ENGINEERING CHANGE NOTICE

Page 1 of 2

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SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]	Tickler File	[]
Environmental Report	[]	Inspection Plan	[]		[]
Environmental Permit	[]	Inventory Adjustment Request	[]		[]

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Tank Characterization Report for Double-Shell Tank 241-AW-105

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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-AW-105. This report supports the requirements of the Tri-Party Agreement Milestone M-44-05.

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Tank Characterization Report for Double-Shell Tank 241-AW-105

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LIST OF TERMS

ANOVA	analysis of variance
Btu/hr	British thermal units per hour
Ci	curies
Ci/g	curies per gram
Ci/L	curies per liter
CF	concentration factor
cm	centimeter
df	degrees of freedom
DN	dilute non-complexed
DOE	U.S. Department of Energy
DQO	data quality objective
DSC	differential scanning calorimetry
EPA	Washington State Environmental Protection Agency
ft	feet
GEA	gamma energy analysis
g	grams
g/L	grams per liter
g/mL	grams per milliliter
HDW	Hanford defined waste
IC	ion chromatography
ICP	inductively coupled plasma spectroscopy
in.	inches
J/g	joules per gram
kg	kilograms
kgal	kilogallons
kL	kiloliters
LANL	Los Alamos National Laboratory
LFL	lower flammability limit
m	meters
mm	milliliters
M	moles per liter
mL	milliliters
mrad/hr	millirads per hour
MTU	metric tons of uranium
n/a	not applicable
NA	not analyzed
N/A	not available
NCRW	neutralized cladding removal waste
nCi/g	nanocuries per gram
n/d	not detected
N/D	not decided
n/r	not required

LIST OF TERMS (Continued)

NR	not reported
N/R	not reviewed
OSD	operating specification document
PCBs	polychlorinated biphenyls
PF	partition factor
PHMC	Project Hanford Management Contractor
PNL	Pacific Northwest Laboratory
ppm	parts per million
ppmv	parts per million volume
PUREX	Plutonium-Uranium Extraction
PXMSC	PUREX miscellaneous waste
QC	quality control
REML	restricted estimated maximum likelihood
RPD	relative percent difference
SAP	sampling and analysis plan
SMM	supernatant mixing model
SMMA2	concentrated 242-A Evaporator salt slurry derived from the SMM
SpG	specific gravity
TCR	tank characterization report
TGA	thermogravimetric analysis
TIC	total inorganic carbon
TLM	tank layer model
TOC	total organic carbon
TRU	transuranic
TWRS	Tank Waste Remediation System
W	watts
WSTRS	Waste Status and Transaction Record Summary
wt%	weight percent
°C	degrees centigrade
°F	degrees fahrenheit
μCi	microcurie
μCi/g	microcuries per gram
μCi/L	microcuries per liter
μCi/mL	microcuries per milliliter
μeq/g	microequivalents per gram
μg/g	micrograms per gram
μg C/g	micrograms carbon per gram
μg C/L	micrograms carbon per liter
μg C/mL	micrograms carbon per millilliter
μg/mL	micrograms per milliliter

1.0 INTRODUCTION

One of the major functions of the Tank Waste Remediation System (TWRS) is to characterize wastes in support of waste management and disposal activities at the Hanford Site. Analytical data from sampling and analysis, along with other available information about a tank, are compiled and maintained in a tank characterization report (TCR). This report and its appendices serve as the TCR for double-shell tank 241-AW-105.

The objectives of this report are: 1) to use characterization data in response to technical issues associated with tank 241-AW-105 waste; and 2) to provide a standard characterization of this waste in terms of a best-basis inventory estimate. The response to technical issues is summarized in Section 2.0, and the best-basis inventory estimate is presented in Section 3.0. Recommendations regarding safety status and additional sampling needs are provided in Section 4.0. Supporting data and information are contained in the appendices. This report supports the requirements of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1996) milestone M-44-05.

1.1 SCOPE

Characterization information presented in this report originated from sample analyses and known historical sources. While only the results of a recent sampling event 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. Historical information for tank 241-AW-105 is provided in Appendix A, including surveillance information, records pertaining to waste transfers and tank operations, and expected tank contents derived from a process knowledge model.

The recent sampling event listed in Table 1-1, as well as pertinent sample data obtained before 1996, are summarized in Appendix B along with the sampling results. The results of the 1996 grab sampling event (Esch 1997) satisfied the data requirements specified in the sampling and analysis plan (SAP) for this tank (Sasaki 1996a). In addition, the tank headspace flammability was measured, which addresses one of the requirements specified in the safety screening DQO (Dukelow et al. 1995). The statistical analysis and numerical manipulation of data used in issue resolution are reported in Appendix C. Appendix D contains the evaluation to establish the best basis for the inventory estimate and the statistical analysis performed for this evaluation. A bibliography that resulted from an in-depth literature search of all known information sources applicable to tank 241-AW-105 and its respective waste types is contained in Appendix E. A majority of the documents listed in Appendix E may be found in the Tank Characterization and Safety Resource Center.

Table 1-1. Summary of Recent Sampling.[1]

Sample/Date	Phase	Location	Segmentation	Percent Recovery
Grab samples 5AW-96-1, 5AW-96-2, and 5AW-96-4 (August 20, 1996)	Liquid	Riser 10A at 394 mm (155 in.), 348 mm (137 in.), and 300 mm (118 in.) from tank bottom	None	100
Grab samples 5AW-96-5, 5AW-96-7, and 5AW-96-9 (August 20, 1996)	Solid	Riser 10A at 241 mm (95 in.), 198 mm (78 in.), and 196 mm (77 in.) from tank bottom	None	100
Grab samples 5AW-96-10, 5AW-96-11, and 5AW-96-14 (August 21, 1996)	Liquid	Riser 15A at 394 mm (155 in.), 348 mm (137 in.), and 300 mm (118 in.) from tank bottom	None	100
Grab sample 5AW-96-15, 5AW-96-17, and 5AW-96-20 (August 21, 1996)	Solid	Riser 15A at 241 mm (95 in.), 185 mm (73 in.), and 168 mm (66 in.) from tank bottom	None	100
Headspace flammability (August 20, 1996)	Gas	Riser 10A: tank headspace, breather/ vent, breathing zone, and sample riser	None	n/a
Headspace flammability (August 20, 1996)	Gas	Riser 15A: tank headspace, breather/ vent, breathing zone, and sample riser	None	n/a

Notes:

n/a = not applicable

[1]Esch (1997)

1.2 TANK BACKGROUND

Tank 241-AW-105 is located in the 200 East Area AW Tank Farm on the Hanford Site. The tank went into service in 1980 by receiving flush water, followed by complexed waste from the 242-A evaporator. In 1982 and 1983, tank 241-AW-105 received dilute non-complexed (DN) waste from tanks 241-AW-103 and 241-AW-104 and from B Plant. Most of the tank contents were removed later that year. Since that time, the tank has received primarily Plutonium-Uranium Extraction (PUREX) miscellaneous waste (PXMSC), PUREX decladding sludge and supernatant (neutralized cladding removal waste [NCRW]), and PUREX spent metathesis waste. The NCRW solids now make up most of the substantial layer of transuranic (TRU) solids in the bottom of tank 241-AW-105. A smaller amount of other wastes is also present in the tank solids (Agnew et al. 1997b).

A description of tank 241-AW-105 is summarized in Table 1-2. The tank has a design capacity of 4,390 kL (1,160 kgal), and, as of October 31, 1996, contained an estimated 1,665 kL (440 kgal) of DN and NCRW waste (Hanlon 1996). The tank is not on the Watch List (Public Law 101-510).

Table 1-2. Description of Tank 241-AW-105.

TANK DESCRIPTION	
Type	Double-Shell
Constructed	1980
In-service	1980
Diameter	22.9 m (75.0 ft)
Operating depth	10.7 m (35.2 ft)
Design Capacity	4,390 kL (1,160 kgal)
Bottom shape	Flat
Ventilation	Active
TANK STATUS[1]	
Waste classification	DN and NCRW
Total waste volume[2] (10/31/96)	1,665 kL (440 kgal)
Supernatant volume	606 kL (160 kgal)
Saltcake volume	0 kL (0 kgal)
Sludge volume	1,060 kL (280 kgal)
Drainable interstitial liquid volume	102 kL (27 kgal)
Waste surface level (11/14/96)	405.6 cm (159.7 in.)
Temperature (4/18/94 to 11/11/96)	15 °C (59 °F) to 28 °C (83 °F)
Integrity	Sound
Watch List	None
SAMPLING DATE	
Grab samples	August 1996
Headspace flammability	August 1996
SERVICE STATUS	
In service	1980 to present

Notes:

DN = dilute non-complexed waste
NCRW = neutralized cladding removal waste

[1]Tank 241-AW-105 is an active tank; transfers into and out of the tank will alter the tank status.
[2]Waste volume is estimated from surface level measurements.

Dates are provided in mm/dd/yy format.

2.0 RESPONSE TO TECHNICAL ISSUES

The following technical issues have been identified for tank 241-AW-105 (Brown et al. 1997). They are:

- Are safety or operational problems created as a result of commingling wastes?
- Does the waste pose or contribute to any recognized potential safety problems?

The SAP (Sasaki 1996a) provides the types of sampling and analysis used to address the waste compatibility issue. Other safety issues are addressed in the safety screening DQO (Dukelow et al. 1995), and can be compared to the analytical results. Data from the recent analysis of twelve grab samples and tank vapor space flammability measurements, as well as available historical information, provided the means to respond to these issues. This response is detailed in the following sections. See Appendix B for sample and analysis data for tank 241-AW-105.

The waste in tank 241-AW-105 is also of interest for Pretreatment and Privatization (Brown et al. 1997). However, at this time, no samples or analytical data are required from this tank to support these issues.

2.1 WASTE COMPATIBILITY EVALUATION

Grab samples were obtained from tank 241-AW-105 to assess the mixing of K Basin sludge with the tank waste. In accordance with Fowler (1995), tank 241-AW-105 was analyzed to assess the safety and operational implications of commingling the wastes in the tank with other wastes. Safety considerations included energetics, criticality, flammable gas generation and accumulation, corrosion and leakage, and unwanted chemical reactions. Operational considerations included TRU segregation, heat load limits of the receiving tank, plugged pipelines and equipment, and complexant waste segregation. Not all of the operational considerations were within the scope of this report, notably the potential chemical reactivity of the waste in a variety of different situations, and the tendency of the waste to plug piping and equipment.

2.1.1 Safety Decision Rules Evaluation

Table 2-1 presents the analyses used to evaluate the waste in terms of the safety considerations for waste compatibility. The primary decision variable, the decision criteria threshold, and the supernatant mean analytical results (Tables B3-8 and B3-9) from the 1996 grab sampling event are listed for each safety issue. Because the 1996 grab sampling event was not able to obtain sample from the bottom two-thirds of the sludge layer, pertinent data from previous sampling events are also presented.

Table 2-1. Safety Decision Variables and Criteria for the Waste Compatibility Data Quality Objective.

Safety Issue	Primary Decision Variable	Decision Criteria Threshold	Analytical Result
Energetics/ Organic layer	Total fuel content/ Organic layer	1.0 exotherm/endotherm ratio; Presence of organic layer	ratio < 1.0 No organic layer
Criticality	$^{239/240}Pu$	Solids:Pu mass ratio $\geq$ 1,000 (or Pu $\leq$ 62μCi/g solids)[1]	1.78 μCi/g
Flammable gas accumulation	Waste specific gravity	Specific gravity < 1.41 g/mL	1.32 g/mL (centrifuged solids)
Corrosion[2]	Concentration of nitrate, hydroxide, and nitrite	$[NO_3^-] \leq 1.0\ M$; and $0.01\ M \leq [OH^-] \leq 5.0\ M$; and $0.011\ M \leq [NO_2^-] \leq 5.5\ M$	$[NO_3^-] = 0.418\ M$ $[OH^-] = 0.212\ M$ $[NO_2^-] = 0.0270\ M$

Notes:

[1]The criterion for a receiving tank with > 10 kg Pu. Assuming all the Pu is ^{239}Pu, the solids:Pu ratio limit of 1,000 may be converted to 62 μCi/g as shown:

$$\left(\frac{1\ \text{g Pu}}{1{,}000\ \text{g solids}}\right)\left(\frac{0.062\ \text{Ci}}{1\ \text{g}\ ^{239}\text{Pu}}\right)\left(\frac{10^6\ \mu\text{Ci}}{1\ \text{Ci}}\right) = 62\ \frac{\mu\text{Ci}}{\text{g solids}}$$

[2]These criteria apply to receiving tanks with operating temperatures of ≤ 100 °C (212 °F).

The waste compatibility DQO decision criteria threshold specifies that the absolute value of the exotherm/endotherm ratio must be < 1.0 for any transfer to be allowed. The ratio was 0 for the supernatant and interstitial liquid samples. For the centrifuged solids samples, the ratio ranged from 0 to 0.039, well below the limit (Esch 1997). However, no DSC measurements exist for the bottom two-thirds of the sludge in tank 241-AW-105. Also, no organic layers were present in the waste. A separable organic layer was observed in a 1984 grab sample (Jansky 1984) and in a 1985 grab sample (Mauss 1985). Because the supernatant in tank 241-AW-105 has been pumped out and replaced seven times since the 1985 sampling event and the pumping of liquids from the tank is through a pump which removes liquid at the waste surface, the organic layer should no longer exist in the tank. No separable organics have been observed in subsequent sampling events.

The potential for criticality is assessed through the waste compatibility DQO by establishing a decision threshold of 1,000 for the solids to Pu mass ratio in the receiving tank after completion of the transfer. This converts to 62 μCi/g solids (using the ^{239}Pu specific activity of 0.062 Ci/g), as displayed in note 1 of Table 2-1. The analytical mean result of 1.78 μCi/g for $^{239/240}$Pu was well below this threshold; this result is for centrifuged solids and will be lower in the tank. Analytical results from the 1986 and 1990 core samples are also well within the criticality limits.

The waste compatibility DQO flammable gas decision threshold requires that the specific gravity weighted mean for the waste be $<$ 1.41 g/mL. The analytical results were below the limit: 1.02 g/mL for the supernatant and 1.32 g/mL for centrifuged solids. The 1986 and 1990 core samples had measured densities of 1.30 to 1.41 g/mL.

The corrosivity of the waste must be controlled to prolong the life of the tanks' carbon steel components. The limits for corrosion protection as stated in the waste compatibility DQO are based on the receiving tank temperature and the concentrations of corrosion-inhibiting chemicals such as sodium hydroxide and salts of nitrate and nitrite. The limits given in Table 2-1 apply to tanks with operating temperatures of $\leq$ 100 °C (212 °F). The mean analytical results from the 1996 grab samples met all of the criteria listed.

The waste compatibility DQO specifies two additional decision rules regarding safety. The first decision rule states that no high-level waste will be accepted for transfer to a tank identified as a Watch List tank without Department of Energy approval. The final decision rule states that potential chemical compatibility hazards are to be identified before acceptance of waste into any double-shell tank, and the source wastes shall be categorized according to a compatibility matrix specified in Fowler (1995).

2.1.2 Operations Decision Rules Evaluation

The waste compatibility program requires a formal operations analysis of non-routine transfers before they are approved. Several criteria are applicable when evaluating the feasibility of a waste transfer between tanks: the segregation of TRU and non-TRU waste, avoiding excess heat generation, high phosphate waste, complexant waste segregation, tank waste type, and waste pumpability. Three of these criteria are listed and compared to the mean analytical results in Table 2-2. The mean analytical results given in this section were obtained from Tables B3-8, B3-9, and B3-11.

Table 2-2. Waste Compatibility Operations Decision Rules.

Operations Issue	Primary Decision Variable	Decision Criteria Threshold	Mean Analytical Result
Transuranics	TRU elements: [^{241}Am], [$^{239/240}$Pu]	0.1 μCi/g [TRU]	1.25E-05 μCi/g (supernatant)[1] 2.12 μCi/g (centrifuged solids)
Heat load	Heat generation rate	20,500 W (70,000 Btu/hr)	2,010 W (6,870 Btu/hr)
High phosphate waste	[PO_4^{-3}]	0.1 *M* [PO_4^{-3}]	< 0.00651 *M*

Note:

[1]The analytical results of < 7.94E-06 μCi/mL for ^{241}Am and < 4.80E-06 μCi/mL for $^{239/240}$Pu were obtained from Table B3-9. The sum of these two values, 1.27E-05 μCi/mL, was converted to 1.25E-05 μCi/g by dividing by the supernatant density of 1.02 g/mL.

The first criterion listed called for the segregation of TRU from non-TRU elements in the waste. If the TRU concentration in the tank is ≥ 0.1 μCi/g, then the waste must be transferred to a TRU storage tank only. Tank 241-AW-105 had been classified as having a non-TRU supernatant and TRU sludge. This was confirmed by the grab sample results. The mean analytical result for the supernatant of 1.25E-05 μCi/g, which was based on ^{241}Am and $^{239/240}$Pu data, was well below the TRU threshold. The result for the sludge was 2.12 μCi/g, confirming the TRU classification.

The heat generation threshold depends on the operating specification document limit for a given tank. The heat generation limit for tank 241-AW-105 was 20,500 W (70,000 Btu/hr) (Fowler 1995). The estimated tank heat load based on the analytical results was 2,010 W (6,870 Btu/hr), far below this limit (see Section 2.3).

High phosphate waste, defined as > 0.1 *M* phosphate, is not to be mixed with defined concentrations of certain other waste types. If mixed with high nitrate salt content waste, it can cause crystallization, resulting in plugged pumps and equipment that make future waste handling difficult. Because the phosphate concentration of tank 241-AW-105 was < 0.00651 *M*, this issue was not a concern.

The last three operations issues are not comparable to analytical results, and are thus outside the scope of this report. They are mentioned for informational purposes only. The first of these is that if a source waste stream is designated as complexant, then any waste transfer must be to a complexant waste receiver tank. Second, the tank waste types have been categorized according to a compatibility matrix, and all transfers must be in accordance with this matrix. Finally, the inputs to the waste pumpability issue are density, viscosity, and volume percent solids, along with the pipe diameter and pump velocity (Fowler 1995).

2.2 SAFETY SCREENING

The information needed to screen the waste in tank 241-AW-105 for potential safety problems is documented in *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 of these conditions is addressed separately below. Because tank 241-AW-105 is not a Watch List tank, the safety screening DQO is the only safety-related DQO with which the grab sampling data will be compared. The following comparisons are provided for informational purposes only, as the SAP did not specifically require the grab sampling to be conducted according to Dukelow et al. (1995).

In addition to the analytical requirements, the safety screening DQO also specifies sampling conditions which must be met for a proper safety assessment. This includes the stipulation that an optimum number of vertical profiles of the waste must be taken. In this case, two risers were sampled from multiple depths, which surpasses the DQO requirement for liquid waste. However, the full depth of the sludge layer was not sampled because the consistency of the waste prevented the grab sampler from obtaining samples from the lower levels of the sludge.

2.2.1 Exothermic Conditions (Energetics)

The first requirement outlined in the safety screening DQO is to ensure that there are not enough exothermic constituents (organic or ferrocyanide) in tank 241-AW-105 to cause a safety hazard. Because this was also a requirement of the waste compatibility DQO, energetics in the waste were evaluated. The design criteria threshold limit for energetics is 480 J/g on a dry weight basis. Results obtained using differential scanning calorimetry (DSC) indicated that no exotherms were apparent in any of the supernatant or interstitial liquid samples. Four of the centrifuged solid samples did have exotherms. However, the largest individual result was 145 J/g on a dry weight basis, well below the threshold limit (Esch 1997). Regarding energetics deep within the sludge layer, none of the earlier sampling data included energetics measurements, so this cannot be assessed analytically.

Although there were no exotherms exceeding the threshold limit for energetics, total organic carbon (TOC) concentrations in three supernatant samples exceeded the operating specification document (OSD) (WHC 1996) limit of 3 weight percent TOC on a dry weight basis (Sasaki 1996b). Because these samples contained 95 weight percent water, these TOC concentrations do not present a safety hazard.

Based on the tank process history (Appendix A), there is one waste type in the tank that is expected to contain an exothermic organic agent: PXMSC. The PXMSC present in the sludge layer is expected to contain approximately 0.003 *M* of dibutyl phosphate and 0.003 *M* of butanol. Because the tank has continued to receive PXMSC waste, the supernatant layer may also contain this waste type. As a note, surface samples removed from the tank in 1984 and 1985 exhibited two phases. There was approximately 65 volume percent of immiscible organic floating over an aqueous phase in the 1984 sample and 2 volume percent in the 1985 sample. The organic phase was found to be 27.5 volume percent tributyl phosphate in the 1984 sample and 30 percent tributyl phosphate and 70 percent normal paraffin hydrocarbon in the 1985 sample (Jansky 1984; Mauss 1985). Because liquid wastes have been added to and pumped from the tank a number of times since 1984 the separable organic layer may no longer exist in the tank. For the reasons discussed in Section 2.1.1, the organic layer should no longer exist in the tank. No separable organics have been observed in any samples taken since 1985.

2.2.2 Flammable Gas

Vapor phase measurements, taken in the tank headspace before the grab samples in August 1996, indicated that flammable gas was between 0 and 1 percent of the lower flammability limit [LFL]) and flammability is not a concern for this tank. Data from these vapor phase measurements are presented in Appendix B.

2.2.3 Criticality

The liquid safety threshold limit for total alpha activity is 1 g ^{239}Pu per liter of waste, which converts to 61.5 μCi/mL. All supernatant results were nondetected values, the largest individual result being < 3.15E-04 μCi/mL. The highest interstitial liquid sample mean and 95 percent confidence interval upper limit were 0.00394 μCi/mL and 0.00431 μCi/mL, respectively. Thus, all liquid results were far below the limit. The safety threshold limit for the centrifuged solid results was 52.5 μCi/g, and all total alpha activity concentrations were also far below this. The highest sample mean and 95 percent confidence interval upper limit were 3.86 μCi/g and 5.25 μCi/g, respectively. The method used to calculate confidence limits is contained in Appendix C. Results from the 1986 and 1990 core samples also show that criticality is not a concern for this tank. Results for $^{239/240}$Pu analysis ranged from 0.237 μCi/g to 3.04 μCi/g in the 1990 core sample; 0.266 μCi/g to 1.137 μCi/g in the July 1986 core sample; and 0.381 μCi/g to 1.003 μCi/g in the September 1986 core sample.

2.3 OTHER TECHNICAL ISSUES

Another factor in assessing tank safety is the heat generation and temperature of the waste. Heat is generated in the tanks from radioactive decay. An estimate of the tank heat load based on $^{89/90}$Sr and ^{137}Cs (from Tables B3-14 and D4-2), yielded 2,010 W (6,870 Btu/hr).

The heat load estimate based on the tank process history was 1,110 W (3,790 Btu/hr) (Agnew 1997a), while the heat load based on the tank headspace temperatures was 498 W (1,700 Btu/hr) (Kummerer 1995).

2.4 SUMMARY

The results from all analyses performed to address potential safety and operational issues showed that no primary analyte exceeded any decision threshold limits. In three supernatant samples, the TOC concentration exceeded the OSD limit of 3 weight percent on a dry weight basis. However, this was not considered a safety hazard because of the high water content (95 weight percent) of the samples. Although the safety screening DQO was not a governing document for the August 1996 sampling event, total alpha activity was nevertheless measured. The waste compatibility DQO required analyses for DSC, specific gravity, and examination for the presence of an organic layer. Vapor space flammability tests were conducted separately. The analytical results are summarized in Table 2-3.

Table 2-3. Summary of Waste Compatibility and Safety Screening Results.

Issue	Sub-issue	Result
Waste compatibility	Energetics/ Organic layer	Exotherm/endotherm ratio < 1.0 for all samples. No organic layer observed.
	Criticality	All results far below upper limit of 62 μCi/g solids.
	Flammable gas accumulation	Specific gravity analytical result below upper limit of 1.41 g/mL.
	Corrosion	All analytical results met the safety specifications.
	Transuranics	Analytical mean far below upper limit of 0.1 μCi/g in the supernatant. Sludge is TRU.
	Heat load	Estimate far below upper limit of 20,500 W (70,000 Btu/hr).
	High phosphate waste	Analytical mean far below upper limit of 0.1 *M*.
Safety screening	Energetics	All exotherms far below upper limit of 480 J/g.
	Flammable gas	Headspace flammability was 0-1 percent of the LFL.
	Criticality	All analyses far below 1 g of ^{239}Pu per liter of waste (including the 95 percent confidence interval upper limits).

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3.0 BEST-BASIS INVENTORY ESTIMATE

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

Chemical inventory information generally is derived using two approaches: 1) component inventories are estimated using the results of sample analyses; and 2) component inventories are predicted using a model based on process knowledge and historical information. The most recent model was developed by Los Alamos National Laboratory (LANL) (Agnew et al. 1997a). Information derived from these two different approaches is often inconsistent.

An effort is underway to provide waste inventory estimates that will serve as standard characterization information for the various waste management activities (Hodgson and LeClair 1996). As part of this effort, an evaluation of available chemical information for tank 241-AW-105 was performed that included:

- Characterization results from the January 1986 grab sampling event, the July and September 1986 core sampling events, the 1990 core sampling event, and the 1996 grab sampling event.

- An estimation of neutralized current acid waste and neutralized cladding removal waste (NCRW) made in 1991 (Schofield 1991) which provides tank content estimates based on a reconciliation of flowsheet records, process tests, and the January 1986 and July 1986 sampling events.

- An engineering evaluation of NCRW sludge based on sampling-based data from tank 241-AW-103.

- Tank content estimates in terms of component concentrations and inventories from the HDW model (Agnew et al. 1997a).

The results from this evaluation support using the July 1986 and September 1986 core sample data as the best basis for the inventory in tank 241-AW-105 sludge for the analytes measured and the 1990 sampling data as the best basis for analytes not reported in 1986. The August

1996 liquid samples provide the best basis for the supernatant. These choices provide the best basis for the following reasons:

- Cation data from the May 1990 core sample are biased high apparently due to inter-element interferences during the inductively coupled plasma spectroscopy (ICP) analyses. Anion concentrations deviate from the 1986 concentrations to a lesser extent than the cations and radionuclides, but significant differences for several key anions still exist.

- The January 1986 grab samples do not include the 30.5 cm (12 in) heel at the bottom of the tank.

- The August 1996 grab sample data do not reflect the entire sludge layer.

- Data from the core samples taken in July and September 1986 are consistent with each other.

- The fraction precipitated basis used for this analysis for major components result in inventory predictions that compare favorably with the 1986 sample analyses.

- The flowsheet bases and waste volumes used for this independent assessment are believed to reflect the processing conditions more closely than those that govern the Hanford defined waste (HDW) model inventories.

- Supernatant data from the August 1996 sampling event are the latest published results available.

Best-basis inventory estimates for tank 241-AW-105 are presented in Tables 3-1 through 3-6. The derivation of the best-basis inventory is presented in Appendix D.

Table 3-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-105 Sludge as of October 31, 1996. (2 Sheets)

Analyte	Sludge Inventory (kg)	Basis (S, M, or E)[1]	Comment
Al	3,505	S	Average of 7/86 and 9/86 samples results. 5/90 = 14,800
Ca	1,400	S	5/90 sample result
Cl	594	S	9/86 sample result. 5/90 = 3,160
TIC as CO_3	10,200	S	9/86 sample result. 5/90 = 45,400

Table 3-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-105 Sludge as of October 31, 1996. (2 Sheets)

Analyte	Sludge Inventory (kg)	Basis (S, M, or E)[1]	Comment
Cr	1,170	S	Average of 7/86 and 9/86 results. 5/90 = 6,030
F	77,300	S	9/86 sample result. 5/90 = 150,000
Fe	2,760	S	Average of 7/86 and 9/86 results. 5/90 = 9,620
K	10,700	S	Average of 7/86 and 9/86 sample results. 5/90 = 28,700
La	443	S	Average of 7/86 and 9/86 sample results. 5/90 = 2,030
Mn	1,090	S	Average of 7/86 and 9/86 sample results. 5/90 = 2,650
Na	1.54E+05	S	Average of 7/86 and 9/86 sample results. 5/90 = 40,300
Ni	200	S	9/86 sample result. 5/90 = 500
NO_2	10,700	S	9/86 sample result. 5/90 = 26,200
NO_3	38,600	S	9/86 sample result. 5/90 = 69,800
OH	11,400	S	9/86 sample result. 5/90 = 11,400
Pb	1,080	S	5/90 sample result.
PO_4	2,050	S	5/90 sample result.
Si	5,270	S	9/86 sample result. 5/90 = 9,540
SO_4	1,500	S	9/86 sample result. 5/90 = 9,540
Sr	12.0	S	9/86 sample result.
TOC	7,240	S	9/86 sample result. 5/90 = 12,900
U_{TOTAL}	12,800	S	Average of 7/86 and 9/86 sample results. 5/90 = 26,900
Zr	98,300	S	Average of 7/86 and 9/86 samples results. 5/90 = 277,000

Notes:

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

Dates are provided in mm/yy format.

Table 3-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-105 Sludge as of October 31, 1996. (Decayed to January 1, 1994).

Analyte	Sludge Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	13.6	S	5/90 sample result.
^{14}C	2.26	S	5/90 sample result.
^{60}Co	486	S	5/90 sample result.
^{90}Sr	2.63E+05	S	5/90 sample result.
^{90}Y	2.63E+05	S	5/90 sample result.
^{99}Tc	108	S	5/90 sample result.
^{125}Sb	1,860	S	9/86 sample result. 5/90 = 7,780
^{134}Cs	95.8	S	9/86 sample result. 5/90 = 424
^{137}Cs	53,200	S	9/86 sample result. 5/90 = 142,000
^{137m}Ba	50,500	S	9/86 sample result. 5/90 = 135,000
^{154}Eu	273	S	9/86 sample result. 5/90 = 3,830
^{155}Eu	199	S	9/86 sample result. 5/90 = 2,550
^{238}Pu	69.1	S	9/86 sample result. 5/90 = 658
$^{239/240}Pu$	821	S	9/86 sample result. 5/90 = 3,280
^{241}Am	477	S	Average of 7/86 and 9/86 sample results. 5/90 = 3,190
$^{243/244}Cm$	184	S	5/90 sample result.

Notes:

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

Dates are provided in mm/yy format.

Table 3-3. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-105 Supernatant as of October 31, 1996.[1]

Analyte	Supernatant Inventory (kg)	Basis (S, M, or E)[1]
Al	26.2	S
Cl	149	S
TIC as CO_3	1,170	S
Cr	1.20	S
F	290	S
K	1,200	S
Na	8,990	S
NO_2	780	S
NO_3	16,300	S
OH	2,840	S
PO_4	59.8	S
Si	32.5	S
SO_4	140	S
TOC	1,140	S

Notes:

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

Table 3-4. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-105 Supernatant as of October 31, 1996 (Decayed to January 1, 1994).

Analyte	Supernatant Inventory (Ci)	Basis (S, M, or E)[1]
^{60}Co	0.223	S
^{79}Se	NR	S
^{90}Sr	14.5	S
^{90}Y	14.5	S
^{137}Cs	454	S
^{137m}Ba	431	S
$^{239/240}$Pu	0.0025	S
^{241}Am	<0.00382	S

Notes:

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

Table 3-5. Best-Basis Total Inventory Estimates for Nonradioactive Components in Tank 241-AW-105 as of October 31, 1996.

Analyte	Total Inventory (kg)	Basis (S, M, or E)[1]	Comment
Al	3,520	S	
Cl	743	S	
TIC as CO_3	11,100	S	
Cr	1,170	S	
F	77,600	S	
Fe	2,760	S	Sludge inventory only.
K	10,900	S	
La	443	S	Sludge inventory only.
Mn	1,090	S	Sludge inventory only.
Na	1.63E+05	S	
Ni	200	S	Sludge inventory only.
NO_2	11,500	S	
NO_3	54,900	S	
OH	14,300	S	
Pb	1,080	S	Sludge inventory only.
PO_4	2,110	S	
Si	5,310	S	
SO_4	1,640	S	
Sr	12.0	S	Sludge inventory only.
TOC	8,380	S	
U_{TOTAL}	12,800	S	Sludge inventory only.
Zr	98,300	S	Sludge inventory only.

Notes:

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

Table 3-6. Best-Basis Total Inventory Estimates for Radioactive Components in Tank 241-AW-105 as of October 31, 1996 (Decayed to January 1, 1994).

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	13.6	S	Sludge inventory only.
^{14}C	2.26	S	Sludge inventory only.
^{60}Co	486	S	
^{90}Sr	2.63E+05	S	
^{90}Y	2.63E+05	S	
^{99}Tc	108	S	Sludge inventory only.
^{125}Sb	1,860	S	Sludge inventory only.
^{134}Cs	95.8	S	Sludge inventory only.
^{137}Cs	53,700	S	
^{137m}Ba	51,000	S	
^{154}Eu	273	S	Sludge inventory only.
^{155}Eu	199	S	Sludge inventory only.
^{238}Pu	69.1	S	Sludge inventory only.
$^{239/240}Pu$	821	S	
^{241}Am	477	S	
$^{243/244}Cm$	184	S	Sludge inventory only.

Notes:

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

4.0 RECOMMENDATIONS

The sampling and analysis activities performed for tank 241-AW-105 have met all requirements of the waste compatibility DQO document and the SAP. The analytical results were well within the safety and operational notification limits specified in the waste compatibility DQO. In addition, all analytical results were within the prescribed limits of the safety screening DQO; however, DSC analyses have not been performed on samples from the bottom two-thirds of the sludge. Furthermore, a characterization best-basis inventory was developed for the tank contents.

Table 4-1 summarizes the status of the Project Hanford Management Contractor (PHMC) TWRS Program review and acceptance of the sampling and analysis results reported in this TCR. All DQO issues required to be addressed by sampling and analysis are listed in column one of Table 4-1. The second column indicates whether the requirements of the DQO were met by the sampling and analysis activities performed and is answered with a "yes" or a "no." The third column indicates concurrence and acceptance by the program in PHMC TWRS that is responsible for the DQO that the sampling and analysis activities performed adequately meet the needs of the DQO. A "yes" or "no" in column three indicates acceptance or disapproval of the sampling and analysis information presented in the TCR. If the results/information have not yet been reviewed, "N/R" is shown in the column. If the results/information have been reviewed, but acceptance or disapproval has not been decided, "N/D" is shown in the column. Safety screening acceptance is indicated as "Partial" because no DSC measurements have been performed on the lower two-thirds of the sludge layer.

Table 4-1. Acceptance of Tank 241-AW-105 Sampling and Analysis.

Issue	Sampling and Analysis Performed	Program[1] Acceptance
Waste compatibility DQO	Yes	Yes
Safety screening DQO	Partial	Partial

Note:

[1]PHMC TWRS

Table 4-2 summarizes the status of PHMC TWRS Program review and acceptance of the evaluations and other characterization information contained in this report. The evaluations specifically outlined in this report are the waste compatibility analysis and the evaluation to determine whether the tank is safe, conditionally safe, or unsafe. Column one lists the different evaluations performed in this report. Columns two and three are in the same format as Table 4-1. The manner in which concurrence and acceptance are summarized is also the same as that in Table 4-1. None of the analyses performed on the grab samples indicated any safety problems. The waste compatibility assessment for tank 241-AW-105 has not yet been performed.

Table 4-2. Acceptance of Evaluation of Characterization Data and Information for Tank 241-AW-105.

Issue	Evaluation Performed	Program[1] Acceptance
Waste compatibility assessment	N/D	N/D
Safety screening assessment	Partial	Partial

Note:
[1]PHMC TWRS

Because tank 241-AW-105 is active and the contents are continually changing, it may need to be resampled after waste transfers into the tank in order to assure safety and operational requirements are not violated.

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APPENDIX A

HISTORICAL TANK INFORMATION

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APPENDIX A

HISTORICAL TANK INFORMATION

Appendix A describes tank 241-AW-105 based on historical information. For this report, historical information includes any information about the fill history, waste types, surveillance, or modeling data about the tank. This information is necessary for providing a balanced assessment of the sampling and analytical results.

This appendix contains the following information:

- **Section A1:** Current status of the tank, including the current waste levels as well as the stabilization and isolation status of the tank.
- **Section A2:** Information about the design of the tank.
- **Section A3:** Process knowledge of the tank; that is, the waste transfer history and the estimated contents of the tank based on modeling data.
- **Section A4:** Surveillance data for tank 241-AW-105, including surface-level readings and temperatures.
- **Section A5:** References for Appendix A.

Historical sampling results (results from samples obtained before 1996) are included in Appendix B.

A1.0 CURRENT TANK STATUS

As of October 31, 1996, tank 241-AW-105 contained an estimated 1,665 kL (440 kgal) of dilute non-complexed waste and NCRW (Hanlon 1996). The waste volumes were estimated using an ENRAF[1] surface-level gauge. The volumes of the waste phases found in the tank are shown in Table A1-1.

Tank 241-AW-105 is an active dilute waste receiver tank for PUREX and its integrity is classified as sound. The tank is flat bottomed, actively ventilated, and not on the Watch List (Public Law 101-510).

[1]ENRAF is a trademark of ENRAF Corporation, Houston, Texas.

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

Waste Type	kL (kgal)
Total waste	1,665 (440)
Supernatant	606 (160)
Sludge	1,060 (280)
Saltcake	0
Drainable interstitial liquid	102 (27)
Drainable liquid remaining	708 (187)
Pumpable liquid remaining	625 (165)

Note:

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

A2.0 TANK DESIGN AND BACKGROUND

Tank 241-AW-105 was constructed between 1978 and 1980 and went into service in 1980. Although it has a design capacity for storing 4,390 kL (1,160 kgal) of waste, safety considerations limit the maximum operating capacity to 4,310 kL (1,140 kgal). It is one of six double-shell tanks comprising the 241-AW Tank Farm located in the southeast corner of the 200 East Area. These tanks are all at the same elevation with no cascade lines between them. Tank 241-AW-105 consists of a heat-treated (stress-relieved) primary steel liner inside a secondary liner, both of which are encased in a reinforced-concrete shell and covered by a reinforced concrete dome. The maximum design temperature for liquid storage is 177 °C (350 °F). The tank has a diameter of 22.9 m (75 ft) and an operating depth of 10.7 m (35.2 ft).

The surface level is monitored through riser 1A with a manual tape liquid level indicator, and with an ENRAF® waste level gauge through riser 2A (Salazar 1994). Riser 4A contains a thermocouple tree. Figure A2-1 is a plan view of the riser configuration. A list of tank 241-AW-105 risers showing their sizes and general use is provided in Table A2-1.

A tank cross section showing the approximate waste level, along with a schematic of the tank equipment, is shown in Figure A2-2. Tank 241-AW-105 has twenty-two risers that provide access to the primary tank. Additional risers access the tank annulus. Risers 3A, 7A, 7B, and 12A are 30 cm (12 in.) in diameter, risers 5A, 5B, and 11A are 107 cm (42 in.), and the remaining risers are all 10 cm (4 in.) in diameter. Risers 1C, 7A, 10A, 12A, 13A, and 15A are tentatively available for sampling (Lipnicki 1996).

Figure A2-1. Riser Configuration for Tank 241-AW-105.

