ENGINEERING CHANGE NOTICE

0051444

Page 1 of 2

1. ECN 654990

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental [] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	Jim G. Field, Data Development and Interpretation, R2-12, 376-3753	[] Yes [X] No	07/06/99
	6. Project Title/No./Work Order No.: Tank 241-AN-102	7. Bldg./Sys./Fac. No.: 241-AN-102	8. Approval Designator: N/A
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.): WHC-SD-WM-ER-545, Rev. 1-B	10. Related ECN No(s).: ECNs: 635339, 640361, 644477	11. Related PO No.: N/A

12a. Modification Work	12b. Work Package No.	12c. Modification Work Complete	12d. Restored to Original Condition (Temp. or Standby ECN only)
[] Yes (fill out Blk. 12b) [X] No (NA Blks. 12b, 12c, 12d)	N/A	N/A Design Authority/Cog. Engineer Signature & Date	N/A Design Authority/Cog. Engineer Signature & Date

13a. Description of Change 13b. Design Baseline Document? [] Yes [X] No

The document has been totally revised to include the results of recent sampling to address technical issues associated with the waste, and to update the best basis standard inventory.

JUL 1999 RECEIVED EDMC

14a. Justification (mark one)

Criteria Change	[X]	Design Improvement	[]	Environmental	[]	Facility Deactivation	[]
As-Found	[]	Facilitate Const	[]	Const. Error/Omission	[]	Design Error/Omission	[]

14b. Justification Details

Changes required to incorporate new sampling data.

15. Distribution (include name, MSIN, and no. of copies)

See attached distribution.

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A-7900-013-2 (05/96) GEF095

A-7900-013-1

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1. ECN (use no. from pg. 1): ECN-654990

16. Design Verification Required	17. Cost Impact				18. Schedule Impact (days)	
	ENGINEERING		CONSTRUCTION			
[] Yes	Additional	[] $	Additional	[] $	Improvement	[]
[X] No	Savings	[] $	Savings	[] $	Delay	[]

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

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	[]		[]

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision
N/A		

21. Approvals

	Signature	Date		Signature	Date
Design Authority			Design Agent		
Cog. Eng. J.G. Field	J G Field	7/6/99	PE		
Cog. Mgr. K.M. Hall	L/M Sasaki for K.M. Hall	7/7/99	QA		
QA			Safety		
Safety			Design		
Environ.			Environ.		
Other J.W. Cammann	JW Cammann	7/7/99	Other		
R.J. Cash	[signature] for RJC	7/8/99	DEPARTMENT OF ENERGY		
			Signature or a Control Number that tracks the Approval Signature		
			ADDITIONAL		

DISTRIBUTION SHEET

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Distribution	Data Development and Interpretation	Date 07/06/99
Project Title/Work Order		EDT No. N/A
Tank Characterization Report for Double-Shell Tank 241-AN-102, HNF-SD-WM-ER-545, Rev. 2		ECN No. ECN-654990

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
<u>OFFSITE</u>					
<u>Sandia National Laboratory</u> P.O. Box 5800 MS-0744, Dept. 6404 Albuquerque, NM 87815					
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J. L. Kovach		X			
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<u>Tank Advisory Panel</u> 102 Windham Road Oak Ridge, TN 37830					
D. O. Campbell		X			

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Distribution	Data Development and Interpretation	Date 07/06/99
Project Title/Work Order Tank Characterization Report for Double-Shell Tank 241-AN-102, HNF-SD-WM-ER-545, Rev. 2		EDT No. N/A
		ECN No. ECN-654990

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
<u>ONSITE</u>					
<u>Office of River Protection</u>					
W. S. Liou	S7-54	X			
DOE Reading Room	H2-53	X			
<u>Fluor Daniel Hanford Corporation</u>					
J. S. Hertzel	H8-67	X			
<u>Lockheed Martin Hanford, Corp.</u>					
J. W. Cammann	R2-11	X			
G. D. Johnson	S7-73	X			
L. M. Sasaki	R2-12	X			
B. C. Simpson	R2-12	X			
D. R. Thompson	R2-12	X			
ERC (Environmental Resource Center)	R1-51	X			
T.C.S.R.C.	R1-10	5			
<u>Lockheed Martin Services, Inc.</u>					
B. G. Lauzon	R1-08	X			
Central Files	B1-07	X			
EDMC	H6-08	X			
<u>Numatec Hanford Corporation</u>					
J. S. Garfield	R3-73	X			
D. L. Herting	T6-07	X			
<u>Pacific Northwest National Laboratory</u>					
A. F. Noonan	K9-91	X			
<u>Scientific Applications International Corporation</u>					
M. D. LeClair	R3-75	X			

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Tank Characterization Report for Double-Shell Tank 241-AN-102

M. I. Rollosson and L. C. Amato
Los Alamos Technical Associates subcontract to
Lockheed Martin Hanford Corp., Richland, WA 99352
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Key Words: Waste Characterization, Double-Shell Tank, DST, Tank 241-AN-102, Tank AN-102, AN-102, AN Farm, Tank Characterization Report, TCR, Waste Inventory, TPA Milestone M-44

Abstract: This document summarizes the information on the historical uses, present status, and the sampling and analysis results of waste stored in Tank 241-AN-102. This report supports the requirements of the Tri-Party Agreement Milestone M-44-15C.

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RECORD OF REVISION	(1) Document Number WHC-SD-WM-ER-545	Page 1

(2) Title
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HNF-SD-WM-ER-545
Revision 2

Tank Characterization Report for Double-Shell Tank 241-AN-102

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LIST OF TERMS

AES	atomic emission spectroscopy
ANOVA	analysis of variance
Bq/L	Bequerels per liter
BNFL	British Nuclear Fuel Limited
Btu/hr	British thermal units per hour
CC	concentrated complexant
Ci	curie
Ci/g	curies per gram
Ci/L	curies per liter
CI	confidence interval
cm	centimeter
CVR	central void reference
DBP	dibutyl phosphate
df	degrees of freedom
DOE	U. S. Department of Energy
DOT	Department of Transportation
DQO	data quality objective
DSC	differential scanning calorimetry
DSSF	double-shell slurry feed
DW	dry weight
EDTA	ethylenediaminetetraacetic acid
FIC	Food Instrument Corporation
ft	feet
g/L	grams per liter
g/mL	grams per milliliter
GC	gas chromatograph
GEA	gamma energy analysis
GFAA	graphite furnance atomic absorption
HEDTA	N-(2-hydroxyethyl)ethylenediamine tetra actetate
HDW	Hanford defined waste
HHF	hydrostatic head fluid
IC	ion chromatography
ICP	inductively coupled plasma spectroscopy
in.	inch
J/g	joules per gram
kg	kilogram
kgal	kilogallon
kL	kiloliter

LIST OF TERMS (Continued)

kW	kilowatt
LAW	low activity waste
LFL	lower flammability limit
LL	lower limit
m	meter
m^2	square meters
M	moles per liter
mL	milliliter
mm	millimeter
mmol/g	millimoles per gram
MS	mass spectroscopy
mR/hr	milliroentgens per hour
MRQ	minimum reportable quantities
n/a	not applicable
nCi/g	nanocuries per gram
n/r	not reported
PAS-I	post-accident sampling container – I
PNNL	Pacific Northwest National Laboratory
PHMC	Project Hanford Management Contractor
ppm	parts per million
PUREX	Plutonium-Uranium Extraction (Facility)
QC	quality control
REML	restricted maximum likelihood method
RPD	relative percent difference
RPP	River Protection Project
RSD	relative standard deviation
SACS	Surveillance Analysis Computer System
SAP	sampling and analysis plan
SMM	supernatant mixing model
SMMA2	Supernatant Mixing Model Saltcake from the 242-A Evaporator
SpG	specific gravity
SVOA	semivolatile organics
TC	thermocouple
TCR	tank characterization report
TGA	thermogravimetric analysis
TIC	total inorganic carbon
TLM	tank layer model
TOC	total organic carbon

LIST OF TERMS (Continued)

TRU	transuranic (waste)
TWRS	Tank Waste Remediation System
UL	upper limit
W	watt
WIT	Waste Disposal Integration Team
WSRC	Westinghouse Savannah River Company
WSTRS	Waste Status and Transaction Record Summary
wt%	weight percent
%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
μCi/g	microcuries per gram
μCi/mL	microcuries per milliliter
μeq/g	microequivalents per gram
μg	microgram
μg C/g	micrograms of carbon per gram
μg C/mL	micrograms of carbon per milliliter
μg/g	micrograms per gram
μg/kg	micrograms per kilogram
μg/mL	micrograms per milliliter

1.0 INTRODUCTION

A major function of the River Protection Project (RPP) is to characterize waste in support of waste management and disposal activities at the Hanford Site. Analytical data from sampling and analysis and 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-AN-102.

The objectives of this report are 1) to use characterization data in response to technical issues associated with tank 241-AN-102 waste, and 2) to provide a standard characterization of this waste in terms of a best-basis inventory estimate. Section 2.0 summarizes the response to technical issues, Section 3.0 shows the best-basis inventory estimate and Section 4.0 makes recommendations about the safety status of the tank and additional sampling needs. The appendices contain supporting data and information. This report supports the requirements of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1997), Milestone M-44-15c, change request M-44-97-03 to "issue characterization deliverables consistent with the Waste Information Requirements Document developed for FY 1999" (Adams et al. 1998).

1.1 SCOPE

The characterization information in this report originated from sample analyses and known historical sources. Samples were obtained and assessed to fulfill requirements for tank specific issues discussed in Section 2.0 of this report. Other information was used to support conclusions derived from these results. Appendix A contains historical information for tank 241-AN-102 including surveillance information, records pertaining to waste transfers and tank operations, and expected tank contents derived from a process knowledge model. Appendix B summarizes recent sampling events (see Table 1-1), historical sample data obtained before 1989, and sampling results. Appendix C provides the statistical analysis and numerical manipulation of data used in issue resolution. Appendix D contains the evaluation to establish the best basis for the inventory estimate. Appendix E is a bibliography that resulted from an in-depth literature search of all known information sources applicable to tank 241-AN-102 and its respective waste types.

Table 1-1. Summary of Recent Sampling. (2 sheets)

Sample/Date	Phase	Location	Segmentation	% Recovery
Push Core (05/24/90)	Solid/Liquid	Riser 10	2 cores, 3 segments each	84 and 92% [1]
Grab samples (10/21/94)	3 supernatant and 1 sludge	Riser 22	n/a	n/a

Table 1-1. Summary of Recent Sampling. (2 sheets)

Sample/Date	Phase	Location	Segmentation	% Recovery
Grab samples (02/15/95)	2 supernatant and 1 sludge	Riser 22	n/a	n/a
Grab samples (11/30/98; 12/14/95)	5 supernatant and 2 sludge	Riser 21	n/a	n/a
Grab samples (02/03/98 - 02/05/98	42 supernatant	Riser 20	n/a	n/a
Grab samples (07/21/98 - 07/23/98; 08/10/98 - 08/12/98)	27 supernatant and 3 sludge	Riser 22	n/a	n/a

Notes:

n/a = not applicable

[1]The percent recoveries provided are for segments 2 and 3 of the core analyzed by Pacific Northwest National Laboratory; a recovery percentage was not given for segment 1 of this core. The other core was extruded at the Process Chemistry Laboratory and archived. No percentage recovery was given.

1.2 TANK BACKGROUND

Tank 241-AN-102 is located in the 200 East Area AN Tank Farm on the Hanford Site. It is one of seven tanks in the AN tank farm, which does not use a cascade system between tanks. The tank went into service in 1981. During the third quarter of 1982, most of the waste in tank 241-AN-102 was transferred to the 242-A Evaporator feed tank (tank 241-AW-102). Tank 241-AN-102 then received non-complexed waste processed in the 242-A Evaporator (Agnew et al. 1997b). Most of this waste was removed during the second quarter of 1983, leaving approximately 125 kL (33 kgal) of waste in the tank. Between the fourth quarter of 1983 and the first quarter of 1984, the tank was filled with evaporator feed from tanks 241-SY-102, 241-AY-102, 241-AW-105, and 241-AN-101. The tank was nearly emptied in the second quarter of 1984, leaving a heel of approximately 129 kL (34 kgal). By the fourth quarter of 1984, tank 241-AN-102 was nearly filled with concentrated complexant waste (from a previous 242-A Evaporator campaign) from tank 241-AW-101 (Agnew et al. 1997b). In 1984 and again in 1992, tank 241-AN-102 received small amounts of miscellaneous waste from the Plutonium-Uranium Extraction (PUREX) Plant. No transfers have been made to or from the tank since 1992. However, slight decreases in the waste level have been recorded since 1992 and are attributed to evaporation.

Table 1-2 is an overall description of tank 241-AN-102. The tank has a maximum storage capacity of 4,390 kL (1,160 kgal), and presently contains an estimated 4,027 kL (1,064 kgal) of concentrated complexant waste (Hanlon 1999). The tank is not on the Watch List (Public Law 101-510).

Table 1-2. Description of Tank 241-AN-102.

