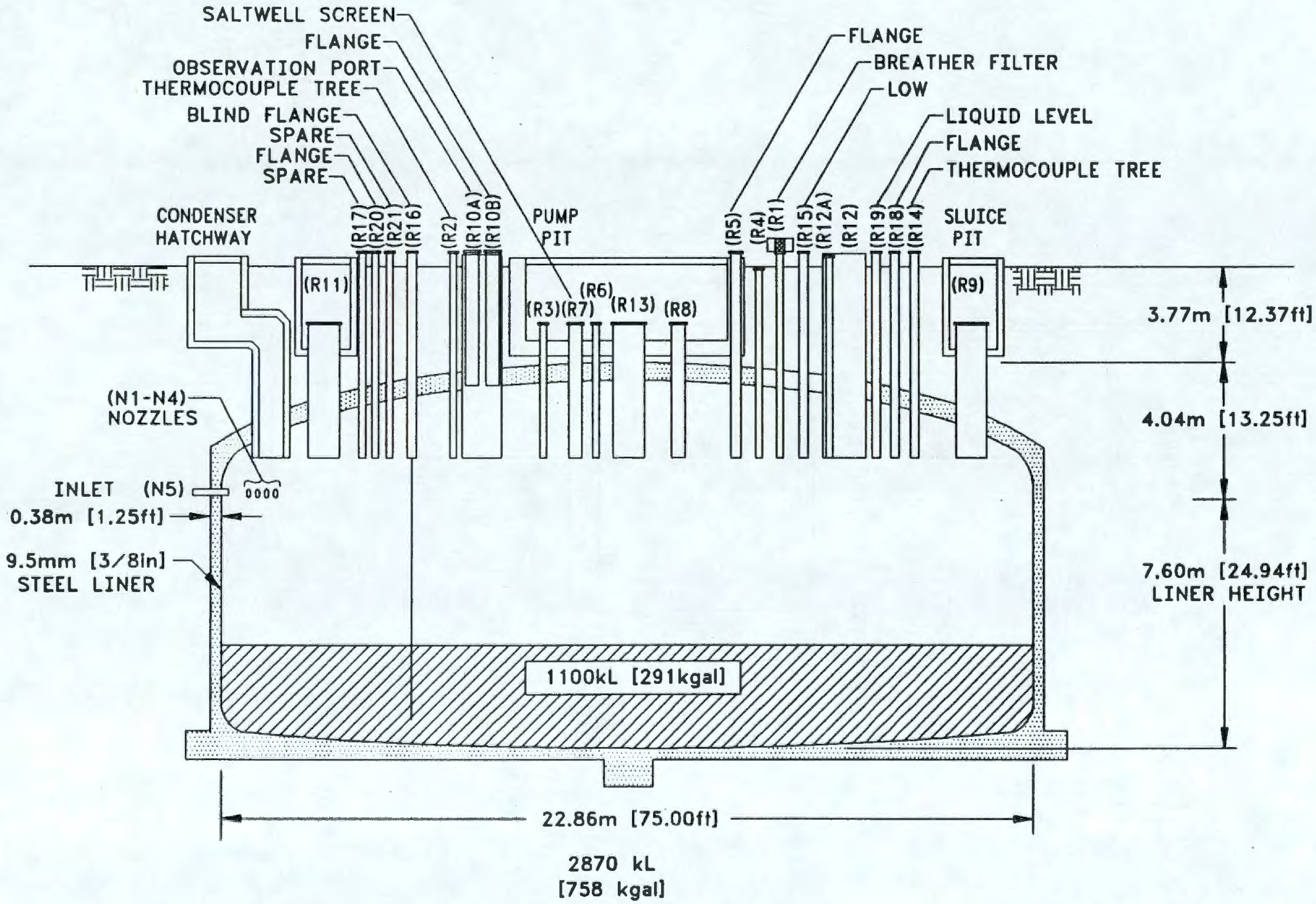


Figure A2-2. Tank 241-BY-112 Cross Section and Schematic.

A3.0 PROCESS KNOWLEDGE

The sections below 1) provide information about the history of the major waste transfers that involved tank 241-BY-112, 2) describe the process wastes that were transferred, and 3) estimate the current tank contents based on the waste transfer history.

A3.1 WASTE TRANSFER HISTORY

Table A3-1 summarizes the waste transfer history of tank 241-BY-112 (Agnew et al. 1997b). Tank 241-BY-112 first received metal waste from B Plant during the second quarter of 1951. During the first and fourth quarters of 1952, the tank received metal waste through the cascade from tank 241-BY-111. During the second, third, and fourth quarters of 1952, tank 241-BY-112 again received metal waste from B Plant.

Metal waste sludge was sent to tank 241-BY-111 during the first quarter of 1955. In the second quarter of 1955, the tank received metal waste from B plant. During 1956, tank 241-BY-112 received supernatant from tanks 241-BY-106, 241-BY-107, and 241-BY-108. Ferrocyanide sludge was received during the second quarter of 1957, and supernatant was sent to the B-028 and B-029 cribs. During the third and fourth quarters of 1957, tank 241-BY-112 received supernatant from tank 241-C-105.

The tank remained static until the second and third quarters of 1965 when supernatant was sent to tanks 241-BY-109, 241-BY-101, and 241-BY-103. The tank received supernatant from tanks 241-C-102 and tank 241-BY-111 from the third quarter of 1965 to the third quarter of 1966. During the fourth quarter of 1967, tank 241-BY-112 received cladding waste from PUREX.

In 1966, a heater was placed in the tank to cause evaporation (ITS2). During late 1967 and early 1968, tank 241-BY-112 received waste from tanks 241-C-110 and 241-B-102. From the first quarter of 1968 to the second quarter of 1996, the tank received waste from the first in-tank solidification unit (ITS1) tank 241-BY-102 as well as tanks 241-BY-111, 241-BY-108, 241-BY-109, 241-BY-110, 241-BY-107, 241-BY-105, 241-BY-106, 241-BY-103, 241-BY-104, 241-B-106, 241-BY-102, 241-B-111, 241-BX-110, 241-BX-111, 241-B-112, 241-B-101, 241-B-105. During this same time, waste was transferred from the tank to tanks 241-B-110, 241-BX-101, 241-BX-104, 241-BY-111, 241-C-102, 241-BY-108, 241-BY-109, 241-B-111, 241-BY-110, 241-BY-107, 241-BY-104, 241-BY-106, 241-B-111, 241-BY-105, 241-BY-102, 241-B-105, 241-BX-110, 241-BY-103, 241-B-112, 241-B-101, 241-BX-106, 241-B-109 and 241-BY-105.

Table A3-1 lists the estimated amount of liquid evaporated during the ITS process from 1968 to 1975.

Interstitial liquor was salt well pumped to tank 241-AW-102 in the third quarter of 1982.

Table A3-1. Tank 241-BY-112 Major Waste Transfers.[1, 2] (3 sheets)

Transfer Source	Transfer Destination	Waste Type	Time Period	Estimated Waste Volume	
				kL	kgal
B Plant		MW1 and MW2	1951-1952	477	126
241-BY-111		MW2	1952	988	261
	241-BY-111	SL	1955	-1,480	-390
B Plant		MW	1955	8	2
241-BY-106 241-BY-107 241-BY-108		SU	1956	2,640	698
U Plant		PFeCN2	1957	651	172
	Cribs B-028, B-029	SU	1957	-2,590	-685
241-C-105		SU	1957	2,173	574
	241-BY-109 241-BY-101 241-BY-103	SU	1965	-2,770	-732
241-C-102 241-BY-111		SU	1965, 1966	2,730	721
PUREX		CWP2	1967	20	4
Cell 23		EVAP	1967, 1968	2,820	746
241-BY-102		CW	1968	12,530	3,311
	241-B-110 241-BX-101 241-BX-104 241-C-102	CW	1968	-3,202	-846
241-BY-108		SU	1968-1971	3,510	926
	241-BY-108	EB	1968-1971	-2,650	-700
	Evaporated	BYCOND	1968-1975	-93,830	-24,790
241-BY-111 241-BY-109		SU	1968-1976	75,049	19,826
	241-BY-111 241-BY-109	EB	1968-1976	-25,038	-6,614
	241-B-111	EB	1969, 1970	-350	-92
241-BY-107		SU	1969-1974	3,600	952
	241-BY-107	EB	1969-1974	-784	-207

Table A3-1. Tank 241-BY-112 Major Waste Transfers.[1,2] (3 sheets)

Transfer Source	Transfer Destination	Waste Type	Time Period	Estimated Waste Volume	
				kL	kgal
241-BY-110		SU	1969-1976	3,770	996
	241-BY-110	EB	1969-1976	-1 810	-479
241-BY-104 241-BY-105 241-BY-106		SU	1970-1974	18,630	4,923
	241-BY-104 241-BY-105 241-BY-106	EB	1970-1974	-3,440	-910
241-B-106		BNW	1971, 1972	140	38
241-BY-103		SU	1971-1973	9,285	2,453
	241-BY-103	EB	1971-1973	-95	-25
241-BY-102 241-BX-111		SU	1971-1974	1,518	401
	241-BY-102 241-BX-111	EB	1971-1974	-2,680	-709
241-B-111 241-B-112		EB, IX	1972	130	34
	241-B-105	EB	1972, 1973	-939	-248
241-BX-110		EB	1972-1973	2,250	595
	241-BX-110	SU	1972-1973	-190	-50
	241-B-112	EB	1973	-965	-255
	241-B-101	SU	1974	-270	-72
241-B-101		SU	1974, 1976	462	122
	241-BX-106	SU	1974, 1975, 1976	-829	-219
241-B-105		SU	1975	749	198

Table A3-1. Tank 241-BY-112 Major Waste Transfers.[1, 2] (3 sheets)

Transfer Source	Transfer Destination	Waste Type	Time Period	Estimated Waste Volume	
				kL	kgal
	241-BX-105 241-B-109	SU	1975, 1976	-1,510	-400
Misc. Sources		Water	1971,1974, 1975	2,210	560
	241-AW-102	EVAP	1982	-72	-19

Notes:

BNW = Battelle Northwest Laboratory waste

BYCOND = Liquid condensed by in-tank evaporators and sent to cribs

CW = Cladding waste

CWP2 = Cladding waste from PUREX

EB = Evaporator bottoms

EVAP = Evaporator feed waste

IX = Ion exchange waste

MW = Metal waste from the bismuth phosphate process (which extracted plutonium) containing all of the uranium, approximately 90 percent of the original fission product activity, and approximately 1 percent of the product. "Metal" was the code word for plutonium.

PFeCN2 = Ferrocyanide sludge produced by scavenging uranium recovery supernatant.

SL = Sludge

SU = Supernatant

[1]Agnew et al. (1997)

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

A3.2 HISTORICAL ESTIMATION OF TANK CONTENTS

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

- *Waste Status and Transaction Record Summary for the Northeast Quadrant* (WSTRS) (Agnew et al. 1997b). WSTRS is a tank-by-tank quarterly summary spreadsheet of waste transactions.

- *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 4* (Agnew et al. 1997a) This document contains the Hanford defined waste (HDW) list, the supernatant mixing model (SMM), and the tank layer model (TLM).

- *Historical Tank Content Estimate for the Northeast Quadrant of the Hanford 200 East Area* (HTCE) (Brevick et al. 1996). This document compiles and summarizes much of the process history, design, and technical information regarding the underground waste storage tanks in the northeast quadrant of the 200 areas.

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

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

Using these records, the TLM defines the sludge and saltcake layers in each tank. The SMM uses information from both the 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 SMM, tank 241-BY-112 contains a top layer of 1,071 kL (283 kgal) BY saltcake above a layer of 27 kL (6 kgal) ferrocyanide sludge (PFeCN2) over a bottom layer of 7.6 kL (2 kgal) of MW. Figure A3-1 is a graph representing the estimated waste type and volume for each waste layer.

The MW (bottom waste layer) should contain, from highest concentration above one weight percent, the following major 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 PFeCN2 layer is estimated to contain, from highest concentration above one weight percent, the following constituents: nitrate, sodium, bismuth, hydroxide, iron, phosphate, uranium, ferrocyanate, carbonate, and sulfate. Constituents contained in this layer above a tenth of a weight percent are calcium, nitrite, nickel, fluoride, chloride, and silicate.

The BY saltcake layer is estimated to contain, from highest concentration above one weight percent, the following constituents: nitrate, sodium, hydroxide, nitrite, aluminum, carbonate, and sulfate. Constituents contained in this layer above a tenth of a weight percent are phosphate, uranium, dibutyl phosphate, citrate, chloride, calcium, chromium, silicate, acetate, and butanol. Table A3-2 shows an estimate of the expected waste constituents and their concentrations.

Figure A3-1. Tank Layer Model.

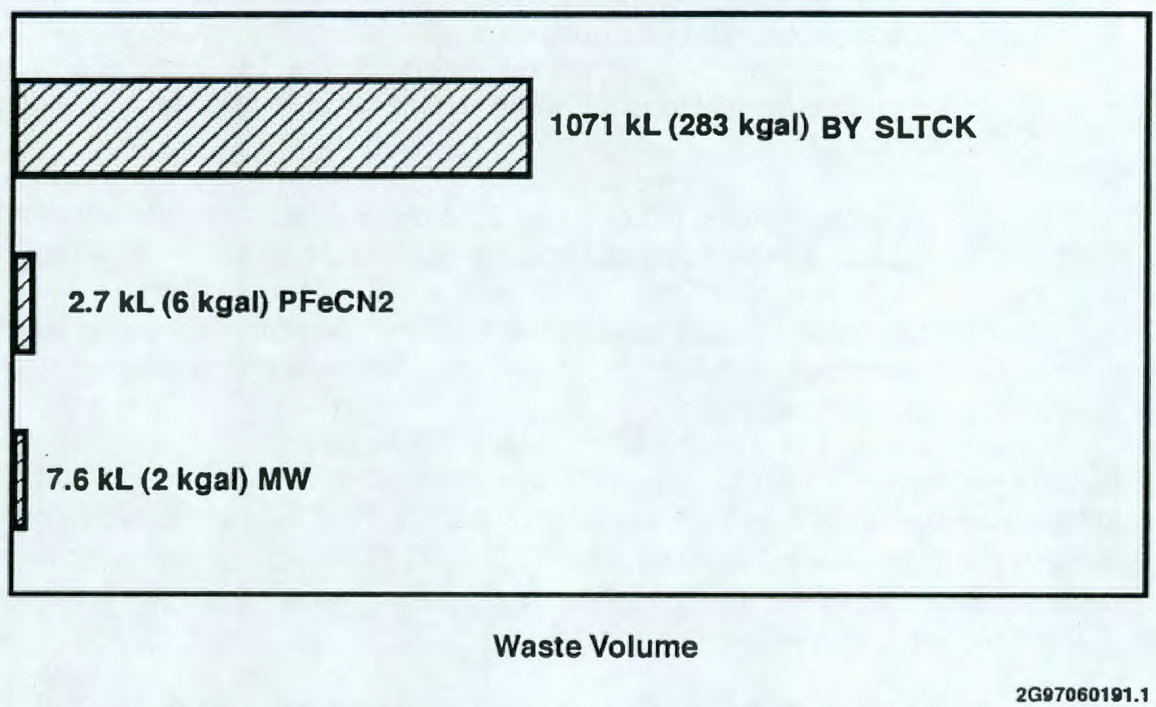


Table A3-2. Historical Tank Inventory Estimate. (6 sheets)

Total Inventory Estimate[1]							
Physical Properties				**-95 CI**	**-67 CI**	**+67 CI**	**+95 CI**
Total waste	1.80E+06 (kg)	(291 kgal)	---	---	---	---	---
Heat load	1.77 (kW)	---	---	1.13	1.49	1.96	2.06
Bulk density	1.63 (g/cm^3)	---	---	1.33	1.48	1.75	1.87
Water wt%[2, 3]	36.1	---	---	16.9	26.3	49.0	60.5
TOC wt% carbon	0.440	---	---	0.348	0.420	0.466	0.475
Chemical Constituents	**mole/L**	**μg/g**	**kg**	**-95 CI (mole/L)**	**-67 CI (mole/L)**	**+67 CI (mole/L)**	**+95 CI (mole/L)**
Na^+	13.0	1.83E+05	3.30E+05	6.89	9.80	15.6	18.5
Al^{3+}	2.06	3.39E+04	6.11E+04	0.886	1.27	3.01	3.92
Fe^{3+} (total Fe)	4.18E-02	1.43E+03	2.57E+03	3.23E-02	3.69E-02	4.66E-02	5.13E-02
Cr^{3+}	5.35E-02	1.70E+03	3.07E+03	4.27E-02	4.84E-02	5.56E-02	5.76E-02
Bi^{3+}	6.75E-03	864	1.55E+03	6.36E-03	6.55E-03	6.95E-03	7.14E-03
La^{3+}	1.99E-06	0.169	0.304	1.65E-06	1.86E-06	2.07E-06	2.03E-06
Hg^{2+}	3.52E-05	4.33	7.79	3.17E-05	3.34E-05	3.70E-05	3.88E-05
Zr (as $ZrO(OH)_2$)	3.30E-05	1.84	3.32	2.72E-05	3.01E-05	3.42E-05	3.42E-05
Pb^{2+}	5.52E-03	700	1.26E+03	3.00E-03	4.23E-03	6.80E-03	8.03E-03
Ni^{2+}	1.58E-02	569	1.02E+03	1.13E-02	1.37E-02	1.69E-02	1.70E-02

Table A3-2. Historical Tank Inventory Estimate. (6 sheets)

Total Inventory Estimate[1]							
Chemical Constituents (Cont'd)	mole/L	μg/g	kg	-95 CI (mole/L)	-67 CI (mole/L)	+67 (mole/L)	+95 CI (mole/L)
Sr^{2+}	0	0	0	0	0	0	0
Mn^{4+}	3.15E-03	106	191	2.32E-03	2.73E-03	3.58E-03	3.98E-03
Ca^{2+}	7.77E-02	1.91E+03	3.43E+03	5.03E-02	6.37E-02	9.14E-02	0.104
K+	3.89E-02	932	1.68E+03	2.82E-02	3.41E-02	4.30E-02	4.01E-02
OH^-	9.63	1.00E+05	1.80E+05	4.70	6.42	13.5	17.1
NO_3^-	6.58	2.50E+05	4.50E+05	3.01	4.85	7.69	8.72
NO_2^-	1.65	4.65E+04	8.37E+04	0.965	1.33	1.89	2.63
CO_3^{2-}	0.510	1.87E+04	3.37E+04	0.358	0.406	0.613	0.668
PO_4^{3-}	7.68E-02	4.46E+03	8.03E+03	6.50E-02	7.31E-02	7.83E-02	8.21E-02
SO_4^{2-}	0.190	1.12E+04	2.01E+04	0.110	0.151	0.224	0.313
Si (as SiO_3^{2-})	7.58E-02	1.30E+03	2.35E+03	4.54E-02	6.18E-02	8.74E-02	9.63E-02
F^-	5.64E-02	657	1.18E+03	4.85E-02	5.33E-02	6.39E-02	8.70E-02
Cl^-	0.129	2.79E+03	5.03E+03	6.96E-02	9.86E-02	0.135	0.135
$C_6H_5O_7^{3-}$	2.32E-02	2.69E+03	4.84E+03	1.92E-02	2.26E-02	2.37E-02	2.37E-02
$EDTA^{4-}$	5.22E-03	920	1.66E+03	4.60E-03	5.03E-03	5.31E-03	5.33E-03
$HEDTA^{3-}$	7.04E-04	118	213	2.13E-04	4.79E-04	8.85E-04	9.00E-04
$glycolate^-$	1.64E-02	752	1.35E+03	8.28E-03	1.28E-02	1.92E-02	1.87E-02
$acetate^-$	3.10E-02	1.12E+03	2.02E+03	2.70E-02	3.06E-02	3.13E-02	3.17E-02
$oxalate^{2-}$	2.61E-06	0.140	0.253	1.91E-06	2.37E-06	2.84E-06	2.98E-06

Table A3-2. Historical Tank Inventory Estimate. (6 sheets)

Total Inventory Estimate[1]							
Chemical Constituents (Cont'd)	**mole/L**	**μg/g**	**kg**	**-95 CI (mole/L)**	**-67 CI (mole/L)**	**+67 CI (mole/L)**	**+95 CI (mole/L)**
DBP	2.47E-02	3.18E+03	5.72E+03	2.13E-02	2.36E-02	2.53E-02	2.52E-02
Butanol	2.47E-02	1.12E+03	2.02E+03	2.13E-02	2.36E-02	2.53E-02	2.52E-02
NH_3	1.92E-02	199	359	1.25E-02	1.54E-02	2.31E-02	2.45E-02
$Fe(CN)_6^{4-}$	1.61E-03	267	480	1.61E-03	1.61E-03	1.61E-03	1.61E-03
Radiological Constituents	**Ci/L**	**μCi/g**	**Ci**	**-95 CI (Ci/L)**	**-67 CI (Ci/L)**	**+67 CI (Ci/L)**	**+95 CI (Ci/L)**
^{3}H	1.27E-04	7.77E-02	140	6.09E-08	6.09E-08	1.28E-04	1.30E-04
^{14}C	3.31E-05	2.02E-02	36.4	2.63E-08	2.63E-08	3.43E-05	3.54E-05
^{59}Ni	3.61E-06	2.21E-03	3.97	8.31E-08	8.31E-08	3.76E-06	3.91E-06
^{63}Ni	3.57E-04	0.219	394	7.49E-06	7.49E-06	3.73E-04	3.87E-04
^{60}Co	3.09E-05	1.89E-02	34.1	2.05E-09	2.05E-09	3.12E-05	3.16E-05
^{79}Se	2.77E-06	1.70E-03	3.06	2.08E-09	2.08E-09	3.40E-06	3.98E-06
^{90}Sr	0.131	80.1	1.44E+05	0.104	0.123	0.139	0.146
^{90}Y	0.131	80.1	1.44E+05	7.01E-03	7.01E-03	0.139	0.146
^{93}Zr	1.34E-05	8.20E-03	14.7	9.88E-09	9.88E-09	1.65E-05	1.93E-05
^{93m}Nb	9.68E-06	5.93E-03	10.7	8.38E-09	8.38E-09	1.19E-05	1.38E-05
^{99}Tc	1.84E-04	0.113	203	9.50E-05	1.44E-04	2.15E-04	2.10E-04
^{106}Ru	6.17E-09	3.78E-06	6.80E-03	7.26E-16	7.26E-16	6.74E-09	7.21E-09
^{113m}Cd	7.09E-05	4.34E-02	78.1	2.32E-08	2.32E-08	8.95E-05	1.06E-04
^{125}Sb	1.39E-04	8.49E-02	153	1.77E-09	1.77E-09	1.40E-04	1.41E-04

Table A3-2. Historical Tank Inventory Estimate. (6 sheets)

Total Inventory Estimate[1]							
Radiological Constituents (Cont'd)	**Ci/L**	**μCi/g**	**Ci**	**-95 CI (Ci/L)**	**-67 CI (Ci/L)**	**+67 CI (Ci/L)**	**+95 CI (Ci/L)**
^{126}Sn	4.15E-06	2.54E-03	4.57	3.12E-09	3.12E-09	5.08E-06	5.96E-06
^{129}I	3.57E-07	2.18E-04	0.393	1.84E-07	2.79E-07	4.17E-07	4.06E-07
^{134}Cs	1.51E-06	9.23E-04	1.66	6.50E-10	6.50E-10	1.51E-06	1.53E-06
^{137}Cs	0.154	94.4	1.70E+05	6.96E-02	0.111	0.181	0.194
^{137m}Ba	0.146	89.3	1.61E+05	7.55E-03	7.55E-03	0.147	0.148
^{151}Sm	9.60E-03	5.88	1.06E+04	7.77E-06	7.77E-06	1.18E-02	1.37E-02
^{152}Eu	4.36E-06	2.67E-03	4.81	1.36E-08	1.36E-08	4.37E-06	4.39E-06
^{154}Eu	5.22E-04	0.320	575	3.54E-08	3.54E-08	6.77E-04	6.50E-04
^{155}Eu	2.65E-04	0.162	291	1.06E-06	1.06E-06	2.65E-04	2.66E-04
^{226}Ra	1.35E-10	8.24E-08	1.48E-04	1.38E-12	1.38E-12	1.70E-10	2.00E-10
^{228}Ra	1.65E-06	1.01E-03	1.82	5.61E-17	5.61E-17	1.67E-06	1.68E-06
^{227}Ac	1.89E-09	1.16E-06	2.08E-03	4.57E-12	4.57E-12	2.51E-09	3.09E-09
^{231}Pa	9.73E-09	5.96E-06	1.07E-02	7.00E-12	7.00E-12	1.28E-08	1.57E-08
^{229}Th	3.82E-08	2.34E-05	4.20E-02	1.09E-14	1.09E-14	3.85E-08	3.88E-08
^{232}Th	6.11E-08	3.74E-05	6.73E-02	2.87E-18	2.87E-18	7.78E-08	9.39E-08
^{232}U	9.22E-06	5.64E-03	10.2	4.15E-06	6.72E-06	1.21E-05	1.52E-05
^{233}U	3.53E-05	2.16E-02	38.9	1.59E-05	2.57E-05	4.65E-05	5.83E-05

Table A3-2. Historical Tank Inventory Estimate. (6 sheets)

Total Inventory Estimate[1]							
Radiological Constituents (Cont'd)	**Ci/L**	**µCi/g**	**CI**	**-95 CI (Ci/L)**	**-67 CI (Ci/L)**	**+67 CI (Ci/L)**	**+95 CI (Ci/L)**
^{234}U	3.45E-06	2.11E-03	3.79	2.87E-06	3.33E-06	3.56E-06	3.66E-06
^{235}U	1.35E-07	8.27E-05	0.149	1.17E-07	1.31E-07	1.40E-07	1.44E-07
^{236}U	8.92E-08	5.46E-05	9.83E-02	7.48E-08	8.52E-08	9.33E-08	9.73E-08
^{238}U	6.19E-06	3.79E-03	6.82	5.68E-06	6.09E-06	6.29E-06	6.39E-06
^{237}Np	6.18E-07	3.78E-04	0.680	3.35E-07	4.92E-07	7.17E-07	6.94E-07
^{238}Pu	2.46E-06	1.51E-03	2.71	1.10E-06	1.78E-06	3.15E-06	3.82E-06
^{239}Pu	8.83E-05	5.40E-02	97.2	4.25E-05	6.57E-05	1.11E-04	1.32E-04
^{240}Pu	1.51E-05	9.26E-03	16.7	7.13E-06	1.11E-05	1.91E-05	2.30E-05
^{241}Pu	1.78E-04	0.109	196	7.94E-05	1.28E-04	2.27E-04	2.75E-04
^{242}Pu	8.55E-10	5.23E-07	9.42E-04	3.84E-10	6.16E-10	1.09E-09	1.33E-09
^{241}Am	4.33E-05	2.65E-02	47.7	1.51E-05	2.89E-05	5.70E-05	6.76E-05
^{243}Am	1.50E-09	9.17E-07	1.65E-03	4.62E-10	9.57E-10	2.04E-09	2.48E-09
^{242}Cm	8.00E-10	4.89E-07	8.81E-04	2.42E-10	2.42E-10	8.05E-10	8.10E-10
^{243}Cm	1.63E-11	1.00E-08	1.80E-05	4.96E-12	4.96E-12	1.64E-11	1.66E-11
^{244}Cm	2.01E-10	1.23E-07	2.21E-04	2.43E-12	2.43E-12	2.02E-10	2.03E-10

Table A3-2. Historical Tank Inventory Estimate. (6 sheets)

Total Inventory Estimate[1]							
Totals	M	μg/g	kg	-95 CI (M or g/L)	-67 CI (M or g/L)	+67 CI (M or g/L)	+95 CI (M or g/L)
Pu	1.15E-03 (g/L)	--	1.27	3.43E-04	7.51E-04	1.54E-03	1.92E-03
U	3.82E-02	5.57E+03	1.00E+04	3.30E-02	3.70E-02	3.95E-02	4.07E-02

Notes:

[1]Unknowns in tank solids inventory are assigned by TLM.
[2]Water wt% derived from the difference of density and total dissolved species.
[3]Volume average for density, mass average water wt% and TOC wt% carbon.