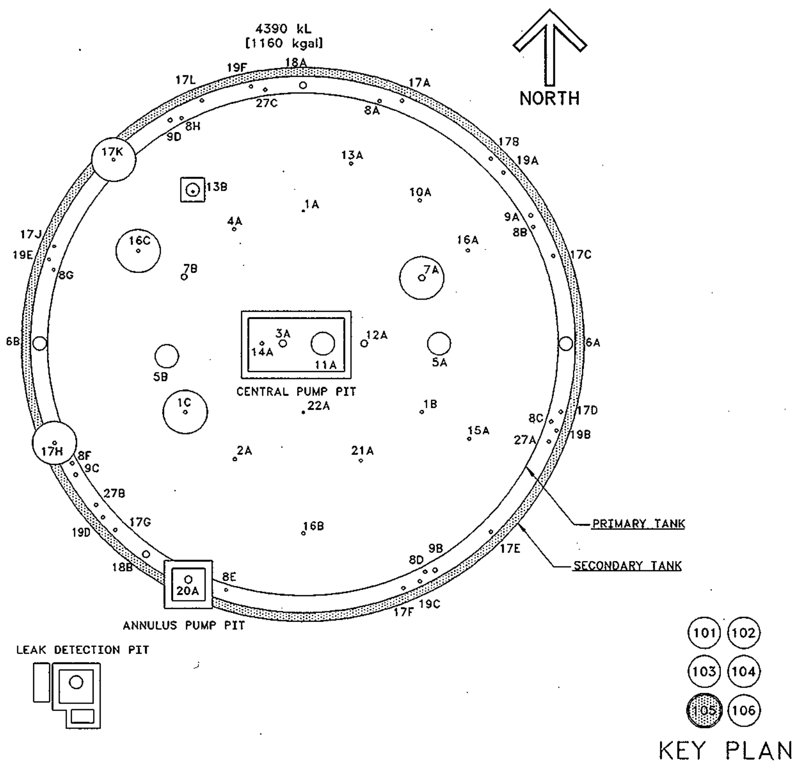


Table A2-1. Tank 241-AW-105 Risers.[1,2,3,4]

New Number[5]	Number	Diameter mm (in.)	Description and Comments
201	1A	102 (4)	Manual tape liquid level indicator
202	1B	102 (4)	Sludge measurement port
203	1C	102 (4)	Sludge measurement port/spare, 305 mm (12 in.) cover
204	2A	102 (4)	ENRAF® waste level indicator
205	3A	305 (12)	Supernatant pump, central pump pit
206	4A	102 (4)	Thermocouple tree
207	5A	1067 (42)	Manhole/spare
208	5B	1067 (42)	Manhole/spare
211	7A	305 (12)	Spare, 305 mm (12 in.) cover
212	7B	305 (12)	Tank ventilation
227	10A	102 (4)	Spare
228	11A	1067 (42)	Slurry distributor, central pump pit
229	12A	305 (12)	Observation port/spare
231	13A	102 (4)	Sludge measurement port/spare
232	13B	102 (4)	Tank pressure, 610 mm (24 in.) cover
233	14A	102 (4)	Supernatant return, central pump pit
234	15A	102 (4)	Spare
235	16A	102 (4)	Sludge measurement port
236	16B	102 (4)	Pressure indicator
237	16C	102 (4)	Sludge measurement port/spare, 305 mm (12 in.) cover
260	21A	102 (4)	High level sensor
262	22A	102 (4)	Sludge measurement port

Notes:

[1]If there was a discrepancy between the documents and the drawing, the drawing shall take precedence.

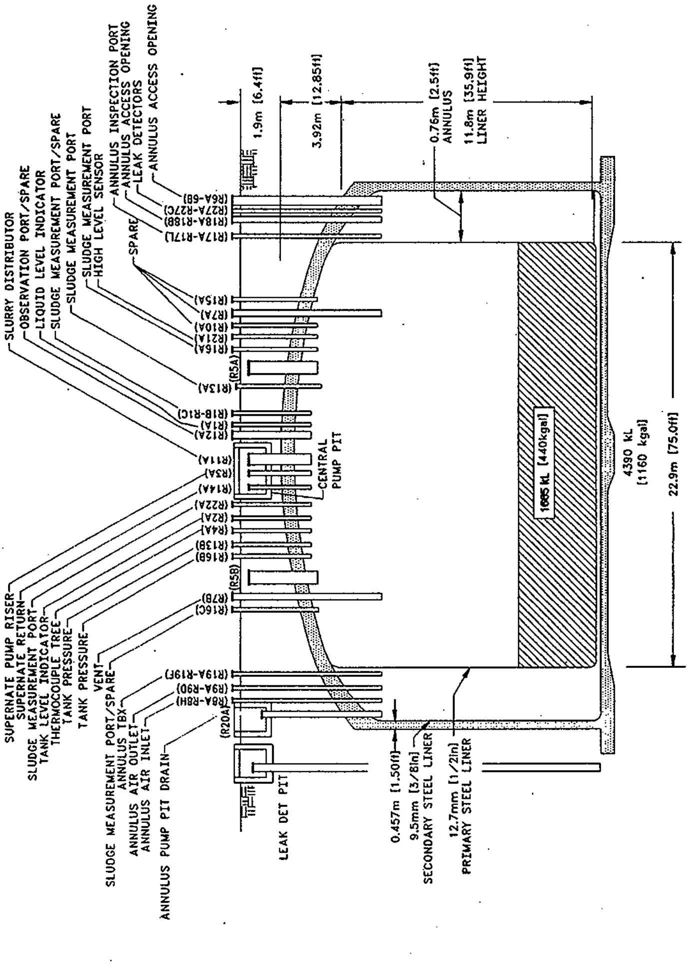
[2]Salazar (1994)

[3]WHC (1994)

[4]WHC (1995)

[5]Denotes Engineering Change Notice 613265, dated January 25, 1995, made against the reference drawings.

Figure A2-2. Tank 241-AW-105 Cross Section and Schematic.



A3.0 PROCESS KNOWLEDGE

The sections below: 1) provide information about the transfer history of tank 241-AW-105; 2) describe the process wastes that made up the transfers; and 3) give an estimate of the current tank contents based on transfer history.

A3.1 WASTE TRANSFER HISTORY

Table A3-1 summarizes the waste transfer history of tank 241-AW-105 (Agnew et al. 1997b, Koreski 1997). The first waste received by tank 241-AW-105 was a small amount of flush water in August 1980. Later that month, the tank received complexed concentrate waste from the 242-A evaporator (Teats 1982). Agnew et al. (1997b) indicates that the complexed concentration was received from tank 241-A-102, however, the waste actually originated in the 200 West Area and was transferred to tank 241-A-101 before waste volume reduction in the 242-A evaporator and storage in tank 241-AW-105 (Teats 1982). This transfer brought the tank's waste volume to 3,580 kL (946 kgal). In the third quarter of 1982, the tank received dilute non-complexed waste from tank 241-AW-104. In the first quarter of 1983 the tank received dilute-non-complexed waste from B Plant. In the second quarter of 1983, waste was transferred to tank 241-AW-101, leaving only 193 kL (51 kgal) of waste in tank 241-AW-105.

From the second quarter of 1983 to the third quarter of 1984 the tank was a receiver for PUREX miscellaneous waste. During this period, the tank also received dilute non-complexed waste from tank 241-AW-103 and tank 241-AW-104 and sent waste to tanks 241-AW-101, 241-AN-101, 241-AN-102, and 241-AZ-102. Waste was also transferred to tank 241-AW-102 in support of evaporator operations.

Starting in the third quarter of 1984 and continuing through the second quarter of 1988, tank 241-AW-105 received repeated transfers of PUREX NCRW waste. The NCRW solids, classified as a TRU waste, were allowed to settle and accumulate in the tank. The NCRW supernatant, classified as dilute non-complexed waste, was periodically transferred to tank 241-AW-102 as feed for the 242-A Evaporator. The continuing transfers of NCRW slurry into the tank and repeated transfers of liquids to other tanks has resulted in accumulation of a substantial layer of NCRW solids in tank 241-AW-105.

During this time, other waste types were transferred into tank 241-AW-105 in relatively small quantities. These include 490 kL (130 kgal) dilute non-complexed saltwell liquids from single-shell tanks 241-BY-101, 241-TY-105, 241-C-111, and 241-C-104 and 322 kL (85 kgal) of Hot Semi-Works TRU solids through tank 241-AW-102.

From the third quarter of 1988 through the first quarter of 1990 tank 241-AW-105 received spent metathesis waste from PUREX. The tank resumed receiving PXMSC from the third quarter of 1992 through the second quarter of 1996. This dilute non-complexed waste consists of process solutions such as sump water, steam condensate, rain water, and laboratory waste. Throughout its operation, the tank received numerous transfers of water from various sources. Most of the water probably came from line flushes following waste transfers. The tank received additional flush water from miscellaneous sources and dilute non-complexed waste from the fourth quarter of 1994 to the first quarter of 1996. In the fourth quarter of 1994, dilute non-complexed waste was transferred to tank 241-AP-108 and in the fourth quarter of 1995, dilute non-complexed waste was transferred to tank 241-AP-104.

Table A3-1. Tank 241-AW-105 Major Transfers.[1,2] (2 sheets)

Transfer Source	Transfer Destination	Waste Type	Time Period	Estimated Volume	
				kL	kgal
242-A Evaporator[3]	---	Complexant concentrate waste	1980	3,550	938
241-AW-104 241-AW-103	---	Dilute non-complexed	1982-1983	1,300	343
B Plant	---	Dilute non-complexed	1983	49	13
---	241-AW-101	Supernatant	1983	-3,860	-1,020
PUREX	---	Dilute non-complexed (PUREX miscellaneous waste)	1983-1984	7,040	1,860
241-AW-102	---	Dilute non-complexed	1983	216	57
---	241-AW-102	Dilute non-complexed	1983	-4,500	-1,320
---	241-AN-102 241-AZ-102 241-AN-101	Dilute non-complexed	1983-1984	- 3,110	- 822
PUREX	---	PUREX decladding waste	1984-1986	5,900	1,560
241-AW-102	---	Dilute non-complexed	1984	227	60
---	241-AW-102	Dilute non-complexed	1984-1986	-5,600	-1,480
241-BY-101 241-TY-105 241-C-111 241-C-104	---	Saltwell liquid	1985	490	130
PUREX	---	PUREX decladding waste	1987-1988	867	229
241-AW-102	---	Dilute non-complexed	1987-1988	2,640	698

Table A3-1. Tank 241-AW-105 Major Transfers.[1,2] (2 sheets)

Transfer Source	Transfer Destination	Waste Type	Time Period	Estimated Volume	
				kL	kgal
---	241-AW-102	Dilute non-complexed	1987-1988	-4,920	-1,300
241-AW-102	---	Hot Semi-Works TRU Solids	1988	322	85
PUREX	---	PUREX spent metathesis waste	1988-1990	965	255
Unknown	---	Unknown	1989-1991	76	20
B Plant	---	PUREX miscellaneous waste	1992-1996	2,370	626
---	241-AP-108 241-AP-104	Dilute non-complexed	1992-1995	4,130	- 1,090

Notes:

[1]Agnew et al. (1997b) and Koreski (1997)

[2]Because only major transfers are listed, the sum of these transfers will not equal the current tank waste volume. Also, multiple additions of water (primarily line flushes following transfers) occurred over the years on a regular basis.

[3]Agnew et al. (1997b) incorrectly identifies transfer source as tank 241-A-102.

A3.2 HISTORICAL ESTIMATION OF TANK CONTENTS

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

- *Waste Status and Transaction Record Summary (WSTRS, Rev. 4)* (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), the Tank Layer Model (TLM) and the Historical Tank Inventory Estimates.

- The HDW list is comprised of approximately 50 waste types defined by concentration for major analytes/compounds for both sludge and supernatant layers.

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

- The SMM 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 the Waste Status and Transaction Record Summary (WSTRS), TLM, and HDW list to describe the supernatants and concentrates in each tank. Together the WSTRS, TLM, SMM, and HDW list determine each tank's inventory estimate. These model predictions are considered estimates that require further evaluation using analytical data.

Based on Agnew et al. (1997a), the tank 241-AW-105 sludge layer contains small amounts of PXMSC on the top and bottom, concentrated 242-A Evaporator salt slurry derived from the SMM (SMMA2) waste in the middle, and a layer of NCRW above and below the SMMA2 waste. Because this tank is still active, the TLM does not include any representation of the supernatant above the sludge layer due to its transient nature. Figure A3-1 shows a graphical representation of the estimated waste types and volume. The PXMSC layers should contain greater than one weight percent iron, hydroxide, carbonate, sodium, calcium, nitrate, and uranium. The NCRW layers should contain greater than one weight percent sodium, iron, zirconium, hydroxide, fluoride, and nitrate. The specific estimated concentrations of the constituents of the SMMA2 layer were not characterized by the model of Agnew et al. (1997a). Cesium and strontium were present in relatively small quantities in the two waste types described, accounting for the low heat load estimate given in Table A3-2. Table A3-2 shows the historical estimate of the expected waste constituents and their concentrations. The HDW only takes into account waste transfers through 1993. The supernatant in tank 241-AW-105 in 1993 has since been transferred out of the tank and therefore the HDW estimate of the supernatant no longer reflects the tank contents. Therefore, Table A3-2 provides the HDW estimate for the tank 241-AW-105 solids only.

Figure A3-1. Tank Layer Model for Tank 241-AW-105.

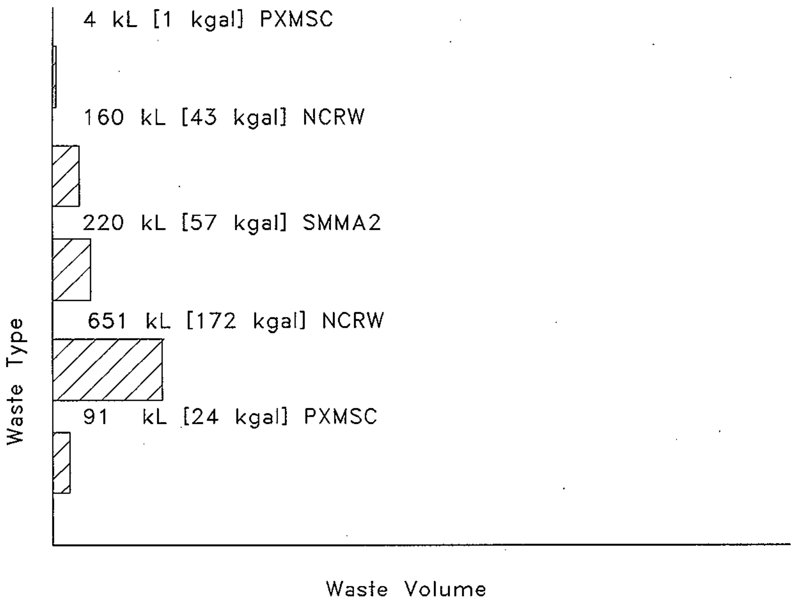


Table A3-2. Tank 241-AW-105 Historical Tank Inventory Estimate for Solids.[1,2] (4 sheets)

Total Inventory Estimate			
Physical Properties			
Total solid waste	1.16E+06 kg (240 kgal)		
Heat Load	42.1 W (144 Btu/hr)		
Bulk Density[3]	1.28 g/mL		
Water wt%[3]	64.1		
Total organic carbon wt% carbon (wet)[3]	0.00355		
Chemical Constituents	*M*	$\mu g/g$	kg[4]
Na^{+}	4.99	89,400	104,000
Al^{3+}	0	0	0
Fe^{3+} (total Fe)	0.524	22,800	26,600
Cr^{3+}	7.42E-04	30.1	35.0
Bi^{3+}	0	0	0
La^{3+}	0	0	0
Hg^{2+}	0.00188	294	342
Zr (as $ZrO(OH)_2$)	0.830	59,100	68,800
Pb^{2+}	4.03E-06	0.651	0.758
Ni^{2+}	0.0116	533	621
Sr^{2+}	0	0	0
Mn^{4+}	5.56E-04	23.8	27.8
Ca^{2+}	0.133	4,150	4,840
K^{+}	0.172	5,240	6,100
OH^{-}	5.22	6,930	80,700
NO_3^{-}	0.321	15,500	18,100
NO_2^{-}	0.00916	328	383
CO_3^{2-}	0.142	6,660	7,760
PO_4^{3-}	0.00644	477	556
SO_4^{2-}	3.75E-04	28.1	32.7
Si (as SiO_3^{2-})	0	0	0
F^{-}	4.74	70,200	81,700
Cl^{-}	0.00392	108	126
Citrate	0	0	0

Table A3-2. Tank 241-AW-105 Historical Tank Inventory Estimate for Solids.[1,2] (4 sheets)

Total Inventory Estimate			
Chemical Constituents (Cont'd)	*M*	μg/g	kg[4]
$EDTA^{4-}$	0	0	0
$HEDTA^{3-}$	0	0	0
glycolate	0	0	0
acetate	0	0	0
oxalate	0	0	0
DBP	3.16E-04	51.8	60.3
butanol	3.16E-04	18.3	21.3
NH_3	0.587	7,780	9,060
$Fe(CN)_6^{4-}$	0	0	0
Radiological Constituents	Ci/L	μCi/g	Ci[4]
^{3}H	1.56E-05	0.0122	14.2
^{14}C	1.93E-07	1.50E-04	0.175
^{59}Ni	1.27E-07	9.90E-05	0.115
^{63}Ni	1.47E-07	0.0114	13.3
^{60}Co	2.97E-06	0.00232	2.70
^{79}Se	4.41E-08	1.88E-05	0.0219
^{90}Sr	0.00378	2.94	3,430
^{90}Y	0.00378	2.94	3,430
^{93}Zr	1.16E-07	9.06E-05	0.105
^{93m}Nb	4.90E-08	3.82E-05	0.0445
^{99}Tc	8.04E-07	6.27E-04	0.731
^{106}Ru	4.63E-04	0.361	421
^{113m}Cd	1.25E-06	9.78E-04	1.14
^{125}Sb	2.19E-05	0.0561	65.3
^{126}Sn	3.80E-08	2.96E-05	0.0345
^{129}I	1.62E-09	1.26E-06	0.00147
^{134}Cs	3.19E-05	0.0249	29.0
^{137}Cs	0.00446	3.48	4,050
^{137m}Ba	0.00422	3.29	3,830
^{151}Sm	8.33E-05	0.0649	75.6

Table A3-2. Tank 241-AW-105 Historical Tank Inventory Estimate for Solids.[1,2] (4 sheets)

Total Inventory Estimate			
Radiological Constituents (Cont'd)	Ci/L	μCi/g	Ci[4]
^{152}Eu	9.38E-07	7.32E-04	0.852
^{154}Eu	2.22E-05	0.0173	20.2
^{155}Eu	1.70E-04	0.133	155
^{226}Ra	1.94E-13	1.51E-10	1.76E-07
^{226}Ra	8.50E-17	6.63E-14	7.72E-11
^{227}Ac	1.12E-12	8.70E-10	1.01E-06
^{231}Pa	6.37E-12	4.97E-09	5.78E-06
^{229}Th	9.72E-15	7.58E-12	8.83E-09
^{232}Th	3.25E-17	2.54E-14	2.95E-11
^{232}U	1.07E-09	8.32E-07	9.69E-04
^{233}U	1.09E-11	8.53E-09	9.94E-06
^{234}U	4.80E-06	0.00374	4.36
^{235}U	1.82E-07	1.42E-04	0.166
^{236}U	3.95E-07	3.08E-04	0.359
^{238}U	3.29E-06	0.00257	2.99
Total U	0.0416 *M*	7,710 μg/g	8,980 kg
^{237}Np	1.18E-08	9.19E-06	0.0107
^{238}Pu	1.37E-04	0.107	124
^{239}Pu	0.00111	0.866	1,010
^{240}Pu	3.37E-04	0.263	306
^{241}Pu	0.0140	10.9	12,700
^{242}Pu	5.22E-08	4.07E-05	0.0474
Total Pu	0.0195 g/L	NR	17.7 kg
^{241}Am	1.48E-05	0.0116	13.5
^{243}Am	3.19E-09	2.44E-06	0.00284

Table A3-2. Tank 241-AW-105 Historical Tank Inventory Estimate for Solids.[1,2] (4 sheets)

Total Inventory Estimate			
Radiological Constituents (Cont'd)	Ci/L	μCi/g	Ci[4]
^{242}Cm	8.26E-08	6.44E-05	0.0750
^{243}Cm	1.38E-08	1.08E-05	0.0126
^{244}Cm	5.69E-08	4.44E-05	0.0517

Notes:

NR = not reported

[1]Agnew et al. (1997a)

[2]These estimates have not been validated and should be used with caution.
Unknowns in tank solids inventory are assigned by the TLM.

[3]Volume average for density, mass average water weight percent and total organic carbon (TOC) weight percent carbon.

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

A4.0 SURVEILLANCE DATA

Tank 241-AW-105 surveillance consists of surface-level measurements (liquid and solid), temperature monitoring inside the tank (waste and headspace), and leak detection equipment in the tank annulus. Liquid-level measurements provide the basis for determining whether the tank has a major leak. Solid surface-level measurements provide an indication of physical changes in and consistencies of the solid layers of a tank.

A4.1 SURFACE-LEVEL READINGS

Tank 241-AW-105 is categorized as sound. To monitor the surface level of the waste, tank 241-AW-105 is equipped with an ENRAF® gauge located in riser 2A and a manual tape located in riser 1A. Manual readings are required daily in case the ENRAF® gauge fails or if the Computer Automated Surveillance System readings are zero. On November 14, 1996, the ENRAF® reading was 405.6 cm (159.7 in.) and the manual tape reading was 404.6 cm (159.3 in.). The level history graph of the volume measurements is presented in

Figure A4-1, showing the continually changing waste levels of the tank since it entered service in 1980.

A4.2 INTERNAL TANK TEMPERATURES

Tank 241-AW-105 has a single thermocouple tree with 18 thermocouples to monitor the waste temperature through riser 4A. These thermocouples are located at 0.61 m (2 ft) intervals with the exception of the two nearest the waste surface, which are 1.22 m (4 ft) apart (Tran 1993). The temperature readings for tank 241-AW-105 have been automatically recorded since 1990 by the Surveillance Analysis Computer Systems and are downloaded daily.

The average tank temperature between April 18, 1994 and November 11, 1996 was 21 °C (69 °F), the minimum was 15 °C (59 °F), and the maximum was 28 °C (83 °F). The most recent information available, from November 11, 1996, indicated a maximum temperature of 21 °C (70 °F), and a minimum of 18 °C (64 °F). Plots of the thermocouple readings can be found in the supporting document for the historical tank content estimate (Brevick et al. 1995). Figure A4-2 shows a graph of the weekly high temperature.

A4.3 TANK 241-AW-105 PHOTOGRAPHS

There are no in-tank photographs for tank 241-AW-105.

Figure A4-1. Tank 241-AW-105 Level History.

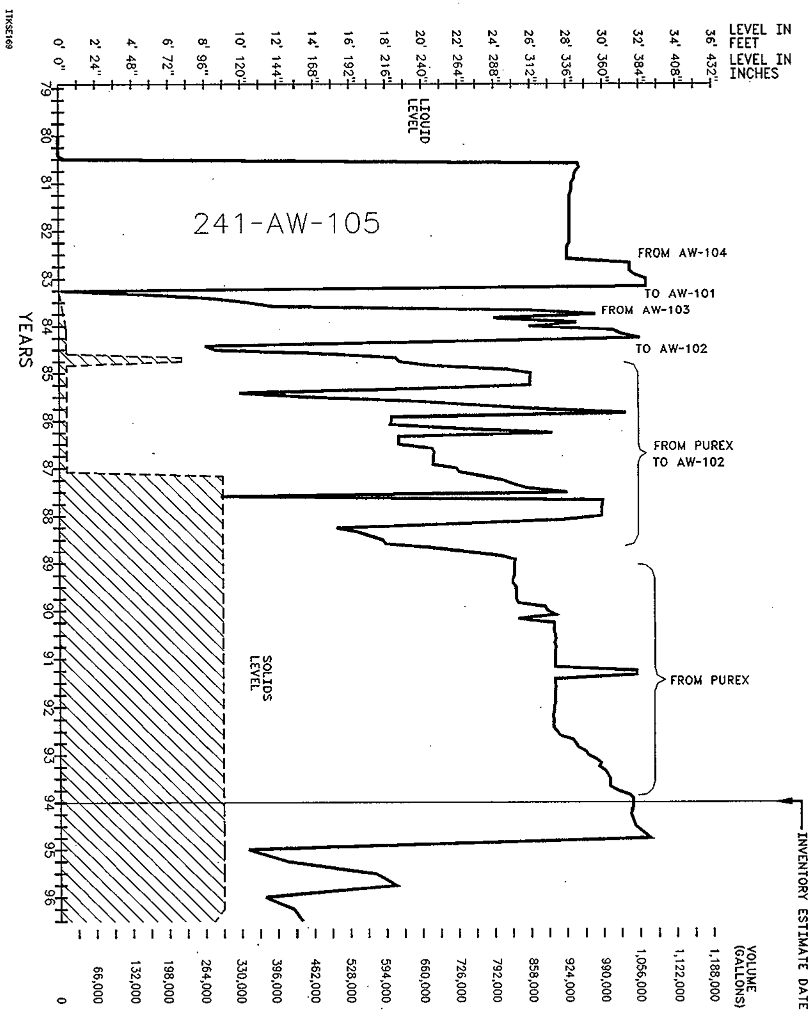
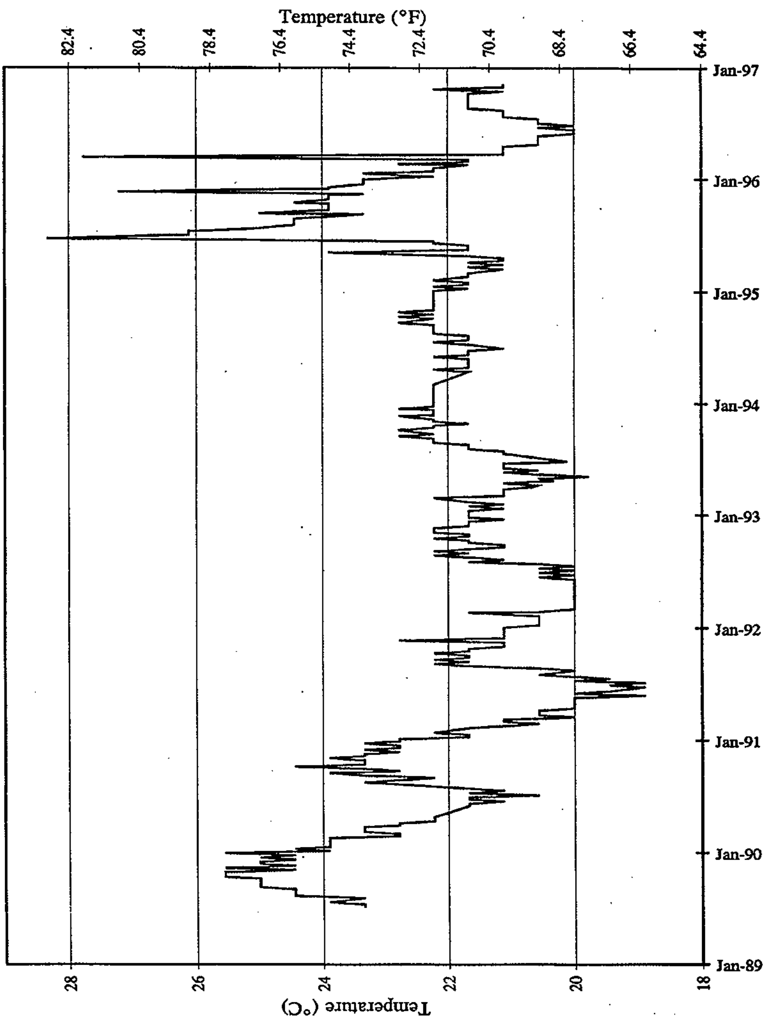


Figure A4-2. Tank 241-AW-105 High Temperature Plot.



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APPENDIX B

SAMPLING OF TANK 241-AW-105

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APPENDIX B

SAMPLING OF TANK 241-AW-105

Appendix B provides sampling and analysis information for each known sampling event for tank 241-AW-105 and provides an assessment of the sample results.

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

Future sampling of tank 241-AW-105 will be appended to the above list.

B1.0 TANK SAMPLING OVERVIEW

This section describes the August 1996 sampling and analysis event for tank 241-AW-105. Grab samples were taken to satisfy the requirements of the *Data Quality Objectives for Tank Farms Waste Compatibility Program* (Fowler 1995). The sampling and analyses were performed in accordance with the *Compatibility Grab Sampling and Analysis Plan* (Sasaki 1996). In addition, the safety thresholds specified in the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995) were applied to the analytical results. Further discussions of the sampling and analysis procedures can be found in the *Tank Characterization Reference Guide* (DeLorenzo et al. 1994). There were also several historical sampling events for this tank; these sampling events are discussed in Section B1.4.

B1.1 DESCRIPTION OF SAMPLING EVENT

On August 20 and 21, 1996, 20 grab samples were collected from tank 241-AW-105. Samples 5AW-96-1 through 5AW-96-9 were removed from riser 10A, and samples 5AW-96-10 through 5AW-96-20 were removed from riser 15A. All samples were received at the Westinghouse Hanford Company 222-S Laboratory between August 21 and August 27, 1996 (Esch 1997). Analyses were performed on only 12 of the 20 samples as directed by the SAP (Sasaki 1996). The remaining eight samples are on hold at the 222-S Laboratory for the K-Basin Sludge Mixing/Compatibility Studies.

Before the grab sampling event, the tank headspace vapors were sampled from riser 10A and riser 15A. These measurements for the presence of flammable gases fulfilled one of the requirements of the safety screening DQO. The results are presented in Section B2.8.

Sampling and analytical requirements from the safety screening and compatibility DQOs are summarized in Table B1-1. The August 1996 grab samples were analyzed to meet the requirements of the Compatibility DQO only. However, the analytical results can also be used to partially satisfy the requirements of the safety screening DQO.

Table B1-1. Integrated Data Quality Objective Requirements for Tank 241-AW-105. (2 sheets)

Sampling Event	Applicable DQOs	Sampling Requirements	Analytical Requirements
September 1996 grab sampling	Safety screening (Dukelow et al. 1995)[1]	Vertical waste profiles.[2] Flammability measurements made in tank headspace.	▸ Energetics ▸ Moisture content ▸ Total alpha activity ▸ Specific gravity ▸ Visual check for organic layer
	Waste compatibility (Fowler 1995)	Grab samples from different depths	▸ Energetics ▸ Moisture content ▸ Visual check for organic layer ▸ Metals by ICP ▸ Anions by IC ▸ Radionuclides ▸ TIC, TOC ▸ Hydroxide ▸ Specific gravity ▸ pH ▸ Percent solids

Table B1-1. Integrated Data Quality Objective Requirements for Tank 241-AW-105. (2 sheets)

Sampling Event	Applicable DQOs	Sampling Requirements	Analytical Requirements
Combustible gas meter reading	Safety screening[1]	Measurement in a minimum of one location within tank vapor space.	▸ Flammable gas concentration

Notes:

ICP = inductively coupled plasma
IC = ion chromatography
TIC = total inorganic carbon

[1]The safety screening DQO was not required in the SAP.
[2]The number of samples required to characterize a tank is a function of waste variability (heterogeneity) and the desired confidence to make a correct decision (Dukelow et al. 1995).

B1.2 SAMPLE HANDLING

Table B1-2 lists the sampling dates and the dates the samples were received by the 222-S Laboratory, the actual sampling elevation, percent solids settled, and sample appearance. Although only twelve samples were analyzed, all twenty samples collected are included in the table.

Table B1-2. Appearance Information for Tank 241-AW-105 Grab Samples.[1] (3 sheets)

Segment Number	Date Sampled	Date Received	Actual Elevation (in.)[2]	% Settled Solids	Sample Description
5AW-96-1	8/20/96	8/26/96	155	Trace	Clear yellow liquid; no organic layer; trace amount of solids.
5AW-96-2	8/20/96	8/27/96	137	Trace	Clear yellow liquid; no organic layer; trace amount of solids.
5AW-96-3	8/20/96	8/21/96	137	N/A	Sample designated for K Basin sludge mixing studies.
5AW-96-4	8/20/96	8/27/96	118	Trace	Clear yellow liquid; no organic layer; trace amount of solids.

Table B1-2. Appearance Information for Tank 241-AW-105 Grab Samples.[1] (3 sheets)

Segment Number	Date Sampled	Date Received	Actual Elevation (in.)[2]	% Settled Solids	Sample Description
5AW-96-5	8/20/96	8/27/96	95	~22%	Clear yellow liquid with approximately 22% settled solids. Solids were a yellow soft sludge material with some small black particulates.
5AW-96-6	8/20/96	8/26/96	78	N/A	Sample designated for K Basin sludge mixing studies.
5AW-96-7	8/20/96	8/26/96	78	~90%	Liquid color was indistinguishable. Solids were a yellow/gray soft sludge material with some small black particulates.
5AW-96-8	8/20/96	8/21/96	78	N/A	Sample designated for K Basin sludge mixing studies.
5AW-96-9	8/20/96	8/27/96	77	~90%	Liquid color was indistinguishable. Solids were a nonhomogeneous mixture of light yellow and gray soft sludge material with some small black particulates.
5AW-96-10	8/21/96	8/22/96	155	Trace	Clear yellow liquid; no organic layer; trace amount of solids.
5AW-96-11	8/21/96	8/22/96	137	Trace	Clear yellow liquid; no organic layer; trace amount of solids.
5AW-96-12	8/21/96	8/23/96	137	N/A	Sample designated for K Basin sludge mixing studies.
5AW-96-13	8/21/96	8/23/96	137	N/A	Sample designated for K Basin sludge mixing studies.
5AW-96-14	8/21/96	8/23/96	118	Trace	Clear yellow liquid; no organic layer; trace amount of solids.
5AW-96-15	8/21/96	8/23/96	95	~90%	Liquid color was indistinguishable. Solids were a nonhomogeneous mixture of dark yellow and gray soft sludge material with some small black particulates.
5AW-96-16	8/21/96	8/23/96	73	N/A	Sample designated for K Basin sludge mixing studies.

Table B1-2. Appearance Information for Tank 241-AW-105 Grab Samples.[1] (3 sheets)

Segment Number	Date Sampled	Date Received	Actual Elevation (in.)[2]	% Settled Solids	Sample Description
5AW-96-17	8/21/96	8/23/96	73	~90%	Liquid color was indistinguishable. Solids were a nonhomogeneous mixture composed mostly of dark gray/black soft sludge material with some yellow sludge swirled throughout.
5AW-96-18	8/21/96	8/23/96	73	N/A	Sample designated for K Basin sludge mixing studies.
5AW-96-19	8/21/96	8/23/96	73	N/A	Sample designated for K Basin sludge mixing studies.
5AW-96-20	8/21/96	8/26/96	66	~93%	Liquid color was indistinguishable. Solids were a nonhomogeneous mixture composed mostly of a somewhat even mixture of yellow and gray soft sludge material swirled together. There were some larger "chunks" of material scattered throughout - some black and some nearly white.

Notes:

N/A = This information was not available.

[1]Esch (1997)

[2]Actual elevation was the distance (in.) from the bottom of the tank to the mouth of the sample bottle.
Dates are provided in mm/dd/yy format.

The six supernatant samples were analyzed directly. The six sludge samples were first measured for volume percent settled solids, after which any supernatant portion was discarded. Following bulk density measurements, the solids portion of each sample was then centrifuged. The centrifuged solids and centrifuged liquids (interstitial liquids) were then measured independently for the various analytes, as described in Section B1.3. Table B1-3 gives the sludge separation information for tank 241-AW-105. All of the sludge samples that were analyzed are included in the table. The sample bottle size was 125 mL, and full recovery was obtained from all samples. The remaining eight samples from this sampling event were archived and are now stored at the 222-S Laboratory.

Table B1-3. Sludge Separation Information for Tank 241-AW-105 August 1996 Grab Samples.[1]

Segment Number	Supernatant Removed		Centrifuged Solids		Interstitial Liquid	
	Weight (g)	Volume (mL)	Weight (g)	Volume (mL)	Weight (g)	Volume (mL)
5AW-96-5	106.26	101.0	10.34	9.0	17.60	17.0
5AW-96-7	3.73	3.5	118.63	89.5	40.86	39.0
5AW-96-9	9.16	8.0	115.85	89.5	32.88	32.0
5AW-96-15	27.20	25.3	100.11	79.5	28.45	29.0
5AW-96-17	10.60	9.5	108.22	82.5	41.28	39.5
5AW-96-20	18.27	17.0	119.14	94.5	27.2	25.0

Note:

[1]Esch (1997)

B1.3 SAMPLE ANALYSIS

All of the analyses required by the waste compatibility DQO were performed on the grab samples. In addition to the analyses requested in the SAP, many inductively coupled plasma (ICP) analytes as well as bromide, oxalate, and ^{60}Co were obtained on an opportunistic basis. These were reported in accordance with Kristofzski (1995) because doing so required little additional effort. The analyses required by the waste compatibility DQO included safety parameters such as thermal properties by DSC, content of fissile material from $^{239/240}$Pu, specific gravity, and the concentrations of several anions to assess corrosivity.

The six supernatant samples and the interstitial liquid portions from the sludge samples were all analyzed on the direct samples; the ICP analytes were first subjected to an acid dilution. The six centrifuged solid samples were analyzed directly for bulk density, DSC, thermogravimetric analysis (TGA), total inorganic carbon (TIC), TOC, pH, and polychlorinated biphenyls (PCBs). The anions and hydroxide were analyzed following a water digestion, and the ICP analytes and radionuclides were analyzed following a fusion digestion.

All analyses were performed at the 222-S Laboratory, and were conducted in accordance with approved laboratory procedures. A list of the sample numbers and applicable analyses is presented in Table B1-4. The procedure numbers are presented in the discussion in Section B2.0.