TANK DESCRIPTION	
Type	Double-Shell
Constructed	1980-1981
In service	1981
Diameter	22.9 m (75.0 ft)
Operating depth	10.7 m (35.2 ft)
Capacity	4,390 kL (1,160 kgal)
Bottom shape	Flat
Ventilation	Operating Exhauster
TANK STATUS (as of December 31, 1998)[1]	
Waste classification	Concentrated complexant waste
Total waste volume	4,027 kL (1,064 kgal)
Supernatant volume	3,690 kL (975 kgal)
Saltcake volume	0 kL (0 kgal)
Sludge volume	337 kL (89 kgal)
Drainable interstitial liquid volume	11 kL (3 kgal)
Waste surface level (2/16/99)[2]	981.5 cm (386.4 in.)
Temperature (2/16/98 to 2/16/99)	21.7 °C - 33.9 °C (71 °F – 93 °F)
Integrity	Sound
Watch List	None
Flammable Gas Facility Group	2
SAMPLING DATE	
Grab samples	July/August 1998
Grab samples	February 1998
Grab samples	November/December 1995
Grab samples	February 1995
Grab samples	October 1994
Core sample	May 1990
Active	1981 to present

Notes:

[1]Waste volume estimates are based on Auto-Food Instrument Corporation (FIC) measurements and Hanlon (1999).

[2]Surface level reported is Auto-FIC measurement; manual tape measurement on 2/16/99 was 984.9 cm (387.75 in.).

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2.0 RESPONSE TO TECHNICAL ISSUES

The following technical issues have been identified for tank 241-AN-102 (Brown et al. 1998).

- **Privatization**: Do the samples taken from tank 241-AN-102 and the subsequent laboratory analysis meet the needs of the privatization low-activity waste data quality objective (DQO) (Wiemers and Miller 1997)? Have the required samples been provided to the privatization contractor (Gasper 1998)?

- **Waste feed delivery**: Does the waste feed meet specifications as a feed source for tank waste privatization (Certa 1998)?

- **Compatibility**: Will safety problems be created as a result of co-mingling wastes in interim storage? Do operations issues exist which should be addressed before waste is transferred?

- **Regulatory**: What regulatory requirements (i.e., air-emissions, dangerous waste) apply to this tank?

Additional technical issues required by Brown et al. (1997) and addressed by sampling events include:

- **Safety screening**: Does the waste pose or contribute to any recognized potential safety problems?

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

Data from the analysis of grab samples, tank vapor space measurements, and available historical information provided the means to respond to the technical issues. Sections 2.1 through 2.6 present the responses. See Appendix B for sample and analysis data for tank 241-AN-102.

2.1 PRIVATIZATION

2.1.1 Low-Activity Waste Feed Data Quality Objectives

Tank 241-AN-102 is within the scope of the *Low-Activity Waste Feed Data Quality Objectives* (Truex and Wiemers 1998). However, this assessment is based on the requirements of Wiemers and Miller (1997), a previous low-activity waste (LAW) feed DQO, because the sampling and analysis were performed to meet these requirements.

The purpose of the LAW DQO is to address technical issues pertinent to pretreatment, immobilization, and balance-of-plant for low-activity waste processing. Waste will be characterized to determine whether it falls within the defined process design envelope. Data collected in support of this DQO will be used primarily for planning activities of RPP privatization contractors as specified in the privatization request for proposals.

Supernatant grab samples were obtained from tank 241-AN-102 in February 1998, as directed by the *Privatization Grab Sampling and Analysis Plan* (SAP) (Jo 1998a), to support privatization. The 222-S Laboratory performed the analysis of the grab samples according to the requirements of the LAW Feed DQO (Wiemers and Miller 1997). Table 6 in Esch (1998a) provides a comparison of the supernatant results to the envelope C contract limits. It was determined that all constituents analyzed met the envelope C contract limits identified in Wiemers and Miller (1997) for low-activity waste. Only one analyte (SO_4; 84.87%) fell within the sensitivity boundary of $\pm$30% of the envelope limit. Solubility screening tests were also performed on the February 1998 grab samples, as directed by Jo (1998a), according to the requirements of the LAW Feed DQO (Wiemers and Miller 1997).

A new LAW Feed DQO (Truex and Wiemers 1998) has been released since the tank 241-AN-102 analyses were conducted on the February 1998 samples. This DQO imposes control limits on constituents not required by Wiemers and Miller (1997) (e.g., ^{60}Co, ^{154}Eu, and ^{155}Eu). Therefore, further analysis may be required for these analytes.

2.1.2 Provide Samples to Contractor

The Waste Disposal Division and Waste Disposal Integration Team (WIT) identified the need for tank waste samples to be provided to the Privatization Contractor for process validation work before the commencement of hot operations (Gasper 1998). It was determined that fifteen liters of waste were to be collected from tank 241-AN-102 and shipped to the contractor (Pauly 1998). Fifteen 500-mL grab samples were obtained from tank 241-AN-102 during July 1998 in accordance with the *Letter of Instruction Supporting Privatization Phase 1B PAS-1 Shipment* (LOI 1) (Seidel 1998). Fifteen additional 500-mL grab samples were taken in August 1998 to meet the requirements of the *Request for Grab Samples from Tank 241-AN-102* (LOI 2)

(Jo 1998b). Representative samples of tank 241-AN-102 waste collected in 1998 were analyzed by the 222-S Laboratory to meet the requirements of the LOI and the results were reported in Esch (1998b). Then the waste was packaged and shipped to the privatization contractor, thus meeting the needs of this issue.

2.2 WASTE FEED DELIVERY

The data required to support waste feed delivery for Phase I low-activity waste are documented in *Data Quality Objectives for TWRS Privatization Phase I: Confirm Tank T is an Appropriate Feed Source for Low-Activity Waste Feed Batch X* (Nguyen 1999). Since the 1998 grab sampling of tank 241-AN-102 took place before the release of Nguyen (1999), these activities were performed to the requirements of a previous version of this DQO (Certa 1998). This assessment is based on the requirements of Certa (1998), resulting from the sampling that was performed to meet these requirements.

Five samples were taken from tank 241-AN-102 in February 1998 and intended to be reserved for future analysis by the Retrieval Program to meet the needs of this DQO. One of the five samples (sample 2AN-98-30, taken from a 127 cm (50 in.) elevation was inadvertently included in the analyses documented in Esch (1998a). However, two sludge samples obtained in July (samples 2AN-98-56 and 2AN-98-57, taken from a 36 cm (14 in.) elevation, have been archived and may be used in place of sample 2AN-98-30 to represent the lowest elevation of the tank. The requirements of this DQO have not been met as no analyses have as yet been performed for waste feed delivery purposes. Analysis is tentatively scheduled for fiscal year 2000.

2.3 COMPATIBILITY

Tank 241-AN-102 is an active waste storage tank that has not received or transferred waste since 1992. Tank 241-AN-102 has been identified as one of the early tanks to be retrieved for low-level waste pretreatment and immobilization. Before pumping waste to other waste tanks, tank farm operations will perform a waste compatibility assessment. The waste compatibility assessment ensures that the waste in tank 241-AN-102 is compatible with the waste in the proposed receiver tank. The *Data Quality Objectives for Tank Farms Waste Compatibility Program* (Mulkey and Miller 1998, Fowler 1995) directs the waste compatibility assessment. Mulkey and Miller (1998) addresses safety issues with waste transfers, while Fowler (1995) addresses operational issues. A waste compatibility assessment adhering to current requirements will need to be performed before transferring waste to or from tank 241-AN-102. This assessment should be performed within five years of sampling of the tank.

A discussion of the waste compatibility issues is presented below. This discussion focuses on the 1994/1995 samples, as they were taken for compatibility purposes. Data from the 1998 samples are only used in cases where 1994/1995 data are not available. In addition, only the liquid data is evaluated. The following discussion does not constitute a compatibility assessment.

Safety considerations in Mulkey and Miller (1998) include criticality, corrosion, energetics, and flammable gas accumulation. Flammable gas accumulation is not evaluated in this discussion, as the receiving tank must be known in order to compare against the Mulkey and Miller (1998) decision limit. Analytical results from the 1994/1995 grab samples were compared with decision criteria thresholds for the remaining safety issues.

To address criticality, Mulkey and Miller (1998) requires a comparison of the total Pu or ^{239}Pu data and the total U or $^{233/235}$U data versus the DQO threshold of 0.001 g/L Pu equivalent. Using the specific activity of ^{239}Pu, the 1994/1995 $^{239/240}$Pu mean of 0.00582 µCi/mL was converted to 9.39E-05 g/L of Pu. A total uranium concentration mean useful for this comparison was not available from the 1994/1995 data set, as all results were below detection limits. Instead, the best-basis inventory values for ^{233}U and ^{235}U were used. These results are based on a ^{238}U analytical result from the July/August 1998 data set and the isotopic distribution from the Hanford Defined Waste model. Because ^{233}U is equivalent to ^{239}Pu on a gram-per-gram basis, the entire ^{233}U value (3.98E-06 g/L) was used. Only the amount of ^{235}U above the level of natural enrichment in total uranium (assumed by Mulkey and Miller [1998] to be 0.72 weight percent) is equivalent to ^{239}Pu on a gram-per-gram basis. As a result, the ^{235}U value was less than 0.72 weight percent of the best-basis total uranium value for tank 241-AN-102, the ^{235}U was excluded from the Pu equivalent calculation. Summing the $^{239/240}$Pu and ^{233}U values yields an overall result of 9.79E-05 g/L, below the 0.001 g/L threshold.

Different corrosion decision rules are specified in Mulkey and Miller (1998) based on the tank temperature and the nitrate concentration. Because the temperature of the waste in tank 241-AN-102 is less than 100 °C (212 °F) and the nitrate concentration is greater than 3.0*M*, the following corrosion rule is applicable:

$$0.3M \leq [OH^-] < 10M$$
$$[OH^-] + [NO_2^-] \geq 1.2M$$
$$[NO_3^-] \leq 5.5M$$

The hydroxide concentration based on the 1994/1995 samples was 0.21*M*, which is outside the corrosion specifications. Consequently, waste from tank 241-AN-102 can only be sent to tanks whose waste currently meet the corrosion requirements. In addition, before transferring waste from tank 241-AN-102, it must be verified that the hydroxide concentration in the receiving tank will be within the corrosion parameters after the tank 241-AN-102 waste has been received. The other corrosion criteria were satisfied, as the sum of the OH^- (0.21*M*) and NO_2^- (1.80*M*) concentrations were above 1.2*M*, and the NO_3^- concentration (3.63 *M*) was below 5.5*M*.

For energetics, Mulkey and Miller (1998) specifies that the exotherm to endotherm ratio must be below 1. This requirement was satisfied for all samples. The ratios ranged from 0.00 to 0.71 (Esch 1996). Also, no separable organic layer was observed in the samples.

Operational issues addressed in Fowler (1995) include segregation of complexant, transuranic (TRU), and high phosphate wastes. In addition, the heat generation rate of the commingled waste (after the transfer) must be below operating specification document limits. The heat generation issue will need to be addressed when a receiving tank has been identified. Following is a discussion of the remaining operational issues.

The waste in tank 241-AN-102 is designated as complexed. Consequently, it must remain segregated from noncomplexed waste.

Fowler (1995) requires segregation of waste that contains greater than 100 nCi/g of TRU constituents. The total concentration of TRU elements in tank 241-AN-102 was calculated by converting the mean $^{239/240}Pu$ and ^{241}Am analytical values to a per-weight basis from a per-volume basis (dividing the mean analytical result for each radionuclide by the mean density) and summing the per-weight results. The result, 102 nCi/g, slightly exceeded the 100 nCi/g waste segregation limit. Therefore, the waste in tank 241-AN-102 should only be commingled with other TRU waste.

If the phosphate concentration exceeds 0.1*M*, the waste should not be mixed with neutralized cladding removal waste or waste that contains greater than 8.0*M* of sodium. The mean phosphate concentration was 0.0507*M*.

Ammonia has recently been identified as a constituent of concern for compatibility purposes (Fowler 1998). No analyses for ammonia were performed on the 1994/1995 samples; however, ammonia analyses were done on the February 1998 supernatant and dissolution composites. The mean ammonia concentration was 132 µg/mL, with a 95 percent confidence interval upper limit of 184 µg/mL.

2.4 REGULATORY EMISSIONS

The data required to sample the waste in tank 241-AN-102 for the presence of dangerous waste are documented in *Data Quality Objectives for Regulatory Requirements for Dangerous Waste Sampling and Analysis* (Mulkey 1996). The dangerous waste DQO identifies the sampling and analytical requirements that are needed to meet state and federal regulations for dangerous wastes under the jurisdiction of RPP.

Dangerous waste sampling and analysis, as defined in the *Tank Characterization Technical Sampling Basis* (Brown et al. 1998) is to be conducted to characterize static tanks before their contents being fed to an immobilization facility operated by the privatization contractor. A static tank is one for which no further waste transfers into or out of the tank are to be conducted. At the time of publication of Brown et al. (1998), tank 241-AN-102 was being planned as a feed tank for the Privatization Contractor. Since that time, changes in the contract have resulted in modifications to the retrieval and disposal baselines. If it is determined that regulatory information is needed from tank 241-AN-102 that cannot be obtained using archive samples, additional sampling may be required.

2.5 SAFETY SCREENING

The data needed to screen the waste in tank 241-AN-102 for potential safety problems are 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 condition is addressed separately below. Only the 1994/1995 grab sample data were used to address the safety screening issue. The 1990 and 1998 sampling events were not performed for safety screening purposes.