CI = confidence interval

A4.0 SURVEILLANCE DATA

Tank 241-BY-112 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 measurements may indicate whether there is a major leak from a tank. Solid surface-level measurements can indicate physical changes and consistency in the solid layers such as those caused by gas generation and retention.

A4.1 SURFACE-LEVEL READINGS

The waste surface level for tank 241-BY-112 is measured by a manual tape located in riser 19. On October 3, 1996, the waste surface level was 2.87 m (113 in.) as measured by the manual tape. Figure A4-1 is a level history graph of the volume measurements.

A4.2 DRY WELL READINGS

Tank 241-BY-112 has 7 dry wells. No dry well had readings greater than the 50 counts per second above background radiation.

A4.3 INTERNAL TANK TEMPERATURES

Tank 241-BY-112 has a thermocouple tree located in risers 2. The Surveillance Analysis Computer System (SACS) has data only from the thermocouple tree located in riser 2, with 6 thermocouples to monitor the waste temperature. The elevations of all thermocouples on this tree are available. Temperature data, recorded from August 1974 through December 1996, were obtained from the SACS database (LMHC 1997).

The average temperature was 28.4 °C (83.2 °F), the minimum was 5 °C (41 °F), and the maximum was 62.2 °C (144 °F). The average temperature of the SACS data over the last year (December 1995 through December 1996) was 28.1 °C (82.6 °F), the minimum was 19 °C (66 °F), and the maximum was 32.3 °C (90.1 °F). The maximum temperature on December 18, 1996 was 31.6 °C (88.9 °F) on thermocouple 3 (in the waste) and the minimum was 22.3 °C (72.1 °F) on thermocouple 6 (in the headspace). Figure A4-2 is a graph of the weekly high temperatures. Brevick et al. (1996b) plots the individual thermocouple readings.

A4.4 TANK 241-BY-112 PHOTOGRAPHS

The April 1988 photographic montage of the interior of tank 241-BY-112 (Brevick et al. 1996b) shows a white dry surface of saltcake. Various pieces of equipment, for example, risers and identifiable debris have been labeled in the photograph. The waste level has not changed since the photographs were taken; therefore, this photographic montage should accurately represent the current appearance of the tank's waste.

Figure A4-1. Tank 241-BY-112 Level History.

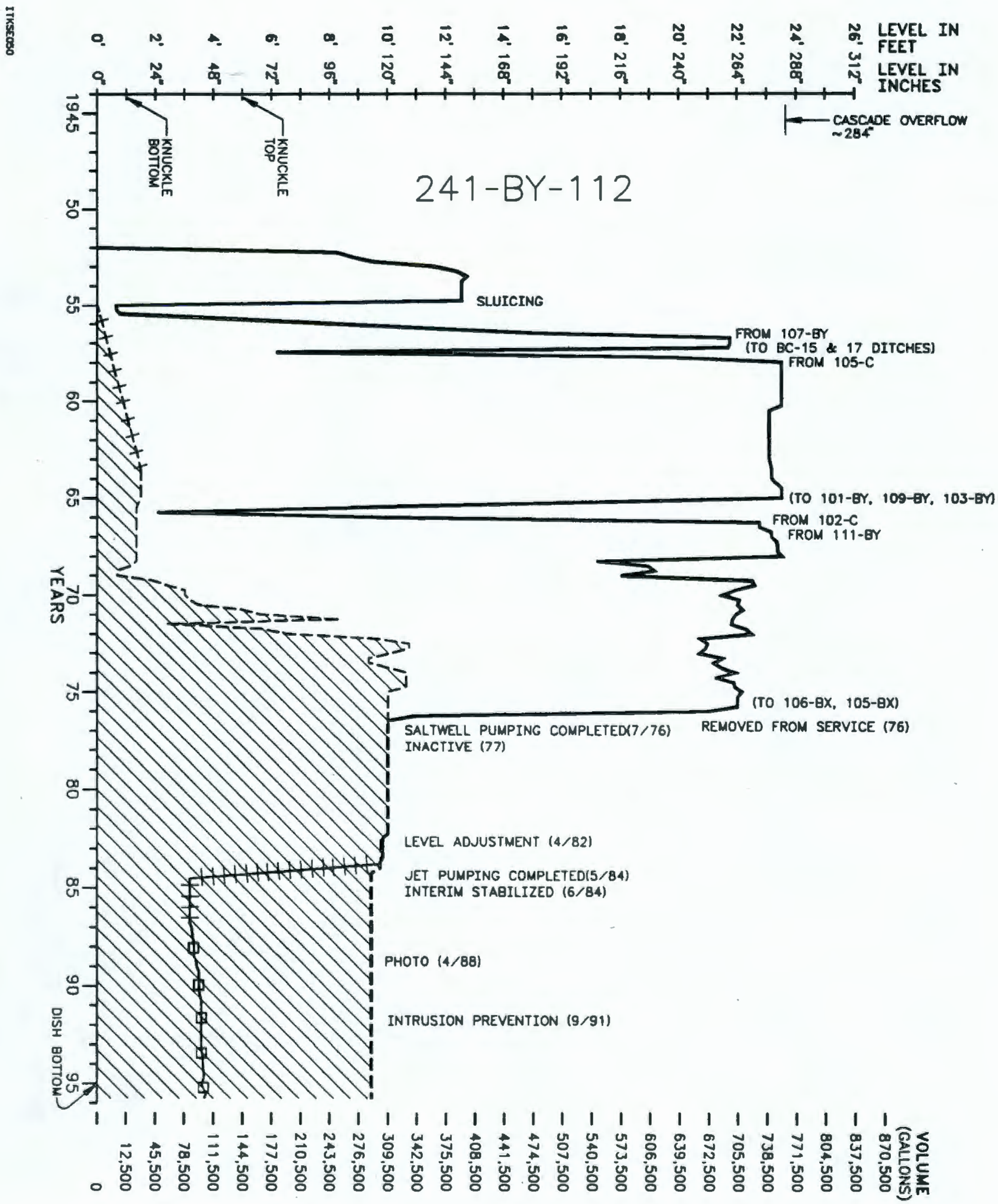
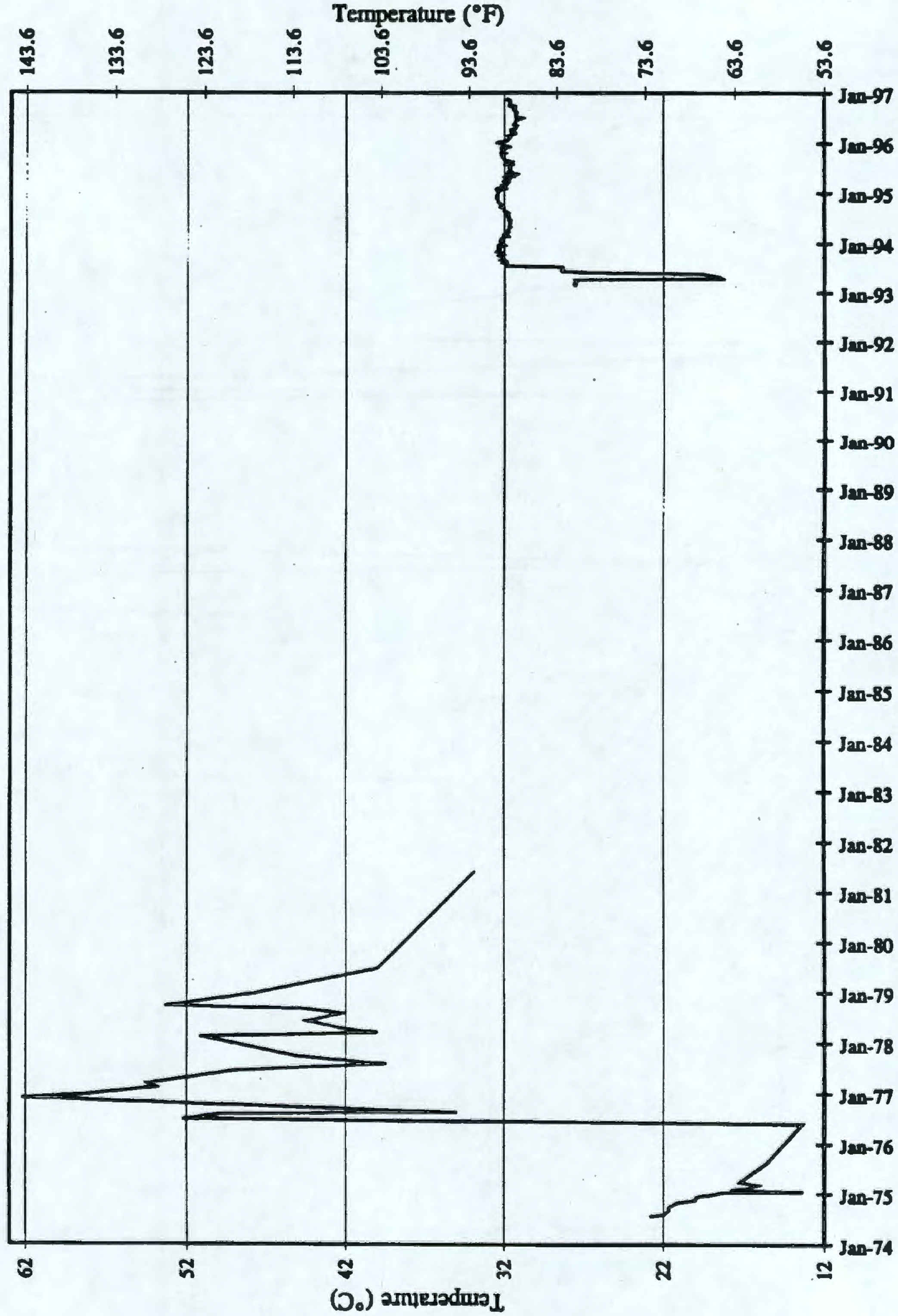


Figure A4-2. Tank 241-BY-112 Weekly High Temperature Plot.



A5.0 APPENDIX A REFERENCES

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APPENDIX B

SAMPLING OF TANK 241-BY-112

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APPENDIX B

SAMPLING OF TANK 241-BY-112

Appendix B provides sampling and analysis information for each known sampling event for tank 241-BY-112 and assesses push mode sample results.

- **Section B1.0**: Tank Sampling Overview
- **Section B2.0**: Sampling Events
- **Section B3.0**: Assessment of Characterization Results
- **Section B4.0**: References for Appendix B

Future sampling of tank 241-BY-112 will be appended to the above list.

B1.0 TANK SAMPLING OVERVIEW

This section describes the sampling and analysis events for tank 241-BY-112. Push mode samples were taken to satisfy the requirements of the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995). The sampling and analyses were performed in accordance with the *Tank 241-BY-112 Push Mode Sampling and Analysis Plan* (Baldwin 1997). For further information about the sampling and analysis procedures, refer to the *Tank Characterization Reference Guide* (DeLorenzo et al. 1994).

Headspace and vapor samples were collected from tank 241-BY-112. Sample collection and analysis were performed as directed by *Tank 241-BY-112 Tank Characterization Plan* (Homi 1994).

B2.0 SAMPLING EVENTS

This section describes sampling events. Tables B2-6 through B2-63 show analytical results. The analytical results used to characterize current tank contents were the 1994 vapor sample and 1996 push mode core sample. Section 2.4 provides historical sample results.

B2.1 1996 PUSH MODE SAMPLING EVENT

Two push mode samples were collected from tank 241-BY-112. Core 174, composed of 6 segments, was obtained on October 2 and 3, 1996, from riser number 18. Core 177, composed of 6 segments, was obtained on October 7, 1996, from riser 21. Core 174 was received at the 222-S Laboratory on October 29, 1996 and extruded on November 4, 1996. Core 177 was received by the 222-S Laboratory on October 31, 1996, and extruded on November 5 to 8, 1996. Core sampling was used because of the depth of the waste and the expectation that a full vertical profile of the waste would be obtained.

Table 1-1 provides data on the segment recoveries from the cores. Each segment is 48.3 cm (19 in.) long, 2.54 cm (1 in.) in diameter, and has a maximum volume of 244.5 cm^3 (14.9 $in.^3$). Segment recoveries were identified as percent recovered based on the theoretical volume of the sampler.

A vertical profile was used to satisfy the safety screening DQO (Dukelow et al. 1995). Safety screening analyses included: total alpha to determine criticality, DSC to determine the fuel energy value, and thermogravimetric analysis (TGA) to determine the total moisture content. In addition, combustible gas meter readings in the tank headspace were performed to measure flammability.

Table B2-1 summarizes the sampling and analytical requirements from the safety screening DQO.

Table B2-1. Integrated Data Quality Objective Requirements for Tank 241-BY-112.[1]

Sampling Event	Applicable DQOs	Sampling Requirements	Analytical Requirement
Push mode core sampling	Safety screening - Energetics - Moisture content - Total alpha - Flammable gas	Core samples from a minimum of two risers separated radially to the maximum extent possible. Combustible gas measurement	Flammability energetics, moisture total alpha, density, anions, cations, radionuclides, total organic carbon
Vapor sampling	Hazardous vapor	Steel canisters, triple sorbent traps, sorbent trap systems	Flammable gas Organic vapors Permanent gases
	Organic solvents (DOE-RL 1996 and Cash 1996b)		

Note:

[1]Baldwin (1997)

B2.1.1 Sample Handling

Core 174

Six push mode core segments were removed from tank 241-BY-112 riser 18 on October 2 and 3, 1996. All segments were received by the 222-S Laboratory on October 29, 1996. Table B2-2 gives the subsampling scheme and sample description.

Core 177

Six push mode core segments were removed from tank 241-BY-112 riser 21 on October 7, 1996. All segments were received by the 222-S Laboratory on October 31, 1996. Table B2-3 gives the subsampling scheme and sample description.

Field Blank

The field blank sample was prepared on October 8, 1996 and received by the 222-S Laboratory on October 15, 1996. The material recovered was treated as a drainable liquid as directed by Baldwin (1997).

Hydrostatic Head Fluid Blank

There is no indication of the use of hydrostatic head fluid in procuring these samples. A blank was not provided to the 222-S Laboratory.

Table B2-2. Sample Receipt and Extrusion Information for Tank 241-BY-112, Core 174.

Riser	Segment	Inches Extruded[1]	Liquid Recovered (g)	Solids Recovered (g)	Sample Description
18	1	5.0	0.0	62.0--Lower half	Solids were yellow to brown and resembled a dry salt.
	2	6.0	0.0	103.8--Lower half	Solids were brown and resembled a dry salt.
	3	6.0	0.0	84.5--Lower half	Solids were brown and resembled a dry salt.
	4	7.0	0.0	164.5--Lower half	Solids were brown to green and resembled a moist salt.
	5	18.0	128.5--Drainable	115.3--Lower half 100.0--Upper half	Solids were gray and resembled a wet salt. Drainable liquid was gray and opaque with no organic layer.
	6	18.0	0.0	143.3--Lower half 240.5--Upper half	Lower half solids were gray and resembled a wet sludge. Upper half solids were gray and resembled a salt slurry.

Note:

[1]Approximate inches extruded

Table B2-3. Sample Receipt and Extrusion Information for Tank 241-BY-112, Core 177.

Riser	Segment	Inches Extruded[1]	Liquid Recovered (g)	Solids Recovered (g)	Sample Description
21	Field blank	0.0	267.0--Drainable	0.0	Drainable liquid was clear and colorless.
	1	4.0	0.0	33.1--Lower half	Solids were white and black and resembled a dry salt.
	2	4.0	0.0	65.4--Lower half	Solids were yellow to brown and resembled a dry salt.
	3	6.0	0.0	76.6--Lower half	Solids were brown and resembled a dry salt.
	4	10.0	0.0	166.2--Lower half 43.0--Upper half	Solids were dark gray and resembled a moist salt.
	5	14.0	40.0--Drainable	157.6--Lower half 155.6--Upper half	Solids were dark gray and resembled a salt slurry. Drainable liquid was gray and opaque with no organic layer.
	6	6.0	0.0	122.1--Lower half	Solids were dark gray and resembled a moist salt.

Note:

[1]Approximate inches extruded

B2.1.2 Sample Analysis

The analyses performed on the push mode samples were limited to those required by the safety screening DQO. The analyses required by the safety screening DQO included analyses for thermal properties by DSC, moisture content by TGA, and content of fissile material by total alpha activity analysis.

Differential scanning calorimetry and TGA were performed on all samples. Quality control (QC) tests included performing the analyses in duplicate and the use of standards.

Total alpha activity measurements were performed on samples that had been fused in a solution of potassium, then dissolved in acid. The resulting solution was dried on a counting planchet and counted in an alpha proportional counter. Quality control tests included standards, spikes, blanks, and duplicate analyses.

Ion chromatography (IC) was performed on samples that had been prepared by water digestion. Quality control tests included standards, spikes, blanks, and duplicate analyses. Baldwin (1997) required measuring the full suite of IC analytes.

Inductively coupled plasma (ICP) spectrometry was performed on all samples and was prepared by a fusion procedure followed by dissolution in acid. Quality control tests included standards, blanks, spikes, and duplicate analyses. Baldwin (1997) required analyzing the full suite of ICP elements.

All reported analyses were performed in accordance with approved laboratory procedures. Table N2-4 lists the sample numbers and applicable analyses.

Table B2-4. Tank 241-BY-112 Sample Analysis Summary.[1] (3 sheets)

Core Number	Segment	Portion	Sample	Analyte
174	1	Lower half	S96T005865	Bulk density
			S96T005873	DSC, TGA, TIC, TOC
			S96T005897	IC
			S96T005889	ICP, Alpha
	2	Lower half	S96T005866	Bulk density
			S96T005874	DSC, TGA, TIC, TOC
			S96T005898	IC
			S96T005890	ICP, Alpha

Table B2-4. Tank 241-BY-112 Sample Analysis Summary.[1] (3 sheets)

Core Number	Segment	Portion	Sample	Analyte
174 (Cont'd)	3	Lower half	S96T005867	Bulk density
			S96T005875	DSC, TGA, TIC, TOC
			S96T005899	IC
			S96T005891	ICP, Alpha
	4	Lower half	S96T005868	Bulk density
			S96T005876	DSC, TGA, TIC, TOC
			S96T005900	IC
			S96T005892	ICP, Alpha
	5	Drainable liquid	S96T005907	DSC, TGA, TIC, TOC, specific gravity, IC, ICP, Alpha
		Lower half	S96T005869	Bulk density
			S96T005877	DSC, TGA, TIC, TOC
			S96T005901	IC
			S96T005893	ICP, Alpha
		Upper half	S96T005878	DSC, TGA, TIC, TOC
			S96T005902	IC
			S96T005894	ICP
	6	Lower half	S96T005871	Bulk density
			S96T005879	DSC, TGA, TIC, TOC
			S96T005903	IC
			S96T005895	ICP, Alpha
		Upper half	S96T005880	DSC, TGA, TIC, TOC
			S96T005904	IC
			S96T005896	ICP
177	1	Lower half	S96T005911	Bulk density
			S96T005917	DSC, TGA, TIC, TOC
			S96T005935	IC
			S96T005929	ICP, Alpha

Table B2-4. Tank 241-BY-112 Sample Analysis Summary.[1] (3 sheets)

Core Number	Segment	Portion	Sample	Analyte
177 (Cont'd)	2	Lower half	S96T005912	Bulk density
			S96T005918	DSC, TGA, TIC, TOC
			S96T005936	IC
			S96T005930	ICP, Alpha
	3	Lower half	S96T005913	Bulk density
			S96T005919	DSC, TGA, TIC, TOC
			S96T005937	IC
			S96T005931	ICP, Alpha
	4	Lower half	S96T005915	Bulk density
			S96T005921	DSC, TGA, TIC, TOC
			S96T005939	IC
			S96T005933	ICP, Alpha
		Upper half	S96T005920	DSC, TGA, TIC, TOC
			S96T005938	IC
			S96T005932	ICP
	5	Drainable liquid	S96T005960	DSC, TGA, TIC, TOC, specific gravity, IC, ICP, Alpha
		Lower half	S96T005942	Bulk density
			S96T005951	DSC, TGA, TIC, TOC
			S96T005959	IC
			S96T005957	ICP, Alpha
		Upper half	S96T005950	DSC, TGA, TIC, TOC
			S96T005958	IC
			S96T005956	ICP
	6	Lower half	S96T005916	Bulk density
			S96T005922	DSC, TGA, TIC, TOC
			S96T005940	IC
			S96T005934	ICP, Alpha

Note:

[1]Nuzum (1997)

B2.1.3 Analytical Results

This section summarizes the sampling and analytical results associated with the October 1996 push mode sampling and analysis of tank 241-BY-112. Table B2-5 shows the location of total alpha activity, percent water, energetics, IC, bulk density, specific gravity TIC, TOC, and ICP analytical results associated with this tank. These results are documented in Nuzum (1997).

Table B2-5. Analytical Tables.

Analysis	Table Number
Summary data for metals by ICP	B2-6 through B2-42
Anions by IC	B2-43 through B2-50
Bulk density	B2-51
Differential scanning calorimetry	B2-52
Percent water	B2-53
Specific gravity	B2-54
Total alpha activity	B2-55
Total inorganic carbon	B2-56
Total organic carbon	B2-57

The four QC parameters assessed in conjunction with the tank 241-BY-112 samples were standard recoveries, spike recoveries, duplicate analyses (relative percent differences [RPDs]), and blanks. The QC criteria are specified in the Baldwin (1997). Sample and duplicate pairs, in which any QC parameter was outside these limits, are footnoted in the sample mean column of the following data summary tables with an a, b, c, d, e, or f as follows:

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

B2.1.3.1 Total Alpha Activity. Analyses for total alpha activity were performed on the samples recovered from tank 241-BY-112. Alpha total (AT) analyses were requested for lower half segments only in accordance with Baldwin (1997). The samples were prepared by fusion digestion. Two fusions were prepared per sample (for duplicate results). Liquid AT results were below the total alpha activity notification limit of 61.5 μCi/mL. All solid AT results were below the total alpha activity notification limit of 33.1 μCi/g (based on a bulk density of 1.86 g/mL).

B2.1.3.2 Thermogravimetric Analysis. Thermogravimetric analysis measures the mass of a sample as its temperature is increased at a constant rate. Nitrogen is passed over the sample during heating to remove any released gases. A decrease in the weight of a sample during TGA represents a loss of gaseous matter from the sample, through evaporation or through a reaction that forms gas phase products. The moisture content is estimated by assuming that 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.

A second analysis of the lower half of segment 1 of core 177 (S96T005917) was performed because of the differences in appearance of the thermograms between the sample and duplicate. These differences were not seen in the replicate analysis. Table B2-53 shows the results for both analyses.

B2.1.3.3 Differential Scanning Calorimetry. In a DSC analysis, heat absorbed or emitted by a substance is measured while 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.

The exothermic energy, based on dry weight of subsample, was calculated for all subsamples. The average of the TGA results for each subsample was used in the dry weight correction for that subsample.

No exotherms above the threshold were observed. However, because of sample heterogeneity, three samples exceeded the limit of 480 J/g at the upper 95 percent confidence interval of the mean on a dry basis. The percent water for the same samples exceeded 25 percent, and the TOC for the samples was less than the limit of 30,000 μg/g, There is no DSC safety concern for tank 241-BY-112.

B2.1.3.4 Inductively Coupled Plasma. Samples were prepared by fusion or acid digests. Although a full suite of analytes were reported, only lithium was specifically requested. The potassium and nickel results for the ICP fusion analyses were ignored because of bias. The samples were prepared in a nickel crucible by fusion using potassium hydroxide.

B2.1.3.5 Total Organic Carbon. Table B2-57 shows the results of the TOC analyses. The lower half of segment 4 of core 174 (S96T005876) and the lower half of segment 4 of core 177 (S96T005921) results exceeded the notification limits set forth in Baldwin (1997). Notifications were made in accordance with Baldwin (1997).

The dry weight notification limit for TOC is 30,000 μg/g. Table C1-4 shows the mean dry weight sample results including the upper 95 percent confidence level of the mean. The percent water measured for these samples exceed 23 percent. The DSC measured for these samples is less than the limit of 480 J/g. The low DSC results associated with the relatively high TOC values indicates a majority of the measured carbon is no longer associated with hydrogen containing compounds and not reactive. There is no TOC safety concern for tank 241-BY-112.