Table B1-4. Tank 241-AW-105 August 1996 Sample Analysis Summary.[1] (3 sheets)

Riser	Segment Number	Sample Portion	Sample Number[2]	Analyses
10A	5AW-96-1	Supernatant	5004	DSC, TGA, SpG, pH, TIC, TOC, ICP, IC, OH^-
			5007	^{241}Am, $^{239/240}Pu$, $^{89/90}Sr$, GEA, total alpha
	5AW-96-2	Supernatant	5005	DSC, TGA, pH, ICP
			5008	SpG, TIC, TOC, IC, OH^-, ^{241}Am, $^{239/240}Pu$, $^{89/90}Sr$, GEA, total alpha
	5AW-96-4	Supernatant	5006	DSC, TGA, SpG, pH, TIC, TOC, ICP, IC, OH^-
			5009	^{241}Am, $^{239/240}Pu$, $^{89/90}Sr$, GEA, total alpha
	5AW-96-5	Centrifuged Solids	5019	DSC, TGA, bulk density, pH, TIC, TOC
			5052	ICP, ^{241}Am, $^{239/240}Pu$, $^{89/90}Sr$, GEA, total alpha
			5055	IC, OH^-
			5046	PCBs
		Centrifuged Liquids	5049	DSC, TGA, bulk density, pH, TIC, TOC, ICP, IC, OH^-, ^{241}Am, $^{239/240}Pu$, $^{89/90}Sr$, GEA, total alpha
		Sludge	4809	Bulk density, volume percent solids
	5AW-96-7	Centrifuged Solids	5020	DSC, TGA, bulk density, pH, TIC, TOC
			5053	ICP, ^{241}Am, $^{239/240}Pu$, $^{89/90}Sr$, GEA, total alpha
			5056	IC, OH^-
			5047	PCBs
		Centrifuged Liquids	5050	DSC, TGA, bulk density, pH, TIC, TOC, ICP, IC, OH^-, ^{241}Am, $^{239/240}Pu$, $^{89/90}Sr$, GEA, total alpha
		Sludge	4811	Bulk density, volume percent solids

Table B1-4. Tank 241-AW-105 August 1996 Sample Analysis Summary.[1] (3 sheets)

Riser	Segment Number	Sample Portion	Sample Number[2]	Analyses
10A (Cont'd)	5AW-96-9	Centrifuged Solids	5021	DSC, TGA, bulk density, pH, TIC, TOC
			5054	ICP, ^{241}Am, $^{239/240}$Pu, $^{89/90}$Sr, GEA, total alpha
			5057	IC, OH^-
			5048	PCBs
		Centrifuged liquids	5051	DSC, TGA, bulk density, pH, TIC, TOC, ICP, IC, OH^-, ^{241}Am, $^{239/240}$Pu, $^{89/90}$Sr, GEA, total alpha
		Sludge	4813	Bulk density, volume percent solids
15A	5AW-96-10	Supernatant	5010	DSC, TGA, SpG, pH, TIC, TOC, ICP, IC, OH^-
			5013	^{241}Am, $^{239/240}$Pu, $^{89/90}$Sr, GEA, total alpha
	5AW-96-11	Supernatant	5011	DSC, TGA, SpG, pH, TIC, TOC, ICP, IC, OH^-
			5014	^{241}Am, $^{239/240}$Pu, $^{89/90}$Sr, GEA, total alpha
	5AW-96-14	Supernatant	5012	DSC, TGA, SpG, pH, TIC, TOC, ICP, IC, OH^-
			5015	^{241}Am, $^{239/240}$Pu, $^{89/90}$Sr, GEA, total alpha
	5AW-96-15	Centrifuged solids	5075	DSC, TGA, bulk density, pH, TIC, TOC
			5084	ICP, ^{241}Am, $^{239/240}$Pu, $^{89/90}$Sr, GEA, total alpha
			5087	IC, OH^-
			5078	PCBs
		Centrifuged liquids	5081	DSC, TGA, bulk density, pH, TIC, TOC, ICP, IC, OH^-, ^{241}Am, $^{239/240}$Pu, $^{89/90}$Sr, GEA, total alpha
		Sludge	4819	Bulk density, volume percent solids

Table B1-4. Tank 241-AW-105 August 1996 Sample Analysis Summary.[1] (3 sheets)

Riser	Segment Number	Sample Portion	Sample Number[2]	Analyses
15A (Cont'd)	5AW-96-17	Centrifuged solids	5076	DSC, TGA, bulk density, pH, TIC, TOC
			5085	ICP, ^{241}Am, $^{239/240}$Pu, $^{89/90}$Sr, GEA, total alpha
			5088	IC, OH^-
			5079	PCBs
		Centrifuged liquids	5082	DSC, TGA, bulk density, pH, TIC, TOC, ICP, IC, OH^-, ^{241}Am, $^{239/240}$Pu, $^{89/90}$Sr, GEA, total alpha
		Sludge	4821	Bulk density, volume percent solids
15A (Cont'd)	5AW-96-20	Centrifuged solids	5077	DSC, TGA, bulk density, pH, TIC, TOC
			5086	ICP, ^{241}Am, $^{239/240}$Pu, $^{89/90}$Sr, GEA, total alpha
			5089	IC, OH^-
			5080	PCBs
		Centrifuged liquids	5083	DSC, TGA, bulk density, pH, TIC, TOC, ICP, IC, OH^-, ^{241}Am, $^{239/240}$Pu, $^{89/90}$Sr, GEA, total alpha
		Sludge	4824	Bulk density, volume percent solids

Notes:

IC = ion chromatography
SpG = specific gravity
GEA = gamma energy analysis

[1]Esch (1997)
[2]Sample numbers start with S96T00.

B1.4 DESCRIPTION OF PREVIOUS SAMPLING EVENTS

There were several previous sampling events for tank 241-AW-105. Because of the active status of the tank, none of the historical supernatant samplings represent the current tank contents. Therefore, they are not included in this report. However, two supernatant sampling events should be noted. Separable organic layers were reported in surface samples taken from tank 241-AW-105 in 1984 and in January 1985 (Jansky 1984, Mauss 1985). The

1984 surface sample was reported to be 65 volume percent separable organic; the organic layer was determined to be 27.5 volume percent tributyl phosphate (Jansky 1984). The January 1985 surface sample consisted of 2 volume percent separable organic; the organic layer was determined to be approximately 30 percent tributyl phosphate and 70 percent normal paraffin hydrocarbons (Mauss 1985). Because the supernatant in tank 241-AW-105 has been pumped out and replaced seven times since the January 1985 sampling event and the pumping of liquids from the tank is through a pump which removes liquid from the waste surface, the organic layer should no longer exist in the tank. No separable organics have been reported in subsequent sampling events.

Four prior sludge sampling events largely represent the current sludge contents, and are discussed below starting with the earliest relevant sampling event. The transfer history indicates that the composition of this solids layer has remained relatively unchanged since the first of these historical sludge sampling events, with just a slight increase in volume.

B1.4.1 Description of Early 1986 Grab Sampling Event

Five samples of waste from tank 241-AW-105 were received by Pacific Northwest Laboratory (PNL) in early 1986. The exact date of the sampling event was not given in the report, which was issued on May 1, 1986. The objective of the sampling event was to compare the properties of a sample of NCRW with those available for simulated NCRW and from the Zirflex Decladding Waste Flowsheet. Four of these samples were described as very thick sludges, and the fifth was a relatively clear liquid. Before chemical analysis, the sludges were transferred to a single container. The liquid was used to make the solids more fluid to allow transfer, and to rinse the shipping containers. This NCRW sludge composite was mustard yellow in color and appeared to be a homogeneous paste having the consistency of thick pudding (Scheele and McCarthy 1986). No information regarding sampling location, depth, or other sampling parameters was provided. The sample handling and analytical results of this sampling event are presented in Section B2.9.1.

B1.4.2 Description of July 1986 Core Sampling Event

A core sample consisting of ten segments was obtained on July 2, 1986 from riser 13A of tank 241-AW-105. The major purpose in sampling the tank was to determine whether the solids material stored in it could be classified as TRU or non-TRU. The operational field data from this event are presented in Table B1-5.

The first three segments contained only supernatant (which was discarded) while the fourth segment was found to be empty. The fifth segment contained only 5.8 cm (2 in.) of white NCRW solids with the remainder being supernatant. Segments six through nine contained white NCRW solids. The solids bulk density increased at lower depths in the tank, with the solids from segment nine having the consistency of toothpaste. Segment ten contained approximately 30.5 cm (12 in.) of black, grainy solids at the bottom with the remainder being white NCRW solids. It is assumed that the black material, the "heel", consists of PXMSC waste solids (Peters 1986). The results of this sampling event are presented in Section B2.9.2.

Table B1-5. Field Data from the July 1986 Historical Sludge Sampling Event for Tank 241-AW-105.[1]

Segment Number	Distance from Tank Bottom to Segment Bottom (in.)	Dose Rate Through Drill String (mrad/hr)
1	168.75	180
2	149.75	190
3	130.75	210
4	111.75	5
5	92.75	200
6	73.75	4,200
7	54.75	300
8	35.75	900
9	16.75	360
10	0	750

Notes:

mrad/hr = millirads per hour

[1]Vail (1986)

B1.4.3 Description of September 1986 Core Sampling Event

A core sample consisting of six segments was obtained in September 1986 from riser 15A of tank 241-AW-105. The samples extended from just above the sludge surface to the bottom of the tank. Segment 2A was described as mostly supernatant with 5.8 cm (2 in.) of white solids. Segments 3A, 4A, and 5A were all described as white solids, and segments 6A and 6B consisted of 30.5 cm (12 in.) of black solids with the remainder being white solids (Brevick et al. 1995). No further detail regarding the sampling event was given. The results of this sampling event are presented in Section B2.9.3.

B1.4.4 Description of May 1990 Core Sampling Event

Seven core sample segments were collected from May 14 to 17, 1990, from riser 16B using a rotary core sampling truck. A stainless steel sampler was used to obtain a 48 cm (19 in.) long and 2.5 cm (1 in.) diameter core of waste (maximum volume of 187 mL). At the time of this sampling event, tank 241-AW-105 contained about 8.33 m (328 in.) of waste, of which approximately 2.74 m (108 in.) consisted of sludge and 5.59 m (220 in.) consisted of supernatant. Waste from above the sludge surface to the tank bottom was sampled. Sample segments 1 and 2 consisted entirely of supernatant, while segments 3 through 7 were taken from the sludge layer and contained no drainable liquids (Tingey and Simpson 1994). The extrusion information is listed in Table B1-6. The results of this sampling event are presented in Section B2.9.4.

Table B1-6. Tank 241-AW-105, May 1990 Core 19 Sample Description.[1] (2 sheets)

Core	Seg.	Sample ID	Percent Recovery	Sample Recovered[2] (cm)	Sample Amount		Sample Description
					Drainable Liquid (mL)	Solid (g)	
19	1	90-014	80	39	205	0	No solids were observed.
	2	90-015	96	46	245	0	No solids were observed.
	3	90-016	92	44	0	294	The top 28 cm (11 in.) appeared as a gray slurry that could not hold its shape; the bottom portion of the segment retained its shape. Progressing down the segment, the color became lighter until it was white at 28 cm (11 in.) from the top. No free liquids were observed.
	4	90-017	98	47	0	314	Solids were a white sludge, similar to the bottom of segment 3. No free liquids were observed.
	5	90-018	93	45	0	307	Solids were white, with the exception of some brown and black spots. The material was dry and broke off into chunks as it was extruded. No free liquids were observed.

Table B1-6. Tank 241-AW-105, May 1990 Core 19 Sample Description.[1] (2 sheets)

Core	Seg.	Sample ID	Percent Recovery	Sample Recovered[2] (cm)	Sample Amount: Drainable Liquid (mL)	Sample Amount: Solid (g)	Sample Description
19 (Cont'd)	6	90-019	95	46	0	323	The top ~18 cm (~7 in.) were similar to segment 5, a dry white material with streaks of brown. The bottom ~30 cm (~12 in.) were grayish white and had a margarine-like consistency. No free liquids were observed.
	7	90-020	34	17	0	122	The solids were harder than in the previous segments. They were very dark in color with white marbling in the top 10 cm (4 in.). No free liquids were observed.

Notes:

[1]Tingey and Simpson (1994)
[2]Calculated from amount of liquid and solid recovered.

B2.0 ANALYTICAL RESULTS

B2.1 OVERVIEW

This section summarizes the sampling and analytical results associated with the August 1996 sampling and analysis of tank 241-AW-105. The locations of the analytical results for the inorganic, organic, carbon, radionuclide, physical, thermodynamic, and vapor phase measurements are presented in Table B2-1. These results are documented in *Tank 241-AW-105, Grab Samples, 5AW-96-1 through 5AW-96-20 Analytical Results for the Final Report* (Esch 1997). Table B2-1 also lists the locations of the historical results associated with this tank.

In each data table, the "Sample Elevation" column refers to the distance from the bottom of the tank to the mouth of the sample bottle. The "Mean" column is the average of the result and duplicate values. All values, including those below the detection level (denoted by the less-than symbol, "<"), were averaged. If both sample and duplicate values were non-detected, the mean is expressed as a non-detected value. If one value was detected while the other was not, the mean is also expressed as a non-detected value. If both values were detected, the mean is expressed as a detected value.

Table B2-1. Analytical Presentation Tables. (2 sheets)

Analysis	Table Number
Non-detected results	B2-2
Metals by ICP	B2-3 through B2-25
Anions by IC	B2-26 through B2-32
Hydroxide	B2-33
PCBs	B2-34
Total inorganic carbon	B2-35
Total organic carbon	B2-36
^{241}Am	B2-37
$^{239/240}Pu$	B2-38
$^{89/90}Sr$	B2-39
^{137}Cs and ^{60}Co by GEA	B2-40 and B2-41
Total alpha activity	B2-42
Bulk density	B2-43
pH	B2-44
Specific gravity	B2-45

Table B2-1. Analytical Presentation Tables. (2 sheets)

Analysis	Table Number
Volume percent solids	B2-46
TGA	B2-47
DSC	B2-48
Vapor space measurements	B2-49
Early 1986 sampling data	B2-50
July 1986 sampling data	B2-51
September 1986 sampling data	B2-52
1990 sampling data	B2-53 through B2-57

For those analytes in which all data results from all waste phases were nondetected, each individual non-detected value is not listed in a separate data table. Instead, Table B2-2 lists these analytes along with their single highest nondetected value.

Table B2-2. Tank 241-AW-105 Nondetected Analytes.[1] (2 sheets)

Analyte	Highest Non-Detected Value		
	Supernatant (μg/mL)	Interstitial Liquid (μg/mL)	Centrifuged solids (μg/mL)
Arsenic	<4.10	<10.1	<3,630
Barium	<2.05	<5.05	<1,810
Bismuth	<4.10	<10.1	<3,630
Cerium	<4.10	<10.1	<3,630
Cobalt	<0.820	<2.02	<726
Copper	<0.410	<1.01	<363
Lead	<4.10	<10.1	<3,630
Neodymium	<4.10	<10.1	<3,630
Samarium	<4.10	<10.1	<3,630
Selenium	<4.10	<10.1	<3,630
Strontium	<0.410	<1.01	<363
Thallium	<8.20	<20.2	<7,260

Table B2-2. Tank 241-AW-105 Nondetected Analytes.[1] (2 sheets)

Analyte	Highest Non-Detected Value		
	Supernatant (μg/mL)	Interstitial Liquid (μg/mL)	Centrifuged solids (μg/mL)
Titanium	<0.410	<1.01	<363
Vanadium	<2.05	<5.05	<1,810
Bromide	<644	<265	<1,220

Note:

[1]Esch (1997)

The four quality control (QC) parameters assessed in conjunction with the tank 241-AW-105 samples were standard recoveries, spike recoveries, duplicate analyses, and blanks. The QC criteria for the waste compatibility analytes were specified in the SAP (Sasaki 1996), whereas the criteria for the opportunistic analytes were taken from the *Hanford Analytical Services Quality Assurance Plan* (DOE 1995). Sample and duplicate pairs in which any of the QC parameters were outside of these criteria 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 that the standard recovery was below the QC limit.
- "b" indicates that the standard recovery was above the QC limit.
- "c" indicates that the spike recovery was below the QC limit.
- "d" indicates that the spike recovery was above the QC limit.
- "e" indicates that the relative percent difference (RPD) was above the QC limit.
- "f" indicates that the blank was contaminated.

B2.2 INORGANIC ANALYSES

B2.2.1 Inductively Coupled Plasma

Analyses by ICP for the waste metallic constituents were performed in duplicate on all samples, and a full suite of analytes were reported. The analyses were performed directly on the supernatant and interstitial liquid samples per procedure LA-505-161, Rev. B1 following an acid dilution. The centrifuged solid samples were analyzed per procedure LA-505-161, Rev. B1 following a fusion digestion per procedure LA-549-141, Rev. F0. The results are presented in Tables B2-3 through B2-25.

Table B2-3. Tank 241-AW-105 Analytical Results: Aluminum.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μg/mL	μg/mL	μg/mL
S96T005004	5AW-96-1	10A	155	15.6	16.1	15.85
S96T005005	5AW-96-2	10A	137	16.5	16.9	16.7
S96T005006	5AW-96-4	10A	118	17.4	17	17.2
S96T005010	5AW-96-10	15A	155	16	16.2	16.1
S96T005011	5AW-96-11	15A	137	16.9	16.9	16.9
S96T005012	5AW-96-14	15A	118	88.3	89.1	88.7
Interstitial Liquid			in.	μg/mL	μg/mL	μg/mL
S96T005049	5AW-96-5	10A	95	129	135	132
S96T005050	5AW-96-7	10A	78	696	713	704.5
S96T005051	5AW-96-9	10A	77	660	667	663.5
S96T005081	5AW-96-15	15A	95	464	461	462.5
S96T005082	5AW-96-17	15A	73	702	707	704.5
S96T005083	5AW-96-20	15A	66	588	591	589.5
Centrifuged Solids			in.	μg/g	μg/g	μg/g
S96T005052	5AW-96-5	10A	95	<1,780	<1,810	<1,800
S96T005053	5AW-96-7	10A	78	1,220	999	1,110
S96T005054	5AW-96-9	10A	77	1,030	1,390	1,210
S96T005084	5AW-96-15	15A	95	1,050	1,150	1,100
S96T005085	5AW-96-17	15A	73	1,690	1,670	1,680
S96T005086	5AW-96-20	15A	66	1,130	1,170	1,150

Table B2-4. Tank 241-AW-105 Analytical Results: Antimony.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μg/mL	μg/mL	μg/mL
S96T005004	5AW-96-1	10A	155	<2.460	<2.46	<2.46
S96T005005	5AW-96-2	10A	137	<2.460	<2.46	<2.46
S96T005006	5AW-96-4	10A	118	<2.460	<2.46	<2.46
S96T005010	5AW-96-10	15A	155	<2.460	<2.46	<2.46
S96T005011	5AW-96-11	15A	137	<2.460	<2.46	<2.46
S96T005012	5AW-96-14	15A	118	<2.460	<2.46	<2.46
Interstitial Liquid			in.	μg/mL	μg/mL	μg/mL
S96T005049	5AW-96-5	10A	95	<6.060	<6.06	<6.06
S96T005050	5AW-96-7	10A	78	<6.060	<6.06	<6.06
S96T005051	5AW-96-9	10A	77	<6.060	<6.06	<6.06
S96T005081	5AW-96-15	15A	95	<6.060	<6.06	<6.06
S96T005082	5AW-96-17	15A	73	<6.060	<6.06	<6.06
S96T005083	5AW-96-20	15A	66	<6.060	<6.06	<6.06
Centrifuged Solids			in.	μg/g	μg/g	μg/g
S96T005052	5AW-96-5	10A	95	<2,130	2,660	<2,400
S96T005053	5AW-96-7	10A	78	<1,160	1,300	<1,230
S96T005054	5AW-96-9	10A	77	<1,210	1,470	<1,340
S96T005084	5AW-96-15	15A	95	<1,160	<1,200	<1,180
S96T005085	5AW-96-17	15A	73	<1,190	<1,210	<1,200
S96T005086	5AW-96-20	15A	66	<1,220	<1,200	<1,210

Table B2-5. Tank 241-AW-105 Analytical Results: Beryllium.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	µg/mL	µg/mL	µg/mL
S96T005004	5AW-96-1	10A	155	<0.205	<0.205	<0.205
S96T005005	5AW-96-2	10A	137	<0.205	<0.205	<0.205
S96T005006	5AW-96-4	10A	118	<0.205	<0.205	<0.205
S96T005010	5AW-96-10	15A	155	<0.205	<0.205	<0.205
S96T005011	5AW-96-11	15A	137	<0.205	<0.205	<0.205
S96T005012	5AW-96-14	15A	118	<0.205	<0.205	<0.205
Interstitial Liquid			in.	µg/mL	µg/mL	µg/mL
S96T005049	5AW-96-5	10A	95	<0.505	<0.505	<0.505
S96T005050	5AW-96-7	10A	78	1.36	1.38	1.37
S96T005051	5AW-96-9	10A	77	1.2	1.21	1.205
S96T005081	5AW-96-15	15A	95	<0.505	<0.505	<0.505
S96T005082	5AW-96-17	15A	73	1.03	1.04	1.035
S96T005083	5AW-96-20	15A	66	0.995	1.01	1.002
Centrifuged Solids			in.	µg/g	µg/g	µg/g
S96T005052	5AW-96-5	10A	95	<178	<181	<180
S96T005053	5AW-96-7	10A	78	<96.90	<97.0	<97.0
S96T005054	5AW-96-9	10A	77	<101	<102	<102
S96T005084	5AW-96-15	15A	95	<96.70	<100	<98.4
S96T005085	5AW-96-17	15A	73	<98.80	<101	<99.9
S96T005086	5AW-96-20	15A	66	<102	<99.7	<101

Table B2-6. Tank 241-AW-105 Analytical Results: Boron.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	µg/mL	µg/mL	µg/mL
S96T005004	5AW-96-1	10A	155	3.18	3.24	3.21
S96T005005	5AW-96-2	10A	137	5.44	5.46	5.45
S96T005006	5AW-96-4	10A	118	2.98	2.86	2.92
S96T005010	5AW-96-10	15A	155	2.85	2.87	2.86
S96T005011	5AW-96-11	15A	137	2.68	2.66	2.67
S96T005012	5AW-96-14	15A	118	2.68	2.83	2.755
Interstitial Liquid			in.	µg/mL	µg/mL	µg/mL
S96T005049	5AW-96-5	10A	95	9.1	9.19	9.145
S96T005050	5AW-96-7	10A	78	5.93	6.18	6.055
S96T005051	5AW-96-9	10A	77	<5.050	<5.05	<5.05
S96T005081	5AW-96-15	15A	95	<5.050	<5.05	<5.05
S96T005082	5AW-96-17	15A	73	<5.050	<5.05	<5.05
S96T005083	5AW-96-20	15A	66	<5.050	<5.05	<5.05
Centrifuged Solids			in.	µg/g	µg/g	µg/g
S96T005052	5AW-96-5	10A	95	<1,780	<1,810	<1,800
S96T005053	5AW-96-7	10A	78	<969	<970	<970
S96T005054	5AW-96-9	10A	77	<1,010	<1,020	<1,020
S96T005084	5AW-96-15	15A	95	<967	<1,000	<984
S96T005085	5AW-96-17	15A	73	<988	<1,010	<999
S96T005086	5AW-96-20	15A	66	<1,020	<997	<1,010

Table B2-7. Tank 241-AW-105 Analytical Results: Cadmium.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	µg/mL	µg/mL	µg/mL
S96T005004	5AW-96-1	10A	155	<0.205	<0.205	<0.205
S96T005005	5AW-96-2	10A	137	<0.205	<0.205	<0.205
S96T005006	5AW-96-4	10A	118	<0.205	<0.205	<0.205
S96T005010	5AW-96-10	15A	155	<0.205	<0.205	<0.205
S96T005011	5AW-96-11	15A	137	<0.205	<0.205	<0.205
S96T005012	5AW-96-14	15A	118	<0.205	<0.205	<0.205
Interstitial Liquid			in.	µg/mL	µg/mL	µg/mL
S96T005049	5AW-96-5	10A	95	<0.505	0.717	<0.611
S96T005050	5AW-96-7	10A	78	<0.505	<0.505	<0.505
S96T005051	5AW-96-9	10A	77	<0.505	<0.505	<0.505
S96T005081	5AW-96-15	15A	95	<0.505	<0.505	<0.505
S96T005082	5AW-96-17	15A	73	<0.505	<0.505	<0.505
S96T005083	5AW-96-20	15A	66	<0.505	<0.505	<0.505
Centrifuged Solids			in.	µg/g	µg/g	µg/g
S96T005052	5AW-96-5	10A	95	<178	<181	<180
S96T005053	5AW-96-7	10A	78	110	<97.0	<104
S96T005054	5AW-96-9	10A	77	<101	126	<114
S96T005084	5AW-96-15	15A	95	249	262	255.5
S96T005085	5AW-96-17	15A	73	104	107	105.5
S96T005086	5AW-96-20	15A	66	238	246	242

Table B2-8. Tank 241-AW-105 Analytical Results: Calcium.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	µg/mL	µg/mL	µg/mL
S96T005004	5AW-96-1	10A	155	<4.100	<4.10	<4.10
S96T005005	5AW-96-2	10A	137	6.18	6.23	6.205
S96T005006	5AW-96-4	10A	118	<4.100	<4.10	<4.10
S96T005010	5AW-96-10	15A	155	<4.100	<4.10	<4.10
S96T005011	5AW-96-11	15A	137	4.17	4.19	4.18
S96T005012	5AW-96-14	15A	118	<4.100	<4.10	<4.10
Interstitial Liquid			in.	µg/mL	µg/mL	µg/mL
S96T005049	5AW-96-5	10A	95	16.6	96.9	56.75
S96T005050	5AW-96-7	10A	78	<10.10	<10.1	<10.1
S96T005051	5AW-96-9	10A	77	<10.10	<10.1	<10.1
S96T005081	5AW-96-15	15A	95	<10.10	<10.1	<10.1
S96T005082	5AW-96-17	15A	73	<10.10	<10.1	<10.1
S96T005083	5AW-96-20	15A	66	<10.10	<10.1	<10.1
Centrifuged Solids			in.	µg/g	µg/g	µg/g
S96T005052	5AW-96-5	10A	95	9,410	9,180	9,300
S96T005053	5AW-96-7	10A	78	<1,940	<1,940	<1,940
S96T005054	5AW-96-9	10A	77	<2,010	<2,050	<2,030
S96T005084	5AW-96-15	15A	95	<1,930	<2,000	<1,970
S96T005085	5AW-96-17	15A	73	<1,980	<2,020	<2,000
S96T005086	5AW-96-20	15A	66	<2,030	<1,990	<2,010

Table B2-9. Tank 241-AW-105 Analytical Results: Chromium.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	µg/mL	µg/mL	µg/mL
S96T005004	5AW-96-1	10A	155	0.640	0.573	0.607
S96T005005	5AW-96-2	10A	137	0.615	0.631	0.623
S96T005006	5AW-96-4	10A	118	0.651	0.652	0.651
S96T005010	5AW-96-10	15A	155	0.610	0.648	0.629
S96T005011	5AW-96-11	15A	137	0.653	0.643	0.648
S96T005012	5AW-96-14	15A	118	3.99	4.05	4.02
Interstitial Liquid			in.	µg/mL	µg/mL	µg/mL
S96T005049	5AW-96-5	10A	95	6.72	8.54	7.63
S96T005050	5AW-96-7	10A	78	28.1	28.6	28.35
S96T005051	5AW-96-9	10A	77	30.4	30.5	30.45
S96T005081	5AW-96-15	15A	95	15.2	15.1	15.15
S96T005082	5AW-96-17	15A	73	32.6	33.3	32.95
S96T005083	5AW-96-20	15A	66	35.3	35.7	35.5
Centrifuged Solids			in.	µg/g	µg/g	µg/g
S96T005052	5AW-96-5	10A	95	<355	<363	<359
S96T005053	5AW-96-7	10A	78	231	<194	<213
S96T005054	5AW-96-9	10A	77	<201	267	<234
S96T005084	5AW-96-15	15A	95	202	<200	<201
S96T005085	5AW-96-17	15A	73	752	712	732
S96T005086	5AW-96-20	15A	66	214	203	208.5

Table B2-10. Tank 241-AW-105 Analytical Results: Iron.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μg/mL	μg/mL	μg/mL
S96T005004	5AW-96-1	10A	155	<2.050	<2.05	<2.05
S96T005005	5AW-96-2	10A	137	<2.050	<2.05	<2.05
S96T005006	5AW-96-4	10A	118	<2.050	<2.05	<2.05
S96T005010	5AW-96-10	15A	155	<2.050	<2.05	<2.05
S96T005011	5AW-96-11	15A	137	<2.050	<2.05	<2.05
S96T005012	5AW-96-14	15A	118	<2.050	<2.05	<2.05
Interstitial Liquid			in.	μg/mL	μg/mL	μg/mL
S96T005049	5AW-96-5	10A	95	<5.050	34.9	<20.0
S96T005050	5AW-96-7	10A	78	<5.050	<5.05	<5.05
S96T005051	5AW-96-9	10A	77	<5.050	<5.05	<5.05
S96T005081	5AW-96-15	15A	95	<5.050	<5.05	<5.05
S96T005082	5AW-96-17	15A	73	<5.050	<5.05	<5.05
S96T005083	5AW-96-20	15A	66	<5.050	<5.05	<5.05
Centrifuged Solids			in.	μg/g	μg/g	μg/g
S96T005052	5AW-96-5	10A	95	3,710	3,770	3,740
S96T005053	5AW-96-7	10A	78	1,270	3,260	2,260
S96T005054	5AW-96-9	10A	77	1,340	1,350	1,340
S96T005084	5AW-96-15	15A	95	1,810	2,890	2,350
S96T005085	5AW-96-17	15A	73	4,850	4,300	4,580
S96T005086	5AW-96-20	15A	66	2,060	1,300	1,680

Table B2-11. Tank 241-AW-105 Analytical Results: Lanthanum.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	µg/mL	µg/mL	µg/mL
S96T005004	5AW-96-1	10A	155	<2.050	<2.05	<2.05
S96T005005	5AW-96-2	10A	137	<2.050	<2.05	<2.05
S96T005006	5AW-96-4	10A	118	<2.050	<2.05	<2.05
S96T005010	5AW-96-10	15A	155	<2.050	<2.05	<2.05
S96T005011	5AW-96-11	15A	137	<2.050	<2.05	<2.05
S96T005012	5AW-96-14	15A	118	<2.050	<2.05	<2.05
Interstitial Liquid			in.	µg/mL	µg/mL	µg/mL
S96T005049	5AW-96-5	10A	95	<5.050	<5.05	<5.05
S96T005050	5AW-96-7	10A	78	<5.050	5.95	<5.50
S96T005051	5AW-96-9	10A	77	<5.050	<5.05	<5.05
S96T005081	5AW-96-15	15A	95	<5.050	<5.05	<5.05
S96T005082	5AW-96-17	15A	73	<5.050	<5.05	<5.05
S96T005083	5AW-96-20	15A	66	<5.050	<5.05	<5.05
Centrifuged Solids			in.	µg/g	µg/g	µg/g
S96T005052	5AW-96-5	10A	95	<1,780	<1,810	<1,800
S96T005053	5AW-96-7	10A	78	1,560	1,580	1,570
S96T005054	5AW-96-9	10A	77	1,470	1,460	1,460
S96T005084	5AW-96-15	15A	95	1,050	1,150	1,100
S96T005085	5AW-96-17	15A	73	2,370	2,200	2,280
S96T005086	5AW-96-20	15A	66	1,070	1,010	1,040

Table B2-12. Tank 241-AW-105 Analytical Results: Lithium.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μg/mL	μg/mL	μg/mL
S96T005004	5AW-96-1	10A	155	<0.410	<0.410	<0.410
S96T005005	5AW-96-2	10A	137	<0.410	<0.410	<0.410
S96T005006	5AW-96-4	10A	118	<0.410	<0.410	<0.410
S96T005010	5AW-96-10	15A	155	<0.410	<0.410	<0.410
S96T005011	5AW-96-11	15A	137	<0.410	<0.410	<0.410
S96T005012	5AW-96-14	15A	118	<0.410	<0.410	<0.410
Interstitial Liquid			in.	μg/mL	μg/mL	μg/mL
S96T005049	5AW-96-5	10A	95	<1.010	<1.01	<1.01
S96T005050	5AW-96-7	10A	78	<1.010	<1.01	<1.01
S96T005051	5AW-96-9	10A	77	<1.010	<1.01	<1.01
S96T005081	5AW-96-15	15A	95	<1.010	<1.01	<1.01
S96T005082	5AW-96-17	15A	73	<1.010	<1.01	<1.01
S96T005083	5AW-96-20	15A	66	<1.010	<1.01	<1.01
Centrifuged Solids			in.	μg/g	μg/g	μg/g
S96T005052	5AW-96-5	10A	95	355	<363	<359
S96T005053	5AW-96-7	10A	78	194	<194	<194
S96T005054	5AW-96-9	10A	77	201	<205	<203
S96T005084	5AW-96-15	15A	95	193	<200	<197
S96T005085	5AW-96-17	15A	73	198	<202	<200
S96T005086	5AW-96-20	15A	66	203	<199	<201

Table B2-13. Tank 241-AW-105 Analytical Results: Magnesium.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	µg/mL	µg/mL	µg/mL
S96T005004	5AW-96-1	10A	155	<4.100	<4.10	<4.10
S96T005005	5AW-96-2	10A	137	<4.100	<4.10	<4.10
S96T005006	5AW-96-4	10A	118	<4.100	<4.10	<4.10
S96T005010	5AW-96-10	15A	155	<4.100	<4.10	<4.10
S96T005011	5AW-96-11	15A	137	<4.100	<4.10	<4.10
S96T005012	5AW-96-14	15A	118	<4.100	<4.10	<4.10
Interstitial Liquid			in.	µg/mL	µg/mL	µg/mL
S96T005049	5AW-96-5	10A	95	<10.10	<10.1	<10.1
S96T005050	5AW-96-7	10A	78	<10.10	<10.1	<10.1
S96T005051	5AW-96-9	10A	77	<10.10	<10.1	<10.1
S96T005081	5AW-96-15	15A	95	<10.10	<10.1	<10.1
S96T005082	5AW-96-17	15A	73	<10.10	<10.1	<10.1
S96T005083	5AW-96-20	15A	66	<10.10	<10.1	<10.1
Centrifuged Solids			in.	µg/g	µg/g	µg/g
S96T005052	5AW-96-5	10A	95	3,550	<3,630	<3,590
S96T005053	5AW-96-7	10A	78	1,940	<1,940	<1,940
S96T005054	5AW-96-9	10A	77	2,010	<2,050	<2,030
S96T005084	5AW-96-15	15A	95	1,930	<2,000	<1,970
S96T005085	5AW-96-17	15A	73	1,980	<2,020	<2,000
S96T005086	5AW-96-20	15A	66	2,030	<1,990	<2,010

Table B2-14. Tank 241-AW-105 Analytical Results: Manganese.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μg/mL	μg/mL	μg/mL
S96T005004	5AW-96-1	10A	155	<0.410	<0.410	<0.410
S96T005005	5AW-96-2	10A	137	<0.410	<0.410	<0.410
S96T005006	5AW-96-4	10A	118	<0.410	<0.410	<0.410
S96T005010	5AW-96-10	15A	155	<0.410	<0.410	<0.410
S96T005011	5AW-96-11	15A	137	<0.410	<0.410	<0.410
S96T005012	5AW-96-14	15A	118	<0.410	<0.410	<0.410
Interstitial Liquid			in.	g/mL	μg/mL	μg/mL
S96T005049	5AW-96-5	10A	95	<1.010	1.51	<1.26
S96T005050	5AW-96-7	10A	78	<1.010	<1.01	<1.01
S96T005051	5AW-96-9	10A	77	<1.010	<1.01	<1.01
S96T005081	5AW-96-15	15A	95	<1.010	<1.01	<1.01
S96T005082	5AW-96-17	15A	73	1.09	<1.01	<1.05
S96T005083	5AW-96-20	15A	66	<1.010	<1.01	<1.01
Centrifuged Solids			in.	μg/g	μg/g	μg/g
S96T005052	5AW-96-5	10A	95	<355	<363	<359
S96T005053	5AW-96-7	10A	78	988	967	977.5
S96T005054	5AW-96-9	10A	77	829	856	842.5
S96T005084	5AW-96-15	15A	95	752	789	770.5
S96T005085	5AW-96-17	15A	73	4,280	4,000	4,140
S96T005086	5AW-96-20	15A	66	740	745	742.5

Table B2-15. Tank 241-AW-105 Analytical Results: Molybdenum.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μg/mL	μg/mL	μg/mL
S96T005004	5AW-96-1	10A	155	<2.050	<2.05	<2.05
S96T005005	5AW-96-2	10A	137	<2.050	<2.05	<2.05
S96T005006	5AW-96-4	10A	118	<2.050	<2.05	<2.05
S96T005010	5AW-96-10	15A	155	<2.050	<2.05	<2.05
S96T005011	5AW-96-11	15A	137	<2.050	<2.05	<2.05
S96T005012	5AW-96-14	15A	118	<2.050	<2.05	<2.05
Interstitial Liquid			in.	μg/mL	μg/mL	μg/mL
S96T005049	5AW-96-5	10A	95	<5.050	<5.05	<5.05
S96T005050	5AW-96-7	10A	78	<5.050	<5.05	<5.05
S96T005051	5AW-96-9	10A	77	<5.050	<5.05	<5.05
S96T005081	5AW-96-15	15A	95	<5.050	<5.05	<5.05
S96T005082	5AW-96-17	15A	73	<5.050	<5.05	<5.05
S96T005083	5AW-96-20	15A	66	<5.050	<5.05	<5.05
Centrifuged Solids			in.	μg/g	μg/g	μg/g
S96T005052	5AW-96-5	10A	95	1,780	<1,810	<1,800
S96T005053	5AW-96-7	10A	78	969	<9,70	<970
S96T005054	5AW-96-9	10A	77	1,010	<1,020	<1,020
S96T005084	5AW-96-15	15A	95	967	<1,000	<984
S96T005085	5AW-96-17	15A	73	988	<1,010	<999
S96T005086	5AW-96-20	15A	66	1,020	<997	<1,010

Table B2-16. Tank 241-AW-105 Analytical Results: Nickel.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μg/mL	μg/mL	μg/mL
S96T005004	5AW-96-1	10A	155	<0.820	<0.820	<0.820
S96T005005	5AW-96-2	10A	137	<0.820	<0.820	<0.820
S96T005006	5AW-96-4	10A	118	<0.820	<0.820	<0.820
S96T005010	5AW-96-10	15A	155	<0.820	<0.820	<0.820
S96T005011	5AW-96-11	15A	137	<0.820	<0.820	<0.820
S96T005012	5AW-96-14	15A	118	<0.820	<0.820	<0.820
Interstitial Liquid			in.	μg/mL	μg/mL	μg/mL
S96T005049	5AW-96-5	10A	95	<2.020	<2.02	<2.02
S96T005050	5AW-96-7	10A	78	2.61	2.54	2.575
S96T005051	5AW-96-9	10A	77	2.4	<2.02	<2.21
S96T005081	5AW-96-15	15A	95	<2.020	<2.02	<2.02
S96T005082	5AW-96-17	15A	73	3.13	3.25	3.19
S96T005083	5AW-96-20	15A	66	<2.020	2.78	<2.40

Table B2-17: Tank 241-AW-105 Analytical Results: Phosphorus. (2 sheets)

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μg/mL	μg/mL	μg/mL
S96T005004	5AW-96-1	10A	155	14.4	13.8	14.1
S96T005005	5AW-96-2	10A	137	13.4	13.4	13.4
S96T005006	5AW-96-4	10A	118	12.9	13.7	13.3
S96T005010	5AW-96-10	15A	155	13.3	13	13.15
S96T005011	5AW-96-11	15A	137	11.6	12.3	11.95
S96T005012	5AW-96-14	15A	118	53.9	54.9	54.4
Interstitial Liquid			in.	μg/mL	μg/mL	μg/mL
S96T005049	5AW-96-5	10A	95	89.3	121	105.2
S96T005050	5AW-96-7	10A	78	443	448	445.5
S96T005051	5AW-96-9	10A	77	417	416	416.5
S96T005081	5AW-96-15	15A	95	250	247	248.5
S96T005082	5AW-96-17	15A	73	392	392	392
S96T005083	5AW-96-20	15A	66	387	393	390
Centrifuged Solids			in.	μg/g	μg/g	μg/g
S96T005052	5AW-96-5	10A	95	<7,110	<7,260	<7,190
S96T005053	5AW-96-7	10A	78	<3,880	<3,880	<3,880
S96T005054	5AW-96-9	10A	77	<4,030	<4,100	<4,070
S96T005084	5AW-96-15	15A	95	<3,870	<4,000	<3,940
S96T005085	5AW-96-17	15A	73	<3,950	<4,040	<4,000
S96T005086	5AW-96-20	15A	66	<4,070	<3,990	<4,030