2.5.1 Exothermic Conditions (Energetics)

The first requirement outlined in the safety screening DQO (Dukelow et al. 1995) is to ensure there are not sufficient exothermic constituents (organic or ferrocyanide) in tank 241-AN-102 to pose a safety hazard. The safety screening DQO required the waste sample profile be tested to determine whether the energetics exceeded the safety threshold limit. The threshold limit for energetics is 480 J/g on a dry weight basis.

Results obtained using differential scanning calorimetry (DSC) indicated that 12 of the 14 grab samples obtained in 1994/1995 from tank 241-AN-102 had mean exothermic reactions (on a dry-weight basis) exceeding the safety screening DQO limit. The maximum dry weight exotherm observed was 1,200 J/g, while the maximum upper limit to a 95 percent confidence interval on the mean was 1,501 J/g (both from sample 2AN-95-2).

Total organic carbon analyses were performed as secondary analyses when the DSC notification limit was exceeded. The organic safety program has established a dry-weight total organic carbon (TOC) concentration limit of 4.5 weight percent, or 45,000 µg C/g. Results for three out of the ten samples analyzed for TOC were above this limit. Six of the ten samples had an upper limit to a one-sided 95 percent confidence interval on the mean exceeding the threshold, with the highest being 57,900 µg C/g (from sample 2AN-95-4A).

Although exothermic reactions were found in the waste, they do not present a safety concern due to the high water contents of both the sludge and supernatant.

2.5.2 Flammable Gas

Headspace measurements using a combustible gas meter were taken from riser 22 before obtaining the July and August 1998 grab samples, from riser 20 before taking the February 1998 grab samples, and from riser 21 before obtaining the November/December 1995 grab samples. Flammable gas was not detected in the headspace (0 percent of the lower flammability limit [LFL]) during any of these measurements. The safety screening limit for flammable gas concentration is 25 percent of the LFL. Therefore, flammability is not a concern for this tank. Data for the 1998 and 1995 headspace measurements are presented in Appendix B, Sections B2.3 and B2.4, respectively.

2.5.3 Criticality

The potential for criticality can be assessed from the total alpha activity data from the 1994/1995 grab samples. The safety screening decision threshold is 1 g/L, or 61.5 µCi/mL for the supernatant (based on the specific activity of ^{239}Pu). The overall supernatant mean was 0.163 µCi/mL, well below the decision threshold. The upper limit to a 95 percent confidence interval on the mean for each sample/duplicate pair was also below the DQO decision threshold, with the highest value being 0.290 µCi/mL. For the sludge, the 1 g/L decision threshold was converted to 41.0 µCi/g using the mean sludge density of 1.5 g/mL. The overall sludge mean was 0.296 µCi/g, well below the limit. Because the sludge was analyzed as centrifuged fractions, the 95 percent confidence interval limits on the mean were determined on the centrifuged solids and centrifuged liquid results. The highest upper limits to a one-sided 95 percent confidence interval on the mean for the centrifuged solids and centrifuged liquid were 1.414 µCi/g and 0.296 µCi/mL, respectively, indicating that the potential for a criticality event is extremely low. Therefore, criticality is not a concern for this tank. Appendix C contains the method used to calculate confidence limits.

2.6 ORGANIC SOLVENT SAFETY SCREENING

The data required to support the organic solvent safety screening issue are documented in *Data Quality Objective to Support Resolution of the Organic Solvent Safety Issue* (Meacham et al. 1997). The organic solvents DQO requires tank headspace samples be analyzed for total nonmethane organic compounds to determine whether the organic extractant pool in the tank is a hazard. The purpose of this assessment is to ensure that an organic solvent pool fire or ignition of organic solvents cannot occur.

No vapor samples have been taken to estimate the organic pool size. However, the organic program has determined that even if an organic solvent pool does exist, the consequence of a fire or ignition of organic solvents is below risk evaluation guidelines for all the tanks (Brown et al. 1998). Consequently, vapor samples are not required for this tank. The organic solvent issue is expected to be closed in 1999.

2.7 OTHER TECHNICAL ISSUES

2.7.1 Tank Waste Heat Load

A factor in assessing tank safety is the heat generation and temperature of the waste. The heat-load value calculated using the best-basis total inventory estimates (see Appendix D) was 9,500 W (32,400 Btu/hr), as shown in Table 2-1. As a comparison, the heat-load estimate based on the tank process history was 11,000 W (37,500 Btu/hr) (Agnew et al. 1997a), while the heat load estimate based on the tank headspace temperature was 12,000 W (41,000 Btu/hr) (Kummerer 1995). All of these estimates are well below the design specification limit of 20,500 W (70,000 Btu/hr) for the AN Tank Farm.

Table 2-1. Heat-Load Estimate Based on the Best-Basis Radionuclide Inventory.

Radionuclide	Waste Inventory[1]	Specific Activity	Heat Load
Strontium-90	3.68E+05 Ci	0.00670 W/Ci	2,470 W
Cesium-137	1.49E+06 Ci	0.00472 W/Ci	7,030 W
Total			9,500 W

Note:

[1]Obtained from Appendix D.

2.8 SUMMARY

At this time, the results of sampling and analysis indicate the requirements for the privatization, provide samples to contractor, safety screening, and compatibility issues have been met. The results of all sampling and analysis performed to address the privatization issue indicate the waste in tank 241-AN-102 meets the envelope C limits specified in Wiemers and Miller (1997). Further analysis may be required, resulting from the current LAW DQO (Truex and Wiemers 1998), which requires analysis on additional constituents. Though sampling and analysis have been completed for the compatibility issue, a compatibility assessment is needed before waste may be transferred from tank 241-AN-102. No further action is required to address the safety screening DQO and provide samples to the contractor issue for tank 241-AN-102.

It has also been determined that sampling and analysis of tank 241-AN-102 are not required to support the organic solvent issue. This issue is expected to be closed in 1999.

However, outstanding actions are required before the dangerous waste and waste feed delivery issues may be closed. Sampling has been completed for the waste feed delivery issue and the analyses are tentatively scheduled for fiscal year 2000. Sampling to support the dangerous waste issue is scheduled for after fiscal year 2005. Table 2-1 summarizes the technical issues and the analytical results that support resolution of these issues.

Table 2-2. Summary of Technical Issues.

Issue	Sub-issue	Result
Privatization	Low-activity waste	Analytes met envelope C limits for moles per mole of sodium. Solubility screening tests were performed.
	Provide samples to contractors	Samples were obtained, analyzed for DOT shipping requirements, and shipped to the contractor, as required.
Waste feed delivery	Waste feed meets privatization envelope specifications	Samples have been collected, analyses are tentatively scheduled for fiscal year 2000.
Compatibility	Waste compatibility assessment	A compatibility assessment of tank 241-AN-102 has not been performed. A waste compatibility assessment adhering to current criteria will be required before transferring waste into or from tank.
Regulatory	Dangerous Waste	Sampling is scheduled for after fiscal year 2005.
Safety screening[1]	Energetics	8 of 14 supernatant samples exceeded the threshold (highest value = 1,200 J/g). 11 samples had upper limit to a one-sided 95 percent confidence interval on the mean above threshold (highest value = 1,501 J/g). Although exothermic reactions were found in the waste, they do not present a safety concern because of the high water contents of both the sludge and supernatant.
	Flammable gas	Headspace measurements reported 0 percent of LFL.
	Criticality	All total alpha results and 95 percent confidence interval upper limits were well below the safety screening limits of 41.0 µCi/g for sludge and 61.5 µCi/g for supernatant.
Organic solvent safety[2]	Solvent pool size	Total non-methane hydrocarbons were not measured. The organic program has determined that even if an organic solvent pool does exist, the consequence of a fire or ignition of organic solvents is below risk evaluation guidelines for all of the tanks (Brown et al. 1998). Consequently, vapor samples are not required for this tank.

Notes:

[1]The safety screening evaluation was performed on the 1994/1995 grab samples only.

[2]The organic solvent safety issue is expected to be closed in 1999.

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3.0 BEST-BASIS STANDARD INVENTORY ESTIMATE

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

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

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 chemical information for tank 241-AN-102 was performed, and a best basis inventory was established. This work, follows the methodology that was established by the standard inventory task.

The results from this evaluation support using a combination of the 1994/1995 and 1998 data sets for the liquid and the 1990 data set for the saltcake for the following reasons:

1. No waste has been added or removed since the 1994/1995 sampling events.

2. The 1994/1995 results compared well with the February, July, and August 1998 liquid grab data.

3. The 1998 data set did not replace the 1994/1995 data set because no new information was obtained. There was some uncertainty regarding the representativeness of the 1998 supernatant samples as a result of the sample handling and compositing procedures,. The February 1998 supernatant and dissolution composite means were used to supplement the 1994/1995 data set as denoted in the following tables. The volume used to derive the inventories for the February 1998 data set was the supernatant volume at the time of sampling, 3,709 kL (980 kgal). The ^{238}U value from the July/August 1998 data set was used to derive the total uranium value for the supernatant. The volume used in the inventory calculation for total uranium was the volume at the time of the July/August 1998 sampling, 3,702 kL (978 kgal).

4. The saltcake solids best-basis inventories are based on data from the 1990 core sample. A small amount of waste was transferred into the tank in 1992; however, this waste is not expected to add to the solids volume.

5. The solid composite from the February 1998 grab sampling was formed from the recovered solids from supernatant samples, and was not actually representative of the saltcake layer. In addition, it is suspected that the solids may have precipitated in the laboratory as a result of the decrease in temperature from the tank to the hotcell.

6. Substantial uncertainty exists regarding the representativeness of the July 1998 solids sample because of the abnormally low metal concentrations in the sample.

Once the best-basis inventories were determined, the hydroxide inventory was calculated by performing a charge balance with the valences of other analytes. This charge balance approach is consistent with that used by Agnew et al. (1997a).

Best-basis tank inventory values are derived for 46 key radionuclides (as defined in Section 3.1 of Kupfer et al. 1999), all decayed to a common report date of January 1, 1994. Often, waste sample analyses have only reported ^{90}Sr, ^{137}Cs, $^{239/240}$Pu, and total uranium (or total beta and total alpha), while other key radionuclides such as ^{60}Co, ^{99}Tc, ^{129}I, ^{154}Eu, ^{155}Eu, ^{241}Am, etc., have been infrequently reported. For this reason, it has been necessary to derive most of the 46 key radionuclides by computer models. These models estimate radionuclide activity in batches of reactor fuel, account for the split of radionuclides to various separations plant waste streams, and track their movement with tank waste transactions. (These computer models are described in Kupfer et al. [1999], Section 6.1 and in Watrous and Wootan [1997].) Model generated values for radionuclides in any of 177 tanks are reported in the HDW Rev. 4 model results (Agnew et al. 1997a). The best-basis value for any one analyte may be either a model result or a sample or engineering assessment-based result, if available.

Best-basis inventory estimates for tank 241-AN-102 are presented in Tables 3-1 and 3-2. The inventory values reported in these tables are subject to change. Refer to the Tank Characterization Database (LMHC 1999) for the most current inventory values. Concentrations reported as less-than values (below detection limit) were often used as actual values in Tables 3-1 and 3-2 if they were significantly lower than the corresponding HDW Model values. Model generated values were used if the sample analytical data were based on high detection limits. Inventory breakouts by waste phase are presented in Appendix D.

Table 3-1. Best-Basis Total Inventory Estimates for Nonradioactive Components in Tank 241-AN-102. (Effective April 19, 1999) (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, E, or C)[1]	Comment
Al	62,900	S	
Bi	0	E	HDW Model assumes 1,290 kg because of erroneous solubility assumption.
Ca	2,680	S	

Table 3-1. Best-Basis Total Inventory Estimates for Nonradioactive Components in Tank 241-AN-102. (Effective April 19, 1999) (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, E, or C)[1]	Comment
Cl	15,300	S	
TIC as CO_3	2.79E+05	S	
Cr	1,810	S	
F	7,430	S	
Fe	1,040	S	
Hg	0	E	Majority of Hg in cladding waste (Simpson 1998).
K	15,400	S	
La	0	E	La is relatively insoluble in the supernatants added to tank 241-AN-102.
Mn	389	S	
Na	1.02E+06	S	
Ni	1,650	S	
NO_2	3.30E+05	S	
NO_3	9.01E+05	S	
OH_{TOTAL}	2.61E+05	C	
Pb	820	S	Upper bounding estimate
PO_4	19,600	S	IC analysis
Si	763	S/E	Upper bounding estimate
SO_4	64,900	S	IC analysis
Sr	17.1	S	
TOC	1.07E+05	S	
U_{TOTAL}	881	S	
Zr	315	S	

Note:

[1]S = sample-based; M = Hanford defined waste model-based (Agnew et al. [1997a]); E = engineering assessment-based; and C = calculated by charge balance - includes oxides as hydroxides, not including CO_3, NO_2, NO_3, PO_4, SO_4, and SiO_3.