B.2.1.3.6 Total Inorganic Carbon. Table B2-56 shows the TIC results as "opportunistic." The analytical results are not discussed in the laboratory report (Nuzum, 1997). The elevated TIC results are not unexpected. Because of the ITS2 unit and boiling that occurred, conditions were favorable to carbonate formation.

B2.1.3.7 Specific Gravity. There were no exceptions to the QC parameters stated in Baldwin (1977) for these subsamples.

B2.1.3.8 Ion Chromatography. Tables B2-43 through B2-50 show the IC results as opportunistic analyses. These analytes are not discussed in the laboratory report (Nuzum 1997).

B2.1.3.9 Density. Bulk density was requested only on lower half segments in accordance with Baldwin (1997). Bulk density could not be determined for segment 1 of core 177 (S96T005911) because of subsample dryness. Results from bulk density tests ranged from 1.03 g/mL to 1.86 g/mL. The main density was 1.46 g/mL.

B2.2 ANALYTICAL DATA TABLES

The following tables are the analytical results associated with the October 1996 push mode sampling and analysis of tank 241-BY-112.

Table B2-6. Tank 241-BY-112 Analytical Results: Aluminum (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S96T005907	174: 5	Drainable liquid	56,700	56,500	56,600[QC:e]
S96T005960	177: 5	Drainable liquid	54,000	54,600	54,300[QC:e]
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S96T005889	174: 1	Lower half	59,000	67,400	63,200
S96T005890	174: 2	Lower half	1,820	1,580	1,700
S96T005891	174: 3	Lower half	1,870	1,840	1,855
S96T005892	174: 4	Lower half	17,800	17,100	17,450
S96T005894	174: 5	Upper half	32,000	36,000	34,000
S96T005893		Lower half	31,300	33,300	32,300
S96T005896	174: 6	Upper half	26,700	26,000	26,350
S96T005895		Lower half	31,800	32,700	32,250
S96T005929	177: 1	Lower half	11,100	13,400	12,250
S96T005930	177: 2	Lower half	1,250	1,100	1,175
S96T005931	177: 3	Lower half	1,780	1,520	1,650
S96T005932	177: 4	Upper half	11,800	14,800	13,300[QC:e]
S96T005933		Lower half	16,400	15,500	15,950
S96T005956	177: 5	Upper half	21,400	22,100	21,750
S96T005957		Lower half	24,600	21,800	23,200
S96T005934	177: 6	Lower half	20,700	18,400	19,550

Table B2-7. Tank 241-BY-112 Analytical Results: Antimony (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	<36.1	<36.1	<36.1
S96T005960	177: 5	Drainable liquid	<36.1	<36.1	<36.1[QC:d]
Solids: fusion			μg/g	μg/g	μg/g
S96T005889	174: 1	Lower half	<1,260	<1,180	<1,220
S96T005890	174: 2	Lower half	<1,180	<1,150	<1,165
S96T005891	174: 3	Lower half	<1,170	<1,310	<1,240
S96T005892	174: 4	Lower half	<1,180	<1,110	<1,145
S96T005894	174: 5	Upper half	<1,270	<1,180	<1,225
S96T005893		Lower half	<1,200	<1,200	<1,200
S96T005896	174: 6	Upper half	<1,220	<1,210	<1,215
S96T005895		Lower half	<1,230	<1,340	<1,285
S96T005929	177: 1	Lower half	<1,190	<1,110	<1,150
S96T005930	177: 2	Lower half	<1,140	<1,120	<1,130
S96T005931	177: 3	Lower half	<1,110	<1,260	<1,185
S96T005932	177: 4	Upper half	<1,230	<1,190	<1,210
S96T005933		Lower half	<1,280	<1,250	<1,265
S96T005956	177: 5	Upper half	<1,310	<1,290	<1,300
S96T005957		Lower half	<1,350	<1,260	<1,305
S96T005934	177: 6	Lower half	<1,290	<1,320	<1,305

Table B2-8. Tank 241-BY-112 Analytical Results: Arsenic (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	<60.1	<60.1	<60.1
S96T005960	177: 5	Drainable liquid	<60.1	<60.1	<60.1
Solids: fusion			µg/g	µg/g	µg/g
S96T005889	174: 1	Lower half	<2,110	<1,970	<2,040
S96T005890	174: 2	Lower half	<1,960	<1,920	<1,940
S96T005891	174: 3	Lower half	<1,960	<2,180	<2,070
S96T005892	174: 4	Lower half	<1,960	<1,840	<1,900
S96T005894	174: 5	Upper half	<2,120	<1,970	<2,045
S96T005893		Lower half	<2,000	<2,010	<2,005
S96T005896	174: 6	Upper half	<2,030	<2,010	<2,020
S96T005895		Lower half	<2,050	<2,240	<2,145
S96T005929	177: 1	Lower half	<1,990	<1,860	<1,925
S96T005930	177: 2	Lower half	<1,910	<1,860	<1,885
S96T005931	177: 3	Lower half	<1,850	<2,090	<1,970
S96T005932	177: 4	Upper half	<2,050	<1,980	<2,015
S96T005933		Lower half	<2,130	<2,080	<2,105
S96T005956	177: 5	Upper half	<2,190	<2,140	<2,165
S96T005957		Lower half	<2,250	<2,110	<2,180
S96T005934	177: 6	Lower half	<2,160	<2,200	<2,180

Table B2-9. Tank 241-BY-112 Analytical Results: Barium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			**μg/mL**	**μg/mL**	**μg/mL**
S96T005907	174: 5	Drainable liquid	<30.1	<30.1	<30.1
S96T005960	177: 5	Drainable liquid	<30.1	<30.1	<30.1
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S96T005889	174: 1	Lower half	<1,050	<987	<1,018.5
S96T005890	174: 2	Lower half	<982	<962	<972
S96T005891	174: 3	Lower half	<979	<1,090	<1,034.5
S96T005892	174: 4	Lower half	<981	<922	<951.5
S96T005894	174: 5	Upper half	<1,060	<987	<1,023.5
S96T005893		Lower half	<998	<1,000	<999
S96T005896	174: 6	Upper half	<1,020	<1,010	<1,015
S96T005895		Lower half	<1,030	<1,120	<1,075
S96T005929	177: 1	Lower half	<995	<928	<961.5
S96T005930	177: 2	Lower half	<953	<931	<942
S96T005931	177: 3	Lower half	<926	<1,050	<988
S96T005932	177: 4	Upper half	<1,020	<988	<1,004
S96T005933		Lower half	<1,060	<1,040	<1,050
S96T005956	177: 5	Upper half	<1,090	<1,070	<1,080
S96T005957		Lower half	<1,130	<1,050	<1,090
S96T005934	177: 6	Lower half	<1,080	<1,100	<1,090

Table B2-10. Tank 241-BY-112 Analytical Results: Beryllium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	<3	<3	<3
S96T005960	177: 5	Drainable liquid	<3	<3	<3
Solids: fusion			µg/g	µg/g	µg/g
S96T005889	174: 1	Lower half	<105	<98.7	<101.85
S96T005890	174: 2	Lower half	<98.2	<96.2	<97.2
S96T005891	174: 3	Lower half	<97.9	<109	<103.45
S96T005892	174: 4	Lower half	<98.1	<92.2	<95.15
S96T005894	174: 5	Upper half	<106	<98.7	<102.35
S96T005893		Lower half	<99.8	<100	<99.9
S96T005896	174: 6	Upper half	<102	<101	<101.5
S96T005895		Lower half	<103	<112	<107.5
S96T005929	177: 1	Lower half	<99.5	<92.8	<96.15
S96T005930	177: 2	Lower half	<95.3	<93.1	<94.2
S96T005931	177: 3	Lower half	<92.6	<105	<98.8
S96T005932	177: 4	Upper half	<102	<98.8	<100.4
S96T005933		Lower half	<106	<104	<105
S96T005956	177: 5	Upper half	<109	<107	<108
S96T005957		Lower half	<113	<105	<109
S96T005934	177: 6	Lower half	<108	<110	<109

Table B2-11. Tank 241-BY-112 Analytical Results: Bismuth (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	<60.1	<60.1	<60.1
S96T005960	177: 5	Drainable liquid	<60.1	<60.1	<60.1
Solids: fusion			μg/g	μg/g	μg/g
S96T005889	174: 1	Lower half	<2,110	<1,970	<2,040
S96T005890	174: 2	Lower half	<1,960	<1,920	<1,940
S96T005891	174: 3	Lower half	<1,960	<2,180	<2,070
S96T005892	174: 4	Lower half	<1,960	<1,840	<1,900
S96T005894	174: 5	Upper half	<2,120	<1,970	<2,045
S96T005893		Lower half	<2,000	<2,010	<2,005
S96T005896	174: 6	Upper half	<2,030	<2,010	<2,020
S96T005895		Lower half	<2,050	<2,240	<2,145
S96T005929	177: 1	Lower half	<1,990	<1,860	<1,925
S96T005930	177: 2	Lower half	<1,910	<1,860	<1,885
S96T005931	177: 3	Lower half	<1,850	<2,090	<1,970
S96T005932	177: 4	Upper half	<2,050	<1,980	<2,015
S96T005933		Lower half	<2,130	<2,080	<2,105
S96T005956	177: 5	Upper half	<2,190	<2,140	<2,165
S96T005957		Lower half	<2,250	<2,110	<2,180
S96T005934	177: 6	Lower half	<2,160	<2,200	<2,180

Table B2-12. Tank 241-BY-112 Analytical Results: Boron (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	35.1	35.1	35.1
S96T005960	177: 5	Drainable liquid	40.3	39	39.65[QC:d]
Solids: fusion			μg/g	μg/g	μg/g
S96T005889	174: 1	Lower half	<1,050	<987	<1,018.5
S96T005890	174: 2	Lower half	<982	<962	<972
S96T005891	174: 3	Lower half	<979	<1,090	<1,034.5
S96T005892	174: 4	Lower half	<981	<922	<951.5
S96T005894	174: 5	Upper half	<1,060	<987	<1,023.5
S96T005893		Lower half	<998	<1,000	<999
S96T005896	174: 6	Upper half	<1,020	<1,010	<1,015
S96T005895		Lower half	<1,030	<1,120	<1,075
S96T005929	177: 1	Lower half	<995	<928	<961.5
S96T005930	177: 2	Lower half	<953	<931	<942
S96T005931	177: 3	Lower half	<926	<1,050	<988
S96T005932	177: 4	Upper half	<1,020	<988	<1,004
S96T005933		Lower half	<1,060	<1,040	<1,050
S96T005956	177: 5	Upper half	<1,090	<1,070	<1,080
S96T005957		Lower half	<1,130	<1,050	<1,090
S96T005934	177: 6	Lower half	<1,080	<1,100	<1,090

Table B2-13. Tank 241-BY-112 Analytical Results: Cadmium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	<3	<3	<3
S96T005960	177: 5	Drainable liquid	<3	<3	<3
Solids: fusion			µg/g	µg/g	µg/g
S96T005889	174: 1	Lower half	<105	<98.7	<101.85
S96T005890	174: 2	Lower half	<98.2	<96.2	<97.2
S96T005891	174: 3	Lower half	<97.9	<109	<103.45
S96T005892	174: 4	Lower half	127	164	145.5[QC:e]
S96T005894	174: 5	Upper half	114	142	128[QC:e]
S96T005893		Lower half	<99.8	<100	<99.9
S96T005896	174: 6	Upper half	<102	<101	<101.5
S96T005895		Lower half	<103	<112	<107.5
S96T005929	177: 1	Lower half	<99.5	<92.8	<96.15
S96T005930	177: 2	Lower half	<95.3	<93.1	<94.2
S96T005931	177: 3	Lower half	<92.6	<105	<98.8
S96T005932	177: 4	Upper half	139	136	137.5
S96T005933		Lower half	132	116	124
S96T005956	177: 5	Upper half	110	119	114.5
S96T005957		Lower half	<113	<105	<109
S96T005934	177: 6	Lower half	<108	<110	<109

Table B2-14. Tank 241-BY-112 Analytical Results: Calcium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	<60.1	<60.1	<60.1
S96T005960	177: 5	Drainable liquid	<60.1	<60.1	<60.1
Solids: fusion			μg/g	μg/g	μg/g
S96T005889	174: 1	Lower half	<2,110	<1,970	<2,040
S96T005890	174: 2	Lower half	<1,960	<1,920	<1,940
S96T005891	174: 3	Lower half	<1,960	<2,180	<2,070
S96T005892	174: 4	Lower half	<1,960	<1,840	<1,900
S96T005894	174: 5	Upper half	<2,120	<1,970	<2,045
S96T005893		Lower half	<2,000	<2,010	<2,005
S96T005896	174: 6	Upper half	<2,030	<2,010	<2,020
S96T005895		Lower half	<2,050	<2,240	<2,145
S96T005929	177: 1	Lower half	<1,990	<1,860	<1,925
S96T005930	177: 2	Lower half	<1,910	<1,860	<1,885
S96T005931	177: 3	Lower half	<1,850	<2,090	<1,970
S96T005932	177: 4	Upper half	<2,050	<1,980	<2,015
S96T005933		Lower half	<2,130	<2,080	<2,105
S96T005956	177: 5	Upper half	<2,190	<2,140	<2,165
S96T005957		Lower half	<2,250	<2,110	<2,180
S96T005934	177: 6	Lower half	<2,160	<2,200	<2,180

Table B2-15. Tank 241-BY-112 Analytical Results: Cerium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	<60.1	<60.1	<60.1
S96T005960	177: 5	Drainable liquid	<60.1	<60.1	<60.1
Solids: fusion			µg/g	µg/g	µg/g
S96T005889	174: 1	Lower half	<2,110	<1,970	<2,040
S96T005890	174: 2	Lower half	<1,960	<1,920	<1,940
S96T005891	174: 3	Lower half	<1,960	<2,180	<2,070
S96T005892	174: 4	Lower half	<1,960	<1,840	<1,900
S96T005894	174: 5	Upper half	<2,120	<1,970	<2,045
S96T005893		Lower half	<2,000	<2,010	<2,005
S96T005896	174: 6	Upper half	<2,030	<2,010	<2,020
S96T005895		Lower half	<2,050	<2,240	<2,145
S96T005929	177: 1	Lower half	<1,990	<1,860	<1,925
S96T005930	177: 2	Lower half	<1,910	<1,860	<1,885
S96T005931	177: 3	Lower half	<1,850	<2,090	<1,970
S96T005932	177: 4	Upper half	<2,050	<1,980	<2,015
S96T005933		Lower half	<2,130	<2,080	<2,105
S96T005956	177: 5	Upper half	<2,190	<2,140	<2,165
S96T005957		Lower half	<2,250	<2,110	<2,180
S96T005934	177: 6	Lower half	<2,160	<2,200	<2,180

Table B2-16. Tank 241-BY-112 Analytical Results: Chromium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	8,820	8,840	8,830
S96T005960	177: 5	Drainable liquid	13,200	13,300	13,250[QC:e]
Solids: fusion			µg/g	µg/g	µg/g
S96T005889	174: 1	Lower half	4,640	4,610	4,625
S96T005890	174: 2	Lower half	9,530	8,780	9,155
S96T005891	174: 3	Lower half	13,100	14,900	14,000
S96T005892	174: 4	Lower half	47,600	49,000	48,300
S96T005894	174: 5	Upper half	26,700	29,200	27,950
S96T005893		Lower half	19,500	15,700	17,600[QC:e]
S96T005896	174: 6	Upper half	9,080	8,950	9,015
S96T005895		Lower half	3,830	3,650	3,740
S96T005929	177: 1	Lower half	4,700	4,380	4,540
S96T005930	177: 2	Lower half	6,200	6,120	6,160
S96T005931	177: 3	Lower half	9,700	8,700	9,200
S96T005932	177: 4	Upper half	25,500	24,900	25,200
S96T005933		Lower half	47,400	43,900	45,650
S96T005956	177: 5	Upper half	37,500	35,300	36,400
S96T005957		Lower half	21,000	19,100	20,050
S96T005934	177: 6	Lower half	13,800	14,000	13,900

Table B2-17. Tank 241-BY-112 Analytical Results: Cobalt (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	<12	<12	<12
S96T005960	177: 5	Drainable liquid	<12	<12	<12
Solids: fusion			μg/g	μg/g	μg/g
S96T005889	174: 1	Lower half	<421	<395	<408
S96T005890	174: 2	Lower half	<393	<385	<389
S96T005891	174: 3	Lower half	<392	<436	<414
S96T005892	174: 4	Lower half	<392	<369	<380.5
S96T005894	174: 5	Upper half	<425	<395	<410
S96T005893		Lower half	<399	<401	<400
S96T005896	174: 6	Upper half	<406	<403	<404.5
S96T005895		Lower half	<411	<447	<429
S96T005929	177: 1	Lower half	<398	<371	<384.5
S96T005930	177: 2	Lower half	<381	<373	<377
S96T005931	177: 3	Lower half	<371	<419	<395
S96T005932	177: 4	Upper half	<409	<395	<402
S96T005933		Lower half	<425	<415	<420
S96T005956	177: 5	Upper half	<438	<429	<433.5
S96T005957		Lower half	<450	<421	<435.5
S96T005934	177: 6	Lower half	<431	<439	<435

Table B2-18. Tank 241-BY-112 Analytical Results: Copper (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	<6.01	<6.01	<6.01
S96T005960	177: 5	Drainable liquid	<6.01	<6.01	<6.01
Solids: fusion			μg/g	μg/g	μg/g
S96T005889	174: 1	Lower half	<211	<197	<204
S96T005890	174: 2	Lower half	<196	<192	<194
S96T005891	174: 3	Lower half	<196	<218	<207
S96T005892	174: 4	Lower half	<196	<184	<190
S96T005894	174: 5	Upper half	<212	<197	<204.5
S96T005893		Lower half	<200	<201	<200.5
S96T005896	174: 6	Upper half	<203	<201	<202
S96T005895		Lower half	<205	<224	<214.5
S96T005929	177: 1	Lower half	<199	<186	<192.5
S96T005930	177: 2	Lower half	<191	<186	<188.5
S96T005931	177: 3	Lower half	<185	<209	<197
S96T005932	177: 4	Upper half	<205	<198	<201.5
S96T005933		Lower half	<213	<208	<210.5
S96T005956	177: 5	Upper half	<219	<214	<216.5
S96T005957		Lower half	<225	<211	<218
S96T005934	177: 6	Lower half	<216	<220	<218

Table B2-19. Tank 241-BY-112 Analytical Results: Iron (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	<30.1	<30.1	<30.1
S96T005960	177: 5	Drainable liquid	<30.1	<30.1	<30.1
Solids: fusion			μg/g	μg/g	μg/g
S96T005889	174: 1	Lower half	4,270	5,560	4,915[QC:e]
S96T005890	174: 2	Lower half	<982	<962	<972
S96T005891	174: 3	Lower half	<979	<1,090	<1,034.5
S96T005892	174: 4	Lower half	6,410	8,220	7,315[QC:e]
S96T005894	174: 5	Upper half	3,390	4,000	3,695
S96T005893		Lower half	1,300	<1,000	<1,150[QC:e]
S96T005896	174: 6	Upper half	<1,020	<1,010	<1,015
S96T005895		Lower half	7,220	6,900	7,060
S96T005929	177: 1	Lower half	3,110	3,310	3,210
S96T005930	177: 2	Lower half	<953	<931	<942
S96T005931	177: 3	Lower half	<926	<1,050	<988
S96T005932	177: 4	Upper half	1,220	1,280	1,250
S96T005933		Lower half	5,310	4,980	5,145
S96T005956	177: 5	Upper half	4,910	5,100	5,005
S96T005957		Lower half	<1,130	<1,050	<1,090
S96T005934	177: 6	Lower half	2,750	2,520	2,635

Table B2-20. Tank 241-BY-112 Analytical Results: Lanthanum (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	<30.1	<30.1	<30.1
S96T005960	177: 5	Drainable liquid	<30.1	<30.1	<30.1
Solids: fusion			μg/g	μg/g	μg/g
S96T005889	174: 1	Lower half	<1,050	<987	<1,018.5
S96T005890	174: 2	Lower half	<982	<962	<972
S96T005891	174: 3	Lower half	<979	<1,090	<1,034.5
S96T005892	174: 4	Lower half	<981	<922	<951.5
S96T005894	174: 5	Upper half	<1,060	<987	<1,023.5
S96T005893		Lower half	<998	<1,000	<999
S96T005896	174: 6	Upper half	<1,020	<1,010	<1,015
S96T005895		Lower half	<1,030	<1,120	<1,075
S96T005929	177: 1	Lower half	<995	<928	<961.5
S96T005930	177: 2	Lower half	<953	<931	<942
S96T005931	177: 3	Lower half	<926	<1,050	<988
S96T005932	177: 4	Upper half	<1,020	<988	<1,004
S96T005933		Lower half	<1,060	<1,040	<1,050
S96T005956	177: 5	Upper half	<1,090	<1,070	<1,080
S96T005957		Lower half	<1,130	<1,050	<1,090
S96T005934	177: 6	Lower half	<1,080	<1,100	<1,090

Table B2-21. Tank 241-BY-112 Analytical Results: Lead (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	<60.1	<60.1	<60.1
S96T005960	177: 5	Drainable liquid	<60.1	<60.1	<60.1
Solids: fusion			µg/g	µg/g	µg/g
S96T005889	174: 1	Lower half	<2,110	<1,970	<2,040
S96T005890	174: 2	Lower half	<1,960	<1,920	<1,940
S96T005891	174: 3	Lower half	<1,960	<2,180	<2,070
S96T005892	174: 4	Lower half	<1,960	<1,840	<1,900
S96T005894	174: 5	Upper half	<2,120	<1,970	<2,045
S96T005893		Lower half	<2,000	<2,010	<2,005
S96T005896	174: 6	Upper half	<2,030	<2,010	<2,020
S96T005895		Lower half	<2,050	<2,240	<2,145
S96T005929	177: 1	Lower half	<1,990	<1,860	<1,925
S96T005930	177: 2	Lower half	<1,910	<1,860	<1,885
S96T005931	177: 3	Lower half	<1,850	<2,090	<1,970
S96T005932	177: 4	Upper half	<2,050	<1,980	<2,015
S96T005933		Lower half	<2,130	<2,080	<2,105
S96T005956	177: 5	Upper half	<2,190	<2,140	<2,165
S96T005957		Lower half	<2,250	<2,110	<2,180
S96T005934	177: 6	Lower half	<2,160	<2,200	<2,180

Table B2-22. Tank 241-BY-112 Analytical Results: Lithium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	<6.01	<6.01	<6.01
S96T005960	177: 5	Drainable liquid	<6.01	<6.01	<6.01
Solids: fusion			µg/g	µg/g	µg/g
S96T005889	174: 1	Lower half	<211	<197	<204
S96T005890	174: 2	Lower half	<196	<192	<194
S96T005891	174: 3	Lower half	<196	<218	<207
S96T005892	174: 4	Lower half	<196	<184	<190
S96T005894	174: 5	Upper half	<212	<197	<204.5
S96T005893		Lower half	<200	<201	<200.5
S96T005896	174: 6	Upper half	<203	<201	<202
S96T005895		Lower half	<205	<224	<214.5
S96T005929	177: 1	Lower half	<199	<186	<192.5
S96T005930	177: 2	Lower half	<191	<186	<188.5
S96T005931	177: 3	Lower half	<185	<209	<197
S96T005932	177: 4	Upper half	<205	<198	<201.5
S96T005933		Lower half	<213	<208	<210.5
S96T005956	177: 5	Upper half	<219	<214	<216.5
S96T005957		Lower half	<225	<211	<218
S96T005934	177: 6	Lower half	<216	<220	<218

Table B2-23. Tank 241-BY-112 Analytical Results: Magnesium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	<60.1	<60.1	<60.1
S96T005960	177: 5	Drainable liquid	<60.1	<60.1	<60.1
Solids: fusion			µg/g	µg/g	µg/g
S96T005889	174: 1	Lower half	<2,110	<1,970	<2,040
S96T005890	174: 2	Lower half	<1,960	<1,920	<1,940
S96T005891	174: 3	Lower half	<1,960	<2,180	<2,070
S96T005892	174: 4	Lower half	<1,960	<1,840	<1,900
S96T005894	174: 5	Upper half	<2,120	<1,970	<2,045
S96T005893		Lower half	<2,000	<2,010	<2,005
S96T005896	174: 6	Upper half	<2,030	<2,010	<2,020
S96T005895		Lower half	<2,050	<2,240	<2,145
S96T005929	177: 1	Lower half	<1,990	<1,860	<1,925
S96T005930	177: 2	Lower half	<1,910	<1,860	<1,885
S96T005931	177: 3	Lower half	<1,850	<2,090	<1,970
S96T005932	177: 4	Upper half	<2,050	<1,980	<2,015
S96T005933		Lower half	<2,130	<2,080	<2,105
S96T005956	177: 5	Upper half	<2,190	<2,140	<2,165
S96T005957		Lower half	<2,250	<2,110	<2,180
S96T005934	177: 6	Lower half	<2,160	<2,200	<2,180

Table B2-24. Tank 241-BY-112 Analytical Results: Manganese (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	<6.01	<6.01	<6.01
S96T005960	177: 5	Drainable liquid	<6.01	<6.01	<6.01
Solids: fusion			µg/g	µg/g	µg/g
S96T005889	174: 1	Lower half	<211	<197	<204
S96T005890	174: 2	Lower half	<196	<192	<194
S96T005891	174: 3	Lower half	<196	<218	<207
S96T005892	174: 4	Lower half	686	793	739.5
S96T005894	174: 5	Upper half	464	504	484
S96T005893		Lower half	217	<201	<209
S96T005896	174: 6	Upper half	<203	<201	<202
S96T005895		Lower half	<205	<224	<214.5
S96T005929	177: 1	Lower half	<199	<186	<192.5
S96T005930	177: 2	Lower half	<191	<186	<188.5
S96T005931	177: 3	Lower half	<185	<209	<197
S96T005932	177: 4	Upper half	<205	<198	<201.5
S96T005933		Lower half	550	515	532.5
S96T005956	177: 5	Upper half	485	453	469
S96T005957		Lower half	<225	<211	<218
S96T005934	177: 6	Lower half	<216	<220	<218