Table B2-18. Tank 241-AW-105 Analytical Results: Potassium.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μg/mL	μg/mL	μg/mL
S96T005004	5AW-96-1	10A	155	1,230	1,260	1,240[QC:d]
S96T005005	5AW-96-2	10A	137	1,270	1,290	1,280[QC:d]
S96T005006	5AW-96-4	10A	118	1,320	1,320	1,320
S96T005010	5AW-96-10	15A	155	1,270	1,270	1,270
S96T005011	5AW-96-11	15A	137	1,310	1,310	1,310
S96T005012	5AW-96-14	15A	118	3,330	3,360	3,340[QC:d]
Interstitial Liquid			in.	μg/mL	μg/mL	μg/mL
S96T005049	5AW-96-5	10A	95	4,150	4,150	4,150
S96T005050	5AW-96-7	10A	78	10,800	11,100	11,000[QC:d]
S96T005051	5AW-96-9	10A	77	10,200	10,400	10,300[QC:d]
S96T005081	5AW-96-15	15A	95	7,360	7,360	7,360[QC:c]
S96T005082	5AW-96-17	15A	73	10,400	10,500	10,400[QC:c]
S96T005083	5AW-96-20	15A	66	9,290	9,370	9,330[QC:c]

Table B2-19. Tank 241-AW-105 Analytical Results: Silicon.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μg/mL	μg/mL	μg/mL
S96T005004	5AW-96-1	10A	155	45.6	46.3	45.95
S96T005005	5AW-96-2	10A	137	51.3	51.5	51.4
S96T005006	5AW-96-4	10A	118	47.7	47.4	47.55
S96T005010	5AW-96-10	15A	155	39.6	40.1	39.85
S96T005011	5AW-96-11	15A	137	39.1	39	39.05
S96T005012	5AW-96-14	15A	118	47.2	48.3	47.75
Interstitial Liquid			in.	μg/mL	μg/mL	μg/mL
S96T005049	5AW-96-5	10A	95	94.9	113	104
S96T005050	5AW-96-7	10A	78	56.9	58.6	57.75
S96T005051	5AW-96-9	10A	77	52.4	55.2	53.8
S96T005081	5AW-96-15	15A	95	31	35.8	33.4
S96T005082	5AW-96-17	15A	73	49.2	53	51.1
S96T005083	5AW-96-20	15A	66	52.5	56	54.25
Centrifuged Solids			in.	μg/g	μg/g	μg/g
S96T005052	5AW-96-5	10A	95	1,830	<1,810	<1,820
S96T005053	5AW-96-7	10A	78	1,030	1,180	1,100
S96T005054	5AW-96-9	10A	77	1,010	<1,020	<1,020
S96T005084	5AW-96-15	15A	95	<967	<1,000	<984
S96T005085	5AW-96-17	15A	73	1,230	1,280	1,260
S96T005086	5AW-96-20	15A	66	<1,020	<997	<1,010

Table B2-20. Tank 241-AW-105 Analytical Results: Silver.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	µg/mL	µg/mL	µg/mL
S96T005004	5AW-96-1	10A	155	.994	1.02	1.007
S96T005005	5AW-96-2	10A	137	1.07	1.12	1.095
S96T005006	5AW-96-4	10A	118	1.14	1.06	1.1
S96T005010	5AW-96-10	15A	155	1.04	1.07	1.055
S96T005011	5AW-96-11	15A	137	1.16	1.15	1.155
S96T005012	5AW-96-14	15A	118	1.55	1.5	1.525
Interstitial Liquid			in.	µg/mL	µg/mL	µg/mL
S96T005049	5AW-96-5	10A	95	1.26	1.62	1.44
S96T005050	5AW-96-7	10A	78	2.73	2.82	2.775
S96T005051	5AW-96-9	10A	77	2.61	2.62	2.615
S96T005081	5AW-96-15	15A	95	2.08	1.9	1.99
S96T005082	5AW-96-17	15A	73	2.65	2.68	2.665
S96T005083	5AW-96-20	15A	66	2.67	2.63	2.65
Centrifuged Solids			in.	µg/g	µg/g	µg/g
S96T005052	5AW-96-5	10A	95	<355	<363	<359
S96T005053	5AW-96-7	10A	78	424	366	395
S96T005054	5AW-96-9	10A	77	342	421	381.5
S96T005084	5AW-96-15	15A	95	<193	<200	<197
S96T005085	5AW-96-17	15A	73	320	296	308
S96T005086	5AW-96-20	15A	66	<203	<199	<201

Table B2-21. Tank 241-AW-105 Analytical Results: Sodium.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μg/mL	μg/mL	μg/mL
S96T005004	5AW-96-1	10A	155	12,600	12,700	12,600[QC:d]
S96T005005	5AW-96-2	10A	137	12,700	12,900	12,800[QC:d]
S96T005006	5AW-96-4	10A	118	13,000	13,000	13,000[QC:e]
S96T005010	5AW-96-10	15A	155	12,700	12,800	12,800
S96T005011	5AW-96-11	15A	137	12,900	12,900	12,900[QC:e]
S96T005012	5AW-96-14	15A	118	18,700	18,800	18,800[QC:d]
Interstitial Liquid			in.	μg/mL	μg/mL	μg/mL
S96T005049	5AW-96-5	10A	95	21,300	21,100	21,200[QC:e]
S96T005050	5AW-96-7	10A	78	36,600	37,600	37,100[QC:d]
S96T005051	5AW-96-9	10A	77	37,100	37,400	37,200[QC:d]
S96T005081	5AW-96-15	15A	95	27,700	27,700	27,700[QC:e]
S96T005082	5AW-96-17	15A	73	36,900	37,100	37,000[QC:e]
S96T005083	5AW-96-20	15A	66	36,700	36,800	36,800[QC:e]
Centrifuged Solids			in.	μg/g	μg/g	μg/g
S96T005052	5AW-96-5	10A	95	78,000	78,800	78,400
S96T005053	5AW-96-7	10A	78	98,700	91,400	95,000
S96T005054	5AW-96-9	10A	77	91,400	90,800	91,100
S96T005084	5AW-96-15	15A	95	62,000	62,900	62,400
S96T005085	5AW-96-17	15A	73	80,400	78,400	79,400
S96T005086	5AW-96-20	15A	66	67,500	71,600	69,600

Table B2-22. Tank 241-AW-105 Analytical Results: Sulfur.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	µg/mL	µg/mL	µg/mL
S96T005004	5AW-96-1	10A	155	46	46.5	46.25
S96T005005	5AW-96-2	10A	137	45.9	46	45.95
S96T005006	5AW-96-4	10A	118	46.7	46.5	46.6
S96T005010	5AW-96-10	15A	155	46.5	45.9	46.2
S96T005011	5AW-96-11	15A	137	47.2	47.4	47.3
S96T005012	5AW-96-14	15A	118	94	94.9	94.45
Interstitial Liquid			in.	µg/mL	µg/mL	µg/mL
S96T005049	5AW-96-5	10A	95	147	153	150
S96T005050	5AW-96-7	10A	78	586	591	588.5
S96T005051	5AW-96-9	10A	77	540	543	541.5
S96T005081	5AW-96-15	15A	95	351	348	349.5
S96T005082	5AW-96-17	15A	73	531	531	531
S96T005083	5AW-96-20	15A	66	457	459	458
Centrifuged Solids			in.	µg/g	µg/g	µg/g
S96T005052	5AW-96-5	10A	95	<3,550	<3,630	<3,590
S96T005053	5AW-96-7	10A	78	<1,940	<1,940	<1,940
S96T005054	5AW-96-9	10A	77	<2,010	<2,050	<2,030
S96T005084	5AW-96-15	15A	95	<1,930	<2,000	<1,970
S96T005085	5AW-96-17	15A	73	<1,980	<2,020	<2,000
S96T005086	5AW-96-20	15A	66	<2,030	<1,990	<2,010

Table B2-23. Tank 241-AW-105 Analytical Results: Uranium.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μg/mL	μg/mL	μg/mL
S96T005004	5AW-96-1	10A	155	<20.50	<20.5	<20.5
S96T005005	5AW-96-2	10A	137	<20.50	<20.5	<20.5
S96T005006	5AW-96-4	10A	118	<20.50	<20.5	<20.5
S96T005010	5AW-96-10	15A	155	<20.50	<20.5	<20.5
S96T005011	5AW-96-11	15A	137	<20.50	<20.5	<20.5
S96T005012	5AW-96-14	15A	118	<20.50	<20.5	<20.5
Interstitial Liquid			in.	μg/mL	μg/mL	μg/mL
S96T005049	5AW-96-5	10A	95	76.7	464	270.4
S96T005050	5AW-96-7	10A	78	123	151	137
S96T005051	5AW-96-9	10A	77	<50.50	<50.5	<50.5
S96T005081	5AW-96-15	15A	95	58.4	<50.5	<54.5
S96T005082	5AW-96-17	15A	73	78.9	55.8	67.35
S96T005083	5AW-96-20	15A	66	<50.50	<50.5	<50.5
Centrifuged Solids			in.	μg/g	μg/g	μg/g
S96T005052	5AW-96-5	10A	95	61,700	56,300	59,000
S96T005053	5AW-96-7	10A	78	42,900	44,700	43,800
S96T005054	5AW-96-9	10A	77	56,000	53,000	54,500
S96T005084	5AW-96-15	15A	95	92,700	97,500	95,100
S96T005085	5AW-96-17	15A	73	43,900	41,800	42,800
S96T005086	5AW-96-20	15A	66	94,300	94,600	94,400

Table B2-24. Tank 241-AW-105 Analytical Results: Zinc.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μg/mL	μg/mL	μg/mL
S96T005004	5AW-96-1	10A	155	1.29	1.28	1.285
S96T005005	5AW-96-2	10A	137	1.57	1.58	1.575
S96T005006	5AW-96-4	10A	118	1.34	1.32	1.33
S96T005010	5AW-96-10	15A	155	2.61	2.67	2.64
S96T005011	5AW-96-11	15A	137	2.82	2.8	2.81
S96T005012	5AW-96-14	15A	118	4.77	4.83	4.8
Interstitial Liquid			in.	μg/mL	μg/mL	μg/mL
S96T005049	5AW-96-5	10A	95	5.88	7.05	6.465
S96T005050	5AW-96-7	10A	78	6.97	7.18	7.075
S96T005051	5AW-96-9	10A	77	10.3	10.3	10.3
S96T005081	5AW-96-15	15A	95	3.75	3.7	3.725
S96T005082	5AW-96-17	15A	73	3.82	3.96	3.89
S96T005083	5AW-96-20	15A	66	3.69	3.67	3.68
Centrifuged Solids			in.	μg/g	μg/g	μg/g
S96T005052	5AW-96-5	10A	95	<355	913	<634
S96T005053	5AW-96-7	10A	78	258	403	330.5
S96T005054	5AW-96-9	10A	77	561	258	409.5
S96T005084	5AW-96-15	15A	95	<193	<200	<197
S96T005085	5AW-96-17	15A	73	<198	<202	<200
S96T005086	5AW-96-20	15A	66	<203	<199	<201

Table B2-25. Tank 241-AW-105 Analytical Results: Zirconium.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μg/mL	μg/mL	μg/mL
S96T005004	5AW-96-1	10A	155	<0.410	<0.410	<0.410
S96T005005	5AW-96-2	10A	137	<0.410	<0.410	<0.410
S96T005006	5AW-96-4	10A	118	<0.410	<0.410	<0.410
S96T005010	5AW-96-10	15A	155	<0.410	<0.410	<0.410
S96T005011	5AW-96-11	15A	137	<0.410	<0.410	<0.410
S96T005012	5AW-96-14	15A	118	<0.410	<0.410	<0.410
Interstitial Liquid			in.	μg/mL	μg/mL	μg/mL
S96T005049	5AW-96-5	10A	95	1.59	12.5	7.045
S96T005050	5AW-96-7	10A	78	49.5	62.5	56
S96T005051	5AW-96-9	10A	77	13.7	6.72	10.21
S96T005081	5AW-96-15	15A	95	4.21	2.46	3.335
S96T005082	5AW-96-17	15A	73	18.9	13.3	16.1
S96T005083	5AW-96-20	15A	66	4.71	2.22	3.465
Centrifuged Solids			in.	μg/g	μg/g	μg/g
S96T005052	5AW-96-5	10A	95	583	558	570.5
S96T005053	5AW-96-7	10A	78	84,400	84,000	84,200
S96T005054	5AW-96-9	10A	77	69,300	69,800	69,600
S96T005084	5AW-96-15	15A	95	17,000	16,300	16,600
S96T005085	5AW-96-17	15A	73	78,900	76,700	77,800
S96T005086	5AW-96-20	15A	66	16,000	18,300	17,200

B2.2.2 Ion Chromatography

The analyses for ion chromatography (IC) were performed in duplicate on all samples. The analyses were performed directly on the supernatant and centrifuged liquid samples per procedure LA-533-105, Rev. D1. The centrifuged solid samples were analyzed per procedure LA-533-105, Rev. D1 following a water digestion per procedure LA-504-101, Rev. E0. The concentrations of anions by IC are shown in Tables B2-26 through B2-32.

Table B2-26. Tank 241-AW-105 Analytical Results: Chloride.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μg/mL	μg/mL	μg/mL
S96T005004	5AW-96-1	10A	155	222	230	225.8
S96T005006	5AW-96-4	10A	137	221	216	218.3
S96T005008	5AW-96-2	10A	118	262	231	246.6
S96T005010	5AW-96-10	15A	155	214	210	211.8
S96T005011	5AW-96-11	15A	137	252	248	249.8
S96T005012	5AW-96-14	15A	118	308	307	307.4
Interstitial Liquid			in.	μg/mL	μg/mL	μg/mL
S96T005049	5AW-96-5	10A	95	248	257	252.3
S96T005050	5AW-96-7	10A	78	315	312	313.4
S96T005051	5AW-96-9	10A	77	399	420	409.4
S96T005081	5AW-96-15	15A	95	398	393	395.6
S96T005082	5AW-96-17	15A	73	324	323	323.6
S96T005083	5AW-96-20	15A	66	296	298	296.8
Centrifuged Solids			in.	μg/g	μg/g	μg/g
S96T005055	5AW-96-5	10A	95	208	203	205.6
S96T005056	5AW-96-7	10A	78	175	<166	<171
S96T005057	5AW-96-9	10A	77	186	208	196.8
S96T005087	5AW-96-15	15A	95	221	228	224.4
S96T005088	5AW-96-17	15A	73	113	120	116.5
S96T005089	5AW-96-20	15A	66	272	365	318.6

Table B2-27. Tank 241-AW-105 Analytical Results: Fluoride.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μg/mL	μg/mL	μg/mL
S96T005004	5AW-96-1	10A	155	159	127	142.9[QC:e]
S96T005006	5AW-96-4	10A	137	174	166	170.2
S96T005008	5AW-96-2	10A	118	155	154	154.3
S96T005010	5AW-96-10	15A	155	131	129	129.9
S96T005011	5AW-96-11	15A	137	159	153	156.2
S96T005012	5AW-96-14	15A	118	1,060	1,160	1,110
Interstitial Liquid			in.	μg/mL	μg/mL	μg/mL
S96T005049	5AW-96-5	10A	95	1,510	1,490	1,500
S96T005050	5AW-96-7	10A	78	9,610	9,610	9,610
S96T005051	5AW-96-9	10A	77	12,500	12,600	12,600
S96T005081	5AW-96-15	15A	95	4,230	4,230	4,230
S96T005082	5AW-96-17	15A	73	10,400	10,500	10,500
S96T005083	5AW-96-20	15A	66	9,890	9,810	9,850
Centrifuged Solids			in.	μg/g	μg/g	μg/g
S96T005055	5AW-96-5	10A	95	1,410	1,380	1,400
S96T005056	5AW-96-7	10A	78	38,400	34,800	36,600
S96T005057	5AW-96-9	10A	77	28,200	28,600	28,400
S96T005087	5AW-96-15	15A	95	4,030	4,110	4,070
S96T005088	5AW-96-17	15A	73	20,200	19,900	20,000
S96T005089	5AW-96-20	15A	66	4,150	4,230	4,190

Table B2-28. Tank 241-AW-105 Analytical Results: Nitrate.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μg/mL	μg/mL	μg/mL
S96T005004	5AW-96-1	10A	155	23,900	24,100	24,000
S96T005006	5AW-96-4	10A	137	24,100	24,100	24,100
S96T005008	5AW-96-2	10A	118	24,300	24,600	24,500[QC:d]
S96T005010	5AW-96-10	15A	155	24,600	24,800	24,700
S96T005011	5AW-96-11	15A	137	29,200	28,500	28,800
S96T005012	5AW-96-14	15A	118	28,000	30,200	29,100
Interstitial Liquid			in.	μg/mL	μg/mL	μg/mL
S96T005049	5AW-96-5	10A	95	33,900	33,500	33,700
S96T005050	5AW-96-7	10A	78	26,800	26,900	26,900
S96T005051	5AW-96-9	10A	77	27,700	28,100	27,900
S96T005081	5AW-96-15	15A	95	29,300	29,100	29,200
S96T005082	5AW-96-17	15A	73	27,000	26,900	27,000
S96T005083	5AW-96-20	15A	66	30,300	30,300	30,300
Centrifuged Solids			in.	μg/g	μg/g	μg/g
S96T005055	5AW-96-5	10A	95	26,200	26,400	26,300
S96T005056	5AW-96-7	10A	78	18,600	16,900	17,800
S96T005057	5AW-96-9	10A	77	18,300	18,300	18,300
S96T005087	5AW-96-15	15A	95	23,000	23,100	23,000
S96T005088	5AW-96-17	15A	73	18,800	18,500	18,700
S96T005089	5AW-96-20	15A	66	22,400	23,100	22,700

Table B2-29. Tank 241-AW-105 Analytical Results: Nitrite.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	µg/mL	µg/mL	µg/mL
S96T005004	5AW-96-1	10A	155	1,090	1,120	1,100
S96T005006	5AW-96-4	10A	137	1,120	1,100	1,110
S96T005008	5AW-96-2	10A	118	1,200	1,130	1,170
S96T005010	5AW-96-10	15A	155	1,090	1,070	1,080
S96T005011	5AW-96-11	15A	137	1,280	1,250	1,270
S96T005012	5AW-96-14	15A	118	1,660	1,760	1,710
Interstitial Liquid			in.	µg/mL	µg/mL	µg/mL
S96T005049	5AW-96-5	10A	95	1,520	1,530	1,520
S96T005050	5AW-96-7	10A	78	4,640	4,640	4,640
S96T005051	5AW-96-9	10A	77	4,700	4,680	4,690
S96T005081	5AW-96-15	15A	95	3,010	2,930	2,970
S96T005082	5AW-96-17	15A	73	4,710	4,730	4,720
S96T005083	5AW-96-20	15A	66	3,940	3,920	3,930
Centrifuged Solids			in.	µg/g	µg/g	µg/g
S96T005055	5AW-96-5	10A	95	1,310	1,260	1,280
S96T005056	5AW-96-7	10A	78	3,680	3,520	3,600
S96T005057	5AW-96-9	10A	77	2,990	2,990	2,990
S96T005087	5AW-96-15	15A	95	2,220	2,280	2,250
S96T005088	5AW-96-17	15A	73	3,490	3,390	3,440
S96T005089	5AW-96-20	15A	66	2,520	2,600	2,560

Table B2-30. Tank 241-AW-105 Analytical Results: Oxalate.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	µg/mL	µg/mL	µg/mL
S96T005004	5AW-96-1	10A	155	<63.63	<63.6	<63.6
S96T005006	5AW-96-4	10A	137	<63.63	<63.6	<63.6
S96T005008	5AW-96-2	10A	118	<117	<117	<117
S96T005010	5AW-96-10	15A	155	<117	<117	<117
S96T005011	5AW-96-11	15A	137	<117	<117	<117
S96T005012	5AW-96-14	15A	118	<541	<541	<541
Interstitial Liquid			in.	µg/mL	µg/mL	µg/mL
S96T005049	5AW-96-5	10A	95	<117	<117	<117
S96T005050	5AW-96-7	10A	78	320	311	315.6
S96T005051	5AW-96-9	10A	77	327	<223	<275
S96T005081	5AW-96-15	15A	95	196	232	213.9
S96T005082	5AW-96-17	15A	73	321	388	354.4
S96T005083	5AW-96-20	15A	66	272	287	279.6
Centrifuged Solids			in.	µg/g	µg/g	µg/g
S96T005055	5AW-96-5	10A	95	<193	<192	<193
S96T005056	5AW-96-7	10A	78	<1,020	<1,030	<1,030
S96T005057	5AW-96-9	10A	77	446	<415	<431
S96T005087	5AW-96-15	15A	95	236	<233	<235
S96T005088	5AW-96-17	15A	73	<512	<510	<511
S96T005089	5AW-96-20	15A	66	<517	<531	<524

Table B2-31. Tank 241-AW-105 Analytical Results: Phosphate.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	µg/mL	µg/mL	µg/mL
S96T005004	5AW-96-1	10A	155	<72.05	<72.1	<72.1
S96T005006	5AW-96-4	10A	137	<72.05	<72.1	<72.1
S96T005008	5AW-96-2	10A	118	<133	<133	<133
S96T005010	5AW-96-10	15A	155	<133	<133	<133
S96T005011	5AW-96-11	15A	137	<133	<133	<133
S96T005012	5AW-96-14	15A	118	<618	<618	<618
Interstitial Liquid			in.	µg/mL	µg/mL	µg/mL
S96T005049	5AW-96-5	10A	95	<133	<133	<133
S96T005050	5AW-96-7	10A	78	289	324	306.6
S96T005051	5AW-96-9	10A	77	590	599	594.2
S96T005081	5AW-96-15	15A	95	228	223	225.4
S96T005082	5AW-96-17	15A	73	369	414	391.6
S96T005083	5AW-96-20	15A	66	393	404	398.6
Centrifuged Solids			in.	µg/g	µg/g	µg/g
S96T005055	5AW-96-5	10A	95	445	486	465.6
S96T005056	5AW-96-7	10A	78	<1,160	<1,170	<1,170
S96T005057	5AW-96-9	10A	77	<472	<474	<473
S96T005087	5AW-96-15	15A	95	411	378	394.7
S96T005088	5AW-96-17	15A	73	<585	<583	<584
S96T005089	5AW-96-20	15A	66	<591	<607	<599

Table B2-32. Tank 241-AW-105 Analytical Results: Sulfate.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	µg/mL	µg/mL	µg/mL
S96T005004	5AW-96-1	10A	155	167	166	166.3
S96T005006	5AW-96-4	10A	137	175	189	182.1
S96T005008	5AW-96-2	10A	118	230	225	227.5
S96T005010	5AW-96-10	15A	155	221	187	204.1
S96T005011	5AW-96-11	15A	137	214	214	213.8
S96T005012	5AW-96-14	15A	118	<711	<711	<711
Interstitial Liquid			in.	µg/mL	µg/mL	µg/mL
S96T005049	5AW-96-5	10A	95	412	399	405.2
S96T005050	5AW-96-7	10A	78	1,550	1,580	1,560
S96T005051	5AW-96-9	10A	77	1,610	1,650	1,630
S96T005081	5AW-96-15	15A	95	951	949	949.9
S96T005082	5AW-96-17	15A	73	1,540	1,490	1,510
S96T005083	5AW-96-20	15A	66	1,240	1,280	1,260
Centrifuged Solids			in.	µg/g	µg/g	µg/g
S96T005055	5AW-96-5	10A	95	434	415	424.5
S96T005056	5AW-96-7	10A	78	1,540	1,730	1,630
S96T005057	5AW-96-9	10A	77	1,190	1,260	1,220
S96T005087	5AW-96-15	15A	95	880	851	865.6
S96T005088	5AW-96-17	15A	73	1,680	1,690	1,680
S96T005089	5AW-96-20	15A	66	1,160	1,310	1,240

B2.2.3 Potentiometric Titration

The titration analyses for hydroxide were performed in duplicate directly on all of the grab samples per procedure LA-211-102, Rev. C0. The results are shown in Table B2-33.

Table B2-33. Tank 241-AW-105 Analytical Results: Hydroxide.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	µg/mL	µg/mL	µg/mL
S96T005004	5AW-96-1	10A	155	3,270	3,370	3,320
S96T005006	5AW-96-4	10A	137	3,270	3,190	3,230
S96T005008	5AW-96-2	10A	118	3,680	3,890	3,780
S96T005010	5AW-96-10	15A	155	2,900	2,850	2,880
S96T005011	5AW-96-11	15A	137	3,150	3,370	3,260
S96T005012	5AW-96-14	15A	118	5,130	5,180	5,160
Interstitial Liquid			in.	µg/mL	µg/mL	µg/mL
S96T005049	5AW-96-5	10A	95	5,410	5,480	5,440
S96T005050	5AW-96-7	10A	78	8,640	8,530	8,580
S96T005051	5AW-96-9	10A	77	9,410	9,500	9,460
S96T005081	5AW-96-15	15A	95	7,620	7,440	7,530
S96T005082	5AW-96-17	15A	73	9,040	9,390	9,220
S96T005083	5AW-96-20	15A	66	8,660	9,070	8,860
Centrifuged Solids			in.	µg/g	µg/g	µg/g
S96T005055	5AW-96-5	10A	95	<42.00	<42	<42.0
S96T005056	5AW-96-7	10A	78	<42.00	<42	<42.0
S96T005057	5AW-96-9	10A	77	<42.00	<42	<42.0
S96T005087	5AW-96-15	15A	95	<42.00	<42	<42.0
S96T005088	5AW-96-17	15A	73	<42.00	<42	<42.0
S96T005089	5AW-96-20	15A	66	<42.00	<42	<42.0

B2.3 ORGANIC ANALYSES

The SAP (Sasaki 1996) requested analyses for PCBs for all liquid and solid samples. The PCB analysis for the liquids has been delayed and will be included in a revision to this document. The centrifuged solid samples were analyzed directly per procedure LA-523-434, Rev. A0. The samples were prepared by addition of anhydrous sodium sulfate for drying, followed by two extractions with hexane. The combined extracts from each sample were condensed to 2 mL each under a nitrogen blanket. The results are presented in Table B2-34.

Table B2-34. Tank 241-AW-105 Analytical Results: Polychlorinated Biphenyls.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result
Centrifuged Solids			in.	μg/g
S96T005046	5AW-96-5	10A	95	<0.993
S96T005047	5AW-96-7	10A	78	<0.888
S96T005048	5AW-96-9	10A	77	<0.955
S96T005078	5AW-96-15	15A	95	<0.903
S96T005079	5AW-96-17	15A	73	<0.897
S96T005080	5AW-96-20	15A	66	<0.855

B2.4 CARBON ANALYSES

B2.4.1 Total Inorganic Carbon

The analyses for TIC were performed in duplicate on all samples by coulometry following an acid preparation per procedure LA-342-100, Rev. E0. The results are presented in Table B2-35.

Table B2-35. Tank 241-AW-105 Analytical Results: Total Inorganic Carbon. (2 sheets)

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μg C/mL	μg C/mL	μg C/mL
S96T005004	5AW-96-1	10A	155	170	204	187
S96T005006	5AW-96-4	10A	137	178	193	185.5
S96T005008	5AW-96-2	10A	118	187	190	188.5
S96T005010	5AW-96-10	15A	155	432	437	434.5
S96T005011	5AW-96-11	15A	137	367	398	382.5
S96T005012	5AW-96-14	15A	118	437	484	460.5

Table B2-35. Tank 241-AW-105 Analytical Results: Total Inorganic Carbon. (2 sheets)

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Interstitial Liquid			in.	μg C/mL	μg C/mL	μg C/mL
S96T005049	5AW-96-5	10A	95	392	459	425.5
S96T005050	5AW-96-7	10A	78	850	841	845.5
S96T005051	5AW-96-9	10A	77	745	741	743
S96T005081	5AW-96-15	15A	95	576	586	581
S96T005082	5AW-96-17	15A	73	775	792	783.5
S96T005083	5AW-96-20	15A	66	676	686	681
Centrifuged Solids			in.	μg C/g	μg C/g	μg C/g
S96T005019	5AW-96-5	10A	95	1,120	1,090	1,100
S96T005020	5AW-96-7	10A	78	969	870	919.5
S96T005021	5AW-96-9	10A	77	921	827	874
S96T005075	5AW-96-15	15A	95	630	676	653
S96T005076	5AW-96-17	15A	73	808	812	810
S96T005077	5AW-96-20	15A	66	635	766	700.5

B2.4.2 Total Organic Carbon

The analyses for TOC were performed in duplicate by furnace oxidation directly on all samples. The supernatant and centrifuged liquid sample analyses were performed per procedure LA-344-105, Rev. D1. The centrifuged solid samples were analyzed directly per procedure LA-342-100, Rev. E0 following a persulfate acid digestion. The results are presented in Table B2-36 (wet weight basis). Because of QC questions, replicates were conducted on the supernatant sample 5AW-96-2 and on the centrifuged liquid sample 5AW-96-5. Three of the supernatant samples exceeded the waste compatibility notification limit of 30,000 μg C/mL, the largest sample mean being 100,000 μg C/mL on a dry weight basis from sample 5AW-96-1.

Table B2-36. Tank 241-AW-105 Analytical Results: Total Organic Carbon.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	µg C/mL	µg C/mL	µg C/mL
S96T005004	5AW-96-1	10A	155	4,540	4,700	4,620
S96T005008	5AW-96-2	10A	118	97.9	102	99.95
S96T005008	5AW-96-2	10A	118	108	99.6	103.8
S96T005006	5AW-96-4	10A	137	4,590	5,080	4,840
S96T005010	5AW-96-10	15A	155	1,510	1,530	1,520
S96T005011	5AW-96-11	15A	137	1,440	1,420	1,430
S96T005012	5AW-96-14	15A	118	1,670	1,710	1,690
Interstitial Liquid			in.	µg C/mL	µg C/mL	µg C/mL
S96T005049	5AW-96-5	10A	95	951	589 (539)[1]	693
S96T005049	5AW-96-5	10A	95	704	704	704
S96T005050	5AW-96-7	10A	78	2,570	2,510	2,540
S96T005051	5AW-96-9	10A	77	2,240	2,180	2,210
S96T005081	5AW-96-15	15A	95	1,770	1,570	1,670
S96T005082	5AW-96-17	15A	73	2,290	2,250	2,270
S96T005083	5AW-96-20	15A	66	1,920	1,820	1,870
Centrifuged Solids			in.	µg C/g	µg C/g	µg C/g
S96T005019	5AW-96-5	10A	95	1,810	1,730	1,770
S96T005020	5AW-96-7	10A	78	1,770	1,720	1,740
S96T005021	5AW-96-9	10A	77	1,640	1,700	1,670
S96T005075	5AW-96-15	15A	95	1,400	1,290	1,340
S96T005076	5AW-96-17	15A	73	2,080	2,330	2,200
S95T005077	5AW-96-20	15A	66	1,770	1,430	1,600[QC:e]

Note:

[1]Triplicate measurement.

B2.5 RADIONUCLIDE ANALYSES

B2.5.1 Alpha Proportional Counting

The analysis for ^{241}Am were performed in duplicate directly on the supernatant and interstitial liquid samples per procedure LA-953-103, Rev. B0. The centrifuged solid samples were analyzed in duplicate per procedure LA-953-103, Rev. B0 following a fusion digestion per procedure LA-549-141, Rev. F0. The analyses for $^{239/240}$Pu was performed in duplicate directly on the supernatant and interstitial liquid samples per procedure LA-943-128, Rev. B0. The centrifuged solid samples were analyzed in duplicate per procedure LA-943-128, Rev. B0 following a fusion digestion per procedure LA-549-141, Rev. F0. The results are presented in Tables B2-37 and B2-38.

Table B2-37. Tank 241-AW-105 Analytical Results: Americium-241. (2 sheets)

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μCi/mL	μCi/mL	μCi/mL
S96T005007	5AW-96-1	10A	155	<5.27E-06	<6.08E-06	<5.68E-06
S96T005008	5AW-96-2	10A	137	<7.94E-06	<6.75E-06	<7.35E-06
S96T005009	5AW-96-4	10A	118	<6.00E-06	<6.02E-06	<6.01E-06
S96T005013	5AW-96-10	15A	155	<6.57E-06	<5.58E-06	<6.08E-06
S96T005014	5AW-96-11	15A	137	<6.08E-06	<6.14E-06	<6.09E-06
S96T005015	5AW-96-14	15A	118	<6.59E-06	<6.68E-06	<6.64E-06
Interstitial Liquid			in.	μCi/mL	μCi/mL	μCi/mL
S96T005049	5AW-96-5	10A	95	<6.44E-05	7.75E-05	<7.10E-05
S96T005050	5AW-96-7	10A	78	2.63E-04	2.89E-04	2.76E-04
S96T005051	5AW-96-9	10A	77	<6.13E-05	<5.88E-05	<6.01E-05
S96T005081	5AW-96-15	15A	95	<3.33E-05	<3.66E-05	<3.50E-05
S96T005082	5AW-96-17	15A	73	<4.13E-05	<4.49E-05	<4.31E-05
S96T005083	5AW-96-20	15A	66	5.44E-04	6.09E-04	5.76E-04

Table B2-37. Tank 241-AW-105 Analytical Results: Americium-241. (2 sheets)

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Centrifuged Solids			in.	μCi/g	μCi/g	μCi/g
S96T005052	5AW-96-5	10A	95	0.324	0.287	0.305
S96T005053	5AW-96-7	10A	78	0.387	0.381	0.384
S96T005054	5AW-96-9	10A	77	0.371	0.355	0.363
S96T005084	5AW-96-15	15A	95	0.454	0.489	0.472
S96T005085	5AW-96-17	15A	73	1.07	0.672	0.871
S96T005086	5AW-96-20	15A	66	0.418	0.432	0.425

Table B2-38. Tank 241-AW-105 Analytical Results: Plutonium-239/240.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	µCi/mL	µCi/mL	µCi/mL
S96T005007	5AW-96-1	10A	155	<3.73E-06	<3.75E-06	<3.74E-06
S96T005008	5AW-96-2	10A	137	<4.00E-06	<3.60E-06	<3.80E-06
S96T005009	5AW-96-4	10A	118	<4.08E-06	<3.74E-06	<3.91E-06
S96T005013	5AW-96-10	15A	155	<4.58E-06	<4.15E-06	<4.37E-06
S96T005014	5AW-96-11	15A	137	<4.26E-06	<4.44E-06	<4.35E-06
S96T005015	5AW-96-14	15A	118	<4.80E-06	<4.28E-06	<4.54E-06
Interstitial Liquid			in.	µCi/mL	µCi/mL	µCi/mL
S96T005049	5AW-96-5	10A	95	0.00118	0.00100	0.00109
S96T005050	5AW-96-7	10A	78	0.00182	0.00191	0.00186
S96T005051	5AW-96-9	10A	77	0.00585	0.00530	0.00558
S96T005081	5AW-96-15	15A	95	0.00477	0.00436	0.00456
S96T005082	5AW-96-17	15A	73	0.00286	0.00259	0.00272
S96T005083	5AW-96-20	15A	66	0.00178	0.00213	0.00196
Centrifuged Solids			in.	µCi/g	µCi/g	µCi/g
S96T005052	5AW-96-5	10A	95	0.458	0.447	0.453
S96T005053	5AW-96-7	10A	78	1.64	1.67	1.655
S96T005054	5AW-96-9	10A	77	1.77	1.73	1.75
S96T005084	5AW-96-15	15A	95	3.47	3.77	3.62
S96T005085	5AW-96-17	15A	73	3.76	3.03	3.395[QC:e]
S96T005086	5AW-96-20	15A	66	3.28	3.24	3.26

B2.5.2 Beta Proportional Counting

The analyses for ^{90}Sr were performed in duplicate directly on the supernatant and interstitial liquid samples per procedure LA-220-101, Rev. D1. The centrifuged solid samples were analyzed in duplicate per procedure LA-220-101, Rev. D1 following a fusion digestion per procedure LA-549-141, Rev. 0. The results are presented in Table B2-39.

Table B2-39. Tank 241-AW-105 Analytical Results: Strontium-89/90.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μCi/mL	μCi/mL	μCi/mL
S96T005007	5AW-96-1	10A	155	0.0211	0.0201	0.0206
S96T005008	5AW-96-2	10A	137	0.0302	0.0312	0.0307
S96T005009	5AW-96-4	10A	118	0.0161	0.0159	0.0160
S96T005013	5AW-96-10	15A	155	0.0211	0.0193	0.0202
S96T005014	5AW-96-11	15A	137	0.0241	0.0262	0.0251
S96T005015	5AW-96-14	15A	118	7.33E-04	4.38E-04	5.86E-04[QC:e]
Interstitial Liquid			in.	μCi/mL	μCi/mL	μCi/mL
S96T005049	5AW-96-5	10A	95	0.294	0.0960	0.195[QC:e]
S96T005050	5AW-96-7	10A	78	0.00172	0.00232	0.00202[QC:e]
S96T005051	5AW-96-9	10A	77	0.684	0.623	0.653
S96T005081	5AW-96-15	15A	95	6.91E-04	5.30E-04	6.10E-04[QC:e]
S96T005082	5AW-96-17	15A	73	0.147	0.124	0.136
S96T005083	5AW-96-20	15A	66	8.28E-04	0.00177	0.00130[QC:e]
Centrifuged Solids			in.	μCi/g	μCi/g	μCi/g
S96T005052	5AW-96-5	10A	95	19.6	19.3	19.45
S96T005053	5AW-96-7	10A	78	65.2	65	65.1
S96T005054	5AW-96-9	10A	77	50.7	50	50.35
S96T005084	5AW-96-15	15A	95	30.5	32.2	31.35
S96T005085	5AW-96-17	15A	73	16.1	18.6	17.35
S96T005086	5AW-96-20	15A	66	31.4	29.5	30.45

B2.5.3 Gamma Energy Analysis

The gamma energy analysis (GEA) analyses for ^{137}Cs and ^{60}Co were performed in duplicate directly on the supernatant and interstitial liquid samples per procedure LA-548-121, Rev. E0. The centrifuged solid samples were analyzed in duplicate per procedure LA-548-121, Rev. E0 following a fusion digestion per procedure LA-549-141, Rev. F0. The results are presented in Tables B2-40 and B2-41, respectively.