Table 3-2. Best-Basis Total Inventory Estimates for Radioactive Components in Tank 241-AN-102 Decayed to January 1, 1994. (Effective April 19, 1999) (2 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	4.56	S	
^{14}C	3.26	S	
^{59}Ni	11.5	M	
^{60}Co	760	S	
^{63}Ni	1,140	M	
^{79}Se	3.25	S	
^{90}Sr	3.68E+05	S	
^{90}Y	3.68E+05	S	Referenced to ^{90}Sr
^{93}Zr	103	M	
^{93m}Nb	73.8	M	
^{99}Tc	569	S	
^{106}Ru	0.0485	M	
^{113m}Cd	565	M	
^{125}Sb	1,260	M	
^{126}Sn	31.5	M	
^{129}I	3.17	M	
^{134}Cs	61.9	M	
^{137}Cs	1.49E+06	S	
^{137m}Ba	1.41E+06	S	Referenced to ^{137}Cs
^{151}Sm	73,400	M	
^{152}Eu	27.3	M	
^{154}Eu	1,850	S	
^{155}Eu	1,470	S/E	Upper bounding estimate
^{226}Ra	7.95E-04	M	
^{227}Ac	0.00490	M	
^{228}Ra	1.72	M	
^{229}Th	0.0399	M	
^{231}Pa	0.0235	M	
^{232}Th	0.183	M	
^{232}U	0.421	S/M	Based on U_{TOTAL} and HDW Model isotopic distribution
^{233}U	1.62	S/M	Based on U_{TOTAL} and HDW Model isotopic distribution
^{234}U	0.333	S/M	Based on U_{TOTAL} and HDW Model isotopic distribution

Table 3-2. Best-Basis Total Inventory Estimates for Radioactive Components in Tank 241-AN-102 Decayed to January 1, 1994. (Effective April 19, 1999) (2 sheets)

Analyte	**Total Inventory (Ci)**	**Basis (S, M, or E)[1]**	**Comment**
^{235}U	0.0132	S/M	Based on U_{TOTAL} and HDW Model isotopic distribution
^{236}U	0.0118	S/M	Based on U_{TOTAL} and HDW Model isotopic distribution
^{237}Np	5.72	M	
^{238}Pu	12.3	S/M	Saltcake portion based on sample data; liquid portion based on ^{239}Pu and HDW Model isotopic distribution
^{238}U	0.294	S/M	Based on U_{TOTAL} and HDW Model isotopic distribution
^{239}Pu	48.9	S/M	Based on $^{239/240}Pu$ and HDW Model isotopic distribution
^{240}Pu	8.62	S/M	Based on $^{239/240}Pu$ and HDW Model isotopic distribution
^{241}Am	813	S	
^{241}Pu	113	S/M	Based on ^{239}Pu and HDW Model isotopic distribution
^{242}Cm	2.26	S/M	Based on ^{241}Am and HDW Model isotopic distribution
^{242}Pu	6.06E-04	S/M	Based on ^{239}Pu and HDW Model isotopic distribution
^{243}Am	0.0320	S/M	Based on ^{241}Am and HDW Model isotopic distribution
^{243}Cm	0.843	S/M	Based on the 1990 core for the solids and the HDW Model isotopic distribution from ^{241}Am for the liquid.
^{244}Cm	18.1	S/M	Based on the 1990 core for the solids and the HDW Model isotopic distribution from ^{241}Am for the liquid.

Note:

[1]S = sample-based; M = Hanford Defined Waste Model-based (Agnew et al. [1997a]); E = engineering assessment-based

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4.0 RECOMMENDATIONS

The February 1998 grab sampling and subsequent analyses met the requirements of the privatization LAW Feed DQO (Wiemers and Miller et al. 1997). However, because this DQO has been revised since the analyses were performed and the current DQO (Truex and Wiemers 1998) requires analyses on additional constituents, further analysis may be required.

The sampling to support the waste feed delivery DQO (Certa 1998) was completed in February 1998; however, the analyses required to support this issue have not been performed. These analyses are tentatively scheduled for fiscal year 2000. These analyses should be performed in accordance with the current waste feed delivery DQO (Nguyen 1999).

At this time, no sampling has been performed to address the requirements of the dangerous waste DQO (Mulkey 1996) for tank 241-AN-102. Changes in the privatization contract have resulted in modifications to the retrieval and disposal baselines. The tank will be sampled to meet the dangerous waste DQO before waste is transferred to the privatization contractor. This activity is currently scheduled after fiscal year 2005.

Analyses were performed on the 1994/1995 grab samples to address the waste compatibility issue. All safety considerations required by Mulkey and Miller (1998) were met with the exception of (OH), which was out of specification. Because tank 241-AN-102 currently requires caustic mitigation, waste from this tank can only be sent to tanks whose waste currently meets the corrosion requirements. Also, it must be verified before transfer that the composition limit in the receiving tank will not be violated. An evaluation of the operational considerations required by Fowler (1995) shows that tank 241-AN-102 waste should only be co-mingled with other TRU waste and must remain segregated from noncomplexed waste.

The 1994/1995 grab samples were also analyzed to support the safety screening DQO (Dukelow et al. 1995). The analytical results for eight samples exceeded the safety decision threshold limits for DSC. Total organic carbon analyses were performed as secondary analyses when the DSC notification limit was exceeded. Results for three out of the ten TOC samples exceeded the established threshold limit. However, the exotherms were determined not to present safety concerns as a result of high water content noted in both the sludge and the supernatant. The total alpha activity means and the 95 percent confidence interval upper limits on the mean for both the supernatant and the sludge were well below the limits of 61.5 µCi/mL and 41.0 µCi/g, respectively. Therefore, the potential for criticality is not a safety concern for this tank. In addition, the flammable gas in the tank headspace was measured to be 0 percent of the LFL.

Table 4-1 summarizes the Project Hanford Management Contractor (PHMC) RPP review status and acceptance of the sampling and analysis results reported in this TCR. All issues required to be addressed by sampling and analysis are listed in column 1 of Table 4-1. Column 2 indicates by "yes" or "no" whether issue requirements were met by the sampling and analysis performed.

Column 3 indicates concurrence and acceptance by the program in PHMC/RPP that is responsible for the applicable issue. A "yes" in column 3 indicates that no additional sampling or analyses are needed. Conversely, "no" indicates additional sampling or analysis may be needed to satisfy issue requirements.

Table 4-2 summarizes the status of PHMC RPP review and acceptance of the evaluations and other characterization information contained in this report. Column 1 lists the different evaluations performed in this report. Column 2 shows whether issue evaluations have been completed or are in progress. Column 3 indicates concurrence and acceptance with the evaluation by the program in PHMC/RPP that is responsible for the applicable issue. A "yes" indicates that the evaluation is completed and meets all issue requirements.

Table 4-1. Acceptance of Tank 241-AN-102 Sampling and Analysis.

Issue	**Sampling and Analysis Performed**	**RPP/PHMC Program Acceptance**
Privatization LAW Feed DQO (Wiemers and Miller 1997)[1]	Yes	Yes
Provide samples to contractor (Gasper 1998, Pauly 1998)	Yes	Yes
Waste Feed Delivery DQO (Certa 1998)[2]	Partial	n/a
Dangerous Waste DQO (Mulkey 1996)[3]	No	n/a
Organic solvents DQO[4] (Meacham et al. 1997)	No	n/a
Safety screening DQO (Dukelow et al. 1995)	Yes	Yes
Compatibility DQO (Mulkey and Miller 1998, Fowler 1995)	Yes	Yes

Notes:

n/a = not applicable

[1]Further analysis may be required to meet Truex and Wiemers (1998).

[2] Sampling has been completed and the analyses are tentatively scheduled for fiscal year 2000.

[3]Sampling is scheduled for after fiscal year 2005.

[4]The organic solvent safety issue is expected to be closed in 1999. The PHMC RPP safety program has determined that additional sampling is not required to close this issue for this tank.

Table 4-2. Acceptance of Evaluation of Characterization Data and Information for Tank 241-AN-102.

Issue	Evaluation Performed	RPP/PHMC Program Acceptance
Privatization LAW Feed DQO	Yes	Yes
Provide samples to contractor	Yes	Yes
Waste feed delivery DQO[1]	Partial	n/a
Dangerous Waste DQO[2]	No	n/a
Organic solvents DQO[3]	Yes	Yes
Safety screening DQO	Yes	Yes
Compatibility DQO	Yes	Yes

Notes:

n/a = not applicable

[1] Sampling has been completed and the analyses are tentatively scheduled for fiscal year 2000.

[2] Sampling is scheduled for after fiscal year 2005.

[3] The organic solvent issue is expected to be closed in 1999. The PHMC RPP safety program has determined that additional sampling is not required to close this issue for this tank.

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APPENDIX A

HISTORICAL TANK INFORMATION

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APPENDIX A

HISTORICAL TANK INFORMATION

Appendix A describes tank 241-AN-102 based on historical information. For this report, historical information includes information about the fill history, waste types, surveillance, or modeling data about the tank. This information is necessary for providing a balanced assessment of sampling and analytical results.

This appendix contains the following information:

- **Section A1.0**: Current tank status, including the current waste levels and the tank stabilization and isolation status
- **Section A2.0**: Information about the tank design
- **Section A3.0**: Process knowledge about the tank, the waste transfer history, and the estimated contents of the tank based on modeling data
- **Section A4.0**: Surveillance data for tank 241-AN-102, including surface-level readings, temperatures, and a description of the waste surface based on photographs
- **Section A5.0**: References for Appendix A.

A1.0 CURRENT TANK STATUS

As of December 31, 1998, tank 241-AN-102 contained an estimated 4,027 kL (1,064 kgal) of concentrated complexant waste (Hanlon 1999). The liquid waste volume was estimated using an FIC automatic surface level gauge, which is backed up by a manual tape surface-level gauge. The solid waste volume was estimated using a sludge level measurement device. The last update on the solids level was August 22, 1989. Table A1-1 shows the volumes of the waste phases found in the tank.

Tank 241-AN-102 is in service at the present time; however, there have been no waste transfers to or from the tank since 1992. The tank is actively ventilated, and its integrity categorized as sound. Tank 241-AN-102 is not on the Watch List. All monitoring systems were in compliance with documented standards as of December 31, 1998 (Hanlon 1999).

Table A1-1. Tank Contents Status Summary.

Waste Type	kL (kgal)
Total waste	4,027 (1,064)
Supernatant	3,690 (975)
Sludge	337 (89)
Saltcake	0 (0)
Drainable interstitial liquid	11 (3)
Drainable liquid remaining	3,702 (978)
Pumpable liquid remaining	3,690 (975)

A2.0 TANK DESIGN AND BACKGROUND

The AN Tank Farm is a double-shell tank farm built between 1980 and 1981. This tank farm consists of seven 4,390 kL (1,160 kgal) tanks of the 100-series type. These tanks were designed for a maximum fluid temperature of 177 °C (350 °F) (Leach and Stahl 1997). The 241-AN Tank Farm does not use a cascade system between tanks.

Tank 241-AN-102 was constructed with concrete walls that are 46 cm (1.5 ft) thick and a concrete dome that is 38 cm (1.25 ft) thick. The mild carbon steel inner liner on the bottom is 1.3 cm (1/2 in.) thick, while the lower portion of the sides are 1.9 cm (3/4 in.) thick. The sides of the upper portion inner liner are 1.3 cm (1/2 in.) thick and the steel dome liner is 0.95 cm (3/8 in.) thick. The inner liner has been heat-treated and stress-relieved. The secondary liner is made of 0.95 cm (3/8 in.)-thick mild carbon steel. The outer liner has not been heat-treated. The tank has a flat bottom and a maximum operating depth of 10.7 m (35.2 ft). The tank is set on an insulated, reinforced concrete foundation. This foundation has a grid of drain slots designed to collect any tank leakage and divert it to a leak-detection well. The grid also serves as an escape route for free water released from the concrete grout generated by temperature gradients during initial filling of the tank. Various coatings and sealants were used to ensure that no leaks or intrusions occurred.

A list of tank 241-AN-102 risers (annulus risers not included), showing the size and general use, is provided in Table A2-1. Two riser-numbering systems (an old and a new) are given in the table. The new riser numbers are used throughout this document, except in the data tables in Appendix B2.7.3.1 where database constraints require the use of the old numbering system. Refer to Table A2-1 to corrolate between the old and new numbers. A plan view that depicts the riser configuration and locations is shown in Figure A2-1. Tank 241-AN-102 has 59 risers ranging in diameter from 10.0 cm (4 in.) to 1.1 m (42 in.), with 22 risers that provide surface level access to the interior of the underground tank, and 37 risers that give access to the tank annulus. This tank has six risers tentatively available for sampling: four 10.0-cm (4-in.) diameter risers (11, 14, 17, and 21) and two 30.0-cm (12-in.) diameter risers (10 and 13). A tank cross-section showing the approximate waste level, along with a schematic of the tank equipment using the new riser numbers is found in Figure A2-2.