Table B2-25. Tank 241-BY-112 Analytical Results: Molybdenum (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	100	99.5	99.75
S96T005960	177: 5	Drainable liquid	94	97.3	95.65[QC:d]
Solids: fusion			µg/g	µg/g	µg/g
S96T005889	174: 1	Lower half	<1,050	<987	<1,018.5
S96T005890	174: 2	Lower half	<982	<962	<972
S96T005891	174: 3	Lower half	<979	<1,090	<1,034.5
S96T005892	174: 4	Lower half	<981	<922	<951.5
S96T005894	174: 5	Upper half	<1,060	<987	<1,023.5
S96T005893		Lower half	<998	<1,000	<999
S96T005896	174: 6	Upper half	<1,020	<1,010	<1,015
S96T005895		Lower half	<1,030	<1,120	<1,075
S96T005929	177: 1	Lower half	<995	<928	<961.5
S96T005930	177: 2	Lower half	<953	<931	<942
S96T005931	177: 3	Lower half	<926	<1,050	<988
S96T005932	177: 4	Upper half	<1,020	<988	<1,004
S96T005933		Lower half	<1,060	<1,040	<1,050
S96T005956	177: 5	Upper half	<1,090	<1,070	<1,080
S96T005957		Lower half	<1,130	<1,050	<1,090
S96T005934	177: 6	Lower half	<1,080	<1,100	<1,090

Table B2-26. Tank 241-BY-112 Analytical Results: Neodymium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	<60.1	<60.1	<60.1
S96T005960	177: 5	Drainable liquid	<60.1	<60.1	<60.1
Solids: fusion			μg/g	μg/g	μg/g
S96T005889	174: 1	Lower half	<2,110	<1,970	<2,040
S96T005890	174: 2	Lower half	<1,960	<1,920	<1,940
S96T005891	174: 3	Lower half	<1,960	<2,180	<2,070
S96T005892	174: 4	Lower half	<1,960	<1,840	<1,900
S96T005894	174: 5	Upper half	<2,120	<1,970	<2,045
S96T005893		Lower half	<2,000	<2,010	<2,005
S96T005896	174: 6	Upper half	<2,030	<2,010	<2,020
S96T005895		Lower half	<2,050	<2,240	<2,145
S96T005929	177: 1	Lower half	<1,990	<1,860	<1,925
S96T005930	177: 2	Lower half	<1,910	<1,860	<1,885
S96T005931	177: 3	Lower half	<1,850	<2,090	<1,970
S96T005932	177: 4	Upper half	<2,050	<1,980	<2,015
S96T005933		Lower half	<2,130	<2,080	<2,105
S96T005956	177: 5	Upper half	<2,190	<2,140	<2,165
S96T005957		Lower half	<2,250	<2,110	<2,180
S96T005934	177: 6	Lower half	<2,160	<2,200	<2,180

Table B2-27. Tank 241-BY-112 Analytical Results: Nickel (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	<12	<12	<12
S96T005960	177: 5	Drainable liquid	<12	<12	<12

Table B2-28. Tank 241-BY-112 Analytical Results: Phosphorus (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	382	389	385.5
S96T005960	177: 5	Drainable liquid	387	408	397.5[QC:d]
Solids: fusion			µg/g	µg/g	µg/g
S96T005889	174: 1	Lower half	30,000	16,900	23,450[QC:e]
S96T005890	174: 2	Lower half	<3,930	<3,850	<3,890
S96T005891	174: 3	Lower half	<3,920	6,540	<5,230[QC:e]
S96T005892	174: 4	Lower half	4,900	<3,690	<4,295[QC:e]
S96T005894	174: 5	Upper half	<4,250	5,660	<4,955[QC:e]
S96T005893		Lower half	<3,990	<4,010	<4,000
S96T005896	174: 6	Upper half	<4,060	<4,030	<4,045
S96T005895		Lower half	<4,110	<4,470	<4,290
S96T005929	177: 1	Lower half	37,800	37,000	37,400
S96T005930	177: 2	Lower half	7,890	4,010	5,950[QC:e]
S96T005931	177: 3	Lower half	<3,710	<4,190	<3,950
S96T005932	177: 4	Upper half	<4,090	<3,950	<4,020
S96T005933		Lower half	<4,250	<4,150	<4,200
S96T005956	177: 5	Upper half	<4,380	<4,290	<4,335
S96T005957		Lower half	<4,500	<4,210	<4,355
S96T005934	177: 6	Lower half	<4,310	7,700	<6,005[QC:e]

Table B2-29. Tank 241-BY-112 Analytical Results: Potassium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	10,200	10,200	10,200
S96T005960	177: 5	Drainable liquid	9,940	10,100	10,020[QC:c]

Table B2-30. Tank 241-BY-112 Analytical Results: Samarium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	<60.1	<60.1	<60.1
S96T005960	177: 5	Drainable liquid	<60.1	<60.1	<60.1
Solids: fusion			µg/g	µg/g	µg/g
S96T005889	174: 1	Lower half	<2,110	<1,970	<2,040
S96T005890	174: 2	Lower half	<1,960	<1,920	<1,940
S96T005891	174: 3	Lower half	<1,960	<2,180	<2,070
S96T005892	174: 4	Lower half	<1,960	<1,840	<1,900
S96T005894	174: 5	Upper half	<2,120	<1,970	<2,045
S96T005893		Lower half	<2,000	<2,010	<2,005
S96T005896	174: 6	Upper half	<2,030	<2,010	<2,020
S96T005895		Lower half	<2,050	<2,240	<2,145
S96T005929	177: 1	Lower half	<1,990	<1,860	<1,925
S96T005930	177: 2	Lower half	<1,910	<1,860	<1,885
S96T005931	177: 3	Lower half	<1,850	<2,090	<1,970
S96T005932	177: 4	Upper half	<2,050	<1,980	<2,015
S96T005933		Lower half	<2,130	<2,080	<2,105
S96T005956	177: 5	Upper half	<2,190	<2,140	<2,165
S96T005957		Lower half	<2,250	<2,110	<2,180
S96T005934	177: 6	Lower half	<2,160	<2,200	<2,180

Table B2-31. Tank 241-BY-112 Analytical Results: Selenium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	<60.1	<60.1	<60.1
S96T005960	177: 5	Drainable liquid	<60.1	<60.1	<60.1
Solids: fusion			μg/g	μg/g	μg/g
S96T005889	174: 1	Lower half	<2,110	<1,970	<2,040
S96T005890	174: 2	Lower half	<1,960	<1,920	<1,940
S96T005891	174: 3	Lower half	<1,960	<2,180	<2,070
S96T005892	174: 4	Lower half	6,740	6,180	6,460
S96T005894	174: 5	Upper half	2,320	3,660	2,990[QC:e]
S96T005893		Lower half	2,090	<2,010	<2,050
S96T005896	174: 6	Upper half	<2,030	<2,010	<2,020
S96T005895		Lower half	<2,050	<2,240	<2,145
S96T005929	177: 1	Lower half	<1,990	<1,860	<1,925
S96T005930	177: 2	Lower half	<1,910	<1,860	<1,885
S96T005931	177: 3	Lower half	<1,850	<2,090	<1,970
S96T005932	177: 4	Upper half	<2,050	<1,980	<2,015
S96T005933		Lower half	<2,130	<2,080	<2,105
S96T005956	177: 5	Upper half	<2,190	<2,140	<2,165
S96T005957		Lower half	<2,250	<2,110	<2,180
S96T005934	177: 6	Lower half	<2,160	<2,200	<2,180

Table B2-32. Tank 241-BY-112 Analytical Results: Silicon (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	438	453	445.5
S96T005960	177: 5	Drainable liquid	406	380	393[QC:d]
Solids: fusion			μg/g	μg/g	μg/g
S96T005889	174: 1	Lower half	2,240	2,140	2,190
S96T005890	174: 2	Lower half	1,300	1,220	1,260
S96T005891	174: 3	Lower half	2,340	1,720	2,030[QC:e]
S96T005892	174: 4	Lower half	3,990	4,650	4,320
S96T005894	174: 5	Upper half	1,830	2,380	2,105[QC:e]
S96T005893		Lower half	1,570	1,530	1,550
S96T005896	174: 6	Upper half	<1,020	<1,010	<1,015
S96T005895		Lower half	5,410	5,230	5,320
S96T005929	177: 1	Lower half	2,090	1,770	1,930
S96T005930	177: 2	Lower half	2,180	2,270	2,225
S96T005931	177: 3	Lower half	2,760	2,180	2,470[QC:e]
S96T005932	177: 4	Upper half	2,100	1,250	1,675[QC:e]
S96T005933		Lower half	3,680	3,270	3,475
S96T005956	177: 5	Upper half	2,380	3,050	2,715[QC:e]
S96T005957		Lower half	<1,130	1,080	<1,105
S96T005934	177: 6	Lower half	3,440	3,460	3,450

Table B2-33. Tank 241-BY-112 Analytical Results: Silver (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	17.4	17.2	17.3
S96T005960	177: 5	Drainable liquid	18	17.9	17.95
Solids: fusion			μg/g	μg/g	μg/g
S96T005889	174: 1	Lower half	<211	<197	<204
S96T005890	174: 2	Lower half	<196	<192	<194[QC:c]
S96T005891	174: 3	Lower half	<196	<218	<207
S96T005892	174: 4	Lower half	<196	<184	<190
S96T005894	174: 5	Upper half	<212	<197	<204.5
S96T005893		Lower half	<200	<201	<200.5
S96T005896	174: 6	Upper half	<203	<201	<202
S96T005895		Lower half	<205	<224	<214.5
S96T005929	177: 1	Lower half	<199	<186	<192.5[QC:c]
S96T005930	177: 2	Lower half	<191	<186	<188.5
S96T005931	177: 3	Lower half	<185	<209	<197
S96T005932	177: 4	Upper half	<205	<198	<201.5
S96T005933		Lower half	<213	<208	<210.5
S96T005956	177: 5	Upper half	<219	<214	<216.5
S96T005957		Lower half	<225	<211	<218
S96T005934	177: 6	Lower half	<216	<220	<218

Table B2-34. Tank 241-BY-112 Analytical Results: Sodium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	2.440E+05	2.440E+05	2.440E+05[QC:c]
S96T005960	177: 5	Drainable liquid	2.430E+05	2.460E+05	2.445E+05[QC:c]
Solids: fusion			µg/g	µg/g	µg/g
S96T005889	174: 1	Lower half	3.340E+05	3.550E+05	3.445E+05
S96T005890	174: 2	Lower half	4.530E+05	4.640E+05	4.585E+05
S96T005891	174: 3	Lower half	4.520E+05	4.350E+05	4.435E+05
S96T005892	174: 4	Lower half	3.420E+05	3.770E+05	3.595E+05
S96T005894	174: 5	Upper half	3.730E+05	3.880E+05	3.805E+05
S96T005893		Lower half	3.330E+05	3.350E+05	3.340E+05
S96T005896	174: 6	Upper half	2.660E+05	2.660E+05	2.660E+05
S96T005895		Lower half	2.710E+05	2.800E+05	2.755E+05[QC:d]
S96T005929	177: 1	Lower half	2.600E+05	2.470E+05	2.535E+05
S96T005930	177: 2	Lower half	3.290E+05	3.330E+05	3.310E+05
S96T005931	177: 3	Lower half	3.390E+05	3.610E+05	3.500E+05
S96T005932	177: 4	Upper half	3.230E+05	3.040E+05	3.135E+05[QC:c]
S96T005933		Lower half	2.650E+05	2.720E+05	2.685E+05
S96T005956	177: 5	Upper half	2.730E+05	2.740E+05	2.735E+05
S96T005957		Lower half	2.730E+05	2.680E+05	2.705E+05
S96T005934	177: 6	Lower half	2.990E+05	2.810E+05	2.900E+05

Table B2-35. Tank 241-BY-112 Analytical Results: Strontium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	<6.01	<6.01	<6.01
S96T005960	177: 5	Drainable liquid	<6.01	<6.01	<6.01
Solids: fusion			μg/g	μg/g	μg/g
S96T005889	174: 1	Lower half	<211	203	<207
S96T005890	174: 2	Lower half	<196	<192	<194
S96T005891	174: 3	Lower half	<196	<218	<207
S96T005892	174: 4	Lower half	<196	<184	<190
S96T005894	174: 5	Upper half	<212	<197	<204.5
S96T005893		Lower half	<200	<201	<200.5
S96T005896	174: 6	Upper half	<203	<201	<202
S96T005895		Lower half	<205	<224	<214.5
S96T005929	177: 1	Lower half	<199	<186	<192.5
S96T005930	177: 2	Lower half	<191	<186	<188.5
S96T005931	177: 3	Lower half	<185	<209	<197
S96T005932	177: 4	Upper half	<205	<198	<201.5
S96T005933		Lower half	<213	<208	<210.5
S96T005956	177: 5	Upper half	<219	<214	<216.5
S96T005957		Lower half	<225	<211	<218
S96T005934	177: 6	Lower half	<216	<220	<218

Table B2-36. Tank 241-BY-112 Analytical Results: Sulfur (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	331	328	329.5
S96T005960	177: 5	Drainable liquid	317	331	324[QC:d]
Solids: fusion			μg/g	μg/g	μg/g
S96T005889	174: 1	Lower half	<2,110	<1,970	<2,040
S96T005890	174: 2	Lower half	8,040	7,250	7,645
S96T005891	174: 3	Lower half	5,870	7,010	6,440
S96T005892	174: 4	Lower half	15,500	15,500	15,500
S96T005894	174: 5	Upper half	6,760	7,630	7,195
S96T005893		Lower half	7,210	4,880	6,045[QC:e]
S96T005896	174: 6	Upper half	10,400	9,010	9,705
S96T005895		Lower half	43,400	43,300	43,350
S96T005929	177: 1	Lower half	<1,990	<1,860	<1,925
S96T005930	177: 2	Lower half	2,630	2,450	2,540
S96T005931	177: 3	Lower half	2,210	<2,090	<2,150
S96T005932	177: 4	Upper half	6,680	6,300	6,490
S96T005933		Lower half	9,840	10,700	10,270
S96T005956	177: 5	Upper half	6,190	5,770	5,980
S96T005957		Lower half	4,380	4,130	4,255
S96T005934	177: 6	Lower half	24,100	28,400	26,250

Table B2-37. Tank 241-BY-112 Analytical Results: Thallium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	<120	<120	<120
S96T005960	177: 5	Drainable liquid	<120	<120	<120
Solids: fusion			μg/g	μg/g	μg/g
S96T005889	174: 1	Lower half	<4,210	<3,950	<4,080
S96T005890	174: 2	Lower half	<3,930	<3,850	<3,890
S96T005891	174: 3	Lower half	<3,920	<4,360	<4,140
S96T005892	174: 4	Lower half	<3,920	<3,690	<3,805
S96T005894	174: 5	Upper half	<4,250	<3,950	<4,100
S96T005893		Lower half	<3,990	<4,010	<4,000
S96T005896	174: 6	Upper half	<4,060	<4,030	<4,045
S96T005895		Lower half	<4,110	<4,470	<4,290
S96T005929	177: 1	Lower half	<3,980	<3,710	<3,845
S96T005930	177: 2	Lower half	<3,810	<3,730	<3,770
S96T005931	177: 3	Lower half	<3,710	<4,190	<3,950
S96T005932	177: 4	Upper half	<4,090	<3,950	<4,020
S96T005933		Lower half	<4,250	<4,150	<4,200
S96T005956	177: 5	Upper half	<4,380	<4,290	<4,335
S96T005957		Lower half	<4,500	<4,210	<4,355
S96T005934	177: 6	Lower half	<4,310	<4,390	<4,350

Table B2-38. Tank 241-BY-112 Analytical Results: Titanium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			**μg/mL**	**μg/mL**	**μg/mL**
S96T005907	174: 5	Drainable liquid	<6.01	<6.01	<6.01
S96T005960	177: 5	Drainable liquid	<6.01	<6.01	<6.01[QC:d]
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S96T005889	174: 1	Lower half	<211	<197	<204
S96T005890	174: 2	Lower half	<196	<192	<194
S96T005891	174: 3	Lower half	<196	<218	<207
S96T005892	174: 4	Lower half	<196	<184	<190
S96T005894	174: 5	Upper half	<212	<197	<204.5
S96T005893		Lower half	<200	<201	<200.5
S96T005896	174: 6	Upper half	<203	<201	<202
S96T005895		Lower half	<205	<224	<214.5
S96T005929	177: 1	Lower half	<199	<186	<192.5
S96T005930	177: 2	Lower half	<191	<186	<188.5
S96T005931	177: 3	Lower half	<185	<209	<197
S96T005932	177: 4	Upper half	<205	<198	<201.5
S96T005933		Lower half	<213	<208	<210.5
S96T005956	177: 5	Upper half	<219	<214	<216.5
S96T005957		Lower half	<225	<211	<218
S96T005934	177: 6	Lower half	<216	<220	<218

Table B2-39. Tank 241-BY-112 Analytical Results: Total Uranium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	<300	<300	<300
S96T005960	177: 5	Drainable liquid	<300	<300	<300
Solids: fusion			µg/g	µg/g	µg/g
S96T005889	174: 1	Lower half	<10,500	<9,870	<10,185
S96T005890	174: 2	Lower half	<9,820	<9,620	<9,720
S96T005891	174: 3	Lower half	<9,790	<10,900	<10,345
S96T005892	174: 4	Lower half	<9,810	<9,220	<9,515
S96T005894	174: 5	Upper half	<10,600	<9,870	<10,235
S96T005893		Lower half	<9,980	<10,000	<9,990
S96T005896	174: 6	Upper half	<10,200	<10,100	<10,150
S96T005895		Lower half	<10,300	<11,200	<10,750
S96T005929	177: 1	Lower half	<9,950	<9,280	<9,615
S96T005930	177: 2	Lower half	<9,530	<9,310	<9,420
S96T005931	177: 3	Lower half	<9,260	<10,500	<9,880
S96T005932	177: 4	Upper half	<10,200	<9,880	<10,040
S96T005933		Lower half	<10,600	<10,400	<10,500
S96T005956	177: 5	Upper half	<10,900	<10,700	<10,800
S96T005957		Lower half	<11,300	<10,500	<10,900
S96T005934	177: 6	Lower half	<10,800	<11,000	<10,900

Table B2-40. Tank 241-BY-112 Analytical Results: Vanadium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	<30.1	<30.1	<30.1
S96T005960	177: 5	Drainable liquid	<30.1	<30.1	<30.1
Solids: fusion			µg/g	µg/g	µg/g
S96T005889	174: 1	Lower half	<1,050	<987	<1,018.5
S96T005890	174: 2	Lower half	<982	<962	<972
S96T005891	174: 3	Lower half	<979	<1,090	<1,034.5
S96T005892	174: 4	Lower half	<981	<922	<951.5
S96T005894	174: 5	Upper half	<1,060	<987	<1,023.5
S96T005893		Lower half	<998	<1,000	<999
S96T005896	174: 6	Upper half	<1,020	<1,010	<1,015
S96T005895		Lower half	<1,030	<1,120	<1,075
S96T005929	177: 1	Lower half	<995	<928	<961.5
S96T005930	177: 2	Lower half	<953	<931	<942
S96T005931	177: 3	Lower half	<926	<1,050	<988
S96T005932	177: 4	Upper half	<1,020	<988	<1,004
S96T005933		Lower half	<1,060	<1,040	<1,050
S96T005956	177: 5	Upper half	<1,090	<1,070	<1,080
S96T005957		Lower half	<1,130	<1,050	<1,090
S96T005934	177: 6	Lower half	<1,080	<1,100	<1,090

Table B2-41. Tank 241-BY-112 Analytical Results: Zinc (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	<6.01	<6.01	<6.01
S96T005960	177: 5	Drainable liquid	<6.01	<6.01	<6.01
Solids: fusion			μg/g	μg/g	μg/g
S96T005889	174: 1	Lower half	<211	<197	<204
S96T005890	174: 2	Lower half	<196	<192	<194
S96T005891	174: 3	Lower half	318	<218	<268[QC:e]
S96T005892	174: 4	Lower half	<196	438	<317[QC:e]
S96T005894	174: 5	Upper half	<212	442	<327[QC:e]
S96T005893		Lower half	<200	<201	<200.5
S96T005896	174: 6	Upper half	<203	<201	<202
S96T005895		Lower half	<205	<224	<214.5
S96T005929	177: 1	Lower half	<199	<186	<192.5
S96T005930	177: 2	Lower half	<191	<186	<188.5
S96T005931	177: 3	Lower half	<185	<209	<197
S96T005932	177: 4	Upper half	<205	<198	<201.5
S96T005933		Lower half	<213	<208	<210.5
S96T005956	177: 5	Upper half	<219	<214	<216.5
S96T005957		Lower half	<225	<211	<218
S96T005934	177: 6	Lower half	<216	<220	<218

Table B2-42. Tank 241-BY-112 Analytical Results: Zirconium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	<6.01	<6.01	<6.01
S96T005960	177: 5	Drainable liquid	<6.01	<6.01	<6.01[QC:d]
Solids: fusion			µg/g	µg/g	µg/g
S96T005889	174: 1	Lower half	<211	<197	<204
S96T005890	174: 2	Lower half	<196	<192	<194
S96T005891	174: 3	Lower half	<196	<218	<207
S96T005892	174: 4	Lower half	<196	<184	<190
S96T005894	174: 5	Upper half	<212	<197	<204.5
S96T005893		Lower half	<200	<201	<200.5
S96T005896	174: 6	Upper half	<203	<201	<202
S96T005895		Lower half	<205	<224	<214.5
S96T005929	177: 1	Lower half	<199	<186	<192.5
S96T005930	177: 2	Lower half	<191	<186	<188.5
S96T005931	177: 3	Lower half	<185	<209	<197
S96T005932	177: 4	Upper half	<205	<198	<201.5
S96T005933		Lower half	<213	<208	<210.5
S96T005956	177: 5	Upper half	<219	<214	<216.5
S96T005957		Lower half	<225	<211	<218
S96T005934	177: 6	Lower half	<216	<220	<218

Table B2-43. Tank 241-BY-112 Analytical Results: Bromide (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			μg/g	μg/g	μg/g
S96T005897	174: 1	Lower half	466.5	402	434.25
S96T005898	174: 2	Lower half	<265.3	<283	<274.15
S96T005899	174: 3	Lower half	<266	<281	<273.5
S96T005900	174: 4	Lower half	<24.53	<546	<285.265[QC:e]
S96T005902	174: 5	Upper half	<512	<546	<529
S96T005901		Lower half	<24.65	<24.9	<24.775
S96T005904	174: 6	Upper half	<905.3	<1,040	<972.65
S96T005903		Lower half	<2,598	<2,530	<2,564
S96T005935	177: 1	Lower half	<956.3	<1,020	<988.15
S96T005936	177: 2	Lower half	<929.5	<982	<955.75
S96T005937	177: 3	Lower half	<1,051	<952	<1,001.5
S96T005938	177: 4	Upper half	<262.9	<271	<266.95
S96T005939		Lower half	<518.1	<511	<514.55
S96T005958	177: 5	Upper half	<554.9	<542	<548.45
S96T005959		Lower half	<1,078	<1,030	<1,054
S96T005940	177: 6	Lower half	<1,049	<981	<1,015
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	<1,275	<1,280	<1,277.5
S96T005960	177: 5	Drainable liquid	<643.9	<644	<643.95

Table B2-44. Tank 241-BY-112 Analytical Results: Chloride (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T005897	174: 1	Lower half	268.1	211	239.55[QC:e]
S96T005898	174: 2	Lower half	171.3	188	179.65
S96T005899	174: 3	Lower half	245.3	331	288.15[QC:e]
S96T005900	174: 4	Lower half	772.9	1,190	981.45[QC:e]
S96T005902	174: 5	Upper half	2,083	2,170	2,126.5
S96T005901		Lower half	52.86	115	83.93[QC:e]
S96T005904	174: 6	Upper half	2,944	3,460	3,202
S96T005903		Lower half	3,072	3,080	3,076
S96T005935	177: 1	Lower half	372.5	395	383.75
S96T005936	177: 2	Lower half	215.8	267	241.4[QC:e]
S96T005937	177: 3	Lower half	292.7	272	282.35
S96T005938	177: 4	Upper half	1,009	1,050	1,029.5
S96T005939		Lower half	1,385	1,510	1,447.5
S96T005958	177: 5	Upper half	2,304	2,200	2,252
S96T005959		Lower half	3,017	2,880	2,948.5
S96T005940	177: 6	Lower half	2,216	2,150	2,183
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	10,410	10,400	10,405
S96T005960	177: 5	Drainable liquid	7,702	7,670	7,686

Table B2-45. Tank 241-BY-112 Analytical Results: Fluoride (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			μg/g	μg/g	μg/g
S96T005897	174: 1	Lower half	6,316	6,210	6,263
S96T005898	174: 2	Lower half	7,358	6,960	7,159
S96T005899	174: 3	Lower half	4,658	5,490	5,074
S96T005900	174: 4	Lower half	2,652	6,390	4,521[QC:d,e]
S96T005902	174: 5	Upper half	4,707	3,610	4,158.5[QC:e]
S96T005901		Lower half	291.3	134	212.65[QC:e]
S96T005904	174: 6	Upper half	9,042	10,600	9,821
S96T005903		Lower half	55,800	54,600	55,200
S96T005935	177: 1	Lower half	12,340	12,300	12,320
S96T005936	177: 2	Lower half	1,948	5,220	3,584[QC:e]
S96T005937	177: 3	Lower half	6,378	6,700	6,539
S96T005938	177: 4	Upper half	5,329	5,160	5,244.5
S96T005939		Lower half	6,935	7,940	7,437.5
S96T005958	177: 5	Upper half	5,699	5,370	5,534.5
S96T005959		Lower half	2,882	2,800	2,841
S96T005940	177: 6	Lower half	15,960	15,600	15,780
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	624	618	621
S96T005960	177: 5	Drainable liquid	809.8	724	766.9