Table B2-40. Tank 241-AW-105 Analytical Results: Cesium-137.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	µCi/mL	µCi/mL	µCi/mL
S96T005007	5AW-96-1	10A	155	0.739	0.736	0.738
S96T005008	5AW-96-2	10A	137	0.755	0.744	0.750
S96T005009	5AW-96-4	10A	118	0.788	0.800	0.794
S96T005013	5AW-96-10	15A	155	0.719	0.714	0.716
S96T005014	5AW-96-11	15A	137	0.745	0.755	0.750
S96T005015	5AW-96-14	15A	118	4.71	4.81	4.76
Interstitial Liquid			in.	µCi/mL	µCi/mL	µCi/mL
S96T005049	5AW-96-5	10A	95	6.46	6.66	6.56
S96T005050	5AW-96-7	10A	78	26.7	26.2	26.45
S96T005051	5AW-96-9	10A	77	25	25	25
S96T005081	5AW-96-15	15A	95	16.4	15.4	15.9
S96T005082	5AW-96-17	15A	73	24.8	25.4	25.1
S96T005083	5AW-96-20	15A	66	22.5	21.9	22.2
Centrifuged Solids			in.	µCi/g	µCi/g	µCi/g
S96T005052	5AW-96-5	10A	95	6.328	6.58	6.454
S96T005053	5AW-96-7	10A	78	20.66	20.6	20.63
S96T005054	5AW-96-9	10A	77	18.86	19.2	19.03
S96T005084	5AW-96-15	15A	95	13.58	13.8	13.69
S96T005085	5AW-96-17	15A	73	20.39	20.2	20.3
S96T005086	5AW-96-20	15A	66	13.94	14.2	14.07

Table B2-41. Tank 241-AW-105 Analytical Results: Cobalt-60.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	μCi/mL	μCi/mL	μCi/mL
S96T005007	5AW-96-1	10A	155	1.08E-04	1.07E-04	1.07E-04
S96T005008	5AW-96-2	10A	137	1.06E-04	9.63E-05	1.01E-04
S96T005009	5AW-96-4	10A	118	<6.31E-05	1.16E-04	<8.96E-05
S96T005013	5AW-96-10	15A	155	1.30E-04	1.04E-04	1.17E-04
S96T005014	5AW-96-11	15A	137	7.85E-05	1.14E-04	9.63E-05
S96T005015	5AW-96-14	15A	118	9.66E-04	0.00116	0.00106
Interstitial Liquid			in.	μCi/mL	μCi/mL	μCi/mL
S96T005049	5AW-96-5	10A	95	0.00207	0.00211	0.00209
S96T005050	5AW-96-7	10A	78	0.0257	0.0259	0.0258
S96T005051	5AW-96-9	10A	77	0.0245	0.0232	0.0238
S96T005081	5AW-96-15	15A	95	0.0121	0.0112	0.0117
S96T005082	5AW-96-17	15A	73	0.0213	0.0217	0.0215
S96T005083	5AW-96-20	15A	66	0.0201	0.0194	0.0198
Centrifuged Solids			in.	μCi/g	μCi/g	μCi/g
S96T005052	5AW-96-5	10A	95	<0.0355	<0.0381	<0.0368
S96T005053	5AW-96-7	10A	78	0.0960	0.0743	0.0851
S96T005054	5AW-96-9	10A	77	0.0746	0.0555	0.0651
S96T005084	5AW-96-15	15A	95	0.0363	0.0354	0.0358
S96T005085	5AW-96-17	15A	73	<0.106	<0.103	<0.105
S96T005086	5AW-96-20	15A	66	0.0315	0.0306	0.0311

B2.5.4 Total Alpha Activity

The analyses for total alpha activity were performed in duplicate directly on the supernatant and interstitial liquid samples per procedure LA-508-101, Rev. E1. The centrifuged solid samples were analyzed in duplicate following a fusion digestion per procedure LA-508-101, Rev. E1. The results are presented in Table B2-42.

Table B2-42. Tank 241-AW-105 Analytical Results: Total Alpha Activity.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	µCi/mL	µCi/mL	µCi/mL
S96T005007	5AW-96-1	10A	155	<6.59E-05	<4.09E-05	<5.34E-05[QC:e]
S96T005008	5AW-96-2	10A	137	<8.18E-05	<4.09E-05	<6.14E-05[QC:e]
S96T005009	5AW-96-4	10A	118	<5.79E-05	<6.59E-05	<6.19E-05[QC:e]
S96T005013	5AW-96-10	15A	155	<7.87E-05	<7.07E-05	<7.47E-05
S96T005014	5AW-96-11	15A	137	<5.34E-05	<6.00E-05	<5.67E-05
S96T005015	5AW-96-14	15A	118	<1.85E-04	<3.15E-04	<2.50E-04
Interstitial Liquid			in.	µCi/mL	µCi/mL	µCi/mL
S96T005049	5AW-96-5	10A	95	0.00397	0.00390	0.00394[QC:e]
S96T005050	5AW-96-7	10A	78	0.00303	0.00255	0.00279[QC:e]
S96T005051	5AW-96-9	10A	77	0.00105	0.00169	0.00137[QC:e]
S96T005081	5AW-96-15	15A	95	8.80E-04	0.00138	0.00113[QC:e]
S96T005082	5AW-96-17	15A	73	0.00178	9.80E-04	0.00138[QC:e]
S96T005083	5AW-96-20	15A	66	5.47E-04	6.14E-04	5.80E-04[QC:e]
Centrifuged Solids			in.	µCi/g	µCi/g	µCi/g
S96T005052	5AW-96-5	10A	95	0.620	0.568	0.594[QC:e]
S96T005053	5AW-96-7	10A	78	1.74	1.83	1.785[QC:e]
S96T005054	5AW-96-9	10A	77	2.39	2.36	2.375[QC:e]
S96T005084	5AW-96-15	15A	95	4.08	3.64	3.86
S96T005085	5AW-96-17	15A	73	1.72	1.68	1.70
S96T005086	5AW-96-20	15A	66	3.69	3.48	3.585

B2.6 PHYSICAL ANALYSES

B2.6.1 Bulk Density

The bulk densities of the sludge, centrifuged solids, and interstitial liquid were measured directly on single samples from each grab sample according to procedure LO-160-103, Rev. B0. The results are presented in Table B2-43.

Table B2-43. Tank 241-AW-105 Analytical Results: Bulk Density.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result
Sludge			in.	g/mL
S96T004809	5AW-96-5	10A	95	1.06
S96T004811	5AW-96-7	10A	78	1.24
S96T004813	5AW-96-9	10A	77	1.22
S96T004819	5AW-96-15	15A	95	1.16
S96T004821	5AW-96-17	15A	73	1.22
S96T004824	5AW-96-20	15A	66	1.2
Interstitial Liquid			in.	g/mL
S96T005049	5AW-96-5	10A	95	1.04
S96T005050	5AW-96-7	10A	78	1.05
S96T005051	5AW-96-9	10A	77	1.03
S96T005081	5AW-96-15	15A	95	0.980
S96T005082	5AW-96-17	15A	73	1.04
S96T005083	5AW-96-20	15A	66	1.09
Centrifuged Solids			in.	g/mL
S96T005019	5AW-96-5	10A	95	1.15
S96T005020	5AW-96-7	10A	78	1.32
S96T005021	5AW-96-9	10A	77	1.29
S96T005075	5AW-96-15	15A	95	1.26
S96T005076	5AW-96-17	15A	73	1.31
S96T005077	5AW-96-20	15A	66	1.26

B2.6.2 pH

The pH of the waste material was analyzed in duplicate directly on the supernatant and interstitial liquid samples per procedure LA-212-106, Rev. B0. The centrifuged solid samples were analyzed directly in duplicate per procedure LA-212-105, Rev. B0. Results for pH that are greater than 12.5 are suspect and should be considered estimates. This is because the highest calibration buffer available is 12.5 and pH electrode performance degrades at high pH. The results are presented in Table B2-44.

Table B2-44. Tank 241-AW-105 Analytical Results: pH.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	Unitless	Unitless	Unitless
S96T005004	5AW-96-1	10A	155	13.38	13.39	13.39
S96T005005	5AW-96-2	10A	137	13.43	13.44	13.43
S96T005006	5AW-96-4	10A	118	13.47	13.48	13.48
S96T005010	5AW-96-10	15A	155	13.41	13.42	13.41
S96T005011	5AW-96-11	15A	137	13.46	13.46	13.46
S96T005012	5AW-96-14	15A	118	13.63	13.64	13.64
Interstitial Liquid			in.	Unitless	Unitless	Unitless
S96T005049	5AW-96-5	10A	95	13.24	13.26	13.25
S96T005050	5AW-96-7	10A	78	13.45	13.49	13.47
S96T005051	5AW-96-9	10A	77	13.48	13.55	13.52
S96T005081	5AW-96-15	15A	95	13.46	13.48	13.47
S96T005082	5AW-96-17	15A	73	13.42	13.43	13.43
S96T005083	5AW-96-20	15A	66	13.34	13.28	13.31
Centrifuged Solids			in.	Unitless	Unitless	Unitless
S96T005019	5AW-96-5	10A	95	11.66	11.7	11.68
S96T005020	5AW-96-7	10A	78	12.26	12.25	12.25
S96T005021	5AW-96-9	10A	77	12.44	12.47	12.46
S96T005075	5AW-96-15	15A	95	12.35	12.33	12.34
S96T005076	5AW-96-17	15A	73	12.35	12.27	12.31
S96T005077	5AW-96-20	15A	66	12.49	12.48	12.48

B2.6.3 Specific Gravity

Specific gravity was measured directly on the duplicate supernatant samples following procedure LA-510-112, Rev. C3, and the results are presented in Table B2-45.

Table B2-45. Tank 241-AW-105 Analytical Results: Specific Gravity.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	Unitless	Unitless	Unitless
S96T005004	5AW-96-1	10A	155	1.021	1.015	1.018
S96T005008	5AW-96-2	10A	137	1.019	1.02	1.019
S96T005006	5AW-96-4	10A	118	1.012	1.01	1.011
S96T005010	5AW-96-10	15A	155	1.016	1.027	1.022
S96T005011	5AW-96-11	15A	137	1.021	1.025	1.023
S96T005012	5AW-96-14	15A	118	1.038	1.04	1.039

B2.6.4 Volume Percent Solids

The volume percent solids was measured directly on each grab sample according to procedure LA-519-132, Rev. D0, and the results are presented in Table B2-46.

Table B2-46. Tank 241-AW-105 Analytical Results: Volume Percent Solids.

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Sludge			in.	Percent	Percent	Percent
S96T004809	5AW-96-5	10A	95	7.09	n/a	7.09
S96T004811	5AW-96-7	10A	78	67.8	n/a	67.8
S96T004813	5AW-96-9	10A	77	73.7	n/a	73.7
S96T004819	5AW-96-15	15A	95	73.3	n/a	73.3
S96T004821	5AW-96-17	15A	73	67.6	n/a	67.6
S96T004824	5AW-96-20	15A	66	79.1	n/a	79.1

B2.7 THERMODYNAMIC ANALYSES

As required by the waste compatibility DQO, TGA and DSC were performed in duplicate directly on the samples.

B2.7.1 Thermogravimetric Analysis

Thermogravimetric analysis measures the mass of a sample while its temperature is increased at a constant rate. Nitrogen is passed over the sample during heating to remove any released gases. Any decrease in the weight of a sample during TGA represents a loss of gaseous matter from the sample, either through evaporation or through a reaction that forms gas phase products. The moisture content is estimated by assuming that all TGA sample weight loss up to a certain temperature (typically 150 to 200 °C [302 to 392 °F) is due to 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.

Tank 241-AW-105 samples were directly analyzed in duplicate by TGA using either procedure LA-514-114, Rev. D0 on a Perkin-Elmer TGA 7 instrument, or procedure LA-560-112, Rev. C0 on a Mettler TG 50 instrument. The TGA results are presented in Table B2-47.

Table B2-47. Tank 241-AW-105 Analytical Results: Weight Percent Water. (2 sheets)

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Supernatant			in.	Weight Percent	Weight Percent	Weight Percent
S96T005007	5AW-96-1	10A	155	95.04	95.72	95.38
S96T005008	5AW-96-2	10A	137	95.67	95.63	95.65
S96T005009	5AW-96-4	10A	118	94.61	94.53	94.57
S96T005013	5AW-96-10	15A	155	95.1	94.98	95.04
S96T005014	5AW-96-11	15A	137	94.79	94.92	94.86
S96T005015	5AW-96-14	15A	118	94.03	93.7	93.87

Table B2-47. Tank 241-AW-105 Analytical Results: Weight Percent Water. (2 sheets)

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Interstitial Liquid			in.	Weight Percent	Weight Percent	Weight Percent
S96T005049	5AW-96-5	10A	95	92.61	92.74	92.67
S96T005050	5AW-96-7	10A	78	88.66	88.43	88.55
S96T005051	5AW-96-9	10A	77	88.68	89.02	88.85
S96T005081	5AW-96-15	15A	95	90.54	90.78	90.66
S96T005082	5AW-96-17	15A	73	90.16	74.58	82.37
S96T005083	5AW-96-20	15A	66	89.29	90.05	89.67
Centrifuged Solids			in.	Percent	Percent	Percent
S96T005019	5AW-96-5	10A	95	80.79	79.42	80.11
S96T005020	5AW-96-7	10A	78	64.68	66.26	65.47
S96T005021	5AW-96-9	10A	77	66.46	66.61	66.53
S96T005075	5AW-96-15	15A	95	75.58	75.23	75.41
S96T005076	5AW-96-17	15A	73	65.12	66.79	65.96
S96T005077	5AW-96-20	15A	66	66.19	71.2	68.69

B2.7.2 Differential Scanning Calorimetry

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

The DSC analyses for tank 241-AW-105 were performed using either procedure LA-514-113, Rev. C1 on a Mettler™ DSC 20 instrument or procedure LA-514-114, Rev. D0 on a Perkin-Elmer™ DSC 7 instrument. Exothermic reactions were noted in four of the centrifuged solid samples. However, all samples yielded exotherm/endotherm ratios below the waste compatibility limit of 1.0. Also, the individual results ranged from 42.1 J/g to 145 J/g on a dry weight basis, all of which were well below the safety screening DQO limit of 480 J/g. The samples with exothermic reactions and their results (wet weight basis) are presented in Table B2-48.

Table B2-48. Tank 241-AW-105 Analytical Results: Differential Scanning Calorimetry. (wet weight)

Sample Number	Grab Sample	Riser Number	Sample Elevation	Result	Duplicate	Mean
Centrifuged Solids			in.	J/g	J/g	J/g
S96T005021	5AW-96-9	10A	77	14.10	0.00	7.050
S96T005075	5AW-96-15	15A	95	16.4	15.8	16.1
S96T005076	5AW-96-17	15A	73	31.6	49.5	40.55
S96T005077	5AW-96-20	15A	66	22.2	21.5	21.85

B2.8 VAPOR PHASE MEASUREMENT

On August 20, 1996 vapor phase measurements were conducted per procedure WHC-IP-0030, IH 1.4 and IH 2.1 on tank 241-AW-105. These measurements supported the safety screening DQO (Dukelow et al. 1995), and were taken to resolve flammable gas issues. The vapor phase measurements were taken at 3 to 4 different locations from two risers. The results of these measurements are provided in Table B2-49. All of the flammability measurements indicated that the gases in the tank headspace were ≤ 1 percent of the LFL.

Table B2-49. Results of Vapor Phase Measurements of Tank 241-AW-105.[1] (2 sheets)

Measurement	Breather/Vent	Sample Riser	Dome Space	Breathing Zone
Riser 10A				
Percent of LFL	0	0	0	0
Ammonia (ppmv)	50	0	100	0
TOC(ppmv)	7.1	0	10.8	0
Oxygen (percent)	21	21	21	21
Riser 15A, first measurement				
Percent of LFL	0	1	1	0
Ammonia (ppmv)	50	0	100	0
TOC (ppmv)	9.4	0	10.1	<1
Oxygen (percent)	21	21	20.8	21

Table B2-49. Results of Vapor Phase Measurements of Tank 241-AW-105.[1] (2 sheets)

Measurement	Breather/Vent	Sample Riser	Dome Space	Breathing Zone
Riser 15A, second measurement				
Percent of LFL	0	0	---	0
Ammonia (ppmv)	50	0	---	0
TOC(ppmv)	6-8	0	---	0
Oxygen (percent)	21	21	---	21

Note:

[1]ppm = parts per million

B2.9 RESULTS FROM PREVIOUS SAMPLING EVENTS

The results of the four historical sludge sampling events are presented in the following subsections, beginning with the earliest sampling event.

B2.9.1 Results of Early 1986 Sludge Sampling Event

The supernatant from the early 1986 sampling event was analyzed by ICP and IC directly. The water soluble solids and water soluble sludge were first mixed with 1,000 g of de-ionized water/g of solids or sludge, and the centrifuged solids and sludge were first dissolved in 1,000 g of 0.8 *M* nitric acid/g of solids or sludge. Regarding the radionuclide analyses, the supernatant was analyzed following acidification, and the water soluble solids and water soluble sludge were analyzed after being mixed with 1,000 g of de-ionized water/g of solids or sludge following acidification. The centrifuged solids were first dissolved in 1,000 g of 0.8 *M* nitric acid/g of solids, and the 0.21 g sludge sample was first treated with 20 g of de-ionized water and acidified.

Based on the $^{239/240}$Pu result of 0.563 μCi/g, the waste is classified as TRU waste. Table B2-50 presents the results of this sampling event. For further details, see Scheele and McCarthy (1986). These data have not been validated and should be used with caution.

Table B2-50. Early 1986 Sludge Results for Tank 241-AW-105.[1] (3 sheets)

Analyte	Supernatant	Water Soluble Solids	Centrifuged Solids	Water Soluble Sludge	Sludge
Physical Data					
Supernate density (g/mL)	1.079	NR	NR	NR	NR
Sludge density (g/mL)	NR	NR	NR	1.20	1.20
Density (g/mL)	NR	NR	1.35	NR	NR
pH	13.2	9.7		7.3	NR
Total solids (wt%)	28				
Percent water (wt%)	72				
Chemical Analysis					
Fluoride (μg/g)	11,000	28,000	39,000	85,000	75,000
Chloride (μg/g)	4,000	1,000	2,000	1,000	2,000
Nitrite (μg/g)	5,000	3,700	NR	4,500	NR
Nitrate (μg/g)	28,000	21,000	NR	25,000	NR
Phosphate (μg/g)	<2,000	<1,000	<26,000	<1,000	<25,000
Sulfate (μg/g)	11,000	9,000	<90,000	5,800	85,000[2]
TOC (μg C/g)	3,200	NR	5,200	5,400	5,200
Carbonate (μg/g)	52,000	NR	NR	63,000	NR
Hydroxide (μg/g)	12,000	NR	12,000	NR	11,000
Ammonia (μg/g)	1,800	NR	220	NR	390
Group I[3]					
Aluminum (μg/g)	410	430	1,200	95	960
Barium (μg/g)	NR	50	110	15	70
Calcium (μg/g)	40	110	240	36	200
Chromium (μg/g)	30	25	200	20	170
Iron (μg/g)	NR	30	450	10	320
Potassium (μg/g)	12,600	10,400	12,800	11,800	12,300
Lanthanum (μg/g)	NR	NR	530	NR	340
Magnesium (μg/g)	90	40	10	30	10
Manganese (μg/g)	NR	NR	10	NR	10
Molybdenum (μg/g)	220	25	NR	20	15

Table B2-50. Early 1986 Sludge Results for Tank 241-AW-105.[1] (3 sheets)

Analyte	Supernatant	Water Soluble Solids	Centrifuged Solids	Water Soluble Sludge	Sludge
Group I[3] (Cont'd)					
Sodium (μg/g)	38,400	56,700	82,000	1.10E+05	1.12E+05
Neodymium (μg/g)	NR	NR	180	NR	80[2]
Nickel (μg/g)	NR	30	80	30	60
Ruthenium (μg/g)	NR	NR	<30	NR	100[2]
Silicon (μg/g)	NR	600	1,500	280	1,100
Zirconium (μg/g)	NR	6,200	1.16E+05	2,200	79,000
Group II[4]					
Silver (μg/g)	<240	<100	310[2]	<100	200[2]
Arsenic (μg/g)	<2,400	<960	<1,000	<980	<1,000
Cadmium (μg/g)	<120	<50	<50	<50	<50
Copper (μg/g)	<120	<50	<50	<50	<50
Mercury (μg/g)	<12,000	<4,800	<5,200	<4,900	<5,100
Lead (μg/g)	<1,200	<480	4,600	<490	3,100
Antimony (μg/g)	<1,200	<480	<500	<490	<500
Selenium (μg/g)	<4,700	<1,900	<2,100	<2,000	<2,000
Tin (μg/g)	<1,200	<480	940[2]	<490	1,200[2]
Radionuclide Analysis					
^{144}Ce (μCi/g)	0.421	3.63	48.7	NR	32.8
^{137}Cs (μCi/g)	45.9	46.2	42.3	33	36.9
^{134}Cs (μCi/g)	1.88	1.85	1.7	1.12	1.49
^{103}Ru (μCi/g)	NR	NR	<1.4	NR	<0.8
^{106}Ru (μCi/g)	7.83	10.9	50.6	6.06	35.3
^{125}Sb/Te (μCi/g)	<0.05	1.97	17.7	1.62	11.1
^{95}Nb (μCi/g)	NR	9.95	224	0.845	122
^{95}Zr (μCi/g)	NR	5.12	108	0.47	57.1
$^{239/240}$Pu (μCi/g)	1.07E-04	0.0666	0.786	0.0172	0.563
^{239}Pu[5] (μCi/g)	7.79E-05	0.0482	0.572	0.0125	0.41
^{240}Pu[5] (μCi/g)	2.91E-05	0.018	0.214	0.00469	0.153

Table B2-50. Early 1986 Sludge Results for Tank 241-AW-105.[1] (3 sheets)

Analyte	Supernatant	Water Soluble Solids	Centrifuged Solids	Water Soluble Sludge	Sludge
Radionuclide Analysis (Cont'd)					
$^{241}Pu^{5}$ (μCi/g)	0.00224	1.39	16.5	0.361	11.8
Total uranium (μg/g)	6.92	1,540	7,040	0.0254	6,580
^{241}Am (μCi/g)	9E-06	0.0208	0.169	0.0115	0.112
^{90}Sr (μCi/g)	0.00337	2.92	15.2	0.363	10.8
^{99}Tc (μCi/g)	0.0115	0.0104	0.0166	0.00955	0.0137
^{14}C (μCi/g)	9.18E-05	0.0805	0.0152	<0.00477	0.00236
^{129}I (μCi/g)	2.8E-05	< 2E-05	1.89E-05	NR	3.56E-05
Total alpha activity (μCi/g)	2.32E-04	0.0943	1.02	0.0387	0.739
Total beta activity (μCi/g)	61.5	8.48	349	43.0	230

Notes:

[1]Scheele and McCarthy (1986). Pre-1989 analytical data have not been validated and should be used with caution.

[2]At or near detection limit.

[3]Group I elements measured using direct reader spectrometer of the ICP.

[4]Group II elements measured using scanning reader spectrometer of the ICP.

[5]Calculated using ^{239}Pu + ^{240}Pu analysis and isotopic mass ratios ^{240}Pu: ^{239}Pu and ^{241}Pu: ^{239}Pu.

B2.9.2 Results of July 1986 Sludge Sampling Event

A blended, representative sample of each solids bearing segment was submitted for analysis. Replicate samples were also submitted for segments 6, 8, and 10. A composite sample was prepared by mixing equal portions of segments six through ten (Peters 1986). The "white" samples dissolved in about 3 *M* nitric acid with only a trace of turbidity. The two dark colored samples did not completely dissolve initially. After stirring and diluting by a factor of 250 in 2 *M* nitric acid, no undissolved residue was observed. All samples were stirred before sample aliquots were taken (Leaf 1986). All results are reported per gram of settled solids.

To verify the accuracy of the TRU analysis method, two samples of synthetic NCRW, spiked with known amounts of plutonium and americium, were also submitted for analysis. The results of this spike analysis indicate that a high degree of confidence can be placed on the plutonium and americium results (Peters 1986).

Tank 241-AW-105 was found to contain TRU elements in excess of the targeted 0.1 μCi/g of solids. Rare earth elements such as lanthanum were also found in greater concentrations than expected. Table B2-51 gives the results of the July 2, 1986 sampling and analysis event. For further information, see Peters (1986), Peters and Patterson (1986), and Leaf (1986). These data have not been validated and should be used with caution.

B2.9.3 Results of September 1986 Sludge Sampling Event

Table B2-52 gives the analytical results of the September 1986 sampling event. All results are based on the sample weight before settling or centrifuging (Leaf and McCown 1987). No further information regarding sample analysis was provided.

The results from this core were compared to the results of the core removed from riser 13A on July 2, 1986, and no significant differences between the two sets of data were found (Sasaki 1987). These data have not been validated and should be used with caution.

Table B2-51. July 2, 1986 Sludge Results for Tank 241-AW-105.[1,2,3,4] (2 Sheets)

Analyte	Seg. 5	Seg. 6	Seg. 6	Seg. 7	Seg. 8	Seg. 8	Seg. 9	Seg. 10	Seg. 10	Composite	Lab Units
Physical Data											
Density	1.22	1.34		1.28	1.36	1.35	1.41	1.44	1.39	1.39	g/mL
[2]Density settled solids	1.22	1.74	1.34	1.28	1.36	1.35	1.41	1.44	1.39	1.39	g/mL
[2]Density centrifuged solids	1.22	1.73	1.34	1.30	1.37	1.35	1.38	1.43	1.38	1.34	g/mL
[2]Centrifuged solids	90	97	94	84	93	91	95	100	100	97	vol%
[3]Percent water	NR	NR	NR	NR	63		NR	NR	NR	NR	wt%
Chemical Analysis											
Lanthanum	0.04	0.07	0.07	0.06	0.04	0.04	<0.01	<0.01	<0.01	0.03	wt%
Zirconium	5.09	7.44	7.70	6.53	7.27	7.48	8.20	2.91	3.11	6.89	wt%
Tin	0.04	0.07	0.07	0.05	0.06	0.07	0.08	0.08	0.07	0.07	wt%
Aluminum	<0.05	0.1	<0.08	<0.09	0.11	0.12	0.16	0.67	0.65	0.26	wt%
Sodium	6.57	9.91	9.69	9.02	12.2	12.6	12.5	10.7	10.7	11.1	wt%
Manganese	NR	NR	NR	NR	NR	NR	NR	0.56	0.57	0.12	wt%
Chromium	NR	0.01	<0.01	<0.01	<0.01	<0.01	NR	0.35	0.33	0.1	wt%
Uranium	0.18	0.47	0.48	0.45	0.48	0.47	1.38	6.02	5.95	1.07	wt%
Iron	0.02	0.09	0.04	0.03	0.06	0.05	0.04	1.05	0.97	0.24	wt%
Potassium	1.3	1.2	1.2	1.0	0.8	0.8	<0.5	<0.2	<0.2	<0.7	wt%

Table B2-51. July 2, 1986 Sludge Results for Tank 241-AW-105.[1,2,3,4] (2 Sheets)

Analyte	Seg. 5	Seg. 6	Seg. 6	Seg. 7	Seg. 8	Seg. 8	Seg. 9	Seg. 10	Seg. 10	Composite	Lab Units
Radiological Analysis											
$^{239/240}Pu$	0.266	0.524	0.520	1.137	0.382	0.368	0.666	0.527	0.546	0.636	μCi/g
^{241}Am	0.019	0.037	0.029	0.504	0.018	0.019	0.042	2.178	1.170	0.400	μCi/g

Notes:

[1]Leaf (1986)
[2]Peters (1986)
[3]Peters and Patterson (1986)
[4]Pre-1989 data have not been validated and should be used with caution.

Table B2-52. September 1986 Sludge Results for Tank 241-AW-105.[1,2,3] (3 sheets)

Analyte	Seg. 2A	Seg. 3A	Seg. 4A	Seg. 5A	Seg. 6A	Seg. 6B	Composite	Lab Units
Physical Data								
Settled solids	96	100	88	99	100	100	96.6	%
Density	1.17	1.18	1.43	1.34	1.41	1.36	1.30	g/mL
Centrifuged solids	64	78	78	86	77	94	77.7	%
Density	1.3	1.29	1.37	1.38	1.57	1.37	1.37	g/mL
Percent water	73	70	65	57	53	53	63.6	wt%
Chemical Analysis								
Uranium	7.6	5.07	6.72	8.04	9.02	40.8	9.3	g/L
TOC	1.12	3.693	6.249	7.236	13.409	21.216	6.83	g C/L
Carbonate	0.071	0.069	0.084	0.163	0.371	0.519	0.161	*M*
Aluminum	0.0269	0.035	0.0567	0.109	0.25	0.498	0.111	*M*
Boron	0.0281	0.0251	0.086	0.0645	0.0326	0.0151	0.0462	*M*
Barium	7.67E-04	8.59E-04	0.00156	0.00127	0.00113	6.93E-04	0.00109	*M*
Calcium	0.00204	0.00324	0.00678	0.00501	0.0204	0.168	0.0168	*M*
Cerium	NR	NR	NR	NR	NR	0.00272	1.72E-04	*M*
Chromium	0.00202	0.00227	0.00330	0.00387	0.00922	0.192	0.0157	*M*
Iron	0.00398	0.00444	0.00666	0.0101	0.00631	0.438	0.0336	*M*
Potassium	0.389	0.332	0.311	0.223	0.101	0.0661	0.269	*M*
Lanthanum	0.00438	0.0045	0.00576	9.65E-05	1.42E-04	6.85E-04	0.00301	*M*
Magnesium	9.63E-04	0.00194	0.00471	0.00276	0.00174	0.0772	0.00719	*M*
Manganese	NR	8.59E-05	1.04E-04	2.44E-04	0.00693	0.272	0.0182	*M*

Table B2-52. September 1986 Sludge Results for Tank 241-AW-105.[1,2,3] (3 sheets)

Analyte	Seg. 2A	Seg. 3A	Seg. 4A	Seg. 5A	Seg. 6A	Seg. 6B	Composite	Lab Units
Chemical Analysis (Cont'd)								
Molybdenum	NR	NR	NR	NR	NR	4.25E-04	2.69E-05	*M*
Sodium	3.87	4.36	6.72	7.58	8.22	5.38	5.97	*M*
Neodymium	0.00146	0.00155	0.00178	1.86E-04	4.89E-04	0.00236	0.00121	*M*
Nickel	5.98E-04	8.04E-04	0.00122	0.00274	0.00504	0.0229	0.00321	*M*
Rhodium	NR	NR	NR	NR	NR	0.0041	2.59E-04	*M*
Ruthenium	NR	NR	NR	NR	0.00151	0.00387	4.51E-04	*M*
Silicon	0.0916	0.0924	0.351	0.248	0.113	0.0692	0.177	*M*
Strontium	4.01E-05	6.73E-05	1.14E-04	9.18E-05	1.29E-04	7.76E-04	1.29E-04	*M*
Tellurium	NR	NR	NR	NR	4.42E-04	0.00107	1.28E-04	*M*
Titanium	7.33E-04	7.39E-04	8.96E-04	0.00112	0.00118	0.00142	9.48E-04	*M*
Zinc	NR	NR	NR	NR	4.31E-04	0.0025	2.17E-04	*M*
Zirconium	0.782	0.879	1.08	1.28	1.24	0.24	0.989	*M*
Ammonia	0.127	0.089	0.134	0.08	0.049	0.007	0.0932	*M*
Hydroxide	0.757	0.694	0.504	0.63	0.663	0.384	0.632	*M*
Fluoride	2.525	3.105	5.043	5.289	4.482	0.587	3.84	*M*
Chloride	0.01	0.01	0.01	0.02	0.028	0.031	0.0158	*M*
Nitrite	0.074	0.085	0.131	0.271	0.509	0.591	0.219	*M*
Nitrate	0.283	0.324	0.369	0.713	1.233	1.294	0.588	*M*
Sulfate	0.01	0.012	0.015	0.012	0.022	0.028	0.0147	*M*

Table B2-52. September 1986 Sludge Results for Tank 241-AW-105.[1,2,3] (3 sheets)

Analyte	Seg. 2A	Seg. 3A	Seg. 4A	Seg. 5A	Seg. 6A	Seg. 6B	Composite	Lab Units
Radiological Analysis								
$^{239/240}Pu$	412	1,003	381	610	481	883	603	nCi/g
^{241}Am	28	425	83	42	250	1,820	265	nCi/g
^{95}Nb	20,400	60,100	27,000	911	NR	NR	27,100	µCi/L
^{95}Zr	9,280	29,000	12,400	487	NR	NR	12,800	µCi/L
^{106}Ru	25,900	26,800	35,300	23,800	21,000	9,010	25,800	µCi/L
^{125}Sb	9,750	8,450	12,700	13,900	14,000	3,330	11,100	µCi/L
^{134}Cs	1,700	1,370	1,190	779	412	NR	1,060	µCi/L
^{137}Cs	39,000	31,000	34,900	67,000	1.12E+05	1.54E+05	59,400	µCi/L
^{144}Ce	32,000	31,000	35,700	23,800	16,500	85,800	32,200	µCi/L
^{60}Co	205	292	225	447	457	67.4	301	µCi/L
^{154}Eu	NR	NR	NR	NR	1,230	4,730	466	µCi/L
^{155}Eu	NR	NR	NR	NR	1,300	5,950	553	µCi/L
^{238}Pu	21	145	77	33	60	90	69.1	nCi/g
^{239}Pu	322	653	283	480	378	681	442	nCi/g
^{240}Pu	90	350	98	130	102	202	160	nCi/g
^{241}Pu	5,058	26,182	6,263	7,159	5,557	7,336	10,200	nCi/g
^{242}Pu	0.009	0.128	0.023	0.01	0.009	0.03	0.0374	nCi/g

Notes:

[1]Brevick et al. (1995)
[2]Leaf and McCown (1987).
[3]Pre-1989 data have not been validated and should be used with caution.

B2.9.4 Results of May 1990 Sludge Sampling Event

Segments 1 through 3 were received by the PNL 325 Laboratory on May 17, 1990, segments 4 through 6 were received on May 23, 1990 and segment 7 was received on June 6, 1990. Analyses of the waste were performed during the latter half of 1990.

Segments 1 and 2 contained 205 mL and 245 mL of opaque liquid, respectively, with no observable solids. Segments 3 through 7 contained no free liquids. Segment 3 appeared as a gray slurry on the top 28 cm. With increasing depth, the color lightened from gray to white at 28 cm near the bottom and could not hold its shape. Segment 4 was a white sludge, similar to the material at the bottom of segment 3. The material in segment 5 was dry and broke off into chunks upon extrusion. The material was white with the exception of some brown and black spots. The first 18 cm of segment 6 appeared similar to segment 5, but with streaks of brown. The bottom 30 cm were grayish white and had a margarine-like consistency. Segment 7 was very dark in color with white marbling in the top 10 cm. The material in segment 7 was harder than the previous segments (Tingey and Simpson 1994).

Select segments, composites, and dilutions were prepared for analysis of chemical and radiochemical components.. The segment 6 and the segment 3 to 6 composite were centrifuged and the centrifuged solids and decanted liquid were analyzed separately. The segment 5 and 7 and segment 3-4 composite solids were not centrifuged before analysis. Before analysis, two fusions of each of the solids were performed, and liquids were filtered through a 0.2 micrometer filter. The first fusion was a sodium peroxide fusion in a zirconium crucible, and the second was a potassium hydroxide fusion in a nickel crucible. The fusions were dissolved in hydrochloric acid. The chemical and radiochemical analyses were then performed on these solutions. To determine transuranic content, the analysis of solids was run on a sodium peroxide fusion of the samples. A water leach of each solid and a dilution of each liquid was used before measurement of the anions by IC. Rheological measurements were performed on segment 5 (Tingey and Simpson 1994). The sludge results of the 1990 core sampling event are given in Tables B2-53 through B2-56. Table B2-57 presents the estimated solids concentration based on the analytical results (DiCenso et al. 1994)

Table B2-53. 1990 Core Sample Results for Tank 241-AW-105: Solids.[1] (4 sheets)

Analyte	Segment[2]				
	3-4 Composite	5	6	7	3-6 Composite
Elemental Analysis (wt%)					
Ag	(0.0017)[3]	0.0218	0.0314	0.0119	0.0144
Al	0.324	0.252	0.332	3.66	0.352
As	0.0476	0.0817	0.0616	0.0509	0.0509
B	(0.12)	0.0467	0.0467	0.0467	0.0467
Ba	0.0209	0.0184	0.0168	0.0086	0.0194
Be	0.016	0.0138	0.0139	0.00155	0.0172
Ca	0.0944	0.0694	0.0696	0.0977	0.134
Cd	(0.0024)	0.0116	0.0116	0.0116	0.0116
Ce	(0.063)	(0.13)	(0.13)	(0.13)	(0.13)
Co	0.0903	0.29	0.29	0.29	0.29
Cr	0.0676	0.0522	0.0477	1.75	0.0868
Cr(VI)	n/r	n/r	n/r	0.283	0.0170
Cu	0.0273	0.0130	0.0175	0.0294	0.0285
Dy	0.00355	0.0075	0.0075	0.0075	0.0075
Fe	0.359	0.172	0.158	1.94	0.568
K	2.02	2.37	1.029	0.471	3.65
La	0.180	0.200	0.0213	0.0165	0.255
Li	(0.014)	(0.0032)	(0.0032)	(0.0032)	(0.0032)
Mg	0.0091	0.0041	0.0081	0.058	0.0131
Mn	0.0954	0.0106	0.0152	0.55	0.211
Mo	0.003	0.0051	0.0051	0.0079	0.0051
Na	27.0	27.0	28.7	25.5	25.8
Nd	0.0949	0.0627	0.0351	0.042	0.0658
Ni	0.0377	0.0178	0.0288	0.0556	0.0261
P	0.432	0.586	0.123	0.250	0.285
Pb	0.0337	0.0700	0.0598	0.136	0.0598
Re	0.0089	0.0105	0.0105	0.0105	0.0105
Rh	0.0449	0.109	0.0801	0.0587	0.0587

Table B2-53. 1990 Core Sample Results for Tank 241-AW-105: Solids.[1] (4 sheets)

Analyte	Segment[2]				
	3-4 Composite	5	6	7	3-6 Composite
Elemental Analysis (wt%) (Cont'd)					
Ru	(0.034)	0.0397	0.0397	0.0397	0.0397
Sb	(0.080)	0.0611	0.0611	0.0611	0.0611
Se	(0.096)	0.124	0.124	0.124	0.124
Si	0.888	0.827	0.492	0.306	0.659
Sr	0.0024	0.0019	0.00205	0.0023	0.00255
Te	0.0433	0.0566	0.0566	0.0566	0.0566
Th	0.0936	0.129	0.129	0.129	0.129
Ti	0.0047	0.0196	0.0162	0.0068	0.0141
Tl	(0.98)	(1.4)	(1.4)	(1.4)	(1.4)
U	0.310	2.44	3.06	1.25	1.90
V	0.00725	0.0081	0.0081	0.0081	0.0081
Zn	0.0747	0.0251	0.0138	0.032	0.0171
Zr	23.8	21.0	21.6	2.36	23.2
Anion and Other Chemical Analyses (μg/g)					
F (μg/mL)	86800	170000	150000	22000	71800
Cl	1820	2800	2500	1900	1500
Br	(300)	(200)	(200)	(200)	(5)
NO_2	12100	18000	19000	30000	7700
NO_3	41500	46000	42000	81000	21500
PO_4	1120	2900	(500)	1300	(1000)
SO_4	2600	3100	1800	5600	1000
CO_3 (wt% C)	1.6	0.24	0.42	0.57	0.19
TOC (wt% C)	0.3	0.41	0.35	2.93	0.29
TC (wt% C)	1.9	0.65	0.77	3.68	0.48

Table B2-53. 1990 Core Sample Results for Tank 241-AW-105: Solids.[1] (4 sheets)

Analyte	Segment[2]				
	3-4 Composite	5	6	7	3-6 Composite
Radiochemical Analyses (nCi/g)					
^{3}H	n/r	n/r	n/r	16.8	5.41
^{14}C	n/r	n/r	n/r	2.7	0.300
^{79}Se	n/r	n/r	n/r	(32.4)	(2.66)
^{90}Sr	n/r	n/r	n/r	3.00E+05	81,500
^{94}Nb	n/r	n/r	n/r	(2.26)	27.2
^{99}Tc	n/r	n/r	n/r	(90.1)	53.6
^{129}I	n/r	n/r	n/r	(3.47)	1.52
^{237}Np	n/r	n/r	n/r	3.45	2.47
^{241}Am	1,500	1,950	745	5,430	1,040
$^{243/244}Cm$	16.2	n/d	n/d	376	30.9
^{238}Pu & ^{241}Am	1,020	2,000	437	NR	NR
$^{239/240}Pu$	3,040	2,980	1,780	237	2,870
^{238}Pu	NR	NR	NR	(608)	291
^{60}Co	560	532	496	597	430
^{106}Ru	19,100	8,220	5,240	n/d	5,990
^{125}Sb	13,900	12,500	14,800	n/d	10,800
^{134}Cs	1,710	994	613	n/d	548
^{137}Cs	1.04E+05	82,900	83,200	1.76E+05	69,200
^{144}Ce	29,900	4,140	3,610	n/d	6,580
^{154}Eu	n/d	939	n/d	8,900	410

Table B2-53. 1990 Core Sample Results for Tank 241-AW-105: Solids.[1] (4 sheets)

Analyte	Segment[2]				
	3-4 Composite	5	6	7	3-6 Composite
Radiochemical analyses (nCi/g) (Cont'd)					
^{155}Eu	1,550	433	821	11,100	649
Total alpha	4,140	4,950	2,220	NR	NR
Total beta	n/r	n/r	n/r	8.20E+05	2.54E+05

Notes:

n/d = not detected
n/r = analysis not required
NR = not reported

[1]Tingey and Simpson (1994)

[2]Segment 6 and segment 3-6 composite are centrifuged solids analyses, segments 5 and 7 and segment 3-4 composite were not centrifuged.