Table A2-1. Riser Configuration for Tank 241-AN-102 Risers.[1,2,3,4,5]

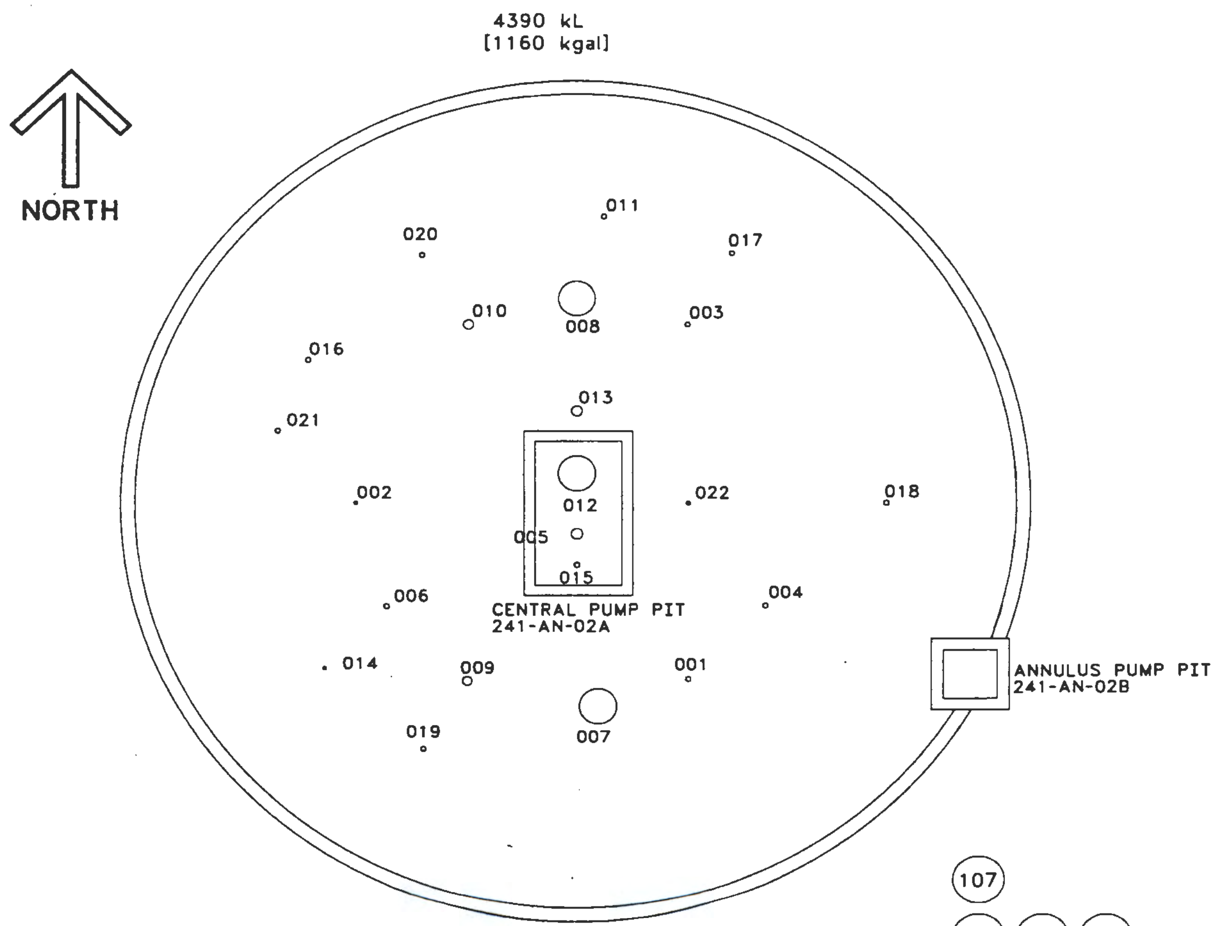
New Number[4]	Old Number[2]	Diameter cm (in.)	Description and Comments
001	1C	10 (4)	Sludge measurement port, (12 in.CVR)
002	1A	10 (4)	Manual level indicator
003	1B	10 (4)	Sludge measurement port
004	2A	10 (4)	Tank level indicator (FIC)
005	3A	30 (12)	Pump access
006	4A	10 (4)	Thermocouple probe
008	5A	107 (42)	Manhole, below grade
007	5B	107 (42)	Manhole, below grade
009	7B	30 (12)	Primary tank exhaust vent
010*	7A	30 (12)	Inlet air filter
011*	10A	10 (4)	Pressure indicator
012	11A	107 (42)	Slurry distributor
013*	12A	30 (12)	Observation port
014*	13A	10 (4)	Tank pressure indicator
015	14A	10 (4)	Central pump pit dropleg nozzle supernatant return
016	15B	10 (4)	High level sensor
017*	15A	10 (4)	Spare
018	16B	10 (4)	Sludge measurement port
019	16C	10 (4)	Sludge measurement port
020	16A	10 (4)	Sludge measurement port
021*	21A	10 (4)	Multi-purpose probe
022	22A	10 (4)	Sludge measurement port

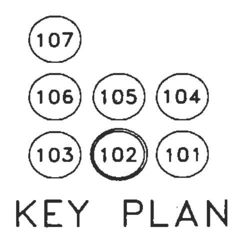
Notes:

CVR = central void reference

[1]Lipnicki (1997)
[2]LMHC (1998)
[3]Salazar (1994)
[4]Tran (1993)
[5]WHC (1997)
* Denotes risers tentatively available for sampling.

Figure A2-1. Riser Configuration for Tank 241-AN-102.





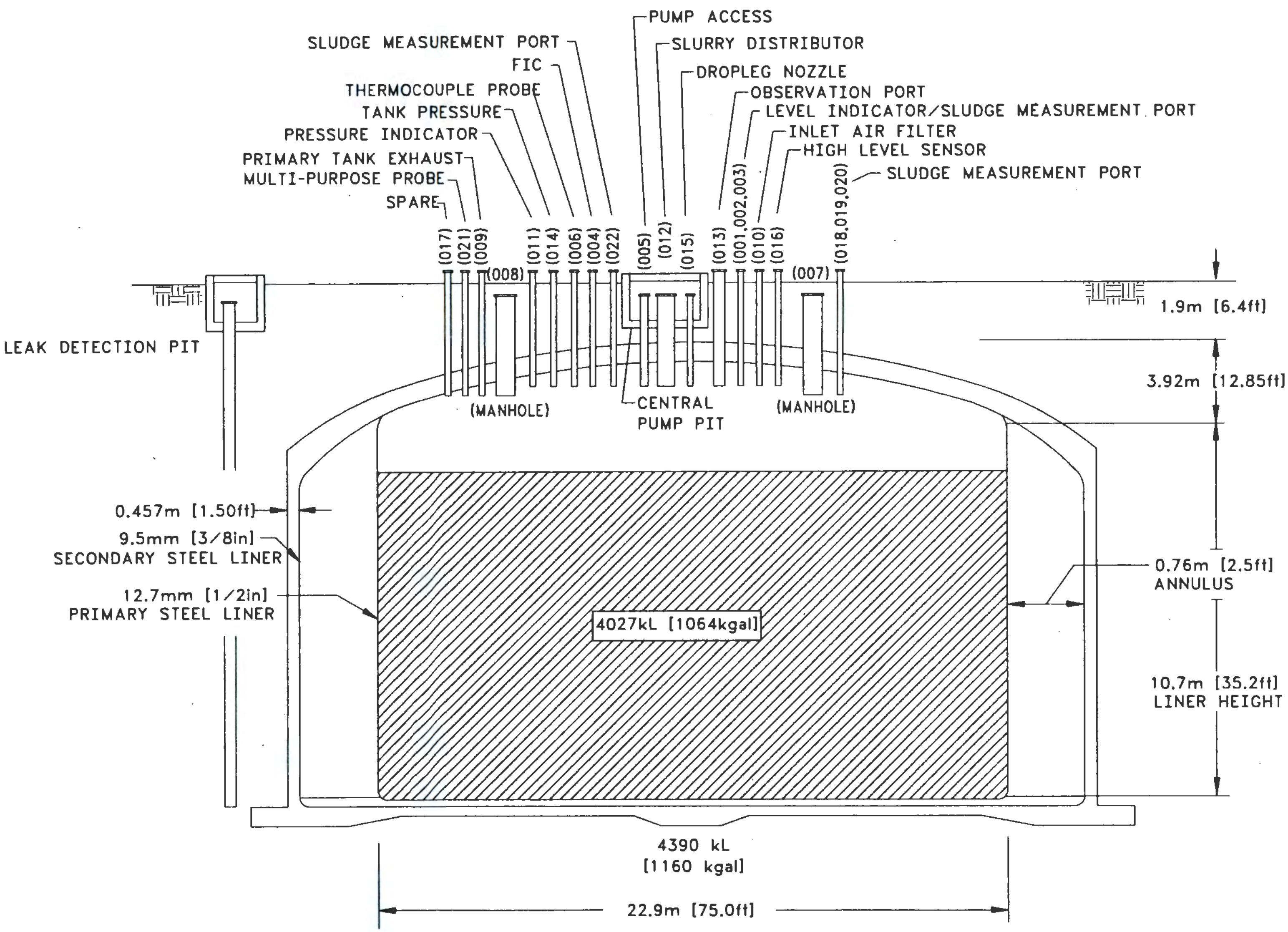


Figure A2-2. Tank 241-AN-102 Cross Section and Schematic.

A3.0 PROCESS KNOWLEDGE

The sections below 1) provide information about the transfer history of tank 241-AN-102, 2) describe the process wastes that made up the transfers, and 3) estimate the current tank contents based on transfer history.

A3.1 WASTE TRANSFER HISTORY

A small amount of water for hydrotesting was received by tank 241-AN-102 in 1981. Dilute, non-complexed waste from tank 241-SY-102 was received during the second and third quarters of 1982. Water was added to tank 241-AN-102 intermittently from the second quarter of 1982 until the third quarter of 1983.

During the third quarter of 1982, most of the waste in tank 241-AN-102 was transferred to the 242-A Evaporator feed tank (tank 241-AW-102). Tank 241-AN-102 then received non-complexed waste processed in the 242-A Evaporator (Agnew et al. 1997b). Most of this waste was removed during the second quarter of 1983, leaving approximately 125 kL (33 kgal) of waste in tank 241-AN-102. Between the fourth quarter of 1983 and the first quarter of 1984, the tank was filled with evaporator feed from tanks 241-SY-102, 241-AY-102, 241-AW-105, and 241-AN-101. Most of this waste was removed in the second quarter of 1984 for an evaporator campaign, leaving a heel of approximately 129 kL (34 kgal) in tank 241-AN-102. By the fourth quarter of 1984, tank 241-AN-102 was nearly filled with concentrated complexant waste (from a previous 242-A Evaporator campaign) from tank 241-AW-101 (Agnew et al. 1997b). Since then, tank 241-AN-102 has received only small amounts of miscellaneous waste from the PUREX Plant and waste water. A chronological summary of the major transfers of waste through tank 241-AN-102 is shown in Table A3-1. Slight fluctuations in the waste level have been recorded since 1992. These variations are not a result of waste transfers; they are attributed to evaporation.

Table A3-1 summarizes the waste transfer history of tank 241-AN-102 (Agnew et al. 1997b).

Table A3-1. Tank 241-AN-102 Major Transfers.[1,2]

Transfer Source	Transfer Destination	Waste Type	Time Period	Estimated Waste Volume	
				kL	kgal
Unknown[3]		Unknown	1981	57	15
Miscellaneous		Water	1982-1984	681	180
241-SY-102		Supernatant	1982-1983	4,455	1,177
	241-AW-102	DN	1982	3,800	1,004
241-AW-102		DN	1982	1,760	465
	241-AN-107	Supernatant	1983	1,760	465
241-AY-102		Supernatant	1983	780	206
241-AW-105		Supernatant	1983	1166	308
241-AN-101		Supernatant	1984	927	245
	241-AW-102	Supernatant	1984	4,020	1,062
241-AW-101		Supernatant	1984	4,099	1,083
PUREX[4]		PXMSC	1984, 1992	68	18

Notes:

DN = Dilute , non-complexed

PXMSC = Dilute, non-complexed waste from PUREX miscellaneous streams

[1]Agnew (1997b).

[2] Note: Only major transfers are listed in this table. Minor transfers, evaporation, or other gains/losses are not included.

[3]According to Agnew (1997b), the waste type and source for this transfer are unknown. However, this was likely water for a hydrotest.

[4]There have been no transfers since 1992.

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) 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) contains the Hanford defined waste (HDW) list, the supernatant mixing model (SMM), the tank layer model (TLM), and the HDW model tank inventory estimate.

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

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

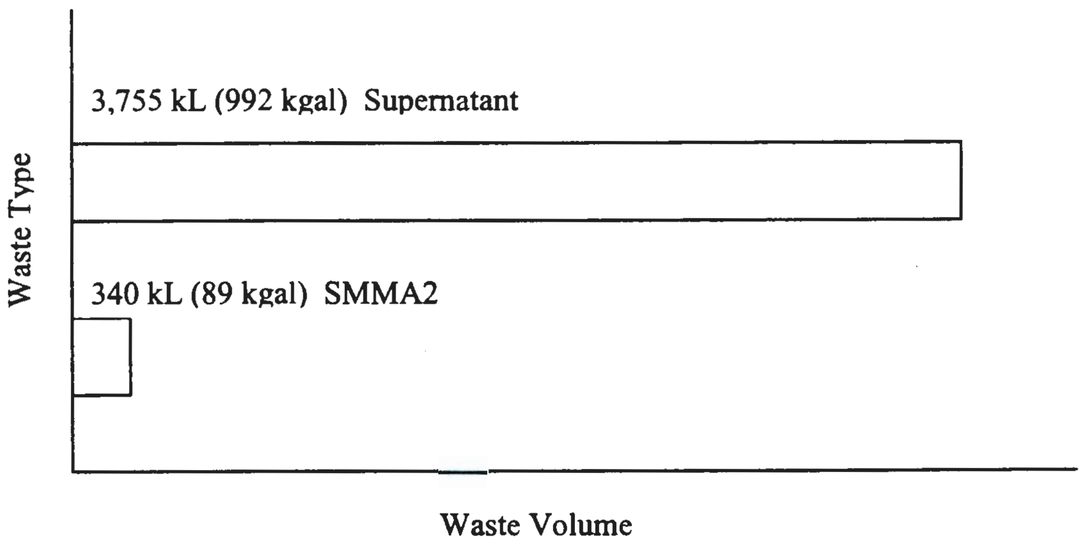
- The SMM is a subroutine within the HDW Model that calculates the volume and composition of certain supernatant blends and concentrates.