Table B2-46. Tank 241-BY-112 Analytical Results: Nitrate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			μg/g	μg/g	μg/g
S96T005897	174: 1	Lower half	11,790	9,490	10,640[QC:e]
S96T005898	174: 2	Lower half	53,700	63,000	58,350
S96T005899	174: 3	Lower half	26,500	24,700	25,600
S96T005900	174: 4	Lower half	67,810	1.870E+05	1.274E+05[QC:d,e]
S96T005902	174: 5	Upper half	84,080	73,400	78,740
S96T005901		Lower half	8,336	3,060	5,698[QC:e]
S96T005904	174: 6	Upper half	73,420	83,700	78,560
S96T005903		Lower half	68,610	69,000	68,805
S96T005935	177: 1	Lower half	14,350	14,300	14,325
S96T005936	177: 2	Lower half	4.663E+05	22,700	2.445E+05[QC:e]
S96T005937	177: 3	Lower half	23,990	47,600	35,795[QC:e]
S96T005938	177: 4	Upper half	57,250	65,100	61,175
S96T005939		Lower half	1.087E+05	81,900	95,300[QC:e]
S96T005958	177: 5	Upper half	87,380	83,000	85,190
S96T005959		Lower half	97,030	1.280E+05	1.125E+05[QC:e]
S96T005940	177: 6	Lower half	86,740	56,600	71,670[QC:e]
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	1.722E+05	1.700E+05	1.711E+05
S96T005960	177: 5	Drainable liquid	2.124E+05	2.070E+05	2.097E+05

Table B2-47. Tank 241-BY-112 Analytical Results: Nitrite (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			**μg/g**	**μg/g**	**μg/g**
S96T005897	174: 1	Lower half	5,285	4,260	4,772.5[QC:e]
S96T005898	174: 2	Lower half	3,108	3,100	3,104
S96T005899	174: 3	Lower half	4,068	5,170	4,619[QC:e]
S96T005900	174: 4	Lower half	14,300	20,400	17,350[QC:d,e]
S96T005902	174: 5	Upper half	39,770	40,800	40,285
S96T005901		Lower half	944	2,160	1,552[QC:e]
S96T005904	174: 6	Upper half	57,720	65,400	61,560
S96T005903		Lower half	56,540	55,200	55,870
S96T005935	177: 1	Lower half	5,474	5,530	5,502
S96T005936	177: 2	Lower half	2,858	4,030	3,444[QC:e]
S96T005937	177: 3	Lower half	4,498	4,340	4,419
S96T005938	177: 4	Upper half	18,610	19,200	18,905
S96T005939		Lower half	25,470	27,600	26,535
S96T005958	177: 5	Upper half	42,020	40,500	41,260
S96T005959		Lower half	54,900	50,800	52,850
S96T005940	177: 6	Lower half	31,840	37,500	34,670
Liquids			**μg/mL**	**μg/mL**	**μg/mL**
S96T005907	174: 5	Drainable liquid	1.311E+05	1.310E+05	1.311E+05
S96T005960	177: 5	Drainable liquid	1.503E+05	1.480E+05	1.492E+05

Table B2-48. Tank 241-BY-112 Analytical Results: Phosphate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			μg/g	μg/g	μg/g
S96T005897	174: 1	Lower half	37,810	39,100	38,455
S96T005898	174: 2	Lower half	4,869	9,780	7,324.5[QC:d,e]
S96T005899	174: 3	Lower half	1,843	953	1,398[QC:e]
S96T005900	174: 4	Lower half	2,760	4,040	3,400[QC:e]
S96T005902	174: 5	Upper half	9,975	2,750	6,362.5[QC:e]
S96T005901		Lower half	221.1	388	304.55[QC:e]
S96T005904	174: 6	Upper half	9,679	11,200	10,439.5
S96T005903		Lower half	<2,494	<2,430	<2,462
S96T005935	177: 1	Lower half	1.063E+05	1.060E+05	1.062E+05
S96T005936	177: 2	Lower half	6,453	18,100	12,276.5[QC:e]
S96T005937	177: 3	Lower half	2,191	7,700	4,945.5[QC:e]
S96T005938	177: 4	Upper half	2,766	2,360	2,563
S96T005939		Lower half	3,905	35,000	19,452.5[QC:e]
S96T005958	177: 5	Upper half	3,462	5,030	4,246[QC:e]
S96T005959		Lower half	3,269	2,580	2,924.5[QC:e]
S96T005940	177: 6	Lower half	2,507	1,860	2,183.5[QC:e]
Liquids			μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	<1,224	1,810	<1,517[QC:e]
S96T005960	177: 5	Drainable liquid	1,479	1,410	1,444.5

Table B2-49. Tank 241-BY-112 Analytical Results: Sulfate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T005897	174: 1	Lower half	3,953	2,620	3,286.5[QC:e]
S96T005898	174: 2	Lower half	17,580	17,300	17,440
S96T005899	174: 3	Lower half	17,470	20,700	19,085
S96T005900	174: 4	Lower half	19,500	28,300	23,900[QC:d,e]
S96T005902	174: 5	Upper half	18,890	17,100	17,995
S96T005901		Lower half	1,279	540	909.5[QC:e]
S96T005904	174: 6	Upper half	36,910	42,400	39,655
S96T005903		Lower half	1.263E+05	1.240E+05	1.252E+05
S96T005935	177: 1	Lower half	5,194	5,230	5,212
S96T005936	177: 2	Lower half	3,944	9,450	6,697[QC:e]
S96T005937	177: 3	Lower half	8,076	7,570	7,823
S96T005938	177: 4	Upper half	20,270	19,200	19,735
S96T005939		Lower half	26,000	30,700	28,350
S96T005958	177: 5	Upper half	16,700	15,800	16,250
S96T005959		Lower half	11,410	13,200	12,305
S96T005940	177: 6	Lower half	71,790	67,500	69,645
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	2,702	2,920	2,811
S96T005960	177: 5	Drainable liquid	<710.8	17,400	<9,055.4[QC:e]

Table B2-50. Tank 241-BY-112 Analytical Results: Oxalate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S96T005897	174: 1	Lower half	8,564	3,040	5,802[QC:e]
S96T005898	174: 2	Lower half	486.2	486	486.1
S96T005899	174: 3	Lower half	4,112	11,600	7,856[QC:e]
S96T005900	174: 4	Lower half	30,210	1.050E+05	67,605[QC:d,e]
S96T005902	174: 5	Upper half	49,830	50,200	50,015
S96T005901		Lower half	4,706	1,100	2,903[QC:e]
S96T005904	174: 6	Upper half	22,950	23,500	23,225
S96T005903		Lower half	2,452	1,270	1,861[QC:c,e]
S96T005935	177: 1	Lower half	2,744	2,690	2,717
S96T005936	177: 2	Lower half	1,304	5,970	3,637[QC:e]
S96T005937	177: 3	Lower half	<882.9	<800	<841.45
S96T005938	177: 4	Upper half	41,050	35,900	38,475[QC:e]
S96T005939		Lower half	1.110E+05	1.300E+05	1.205E+05
S96T005958	177: 5	Upper half	1.185E+05	1.160E+05	1.173E+05
S96T005959		Lower half	34,560	37,300	35,930
S96T005940	177: 6	Lower half	6,203	15,500	10,851.5[QC:e]
Liquids			µg/mL	µg/mL	µg/mL
S96T005907	174: 5	Drainable liquid	<1,071	10,600	<5,835.5[QC:e]
S96T005960	177: 5	Drainable liquid	840.3	750	795.15

Table B2-51. Tank 241-BY-112 Analytical Results: Bulk Density.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Triplicate	Mean
Solids			g/mL	g/mL	g/mL	g/mL
S96T005865	174: 1	Lower half	1.03	n/a	n/a	1.03
S96T005866	174: 2	Lower half	1.1	n/a	n/a	1.1
S96T005867	174: 3	Lower half	1.08	n/a	n/a	1.08
S96T005868	174: 4	Lower half	1.86	n/a	n/a	1.86
S96T005869	174: 5	Lower half	1.66	n/a	n/a	1.66
S96T005871	174: 6	Lower half	1.82	n/a	n/a	1.82
S96T005912	177: 2	Lower half	1.19	n/a	n/a	1.19
S96T005913	177: 3	Lower half	1.07	n/a	n/a	1.07
S96T005915	177: 4	Lower half	1.78	n/a	n/a	1.78
S96T005942	177: 5	Lower half	1.56	n/a	n/a	1.56
S96T005916	177: 6	Lower half	1.86	n/a	n/a	1.86

Table B2-52. Tank 241-BY-112 Analytical Results: Exotherm - Transition 1 Wet (DSC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			**J/g**	**J/g**	**J/g**
S96T005907	174: 5	Drainable liquid	99.19	80.44	89.815[QC:e]
S96T005960	177: 5	Drainable liquid	72.64	36.61	54.625[QC:e]
Solids			**J/g**	**J/g**	**J/g**
S96T005876	174: 4	Lower half	134.5	128.6	131.55
S96T005878	174: 5	Upper half	118.1	233.4	175.75[QC:e]
S96T005877		Lower half	61.3	63.7	62.5
S96T005880	174: 6	Upper half	67.9	139	103.45[QC:e]
S96T005879		Lower half	5.06	22.7	13.88[QC:e]
S96T005919	177: 3	Lower half	76.4	136	106.2[QC:e]
S96T005920	177: 4	Upper half	117	66.9	91.95[QC:e]
S96T005921		Lower half	149.9	127.9	138.9
S96T005950	177: 5	Upper half	50.9	142	96.45[QC:e]
S96T005951		Lower half	99.2	111	105.1
S96T005922	177: 6	Lower half	50.8	58.3	54.55

Table B2-53. Tank 241-BY-112 Analytical Results: Percent Water (TGA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids			%	%	%
S96T005873	174: 1	Lower half	22.29	25.14	23.715
S96T005874	174: 2	Lower half	14.42	14.39	14.405
S96T005875	174: 3	Lower half	13.69	15.65	14.67
S96T005876	174: 4	Lower half	23.17	23.4	23.285
S96T005878	174: 5	Upper half	33.78	34.17	33.975
S96T005877		Lower half	43.53	41.79	42.66
S96T005880	174: 6	Upper half	37.56	36.86	37.21
S96T005879		Lower half	32.89	33.03	32.96
S96T005917	177: 1	Lower half	43.02	39.42	41.22
S96T005917		Lower half	39.43	21.83	30.63[QC:e]
S96T005918	177: 2	Lower half	15.73	15	15.365
S96T005919	177: 3	Lower half	21.15	15.94	18.545
S96T005920	177: 4	Upper half	18.25	21.46	19.855
S96T005921		Lower half	36.42	36.86	36.64
S96T005950	177: 5	Upper half	32.32	34.77	33.545
S96T005951		Lower half	40.34	40.06	40.2
S96T005922	177: 6	Lower half	29.71	27.66	28.685
Liquids			%	%	%
S96T005907	174: 5	Drainable liquid	48.69	48.06	48.375
S96T005960	177: 5	Drainable liquid	48.75	48.6	48.675

Table B2-54. Tank 241-BY-112 Analytical Results: Specific Gravity.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			unitless	unitless	unitless
S96T005907	174: 5	Drainable liquid	1.474	1.478	1.476
S96T005960	177: 5	Drainable liquid	1.462	1.47	1.466

Table B2-55. Tank 241-BY-112 Analytical Results: Total Alpha (Alpha).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μCi/mL	μCi/mL	μCi/mL
S96T005907	174: 5	Drainable liquid	<0.0122	<0.0122	<0.0122
S96T005960	177: 5	Drainable liquid	<0.00611	<0.0346	<0.020355[QC:e]
Solids: fusion			μCi/g	μCi/g	μCi/g
S96T005889	174: 1	Lower half	0.115	0.0874	0.1012[QC:e]
S96T005890	174: 2	Lower half	0.0326	0.0275	0.03005
S96T005891	174: 3	Lower half	0.0373	0.0657	0.0515[QC:e]
S96T005892	174: 4	Lower half	0.236	0.279	0.2575
S96T005893	174: 5	Lower half	0.0665	0.0433	0.0549[QC:e]
S96T005895	174: 6	Lower half	0.0618	0.0628	0.0623[QC:c,f]
S96T005929	177: 1	Lower half	0.00232	0.00232	0.00232
S96T005930	177: 2	Lower half	0.0402	0.0355	0.03785
S96T005931	177: 3	Lower half	0.0497	0.0475	0.0486
S96T005933	177: 4	Lower half	0.174	0.154	0.164
S96T005957	177: 5	Lower half	0.045	0.0459	0.04545[QC:f]
S96T005934	177: 6	Lower half	0.0399	0.039	0.03945[QC:f]

Table B2-56. Tank 241-BY-112 Analytical Results: Total Inorganic Carbon.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Triplicate	Mean
Solids			μg/g	μg/g	μg/g	μg/g
S96T005873	174: 1	Lower half	47,400	44,400		45,900
S96T005874	174: 2	Lower half	85,200	82,600		83,900
S96T005875	174: 3	Lower half	79,700	82,000		80,850
S96T005876	174: 4	Lower half	17,200	12,800	13,300	14,433.3[QC:c,e]
S96T005878	174: 5	Upper half	22,900	25,600		24,250
S96T005877		Lower half	26,800	17,900	27,100	23,933.3[QC:e]
S96T005880	174: 6	Upper half	20,200	11,800	10,600	14,200[QC:e]
S96T005879		Lower half	727	720		723.5
S96T005917	177: 1	Lower half	34,300	36,000		35,150
S96T005918	177: 2	Lower half	78,400	81,900		80,150
S96T005919	177: 3	Lower half	68,500	79,200		73,850
S96T005920	177: 4	Upper half	49,800	56,200		53,000[QC:d]
S96T005921		Lower half	11,900	6,740		9,320[QC:e]
S96T005950	177: 5	Upper half	13,100	11,000		12,050
S96T005951		Lower half	12,700	10,400		11,550
S96T005922	177: 6	Lower half	11,600	17,400		14,500[QC:e]
Liquids			μg/mL	μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	1,590	1,650		1,620[QC:f]
S96T005960	177: 5	Drainable liquid	1,470	1,460		1,465[QC:f]

Table B2-57. Tank 241-BY-112 Analytical Results: Total Organic Carbon (Wet).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Triplicate	Mean
Solids			μg/g	μg/g	μg/g	μg/g
S96T005873	174: 1	Lower half	1,140	1,230		1,185
S96T005874	174: 2	Lower half	378	698		538[QC:e]
S96T005875	174: 3	Lower half	913	1,280		1,096.5[QC:e]
S96T005876	174: 4	Lower half	30,700	34,300		32,500[QC:e]
S96T005878	174: 5	Upper half	14,200	14,100		14,150
S96T005877		Lower half	6,160	7,710	5,360	6,410[QC:c,e]
S96T005880	174: 6	Upper half	6,640	7,990	7,700	7,443.33
S96T005879		Lower half	1,550	1,560		1,555
S96T005917	177: 1	Lower half	1,390	1,260		1,325
S96T005918	177: 2	Lower half	904	750		827
S96T005919	177: 3	Lower half	516	555		535.5
S96T005920	177: 4	Upper half	7,330	6,080		6,705
S96T005921		Lower half	29,800	25,300		27,550
S96T005950	177: 5	Upper half	23,400	17,800		20,600[QC:e]
S96T005951		Lower half	8,450	8,780		8,615
S96T005922	177: 6	Lower half	4,740	4,630		4,685
Liquids			μg/mL	μg/mL	μg/mL	μg/mL
S96T005907	174: 5	Drainable liquid	1,890	1,940		1,915[QC:f]
S96T005960	177: 5	Drainable liquid	1,510	1,530		1,520[QC:f]

B2.2 VAPOR PHASE MEASUREMENTS

B2.2.1 Safety Screening and Flammable Gas Monitoring

Before the October 2 push mode core sampling of tank 241-BY-112, a vapor phase measurement was taken. Additional measurements were made on October 7, 1996. These measurements supported the safety screening DQO (Dukelow et al. 1995). The vapor phase screening was taken for flammability issues. The vapor phase measurements were taken 20 ft below risers 18 and 21 in the headspace of the tank, and results were obtained in the field (that is, no gas sample was sent to the laboratory for analysis). Table B2-58 shows the results of the vapor phase measurements.

B2.2.2 1994 Tank Vapor Samples

Headspace and vapor samples were collected from tank 241-BY-112 using the vapor sampling system on November 18, 1994, by the Westinghouse Hanford Company Sampling and Mobile Laboratories. Sample collection and analysis were performed as directed by the tank 241-BY-112 tank characterization plan (Homi 1994). The results of the headspace gas and vapor characterization are reported in Huckaby and Bratzel (1995). Table B2-59 summarizes the results of these analyses.

Table B2-58. Results of Vapor Measurements of Tank 241-BY-112.

Measurement	Result	
	October 2, 1996	October 7, 1996
Total organic carbon (TOC)	12 ppmv	4.2 ppmv
Lower explosive limit (LEL)	1.0% of LEL	0.0% of LEL
Oxygen	18.5%	20.8%
Ammonia	80 ppmv	50 ppmv

Table B2-59. Result of Vapor Analysis in Headspace of Tank 241-BY-112.

Measurement	Result November 18, 1994
Headspace temperature (°C)	23.2
Ammonia (ppmv)	63
Hydrogen (ppmv)	<94
Carbon dioxide (ppmv)	121
Carbon monoxide (ppmv)	<12
Nitric oxide (ppmv)	0.18
Nitrogen dioxide (ppmv)	≤0.02
Nitrous oxide (ppmv)	40
Water vapor (mg/m^3)	11.2
Water vapor (percent relative humidity)	53
Ethanenitrile (ppmv)	0.10
Propanone (acetone) (ppmv)	1.0
1-Butanol (ppmv)	0.059
n-Dodecane (ppmv)	0.0097
n-Tridecane (ppmv)	0.020
Total organic compounds (mg/m^3)	5.8

B2.3 HISTORICAL SAMPLE RESULTS

B2.3.1 January 1972 Sample Results

Table B2-60 shows the results of the analyses of the January 1972 sampling event for tank 241-BY-112 that are documented in Buckingham (1972). The results indicate the waste contains primarily sodium salts; the solids primarily sodium nitrate. The results also indicated a higher concentration of chromium than expected. As a result, a further review was to be conducted to determine the reason for this anomaly. The radionuclides found in the sample were strontium, cesium, and zirconium/niobium in the liquid and top solids. Antimony, ruthenium/rhodium, and cerium/praseodymium were also found in the bottom sample. These data have not been validated and should be used with caution.

B2.3.2 April 1971 Sample Results

Table B2-61 shows the results of analyses of the April 1971 sampling event for tank 241-BY-112 that were documented in Buckingham (1971). The results indicate the waste contains primarily sodium salts of nitrate and nitrite. The results were very similar to January 1972 results. The radionuclides found in the sample were strontium and cesium in the supernatant sample; the sludge sample also contained ruthenium/rhodium, cobalt, antimony, and cerium/praseodymium; and the crust sample including zirconium/niobium and europium. These data have not been validated and should be used with caution.

Table B2-60. Tank 241-BY-112 Sample.[1]

Waste Tank 241-112-BY Analyses of Tank Samples April 4, 1972				
Sample Date: January 1972				
Component	Top Solids	Liquid	Bottom Solids	Units
Physical Data				
Density	1.48	1.42	1.44	g/cm^3
H_2O	-	-	50.5	%
Chemical Analysis				
Na	24.1	19.1	20.6	%
Al	2.8	4.1	0.6	%
Fe	<0.3	-	<0.5	%
Cr	0.15	-	4.8	%
Ni	0.11	-	0.2	%
Mn	0.02	-	<0.02	%
Si	0.7	-	0.6	%
NO_2	2.3	4.2	0.4	%
NO_3	9.2	7.1	17.8	%
CO_3	0.7	0.8	1.6	%
OH	6.5	7.6	4.4	%
TAD[2]	5.6	7.03	4.0	*M*
Radiological Analysis				
^{90}Sr	34.2	0.27	40.3	$\mu Ci/g$
^{137}Cs	151	483.0	20.6	$\mu Ci/g$
$^{95}Zr^{95}Nb$	25.2	8.6	23.6	$\mu Ci/g$
^{125}Sb	-	-	0.18	$\mu Ci/g$
$^{106}Ru^{106}Rh$	-	-	7.2	$\mu Ci/g$
$^{144}Ce^{144}Pr$	-	-	52.3	$\mu Ci/g$

Notes:

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

Table B2-61. Tank 241-BY-112 Sample.[1]

Waste Tank 241-112-BY Analysis of Supernate, Sludge, and Crust May 29, 1971				
Sample Event: April 1971				
Component	**Supernate**	**Sludge**	**Crust**	**Units**
Chemical Analysis				
Na	11.16	16.9	20.7	*M*
Fe	<1.81E-03	0.42	0.06	*M*
Al	2.05	1.71	0.58	*M*
Si	9.08E-03	0.22	<0.03	*M*
NO_2	1.4	1.54	0.012	*M*
NO_3	2.1	6.17	4.32	*M*
CO_3	0.018	0.67	3.05	*M*
SO_4	0.05	0.12	0.46	*M*
PO_4	0.023	0.26	0.12	*M*
TAD[2]	7.20	8.11	9.84	
Radiological Analysis				
$^{89+90}Sr$	1.85E+03	8.21E+04	9.84E+04	μCi/L
^{137}Cs	4.30E+05	3.17E+05	2.51E+05	μCi/L
^{134}Cs	4.48E+03	4.77E+03	3.11E+03	μCi/L
$^{106}Ru^{106}Rh$		3.91E+04	2.30E+03	μCi/L
^{60}Co		40	4.50E+02	μCi/L
^{125}Sb		3.77E+02	1.20E+03	μCi/L
$^{144}Ce^{144}Pr$		3.29E+04	5.70E+04	μCi/L
$^{95}Zr^{95}Nb$			5.30E+02	μCi/L
^{154}Eu			8.30E+02	μCi/L

Notes:

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

B3.0 ASSESSMENT OF CHARACTERIZATION RESULTS

This section discusses the overall quality and consistency of the current sampling results for tank 241-BY-112.

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

B3.1 FIELD OBSERVATIONS

In October, 1996, two push mode core samples were obtained from risers 18 and 21 of tank 241-BY-112. Core 174 from riser 18 contained 6 segments. The second core, core 177 from riser 21, also contained 6 segments. Sample recovery was poor. Only segments 5 and 6 of core 174 and segments 4 and 5 of core 177 were complete segments, that is, the segments contained material in the upper and lower half of the sampler. These cores show the average saltcake depth beneath the risers is about 279 cm (110 in.) which confirms the measured depth of 287 cm (113 in.) as of October 3, 1996, from riser 19. There is no indication of the use of hydrostatic head fluid in procuring these samples. A blank was not provided to the 222-S Laboratory.

B3.2 QUALITY CONTROL ASSESSMENT

The usual QC assessment includes an evaluation of the appropriate standard recoveries, spike recoveries, duplicate analyses, and blanks that are performed in conjunction with the chemical analyses. All the pertinent QC tests were conducted on the 1996 push mode core samples, allowing a full assessment regarding data accuracy and precision. Baldwin (1997) established the specific criteria for all analytes. Sample and duplicate pairs that had one or more QC results outside the specified criteria are identified by footnotes in the data summary tables.

The standard and spike recovery results provide an estimate of analysis accuracy. 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 RPD, which is defined as the absolute value of the difference between the primary and duplicate samples, divided by their mean, times 100.

B3.2.1 Differential Scanning Calorimetry Analysis

The RPD between sample and duplicate exceeded 20 percent on eight subsamples (see Table B3-1). Poor precision was caused by sample inhomogeneities. Rerun analyses were not requested.

The chemist noted the exotherms for the lower half of segments 4 of core 174 (S96T005876) indicated the decomposition of a relatively pure substance.

Table B3-1. Differential Scanning Calorimetry Relative Percent Differences Exceeding 20 Percent.

Sample	Sample Description	RPD
S96T005878	Core 174, segment 5, upper half	65.6
S96T005907	Core 174, segment 5, drainable liquid	20.7
S96T005880	Core 174, segment 6, upper half	68.7
S96T005879	Core 174, segment 6, lower half	127
S96T005919	Core 177, segment 3, lower half	56.1
S96T005920	Core 177, segment 4, upper half	54.5
S96T005950	Core 177, segment 5, upper half	94.6
S96T005960	Core 177, segment 5, drainable liquid	66.3

B3.2.2 Thermogravimetric Analysis

A second analysis of the lower half of segment 1 of core 177 (S96T005917) was performed because of the differences in appearance of the thermograms between the sample and duplicate. These differences were not seen in the replicate analysis.

The RPD between sample and duplicate for the lower half of segments 3 of core 177 (S96T005919) was 28.1 percent. Results were near the detection limit of the method, and precision was compromised. Rerun analysis was not requested.

B3.2.3 Density

Bulk density could not be determined for segment 1 of core 177 (S96T005911) because of subsample dryness. The highest bulk density result of 1.86 g/mL was used to calculate the laboratory's solid total alpha activity notification limit for this tank (33.1 μCi/g).

B3.2.4 Total Alpha Analysis

The RPD between sample and duplicate exceeded 20 percent for three subsamples. Segments 1, 3, and 5 for core 174 (S96T005889, S96T005891, and S96T005893) had RPDs of 27.3 percent, 55.1 percent, and 42.3 percent, respectively. A high RPD is caused by low sample alpha activity. Rerun analyses were not requested. In addition, two preparations blanks showed AT activity above the detection level. The activity in these preparation blanks is inconsequential when compared to the results for the samples and is caused by high counting error.

B3.2.5 Total Organic Carbon

Sample S96T005921 was reanalyzed for QC purposes, and results were below the notification limits. Sample S96T005876 had a spike recovery result of 0.0 percent caused by sample matrix interference.

The RPD between sample and duplicate exceeded 20 percent for four subsamples. Two subsamples, the lower half of segment 5 of core 174 (S96T005877) and the upper half of segment 6 of core 174 (S96T005880) were performed in triplicate. No rerun was requested. The lower half of segments 2 and 3 of core 174 (S96T005874 and S96T005875, respectively) and the upper half of segment 5 of core 177 had RPDs of 59.5 percent, 33.5 percent, and 27.2 percent, respectively. Poor precision was caused by sample heterogeneity. Rerun analyses were not requested.