[3]A value in parentheses indicates that the analyte was not detected. The values in the parentheses are the instrument detection limit achievable for samples that contain low concentrations of all elements.

Table B2-54. 1990 Core Sample Results for Tank 241-AW-105: Liquids.[1] (3 sheets)

Analyte	Segment					
	1-2 Composite	3-4 Composite	5	6	7	3-6 Composite
Elemental Analysis (μg/mL)						
Ag	(0.169)	n/r	n/r	(0.169)	n/r	(0.169)
Al	906	n/r	n/r	1130	n/r	684
As	6.76	n/r	n/r	9.12	n/r	11.1
B	3.27	n/r	n/r	19.9	n/r	5.96
Ba	0.25	n/r	n/r	4.54	n/r	2.13
Be	0.785	n/r	n/r	2.65	n/r	2.7
Ca	7.86	n/r	n/r	8.03	n/r	19.4
Cd	0.1	n/r	n/r	0.29	n/r	0.12
Ce	(1.2)	n/r	n/r	(1.2)	n/r	(1.2)
Co	(2.2)	n/r	n/r	(2.2)	n/r	(2.2)
Cr	32.5	n/r	n/r	23.9	n/r	133
Cr(VI)	22.2	n/r	n/r	n/r	n/r	(4.5)
Cu	0.45	n/r	n/r	23.7	n/r	15.2
Dy	(0.051)	n/r	n/r	(0.051)	n/r	(0.051)
Fe	0.665	n/r	n/r	1.27	n/r	1.27
K	13700	n/r	n/r	8910	n/r	14900
La	(0.13)	n/r	n/r	(0.13)	n/r	(0.13)
Li	(0.086)	n/r	n/r	(0.086)	n/r	(0.086)
Mg	0.355	n/r	n/r	0.34	n/r	0.525
Mn	0.04	n/r	n/r	0.09	n/r	0.07
Mo	2.78	n/r	n/r	11.9	n/r	7.45
Na	32200	n/r	n/r	58600	n/r	50500
Nd	(0.28)	n/r	n/r	(0.28)	n/r	(0.28)
Ni	0.99	n/r	n/r	200	n/r	70.9
P	317	n/r	n/r	959	n/r	1180
Pb	1.76	n/r	n/r	1.1	n/r	1.1
Re	(0.11)	n/r	n/r	0.3	n/r	0.3
Rh	0.4	n/r	n/r	168	n/r	(0.28)

Table B2-54. 1990 Core Sample Results for Tank 241-AW-105: Liquids.[1] (3 sheets)

Analyte	Segment					
	1-2 Composite	3-4 Composite	5	6	7	3-6 Composite
Elemental Analysis (μg/mL) (Cont'd)						
Ru	0.5	n/r	n/r	3.87	n/r	1.5
Sb	(0.51)	n/r	n/r	1.2	n/r	0.5
Se	(1.23)	n/r	n/r	1.4	n/r	(1.24)
Si	213	n/r	n/r	2030	n/r	5340
Sr	0.02	n/r	n/r	0.105	n/r	0.04
Te	(0.41)	n/r	n/r	(0.41)	n/r	(0.41)
Th	(0.78)	n/r	n/r	(0.78)	n/r	(0.79)
Ti	(0.091)	n/r	n/r	(0.091)	n/r	(0.092)
Tl	(12)	n/r	n/r	(12)	n/r	(12)
U	16.7	n/r	n/r	11	n/r	(5.8)
V	0.1	n/r	n/r	(0.069)	n/r	(0.070)
Zn	4.75	n/r	n/r	2.78	n/r	1.73
Zr	0.45	n/r	n/r	5.27	n/r	0.74
Anion and other chemical analyses (μg/mL)						
NH_3 (m*M*)	59.99	0.79	48.26	44.01	8.94	5.57
F	8300	n/r	n/r	8000	n/r	7700
Cl	440	n/r	n/r	1300	n/r	880
Br	(40)	n/r	n/r	(200)	n/r	(500)
NO_2	4900	n/r	n/r	19500	n/r	11000
NO_3	24000	n/r	n/r	49000	n/r	37000
PO_4	660	n/r	n/r	(400)	n/r	900
SO_4	1760	n/r	n/r	1800	n/r	2100
OH (*N*)	0.76	n/r	n/r	n/r	n/r	0.768
CO_3 (wt% C)	0.12	n/r	n/r	0.1	n/r	0.26
TOC (wt% C)	0.06	n/r	n/r	0.002	n/r	0.485
TC (wt% C)	0.18	n/r	n/r	0.1	n/r	0.745
pH (unitless)	13.18	n/r	n/r	n/r	n/r	13.43

Table B2-54. 1990 Core Sample Results for Tank 241-AW-105: Liquids.[1] (3 sheets)

Analyte	Segment					
	1-2 Composite	3-4 Composite	5	6	7	3-6 Composite
Radiochemical analyses (nCi/mL)						
^{3}H	6.58	n/r	n/r	n/r	n/r	5.9
^{14}C	12.4	n/r	n/r	n/r	n/r	0.910
^{79}Se	0.0215	n/r	n/r	n/r	n/r	(0.0338)
^{90}Sr	0.382	n/r	n/r	n/r	n/r	(11.7)
^{94}Nb	(0.00482)	n/r	n/r	n/r	n/r	(0.00376)
^{99}Tc	6.85	n/r	n/r	n/r	n/r	31.2
^{129}I	0.0269	n/r	n/r	n/r	n/r	0.0241
^{237}Np	(0.00189)	n/r	n/r	n/r	n/r	0.0155
^{241}Am	0.0991	n/r	n/r	n/d	n/r	0.00419
$^{243/244}$Cm	0.0286	n/r	n/r	0.287	n/r	0.000653
^{238}Pu & ^{241}Am	NR	n/r	n/r	0.730	n/r	NR
$^{239/240}$Pu	(0.0450)	n/r	n/r	0.402	n/r	0.00946
^{238}Pu	(0.0450)	n/r	n/r	NR	n/r	0.00236
^{60}Co	21.0	n/r	n/r	131	n/r	102
^{106}Ru	935	n/r	n/r	1,730	n/r	923
^{125}Sb	n/d	n/r	n/r	n/d	n/r	n/d
^{134}Cs	583	n/r	n/r	374	n/r	493
^{137}Cs	46,800	n/r	n/r	85,100	n/r	67,100
^{144}Ce	n/d	n/r	n/r	n/d	n/r	n/d
^{154}Eu	n/d	n/r	n/r	n/d	n/r	n/d
^{155}Eu	n/d	n/r	n/r	n/d	n/r	n/d
Total alpha	NR	n/r	n/r	1.44	n/r	NR
Total beta	49,500	n/r	n/r	n/r	n/r	70,700

Notes:

n/d = not detected
n/r = analysis not required

Table B2-55. Tank 241-AW-105 1990 Core Sample: Physical Properties.

Analyte	Segment							
	1-2	3-4	5	5 1:1	5 1:3	6	7	3-6
Sample density (g/mL)	1.08	1.35	1.40	1.22	1.16	1.44	1.50	1.39
Centrifuged supernate density (g/mL)	1.08	1.21	n/r	n/r	n/r	1.09	n/r	1.01
Centrifuged solids density (g/mL)	n/a	1.42	n/r	n/r	n/r	1.59	n/r	1.58
Vol% settled solids	n/a	100[1]	100[1]	96.9	85.6	100[1]	n/r	100[1]
Wt% settled solids	n/a	100	100	n/r	n/r	100	n/r	100
Vol% centrifuged solids	n/a	63.1	75	38	26	70	n/r	71
Wt% centrifuged solids	n/a	66.8	n/r	n/r	n/r	77.3	n/r	78
Wt% Total solids	7.84	31.2	39.3	25.7	23.0	42.8	58.5	41.6
Wt% oxides	n/r	n/r	n/r	n/r	n/r	n/r	35.8	35.6
Shear strength (10^4 dyne/cm)	n/r	n/r	1.64	n/r	n/r	n/r	n/r	n/r
Penetration Resistance (PSI)	n/r	n/r	3	n/r	n/r	n/r	6	n/r

Notes:

n/a = not applicable

[1]No settling observed after 2 days.

Table B2-56. Linear Fit Parameters for Shear Stress versus Shear Rate.[1]

Waste:Water Dilution	Run	Yield Stress (Pa)	Consistency Index (Pa·s)	Correlation Coefficient[2]
1:1	1	10.3	0.0122	0.9804
	2	9.62	0.0124	0.9899
1:3	1	3.29	0.00806	0.9736
	2	3.37	0.00759	0.9896

Notes:

[1]Parameters to the bingham plastic model $\tau = a + b\gamma$ where τ is the shear stress (Pa), a is the yield stress (Pa), b is the consistency index (Pa·s), and γ is the shear rate (1/s).

[2]Correlation coefficient provides a measure of the fit between the bingham plastic model and the behavior of the tank 241-AW-105 waste dilutions (a perfect fit would be a coefficient of 1).

Table B2-57. 1990 Sludge Results for Tank 241-AW-105.[1] (4 sheets)

Analyte	Result
Metals	(μg/g)
Aluminum	9,840
Antimony	649
Arsenic	585
Barium	168
Beryllium	125
Boron	467
Cadmium	116
Calcium	930
Cerium	<1,300
Chromium	4,010
Cobalt	2,500
Copper	232
Dysprosium	67.1
Iron	6,390
Lanthanum	1,350
Lead	719

Table B2-57. 1990 Sludge Results for Tank 241-AW-105.[1] (4 sheets)

Analyte	Result
Metals (Cont'd)	(μg/g)
Lithium	<32.0
Magnesium	185
Manganese	1,760
Molybdenum	52.4
Neodymium	601
Nickel	332
Phosphorus	3,350
Potassium	19,100
Rhenium	102
Rhodium	703
Ruthenium	397
Selenium	1,240
Silicon	6,340
Silver	199
Sodium	26,800
Tellurium	539
Thallium	<14,000
Thorium	1,220
Titanium	123
Uranium	17,900
Vanadium	79.3
Zinc	325
Zirconium	1.84E+05
Ions	(μg/g)
Bromide	181
Carbonate	30,200
Chloride	2,100
Chromium (VI)	0.150
Fluoride	1.00E+05
Nitrate	46,400

Table B2-57. 1990 Sludge Results for Tank 241-AW-105.[1] (4 sheets)

Analyte	Result
Ions (Cont'd)	(μg/g)
Nitrite	17,400
Phosphate	1,360
Sulfate	2,820
Radionuclides	(μCi/g)
^{241}Am (AEA)	2.13
^{241}Am (APC)	1.15
^{125}Sb	13.0
^{14}C	0.00150
^{144}Ce	11.1
^{134}Cs	0.966
^{137}Cs	103
^{60}Co	0.523
$^{243/244}$Cu	0.141
^{154}Eu	3.42
^{155}Eu	2.91
^{129}I	0.00250
^{237}Np	0.00296
^{94}Nb	0.00127
^{238}Pu	0.450
$^{239/240}$Pu	2.18
^{106}Ru	9.64
^{79}Se	0.0175
^{90}Sr	191
^{99}Tc	0.0719
^{3}H	0.0111
Total Alpha	3.77
Total Beta	537

Table B2-57. 1990 Sludge Results for Tank 241-AW-105.[1] (4 sheets)

Analyte	Result
Physical Properties and Other Analytes	
Density	1.42 g/mL
TOC	8,560 μg/g
TC	15,400 μg/g

Note:

[1]DiCenso et al. (1994)

B3.0 ASSESSMENT OF CHARACTERIZATION RESULTS

The purpose of this chapter is to discuss the overall quality and consistency of the current sampling results for tank 241-AW-105, and to present the results of the calculation of an analytical-based inventory.

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

B3.1 FIELD OBSERVATIONS

Full waste recovery was achieved from all of the grab samples obtained in August 1996. Due to a field error in the requested sampling depth for sample 5AW-96-13, the tank coordinator directed the laboratory to analyze sample 5AW-96-14 instead (Esch 1997). No other anomalies were noted.

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 of the pertinent QC tests were conducted on the 1996 grab samples, allowing a full assessment regarding the accuracy and precision of the data. The specific criteria for the analytes required by the waste compatibility DQO were given in the SAP (Sasaki 1996), whereas the criteria governing the opportunistic analytes were given in DOE (1995). Sample and duplicate pairs which had one or more QC results outside the specified criteria were identified by footnotes in the data summary tables (see Section B.2).

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

All standard recoveries were within the defined criterion. Total alpha activity had several spike recoveries slightly below the limit for the supernatant and interstitial liquid samples. This was probably due to matrix interference caused by the presence of suspended solids in the samples, which negatively impacted the reproducibility of the results. These spike recoveries were all above 70 percent, and thus within the method control limit (Esch 1997). Nitrate had one spike recovery and potassium and sodium had several spike recoveries outside the limits, probably due to the high dilutions required to measure the large analyte concentrations. The high concentrations of nitrate and sodium required high dilutions for the other IC and ICP analytes. These high dilutions in turn can cause poor or meaningless RPDs for those elements that were near the detection limit. Total organic carbon exhibited one RPD in excess of the limit for the centrifuged solids and one for the interstitial liquid. Because the results from the solid sample were consistent with the same sample from the other riser, and this sample was reported to be heterogeneous at the time of sample breakdown, no rerun was requested. Regarding the TOC interstitial liquid with a high RPD, a triplicate analyses, as well as an additional replicate analysis, were performed. These analyses were consistent with the original results, and the high RPD was probably due to suspended solids in the sample (Esch 1997). Four of the interstitial liquid and one of the supernatant samples for $^{89/90}Sr$ had RPDs outside the limits, also attributed to the presence of suspended solids. Total alpha activity had four RPDs outside the limit on the liquid samples due to suspended solids, as well as the low sample activities. Fluoride had one interstitial liquid RPD outside the limit, due to suspended solids, and $^{239/240}Pu$ had one centrifuged solid RPD slightly above the limit. DSC had two of four centrifuged solid RPDs outside the limits, possibly due to sample heterogeneity and small sample sizes, or to the small exothermic reactions. Finally, none of the samples exceeded the criteria for preparation blanks; thus, contamination was not a problem for any of the analytes.

In summary, the QC results were excellent, and the few minor discrepancies mentioned here and footnoted in the data summary tables should not impact either the validity or the use of the data.

B3.3 DATA CONSISTENCY CHECKS

Comparisons of different analytical methods can help to assess the consistency and quality of the data. A comparison was possible between the supernatant sulfur value as analyzed by ICP and the sulfate value as analyzed by IC. No other ICP/IC comparisons were possible due to non-detected values. In addition, mass and charge balances were calculated for both the supernatant and sludge layers to help assess the overall data consistency.

B3.3.1 Comparison of Results from Different Analytical Methods

The following data consistency check compares the result from two different analytical methods. Close agreement between the two methods strengthens the credibility of both results, whereas poor agreement brings the reliability of the data into question. The analytical mean results were taken from Table B3-8.

The supernatant analytical sulfur mean result as determined by ICP was 54.5 μg/mL, which converts to 163 μg/mL of sulfate. This compares with the IC sulfate mean results of 284 μg/mL as calculated using both the detected and non-detected values, and 199 μg/mL as calculated using the detected results only.

B3.3.2 Mass and Charge Balances

The principal objective in performing mass and charge balances is to determine if the measurements are consistent. Separate mass and charge balances were calculated for the supernatant and sludge layers because these waste phases were analyzed separately. The results of these comparisons are presented in Sections B3.3.2.1 and B3.3.2.2.

B3.3.2.1 Mass and charge balances for the supernatant. In calculating the mass and charge balances for the supernatant layer, only those analytes listed in Table B3-8 detected at a concentration of 1,000 μg/g or greater were considered. All analytical results were first converted from μg/mL to μg/g (using the supernatant specific gravity mean of 1.02 g/mL) before use in the tables. Because this portion of the tank is supernatant, the cations listed in Table B3-1 and the anions listed in Table B3-2 were all assumed to be present as ions. The acetate data was derived from the TOC analyses. The concentrations of the cationic and anionic species, along with the weight percent water results, were ultimately used to calculate the mass balance.

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

$$\text{Mass balance} = \%\ \text{Water} + 0.0001 \times \{\text{Total Analyte Concentration}\}$$

$$= \%\ \text{Water} + 0.0001 \times \{K^+ + Na^+ + C_2H_3O_2^- + OH^- + NO_3^- + NO_2^-\}$$

The total analyte concentrations calculated from the above equation is 51,000 μg/g. The mean weight percent water is 94.9 weight percent, or 949,000 μg/g. The mass balance resulting from adding the percent water to the total analyte concentration is 100 percent (Table B3-3).

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) = $[K^+]/39.1 + [Na^+]/23.0 = 628$ μeq/g

Total anions (μeq/g) = $[C_2H_3O_2^-]/59.0 + [OH^-]/17.0 + [NO_3^-]/62.0 + [NO_2^-]/46.0 =$ 742 μeq/g

The charge balance obtained by dividing the sum of the positive charge by the sum of the negative charge was 0.85. There is a net negative charge of 114 μeq/g.

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 for the supernatant are generally self-consistent.

Table B3-1. Supernatant Cation Mass and Charge Data.

Analyte	Concentration (μg/g)	Assumed Species	Concentration of Assumed Species (μg/g)	Charge (μeq/g)
Potassium	1,600	K^+	1,600	41
Sodium	13,500	Na^+	13,500	587
Total			15,100	628

Table B3-2. Supernatant Anion Mass and Charge Data.

Analyte	Concentration (μg/g)	Assumed Species	Concentration of Assumed Species (μg/g)	Charge (μeq/g)
TOC	2,320	$C_2H_3O_2^-$	5,700	97
Hydroxide	3,530	OH^-	3,530	208
Nitrate	25,400	NO_3^-	25,400	410
Nitrite	1,220	NO_2^-	1,220	27
Total			35,900	742

Table B3-3. Supernatant Mass Balance Totals.

Totals	Concentrations ($\mu g/g$)	Charge ($\mu eq/g$)
Cation total from Table B3-1	15,100	628
Anion total from Table B3-2	35,900	742
Weight percent water	949,000	0
Grand total	1,000,000	114

B3.3.2.2 Mass and charge balances for the sludge. In calculating the mass and charge balances for the sludge layer, only those analytes listed in Table B3-11 detected at a concentration of 2,000 μg/g or greater were considered. The positive charge attributed to sodium is usually expected to balance the negative charges exhibited by the anions. The concentrations of cationic species in Table B3-4, the anionic species in Table B3-5, and the weight percent water are then used to calculate the mass balance.

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

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

= % Water + 0.0001 x $\{Na^+ + UO_3 + ZrO(OH)_2 + C_2H_3O_2^- + F^- + OH^- + NO_3^- + NO_2^-\}$

The total analyte concentrations calculated from the above equation is 218,000 μg/g. The mean weight percent water was 75.5 percent, or 755,000 μg/g. The mass balance resulting from adding the percent water to the total analyte concentration is 97.3 percent (Table B3-6).

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

Total cations (μeq/g) = $[Na^+]/23.0$ = 2,800 μeq/g

Total anions (μeq/g) = $[C_2H_3O_2^-]/59.0 + [F^-]/19.0 + [OH^-]/17.0 + [NO_3^-]/62.0 + [NO_2^-]/46.0$ = 1,360 μeq/g

The charge balance obtained by dividing the sum of the positive charge by the sum of the negative charge was 2.06 in this instance, nowhere near the desired ratio of 1.0. The problem with the water digestions used to prepare the anions for analysis is that they measure only water soluble species. On the other hand, the fusion digestion used to prepare cations such as sodium for analysis obtains almost complete dissolution, allowing a more accurate measurement of their true presence in the waste.

Large amounts of NCRW waste is present in this tank. The NCRW contains large amounts of sodium, fluoride, and zirconium. Therefore, an assumption can be made that a large amount of insoluble fluoride is present. Thus, these adjustments are reflected in the mass and charge balances exhibited in Table B3-6. The charge differential of 1,440 μeq/g is multiplied by the atomic weight of fluoride to obtain the assumed insoluble fluoride concentration of 27,400 μg/g.

Table B3-4. Sludge Cation Mass and Charge Data.

Analyte	Concentration (μg/g)	Assumed Species	Concentration of Assumed Species (μg/g)	Charge (μeq/g)
Sodium	64,300	Na^+	64,300	2,800
Uranium	46,500	UO_3	55,900	0
Zirconium	33,400	$ZrO(OH)_2$	51,600	0
Total			172,000	2,800

Table B3-5. Sludge Anion Mass and Charge Data.

Analyte	Concentration (μg/g)	Assumed Species	Concentration of Assumed Species (μg/g)	Charge (μeq/g)
TOC	1,690	$C_2H_3O_2^-$	4,150	70
Fluoride	13,700	F^-	13,700	721
Hydroxide	2,210	OH^-	2,210	130
Nitrate	23,200	NO_3^-	23,200	374
Nitrite	2,910	NO_2^-	2,910	63
Total			46,200	1,360

Table B3-6. Sludge Mass Balance Totals.

Totals	Concentrations (μg/g)	Charge (μeq/g)
Cation total from Table B3-1	172,000	2,800
Anion total from Table B3-2	46,200	1,360
Weight percent water	755,000	0
Subtotal	973,000	(1,440)
Assume charge balanced by fluoride	27,400	1,440
Grand total	1,000,400	1.0

B3.4 MEAN CONCENTRATIONS AND CONFIDENCE INTERVALS

The following statistical evaluation was performed using the analytical data generated from tank 241-AW-105 grab samples obtained in August 1996 from two risers (riser 10A and riser 15A) at six depths each; three from the supernate layer and three from the sludge layer.

For both the supernate layer and the sludge layer, a mean concentration and the associated variability were calculated for each analyte. A two-sided 95 percent confidence interval for the mean concentration was also calculated for each analyte. The confidence interval takes into account the sampling and analytical uncertainties. The upper and lower limits of a two-sided 95 percent confidence interval for the mean are

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

In this equation, $\hat{\mu}$ is the estimate of the mean concentration, $\hat{\sigma}_{\hat{\mu}}$ is the estimate of the standard deviation of the mean concentration, and $t_{(df,0.025)}$ is the quantile from Student's t distribution with degrees of freedom (*df*) for a two-sided 95 percent confidence interval. The mean, $\hat{\mu}$, and the standard deviation of the mean, $\hat{\sigma}_{\hat{\mu}}$, were estimated using restricted maximum likelihood estimation (REML) methods.

B3.4.1 Mean Concentrations

The statistics in this section are based on analytical data from the August 1996 sampling event of tank 241-AW-105. The data were separated into two data sets: the supernatant analytical results and the sludge analytical results. Each data set was statistically evaluated using two different models. The first model used a nested analysis of variance (ANOVA) where the data are identified by grab sample within riser. The second model used one-way ANOVA where the data are identified by one variable (the grab sample). Analysis of variance techniques were used to estimate the mean and its associated variability for all analytes that had at least 50 percent of the reported data as quantitative values.

No ANOVA estimates were computed for analytes that had less than 50 percent of the reported data as quantitative values. For those analytes which had a mixture of both quantitative values and "less than" values, the ANOVA was computed using two different methodologies. Results of both methodologies are presented in the following tables and are footnoted to indicate the methodology used.

> The upper value of the "less than" result (for example, 3.5 for <3.5) was used to represent all "less than" analytical values in the first computation. This produces a bias of unknown magnitude in both the mean analyte concentration and the variance associated with the mean; the mean analyte concentration is biased high. The extension ".lt" was added to the analytes name in the tables to distinguish which analyte was statistically analyzed using "less than" values.
>
> The "less than" values were deleted in the second computation. Deleting data produces unbalanced data sets that complicates the statistical analysis. Deleting data decreases the number of degrees of freedom. Deleting data also produces a bias of unknown magnitude in both the mean analyte concentration and the variance associated with the mean. The extension ".nlt" was added to the analytes name in the tables to distinguish which analyte was statistically analyzed with no "less than" values.

The supernatant mean concentration estimates, along with the two-sided 95 percent confidence interval for the mean concentration, are given in Table B3-7 (nested ANOVA) and Table B3-8 (one-way ANOVA) for those analytes with at least 50 percent of the reported data as quantitative values. For some of the analytes, the lower limit of the 95 percent confidence interval was a negative value due to the magnitude of the variability. Since the actual concentration of a tank sample cannot be less than zero, the lower limit is reported as zero.

The analytes in Table B3-7 where $\hat{\sigma}_{riser}$ is significantly different from zero are footnoted. The one-way ANOVA model is more appropriate for those analytes where $\hat{\sigma}_{riser}$ is not significantly different from zero. The mean concentrations and the variances of the mean concentrations calculated using the two statistical models (one-way ANOVA and nested ANOVA) are not significantly different for these analytes.

The analytes which had less than 50 percent of the reported data as quantitative values are listed in Table B3-9. Table B3-9 cites the largest value observed from the six analytical results.

Table B3-7. Tank 241-AW-105 Supernatant Summary Statistics Mean Concentrations (nested ANOVA).

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	Lower Limit	Upper Limit
ICP.a.Ag	μg/mL	1.16	0.0888	1	0.0274	2.28
ICP.a.Al	μg/mL	28.6	12.0	1	0.00	181
ICP.a.B	μg/mL	3.31	0.549	1	0.00	10.3
IC.Cl^-	μg/mL	243	14.2	1	62.7	424
ICP.a.Co.lt	μg/mL	2.62E-04	1.63E-04	1	0.00	0.00233
ICP.a.Co.nlt	μg/mL	2.67E-04	1.60E-04	1	0.00	0.00229
ICP.a.Cr	μg/mL	1.20	0.569	1	0.00	8.43
GEA.^{137}Cs	μCi/mL	1.42	0.668	1	0.00	9.91
IC.F^-	μg/mL	311	160	1	0.00	2,340
ICP.a.K	μg/mL	1,630	347	1	0.00	6,030
IC.NO_2^-	μg/mL	1,240	113	1	0.00	2,670
IC.NO_3^-	μg/mL	25,900	1,680	1	4,480	47,300
ICP.a.Na	μg/mL	13,800	992	1	1,210	26,400
OH^-	μg/mL	3,600	332	1	0.00	7,820
ICP.a.P	μg/mL	20.1	6.88	1	0.00	107
ICP.a.S	μg/mL	54.5	8.19	1	0.00	159
IC.SO_4^{2-}.lt	μg/mL	284	92.2	1	0.00	1,460
IC.SO_4^{2-}.nlt	μg/mL	199	11.0	1	59.4	338
ICP.a.Si	μg/mL	45.3	3.04	1	6.61	83.9
SpG	---	1.02	0.00583	1	0.948	1.10
$^{89/90}Sr$	μCi/mL	0.0189	0.00419	1	0.00	0.0721
TIC[1]	μg/mL	306	119	1	0.00	1,820
TOC	μg/mL	2,370	817	1	0.00	12,800
TGA. % Water	wt%	94.9	0.307	1	91.0	98.8
ICP.a.Zn[1]	μg/mL	2.41	1.01	1	0.00	15.2
Direct.pH	pH units	13.5	0.0360	1	13.0	13.9

Notes:

.lt = Upper value of the "less thans" used in the statistical analysis.

.nlt = Less than values deleted in the statistical analysis.

[1] $\hat{\sigma}_{riser}$ is significantly different from zero.

Table B3-8. Tank 241-AW-105 Supernatant Summary Statistics Mean Concentrations (one-way ANOVA).

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	Lower Limit	Upper Limit
ICP.a.Ag	µg/mL	1.16	0.0765	5	0.960	1.35
ICP.a.Al	µg/mL	28.6	12.0	5	0.00	59.5
ICP.a.B	µg/mL	3.31	0.434	5	2.19	4.43
$IC.Cl^-$	µg/mL	243	14.2	5	207	280
ICP.a.Co.lt	µg/mL	2.62E-04	1.60E-04	5	0.00	6.74E-04
ICP.a.Co.nlt	µg/mL	2.67E-04	1.60E-04	5	0.00	6.77E-04
ICP.a.Cr	µg/mL	1.20	0.565	5	0.00	2.65
$GEA.^{137}Cs$	µCi/mL	1.42	0.668	5	0.00	3.14
$IC.F^-$	µg/mL	311	160	5	0.00	722
ICP.a.K	µg/mL	1,630	344	5	745	2,510
$IC.NO_2^-$	µg/mL	1,240	98.0	5	987	1,490
$IC.NO_3^-$	µg/mL	25,900	989	5	23,300	28,400
ICP.a.Na	µg/mL	13,800	990	5	11,300	16,400
OH^-	µg/mL	3,600	332	5	2,750	4,460
ICP.a.P	µg/mL	20.1	6.88	5	2.37	37.7
ICP.a.S	µg/mL	54.5	8.00	5	33.9	75.0
$IC.SO_4^{2-}.lt$	µg/mL	284	85.8	5	63.5	505
$IC.SO_4^{2-}.nlt$	µg/mL	199	11.0	5	171	227
ICP.a.Si	µg/mL	45.3	1.98	5	40.2	50.3
SpG	---	1.02	0.00380	5	1.01	1.03
$^{89/90}Sr$	µCi/mL	0.0189	0.00419	5	0.00810	0.0296
TOC	µg C/mL	2,370	782	5	357	4,380
TGA. % Water	wt%	94.9	0.258	5	94.2	95.6
Direct.pH	pH units	13.5	0.0360	5	13.4	13.6

Notes:

.lt = Upper value of the "less thans" used in the statistical analysis.
.nlt = Less than values deleted in the statistical analysis.

Table B3-9. Tank 241-AW-105 Supernate Analytes - >50 percent "Less Than" Values. (2 sheets)

Analyte	Unit	Result
Total Alpha	µCi/mL	<3.15E-04
AEA.^{241}Am	µCi/mL	<7.94E-06
ICP.a.As	µg/mL	<4.1
ICP.a.Ba	µg/mL	<2.05
ICP.a.Be	µg/mL	<0.205
ICP.a.Bi	µg/mL	<4.1
IC.Br^-	µg/mL	<644
ICP.a.Ca	µg/mL	6.23
ICp.a.Cd	µg/mL	<0.205
ICP.a.Ce	µg/mL	<4.1
GEA.^{60}Co	µg/mL	<0.820
ICP.a.Cu	µg/mL	<0.410
ICP.a.Fe	µg/mL	<2.05
ICP.a.La	µg/mL	<2.05
ICP.a.Li	µg/mL	<0.410
ICP.a.Mg	µg/mL	<4.1
ICP.a.Mn	µg/mL	<0.410
ICP.a.Mo	µg/mL	<2.05
ICP.a.Nd	µg/mL	<4.1
ICP.a.Ni	µg/mL	<0.820
IC.Oxalate	µg/mL	<541
IC.PO_4^{3-}	µg/mL	<618
ICP.a.Pb	µg/mL	<4.1
$^{239/240}$Pu	µCi/mL	<4.80E-06
ICP.a.Sb	µg/mL	<2.46
ICP.a.Se	µg/mL	<4.1
ICP.a.Sm	µg/mL	<4.1
ICP.a.Sr	µg/mL	<0.410
ICP.a.Ti	µg/mL	<0.410
ICP.a.Tl	µg/mL	<8.2

Table B3-9. Tank 241-AW-105 Supernate Analytes - >50 percent "Less Than" Values. (2 sheets)

Analyte	Unit	Result
ICP.a.U	μg/mL	<20.5
ICP.a.V	μg/mL	<2.05
ICP.a.Zr	μg/mL	<0.410

The sludge results were calculated using the following equation

$$\text{Sludge}_{ij} = \left(\frac{\text{Interstitial Liquid}_{ij}}{\text{Bulk Density}_i}\right)(\text{Weighting Factor}_{IL_i})$$

$$+ \,(\text{Centrifuged Solid}_{ij})\,(\text{Weighting Factor}_{CS_i})$$

where I indicates grab sample I (I = 1,2,3), j indicates measurement j (j = 1,2), interstitial liquid_{ij} is the interstitial liquid analytical result for grab sample I and measurement j, and centrifuged solid_{ij} is the centrifuged solid analytical result for grab sample I and measurement j. The bulk density term refers to the bulk density measurement for the interstitial liquid of grab sample I. The weighting factor terms refer to the weight fraction interstitial liquid (IL) or centrifuged solids (CS) in each sludge grab sample. The weighting factors can be calculated from the data in columns 4 and 6 of Table B1-3. The statistical analysis was performed using the calculated sludge results. The calculated sludge mean concentration estimates, along with the two-sided 95 percent confidence interval for the mean concentration, are given in Table B3-10 (nested ANOVA) and Table B3-11 (one-way ANOVA) for those analytes with at least 50 percent of the reported data as quantitative values. For some of the analytes, the lower limit of the 95 percent confidence interval was a negative value due to the magnitude of the variability. Since the actual concentration of a tank sample cannot be less than zero, the lower limit is reported as zero.

The analytes in Table B3-10 where $\hat{\sigma}_{riser}$ is significantly different from zero are footnoted. The one-way ANOVA model is more appropriate for those analytes where $\hat{\sigma}_{riser}$ is not significantly different from zero. The mean concentrations and the variances of the mean concentrations calculated using the two statistical models (one-way ANOVA and nested ANOVA) are not significantly different for these analytes.

For those analytes where the quantitative values for centrifuged solids or interstitial liquid were magnitudes larger than the "less than" values for centrifuged solids or interstitial liquid, the calculated sludge is reported as a quantitative value. These analytes are footnoted in

Table 3-10 or Table 3-11. The remainder of the analytes which had less than 50 percent of the reported data as quantitative values are listed in Table B3-12. Table B3-12 cites the largest value observed from the calculated sludge results.

Table B3-10. Tank 241-AW-105 Sludge Summary Statistics Mean Concentrations (nested ANOVA). (2 sheets)

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	Lower Limit	Upper Limit
ICP.a.Ag	μg/g	211	30.8	1	0.00	602
ICP.a.Ag.nlt[1]	μg/g	261	36.2	1	0.00	721
ICP.a.Al.lt	μg/g	1,040	95.2	1	0.00	2,250
ICP.a.Al.nlt	μg/g	1,100	79.7	1	84.8	2,110
Total alpha	μCi/g	1.76	0.626	1	0.00	9.72
AEA.^{241}Am[2]	μCi/g	0.338	0.110	1	0.00	1.74
ICPa.Cd.lt[2]	μg/g	117	40.0	1	0.00	626
ICP.a.Cd.nlt[2]	μg/g	128	33.4	1	0.00	553
IC.Cl^-.lt	μg/g	236	19.7	1	0.00	487
IC.Cl^-.nlt	μg/g	238	19.8	1	0.00	489
ICP.a.Cr.lt	μg/g	228	63.8	1	0.00	1,040
ICP.a.Cr.nlt	μg/g	254	71.9	1	0.00	1,170
GEA.^{137}Cs	μCi/g	16.5	2.41	1	0.00	47.2
IC.F^-	μg/g	13,700	4,880	1	0.00	75,700
ICP.a.Fe[2]	μg/g	1,770	396	1	0.00	6,810
ICP.a.La.lt[2]	μg/g	1,060	143	1	0.00	2,870
ICP.a.La.nlt[2]	μg/g	1,140	147	1	0.00	3,000
ICP.a.Mn.lt[2]	μg/g	954	448	1	0.00	6,650
ICP.a.Mn.nlt[2]	μg/g	1,120	471	1	0.00	7,100
IC.NO_2^-	μg/g	2,910	375	1	0.00	7,680
IC.NO_3^-	μg/g	23,200	1,610	1	2,760	43,600
ICP.a.Na	μg/g	64,300	5,940	1	0.00	1.40E+05
OH^- [2]	μg/g	2,210	291	1	0.00	5,900
$^{239/240}$Pu[1]	μCi/g	1.78	0.861	1	0.00	12.7
IC.SO_4^{2-}	μg/g	1,170	189	1	0.00	3,570
ICP.a.Si.lt[2]	μg/g	817	25.9	1	487	1,150

Table B3-10. Tank 241-AW-105 Sludge Summary Statistics Mean Concentrations (nested ANOVA). (2 sheets)

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	Lower Limit	Upper Limit
ICP.a.Si.nlt[2]	µg/g	858	60.3	1	92.3	1,620
$^{89/90}Sr$	µCi/g	26.2	6.36	1	0.00	107
TIC	µg C/g	753	45.9	1	169	1,340
TOC	µg C/g	1,690	163	1	0.00	3,770
ICP.a.U[2]	µg/g	46,500	14,200	1	0.00	2.26E+05
TGA. % Water	wt%	75.5	2.79	1	39.9	111
ICP.a.Zr	µg/g	33,400	11,100	1	0.00	1.75E+05

Notes:

.lt = Upper value of the "less thans" used in the statistical analysis.
.nlt = Less than values deleted in the statistical analysis.

[1] $\hat{\sigma}_{riser}$ is significantly different from zero.
[2] Sludge value treated as a quantitative value, although technically it should be a "less than" value.