Using these records, the TLM defines the solid layers in each tank. The SMM uses information from the Waste Status and Transaction Record Summary (WSTRS), the TLM, and the HDW list to describe the supernatants and concentrates in each tank. Together the WSTRS, TLM, SMM, and HDW list determine the inventory estimate for each tank. These model predictions are considered estimates that require further evaluation using analytical data.

Based on the Agnew et al. (1997a) TLM, tank 241-AN-102 contains a top layer of 3,789 kL (1,001 kgal) of supernatant waste over a bottom layer of 337 kL (89 kgal) of concentrated saltcake slurry (SMMA2). Figure A3-1 is a graphical representation of the estimated waste type and volume for the tank layer.

The HDW Model predicts that the supernatant should contain greater than 1 weight percent sodium, nitrate, hydroxide, nitrite, N-(2-hydroxyethyl)ethylenediamine tetra actetate (HEDTA), aluminum, carbonate, and sulfate. Additionally, it should contain between 0.1 and 1 weight percent butanol, silicon, potassium, dibutyl phosphate (DBP), chromium, citrate, ethylenediaminetetraacetic acid (EDTA), chloride, phosphate, and glycolate. Table A3-2 shows the historical estimate of the expected waste constituents and their concentrations for chemicals and radionuclides (Agnew 1997a).

Figure A3-1. Tank Layer Model.[1,2]



Notes:

[1]Differs from Hanlon (1999).

[2]Agnew (1997a).

Table A3-2. Hanford Defined Waste Model Tank Inventory Estimate.[1, 2, 3] (4 sheets)

Tank 241-AN-102 Total Inventory Estimate					
Physical Properties				**-95 CI**	**+95 CI**
Total waste	7.28E+06 (kg)	(1.09E+03 kgal)	----	----	----
Heat load	11.0 (kW)	(3.75E+04 Btu/hr)	----	10.1	11.9
Bulk density[4]	1.76 (g/cc)	----	----	1.70	1.81
Water wt%[4]	23.6	----	----	21.1	26.8
TOC wt% C (wet)[4]	1.45	----	----	0.890	2.01
Chemical Constituents	**mole/L**	**ppm**	**kg[5]**	**-95 CI (mole/L)**	**+95 CI (mole/L)**
Na^+	17.7	2.31E+05	1.68E+06	16.3	18.8
Al^{3+}	2.12	3.24E+04	2.36E+05	1.82	2.22
Fe^{3+} (total Fe)	1.31E-02	416	3.03E+03	1.09E-02	1.54E-02
Cr^{3+}	0.157	4.63E+03	3.37E+04	0.140	0.172
Bi^{3+}	1.49E-03	177	1.29E+03	1.41E-03	1.59E-03
La^{3+}	2.50E-05	1.97	14.3	1.84E-05	3.16E-05
Hg^{2+}	1.17E-05	1.33	9.67	1.12E-05	1.21E-05
Zr (as $ZrO(OH)_2$)	2.03E-04	10.5	76.6	1.89E-04	2.18E-04
Pb^{2+}	1.56E-03	183	1.33E+03	1.23E-03	1.89E-03
Ni^{2+}	7.27E-03	242	1.76E+03	7.03E-03	7.43E-03
Sr^{2+}	0	0	0	0	0
Mn^{4+}	7.17E-03	223	1.63E+03	6.08E-03	8.26E-03
Ca^{2+}	3.89E-02	884	6.43E+03	3.56E-02	4.22E-02
K^+	8.56E-02	1.90E+03	1.38E+04	7.56E-02	0.102
OH^-	12.3	1.18E+05	8.60E+05	10.8	13.0
NO_3^-	5.65	1.98E+05	1.44E+06	5.36	5.89
NO_2^-	3.16	8.25E+04	6.00E+05	2.63	3.64
CO_3^{2-}	0.701	2.38E+04	1.74E+05	0.635	0.757
PO_4^{3-}	0.125	6.74E+03	4.91E+04	0.112	0.139
SO_4^{2-}	0.367	2.00E+04	1.45E+05	0.305	0.428
Si (as SiO_3^{2-})	0.101	1.61E+03	1.17E+04	8.57E-02	0.117
F^-	8.03E-02	864	6.29E+03	6.95E-02	9.76E-02
Cl^-	0.306	6.14E+03	4.47E+04	0.270	0.328
$C_6H_5O_7^{3-}$	4.78E-02	5.12E+03	3.72E+04	4.40E-02	5.27E-02

Table A3-2. Hanford Defined Waste Model Tank Inventory Estimate.[1, 2, 3] (4 sheets)

Tank 241-AN-102 Total Inventory Estimate					
Chemical Constituents (Cont'd)	**mole/L**	**ppm**	**kg[5]**	**-95 CI (mole/L)**	**+95 CI (mole/L)**
$EDTA^{4-}$	3.69E-02	6.03E+03	4.39E+04	1.22E-02	6.21E-02
$HEDTA^{3-}$	6.61E-02	1.03E+04	7.47E+04	1.66E-02	0.116
$Glycolate^{-}$	0.171	7.28E+03	5.30E+04	0.122	0.222
$Acetate^{-}$	2.48E-02	831	6.05E+03	1.97E-02	3.28E-02
$Oxalate^{2-}$	3.27E-05	1.63	11.9	2.91E-05	3.63E-05
DBP	3.55E-02	4.23E+03	3.08E+04	3.07E-02	4.28E-02
Butanol	3.55E-02	1.49E+03	1.08E+04	3.07E-02	4.28E-02
NH^3	8.36E-02	805	5.86E+03	6.60E-02	0.113
$Fe(CN)_6^{4-}$	0	0	0	0	0
Radiological Constituents	**Ci/L**	**µCi/g**	**Ci**	**-95 CI (Ci/L)**	**+95 CI (Ci/L)**
^{3}H	3.33E-04	0.189	1.37E+03	1.94E-04	3.77E-04
^{14}C	5.33E-05	3.02E-02	220	2.42E-05	5.48E-05
^{59}Ni	2.79E-06	1.58E-03	11.5	1.43E-06	2.93E-06
^{63}Ni	2.75E-04	0.156	1.14E+03	1.40E-04	2.89E-04
^{60}Co	6.64E-05	3.76E-02	274	3.31E-05	6.92E-05
^{79}Se	5.06E-06	2.87E-03	20.9	3.21E-06	6.38E-06
^{90}Sr	0.159	90.1	6.56E+05	0.149	0.168
^{90}Y	0.159	90.1	6.56E+05	9.49E-02	0.168
^{93}Zr	2.49E-05	1.41E-02	103	1.56E-05	3.15E-05
^{93m}Nb	1.79E-05	1.01E-02	73.8	1.14E-05	2.25E-05
^{99}Tc	3.98E-04	0.226	1.64E+03	2.90E-04	5.08E-04
^{106}Ru	1.18E-08	6.67E-06	4.85E-02	7.46E-09	1.36E-08
^{113m}Cd	1.37E-04	7.76E-02	565	8.12E-05	1.76E-04
^{125}Sb	3.06E-04	0.174	1.26E+03	1.62E-04	3.22E-04
^{126}Sn	7.64E-06	4.33E-03	31.5	4.86E-06	9.62E-06
^{129}I	7.69E-07	4.36E-04	3.17	5.59E-07	9.81E-07
^{134}Cs	1.50E-05	8.50E-03	61.9	1.19E-05	1.81E-05
^{137}Cs	0.340	193	1.40E+06	0.304	0.386
^{137m}Ba	0.321	182	1.33E+06	0.269	0.354
^{151}Sm	1.78E-02	10.1	7.34E+04	1.13E-02	2.24E-02

Table A3-2. Hanford Defined Waste Model Tank Inventory Estimate.[1, 2, 3] (4 sheets)

Tank 241-AN-102 Total Inventory Estimate					
Radiological Constituents (Cont'd)	**Ci/L**	**µCi/g**	**Ci**	**-95 CI (Ci/L)**	**+95 CI (Ci/L)**
^{152}Eu	6.62E-06	3.75E-03	27.3	4.32E-06	7.98E-06
^{154}Eu	1.02E-03	0.580	4.22E+03	5.59E-04	1.26E-03
^{155}Eu	3.98E-04	0.226	1.64E+03	2.62E-04	4.82E-04
^{226}Ra	1.93E-10	1.09E-07	7.95E-04	1.35E-10	2.34E-10
^{228}Ra	4.17E-07	2.36E-04	1.72	1.21E-07	5.06E-07
^{227}Ac	1.19E-09	6.73E-07	4.90E-03	8.54E-10	1.43E-09
^{231}Pa	5.70E-09	3.23E-06	2.35E-02	3.84E-09	7.02E-09
^{229}Th	9.68E-09	5.48E-06	3.99E-02	2.86E-09	1.16E-08
^{232}Th	4.45E-08	2.52E-05	0.183	7.97E-09	6.40E-08
^{232}U	1.29E-06	7.33E-04	5.33	1.00E-06	1.68E-06
^{233}U	4.96E-06	2.81E-03	20.4	3.84E-06	6.45E-06
^{234}U	1.02E-06	5.79E-04	4.22	9.90E-07	1.05E-06
^{235}U	4.06E-08	2.30E-05	0.168	3.94E-08	4.19E-08
^{236}U	3.63E-08	2.06E-05	0.150	3.37E-08	3.73E-08
^{238}U	1.30E-06	7.36E-04	5.36	1.27E-06	1.34E-06
^{237}Np	1.39E-06	7.86E-04	5.72	1.03E-06	1.75E-06
^{238}Pu	2.28E-06	1.29E-03	9.39	1.86E-06	2.69E-06
^{239}Pu	7.02E-05	3.98E-02	290	5.95E-05	8.08E-05
^{240}Pu	1.24E-05	7.01E-03	51.1	1.04E-05	1.44E-05
^{241}Pu	1.63E-04	9.23E-02	672	1.35E-04	1.91E-04
^{242}Pu	8.71E-10	4.94E-07	3.59E-03	7.02E-10	1.04E-09
^{241}Am	8.49E-05	4.81E-02	350	6.52E-05	1.05E-04
^{243}Am	3.34E-09	1.89E-06	1.38E-02	2.58E-09	4.22E-09
^{242}Cm	2.36E-07	1.34E-04	0.975	1.42E-07	2.88E-07
^{243}Cm	2.25E-08	1.27E-05	9.28E-02	1.35E-08	2.71E-08
^{244}Cm	1.95E-07	1.10E-04	0.804	1.02E-07	2.46E-07

Table A3-2. Hanford Defined Waste Model Tank Inventory Estimate.[1, 2, 3] (4 sheets)

Tank 241-AN-102 Total Inventory Estimate					
Totals	**M**	**µg/g**	**kg**	**-95 CI (M or g/L)**	**-95 CI (M or g/L)**
Pu	7.98E-04 (g/L)	----	3.29	5.96E-04	9.98E-04
U	1.14E-02	1.53E+03	1.12E+04	1.10E-02	1.17E-02

Notes:

CI = confidence interval
ppm = parts per million

[1]Agnew et al. (1997a)

[2]Unknowns in tank solids inventory are assigned by the TLM.

[3]HDW Model predictions have not been validated and should be used with caution.

[4]Water weight percent is derived from the difference of density and total dissolved species.

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

A4.0 SURVEILLANCE DATA

Tank 241-AN-102 surveillance consists of surface-level measurements (liquid and solid) and temperature monitoring inside the tank (waste and headspace). The tank annulus is equipped with leak-detection instrumentation consisting of continuous air monitors and conductivity probes. Surveillance data provide the basis for determining tank integrity. For double-shell tanks, the leak detection instruments are the principal means of detecting a leak from the primary tank; liquid level measurements may be used to confirm a possible leak detected by the annulus instruments. No occurrence reports have been written against tank 241-AN-102 that would indicate a leak from the primary tank. Solid-level measurements indicate physical changes in the consistency of the tank's solid layers.

A4.1 SURFACE-LEVEL READINGS

The tank 241-AN-102 waste surface level is monitored with an FIC gauge and a manual tape. Except for a small transfer in 1992, the surface level shows a slow but continuous drop of approximately 5.0 to 6.4 cm (2.0 to 2.5 in.) per year that is attributed to evaporation. The FIC surface level measurement on February 16, 1999 was 981.5 m (386.4 in.) and the manual tape measurement was 984.89 cm (387.75 in.). Figure A4-1 is a level history graph of the volume measurements though 1996. Figure A4-2 provides the level history since January 1996.