In summary, the majority of the QC results were within the boundaries specified in Baldwin (1997). The discrepancies mentioned here and footnoted in the data summary tables should not impact data validity or use.

B3.3 DATA CONSISTENCY CHECKS

Comparing different analytical methods is useful in assessing data consistency and quality. Several comparisons were possible with the data set provided by the two core samples including a comparison of phosphorous as analyzed by ICP with phosphate as analyzed by IC. In addition, mass and charge balances were calculated to help 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 analytical methods. A close comparison between the two methods strengthens the credibility of both results, whereas a poor comparison brings the reliability of the data into question. See Section B2.0 for analytical mean results.

Sulfate data were measured by IC; sulfur was measured by ICP. This allows a comparison of the IC and ICP results. The mean sulfur result of the fusion-digested sample was 9.80E+03 μg/g which included some less than values. This converts to 2.94E+04 μg/g of sulfate. This compares with the water-digested IC mean core composite sulphate result of 2.50E+04 μg/g. The RPD between these two sulfur results was 16 percent. A similar calculation for phosphorous and phosphate was not used because the phosphorous data were below instrument detection levels.

The mean Oxalate IC result was 2.96E+04 μg/g. This converts to 8.07E+03 μg/g TOC which compares well with the mean TOC results of 8.51E+03 μg/g. This agreement between TOC and Oxalate confirms the low DSC results and shows 95 percent of the organics have degraded to Oxalate which is not reactive.

B3.3.2 Mass and Charge Balance

The principal objective in performing mass and charge balances is to determine whether the measurements are consistent. In calculating the balances, only analytes listed in Section B2.0 detected at a concentration of 1,000 μg/g or greater were considered.

Except for sodium, all cations listed in Table B3-2 were assumed to be in their most common hydroxide or oxide form, and the concentrations of the assumed species were calculated stoichiometrically. Because precipitates are neutral species, all positive charge was attributed to the sodium cation. The anions listed in Table B3-3 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 B3-2, the anionic species in Table B3-3, and the percent water were ultimately used to calculate the mass balance. The TOC is assumed to be totally converted to Oxalate and is not included in order to avoid counting it twice.

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 = Percent Water + 0.0001 x {Total Analyte Concentration}

$$= \% \text{ Water} + 0.0001 \times \{Al(OH)_4^- + Cr(OH)_3 + FeO(OH) + Na^+ + Cl^- + F^- + NO_3^- + NO_2^- + PO_4^{-3} + (COO)_2^{-2} + SiO_3^{-2} + SO_4^{-2} + CO_3^{-2}\}$$

The total analyte concentrations calculated from the above equation is 868,000 μg/g. The mean weight percent water (obtained from the mean reported in Table B3-4) is 27 percent or 270,000 μg/g. The mass balance resulting from adding the percent water to the total analyte concentration is 113.8 percent (see Table B3-4).

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) = $[Na^+]/23 = 1.45E+04$ μeq/g

Total anions (μeq/g) = $[Cl^-]/35 + [F^-]/19 + [NO_3^-]/62 + [NO_2^-]/46 + 2[(COO)_2^{-2}]/88 + 3[PO_4^{-3}]/95 + 2[SiO_3^{-2}]/76 + 2[SO_4^{-2}]/96 + 2[CO_3^{-2}]/60 + Al(OH)_4^-/95 =$ 1.15E+04 μeq/g

The charge balance obtained by dividing the sum of the positive charge by the sum of the negative charge was 1.26. The lower anion charge may be due to the presence of total hydroxide values, not accounted for in the charge balance calculations.

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

Table B3-2. Cation Mass and Charge Data.

Analyte	Concentration ($\mu g/g$)	Assumed Species	Concentration of Assumed Species ($\mu g/g$)	Charge ($\mu eq/g$)
Chromium	1.75E+04	$Cr(OH)_3$	3.47E+04	
Iron	2.96E+03	FeO(OH)	4.92E+04	
Sodium	3.34E+05	Na^+	3.34E+05	1.45E+04
Total			4.18E+05	1.45E+04

Table B3-3. Anion Mass and Charge Data.

Analyte	Concentration ($\mu g/g$)	Assumed Species	Concentration of Assumed Species ($\mu g/g$)	Charge ($\mu eq/g$)
Aluminate	1.82E+04	$Al(OH)_4^-$	6.40E+04	6.74E+02
Chloride	1.15E+03	Cl^-	1.15E+03	3.28E+01
Fluoride	9.41E+03	F^-	9.41E+03	4.95E+02
Nitrate	7.34E+04	NO_3^-	7.34E+04	1.18E+03
Nitrite	2.04E+04	NO_2^-	2.04E+04	4.43E+02
Oxalate	2.96E+04	$(COO)_2^{-2}$	2.96E+04	6.72E+02
Phosphate	1.66E+04	PO_4^{-3}	1.66E+04	5.24E+02
Silicon	2.43E+03	SiO_3^{-2}	6.60E+03	1.74E+02
Sulfate	2.50E+04	SO_4^{-2}	2.50E+04	5.21E+02
TIC	4.07E+04	CO_3^{-2}	2.04E+05	6.80E+03
Total			4.50E+05	1.15E+04

Table B3-4. Mass Balance Totals.

Totals	Concentrations ($\mu g/g$)
Total from Table B3-2	418,000
Total from Table B3-3	450,000
Percent Water	270,000
Grand Total	1,138,000

B3.4 MEAN CONCENTRATIONS AND CONFIDENCE INTERVALS

The following evaluation was performed on the analytical data from the samples from tank 241-BY-112.

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. This was done with segment-level data.

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

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

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 df degrees of freedom for a two-sided 95 percent confidence interval.

The mean, $\hat{\mu}$, and the standard deviation, $\hat{\sigma}_{\hat{\mu}}$, were estimated using restricted maximum likelihood estimation (REML) methods. The degrees of freedom (df) for tank 241-BY-112, is the number of cores sampled (two) minus one.

B3.4.1 Liquid and Solid Segment Means

The statistics in this section were based on analytical data from the most recent sampling event of tank 241-BY-112. Analysis of variance (ANOVA) techniques were used to estimate the mean and to 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 the data was 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 segment data from cores 174 and 177 for tank 241-BY-112. Tables B3-5 and B3-6 provide estimates of the mean concentration and confidence interval on the mean concentration for solid segment sample data and for liquid segment sample data, respectively. The lower limit 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 B3-5. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Solid Segment Sample Data. (2 sheets)

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	LL	UL
% water	%	2.70E+01	2.65E+00	1	0.00E+00	6.08E+01
DSC-dry	J/g	9.61E+01	2.29E+01	1	0.00E+00	3.87E+02
Bulk density	g/mL	1.46E+00	1.08E-01	1	8.18E-02	2.83E+00
Alpha	μCi/g	7.46E-02	2.03E-02	1	0.00E+00	3.33E-01
ICP.f.Ag[1]	μg/g	<2.04E+02	n/a	n/a	n/a	n/a
ICP.f.Al	μg/g	1.82E+04	6.24E+03	1	0.00E+00	9.76E+04
ICP.f.As[1]	μg/g	<2.04E+03	n/a	n/a	n/a	n/a
ICP.f.B[1]	μg/g	<1.02E+03	n/a	n/a	n/a	n/a
ICP.f.Ba[1]	μg/g	<1.02E+03	n/a	n/a	n/a	n/a
ICP.f.Be[1]	μg/g	<1.02E+02	n/a	n/a	n/a	n/a
ICP.f.Bi[1]	μg/g	<2.04E+03	n/a	n/a	n/a	n/a
ICP.f.Ca[1]	μg/g	<2.04E+03	n/a	n/a	n/a	n/a
ICP.f.Cd[1]	μg/g	<1.11E+02	n/a	n/a	n/a	n/a
ICP.f.Ce[1]	μg/g	<2.04E+03	n/a	n/a	n/a	n/a
ICP.f.Co[1]	μg/g	<4.07E+02	n/a	n/a	n/a	n/a
ICP.f.Cr	μg/g	1.75E+04	4.01E+03	1	0.00E+00	6.85E+04
ICP.f.Cu[1]	μg/g	<2.04E+02	n/a	n/a	n/a	n/a
ICP.f.Fe[2]	μg/g	2.96E+03	5.71E+02	1	0.00E+00	1.02E+04
ICP.f.La[1]	μg/g	<1.02E+03	n/a	n/a	n/a	n/a
ICP.f.Li[1]	μg/g	<2.04E+02	n/a	n/a	n/a	n/a
ICP.f.Mg[1]	μg/g	<2.04E+03	n/a	n/a	n/a	n/a
ICP.f.Mn[1]	μg/g	<2.92E+02	n/a	n/a	n/a	n/a
ICP.f.Mo[1]	μg/g	<1.02E+03	n/a	n/a	n/a	n/a

Table B3-5. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Solid Segment Sample Data. (2 sheets)

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	LL	UL
ICP.f.Na	µg/g	3.34E+05	3.66E+04	1	0.00E+00	7.99E+05
ICP.f.Nd[1]	µg/g	<2.04E+03	n/a	n/a	n/a	n/a
ICP.f.P[1]	µg/g	<7.77E+03	n/a	n/a	n/a	n/a
ICP.f.Pb[1]	µg/g	<2.04E+03	n/a	n/a	n/a	n/a
ICP.f.S[2]	µg/g	9.80E+03	2.75E+03	1	0.00E+00	4.48E+04
ICP.f.Sb[1]	µg/g	<1.22E+03	n/a	n/a	n/a	n/a
ICP.f.Se[1]	µg/g	<2.38E+03	n/a	n/a	n/a	n/a
ICP.f.Si[2]	µg/g	2.43E+03	2.97E+02	1	0.00E+00	6.21E+03
ICP.f.Sm[1]	µg/g	<2.04E+03	n/a	n/a	n/a	n/a
ICP.f.Sr[1]	µg/g	<2.04E+02	n/a	n/a	n/a	n/a
ICP.f.Ti[1]	µg/g	<2.04E+02	n/a	n/a	n/a	n/a
ICP.f.Tl[1]	µg/g	<4.07E+03	n/a	n/a	n/a	n/a
ICP.f.U[1]	µg/g	<1.02E+04	n/a	n/a	n/a	n/a
ICP.f.V[1]	µg/g	<1.02E+03	n/a	n/a	n/a	n/a
ICP.f.Zn[1]	µg/g	<2.23E+02	n/a	n/a	n/a	n/a
ICP.f.Zr[1]	µg/g	<2.04E+02	n/a	n/a	n/a	n/a
Bromide[1]	µg/g	<7.31E+02	n/a	n/a	n/a	n/a
Chloride	µg/g	1.15E+03	3.14E+02	1	0.00E+00	5.14E+03
Fluoride	µg/g	9.41E+03	3.25E+03	1	0.00E+00	5.07E+04
Nitrate	µg/g	7.34E+04	1.67E+04	1	0.00E+00	2.85E+05
Nitrite	µg/g	2.04E+04	5.80E+03	1	0.00E+00	9.42E+04
Oxalate[2]	µg/g	2.96E+04	1.02E+04	1	0.00E+00	1.60E+05
Phosphate[2]	µg/g	1.66E+04	8.55E+03	1	0.00E+00	1.25E+05
Sulfate	µg/g	2.50E+04	8.23E+03	1	0.00E+00	1.30E+05
TIC	µg/g	4.07E+04	8.50E+03	1	0.00E+00	1.49E+05
TOC	µg/g	8.51E+03	2.53E+03	1	0.00E+00	4.05E+04

Notes:

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

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

Table B3-6. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Liquid Segment Sample Data. (2 sheets)

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	LL	UL
% water	%	4.85E+01	1.58E-01	1	4.65E+01	5.05E+01
DSC-dry	J/g	1.40E+02	3.37E+01	1	0.00E+00	5.68E+02
Specific gravity	g/mL	1.47E+00	5.00E-03	1	1.41E+00	1.53E+00
Alpha[1]	µCi/mL	<1.63E-02	n/a	n/a	n/a	n/a
ICP.a.Ag	µg/mL	1.76E+01	3.25E-01	1	1.35E+01	2.18E+01
ICP.a.A[1]	µg/mL	5.55E+04	1.15E+03	1	4.08E+04	7.01E+04
ICP.a.As[1]	µg/mL	<6.01E+01	n/a	n/a	n/a	n/a
ICP.a.B	µg/mL	3.74E+01	2.27E+00	1	8.47E+00	6.63E+01
ICP.a.Ba[1]	µg/mL	<3.01E+01	n/a	n/a	n/a	n/a
ICP.a.Be[1]	µg/mL	<3.00E+00	n/a	n/a	n/a	n/a
ICP.a.Bi[1]	µg/mL	<6.01E+01	n/a	n/a	n/a	n/a
ICP.a.Ca[1]	µg/mL	<6.01E+01	n/a	n/a	n/a	n/a
ICP.a.Cd[1]	µg/mL	<3.00E+00	n/a	n/a	n/a	n/a
ICP.a.Ce[1]	µg/mL	<6.01E+01	n/a	n/a	n/a	n/a
ICP.a.Co[1]	µg/mL	<1.20E+01	n/a	n/a	n/a	n/a
ICP.a.Cr	µg/mL	1.10E+04	2.21E+03	1	0.00E+00	3.91E+04
ICP.a.Cu[1]	µg/mL	<6.01E+00	n/a	n/a	n/a	n/a
ICP.a.Fe[1]	µg/mL	<3.01E+01	n/a	n/a	n/a	n/a
ICP.a.K	µg/mL	1.01E+04	9.00E+01	1	8.97E+03	1.13E+04
ICP.a.La[1]	µg/mL	<3.01E+01	n/a	n/a	n/a	n/a
ICP.a.Li[1]	µg/mL	<6.01E+00	n/a	n/a	n/a	n/a
ICP.a.Mg[1]	µg/mL	<6.01E+01	n/a	n/a	n/a	n/a
ICP.a.Mn[1]	µg/mL	<6.01E+00	n/a	n/a	n/a	n/a
ICP.a.Mo	µg/mL	9.77E+01	2.05E+00	1	7.17E+01	1.24E+02
ICP.a.Na	µg/mL	2.44E+05	6.29E+02	1	2.36E+05	2.52E+05
ICP.a.Nd[1]	µg/mL	<6.01E+01	n/a	n/a	n/a	n/a
ICP.a.Ni[1]	µg/mL	<1.20E+01	n/a	n/a	n/a	n/a
ICP.a.P	µg/mL	3.92E+02	6.00E+00	1	3.15E+02	4.68E+02
ICP.a.Pb[1]	µg/mL	<6.01E+01	n/a	n/a	n/a	n/a
ICP.a.S	µg/mL	3.27E+02	3.33E+00	1	2.84E+02	3.69E+02

Table B3-6. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Liquid Segment Sample Data. (2 sheets)

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	LL	UL
ICP.a.Sb[1]	μg/mL	<3.61E+01	n/a	n/a	n/a	n/a
ICP.a.Se[1]	μg/mL	<6.01E+01	n/a	n/a	n/a	n/a
ICP.a.Si	μg/mL	4.19E+02	2.63E+01	1	8.57E+01	7.53E+02
ICP.a.Sm[1]	μg/mL	<6.01E+01	n/a	n/a	n/a	n/a
ICP.a.Sr[1]	μg/mL	<6.01E+00	n/a	n/a	n/a	n/a
ICP.a.Ti[1]	μg/mL	<6.01E+00	n/a	n/a	n/a	n/a
ICP.a.Tl[1]	μg/mL	<1.20E+02	n/a	n/a	n/a	n/a
ICP.a.U[1]	μg/mL	<3.00E+02	n/a	n/a	n/a	n/a
ICP.a.V[1]	μg/mL	<3.01E+01	n/a	n/a	n/a	n/a
ICP.a.Zn[1]	μg/mL	<6.01E+00	n/a	n/a	n/a	n/a
ICP.a.Zr[1]	μg/mL	<6.01E+00	n/a	n/a	n/a	n/a
Bromide[1]	μg/mL	<9.62E+02	n/a	n/a	n/a	n/a
Chloride	μg/mL	9.04E+03	1.36E+03	1	0.00E+00	2.63E+04
Fluoride	μg/mL	6.94E+02	7.30E+01	1	0.00E+00	1.62E+03
Nitrate	μg/mL	1.90E+05	1.92E+04	1	0.00E+00	4.35E+05
Nitrite	μg/mL	1.40E+05	9.00E+03	1	2.56E+04	2.54E+05
Oxalate[2]	μg/mL	3.32E+03	2.52E+03	1	0.00E+00	3.53E+04
Phosphate[2]	μg/mL	1.48E+03	1.23E+02	1	0.00E+00	3.04E+03
Sulfate[2]	μg/mL	5.93E+03	3.85E+03	1	0.00E+00	5.49E+04
TIC	μg/mL	1.54E+03	7.75E+01	1	5.58E+02	2.53E+03
TOC[3]	μg/mL	1.72E+03	1.97E+02	1	0.00E+00	4.23E+03

Notes:

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

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

[3]Wet basis

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 liquid segment data and bulk density data is as follows:

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

$$i=1^{12},\ldots,a,\ j= 1^{12},\ldots,b_i,$$

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
b_i	=	the number of analytical results from the i^{th} core

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[1] (Statistical Science 1993).

The statistical model fit to the solid segment data for alpha is as follows:

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

$$i=1^{12},\ldots,a,\ j= 1^{12},\ldots,b_i,\ k=1^{12},\ldots c_{ij}$$

where

Y_{ijk}	=	laboratory results from the k^{th} duplicate from 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

[1]S-PLUS is a registered trademark of Statistical Sciences, Seattle, WA.

S_{ij}	=	the effect of the j^{th} segment from the i^{th} core
A_{ijk}	=	the effect of the k^{th} analytical result from the j^{th} segment from the i^{th} core
a	=	the number of cores
b_i	=	the number of segments from the i^{th} core
c_{ij}	=	the number of analytical results from the j^{th} segment from the i^{th} core

The variables C_i and S_{ij} are assumed to be a random effect. This variable and A_{ij} are assumed to be uncorrelated and normally distributed with means zero and variances $\sigma^2(C)$, $\sigma^2(S)$, and $\sigma^2(A)$, respectively. Estimates of $\sigma^2(C)$, $\sigma^2(S)$, 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 Science 1993).

The statistical model fit to the remaining solid segment data is as follows:

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

$$i=1^{12},\ldots,a,\ j=1^{12},\ldots,b_i,\ k=1,\ldots,c_{ij},\ m=1,\ldots,d_{ijk}$$

where

Y_{ijkm}	=	laboratory results from the m^{th} duplicate in 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 in the i^{th} core
L_{ijk}	=	the effect of the k^{th} location in the j^{th} segment in the i^{th} core
A_{ijkm}	=	the effect of the m^{th} duplicate result in 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

d_{ijk} = the number of analytical results from the k^{th} location in the 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 methods. This method, applied to variance component estimation, is described in Harville (1977). The statistical results were obtained using statistical analysis package S-PLUS® (Statistical Science 1993).

B4.0 APPENDIX B REFERENCES

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APPENDIX C

STATISTICAL ANALYSIS FOR ISSUE RESOLUTION

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APPENDIX C

STATISTICAL ANALYSIS FOR ISSUE RESOLUTION

Appendix C contains information on the data investigations required for the applicable DQOs for tank 241-BY-112, and it documents the results of statistical and other numerical manipulations required in the DQOs. The analyses required for tank 241-BY-112 are reported below.

C1.0 STATISTICS FOR SAFETY SCREENING DQO

The safety screening DQO (Dukelow et al. 1995) defines acceptable decision confidence limits in terms of one-sided 95 percent confidence intervals. In this appendix, one-sided confidence limits supporting the safety screening DQO are calculated for tank 241-BY-112. All data in this section are from the final laboratory data package for the 1996 core sampling event for tank 241-BY-112 (Nuzum 1997).

Confidence intervals were computed for each sample number from tank 241-BY-112 analytical data. Tables C1-1 and C1-2 show the sample numbers and confidence intervals for alpha and DSC, respectively.

The UL of a one-sided 95 percent confidence interval on the mean is as follows:

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

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 percent confidence interval.

For tank 241-BY-112 data (per sample number), df equals the number of observations minus one.

Table C1-1 lists the UL of the 95 percent confidence interval for each sample number based on alpha data. Each confidence interval can be used to make the following statement. If the UL is less than 41 μCi/g (61.5 μCi/mL for liquid), reject the null hypothesis that the alpha is greater than or equal to 41 μCi/g (61.5 μCi/mL for liquid) at the 0.05 level of significance. Because no tank 241-BY-112 UL alpha results exceeded the threshold limits, criticality is not a concern.

Table C1-2 lists the UL of the 95 percent confidence interval for each sample number based on DSC data. Each confidence interval can be used to make the following statement. If the

UL is less than 480 J/g, reject the null hypothesis that DSC is greater than or equal to 480 J/g at the 0.05 level of significance. All measurements are well below the limit. Three samples exceeded the 95 percent confidence interval upper limit of 480 J/g because of sample heterogeneity. However, because moisture content ranged from 33 to 37 percent for these segments (well above the threshold of 17 percent) and because total organic carbon is low, energetics is not a concern for this tank.

Table C1-1. 95 Percent Confidence Interval Upper Limits for Alpha for Tank 241-BY-112. (Units are μCi/g or μCi/mL)

Sample Number	Sample Description	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	UL
S96T005889	Core 174, segment 1, lower half	1.01E-01	1.38E-02	1.88E-01
S96T005890	Core 174, segment 2, lower half	3.01E-02	2.55E-03	4.62E-02
S96T005891	Core 174, segment 3, lower half	5.15E-02	1.42E-02	1.41E-01
S96T005892	Core 174, segment 4, lower half	2.58E-01	2.15E-02	3.93E-01
S96T005893	Core 174, segment 5, lower half	5.49E-02	1.16E-02	1.28E-01
S96T005895	Core 174, segment 6, lower half	6.23E-02	5.00E-04	6.55E-02
S96T005929	Core 177, segment 1, lower half	2.32E-03	0.00E+00	2.32E-03
S96T005930	Core 177, segment 2, lower half	3.79E-02	2.35E-03	5.27E-02
S96T005931	Core 177, segment 3, lower half	4.86E-02	1.10E-03	5.55E-02
S96T005933	Core 177, segment 4, lower half	1.64E-01	1.00E-02	2.27E-01
S96T005957	Core 177, segment 5, lower half	4.55E-02	4.50E-04	4.83E-02
S96T005934	Core 177, segment 6, lower half	3.95E-02	4.50E-04	4.23E-02

Table C1-2. 95 Percent Confidence Interval Upper Limits for Differential Scanning Calorimetry Exotherms for Tank 241-BY-112 (J/g Dry).

Sample Number	Sample Description	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	UL
S96T005873	Core 174, segment 1, lower half	0.00E+00	0.00E+00	0.00E+00
S96T005874	Core 174, segment 2, lower half	0.00E+00	0.00E+00	0.00E+00
S96T005875	Core 174, segment 3, lower half	0.00E+00	0.00E+00	0.00E+00
S96T005876	Core 174, segment 4, lower half	1.72E+02	3.50E+00	1.94E+02
S96T005907	Core 174, segment 5, drainable liquid	1.74E+02	1.80E+01	2.88E+02
S96T005878	Core 174, segment 5, upper half	2.67E+02	8.75E+01	8.19E+02
S96T005877	Core 174, segment 5, lower half	1.09E+02	2.00E+00	1.22E+02
S96T005880	Core 174, segment 6, upper half	1.65E+02	5.65E+01	5.21E+02
S96T005879	Core 174, segment 6, lower half	2.07E+01	1.32E+01	1.04E+02
S96T005917	Core 177, segment 1, lower half	0.00E+00	0.00E+00	0.00E+00
S96T005918	Core 177, segment 2, lower half	0.00E+00	0.00E+00	0.00E+00
S96T005919	Core 177, segment 3, lower half	1.30E+02	3.66E+01	3.61E+02
S96T005920	Core 177, segment 4, upper half	1.15E+02	3.13E+01	3.12E+02
S96T005921	Core 177, segment 4, lower half	2.20E+02	1.75E+01	3.30E+02
S96T005960	Core 177, segment 5, drainable liquid	1.07E+02	3.54E+01	3.30E+02
S96T005950	Core 177, segment 5, upper half	1.45E+02	6.87E+01	5.79E+02
S96T005951	Core 177, segment 5, lower half	1.76E+02	1.00E+01	2.39E+02
S96T005922	Core 177, segment 6, lower half	7.65E+01	5.30E+00	1.10E+02

C2.0 STATISTICS FOR THE ORGANIC DATA QUALITY OBJECTIVE

The organic DQO (Turner et al. 1995) defines acceptable decision confidence limits in terms of one-sided 95 percent confidence intervals. This appendix calculates those one-sided confidence limits for tank 241-BY-112. All data considered are from the final laboratory data package for the 1996 core sampling event for tank 241-BY-112 (Nuzum 1997).

Confidence intervals were computed for each sample number from tank 241-BY-112 analytical data. Tables C1-3 and C1-4 show the sample numbers and confidence intervals for percent water and TOC, respectively.

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

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

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 degrees of freedom for a one-sided 95 percent confidence interval.

For tank 241-BY-112 data (per sample number), df equals the number of observations minus one.

Table C1-3 lists the LL of the 95 percent confidence interval for each sample number based on percent water data. Each confidence interval can be used to make the following statement. If the LL is greater than 17 percent, reject the null hypothesis that the percent water is less than or equal to 17 percent at the 0.05 level of significance. Six samples were below the 95 percent confidence interval LL of 17 percent. However, the DSCs for the same samples were below the DSC limit of 480 J/g.

Table C1-4 lists the upper limit of the 95 percent confidence interval for each sample number based on TOC data. Each confidence interval can be used to make the following statement. If the upper limit is less than 30,000 μg/g, reject the null hypothesis that TOC is greater than or equal to 30,000 μg/g at the 0.05 level of significance. The units for TOC drainable liquid samples were converted from μg/mL to μg/g using the specific gravity results for each sample number. Three samples exceeded the 95 percent confidence interval UL of 30,000 μg/g. The DSCs for these same samples were low, indicating the TOC has degraded and is not reactive.

Table C1-3. 95 Percent Confidence Interval Lower Limits for Percent Water for Tank 241-BY-112 (Units are in Percents).