Table B3-11. Tank 241-AW-105 Sludge Summary Statistics Mean Concentrations (One-Way ANOVA). (2 sheets)

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	Lower Limit	Upper Limit
ICP.a.Ag.lt	µg/g	211.0	29.5	6	139	283
ICP.a.Al.lt	µg/g	1,040	87.7	6	824	1,250
ICP.a.Al.nlt	µg/g	1,100	79.7	5	892	1,300
Total alpha	µCi/g	1.76	0.437	6	0.690	2.83
AEA.^{241}Am[1]	µCi/g	0.338	0.0690	6	0.169	0.506
ICP.a.Cd.lt[1]	µg/g	117	25.6	6	54.8	180
ICP.a.Cd.nlt[1]	µg/g	131	27.8	5	59.2	202
IC.Cl^-.lt	µg/g	236	19.7	6	188	285
IC.Cl^-.nlt	µg/g	238	19.8	6	189	286
ICP.a.Cr.lt	µg/g	228	62.6	6	74.5	381
ICP.a.Cr.nlt	µg/g	254	71.9	5	69.2	439
GEA.^{137}Cs	µCi/g	16.5	2.41	6	10.6	22.4
IC.F^-	µg/g	13,700	4,840	6	1,860	25,600
ICP.a.Fe[1]	µg/g	1,770	327	6	974	2,570

Table B3-11. Tank 241-AW-105 Sludge Summary Statistics Mean Concentrations (One-Way ANOVA). (2 sheets)

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	Lower Limit	Upper Limit
ICP.a.La.lt[1]	µg/g	1,060	143	6	707	1,410
ICP.a.La.nlt[1]	µg/g	1,140	147	5	758	1,510
ICP.a.Mn.lt[1]	µg/g	954.0	418	6	0.00	1,980
ICP.a.Mn.nlt[1]	µg/g	1,120	471	5	0.00	2,330
IC.NO_2^-	µg/g	2,910	375	6	1,990	3,830
IC.NO_3^-	µg/g	23,200	1,610	6	19,200	27,100
ICP.a.Na	µg/g	64,300	5,940	6	49,700	78,800
OH^{-2}	µg/g	2,210	257	6	1,580	2,840
IC.SO_4^{2-}	µg/g	1,170	189	6	709	1,630
ICP.a.Si.lt[1]	µg/g	817	25.9	6	753	880
ICP.a.Si.nlt[1]	µg/g	830	39.3	4	721	940
$^{89/90}Sr$	µCi/g	26.2	6.36	6	10.6	41.7
TIC	µg C/g	753	41.9	6	650	856
TOC	µg C/g	1,690	163	6	1,290	2,090
ICP.a.U[1]	µg/g	46,500	9,540	6	23,200	69,900
TGA. % Water	wt%	75.5	2.79	6	68.6	82.3
ICP.a.Zr	µg/g	33,400	11,100	6	6,170	60,600

Notes:

.lt = Upper value of the "less thans" used in the statistical analysis.
.nlt = Less than values deleted in the statistical analysis.

[1] Sludge value treated as a quantitative value, although technically it should be a "less than" value.

Table B3-12. Tank 241-AW-105 Sludge Analytes - >50 percent "Less Than" Values.

Analyte	Units	Calculated Sludge
ICP.As	µg/g	<1,650
ICP.B	µg/g	<831
ICP.Ba	µg/g	<831
ICP.Be	µg/g	<83.2
ICP.Bi	µg/g	<1,650
IC.Br^-	µg/g	<941
ICP.Ca	µg/g	3,490
ICP.Ce	µg/g	<1,650
ICP.Co	µg/g	<331
GEA.^{60}Co	µCi/g	<1.24
ICP.Cu	µg/g	<165
ICP.Li	µg/g	<165
ICP.Mg	µg/g	<1,650
ICP.Mo	µg/g	<831
ICP.Nd	µg/g	<1,650
IC.Oxalate	µg/g	<842
ICP.P	µg/g	<3,380
IC.PO_4^{3-}	µg/g	<949
ICP.Pb	µg/g	<1,650
ICP.S	µg/g	<1,730
ICP.Sb	µg/g	1,150
ICP.Se	µg/g	<1,650
ICP.Sm	µg/g	<1,650
ICP.Sr	µg/g	<165
ICP.Ti	µg/g	<165
ICP.Tl	µg/g	<3,320
ICP.V	µg/g	<831
ICP.Zn	µg/g	439

B3.4.2 Analysis of Variance Model

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 data were evaluated using two different models. The first model used a nested ANOVA model. The nested ANOVA statistical model used to describe the structure of the data is

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

$$I = 1,2,\ldots,a;\ j = 1,2,\ldots,b_i;\ k = 1,2,\ldots,n_{ij};$$

where

Y_{ijk}	=	concentration from the k^{th} analytical result from the j^{th} grab sample from the i^{th} riser
μ	=	the grand mean
R_i	=	the effect of the i^{th} riser
S_{ij}	=	the effect of the j^{th} grab sample from the i^{th} riser
A_{ijk}	=	the effect of the k^{th} analytical result from the j^{th} grab sample from the i^{th} riser
a	=	the number of risers
b_i	=	the number of grab samples from the i^{th} riser
n_{ij}	=	the number of analytical results from the j^{th} grab sample from the i^{th} riser.

The variables R_i and S_{ij} are assumed to be random effects. These variables, as well as A_{ijk}, are assumed to be uncorrelated and normally distributed with means zero and variances $\sigma^2(R)$, $\sigma^2(S)$, and $\sigma^2(A)$, respectively. Estimates of $\sigma^2(R)$, $\sigma^2(S)$, and $\sigma^2(A)$ were obtained using REML techniques. This method applied to variance component estimation is described in Harville (1977). The results using the REML techniques were obtained using the statistical analysis package S-PLUS (Statistical Sciences 1993). The *df* associated with the standard deviation of the mean (a function of $\sigma^2(R)$, $\sigma^2(S)$, and $\sigma^2(A)$) is the number of risers minus one.

The second model used one-way analysis of variance. The one-way analysis of variance statistical model used to describe the structure of the data is

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

$$I = 1,2,\ldots,a; \; j = 1,2,\ldots,n_i;$$

where

Y_{ij}	=	concentration from the j[th] analytical result from the i[th] grab sample
μ	=	the grand mean
S_i	=	the effect of the i[th] grab sample
A_{ij}	=	the effect of the j[th] analytical result from the i[th] grab sample
a	=	the number of grab samples
n_i	=	the number of analytical results from the i[th] grab sample.

The variable S_i is assumed to be a random effect. This variable, as well as A_{ij}, are assumed to be uncorrelated and normally distributed with means zero and variances $\sigma^2(S)$ and $\sigma^2(A)$, respectively. Estimates of $\sigma^2(S)$ and $\sigma^2(A)$ were obtained using REML techniques. This method applied to variance component estimation is described in Harville (1977). The results using the REML techniques were obtained using the statistical analysis package S-PLUS™ (Statistical Sciences 1993). The *df* associated with the standard deviation of the mean (a function of $\sigma^2(S)$ and $\sigma^2(A)$) is the number of grab samples minus one.

B3.4.3 Sampling Based Tank Inventory

The sampling based tank supernatant inventory for each analyte is calculated by multiplying the tank volume for liquids by the mean concentration. The liquid tank volume for 241-AW-105 is 606 kL (160 kgal) (Hanlon 1996). The lower and upper limits were calculated by multiplying the tank volume by the lower and upper limits from the two-sided 95 percent confidence interval for the mean concentration. The tank inventory for each analyte, along with the upper and lower limits, are presented in Table B3-13 (nested ANOVA results) and Table B3-14 (one-way ANOVA results). For those analytes with less than 50 percent of the data reported as quantitative values, the tank inventory was calculated by multiplying the tank volume by the concentration listed in Table B3-9. These values are presented in Table B3-15. Values for the lower limit and the upper limit are not possible.

Because the sludge samples from the August 1996 sampling event were not representative of the entire sludge in the tank (samples were not obtained from the bottom 65 in. of sludge), a sludge inventory was not calculated.

Table B3-13. Analytical-Based Supernatant Inventory for Tank 241-AW-105 Based on the Nested ANOVA Results.

Analyte	Tank Inventory	Lower Limit (kg or Ci)	Upper Limit (kg or Ci)
ICP.a.Ag	0.701 kg	0.0166	1.38
ICP.a.Al	17.3 kg	0.00	110
ICP.a.B	2.01 kg	0.00	6.23
IC.Cl^-	148 kg	38.0	257
ICP.a.Co.lt	1.59E-04 kg	0.00	0.00141
ICP.a.Co.nlt	1.62E-04 kg	0.00	0.00139
ICP.a.Cr	0.725 kg	0.00	5.11
GEA.^{137}Cs	859 Ci	0.00	6,010
IC.F	188 kg	0.00	1,420
ICP.a.K	987 kg	0.00	3,660
IC.NO_2^-	751 kg	0.00	1,620
IC.NO_3^-	15,700 kg	2,710	28,600
ICP.a.Na	8,370 kg	732	16,000
OH^-	2,180 kg	0.00	4,740
ICP.a.P	12.2 kg	0.00	65.1
ICP.a.S	33.0 kg	0.00	96.1
IC.a.SO_4^{2-}	172 kg	0.00	882
IC.SO_4^{2-}.nlt	120 kg	36.0	205
ICP.a.Si	27.4 kg	4.01	50.8
$^{89/90}$Sr	11.4 Ci	0.00	43.7
TIC	186 kg	0.00	1,110
TOC	1,430 kg	0.00	7,730
TGA. % Water	5.87E+05 kg	5.62E+05	6.11E+05
ICP.a.Zn	1.46 kg	0.00	9.24

Table B3-14. Analytical-Based Supernatant Inventory for Tank 241-AW-105 Based on the One-Way ANOVA Results.

Analyte	Tank Inventory	Lower Limit (kg or Ci)	Upper Limit (kg or Ci)
ICP.a.Ag	0.701 kg	0.582	0.820
ICP.a.Al	17.3 kg	0.00	36.1
ICP.a.B	2.01 kg	1.33	2.68
IC.Cl^-	148 kg	125	170
ICP.a.Co.lt	1.59E-04 kg	0.00	4.09E-04
ICP.a.Co.nlt	1.62E-04 kg	0.00	4.10E-04
ICP.a.Cr	0.725 kg	0.00	1.60
GEA.^{137}Cs	859 Ci	0.00	1,900
IC.F^-	188 kg	0.00	437
ICP.a.K	987 kg	452	1,520
IC.NO_2^-	751 kg	598.0	904
IC.NO_3^-	15,700 kg	14,100	17,200
ICP.a.Na	8,370 kg	6,830	9,910
OH^-	2,180 kg	1,670	2,700
ICP.a.P	12.2 kg	1.44	22.9
ICp.a.S	33.0 kg	20.5	45.5
IC.SO_4^{2-}.lt	172 kg	38.5	306
IC.SO_4^{2-}.nlt	120 kg	103	138
ICP.a.Si	27.4 kg	24.3	30.5
$^{89/90}$Sr	11.4 Ci	4.91	18.0
TOC	1,430 kg	216	2,650
TGA. % Water	5.87E+05 kg	5.82E+05	5.91E+05

Notes:

.lt = Upper value of the "less thans" used in the statistical analysis.
.nlt = Less than values deleted in the statistical analysis.

Table B3-15. Analytical-Based Supernatant Inventory for Tank 241-AW-105 Analytes with >50 percent Less Than Results. (2 sheets)

Analyte	Tank Inventory	Lower Limit (kg or Ci)	Upper Limit (kg or Ci)
Total Alpha	<0.191 Ci	n/a	n/a
AEA.^{241}Am	<0.00481 Ci	n/a	n/a
ICP.a.As	<2.48 kg	n/a	n/a
ICP.a.Ba	<1.24 kg	n/a	n/a
ICP.a.Be	<0.124 kg	n/a	n/a
ICP.a.Bi	<2.48 kg	n/a	n/a
IC.Br^-	<390 kg	n/a	n/a
ICP.a.Ca	3.78 kg	n/a	n/a
ICP.a.Cd	<0.124 kg	n/a	n/a
ICP.a.Ce	<2.48 kg	n/a	n/a
GEA.^{60}C	<0.497 Ci	n/a	n/a
ICP.a.Cu	<0.248 kg	n/a	n/a
ICP.a.Fe	<1.24 kg	n/a	n/a
ICP.a.La	<1.24 kg	n/a	n/a
ICP.a.Li	<0.248 kg	n/a	n/a
ICP.a.Mg	<2.48 kg	n/a	n/a
ICP.a.Mn	<0.248 kg	n/a	n/a
ICP.a.Mo	<1.24 kg	n/a	n/a
ICP.a.Nd	<2.48 kg	n/a	n/a
ICP.a.Ni	<0.497 kg	n/a	n/a
IC.Oxalate	<328 kg	n/a	n/a
IC.PO_4^{3-}	<375 kg	n/a	n/a
ICP.a.Pb	<2.48 kg	n/a	n/a
$^{239/240}$Pu	<0.00291 kg	n/a	n/a
ICP.a.Sb	<1.49 kg	n/a	n/a
ICP.a.Se	<2.48 kg	n/a	n/a
ICP.a.Sm	<2.48 kg	n/a	n/a
ICP.a.Sr	<0.248 kg	n/a	n/a
ICP.a.Ti	<0.248 kg	n/a	n/a

Table B3-15. Analytical-Based Supernatant Inventory for Tank 241-AW-105 Analytes with >50 percent Less Than Results. (2 sheets)

Analyte	Tank Inventory	Lower Limit (kg or Ci)	Upper Limit (kg or Ci)
ICP.a.Tl	<4.97 kg	n/a	n/a
ICP.a.U	<12.4 kg	n/a	n/a
ICP.a.V	<1.24 kg	n/a	n/a
ICP.a.Zr	<0.248 kg	n/a	n/a

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APPENDIX C

STATISTICAL ANALYSIS FOR ISSUE RESOLUTION

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APPENDIX C

STATISTICAL ANALYSIS FOR ISSUE RESOLUTION

C1.0 STATISTICS FOR SAFETY SCREENING DQO

Appendix C reports the results of the statistical analysis required for tank 241-AW-105 by the safety screening DQO (Dukelow et al. 1995). The safety screening DQO defines acceptable decision confidence limits in terms of one-sided 95 percent confidence intervals. In this appendix, one-sided confidence limits are calculated for tank 241-AW-105. Confidence intervals were computed for each grab sample using the analytical data from the 1996 sampling event for tank 241-AW-105 (Esch 1997). The upper limit of a one-sided 95 percent confidence interval for 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 these grab samples (per sample number), *df* equals the number of observations minus one.

Table C1-1 lists the upper limit of the 95 percent confidence interval for each sample number based on DSC (dry weight). Each confidence interval can be used to make the following statement. If the upper limit is less than 480 J/g dry weight, reject the null hypothesis that DSC is greater than or equal to 480 J/g dry weight at the 0.05 level of significance. Fourteen samples (six supernate, six interstitial liquid, and two centrifuged solids) had results of 0.0 J/g dry weight. The upper limit is less than 480 J/g dry weight for the other four samples. Thus, the hypothesis that the DSC results are greater than 480 J/g dry weight is rejected for all 18 samples. Therefore, the available results indicate that energetics is not an issue for this tank.

Because the supernatant analytical results for total alpha activity were less than the detection limit, the calculation of confidence intervals was not possible. The maximum value observed for the supernatant samples was <3.15E-04 μCi/mL, which is less than the total alpha activity limit of 61.5 μCi/mL. The upper limits for the six interstitial liquid samples are below the total alpha activity limit of 61.5 μCi/mL. The upper limits for the six centrifuged solids samples are below the total alpha activity limit of 52.5 μCi/g. Table C1-2 lists the total alpha activity data. Each confidence interval can be used to make the following statement. If the upper limit is less than 61.5 μCi/mL (or 52.5 μCi/g), reject the null hypothesis that the total alpha activity is greater than or equal to 61.5 μCi/mL (or 52.5 μCi/g) at the 0.05 level of significance. Thus, the hypothesis that the total alpha activity results are greater than 61.5 μCi/mL (or 52.5 μCi/g) is rejected for 12 of 18 samples. Calculation of an upper limit is not possible for the remaining six samples because of the less-than values. However, the total alpha activity concentrations for these samples (μCi/mL) were orders of magnitude below the limit (61.5 μCi/mL). Therefore, the results indicate that criticality is not an issue for this tank.

Table C1-1. Summary Statistics: Differential Scanning Calorimetry. (2 sheets)

Sample Number	Sample Description	$\hat{\mu}$ (J/g Dry Weight)	$\hat{\sigma}_{\hat{\mu}}$	Upper Limit
S96T005004	5AW-96-1, riser 10A, elevation = 155 in., supernatant	0.00	0.00	0.00
S96T005005	5AW-96-2, riser 10A, elevation = 137 in., supernatant	0.00	0.00	0.00
S96T005006	5AW-96-4, riser 10A, elevation = 118 in., supernatant	0.00	0.00	0.00
S96T005010	5AW-96-10, riser 15A, elevation = 155 in., supernatant	0.00	0.00	0.00
S96T005011	5AW-96-11, riser 15A, elevation = 137 in., supernatant	0.00	0.00	0.00
S96T005012	5AW-96-14, riser 15A, elevation = 118 in., supernatant	0.00	0.00	0.00
S96T005049	5AW-96-5, riser 10A, elevation = 95 in., interstitial liquid	0.00	0.00	0.00
S96T005050	5AW-96-7, riser 10A, elevation = 78 in., interstitial liquid	0.00	0.00	0.00
S96T005051	5AW-96-9, riser 10A, elevation = 77 in., interstitial liquid	0.00	0.00	0.00
S96T005081	5AW-96-15, riser 15A, elevation = 95 in., interstitial liquid	0.00	0.00	0.00
S96T005082	5AW-96-17, riser 15A, elevation = 73 in., interstitial liquid	0.00	0.00	0.00
S96T005083	5AW-96-20, riser 15A, elevation = 66 in., interstitial liquid	0.00	0.00	0.00

Table C1-1. Summary Statistics: Differential Scanning Calorimetry. (2 sheets)

Sample Number	Sample Description	$\hat{\mu}$ (J/g Dry Weight)	$\hat{\sigma}_{\hat{\mu}}$	Upper Limit
S96T005019	5AW-96-5, riser 10A, elevation = 95 in., centrifuged solids	0.00	0.00	0.00
S96T005020	5AW-96-7, riser 10A, elevation = 78 in., centrifuged solids	0.00	0.00	0.00
S96T005021	5AW-96-9, riser 10A, elevation = 77 in., centrifuged solids	21.1	21.1	154
S96T005075	5AW-96-15, riser 15A, elevation = 95 in., centrifuged solids	65.5	1.20	73.1
S96T005076	5AW-96-17, riser 15A, elevation = 73 in., centrifuged solids	119	26.1	284
S96T005077	5AW-96-20, riser 15A, elevation = 66 in., centrifuged solids	69.8	1.10	76.7

Table C1-2. Summary Statistics: Total Alpha Data. (2 sheets)

Sample Number	Sample Description	$\hat{\mu}$ (μCi/g or μCi/mL)[1]	$\hat{\sigma}_{\hat{\mu}}$	Upper Limit
S96T005007	5AW-96-1, riser 10A, elevation = 155 in., supernatant	<6.59E-05 <4.09E-05	n/a	n/a
S96T005008	5AW-96-2, riser 10A, elevation = 137 in., supernatant	<8.18E-05 <4.09E-05	n/a	n/a
S96T005009	5AW-96-4, riser 10A, elevation = 118 in., supernatant	<5.79E-05 <6.59E-05	n/a	n/a
S96T005013	5AW-96-10, riser 15A, elevation = 155 in., supernatant	<7.87E-05 <7.07E-05	n/a	n/a
S96T005014	5AW-96-11, riser 15A, elevation = 137 in., supernatant	<5.34E-05 <6.00E-05	n/a	n/a
S96T005015	5AW-96-14, riser 15A, elevation = 118 in., supernatant	<1.85E-04 <3.15E-04	n/a	n/a
S96T005049	5AW-96-5, riser 10A, elevation = 95 in., interstitial liquid	0.00394	3.50E-05	0.00416
S96T005050	5AW-96-7, riser 10A, elevation = 78 in., interstitial liquid	0.00279	2.40E-04	0.00431
S96T005051	5AW-96-9, riser 10A, elevation = 77 in., interstitial liquid	0.00137	3.20E-04	0.00339
S96T005081	5AW-96-15, riser 15A, elevation = 95 in., interstitial liquid	0.00113	2.50E-04	0.00271
S96T005082	5AW-96-17, riser 15A, elevation = 73 in., interstitial liquid	0.00138	4.00E-04	0.00391
S96T005083	5AW-96-20, riser 15A, elevation = 66 in., interstitial liquid	5.81E-04	3.35E-05	7.92E-04

Table C1-2. Summary Statistics: Total Alpha Data. (2 sheets)

Sample Number	Sample Description	$\hat{\mu}$ (μCi/g or μCi/mL)[1]	$\hat{\sigma}_{\hat{\mu}}$	Upper Limit
S96T005052	5AW-96-5, riser 10A, elevation = 95 in., centrifuged solids	0.594	0.0260	0.758
S96T005053	5AW-96-7, riser 10A, elevation = 78 in., centrifuged solids	1.79	0.0450	2.07
S96T005054	5AW-96-9, riser 10A, elevation = 77 in., centrifuged solids	2.38	0.0150	2.47
S96T005084	5AW-96-15, riser 15A, elevation = 95 in., centrifuged solids	3.86	0.220	5.25
S96T005085	5AW-96-17, riser 15A, elevation = 73 in., centrifuged solids	1.70	0.0200	1.83
S96T005086	5AW-96-20, riser 15A, elevation = 66 in., centrifuged solids	3.59	0.105	4.25

Note:

[1]Units are μCi/mL for supernatants and interstitial liquids and μCi/g for solids. The mean was not calculated when sample and duplicate results were below detection limits; analytical results are presented instead.

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY DOUBLE-SHELL TANK 241-AW-105

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR TANK 241-AW-105

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-AW-105 was performed, and a best-basis inventory was established. This work, detailed in the following sections, follows the methodology that was established by the standard inventory task.

D1.0 CHEMICAL INFORMATION SOURCES

Available composition information for tank 241-AW-105 is as follows:

- Appendix B of this report provides characterization results from the January 1986 grab sampling event, the July and September 1986 core sampling events, the 1990 core sampling event, and the 1996 grab sampling event.

- An estimate of neutralized current acid waste and NCRW made in 1991 (Schofield 1991) provides tank content estimates based on a reconciliation of flowsheet records, process tests, and the January 1986 and July 1986 sampling events.

- The letter report, *Characterization of Actual Zirflex Decladding Sludge*, (Scheele and McCarthy 1986) provides characterization results of the grab samples taken in January 1986 and analyzed by Pacific Northwest Laboratory.

- The internal memorandum, *Analysis of Neutralized Coating Removal Waste (NCRW) Core Samples from Tank 105-AW*, (Peters 1986) summarizes the results obtained by the Rockwell Hanford Operations laboratories of the July 1986 core sample analyzed by Pacific Northwest Laboratory.

- The HDW model document (Agnew et al. 1997) provides tank content estimates in terms of component concentrations and inventories.

D2.0 COMPARISON OF COMPONENT INVENTORY VALUES

Tables D2-1 and D2-2 compare sample-based sludge inventories derived from the July 1986, September 1986, and May 1990 core samples; and HDW model sludge inventories generated by the Los Alamos National Laboratory model (Agnew et al. 1997). The January 1986 grab sample data is not included in these tables because these samples did not include the bottom layer of the tank where a 30.5 cm (12 in.) uranium-rich waste heel resides. Sludge volumes used to calculate sample-based inventories are from Hanlon (1996b).

The sludge volume reported by Hanlon is 1,060 kL (280 kgal). The sludge volume reported by the HDW model is 1,120 kL (297 kgal), the same as the volume reported earlier by Hanlon (1996a). The volumes reported by Hanlon are based on sludge measurements taken from a maximum of six sludge measurement ports by an ENRAF™ surface-level gauge. The decrease in volume could be caused by a compaction of the solids, shifting of the uneven surface of the solids layer from liquid transfers into the tank, dissolution of soluble solids, or a combination of all these.

Supernatant values are not included because the SMM (Agnew et al. 1997) model tracks supernatant transfers only through January 1994 while the latest analytical data for supernatant were taken in August 1996. No supernatant samples were taken around January 1994 to make a comparison.

Table D2-1. Sample-Based and Hanford Defined Waste Model-Based Sludge Inventory Estimates for Nonradioactive Components.[1] (2 sheets)

Analyte	July 1986 Sampling Sludge Inventory Estimate (kg)	September 1986 Sampling Sludge Inventory Estimate (kg)	May 1990 Sampling Sludge Inventory Estimate (kg)	HDW Model Sludge Inventory Estimate (kg)
Al	3,830	3,180	14,800	0
Bi	NR	NR	NR	0
Ca	NR	714	1,400	4,840
Cl	NR	594	3,160	126
CO_3	NR	10,200	45,400	7,760
Cr	1,470	865	6,030	35.0
F	NR	77,300	1.50E+05	81,700
Fe	3,530	1,990	9,620	26,600
Hg	NR	NR	NR	342
K	10,300	11,100	28,700	6,100

Table D2-1. Sample-Based and Hanford Defined Waste Model-Based Sludge Inventory Estimates for Nonradioactive Components.[1] (2 sheets)

Analyte	July 1986 Sampling Sludge Inventory Estimate (kg)	September 1986 Sampling Sludge Inventory Estimate (kg)	May 1990 Sampling Sludge Inventory Estimate (kg)	HDW Model Sludge Inventory Estimate (kg)
La	442	444	2,030	0
Mn	1,770	419	2,650	27.8
Na	1.64E+05	1.45E+05	40,300	1.04E+05
Ni	NR	200	500	621
NO_2	NR	10,700	26,200	383
NO_3	NR	38,600	69,800	18,100
OH	NR	11,400	NR	80,700
Pb	NR	NR	1,080	0.758
PO_4	NR	NR	2,050	556
Si	NR	5,270	9,540	0
SO_4	NR	1,500	4,240	32.7
Sr	NR	12.0	NR	0
TOC	NR	7,240	12,900	41.2
U_{total}	15,800	9,860	26,900	8,980
Zr	1.01E+05	95,600	2.77E+05	68,800

Note:

[1] Sample-based estimates are based on a sludge volume of 1,060 kL (280 kgal) (Hanlon 1996b) Data was obtained from Appendix B.

Table D2-2. Sample-Based and Hanford Defined Waste Model-Based Sludge Inventory Estimates for Radioactive Components. (Decayed to January 1, 1994)[1]

Analyte	July 1986 Sampling Inventory Estimate (Ci)	September 1986 Sampling Inventory Estimate (Ci)	May 1990 Sampling Inventory Estimate (Ci)	HDW Model Inventory Estimate (Ci)
^{3}H	NR	NR	13.6	14.2
^{14}C	NR	NR	2.26	0.175
^{60}Co	NR	NR	486	2.70
^{90}Sr	NR	NR	2.63E+05	3,430
^{99}Tc	NR	NR	108	0.731
^{125}Sb	NR	1,860	7,780	65.3
^{129}I	NR	NR	NR	0.00147
^{134}Cs	NR	95.8	424	29.0
^{137}Cs	NR	53,200	1.42E+05	4,050
^{154}Eu	NR	273	3,830	20.2
^{155}Eu	NR	199	2,550	155
^{238}Pu	NR	69.1	658	124
$^{239/240}Pu$	935	821	3,280	1,316
^{241}Am	582	361	3,190	13.5
$^{243/244}Cm$	NR	NR	184	0.0643

Note:

[1] Sample-based estimates are based on a sludge volume of 1,060 kL (280 kgal) (Hanlon 1996b). Data was obtained from Appendix B.

D3.0 COMPONENT INVENTORY EVALUATION

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

Results from the July 1986 core sample and the September 1986 core sample were consistent with each other (see Section B2.9.3). The 1990 core sample concentrations for nonradioactive components, except for sodium and nickel, were roughly two to five times higher than the 1986 results. This was probably caused by uranium interference during ICP analysis. Yet, sodium and nickel inventory estimates were significantly lower in the 1990 core sample results. For radioactive components, the differences were even more pronounced; the 1990 concentrations range from approximately 3 to 14 times higher than the 1986 results.

Each core sample was taken from a different riser: the July 1986 core sample was taken from riser 13A (see Figure A2-1); the September 1986 core sample was taken from riser 15A; and the May 1990 core sample was taken from riser 16B. There is a possibility that some variation between the core sample results was caused by lateral heterogeneity in the tank.

The HDW model predictions, while being closer to the 1986 concentrations, still do not agree well with the sample-based numbers. The smallest differences between the HDW model predictions and the 1986 core composite results are reported for fluoride, zirconium, and sodium. The RPD[2] for these components are 5, 35, and 39 percent, respectively. The RPDs for fluoride, zirconium, and sodium between the HDW model predictions and the 1990 core composite results are 59, 120, and 88 percent, respectively.

In Section D3.1, analytical results from the January 1986 grab sampling event and the August 1996 grab sampling event are introduced and compared to the other sample results. In Section D3.2, comparisons are made between the sample-based results and estimates based on the PUREX Plant flowsheet for NCRW and a method for estimating the amount of waste constituents that accumulated in tank 241-AW-105 as sludge. This is done to help decide which sample results are the best basis for sample-based inventories. Section D3.3 discusses contributions made by other waste types.

[2] $\text{RPD} = \frac{|S_2 - S_1|}{(\frac{1}{2}(S_1 + S_2))}$ where S_n = sample concentration.

D3.1 COMPARISON OF CORE SAMPLE DATA

The January 1986 grab samples do not include the bottom layer of waste in the tank. This 30.5 cm (12 in.) heel displays different physical and chemical properties from the sludge above it (see Section B1.4.2). These solids are assumed to have been deposited in tank 241-AW-105 from the 7,030 kL (1857 kgal) of PXMSC waste sent to the tank before it began receiving NCRW waste in 1984 (see Table A3-1).

The August 1996 grab sampling event did not collect sludge samples from the entire depth of the sludge layer; it includes solids added since 1986. Included with these solids were additions of 8,220 kg of uranium and 6.97 kg of plutonium present in a dilute nitric acid solution that had been stored in the PUREX plant (Sasaki 1995). Samples were collected from depths ranging from 168 cm (66 in.) to 241 cm (95 in.) from the tank bottom. The sludge occupies 259 cm (102 in.) of the tank. Although the sludge level did not increase between 1987 and 1996 (it actually decreased), there were solids added to tank 241-AW-105 after 1986. Table A3-1 shows that 121 kL (32 kgal) of PUREX Plant spent metathesis solids and decladding wastes were added in addition to some TRU solids that may have settled from a dilute complexed waste stream sent from the Hot Semi-Works pilot plant. Solids formed a layer of 29.6 cm (11.6 in.) in the tank. To account for this, samples taken at 241 cm (95 in.) from the tank bottom during the August 1996 sampling event were not included in the comparison. This should eliminate solids added after 1986 thereby enabling a direct comparison of the August 1996 means with the other core sample results. To see the changes in composition from this omission, compare Table B3-11 mean concentrations for all August 1996 samples with the mean concentrations in Table D3-1.

As mentioned earlier, the July 1986 core sample was taken from riser 13A, the September 1986 core sample was taken from riser 15A, the May 1990 core sample was taken from riser 16B, and the August 1986 grab samples were taken from risers 10A and 15A. Figure A2-1 shows that the samples were distributed across the eastern half of the tank. It is not known from which riser the January 1986 grab samples were taken.

Instead of comparing the entire core composites with the January 1986 and August 1996 data, the average of segments 5 through 9 from the July 1986 core sample; the average of segments 2A, 3A, 4A, and 5A from the September 1986 core sample; and the composite of segments 3 through 6 from the 1990 core were used for the comparison. These portions of the three cores do not include the 12-in. heel. The 1990 core sample may include solids added after 1986, but sample depths could not be determined (see Section B1.4.4). In the absence of this information, the entire core composite was used in the comparison. For segment concentrations below the detection limit, the detection limits were included to compute the average.

Table D3-1. Comparison of Analytical Concentrations from the Sludge Sampling Events for Tank 241-AW-105.

Analyte	January 1986 Sludge[1] (μg/g)	July 1986 Sludge[2] (μg/g)	September 1986 Sludge[3] (μg/g)	May 1990 Sludge[4] (μg/g)	August 1996 Sludge[5] (μg/g)
Al	960	1,180	1,150	3,520	1,130
Ca	200	NR	129	1,340	<1,530
Cl	2,000	NR	333	1,500	231
CO_3	NR	NR	4,360	30,200	4,010
Cr	170	<100	112	868	228
F	75,000	NR	57,000	71,800	19,200
Fe	320	471	264	5,680	1,850
Hg	<5,100	NR	NR	0.342	NR
K	12,300	9,710	9,220	36,500	NR
La	340	471	385	2,500	1,200
Mn	10	NR	6.00	2,110	1,250
Na	1.12E+05	1.03E+05	97,300	25,800	72,200
Ni	60	NR	59	332	NR
NO_2	NR	NR	4,850	17,400	3,410
NO_3	NR	NR	19,700	46,400	21,100
OH	11,000	NR	8,260	NR	<2,050
Pb	3,100	NR	NR	719	NR
PO_4	<25,000	NR	NR	1,360	NR
Si	1,100	NR	4,130	6,340	848
SO_4	85,000[6]	NR	885	2,820	1,440
Sr	NR	NR	5.16	NR	NR
TOC	5,200	NR	3,440	8,560	1,920
U_{TOTAL}		5,590	5,160	17,900	46,000
Zr	79,000	71,000	69,000	1.84E+05	47,000

Notes:

[1]Core composite concentrations
[2]Average of segments 5, 6, 7, 8, and 9
[3]Average of segments 2A, 3A, 4A, and 5A
[4]Composite of segments 3, 4, 5, and 6
[5]Samples 96-5 and 96-15 were excluded.
[6]This concentration is an outlier. See text for discussion.

The July 1986 and September 1986 samples were observed to possess compositions and properties consistent with each other (see Section D3.0). The January 1986 results also are consistent with the July 1986 and September 1986 core sample results minus the 30.5 cm (12 in.) heel. Except for chloride, silicon, and sulfate, the RPDs between the January 1986 results and averages of the July 1986 and September 1986 results are less than 41 percent. The degree of agreement between the three 1986 sampling events suggests that the earlier samples may be a better basis for sample-based inventories than the 1990 core sample data, but further verification is needed. In the following section, an estimate of NCRW sludge in tank 241-AW-105 is made from the PUREX Plant flowsheet and process knowledge to compare with the sample results and results obtained from the HDW model.

D3.2 EVALUATION OF TECHNICAL FLOWSHEET INFORMATION

In 1991, an evaluation of the NCRW sent to the 241-AW tank farm was made (Schofield 1991). Schofield used PUREX Plant flowsheets, personal knowledge of how the process ran, and other information to develop estimates which he compared to the January and July 1986 sample results. Much of his work was used in the following evaluation.

D3.2.1 Technical Flowsheet Estimate Assumptions

The PUREX flowsheet-based NCRW sludge composition developed in this engineering evaluation is based on:

1. The PUREX flowsheet for Reprocessing N Reactor Fuels (RHO 1982)

2. A methodology that estimates the amount of NCRW that partitioned to the sludge

3. A report that estimates the contents of NCRW based on a reconciliation of flowsheet information, process knowledge, and sample data (Schofield 1991).

In his analysis, Schofield included the following: N Reactor fuel cladding composition (including impurities); the amount and composition of dissolved fuel, fission products, and actinides lost to the NCRW stream; and the process chemicals added as shown in the PUREX Plant flowsheet with adjustments based on his knowledge of how the process ran. Some adjustments included the following: increasing sodium hydroxide additions by five weight percent to account for excess sodium hydroxide added for neutralization; increasing potassium hydroxide additions by 20 percent to account for excess potassium hydroxide added for metatheses; increasing the amount potassium carryover to the NCRW stream; and the addition of extra water to account for extra flushes and jet dilutions.

One change was made to Schofield's assessment of the flowsheet-based NCRW composition. Schofield assumed that potassium hydroxide was added in 20 percent excess of the flowsheet composition. Yet an engineering evaluation of the potassium content in tank 241-AW-103 NCRW sludge, based on the reference flowsheet concentration for potassium, agreed extremely well with the sample-based inventory for that tank (Kupfer et al. 1996). This same flowsheet value for potassium was used in the engineering evaluation for tank 241-AW-105. A corresponding decrease in the hydroxide concentration was made as well.

The adjusted PUREX Plant flowsheet NCRW composition is compared in Table D3-2 to the PUREX Plant flowsheet NCRW composition (RHO 1982), and the HDW model composition for NCRW, or CWZR2 as it is called in the HDW model. Schofield does not provide estimates for calcium, while the PUREX Plant flowsheet reports a value of 0.018*M*. The calcium concentration reported by the flowsheet was used in this evaluation. Except for potassium, hydroxide, and calcium, Schofield's NCRW composition was assumed to be the better basis in this evaluation than the reference flowsheet values.

Table D3-2. Estimated Concentrations of Neutralized Cladding Removal Waste (NCRW) in Tank 241-AW-105.

Analyte	Adjusted Flowsheet NCRW Composition[1] (*M*)	Flowsheet NCRW Composition[2] (*M*)	HDW Model NCRW Composition[3] (*M*)
NO_3	0.026	0.024	0.39
NO_2	0.0075	0.011	0.007
Fe	0.019	NR	0.04
Cr	0.0056	NR	0
Ni	3.4E-04	NR	0
Zr	0.15	0.18	0.1
Na	1.6	1.6	1.02
OH	0.74	0.72	0.64
F	1.3	1.4	0.77
K	0.15[4]	0.15[d]	0.22
Ca	0.018[5]	0.018	0.018
CO_3	0.018[5]	0.018	0.018
U	6.9E-04	0.0031	0.0078

Notes:

[1]Schofield, (1991), with modifications
[2]RHO (1982)
[3]Agnew et al. (1997)
[4]Schofield's adjustment seems high based on sample data from tank 241-AW-103.
[5]Schofield (1991) did not provide concentrations for these components.

The amount of NCRW sent to tank 241-AW-105 derived from the numbers in column 2 of Table D3-2 was calculated based on the following assumptions:

- 4,169 L per metric ton of uranium (MTU) of NCRW waste were processed at the PUREX plant from 1983 to 1988 (Schofield 1991).
- Total production at the PUREX Plant from 1983 to 1988 was 3,920 MTUs (Schofield 1991).
- 36 percent of the NCRW produced at the PUREX Plant was transferred to tank 241-AW-105 based on historical transfer records (Koreski 1995).

An example calculation for estimating the flowsheet-based sodium inventory for the sludge in tank 241-AW-105 is:

(1.639 moles Na/L x 4,169 L/MTU x 3,920 MTU x 0.36 x 23 g Na/mole Na x 1 kg Na/1000 g Na) = 222,000 kg Na sent to tank 241-AW-105.

Table D3-3 shows the amounts for other constituents sent to the tank calculated similarly.

Table D3-3. Estimated Inventory of Neutralized Cladding Removal Waste (NCRW) Sent to Tank 241-AW-105.

Analyte	Adjusted Flowsheet-Based NCRW Inventory[1] (kg)
NO_3	9,440
NO_2	2,040
Fe	629
Cr	220
Ni	116
Zr	83,400
Na	2.22E+05
OH	72,000
F	1.45E+05
K	1.18E+05
Ca	4,240
CO_3	6,350
U	969

Note:

[1]Schofield (1991)

Not all this inventory is in the sludge in tank 241-AW-105. For some constituents, only a fraction of the amounts shown above precipitated from the NCRW waste stream as sludge. The remainder was decanted to the 242-A Evaporator feed tank, concentrated to double-shell slurry feed, and sent to other double-shell tanks. To estimate the amounts partitioned to the sludge, partition factors (PFs), developed for the NCRW in tank 241-AW-103, were used (Kupfer et al. 1996). The PFs were developed by taking the ratio of the core sample concentration for an insoluble component, zirconium in this case, to the PUREX flowsheet concentration for zirconium in NCRW. This ratio is called the concentration factor for zirconium (CF_{Zr}). For other components in NCRW, concentration factors (CFs) can be calculated. For components that are less soluble than zirconium, the CFs will be lower. The ratio of CF_N to CF_{Zr} is the fraction of component N that precipitated as sludge. This fraction, CF_N/CF_{Zr} is called the partitioning factor for component N, or PF_N.

In the case of tank 241-AW-103, these PFs multiplied by the amount sent to that tank (as determined from the PUREX Plant flowsheet) were the amounts estimated to be in the sludge of that tank. These PFs were applied in this evaluation to the NCRW inventory for tank 241-AW-105 to produce a sludge inventory that is compared to the sample-based results and the HDW model predictions in Table D3-2. The PFs used in this evaluation were:

Zr	1.0
Na	0.81
OH	0.19
F	0.51
K	0.42
Ca	0.27

The PFs calculated for chromium, iron, and nickel were 1.3, 1,6, and 1.3, respectively, which indicates that the estimates for corrosion products may have been understated by 30 to 60 percent. A PF of 1.0 was assumed for chromium, iron, and nickel in this evaluation.