A4.2 INTERNAL TANK TEMPERATURES

Temperature data for tank 241-AN-102 are recorded by 18 thermocouples (TCs) attached at known elevations, on one TC tree located in riser 6. Temperature data from the Surveillance Analysis Computer System (SACS) recorded from January 1990 to February 1999 are available for all 18 TCs. The mean temperature of the SACS data for this time span was 33 °C (92 °F), the minimum temperature was 22 °C (71 °F), and the maximum temperature was 39.4 °C (103 °F). The mean temperature of the SACS data for the period of February 16, 1998 to February 16, 1999 was 31 °C (87 °F) with a minimum temperature of 22 °C (71 °F) and a maximum temperature of 34 °C (93 °F). A graph of the weekly high temperatures can be found in Figure A4-3. Plots of the individual TC readings for tank 241-AN-102 can be found in the *Supporting Document for the Historical Tank Content Estimate for AN-Farm* (Brevick et al. 1997).

A4.3 TANK 241-AN-102 PHOTOGRAPHS

There are no photographs of the tank interior available.

Figure A4-1. Tank 241-AN-102 Level History Through 1996.

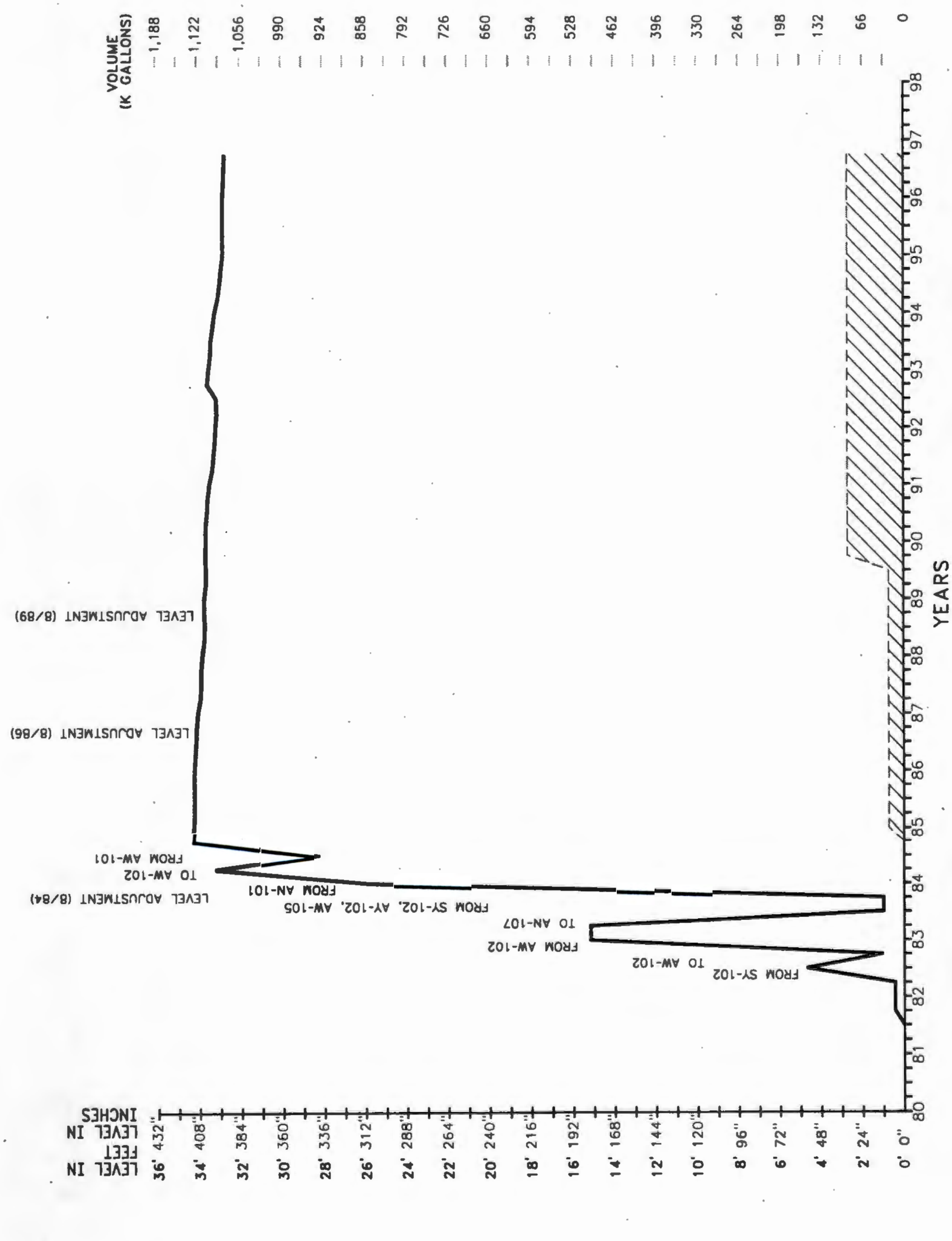


Figure A4-2. Tank 241-AN-102 Level History Since January 1996.

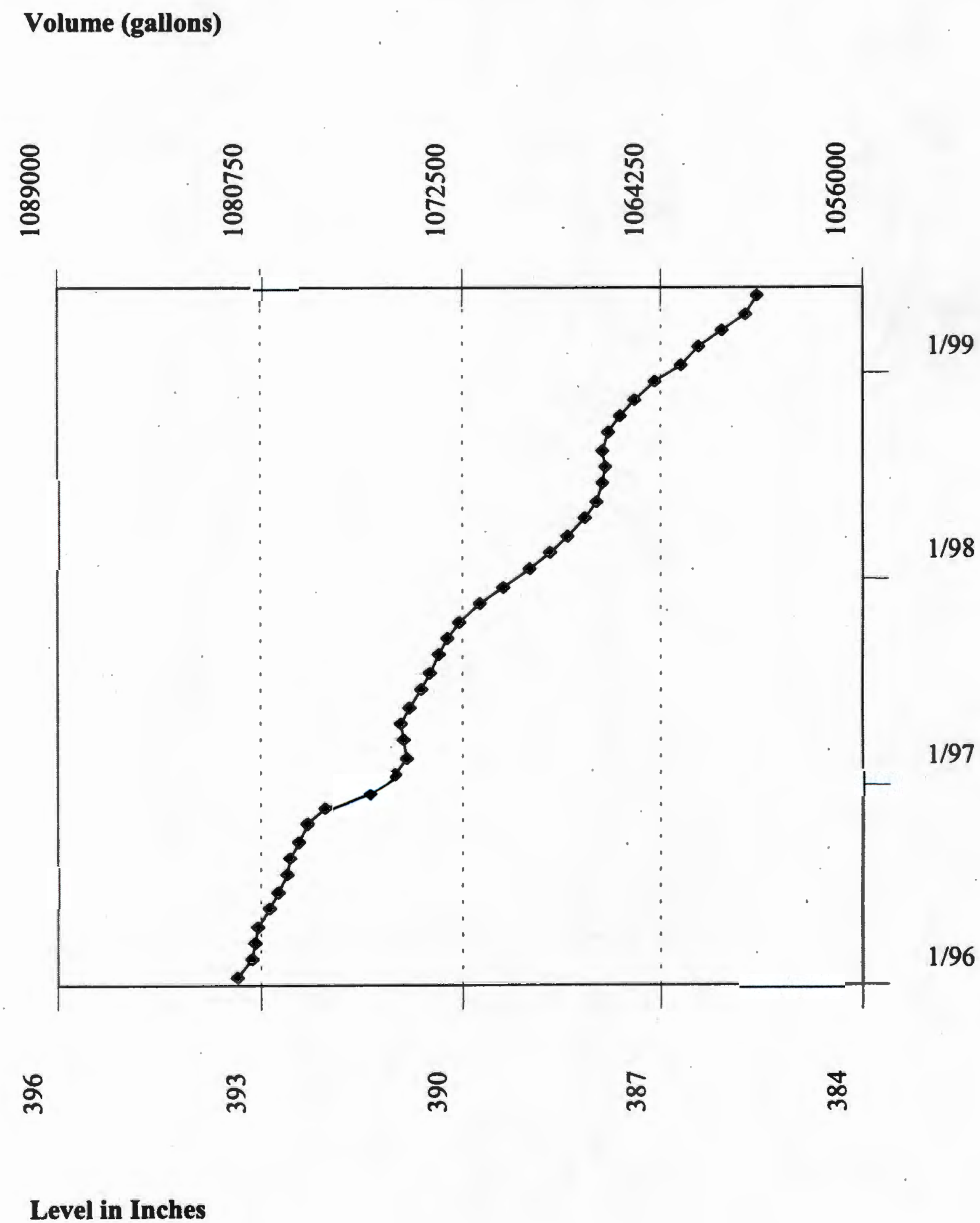
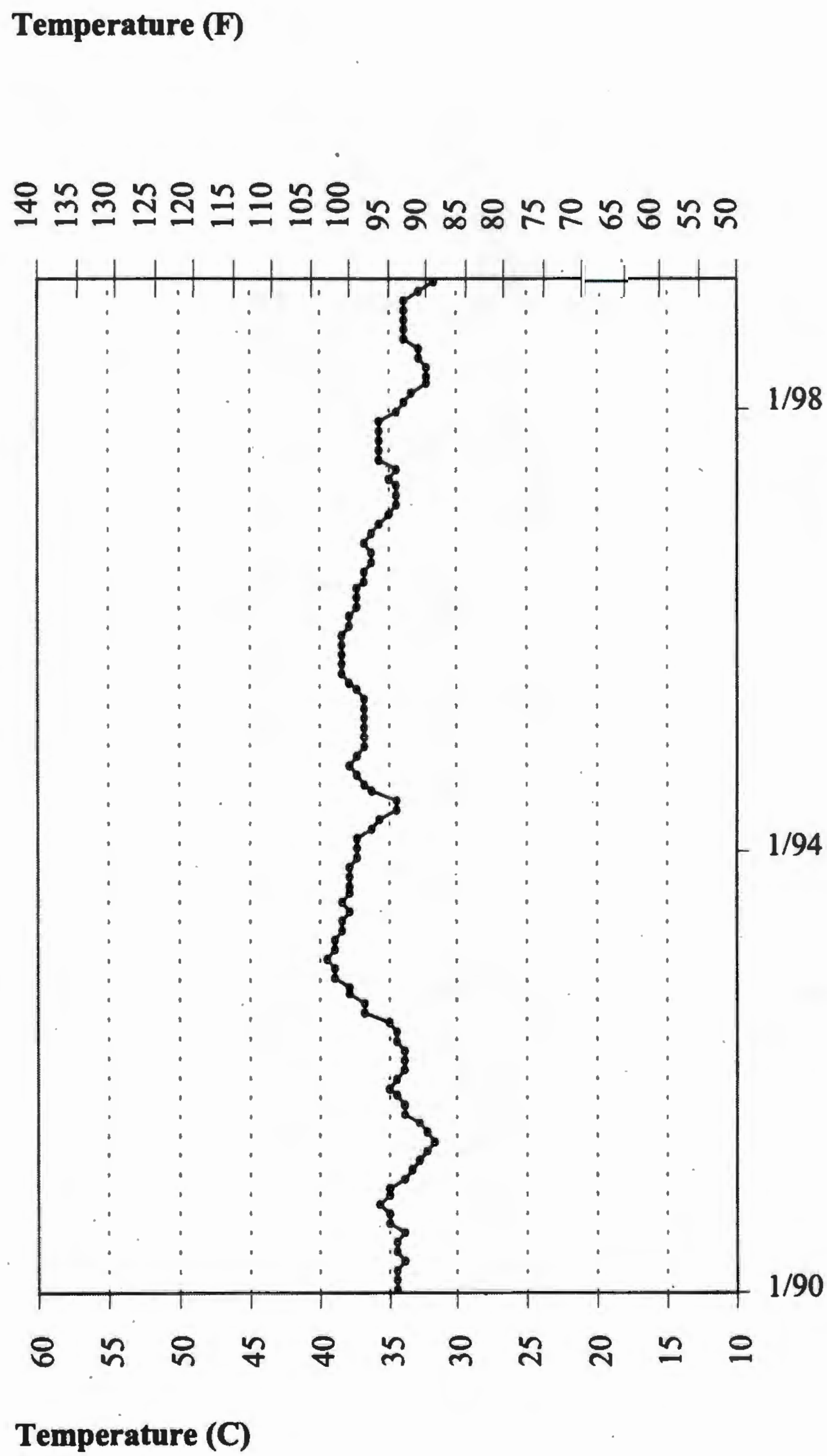


Figure A4-3. Tank 241-AN-102 High Temperature Plot.



A5.0 APPENDIX A REFERENCES

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APPENDIX B

SAMPLING OF TANK 241-AN-102

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APPENDIX B

SAMPLING OF TANK 241-AN-102

Appendix B provides sampling and analysis information for each known sampling event for tank 241-AN-102 and assesses sample results. It includes the following.