Sample Number	Description	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	LL
S96T005873	Core 174, segment 1, lower half	2.37E+01	1.43E+00	1.47E+01
S96T005874	Core 174, segment 2, lower half	1.44E+01	1.50E-02	1.43E+01
S96T005875	Core 174, segment 3, lower half	1.47E+01	9.80E-01	8.48E+00
S96T005876	Core 174, segment 4, lower half	2.33E+01	1.15E-01	2.26E+01
S96T005907	Core 174, segment 5, drainable liquid	4.84E+01	3.15E-01	4.64E+01
S96T005877	Core 174, segment 5, lower half	4.27E+01	8.70E-01	3.72E+01
S96T005878	Core 174, segment 5, upper half	3.40E+01	1.95E-01	3.27E+01
S96T005879	Core 174, segment 6, lower half	3.30E+01	7.00E-02	3.25E+01
S96T005880	Core 174, segment 6, upper half	3.72E+01	3.50E-01	3.50E+01
S96T005917	Core 177, segment 1, lower half	3.59E+01	4.77E+00	2.47E+01
S96T005918	Core 177, segment 2, lower half	1.54E+01	3.65E-01	1.31E+01
S96T005919	Core 177, segment 3, lower half	1.85E+01	2.60E+00	2.10E+00
S96T005921	Core 177, segment 4, lower half	3.66E+01	2.20E-01	3.53E+01
S96T005920	Core 177, segment 4, upper half	1.99E+01	1.61E+00	9.72E+00
S96T005960	Core 177, segment 5, drainable liquid	4.87E+01	7.50E-02	4.82E+01
S96T005951	Core 177, segment 5, lower half	4.02E+01	1.40E-01	3.93E+01
S96T005950	Core 177, segment 5, upper half	3.35E+01	1.23E+00	2.58E+01
S96T005922	Core 177, segment 6, lower half	2.87E+01	1.03E+00	2.22E+01

Table C1-4. 95 Percent Confidence Interval Upper Limits for TOC for Tank 241-BY-112. (Units are in μg/g-Dry)

Sample Number	Description	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	UL
S96T005873	Core 174, segment 1, lower half	1.55E+03	5.90E+01	1.93E+03
S96T005874	Core 174, segment 2, lower half	6.29E+02	1.87E+02	1.81E+03
S96T005875	Core 174, segment 3, lower half	1.29E+03	2.15E+02	2.64E+03
S96T005876	Core 174, segment 4, lower half	4.24E+04	2.35E+03	5.72E+04
S96T005907	Core 174, segment 5, drainable liquid	2.51E+03	3.28E+01	2.72E+03
S96T005877	Core 174, segment 5, lower half	1.12E+04	1.20E+03	1.47E+04
S96T005878	Core 174, segment 5, upper half	2.14E+04	7.57E+01	2.19E+04
S96T005879	Core 174, segment 6, lower half	2.32E+03	7.46E+00	2.37E+03
S96T005880	Core 174, segment 6, upper half	1.19E+04	6.53E+02	1.38E+04
S96T005917	Core 177, segment 1, lower half	2.07E+03	1.01E+02	2.71E+03
S96T005918	Core 177, segment 2, lower half	9.77E+02	9.10E+01	1.55E+03
S96T005919	Core 177, segment 3, lower half	6.57E+02	2.39E+01	8.09E+02
S96T005921	Core 177, segment 4, lower half	4.35E+04	3.55E+03	6.59E+04
S96T005920	Core 177, segment 4, upper half	8.37E+03	7.80E+02	1.33E+04
S96T005960	Core 177, segment 5, drainable liquid	2.02E+03	1.33E+01	2.10E+03
S96T005951	Core 177, segment 5, lower half	1.44E+04	2.76E+02	1.61E+04
S96T005950	Core 177, segment 5, upper half	3.10E+04	4.21E+03	5.76E+04
S96T005922	Core 177, segment 6, lower half	6.57E+03	7.71E+01	7.06E+03

C3.0 APPENDIX C REFERENCES

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-BY-112

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-BY-112

An effort is underway to provide waste inventory estimates that will serve as standard characterization source terms for the various waste management activities (Hodgson and LeClair 1996). As part of this effort, an evaluation of available information for single-shell tank 241-BY-112 was performed, and a best-basis inventory was established. This work follows the methodology that was established by the standard inventory task.

D1.0 CHEMICAL INFORMATION SOURCES

Available waste (chemical) information for tank 241-BY-112 includes the following:

- Data from recent analyses of two partial push-mode core samples that were collected in October, 1996 (see Appendix B).
- The inventory estimate for this tank (Agnew et al. 1997) generated from the HDW model developed at Los Alamos National Laboratory.
- Tank Characterization Report data from other tanks historically identified as having the same BY saltcake waste type. For specific tanks and references, see Section D3.3.

D2.0 COMPARISON OF COMPONENT INVENTORY VALUES

Tables 2-1 and 2-2 compare sample-based inventories derived from the analytical concentration data from the core samples and the HDW model inventories. Table D2-1 compares nonradioactive components on a kilogram (kg) basis, and Table D2-2 compares the radioactive components on a total curie basis. The HDW model document (Agnew et al. 1997) provides tank content estimates in terms of component concentrations and inventories. The chemical species are reported without charge designation according to the best basis inventory convention.

The sample-based inventories listed in the TCR were calculated by multiplying the mean concentration of an analyte by the current waste mass, derived using the current tank volume and the mean density of the waste. However, the sample data are based on incomplete core samples. (A full profile of the waste was not obtained.) The tank is reported by Hanlon (1997) to contain 1,101 kL (291 kgal) total waste consisting of 1,082 kL (286 kgal) saltcake and 18.9 kL (5 kgal) sludge. The mean density is reported to be 1.46 g/mL (see Appendix B).

The HDW model inventory is also based on a waste volume of 1,101 kL (291 kgal), but it assumes a higher density than observed for the samples (1.63 g/mL). The waste in the HDW model is partitioned as follows: 1,071 kL (283 kgal) BY saltcake, 22.7 kL (6 kgal) sludge from ferrocyanide scavenging (PFeCN), and 7.6 kL (2 kgal) metal waste sludge.

The sample-based inventory was developed by assuming that the unsampled last portion of waste at the tank bottom had the same mean concentrations as did the rest of the tank. It is possible that a small layer of PFeCN and metal waste sludge remains in the tank bottom, but no reliable documentation is available to support this assumption. The assumption used for this assessment is that there is no sludge layer at the tank bottom. The potential sludge layer is only a small portion of this tank's waste volume (<3 percent). Only a sample taken at the tank bottom will indicate if this is correct.

Table D2-1. Sample-Based and Hanford Defined Waste-Based Inventory Estimates for Nonradioactive Components in Tank 241-BY-112. (2 sheets)

Analyte	Sampling[1] Inventory Estimate (kg)	HDW[2] Inventory Estimate (kg)	Analyte	Sample[1] Inventory Estimate (kg)	HDW[2] Inventory Estimate (kg)
Al	31,000	61,100	NO_3	124,000	450,000
Bi	<3,270	1,550	OH	NR	180,000
Ca	<3,270	3,430	oxalate	47,700	0.253
Cl	2,110	5,030	Pb	<3,270	1,260
Cr	28,400	3,070	P as PO_4	26,700	8,030
F[c]	15,100	1,180	Si	3,910	2,350
Fe	4,760	2,570	S as SO_4	40,400	20,100
Hg	NR	7.79	Sr	<327	0
K	NR	1,680	TIC as CO_3	326,000	33,700
La	<1,640	0.304	TOC	13,700	7,920
Mn	<469	191	U_{TOTAL}	<16,400	10,000
Na	543,000	330,000	Zr	<327	3.32

Table D2-1. Sample-Based and Hanford Defined Waste-Based Inventory Estimates for Nonradioactive Components in Tank 241-BY-112. (2 sheets)

Analyte	Sampling[1] Inventory Estimate (kg)	HDW[2] Inventory Estimate (kg)	Analyte	Sample[1] Inventory Estimate (kg)	HDW[2] Inventory Estimate (kg)
NH_3	NR	359	H_2O (wt%)	27.0	36.1
Ni	NR	1,020	density (kg/L)	1.46	1.63
NO_2	37,000	83,700			

Notes:

NR = Not reported

[1]See Appendix B
[2]Agnew et al. (1997)
[3]Fluoride based on water soluble portion only

Table D2-2. Sample- and HDW Model-based Inventory Estimates for Radioactive Components in Tank 241-BY-112.

Analyte	Sampling[1] Inventory Estimate (Ci)	HDW[2] Inventory Estimate (Ci)	Analyte	Sampling[1] Inventory Estimate (Ci)	HDW[2] Inventory Estimate (Ci)
^{90}Sr	NR	144,000	$^{239/240}Pu$	NR	97.2
^{137}Cs	NR	170,000			

Notes:

[1]See Appendix B
[2]Agnew et al. (1997)

D3.0 COMPONENT INVENTORY EVALUATION

The following evaluation of tank contents is performed to identify potential errors and/or missing information that would influence the sample-based and HDW model component inventories.

D3.1 EXPECTED TYPE OF WASTE BASED ON THIS ASSESSMENT

The reported waste types in tank 241-BY-112 are below. For a detailed summary of the waste transfer history, see Appendix B.

Agnew et al. (1997): MW, PFeCN, BYSltCk
Hill et al. (1995): TBP-F, EB-ITS, CW

Abbreviations:

PFeCN	=	Uranium recovery or tributyl phosphate supernatants that were ferrocyanide scavenged in U Plant
EB-ITS	=	Evaporator bottoms from in-tank solidification
BYSltCk	=	BY saltcake (the same as EB-ITS in this case)
TBP-F	=	Tributyl phosphate-ferrocyanide scavenged uranium recovery (TBP) supernatants (equivalent to PFeCN)
CW	=	Cladding waste from the bismuth phosphate process
MW	=	Metal waste from the bismuth phosphate process

A sludge layer may exist at the bottom of tank 241-BY-112. During 1955, the tank was sluiced, and it was declared empty in July 1955 (Rodenhizer 1987). However, the HDW model assumes that not all metal waste were removed during the sluicing and attributes 7.6 kL (2 kgal) of the waste volume to metal waste sludge.

There is a possibility that PFeCN supernatants were transferred to the tank after it was sluiced, depositing some sludge in the tank (Agnew et al. 1995). Grigsby et al. (1992) strongly suggests a sludge layer exists in this tank. Because the sampling did not extend to the bottom of the tank, none of these assumptions can be verified. The sample-based inventory and the other portions of this TCR do not assume of sludge layer, therefore to be consistent this engineering assessment does not assume a sludge layer in tank 241-BY-112. The potential sludge layer is only a small portion of this tank's waste volume (<3 percent). Only a new sample from the bottom of tank 241-BY-112 can indicate which assumption is correct.

Salt waste supernatants were evaporated and concentrated in the 1960s and 1970s using an in-tank heater (in-tank solidification unit) in tank 241-BY-112. A major portion of the waste in-tank 241-BY-112 consists of this BYSltCk.

D3.2 ASSUMPTIONS USED

The sections below provide an engineering evaluation of tank 241-BY-112 contents. For this evaluation, the following assumptions and observations were made.

- Total waste mass is calculated using the sample-based measured density and the tank volume listed in (Hanlon 1997) (1,101 kL [291 kgal]). The waste types that contribute to the total volume are slightly different in each reference as described in Sections D2.0 and D3.1. As a result, the two inventory estimates are not made on the same waste type basis but vary by less than about 3 percent. The different densities provide approximately an additional 11 percent error basis.

- Only the BYSltCk waste stream contributed to solids formation.

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

D3.3 BASIS FOR CALCULATIONS USED IN THIS EVALUATION

Table D3-1 summarizes the engineering evaluation approach used on tank 241-BY-112.

Table D3-1. Assessment Methodology Used For Tank 241-BY-112.

Type of Waste	How Calculated	Check Method
Supernatant	No supernatant was predicted.	n/a
Saltcake Vol. = 1,101 kL (291 kgal)	Used the sample-based inventory, calculated by multiplying the average tank analyte concentration by the total mass of waste in tank 241-BY-112. The density used was the average measured density (1.46 g/mL).	The analyte concentrations for several 241-BY tanks containing BYSltCk were compared to tank 241-BY-112. The average sample-based analyte concentrations for three 241-BY tanks (241-BY-102, 241-BY-111 and 241-BY-112) were multiplied by saltcake total mass in tank 241-BY-112 to predict the tank 241-BY-112 inventory. The density used was the density of tank 241-BY-112 (1.46 g/mL).
Sludge	No sludge was assumed.	n/a

BY saltcake denotes salt waste supernatants that were blended and concentrated using in-tank heaters. In-tank solidification campaigns were performed in the BY Tank Farm from 1964 through 1976. Waste supernatants, which were evaporated, originated primarily from the $BiPO_4$ process operations in B Plant. Heaters were placed in tanks 241-BY-101, 241-BY-102, and 241-BY-112. The heater was in tank 241-BY-101 only for a short time. Certain BY tanks were designated as feed tanks. Concentrates from the heated tanks were transferred to other tanks in the BY Tank Farm and some BX Tank Farm tanks where they cooled and crystallized (Agnew et al. 1995).

Agnew et al. (1997) provide a defined waste composition for BY saltcake. Because of the complicated waste transfer history of the ITS campaign and the lack of a flowsheet basis for the waste composition, it is difficult to perform an independent assessment to estimate a saltcake composition that can be compared to the model-based BY saltcake composition.

However, samples from BY Tank Farm tanks, other than tank 241-BY-112, that contain BY saltcake have been analyzed, and the results have been reported. The analytical results for these tanks were evaluated at the core segment level, and BY saltcake was identified. Table D3-2 summarizes the compositions of saltcake from tanks 241-BY-105, 241-BY-106, and 241-BY-110 based on the segment-level analysis reported, respectively, in Simpson et al. (1996a), Bell et al. (1996), and Simpson et al. (1996b). For comparison, Table D3-2 also shows the waste component concentrations for tank 241-BY-102, 241-BY-112, and the saltcake defined waste composition from (Agnew et al. 1997).

As Table D3-2 indicates, the concentrations of major waste components such as sodium, aluminum, nitrate, fluoride, and sulfate vary among the three comparison tanks (tanks 241-BY-105, 241-BY-106, and 241-BY-110) by no more than a factor of about three. However, the variation among tanks for minor components is much higher.

The iron, chromium, nickel, silicon, fluoride, phosphate, and sulfate concentrations in samples from tanks 241-BY-102 and 241-BY-112 are much higher than the corresponding average concentrations of those components in the three BY Tank Farm comparison tanks. The high sulfate and phosphate concentrations in tanks 241-BY-102 and 241-BY-112 are apparently compensated by lower nitrate concentrations. Some apparent anomalies for tanks 241-BY-102 and 241-BY-112 probably result from using tanks 241-BY-102 and 241-BY-112 as ITS units. These tanks contained the heater, whereas several other BY Tank Farm tanks received previously cooled evaporated supernatant from tanks 241-BY-102 and/or 241-BY-112. In particular, components with lower solubilities would probably concentrate and precipitate from solution and collect on the cooler surfaces of the ITS unit in tanks 241-BY-102 or 241-BY-112.

For several analytes, the average analytical-based composition from tanks 241-BY-105, 241-BY-106, and 241-BY-110 compare more favorably with the HDW model saltcake composition than the composition of tanks 241-BY-102 or 241-BY-112. For others, the opposite is true. For this reason, the tanks listed in Table D3-3 were used in the engineering assessment to predict tank 241-BY-112 waste composition not these tanks.

Table D3-2. Concentrations of Components in BY Tank Farm Saltcake Samples. (2 sheets)

Analyte	Component Concentration (μg/g)						
	241-BY-105	241-BY-106	241-BY-110	Average Concentration[1]	241-BY-102	241-BY-112[2]	HDW average[3] BYSltCk
Nonradioactive Components							
Al	18,400	20,400	14,100	17,633	41,600	18,200	34,974
Bi	55.6	NR	NR	55.6	<2,030	<2,040	114.9
Ca	216	308	400	308	<2,100	<2,040	1,791
Chloride	897	2,060	2,250	1,736	1,220	1,150	2,860
Cr	321	855	2,900	1,359	1,870	17,500	1,754
Fluoride	4,100	5,130	5,420	4,883	18,000	9,410	649
Fe	476	215	924	538	1,860	2,960	749
Pb	50.3	64.5	130	82	<2,030	<2,040	721
Mn	54.8	9.57	52.8	39.1	372	<292	109
Ni	75.9	47.9	193	106	4,820	NR	487
Nitrate	491,000	329,000	184,000	335,000	95,000	73,400	249,000
Nitrite	9,410	32,100	30,600	24,037	13,900	20,400	47,144
Oxalate	11,300	8,990	13,600	11,297	19,300	29,600	0.145
Phosphate	4,890	5,270	14,200	8120	27,000	16,600	3,998
P	1,010	1,032	4,650	2,231	<9,500	<7,770	NR
K	712	2,470	1,930	1,704	NR	NR	956
Si	180	184	451	272	4,350	2,430	1,320
Na	198,000	203,000	237,000	213,000	267,000	334,000	185,000

Table D3-2. Concentrations of Components in BY Tank Farm Saltcake Samples.
(2 sheets)

Analyte	Component Concentration ($\mu g/g$)						
	241-BY-105	241-BY-106	241-BY-110	Average Concentration[1]	241-BY-102	241-BY-112[2]	HDW average[3] BYSltCk
Sr	88.3	44.4	58.1	64	<203	<204	0
Sulfate	10,600	11,300	18,400	13,433	57,700	25,000	11,373
S	3,140	3,280	5,950	4,123	17,300	9,800	NR
TIC	NR	7,359	31,800	19,580	27,800	40,700	3,718
TOC	3,250	2,500	5,920	3,890	4,360	8,510	NR
U	261	164.2	697	374	<10,100	<10,200	3,930
Zn	36.8	164.2	32.8	77.9	<396	<223	NR
Zr	5.23	6.28	14.4	8.64	<203	<204	1.9
Density (g/mL)	NR	1.71	NR	1.71	1.50	1.46	1.63
wt% H_2O	16.1	25.5	23.2	21.6	NR	27.0	36.1
Radionuclides							
^{90}Sr	NR	<4.26	22.5	22.5	NR	NR	78
^{137}Cs	NR	106	60	83	NR	NR	92.2
$^{239/240}Pu$	NR	NR	0.0192	0.0192	NR	NR	0.056

Notes:

[1]Average analyte concentrations for tank 241-BY-105, 241-BY-106, and 241-BY-110

[2]From Appendix B

[3]Agnew et al. (1997).

In Table D3-2, component concentrations in tank 241-BY-112 appear more like those for tank 241-BY-102 than those in other BY Tank Farm tanks. It was not expected that component concentrations for tank 241-BY-111, which did not have an ITS unit, are more closely aligned to BY Tank Farm tanks with an ITS unit. Therefore, the engineering assessment compares tank 241-BY-112 concentrations to the concentrations of tank 241-BY-102, an ITS tank, to tank 241-BY-111 (see Table D3-3).

The engineering assessment inventories for tank 241-BY-112 were determined by multiplying the average concentration of the three tanks by 291 (kgal), 3,785 (kgal to L), and 1.46 (the density in g/mL) and then dividing by 1,000,000 (to convert to kg) (see Table D3-3).

Table D3-3. Tank 241-BY-112 Inventory Calculations. (2 sheets)

	μg/g	μg/g	μg/g	μg/g	BY-112SC (kg)
Element	BY-102(SC)	BY-111(SC)	BY-112(SC)	Average Concentration	(SC Volume of 291 kgal)
Al	41,600	25,000	18,200	28,267	45,500
Bi	<2,030	<1,930	<2,040	<2,000	<3,240
Ca	<2,100	<4,180	<2,040	<2,774	<4,490
Chloride	1,220	1,090	1,150	1,153	1,860
Cr	1,870	2,060	17,500	7,143	11,500
Fluoride	18,000	9,620	9,410	12,343	19,800
Fe	1,860	5,960	2,960	3,593	5,780
Pb	<2,030	<1,930	<2,040	<2,000	<3,240
Mn	372	<246	<292	372	598
Ni	4,820	NR	NR	4,820	7,750
NO_3	95,000	153,000	73,400	107,133	172,000
NO_2	13,900	14,200	20,400	16,167	26,000
Oxalate	19,300	19,300	29,600	22,733	36,600
PO_4	27,000	20,000	16,600	21,200	34,100
P	<9,500	9,810	<7,770	9,810	15,800
K	NR	NR	NR	NR	NR
Si	4,350	34,500	2,430	13,760	22,100
Na	267,000	241,000	334,000	280,667	451,000
Sr	<203	<205	<204	<204	<330
SO_4	57,700	34,400	25,000	39,033	62,800

Table D3-3. Tank 241-BY-112 Inventory Calculations. (2 sheets)

	μg/g	μg/g	μg/g	μg/g	BY-112SC (kg)
Element	BY-102(SC)	BY-111(SC)	BY-112(SC)	Average Concentration	(SC Volume of 291 kgal)
S	17,300	11,800	9,800	12,967	20,900
TIC	27,800	23,600	40,700	30,700	49,300
TOC	4,360	6,920	8,510	5,640	10,600
U	<10,000	<9,660	<10,200	<9,954	<16,100
Zr	<203	<201	<204	<203	<328
Radionuclides					
μCi/g	BY-102 (SC)	BY-111 (SC)	BY-112(SC)	Average	Total
^{90}Sr	NR	NR	NR	NR	NR
^{137}Cs	NR	NR	NR	NR	NR
$^{239/240}Pu$	NR	NR	NR	NR	NR

Note:
SC = saltcake

D3.4 ESTIMATED COMPONENT INVENTORIES

Table D3-4 summarizes estimated chemical inventories for tank 241-BY-112. The table shows the sample-based inventory and the inventory estimated by the HDW model. It also shows the predicted (engineering evaluation) inventory based on the average analytical values for the three BY Tank Farm comparison tanks. The following text provides comments and observations.

In the By Tank Farms, tanks 241-BY-112 and tank 241-BY-102 were designated for ITS heating systems. Because the heater was in one tank and subsequent tanks were connected in a series to cooling concentrated supernatant, the ITS system caused a different mix of analytes to settle in tanks 241-BY-102 and 241-BY-112 than in other tanks. For example, significantly less nitrate and nitrite exists in tanks 241-BY-102 or 241-BY-112 than in other BY Tank Farm tanks. More calcium, manganese, nickel, silicon, sulfate, phosphate, fluoride, and iron appears than in the BY saltcake in the original three comparison tanks (241-BY-105, 241-BY-106, and 241-BY-110). At this time, there is no way to predict accurately the saltcake analytical values in an engineering assessment other than by using analytical data from other tanks containing BY saltcake. However, because tank 241-BY-112 was an evaporator tank for the ITS system, using non-evaporator BY Tank Farm tanks as a basis is inappropriate. Therefore, the comparisons to the group of tanks used as evaporators was made. This comparison to ITS heater tanks and tank 241-BY-111 represents a more accurate basis for comparison to the sample-based inventory.

Table D3-4. Comparison of Selected Component Inventory Estimates for Tank 241-BY-112 Waste.

Component	Engineering Assessment (kg)[1]	Sample-Based (kg)	HDW Estimate (kg)
Al	45,500	31,000	61,100
Bi	<3,240	<3,270	1,550
Ca	<4,490	<3,270	3,430
Cl	1,860	2,110	5,030
Cr	11,500	28,400	3,070
F	19,800	15,100	1,180
Fe	5,780	4,760	2,570
K	2,740	NR	1,680
La	<1,640	<1,640	0.304
Mn	598	<469	191
Na	451,000	543,000	330,000
Ni	7,750	NR	1,020
NO_3	172,000	124,000	450,000
NO_2	26,000	37,000	83,700
Oxalate	36,600	47,700	0.253
Pb	<3,240	<3,270	1,260
PO_4	34,100	26,700	8,030
Si	22,100	3,910	2,350
SO_4	62,800	40,400	20,100
Sr	<330	<327	0
TIC	49,300	65,300	6,740
TOC	10,600	13,700	7,920
U	<16,100	<16,500	10,000
Zr	<328	<327	3.32
H_2O (percent)	29.5	27.0	36.1

Note:

[1]Based on average concentrations for components in tanks 241-BY-102, 241-BY-111, and 241-BY-112.

The HDW model does not represent the decreased solubilities for components in tank 241-BY-112 (for example, chromium, phosphate, sulfate, and fluoride) that are normally soluble in other non-ITS evaporator tanks containing BY saltcake. The increased temperatures and rapid boil-off in tank 241-BY-112 probably resulted in concentration and precipitation of these components. These are very complicated multiphasic, multicomponent solution equilibria. The concentrated supernatants were transferred to other BY farm tanks for cooling and further precipitation of the more soluble components.

Because tank 241-BY-112 was an ITS evaporator tank, it is judged that the analytical data from the 1996 core sample best represents the component concentrations for this tank. With the exception of tank 241-BY-102, other tanks in the BY farm received concentrated supernatants from the ITS evaporator tanks. The waste in these receiver tanks exhibit markedly different concentrations of certain components. Tank 241-BY-111 received numerous direct transfers from tank 241-BY-112 and appears to be an exception.

Tank 241-BY-112 has an unusually high concentration of Cr, and tank 241-BY-111 has an unusually high concentration of Si. There is no apparent explanation from process history for these discrepancies. When the concentrations for these components and those of tank 241-BY-102 are averaged, the predicted inventories are not as accurate. This results in an apparent significant under prediction of Cr and a significant over prediction of Si in tank 241-BY-112 in the engineering assessment inventory.

Radionuclides were not measured in tanks 241-BY-102, 241-BY-111 or 241-BY-112. The best basis radionuclide values were engineering assessment values based on the heat load of tank 241-BY-111 from (Kummerer 1995), (Grigsby et al. 1992) or HDW values.

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

Information about chemical, radiological, and/or physical properties is used to perform safety analyses, engineering evaluations, and risk assessment associated with waste management activities, as well as regulatory issues. These activities include overseeing tank farm operations and identifying, monitoring, and resolving safety issues associated with these operations and with the tank wastes. Disposal activities involve designing equipment, processes, and facilities for retrieving wastes and processing them into a form suitable for long-term storage.