The 1986 sample-based inventory in Table D3-4 represents an average of the three 1986 core samples. If a concentration was available from only one source, it was assumed to be the concentration for all three sources. If only two concentrations were available, they were averaged and reported as the final result. Less than values were included to compute the average. The other set includes the results from the 1990 core sample. The August 1996 data is omitted because the data do not reflect the entire NCRW waste layer.

The sample concentrations in Table D3-4 reflect only a portion of the sludge layer in tank 241-AW-105. The sludge portion under consideration does not include the 30 cm (12 in.) heel at the tank bottom. It does include solids that may have accumulated from non-NCRW waste streams including solids precipitated from the 2,320 kL (613 kgal) of slurry sent to the tank in 1987 and 121 kL (32 kgal) of PUREX plant spent metathesis solids transferred in 1989 (See Table A3-1). This creates some error when making comparisons with flowsheet estimates, but a comparison of these data sets and the flowsheet estimate should help determine which data set best reflects the actual NCRW concentrations.

Table D3-4. Comparison of Neutralized Cladding Removal Waste (NCRW) Sludge Inventories in Tank 241-AW-105.

Analyte	Adjusted Flowsheet-Based NCRW Inventory (kg)	1986 Sample-Based NCRW Inventory (kg)	1990 Sample-Based NCRW Inventory (kg)	HDW Model Sludge Inventory (kg)
Fe	629	473	9,620	26,600
Cr	220	171	6,030	35.0
Ni	116	81.4	500	621
Zr	83,400	98,200	2.77E+05	68,800
Na	1.79E+05	1.40E+05	40,300	1.04E+05
OH	13,680	13,000	NR	80,700
F	73,900	88,800	150,000	81,700
K	49,600	14,000	28,700	6,100
Ca	1,140	1,145	1,400	4,840
CO_3	6,350	5,870	75,600	7,760
NO_3	9,440	26,500	69,800	18,100
NO_2	2,030	23,400	26,200	383
U	969	7,230	26,900	8,980

The comparison in Table D3-4 provides further evidence that the 1986 sample data are the best basis for the NCRW inventory estimate in tank 241-AW-105. Not only are the three 1986 samples consistent with each other (and not consistent with the 1990 core sample [see Tables D2-1 and D2-2]), but inventories generated from the 1986 data are consistent, in most cases, with the flowsheet-based estimates generated in this evaluation. When matched with the 1986 data, the flowsheet based inventories for iron, chromium, nickel, zirconium, sodium, hydroxide, fluoride, calcium, and carbonate display RPDs less than 25 percent.

The comparison of zirconium is particularly important. The amount of zirconium charged to the PUREX Plant is accurately known. The solubility of zirconium is very low, and almost all of the zirconium exited the PUREX Plant in the declad waste stream. Based on this information, the amount of zirconium in the NCRW stream was in the range of 265,000 to 285,000 kg (Schofield 1991). For this evaluation 265,000 kg was used. This is the amount of zirconium used by Schofield in his evaluation (1991). Historical transfer records indicate that 36 percent of the NCRW went to tank 241-AW-105 (Koreski 1995). This amounts to 99,000 kg of zirconium compared to 98,200 kg from the sample-based inventory estimate.

The 1990 core sample estimate is 2.8 times higher at 277,000 kg. The HDW model under-predicts the zirconium inventory by about 30,000 kg.

Inventories for iron, chromium, and nickel came primarily from corrosion of process vessels. The ratio of iron, chromium, and nickel in type 304 stainless steel is roughly 6:2:1. The 1986 sample-based results show a Fe:Cr:Ni ratio of 5.8:2.1:1.0. The 1990 sample-based ratio is 19:12:1, and the HDW model ratio is 43:0.057:1 although the HDW model source terms for these three components do not derive exclusively from corrosion assumptions.

The adjusted flowsheet composition in Table D3-4 was checked for electroneutrality. There is an imbalance of +0.35 mole equivalents in the adjusted flowsheet composition. This imbalance could be caused by low nitrite and nitrate concentrations. Increasing these concentrations to achieve a charge balance would bring these concentrations into general agreement with the sample results. To illustrate, the nitrate concentration in the September 1986 data is approximately 0.4*M*. The HDW model used a nitrate concentration of 0.39*M*. Concentrations for nitrite and nitrate in the flowsheet appear to be in error.

The previous evaluation is for the NCRW inventory only. Section D3.2.3 evaluates the contribution made by the 12-in. uranium-rich heel. Section D3.2.4 provides information for the supernatant currently stored in the tank.

D3.2.2 Evaluation of the 12-Inch Heel

When tank 241-AW-105 began service in July 1980, it received flush water followed by a transfer of complexed waste from the 242-A Evaporator. However, little or no solids formed in the tank from this complexed waste (Teats 1982). Tank 241-AW-105 next received DN wastes until it was nearly filled in 1983. The tank was emptied except for a small heel. The tank then received approximately 7,030 kL (1,857 kgal) of PXMSC wastes and some DN waste from tank 241-AW-103 through 1983 and 1984. Starting in 1984, tank 241-AW-105 received NCRW waste in addition to small transfers of PXMSC and flush water.

The 12-in. heel of dark solids in the tank bottom probably came from these PXMSC additions (Peters 1984). Twelve inches of waste corresponds to a volume of 125 kL (33 kgal). This means the 7,030 kL (1,857 kgal) of PXMSC contained an average of 1.8 volume percent solids, which is not an unreasonable number.

A composition for the 12-in. heel can be estimated by assuming that 7 in. of the 19-in. core segment, taken in July 1986, has the same composition as the segment above it (assumed to represent NCRW); then back-calculating the composition of the remaining 12 in. Only July 1986 data were used to do this because the January 1986 core sample did not include the 12-in. heel during the sampling event, and the May 1990 results are assumed to have a high bias. Table D3-5 shows the calculated heel composition, which is compared to the HDW model composition for PXMSC, referred to in the model as PUREX low-level waste.

Table D3-5. Composition of 12-Inch Heel in Tank 241-AW-105.

Analyte	Sample-Based Composition Estimate[1] (*M*)	HDW Model-Based Composition Estimate[2] (*M*)
Al	0.501	0
Cr	0.147	0.00712
Fe	0.401	1.90
K	0.00908	0.00610
La	0.00102	0
Mn	0.231	0.00534
Na	5.96	0.570
U	0.516	0.0561
$^{239/241}$Pu (Ci/L)	6.55E-04	0.00293
^{241}Am (Ci/L)	0.00373	0

Notes:

[1]Based on July 1986 core, segment 10. The assumed sludge density is 1.42 g/L.

[2]Agnew et al. (1997), Appendix B, PUREX low-level waste stream.

Agreement between the sample-based values and the HDW model-based values are poor. The source of the sample-based values are assumed to be the better basis because of good agreement of the NCRW portion of the same core sample with the flowsheet basis (see Section D3.2.1).

D3.2.3 Best-Basis for Sludge Inventory in Tank 241-AW-105

The core samples taken in 1986 provide a better basis for the sludge in tank 241-AW-105 than the 1990 core sample and the HDW model predictions. The January 1986 data were omitted because the data do not include the 30.5 cm (12 in.) heel. Where available, average concentrations for analytes taken from the July 1986 and September 1986 data were used for the best basis inventory. For analytes reported in the 1990 core sample data but not in any 1986 data sets, the 1990 core sample results were used. These values should be viewed with caution because the 1990 results do not compare well with the 1986 data in many cases, particularly for cations and radionuclides.

The differences between the 1990 and 1986 results may be caused by waste heterogeneity. If this is so, then the May 1990 results, although accurate, must be highly localized based on the flowsheet evaluation.

Table D4-1 and D4-2 show the best-basis inventories for the sludge in tank 241-AW-105.

D3.2.4 Evaluation of the Supernatant

Supernatant data from core sample events and predictions made by the HDW model have been made irrelevant by periodic transfers of waste into and out of tank 241-AW-105. The most recent data obtained for the supernatant come from the August 1996 grab sampling event. The previous supernatant sampling event was in August 1995 when three grab samples were taken. Transfers of PXMSC waste into tank 241-AW-105 and transfers from tank 241-AW-105 to tank 241-AP-104 in December 1995 have made the August 1995 sample results no longer applicable. Relatively few analyte concentrations were reported from that sample analysis, which was conducted for waste compatibility purposes only.

The August 1996 supernatant sample concentrations have a high pedigree associated with them. These samples covered a range of 300 to 394 cm (118 to 155 in.) from the tank bottom. The supernatant layer begins at approximately 259 cm (102 in.) and rises up to 406 cm (160 in.) from the tank bottom. From Table B2-1 through B2-43, there is evidence of some waste stratification. There is a concentration gradient for most components that increases with increasing depth. Mean interstitial liquid concentrations generally exceed the mean for the supernatant analyses.

The August 1996 supernatant data is the best basis for the supernatant in tank 241-AW-105 in the absence of other relevant data. Since August 1996, there have been no significant transfers into or out of the tank. For the best-basis inventories in Table D4-3 and D4-4, means from the supernatant samples and interstitial liquid sample 5AW-96-5 were calculated. Interstitial liquid sample 5AW-96-5 was taken very close to the interface between the supernatant and the sludge layers. A supernatant volume of 606 kL (160 kgal) was used to generate the inventories.

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

The results from this evaluation support using the July 1986 and September 1986 core sample data as the best basis for the inventory in tank 241-AW-105 sludge for the analytes provided and the 1990 sampling data as the best basis for analytes not reported in 1986. The August 1996 liquid samples provide the best-basis for the supernatant. These choices provide the best-basis for the following reasons:

1. Cation data from the May 1990 core sample are biased high apparently because of inter-element interferences during the ICP analyses. Anion concentrations deviate from the 1986 concentrations to a lesser extent than the cations and radionuclides, but significant differences still exist for several key anions.

2. The January 1986 grab samples do not include the 30.5 cm (12 in.) heel at the tank bottom.

3. The August 1996 grab sample data does not reflect the entire sludge layer.

4. Data from the core samples taken in July and September 1986 are consistent.

5. The fraction precipitated basis used for this analysis for major components result in inventory predictions that compare favorably with 1986 sample analyses.

6. The flowsheet bases and waste volumes used for this independent assessment are believed to reflect the processing conditions more closely than those that govern the HDW model inventories.

7. Supernatant data from the August 1996 sampling event are the latest published results available.

Tables D4-1 through D4-6 shows the best-basis inventory estimates for tank 241-AW-105.

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-105 Sludge as of October 31, 1996. (2 Sheets)

Analyte	Sludge Inventory (kg)	Basis (S, M, or E)[1]	Comment
Al	3,505	S	Average of 7/86[2] and 9/86 samples results. 5/90 = 14,800
Ca	1,400		5/90 sample result
Cl	594	S	9/86 sample result. 5/90 = 3,160
TIC as CO_3	10,200	S	9/86 sample result. 5/90=45,400
Cr	1,170	S	Average of 7/86 and 9/86 results. 5/90 = 6,030
F	77,300	S	9/86 sample result. 5/90 = 150,000
Fe	2,760	S	Average of 7/86 and 9/86 results. 5/90 = 9,620
K	10,700	S	Average of 7/86 and 9/86 sample results. 5/90 = 28,700
La	443	S	Average of 7/86 and 9/86 sample results. 5/90 = 2,030

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-105 Sludge as of October 31, 1996. (2 Sheets)

Analyte	Sludge Inventory (kg)	Basis (S, M, or E)[1]	Comment
Mn	1,090	S	Average of 7/86 and 9/86 sample results. 5/90 = 2,650
Na	1.54E+05	S	Average of 7/86 and 9/86 sample results. 5/90 = 40,300
Ni	200	S	9/86 sample result. 5/90 = 500
NO_2	10,700	S	9/86 sample result. 5/90 = 26,200
NO_3	38,600	S	9/86 sample result. 5/90 = 69,800
OH	11,400	S	9/86 sample result. 5/90 = 11,400
Pb	1,080	S	5/90 sample result.
PO_4	2,050	S	5/90 sample result.
Si	5,270	S	9/86 sample result. 5/90 = 9,540
SO_4	1,500	S	9/86 sample result. 5/90 = 9,540
Sr	12.0	S	9/86 sample result.
TOC	7,240	S	9/86 sample result. 5/90 = 12,900
U_{TOTAL}	12,800	S	Average of 7/86 and 9/86 sample results. 5/90 = 26,900
Zr	98,300	S	Average of 7/86 and 9/86 samples results. 5/90 = 277,000

Notes:

[1]S = sample-based, M = HDW model-based, and E = engineering assessment-based.
[2]Dates are in the mm/yy format.

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-105 Sludge as of October 31, 1996 (Decayed to January 1, 1994).

Analyte	Sludge Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	13.6	S	5/90[2] sample result.
^{14}C	2.26	S	5/90 sample result.
^{60}Co	486	S	5/90 sample result.
^{90}Sr	2.63E+05	S	5/90 sample result.
^{90}Y	2.63E+05	S	5/90 sample result.
^{99}Tc	108	S	5/90 sample result.
^{125}Sb	1,860	S	9/86 sample result. 5/90 = 7,780
^{134}Cs	95.8	S	9/86 sample result. 5/90 = 424
^{137}Cs	53,200	S	9/86 sample result. 5/90 = 142,000
^{137m}Ba	50,500	S	9/86 sample result. 5/90 = 135,000
^{154}Eu	273	S	9/86 sample result. 5/90 = 3,830
^{155}Eu	199	S	9/86 sample result. 5/90 = 2,550
^{238}Pu	69.1	S	9/86 sample result. 5/90 = 658
$^{239/240}Pu$	821	S	9/86 sample result. 5/90 = 3,280
^{241}Am	477	S	Average of 7/86 and 9/86 sample results. 5/90 = 3,190
$^{243/244}Cm$	184	S	5/90 sample result.

Notes:

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

[2]Dates are in the mm/yy format.

Table D4-3. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-105 Supernatant as of October 31, 1996.

Analyte	Supernatant Inventory (kg)	Basis (S, M, or E)[1]	Comment
Al	26.2	S	
Cl	149	S	
TIC as CO_3	1,170	S	
Cr	1.20	S	
F	290	S	
K	1,200	S	
Na	8,990	S	
NO_2	780	S	
NO_3	16,300	S	
OH	2,840	S	
PO_4	59.8	S	
Si	32.5	S	
SO_4	140	S	
TOC	1,140	S	

Note:
[1]S = sample-based, M = HDW model-based, and E = engineering assessment-based.

Table D4-4. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-105 Supernatant as of October 31, 1996. (Decayed to January 1, 1994)

Analyte	Supernatant Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{60}Co	0.223	S	
^{79}Se	NR	S	
^{90}Sr	14.5	S	
^{90}Y	14.5	S	
^{137}Cs	454	S	
^{137m}Ba	431	S	
$^{239/240}Pu$	0.0025	S	
^{241}Am	<0.00382	S	

Note:

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

Table D4-5. Best-Basis Total Inventory Estimates for Nonradioactive Components in Tank 241-AW-105 as of October 31, 1996.

Analyte	Total Inventory (kg)	Basis (S, M, or E)[1]	Comment
Al	3,520	S	
Cl	743	S	
TIC as CO_3	11,100	S	
Cr	1,170	S	
F	77,600	S	
Fe	2,760	S	Sludge inventory only.
K	10,900	S	
La	443	S	Sludge inventory only.
Mn	1,090	S	Sludge inventory only.
Na	1.63E+05	S	
Ni	200	S	Sludge inventory only.
NO_2	11,500	S	
NO_3	54,900	S	
OH	14,300	S	
Pb	1,080	S	Sludge inventory only.
PO_4	2,110	S	
Si	5,310	S	
SO_4	1,640	S	
Sr	12.0	S	Sludge inventory only.
TOC	8,380	S	
U_{TOTAL}	12,800	S	Sludge inventory only.
Zr	98,300	S	Sludge inventory only.

Note:

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

Table D4-6. Best-Basis Total Inventory Estimates for Radioactive Components in Tank 241-AW-105 as of October 31, 1996 (Decayed to January 1, 1994).

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	13.6	S	Sludge inventory only.
^{14}C	2.26	S	Sludge inventory only.
^{60}Co	486	S	
^{90}Sr	2.63E+05	S	
^{90}Y	2.63E+05	S	
^{99}Tc	108	S	Sludge inventory only.
^{125}Sb	1,860	S	Sludge inventory only.
^{134}Cs	95.8	S	Sludge inventory only.
^{137}Cs	53,700	S	
^{137m}Ba	51,000	S	
^{154}Eu	273	S	Sludge inventory only.
^{155}Eu	199	S	Sludge inventory only.
^{238}Pu	69.1	S	Sludge inventory only.
$^{239/240}Pu$	821	S	
^{241}Am	477	S	
$^{243/244}Cm$	184	S	Sludge inventory only.

Note:

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

D5.0 APPENDIX D REFERENCES

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, Los Alamos National Laboratory, Los Alamos, New Mexico.

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Kupfer, M. J., A. L. Boldt, B. A. Higley, S. L. Lambert, D. E. Place, R. M. Orme, L. W. Shelton, R. A. Watrous, G. L. Borsheim, N. G. Colton, M. D. LeClair, W. W. Schulz, D. Hedengren, and R. T. Winward, 1996, *Interim Report: Best Basis Inventory of Chemical and Radionuclides in Hanford Site Tank Waste*, WHC-SD-WM-TI-740, Rev. C Draft, Westinghouse Hanford Company, Richland, Washington.

Koreski, G. M., 1995, *Historical Transaction Database*, Westinghouse Hanford Company, Richland, Washington.

Peters, B. B., 1986, *Analysis of Neutralized Coating Removal Waste (NCRW) Core Samples from Tank 105-AW*, (internal letter 65453-86-124 to L. M. Sasaki), Rockwell Hanford Operations, Richland, Washington.

RHO, 1982, *Purex Flowsheet for Reprocessing of N Reactor Fuels*, PFD-P-020-00001, Rockwell Hanford Operations, Richland, Washington.

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Schofield, J. S., 1991, *Estimation of Neutralized Current Acid Waste and Neutralized Cladding Removal Waste Constituents*, (internal letter 85440-91-018 to S. A. Barker, July 18), Westinghouse Hanford Company, Richland, Washington.

Teats, M. C., 1982, *Dilute Complexed Waste Concentration, 242-A Evaporator-Crystallizer Campaign 80-9, August 13th to August 30th, 1980*, SD-WM-PE-005, Rev. 0, Rockwell Hanford Operations, Richland, Washington.

APPENDIX E

BIBLIOGRAPHY FOR TANK 241-AW-105

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APPENDIX E

BIBLIOGRAPHY FOR TANK 241-AW-105

Appendix E is a bibliography that supports the characterization of tank 241-AW-105. 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-AW-105 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 and Customers of Characterization Data
- If. Other - Nondocumented or Electronic Sources

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

- IIa. Sampling of Tank Waste and Waste Types
- IIb. Sampling of Similar Waste Types
- IIc. Other - Nondocumented or Electronic Sources

III. COMBINED ANALYTICAL/NON-ANALYTICAL DATA

- IIIa. Inventories using both Campaign and Analytical Information
- IIIb. Compendium of Existing Physical and Chemical Documented Data Sources
- IIIc. Other - Nonndocumented or Electronic Sources

IV. OTHER DOCUMENTED RESOURCES

This bibliography is broken down into the appropriate sections with an annotation at the end of each reference describing the information source. Where possible, a reference is provided for information sources. A majority of the information listed below is available in the Lockheed Martin Hanford Corporation Tank Characterization Resource Center.

I. NON-ANALYTICAL DATA

Ia. Models/Waste Type Inventories/Campaign Information

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

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

Bergmann, D. W., 1988, *Segregation of Decladding Solution from PUREX Cladding Removal Waste*, (internal memorandum 12730-88-175 to E. J. Kosiancic, December 8), Westinghouse Hanford Company, Richland, Washington.

- Contains an attempt to evaluate the feasibility of segregating the decladding waste stream as a possible way of reducing the amount of TRU sent to underground storage.

Mollusky, J. P., 1988, *Process Test Plan for the Segregation of PUREX Neutralized Cladding Removal Wastes*, WHC-SD-WM-PTP-020, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Describes the purpose, scope, and test requirements to produce a low-level TRU decladding waste through chemical treatment and waste segregation.

RHO, 1982, *Purex Flowsheet for Reprocessing of N Reactor Fuels*, PFD-P-020-00001, Rockwell Hanford Operations, Richland, Washington.

- A flowsheet for reprocessing zircaloy clad fuels at PUREX. Includes NCRW and spent metathesis waste stream compositions.

Ib. Fill History/Waste Transfer Records

Agnew, S. F., R. A. Corbin, T. B. Duran, K. A. Jurgensen, T. P. Ortiz, and B. L. Young, 1997, *Waste Status and Transaction Record Summary: WSTRS, Rev. 4*, LA-UR-97-311, Los Alamos National Laboratory, Los Alamos, New Mexico.

- Contains spreadsheets showing all available data on tank additions and 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 to 1981.

Teats, M. C., 1982, *Dilute Complexed Waste Concentration, 242-A Evaporator-Crystallizer Campaign 80-9, August 13th to August 30th, 1980*, SD-WM-PE-005, Rev. 0, Rockwell Hanford Operations, Richland, Washington.

- Describes the 242-A Evaporator-Crystallizer Campaign 80-9, which produced concentrated complexed waste, and the waste transfers performed to support the evaporator campaign.

Ic. Surveillance/Tank Configuration

Hanlon, B. M., 1996, *Waste Tank Summary Report for Month Ending October 31, 1996*, HNF-EP-0182-103, Lockheed Martin Hanford Corporation, Richland, Washington.

- Most recent release of a series of summaries including fill volumes, Watch List tanks, unusual occurrences, integrity information, equipment readings, equipment status, tank location, and other miscellaneous tank information. The series includes monthly summaries from December 1947 to the present; however, Hanlon has only authored the monthly summaries from November 1989 to the present.

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 or completed. Also includes an estimate of the risers available for sampling.

Salazar, B. E., 1994, *Double-Shell Underground Waste Storage Tanks Riser Survey*, WHC-SD-RE-TI-093, Rev. 4, Westinghouse Hanford Company, Richland, Washington.

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

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.

- Compilation of information on thermocouple trees installed in Hanford Site underground waste tanks.

WHC, 1994, *Piping Plan Tank 105*, Drawing H-2-70407, Rev. 5, Westinghouse Hanford Company, Richland, Washington.

- Shows a plan view of the riser locations and piping.

WHC, 1995, *Plan Tank Penetration 241-AW Tanks*, Drawing H-14-010502, Sheet 2, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

- Shows a plan view of the riser locations and piping.

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

- Describes the nature, scope, and frequency of surveillance used for waste storage tanks, states action criteria for response to data deviation, and presents tank data reviews between June 15, 1973 and June 15, 1988.

Id. Sample Planning/Tank Prioritization

40 CFR 261, "Identification and Listing of Hazardous Wastes," *Code of Federal Regulations*, U.S. Environmental Protection Agency, Washington, D.C.

- Identifies and lists hazardous wastes and defines procedures for determining whether a waste should be classified as hazardous.

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- Transmits a request for analysis for six grab samples to be taken from tank 241-AW-105.

Brown, T. M., J. W. Hunt, and L. J. Fergestrom, 1997, *Tank Characterization Technical Sampling Basis*, HNF-SD-WM-TA-164, Rev. 3, Lockheed Martin Hanford Corporation, Richland, Washington.

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

DiLiberto, A. J., 1990, *105-AW Core Sample*, (letter 9054755 to B. P. McGrail, July 2), Westinghouse Hanford Company, Richland, Washington.

- Contains sample descriptions and lists the required analyses for the core sample obtained in 1990 from tank 241-AW-105.

Ecology, EPA, and DOE, 1993, *Hanford Federal Facility Agreement and Consent Order,* as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

- Contains agreement between EPA, DOE, and Ecology which sets milestones for completing work on the Hanford Site tank farms.

Gauck, G. J., 1990, *Requests for 105-AW Core Sample Analysis*, (internal memorandum 82315-90-GJG-001 to B. W. Hall, March 12), Westinghouse Hanford Company, Richland, Washington.

- Directs which analyses are to be conducted on the tank 241-AW-105 core sample removed from riser 16B during May 1990.

Homi, C. S., 1995, *Tank 241-AW-105 Tank Characterization Plan*, WHC-SD-WM-TP-415, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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Peters, B. B., 1986, *Analysis of Neutralized Coating Removal Waste Samples*, (letter R86-3176 to A. C. Leaf, July 9), Rockwell Hanford Operations, Richland, Washington.

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- Requests that nine supernatant and 11 sludge samples be obtained from tank 241-AW-105 for compatibility analyses and for K Basin sludge mixing studies.

Ie. Data Quality Objectives and Customers of Characterization Data

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- Determines whether tanks are under safe operating conditions.

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- Outlines the data needed to make decisions concerning operation of the 242-A Evaporator and the Liquid Effluent Retention Facility.

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- Reports Watch List, Characterization Basis, DQO applicability, and characterization status per tank. The status table is updated weekly.

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

IIa. Sampling of Tank Waste and Waste Types

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- Contains sample analysis results from the liquid grab samples taken in 1995.

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- Contains sample analysis results from the liquid and sludge grab samples taken in 1996.

Jansky, M. T., 1984, *Laboratory Support for Upcoming 242-A Evaporator Campaign Run*, (internal letter 65453-84-134, to E. G. Gratny, May 10), Rockwell Hanford Operations, Richland, Washington.

- Documents the presence of a separable organic layer floating above an aqueous phase in samples removed from tank 241-AW-105.

Jansky, M. T., and S. G. Metcalf, 1982, *Complexed Liquor Analysis and Thermal Degradation of Complexants*, (internal letter 65453-82-345 to J. R. Wetch, September 20), Rockwell Hanford Operations, Richland, Washington.

- Contains sample analysis results for a sample of complexed waste taken from tank 241-AW-105.

Jones, J. M., 1994, *105-AW IC Results (Addition of Reported Hydroxide Conc.)*, (electronic mail to T. M. Brown and P. Sathyanarayana, September 1), Westinghouse Hanford Company, Richland, Washington.

- Provides hydroxide and IC results from the analysis of five supernatant samples and one sludge sample taken from tank 241-AW-105 (samples R6228, R6229, R6230, R6231, R6232, and R6233).

Leaf, A. C., 1986, *Analysis of Neutralized Coating Removal Waste Samples*, (letter 8652298 to B. Peters, August 11), Westinghouse Hanford Company, Richland, Washington.

- Presents analytical results for several physical properties and the primary TRU elements for the July 2, 1986 sampling event for tank 241-AW-105.

Leaf, A. C., and J. J. McCown, 1987, *Analysis of NCRW Core Samples from Tanks 103 AW and 105 AW*, (internal letter 8750316 to L. M. Sasaki, February 2), Westinghouse Hanford Company, Richland, Washington.

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- Presents the analytical results of a liquid grab sample taken from the surface of tank 241-AW-105.

Mauss, B. M., 1986, *242-A Evaporator Campaign 86-1: Laboratory Analyses*, (internal letter 65453-86-023 to R. T. Kimura, February 20), Rockwell Hanford Operations, Richland, Washington.

- Presents the analytical results of a liquid grab sample taken from tank 241-AW-105 on December 9, 1985, before its transfer to the evaporator feed tank.

Metcalf, S. G., 1982, *Technology Transfer of Methodology to Determine ^{99}Tc in Hanford Defense Waste*, (internal letter 65453-82-183 to S. A. Catlow, September 30), Rockwell Hanford Operations, Richland, Washington.

- Presents the results of a technetium-99 analysis performed on tank samples, including supernatant from tank 241-AW-105.

Peters, B. B., 1986, *Analysis of Neutralized Coating Removal Waste (NCRW) Core Samples From Tank AW-105*, (internal letter 65453-86-124 to L. M. Sasaki, October 2), Rockwell Hanford Operations, Richland, Washington.

- Presents analytical results for most analyses from the July 2, 1986, core sampling event for tank 241-AW-105.

Peters, B. B., and K. J. Patterson, 1986, *Percent Water in Tank AW-105 Neutralized Coating Removal Waste*, (internal letter 65453-86-136 to M. W. Gibson, November 3), Rockwell Hanford Operations, Richland, Washington.

- Presents the weight percent water results from the July 2, 1986, sampling event for tank 241-AW-105.

Sasaki, L. M., 1987, "Disposal of July 1986 Tank 105-AW Core Sample Segments," (internal letter 3-1351 to Brian Peters, March 30), Westinghouse Hanford Company, Richland, Washington.

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Scheele, R. D., and D. McCarthy, 1986, *Characterization of Actual Zirflex Decladding Sludge*, a letter report for Rockwell Hanford Operations, Pacific Northwest Laboratory, Richland, Washington.

- Reports the analytical results of five samples removed from tank 241-AW-105 in early 1986.

Teats, M. C., 1982, *Dilute Complexed Waste Concentration, 242-A Evaporator-Crystallizer Campaign 80-9, August 13th to August 30th, 1980*, SD-WM-PE-005, Rev. 0, Rockwell Hanford Operations, Richland, Washington.

- Describes the 242-A Evaporator-Crystallizer Campaign 80-9 which produced the concentrated complexed waste sent to tank 241-AW-105. Document includes results of the analysis of evaporator product obtained from tank 241-AW-105.

Tingey, J. M., and B. C. Simpson, 1994, *Characterization Information for Double-Shell Tank 241-AW-105*, WHC-SD-WM-TI-649, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Preliminary report of the analytical results from the 1990 sampling of tank 241-AW-105.

Vail, T. S., 1986, *Operational Summary of the Core Sample from 241-AW-105*, (internal letter number 65950-86-406 to D. E. McKenney, July 8), Rockwell Hanford Operations, Richland, Washington.

- Lists the sampling locations and dose rates for the July 2, 1986, core sampling event for tank 241-AW-105.

WHC, 1988, *Sample Status Report for T 805. 105-AW A-FD*, (electronic report, August 17), Westinghouse Hanford Company, Richland Washington.

- Provides the results of the analysis of liquid grab sample T-805 taken from tank 241-AW-105.

IIb. Sampling of Similar Waste Types

Tingey, J. M., R. D. Scheele, M. E. Peterson, and M. R. Elmore, 1990, *Characterization of Waste From Double-Shell Tank 103-AW*, Pacific Northwest Laboratory, Richland, Washington.

- Contains the results of the analysis of a core sample of NCRW solids obtained from tank 241-AW-103 in 1989.

Weiss, R. L., 1990, *January 1989 Core Sample From Tank 241-AW-103 Process Chemistry Laboratories Efforts*, (internal letter 12712-PCL90-039 to A. J. DiLiberto, February 22), Westinghouse Hanford Company, Richland, Washington.

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IIc. Other Nondocumented or Electronic Sources

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- Spreadsheets contain historical sampling data for dates before those available in Tank Characterization Database.

Pacific Northwest National Laboratory, 1997, TCD: Tank Characterization Database. In: SYBASE version 4.0. Available: Tank Waste Information Network System (TWINS), Pacific Northwest National Laboratory, Richland, Washington.

- Contains qualified raw sampling data taken in the past few years from 222-S Laboratory. A small amount of information from the 325 Laboratory data is included.

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 Model Rev. 4*, LA-UR-96-3860, Los Alamos National Laboratory, Los Alamos, New Mexico.

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

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

- Contains proposed tank groups based on TLM and a statistical method for comparing analytical information to HDW predictions.

Kupfer, M. J., A. L. Boldt, B. A. Higley, S. L. Lambert, D. E. Place, R. M. Orme, L. W. Shelton, R. A. Watrous, G. L. Borsheim, N. G. Colton, M. D. LeClair, W. W. Schulz, D. Hedengren, and R. T. Winward, 1996, *Interim Report: Best Basis Inventory of Chemical and Radionuclides in Hanford Site Tank Waste*, WHC-SD-WM-TI-740, Rev. C Draft, Westinghouse Hanford Company, Richland, Washington.

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

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 technetium-99 from ORIGEN2 and analytical data.

Schofield, J. S., 1991, *Estimation of Neutralized Current Acid Waste and Neutralized Cladding Removal Waste Constituents*, (internal letter 85440-91-018 to S. A. Barker, July 18), Westinghouse Hanford Company, Richland, Washington.

- Provides an estimate of tank contents for tanks containing neutralized current acid waste and neutralized cladding removal waste based on a reconciliation of flowsheet records, process tests, and January 1996 and July 1986 tank sampling events.

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 supernatant sample analyses.

Brevick, C. H., L. A. Gaddis, and S. D. Consort, 1995, *Supporting Document for the Southeast Quadrant Historical Tank Content Estimate Report for AW-Tank Farm - Volume 1 and 2*, WHC-SD-WM-ER-316, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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

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

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

Brevick, C. H., L. A. Gaddis, and W. W. Pickett, 1996, *Historical Tank Content Estimate for the Southeast Quadrant of the Hanford 200 Areas*, WHC-SD-WM-ER-350, Rev. 0A, ICF Kaiser Hanford Company, Richland, Washington.

- Contains summary information from the supporting documents for tanks in AW, AN, AP, AY, AZ, and SY farms, including in-tank photographic collages and tank inventory estimates.

De Lorenzo, D. S., J. H. Rutherford, D. J. Smith, D. B. Hiller, K. W. Johnson, and B. C. Simpson, 1994, *Tank Characterization Reference Guide*, WHC-SD-WM-TI-648, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Summarizes issues surrounding the characterization of nuclear wastes stored in Hanford Site waste tanks.

Hanlon, B. M., 1996, *Waste Tank Summary Report for Month Ending October 31, 1996*, HNF-EP-0182-103, Lockheed Martin Hanford Corporation, Richland, Washington.

- These documents contain a monthly summary of: fill volumes, Watch List tanks, unusual occurrences, integrity information, equipment readings, equipment status, tank location, and other miscellaneous tank information. All monthly summaries from December 1947 to the present are grouped; however, Hanlon has only authored the monthly summaries from November 1989 to present.

Hartley, S. A., G. Chen, C. A. Lopresti, T. M. Ferryman, A. M. Liebetrau, K. M. Remund, S. A. Allen, and B. C. Simpson, 1996, *A Comparison of Historical Tank Content Estimate (HTCE) Model Rev. 3, and Sample-Based Estimates of Hanford Waste Tank Contents*, PNL-11429, Pacific Northwest Laboratory, Richland, Washington.

- Contains a statistical evaluation of the HDW inventory estimate against analytical values from 12 existing TCRs using a select component data set.

Husa, E. I., R. E. Raymond, R. K. Welty, S. M. Griffith, B. M. Hanlon, R. R. Rios, and N. J. Vermeulen, 1993, *Hanford Site Waste Storage Tank Information Notebook*, WHC-EP-0625, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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

Jones, J. M., 1994, *242-A Evaporator Campaign 95-1 Waste Compatibility Assessment of Tank 241-AW-105 Waste With Tank 241-AP-108*, (internal memorandum 7CF10-055-094 to R. A. Dodd, November 15), Westinghouse Hanford Company, Richland, Washington.

- Presents the results of the compatibility assessment in preparation for transferring tank 241-AW-105 supernatant to tank 241-AP-108 in preparation for 242-A Evaporator Campaign 95-1.

Jones, J. M., 1995, *Waste Compatibility Assessment of Tank 241-AW-105 with D5/E6 PUREX Waste Via Tank F18*, (internal memorandum ETFPE-95-014 to R. A. Dodd, March 6), Westinghouse Hanford Company, Richland, Washington.

- Presents the results of the compatibility assessment for routine transfers of waste from PUREX to tank 241-AW-105.

Lodwick, R. J., 1997, *Technical Review of Criticality Safety of Disposing of K Basin Sludge in Double-Shell Tank AW-105*, (internal letter DESH-9750785 to J. L. Wise, January 29), Duke Engineering and Services Company, Richland, Washington.

- Authorizes Fluor Daniel Northwest, Inc. to provide support and technical review for this report regarding disposal of K Basin sludge into tank 241-AW-105.

Remund, K. M., and B. C. Simpson, 1996, *Hanford Waste Tank Grouping Study*, PNNL-11433, Pacific Northwest National Laboratory, Richland, Washington.

- Contains a statistical evaluation to group tanks into classes with similar waste types.

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 an tank inventory estimate based on analytical information.

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

- Contains a tank inventory estimate based on analytical information.

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

- Contains a tank inventory estimate based on analytical information.

WHC, 1993, *Process Aids: A Compilation of Technical Letters By Process Laboratories and Technology*, WHC-IP-0711-25, Westinghouse Hanford Company, Richland, Washington.

- Contain a collection of internal memoranda and letters concerning tank or process sampling. All the process aids documents from 1969 - 1993 are grouped.

IIIc. Other - Nondocumented or Electronic Sources

Pacific Northwest National Laboratory, 1996, TWINS: Tank Waste Information Network System. In: SYBASE version 4. Available: Hanford Local Area Network (HLAN), Westinghouse Hanford Company, Richland, Washington; or TCP/IP access, Pacific Northwest National Laboratory, Richland, Washington.

- Database provides access to SACS, TMACS, TCD, and Fluor Daniel Northwest Electronic data. Laboratory data from the analysis of tank samples are contained in TCD, tank surveillance data are contained in SACS and TMACS.

IV. OTHER DOCUMENTED RESOURCES

Fluor Daniel Northwest, 1997, Fluor Daniel Northwest Tank Characterization Library. In hard copy. Available: Fluor Daniel Northwest, 200E, Trailer MO-971 Room 26, Sheryl Consort: custodian, Fluor Daniel Northwest, Richland, Washington.

- A resource of 200 Area tanks, process campaigns, reactors, and other unclassified and declassified historical records.

LMHC, 1997, L.S.I.S.: Large Scale Information System, ERS DB - Engineering Release Station Database. In: Database. Available: Hanford Local Area Network (HLAN), Westinghouse Hanford Company, Richland, Washington.

- Database has released document information. Most expedient to search by title and keyword for tank in question.

Lockheed Martin Services, 1997, RMIS: Record Management Information System, Records Database. In: Database. Available: HLAN, Westinghouse Hanford Company, Richland, Washington.

- A database of all released documents since November 1995, which will be back loaded with previous year's data. It can be queried to find documents for any subject by keyword or description. field.

Lockheed Martin Services, 1997, RMIS: Record Management Information System, TFIC Database. In: Database. Available: HLAN, Westinghouse Hanford Company, Richland, Washington.

- A database of tank related reports, memoranda, and letters that have been optically scanned. The database can be queried to find indexed information for a tank [in the tank or description field] or information can be referenced to any subject in the keyword or description field.

LMHC, 1997, TCRC: Tank Characterization and Safety Resource Center. In: hard copy. Available: 2750E, Room A-243, Ann Young: custodian, Westinghouse Hanford Company, Richland, Washington.

- A resource of TWRS characterization data including hard copy file folders of sampling data for each tank, an index of multiple tank documents folders, physical/chemical data compendiums, and studies or reports on 200 Area Tanks or Tank Waste generated by various contractors.

WHC, 1996, 209-E Waste Tanks Document Index. In: Hard copy. Available: Fluor Daniel Northwest Library, Fluor Daniel Northwest, Richland, Washington.

- An index of general and tank specific information for the 200 Area tanks.

DISTRIBUTION SHEET

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