Chemical and radiological inventory information are generally derived using three approaches: 1) component inventories are estimated using results of sample analyses, 2) component inventories are estimated using the HDW model based on process knowledge and historical information, or 3) a tank-specific process estimate is made based on process flowsheets, reactor fuel data, essential material usage, and other operating data. The information derived from these different approaches is often inconsistent.

An effort is underway to provide waste inventory estimates that will serve as standard characterization source terms for waste management activities (Hodgson and LeClair 1996). As part of this effort, an evaluation of available chemical information for tank 241-BY-112 was performed, including the following:

- Data from recent analyses of two push-mode core samples collected in October 1996 (see Appendix B)
- An inventory estimate generated by the HDW model (Agnew et al. 1997)
- Evaluation of BY saltcake data using other BY Tank Farm tanks as a basis.

Based on this evaluation, a best-basis inventory was developed for tank 241-BY-112. For the following reasons, the sample-based inventory was chosen as the best basis for those analytes for which sample-based analytical values were available.

- The sample-based inventory analytical concentrations compared favorably to those of other BY evaporator tanks or the direct outsource tanks.
- No methodology is available to fully predict BY saltcake from process flowsheet or historical records.
- Waste transfer records are not complete and not always accurate.

For those few analytes for which no values could be calculated from the sample-based inventory, the engineering evaluation data or the HDW model values were used. These estimates are less reliable than the values for which sample data are available.

Based on this evaluation, a best-basis inventory was developed for tank 241-BY-112. When the sample-based inventory had a high less-than value or was not measured, the engineering assessment-based values were used (if applicable). Some high less than values are reported because the three tanks used in the engineering assessment had high less than values. Results for radionuclides were not available for the sample-based inventory. The best basis radionuclide values were engineering assessment values based on the heat load of tank 241-BY-112 from Kummerer (1995) or HDW values. The HDW model was used only where no other data were available. Tables D4-1 and D4-2 show the best-basis inventory for tank 241-BY-112.

Once the best-basis inventories were determined, the hydroxide inventory was calculated by performing a charge balance with the valences of other analytes. In some cases, this approach requires that other analyte (for example, sodium or nitrate) inventories be adjusted to achieve the charge balance. During such adjustments, the number of significant figures is not increased. This charge balance approach is consistent with that used by Agnew et al. (1997).

The inventory values reported in Tables D4-1 and D4-2 are subject to change. Refer to the Tank Characterization Database for the most current inventory values.

Best-basis tank inventory values are derived for 46 key radionuclides (Kupfer et al. 1997), all decayed to a common report date of January 1, 1994. Often, waste sample analyses have reported only ^{90}Sr, ^{137}Cs, $^{239/240}Pu$, and total uranium (or total beta and total alpha), while other key radionuclides such as ^{60}Co, ^{99}Tc, ^{129}I, ^{154}Eu, ^{155}Eu, and ^{241}Am have been reported infrequently. For this reason, it has been necessary to derive most of the 46 key radionuclides by computer models. These models estimate radionuclide activity in batches of reactor fuel, account for the split of radionuclides to separations plant waste streams, and track their movement with tank waste transactions. (These computer models are described in Kupfer et al. 1997 and in Watrous and Wootan 1997.) Model generated values for radionuclides in any of 177 tanks are reported in Agnew et al. (1997). The best-basis value for any one analyte may be a model result or a sample or engineering assessment-based result if available. (No attempt has been made to ratio or normalize model results for the 46 radionuclides when values for measured radionuclides disagree with the model.) For a discussion of typical error between model derived values and sample derived values, see Kupfer et al. (1997).

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-BY-112 (Effective May 31, 1997). (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, C, or E)[1]	Comment
Al	31,000	S	---
Bi	<3,270	S	---
Ca	<3,270	S	---
Cl	2,110	S	---
TIC as CO_3	326,000	S	---
Cr	28,400	S	High throughout tank
F	15,100	S	---
Fe	4,760	S	---
Hg	7.79	M	---
K	2,740	E	Used average concentration from other tanks in BY Farm
La	0.304	M	---
Mn	<469	S	---
Na	543,000	S	---
Ni	7,750	E	Used average concentration from other tanks in BY Farm. May be too high as no actual data for ITS tanks.
NO_2	37,000	S	---
NO_3	124,000	S	---
OH_{TOTAL}	209,000	C	Calculated from charge balance
Pb	<3,270	S	---
PO_4	26,700	S	---
Si	3,910	S	---
SO_4	40,400	S	---
Sr	<327	S	---

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-BY-112 (Effective May 31, 1997). (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, C, or E)[1]	Comment
TOC	13,600	S	---
U_{TOTAL}	<16,500	S	---
Zr	<327	S	---

Note:

[1]S = sample-based, M = HDW-model based, E = engineering-based,
C = calculated by charge balance; includes oxides as hydroxides not including CO_3, NO_3, NO_2, PO_4, SO_4, and SiO_3

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-BY-112 Decayed to January 1, 1994. (Effective May 31, 1997) (2 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	140	M	
^{14}C	36.4	M	
^{59}Ni	3.97	M	
^{60}Co	34.1	M	
^{63}Ni	394	M	
^{79}Se	3.06	M	
^{90}Sr	133,000	E	HDW estimate was 144,000
^{90}Y	133,000	E	Based on ^{90}Sr
^{93}Zr	14.7	M	
^{93m}Nb	10.7	M	
^{99}Tc	203	M	
^{106}Ru	0.00680	M	
^{113m}Cd	78.1	M	
^{125}Sb	153	M	
^{126}Sn	4.57	M	
^{129}I	0.393	M	
^{134}Cs	1.66	M	
^{137}Cs	189,000	E	HDW estimate was 170,000
^{137m}Ba	179,000	E	From ^{137}Cs
^{151}Sm	10,600	M	
^{152}Eu	4.81	M	
^{154}Eu	575	M	
^{155}Eu	291	M	
^{226}Ra	1.48E-04	M	
^{227}Ac	0.00208	M	
^{228}Ra	1.82	M	
^{229}Th	0.0420	M	
^{231}Pa	0.0107	M	
^{232}Th	0.0673	M	

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-BY-112 Decayed to January 1, 1994. (Effective May 31, 1997) (2 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{232}U	10.2	M	
^{233}U	38.9	M	
^{234}U	3.79	M	
^{235}U	0.149	M	
^{236}U	0.0983	M	
^{237}Np	0.680	M	
^{238}Pu	2.71	M	
^{238}U	6.82	M	
^{239}Pu	97.2	M	
^{240}Pu	16.7	M	
^{241}Am	47.7	M	
^{241}Pu	196	M	
^{242}Cm	8.81E-04	M	
^{242}Pu	9.42E-04	M	
^{243}Am	0.00165	M	
^{243}Cm	1.80E-05	M	
^{244}Cm	2.21E-04	M	

Notes:

[1]S = sample-based, M = HDW-model based, E = engineering-based,
C = calculated by charge balance; includes oxides as hydroxides not including CO_3, NO_3, NO_2, PO_4, SO_4, and SiO_3

D5.0 APPENDIX D REFERENCES

Agnew, S. F., R. A. Corbin, T. B. Duran, K. A. Jurgensen, T. P. Ortiz, and B. L. Young, 1995, *Waste Status and Transaction Record Summary, WSTRS, Rev. 2*, WHC-SD-WM-TI-615, -614, -669, -689, Rev. 2, Los Alamos National Laboratory, Los Alamos, New Mexico.

Agnew, S. F., J. Boyer, R. A. Corbin, T. B. Duran, J. R. FitzPatrick, K. A. Jurgensen, T. P. Ortiz, and B. L. Young, 1997, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 4*, LA-UR-96-3860, Rev. 4, Los Alamos National Laboratory, Los Alamos, New Mexico.

Bell, K. E., J. Franklin, J. Stroup, and J. L. Huckaby, 1996, *Tank Characterization Report for Single-Shell Tank 241-BY-106*, WHC-SD-WM-ER-616, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Grigsby, J. M., D. B. Bechtold, G. L. Borsheim, M. D. Crippen, D. R. Dickinson, G. L. Fox, D. W. Jeppson, M. Kummerer, J. M. McLaren, J. D. McCormack, A. Padilla, B. C. Simpson, and D. D. Stepnewski, 1992, *Ferrocyanide Waste Tank Hazard Assessment--Interim Report*, WHC-SD-WM-RPT-032, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Hanlon, B. M., 1997, *Waste Tank Summary Report for Month Ending January 31, 1997*, HNF-EP-0182-106, Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

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

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

Kummerer, M., 1995, *Heat Removal Characteristics of Waste Storage Tanks*, WHC-SD-WM-SARR-010, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Kupfer, M. J., A. L. Boldt, B. A. Higley, K. M. Hodgson, L. W. Shelton, R. A. Watrous, S. L. Lambert, D. E. Place, R. M. Orme, G. L. Borsheim, N. G. Colton, M. D. LeClair, R. T. Winward, and W. W. Schulz, 1997, *Standard Inventories of Chemicals and Radionuclides in Hanford Site Tank Wastes*, HNF-SD-WM-TI-740, Rev. 0, Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

Rodenhizer, D. G., 1987, *Hanford Waste Tank Sluicing History*, WHC-SD-WM-TI-302, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Simpson, B. C., J. G. Field, and L. M. Sasaki, 1996a, *Tank Characterization Report for Single-Shell Tank 241-BY-105*, WHC-SD-WM-ER-598, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Simpson, B. C., R. D. Cromar, R. D. Schreiber, 1996b, *Tank Characterization Report for Single-Shell Tank 241-BY-110*, WHC-SD-WM-ER-591, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Watrous, R. A. and D. W. Wootan, 1997, *Activity of Fuel Batches Processed Through Hanford Separations Plants, 1944 Through 1989*, HNF-SD-WM-TI-794, Rev. 0, Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

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APPENDIX E

BIBLIOGRAPHY FOR TANK 241-BY-112

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APPENDIX E

BIBLIOGRAPHY FOR TANK 241-BY-112

Appendix E is a bibliography of information that supports the characterization of tank 241-BY-112. 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-BY-112 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-BY-112
- IIb. Sampling of BY Saltcake Waste Type

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 with an annotation at the end of each reference, or set of references, describing the information source. A majority of the information listed below is available in the Lockheed Martin Hanford Corporation Tank Characterization Safety and Resource Center.

I. NON-ANALYTICAL DATA

Ia. Models/Waste Type Inventories/Campaign Information

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

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

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

- Describes a model for estimating tank waste inventories using process knowledge, radioactive decay estimates using ORIGEN, and assumptions about waste types, solubility, and constraints.

Nguyen, D. M., 1989, *Data Analysis of Conditions in Single-Shell Tanks Suspected of Containing Ferrocyanide*, (internal letter 13314-89-025 to N. W. Kirch, March 2), Westinghouse Hanford Company, Richland, Washington.

- Gives estimates of the ferrocyanide content in a few tanks.

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

- Contains compositions of process stream waste before transfer to 200 Area waste tanks.

Ib. Fill History/Waste Transfer Records

Agnew, S. F., P. Baca, R. A. Corbin, T. B. Duran, and K. A. Jurgensen, 1996, *Waste Status and Transaction Record Summary, WSTRS Rev. 4*, LA-UR-97-311, Rev. 0, Los Alamos National Laboratory, Los Alamos, New Mexico.

- Contains spreadsheets showing all known tank additions/transfers.

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

- Contains tank fill histories 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-MW-TI-053, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Shows riser locations in relation to tank aerial view and a description of each riser and its contents.

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

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

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

- Provides thermocouple location and status information for single- and double-shell tanks.

Welty, R. K., 1988, *Waste Storage Tank Status and Leak Detection Criteria*, WHC-SD-WM-TI-356, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Provides leak detection information for all single- and double-shell tanks. Includes liquid level, liquid observation well, and drywell readings.

Id. Sample Planning/Tank Prioritization

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

- Establishes an approach to determine the priority for tank sampling and characterization and identifies high-priority tanks for sampling.

Baldwin, J. H., 1997, *Tank 241-BY-112 Push Mode Core Sampling and Analysis Plan*, WHC-SD-WM-TSAP-110, Rev. 0A, Lockheed Martin Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.

- Contains detailed sampling and analysis scheme for core samples to be taken from tank 241-BY-112 to address applicable DQOs.

Mulkey, C. H., 1996, *Single-Shell Tank System Waste Analysis Plan*, WHC-EP-0356, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

- The waste analysis plan for single-shell tanks as required by WAC-173-303 and 40 CFR, Part 265.

Stanton, G. A., 1996, *Baseline Sampling Schedule, Change 96-04*, (internal letter 75610-96-11 to Distribution, August 22), Westinghouse Hanford Company, Richland, Washington.

- Provides a tank waste sampling schedule through fiscal year 2002 and lists samples taken since 1994.

Winkelman, W. D., 1996, *Tank 241-BY-112 Tank Characterization Plan*, WHC-SD-WM-TP-281, Rev. 2, Lockheed Martin Hanford Corporation for Fluor Daniel Hanford Inc., Richland, Washington.

- Discusses relevant DQOs and how their requirements will be met for tank 241-BY-112.

Winkelman, W. D., J. W. Hunt, and L. J. Fergestrom, 1996, *Fiscal Year 1997 Tank Waste Analysis Plan*, WHC-SD-WM-PLN-120, Rev. 1, Lockheed Martin Hanford Corporation for Fluor Daniel Hanford Inc., Richland, Washington.

- Contains *Hanford Federal Facility Agreement and Consent Order* requirement-driven TWRS characterization program information and a list of tanks addressed in Fiscal Year 1997.

Ie. Data Quality Objectives/Customers of Characterization Data

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

- Determines whether tanks are under safe operating conditions.

Meacham, J. E., 1996, *Implementation Change Concerning Organic DQO*, Rev. 2, (internal letter 2N160-96-006 to distribution, December 2), Duke Engineering and Services Hanford for Fluor Daniel Hanford, Inc., Richland, Washington.

- Changes the organic DQO strategy to test for TOC for any exotherm.

Meacham, J. E., 1996, *Increase Scope To Organic DQO*, (internal letter 2N160-96-003 to J. G. Kristofzski, October 31), Duke Engineering and Services, Inc. for Fluor Daniel Hanford Inc., Richland, Washington.

- Increases the scope of organic DQO to all single-shell tanks.

Osborne, J. W., J. L. Huckaby, E. R. Hewitt, C. M. Anderson, D. D. Mahlum, B. A. Pulsipher, and J. Y. Young, 1994, *Data Quality Objectives for Generic In-Tank Health and Safety Vapor Issue Resolution*, WHC-SD-WM-DQO-002, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Determines whether tank vapor spaces contain potentially flammable levels of gases and vapors and/or whether there is a potential for worker hazards associated with the toxicity of constituents in any vapor emissions from the tanks.

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

- Determines whether tank vapor spaces contain potentially hazardous gases and vapors.

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

- Categorizes organic tanks as safe, conditionally safe, or unsafe based on fuel and moisture concentrations and supports resolution of the safety issue.

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

IIa. Sampling of Tank 241-BY-112

Anderson, T. D., 1972, *Tank 112-BY Samples and Analyses*, (internal letter 013172 to J. S. Buckingham, January 13), Atlantic Richfield Hanford Company, Richland, Washington.

Buckingham, J. S., 1971, *Dissolution and Analysis of 112-BY Sludge and Crust Samples*, (internal letter O-71-42 to D. J. Larkin, May 29), Atlantic Richfield Hanford Company, Richland, Washington.

- Contains solubility data and chemical analytical results from waste samples.

Buckingham, J. S., 1972, *Analysis of Tank 112-BY Sample*, (internal letter 040472 to T. D. Anderson, April 4), Atlantic Richfield Hanford Company, Richland, Washington.

- Contains analytical results from waste samples taken in January 1972.

Caprio, G. S., 1995, *Vapor and Gas Sampling of Single-Shell Tank 241-BY-112 Using the Vapor Sampling System*, WHC-SD-WM-RPT-125, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Contains vapor sampling analytical results from November 1994.

Huckaby, J. L. and D. R. Bratzel, 1995, *Tank 241-BY-112 Headspace Gas and Vapor Characterization Results for Samples Collected in November 1994*, WHC-SD-WM-ER-441, Rev. 1A, Westinghouse Hanford Company, Richland, Washington.

- Contains vapor sampling analytical results from November 1994.

Schuelein, V. L., 1972, *Dilution Requirements of High Salt Supernatants*, (internal letter 071972 to T. D. Anderson, July 19), Atlantic Richfield Hanford Company, Richland, Washington.

- Contains results of dilution studies of tank 241-BY-112 waste samples.

Schulz, W. W., 1968, *Characterization of the Organic Material in the 112-BY Tank*, BNWL-CC-1517, Pacific Northwest Laboratory, Richland, Washington.

- Contains waste sampling analytical results.

Skolrud, J. O., 1971, *Dissolution of BY112 Sludge Samples*, (internal letter I-71-37 to J. S. Buckingham, April 26), Atlantic Richfield Hanford Company, Richland, Washington.

Wheeler, R. E., 1976, *Analysis of Tank Farm Samples 12/18/1975 through 01/08/1976*, (internal letter 010876 to R. L. Walser, January 8), Atlantic Richfield Hanford Company, Richland, Washington.

IIb. Sampling of BY Saltcake Waste Type

Bell, K. E., J. Franklin, J. Stroup, and J. L. Huckaby, 1996, *Tank Characterization Report for Single-Shell Tank 241-BY-106*, WHC-SD-WM-ER-616, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Contains characterization data for the waste in tank 241-BY-106 which includes BY saltcake.

Benar, C. J., J. G. Field, and L. C. Amato, 1996, *Tank Characterization Report for Single-Shell Tank 241-BY-104*, WHC-SD-WM-ER-608, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Contains characterization data for the waste in tank 241-BY-104 which includes BY saltcake.

Buckingham, J. S., 1972, *Exothermic Reactions in ITS Feed Solutions*, (internal memorandum to D. J. Larkin, March 17), Atlantic Richfield Hanford Company, Richland, Washington.

- Contains differential thermal analysis results and gas chromatography results for ITS feed.

Metz, W. P., 1972, *Nitric Acid Neutralization and Concentration of ITS Feed*, (internal memorandum to J. S. Buckingham, June 2), Atlantic Richfield Hanford Company, Richland, Washington.

- Contains a general chemical analysis of ITS feed.

Simpson, B. C., J. G. Field, and L. M. Sasaki, 1996, *Tank Characterization Report for Single-Shell Tank 241-BY-105*, WHC-SD-WM-ER-598, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Contains characterization data for the waste in tank 241-BY-105 which includes BY saltcake.

Simpson, B. C., R. D. Cromar, and R. D. Schreiber, 1996, *Tank Characterization Report for Single-Shell Tank 241-BY-110*, WHC-SD-WM-ER-591, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Contains characterization data for the waste in tank 241-BY-110 which includes BY saltcake.

III. COMBINED ANALYTICAL/NON-ANALYTICAL DATA

IIIa. Inventories using both Campaign and Analytical Information

Agnew, S. F., J. Boyer, R. A. Corbin, T. B. Duran, J. R. Fitzpatrick, K. A. Jurgensen, T. P. Ortiz, and B. L. Young, 1997, *Hanford Tank Chemical and Radionuclide Inventories: HDW Rev. 4*, LA-UR-96-3860, Rev. 0, Los Alamos National Laboratory, Los Alamos, New Mexico.

- 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., R. A. Corbin, J. Boyer, T. B. Duran, K. A. Jurgensen, T. P. Ortiz, B. L. Young, R. Anema, and C. Ungerecht, 1996, *History of Organic Carbon in Hanford HLW Tanks: HDW Model Rev. 3*, LA-UR-96-989, Los Alamos National Laboratory, Los Alamos, New Mexico.

- Attempts to account for the disposition of soluble organics and provides estimates of TOC content for each tank.

Allen, G. K., 1976, *Estimated Inventory of Chemicals Added to Underground Waste Tanks, 1944 - 1975*, ARH-CD-601B, Rev. 0, Atlantic Richfield Hanford Company, Richland, Washington.

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

Allen, G. K., 1975, *Hanford Liquid Waste Inventory as of September 30, 1974*, ARH-CD-229, Rev. 0, Atlantic Richfield Company, Richland, Washington.

- Contains major components for waste types and some assumptions.

Brevick, C. H., R. L. Newell, and J. W. Funk, 1996, *Historical Tank Content Estimate for the Northeast Quadrant of the Hanford 200 East Area*, WHC-SD-WM-ER-349, Rev. 1A, Westinghouse Hanford Company, Richland, Washington.

- Contains summary information for tanks in B, BX, and BY Tank Farms as well as in-tank photo collages and inventory estimates.

Geier, R. G., 1976, *Estimated Hanford Liquid Wastes Chemical Inventory as of June 30, 1976*, ARH-CD-768, Rev. 0, Atlantic Richfield Hanford Company, Richland, Washington.

- Contains nominal concentrations of various analytes for the liquid waste in some waste tanks.

Klem, M. J., 1988, *Inventory of Chemicals Used at Hanford Production Plants and Support Operations (1944 - 1980)*, WHC-EP-0172, Westinghouse Hanford Company, Richland, Washington.

- Provides a list of chemicals used in production facilities and support operations that sent wastes to the single-shell tanks. List is based on chemical process flowsheets, essential materials consumption records, letters, reports, and other historical data.

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.

- Contains a global component inventory for 200 Area waste tanks. Fourteen chemical and two radionuclide components are inventoried currently.

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

- Contains a global inventory based on process knowledge and radioactive decay estimations using ORIGEN2. Plutonium and uranium waste contributions are taken at one percent of the amount used in processes. Also compares information on Tc-99 from ORIGEN2 and analytical data.

Toth, J. J., C. E. Willingham, P. G. Heasler, and P. D. Whitney, 1994, *Organic Carbon in Hanford Single-Shell Tank Waste*, PNL-9434, Pacific Northwest Laboratory, Richland, Washington.

- Contains organic carbon analytical results and model estimates for tanks.

IIIb. Compendium of Existing Physical and Chemical Documented Data Sources

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

- Gives solubility ranges used for key chemical and radionuclide components based on supernate sample analyses.

Brevick, C. H., R. L. Newell, and J. W. Funk, 1996, *Supporting Document for the Northeast Quadrant Historical Tank Content Estimate Report for BY Tank Farm*, WHC-SD-WM-ER-312, Rev. 1A, Westinghouse Hanford Company, Richland, Washington.

- Contains summary information for tanks in the BY Tank Farm as well as appendixes containing more detailed information including tank waste level history, tank temperature history, cascade and drywell charts, riser information, in-tank photo collages, and tank layer model bar chart and spreadsheet.

Brevick, C. H., L. A. Gaddis, and E. D. Johnson, 1996, *Tank Waste Source Term Inventory Validation, Vol I, II, and III*, WHC-SD-WM-ER-400, Rev. 0A, Westinghouse Hanford Company, Richland, Washington.

- Contains a quick reference to sampling information in spreadsheet or graphical form for 24 chemicals and 11 radionuclides for all tanks.

Hanlon, B. M., 1997, *Waste Tank Summary Report for Month Ending April 30, 1997*, HNF-EP-0182-109, Westinghouse Hanford Company, Richland, Washington.

- Contains a summary of tank waste volumes, Watch List tanks, occurrences, tank integrity information, equipment readings, tank location, leak volumes, and other miscellaneous tank information.

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 describes a system of sorting single-shell tanks into groups based on the major waste types contained in each tank.

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

- Contains in-tank photos and summaries of the tank description, leak detection system, and tank status.

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

- Assesses the relative dryness of tank wastes.

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.

- 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 on August 8), Westinghouse Hanford Company, Richland, Washington.

- 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.

- 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.

- Contains selected sample analysis tables before 1993 for single-shell tanks.

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DISTRIBUTION SHEET

To	From	Page 1 of 2
Distribution	Data Assessment and Interpretation	Date 05/08/97
Project Title/Work Order		EDT No. EDT-617661
Tank Characterization Report for Single-Shell Tank 241-BY-112, HNF-SD-WM-ER-701, Rev. 0		ECN No. N/A

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
OFFSITE					
Sandia National Laboratory P.O. Box 5800 MS-0744, Dept. 6404 Albuquerque, NM 87815					
D. Powers		X			
Nuclear Consulting Services Inc. P. O. Box 29151 Columbus, OH 43229-01051					
J. L. Kovach		X			
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SAIC 20300 Century Boulevard, Suite 200-B Germantown, MD 20874					
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Los Alamos Laboratory CST-14 MS-J586 P. O. Box 1663 Los Alamos, NM 87545					
S. F. Agnew		X			
Los Alamos Technical Associates T. T. Tran	B1-44	X			
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Tank Characterization Report for Single-Shell Tank 241-BY-112, HNF-SD-WM-ER-701, Rev. 0		ECN No. N/A

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
ONSITE					
Department of Energy - Richland Operations					
J. F. Thompson	S7-54	X			
W. S. Liou	S7-54	X			
J. A. Poppiti	S7-54	X			
N. W. Willis	S7-54	X			
DE&S Hanford, Inc.					
R. J. Cash	S7-14	X			
W. L. Cowley	R2-54	X			
G. L. Dunford	A2-34	X			
G. D. Johnson	S7-14	X			
J. E. Meacham	S7-14	X			
Fluor Daniel Northwest					
J. L. Stroup	S3-09	X			
Lockheed Martin Hanford, Corp.					
J. H. Baldwin	R2-12	X			
K. M. Hodgson	H0-34	X			
T. J. Kelley	S7-21	X			
L. M. Sasaki	R2-12	X			
B. C. Simpson	R2-12	X			
L. R. Webb	R2-12	X			
ERC (Environmental Resource Center)	R1-51	X			
T.C.S.R.C.	R1-10	5			
Lockheed Martin Services, Inc.					
B. G. Lauzon	R1-08	X			
Central Files	A3-88	X			
EDMC	H6-08	X			
Numatec Hanford Corporation					
J. S. Garfield	H5-49	X			
J. S. Hertzel	H5-61	X			
D. L. Lamberd	H5-61	X			
Pacific Northwest National Laboratory					
A. F. Noonan	K9-91	X			
Rust Federal Services of Hanford, Inc.					
C. T. Narquis	T6-16	X			