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

B1.0 TANK SAMPLING OVERVIEW

This appendix describes the sampling and analysis events for tank 241-AN-102. Grab samples were taken in July 1998 to meet the requirements of the *Letter of Instruction Supporting Privatization Phase 1B PAS-1 Shipment* (LOI 1) (Seidel 1998). Additional grab samples required to meet the requirements of the *Request for Grab Samples from Tank 241-AN-102* (LOI 2) (Jo 1998a) were taken in August 1998. The results from the July and August 1998 sampling events are provided in Section B2.1.

Grab samples were taken in February 1998 to satisfy the requirements of the *Low-Activity Waste Feed Data Quality Objective* (LAW DQO) (Wiemers and Miller 1997) and *Data Quality Objectives for TWRS-Privatization Phase I: Confirm Tank T is an Appropriate Feed Source for Low-Activity Waste Feed Batch X* (Confirm Tank T DQO) (Certa 1998). The sampling and analysis were performed in accordance with the *Tank 241-AN-102 Privatization Grab Sampling and Analysis Plan* (SAP) (Jo 1998b). Results are discussed in Section B2.2.

In November and December 1995, grab samples were taken to satisfy the requirements of the *Tank Safety Screening Data Quality Objectives* (Dukelow et al. 1995) and the *Data Quality Objectives for Tank Farms Waste Compatibility Program* (Fowler 1995). Before this, grab samples were obtained in February 1995 and October 1994 for process control purposes.

Selected grab samples from these events were archived, then later retrieved for safety screening analyses along with the November/December 1995 grab samples. Results are discussed in Section B2.3.

Jo (1998b) directed vapor measurements before the February 1998 grab sampling event to determine the lower flammability limit in support of the Flammable Gas Safety Project. Vapor readings were also taken before the grab sampling performed in July/August 1998, as well as before the 1994/1995 sampling event. Vapor results are presented in Section B2.4.

In May 1990, two core samples were taken from tank 241-AN-102 as directed by *Analysis of Tank 102-AN Core Sample* (Nguyen 1990). No DQOs were applicable to this event. Section B2.5 summarizes this sampling event and provides the 1990 core analytical results.

In addition, results from three historical sampling events are reported in this TCR: grab samples taken in 1989, sludge and supernatant grab samples obtained in 1988, and sludge and supernatant samples taken in 1984. These results are discussed in Section B2.6.

B2.0 SAMPLING EVENTS

This section describes sampling events and presents analytical results for tank 241-AN-102. The analytical results used to characterize current tank contents are from the 1990 core sampling event and the 1994/1995 grab sampling events. For constituents where data from these events is not available, data from the 1998 grab-sampling events is used. Table B2-1 summarizes the sampling and analytical requirements from the applicable DQOs.

B2.1 DESCRIPTION OF JULY/AUGUST 1998 GRAB SAMPLING EVENTS

The purpose of the July and August 1998 grab sampling of tank 241-AN-102 was to provide waste treatability samples for the Privatization Contractor. The grab sampling was performed to obtain 15 liters of tank waste. The Privatization Contract requires the PHMC to prepare the tank waste samples for shipment to British Nuclear Fuel Limited, Inc. (BNFL) or their subcontractors, Westinghouse Savannah River Company (WSRC) or Pacific Northwest National Laboratory (PNNL). The 222-S Laboratory performed all analyses required by the U.S. Department of Energy (DOE) to ship these samples and package the material to meet the Department of Transportation (DOT) specifications.

Two sets of fifteen samples were collected to support the Privatization Phase IB post-accident sampling container –I (PAS-I) shipments. The first set (samples 2AN-98-43 through 2AN-98-57) was collected between July 21, 1998 and July 23, 1998; the second set (samples 2AN 98 58 through 2AN-98-72) between August 10, 1998 and August 12, 1998. Selected samples were subsampled and analyzed in accordance with the *Letter of Instruction Supporting Privatization Phase 1B PAS-I Shipment* (LOI 1) (Seidel 1998)

The July 1998 grab-sampling of tank 241-AN-102 was performed to obtain 7.5 liters of waste from five levels in the tank using 500-mL tall wide-mouth bottles. Sampling and analysis were performed in accordance with *Request for Grab Samples from Tank 241-AN-102* (LOI 2) (Jo 1998a), respectively. Analyses required for liquid samples were visual inspection for color and solids; net weight, specific gravity, total beta reported as ^{90}Sr, gamma energy analysis (GEA), TOC, inductively coupled plasma spectroscopy/atomic emission spectroscopy (ICP/AES), and ICP/mass spectroscopy (MS). Settled solids were to be analyzed for density, total beta reported as ^{90}Sr, GEA, TOC, ICP/AES, and ICP/MS.

Table B2-1. Integrated Data Quality Objective Requirements for Tank 241-AN-102. (2 sheets)

Sampling Event	Applicable DQOs	Sampling Requirements	Analytical Requirements
August 1998 Grab Sampling	LOI 2 (Jo 1998a)	Fifteen 500-mL grab samples from a single level in the supernatant	Radionuclides, cations, TOC, density, percent solid, total beta
July 1998 Grab Sampling	LOI 1 (Seidel 1998)	Fifteen 500-mL grab samples from 5 levels of the tank	Radionuclides, cations, TOC, density, percent solid, total beta
February 1998 Grab Sampling	LAW DQO (Wiemers and Miller 1997)	Minimum of two grab samples from each level (strata/substrata)	Anions, cations, mercury, hydroxide, TIC, TOC, radionuclides, percent solids, ammonia, specific gravity, total alpha, total beta, PCBs
	Confirm Tank T DQO (Certa 1998)	One grab sample from each level	No analyses required; samples archived for Retrieval Program
November/ December 1995 Grab Sampling	Safety screening - Energetics - Moisture content - Total alpha - Flammable gas Dukelow et al. (1995)	Vertical profiles from two different risers	Flammability, energetics, moisture, total alpha activity, density, anions, cations, radionuclides, TOC, separable organics, phyical properties, TIC, pH, Cr(VI)

Table B2-1. Integrated Data Quality Objective Requirements for Tank 241-AN-102. (2 sheets)

Sampling Event	Applicable DQOs	Sampling Requirements	Analytical Requirements
November/ December 1995 Grab Sampling (Cont'd)	Compatibility Program (Fowler 1995)	A single representative sample	Energetics, moisture, anions, cations, radionuclides, pH, TIC/TOC

Notes:

PCB = polychlorinated biphenyl
TIC = total inorganic carbon

The August 1998 grab sampling of the tank was performed to obtain samples from a single level in the supernatant. Fifteen 500 mL grab samples were collected, although at three different elevations as described in the following section. These variations are not expected to impact the validity or usefulness of the data. The analyses required for liquid samples were visual inspection for color and solids, net weight, specific gravity, total beta, GEA, TOC, ICP/AES, and ICP/MS. Required analyses for solid samples were density, total beta, GEA, TOC, ICP/AES, and ICP/MS.

Vapor readings were taken with a combustible gas meter in the tank headspace before sampling. These measurements are discussed in Section B2.3.

B2.1.1 July/August 1998 Grab Sample Handling

Thirty 500-mL grab samples were taken from riser 22 of tank 241-AN-102 and received at the 222-S Laboratory in two sets of shipments, the first between July 21, 1998 and July 24, 1998; and the second between August 10, 1998 and August 12, 1998. The samples were observed for appearance and determination of the percent settled solids. Table B2-2 provides the sampling, receiving, and appearance information. The appearance information is a visual description of the samples after they were placed in the hotcell and were allowed to stand for several days. All of the samples were very dark opaque liquids. As noted in the table, some of the samples contained settled solids. The volume percent settled solids measurements were obtained by comparing the height, in mm, of the settled solids to the height of the entire sample in the 500-mL bottles.

Some of the sampling depths recorded on the work package data sheets (LMHC 1998a and 1998b) did not match those listed in the process memorandums (DST Engineering 1998a and 1998b). Sample 2AN-98-55 was collected at a depth of 1,669 cm (657 in.) (elevation of 38 cm [15 in.]) rather than 1,671 cm (658 in.) (elevation of 36 cm [14 in.]), and samples 2AN-98-62 and 2AN-98-72 were collected at a depth of 1,227 cm (483 in.) (elevation of 480 cm [189 in.]) instead of 1,240 cm (488 in.) (elevation of 467 cm [184 in.]). Also note that the distance from the flange on riser 22 to the tank bottom is 1,707 cm (672 in.) instead of the 1,697 cm (668 in.) reported in the process memorandums. The sampling elevation information in Table B2-2 was converted from the work package sampling depths using the 1,707 cm (672 in.) distance.

For sample 2AN-98-58, the elevation was recorded as 376 cm (148 in.) rather than 467 cm (180 in.). The work package makes no mention of this error, but Esch (1998a) notes that the 91 cm (36 in.) to account for the equipment set up on the riser may not have been subtracted before recording the sampling elevation in the work package.

Table B2-2. Tank 241-AN-102 July/August 1998 Sample Description.[1] (3 sheets)

Sample ID	Sampling Elevation[2,3] cm (in.)	% Settled Solids[4]	Sample Characteristics
2AN-98-43	975 (384)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-44	975 (384)	<3.6	The cap broke during transfer of bottle to hotcell so that bottle was not completely full. Black opaque liquid; no organic layer, no solids.
2AN-98-45	975 (384)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-46	721 (284)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-47	721 (284)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-48	721 (284)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-49	467 (184)	<3.1	Bottle full. Black, opaque liquid; no organic layer, trace quantity of tan solids.
2AN-98-50	467 (184)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-51	467 (184)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-52	213 (84)	<4.5	Bottle only 3/4 full when sample was collected. Black, opaque liquid; no organic layer, no solids.
2AN-98-53	213 (84)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-54	213 (84)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.

Table B2-2. Tank 241-AN-102 July/August 1998 Sample Description.[1] (3 sheets)

Sample ID	Sampling Elevation[2,3] cm (in.)	% Settled Solids[4]	Sample Characteristics
2AN-98-55	38 (15)	12.0	Bottle full. Black, opaque liquid; tan solids, no organic layer.
2AN-98-56	36 (14)	72.0	Bottle full. Black, opaque liquid; tan solids, no organic layer.
2AN-98-57	36 (14)	66.0	Bottle full. Black, opaque liquid; tan solids, no organic layer.
2AN-98-58	376 (148)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-59	467 (184)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-60	467 (184)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-61	467 (184)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-62	480 (189)	<3.1	The cap broke during transfer of bottle to hotcell so that bottle was not completely full. Black, opaque liquid; no organic layer, no solids.
2AN-98-63	467 (184)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-64	467 (184)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-65	467 (184)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-66	467 (184)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-67	467 (184)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-68	467 (184)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-69	467 (184)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-70	467 (184)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.

Table B2-2. Tank 241-AN-102 July/August 1998 Sample Description.[1] (3 sheets)

Sample ID	Sampling Elevation[2,3] cm (in.)	% Settled Solids[4]	Sample Characteristics
2AN-98-71	467 (184)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-72	480 (189)	<3.1	Bottle full. Black, opaque liquid; no organic layer, no solids.

Notes:

[1]Esch (1998a)

[2]Sampling elevation as determined from the tank bottom to the sample bottle mouth.

[3]Converted from depth measurements given in LMHC (1998a and 1998b).

[4]The percent settled solids measurements were obtained by comparing the height (in mm) of settled solids to the height of the entire sample in the 125-mL bottles.

B2.1.2 July/August 1998 Grab Sample Analysis

For samples 2AN-98-43 through 2AN-98-57, LOI 1 (Seidel 1998) requested analysis of one sample from each sampling elevation (36, 213, 467, 721, and 975 cm [14, 84, 184, 284, and 384 in.]), if the appearance of the samples from the same elevation were identical. In the February 1998 sampling event, selected analyses were performed on four samples that were collected at similar elevations in the tank (127, 257, 457, and 965 cm [50, 101, 180, and 380 in.]). Because the relative standard deviation between the four sample results for all analytes was less than 20 percent, the supernatant was determined to be homogeneous (Esch 1998b). Only one sample (2AN-98-47) from the first four sampling elevations was analyzed to meet the requirements of the LOI, because samples 2AN-09-43 through 2AN-98-54 were identical in appearance.

Although the three sludge samples (2AN-98-55, 2AN-98-56 and 2AN-98-57) had different volumes of settled solids, the laboratory determined the appearance of the solids was identical and only one sample (2AN-98-55) was separated and analyzed.

Supernatant samples 2AN-98-58 through 2AN-98-72 were identical in appearance. Therefore, sample 2AN-98-67 was the only sample analyzed, as directed in LOI 2 (Jo 1998a).

Table B2-3 lists the approved analytical procedures used for reported analyses. Table B2-4 summarizes the sample portions, sample numbers, and analyses performed on each sample.

Table B2-3. Analytical Procedures.

Analysis	Method	Procedure
Solids		
Density	Density	LO-160-103
Total beta reported as ^{90}Sr	Beta counting	LA-508-101
TOC	Persulfate	LA-342-100
Al	ICP/AES	LA-505-151 LA-505-161
^{137}Cs and all detects	GEA	LA-548-121
^{233}U, ^{235}U, ^{238}Pu, ^{239}Pu, ^{241}Pu	ICP/MS	LA-506-101
Liquids		
Color, solids	Visual inspection	LA-519-151
Specific gravity	Gravimetry	LA-510-112
Al	ICP/AES	LA-505-151 LA-505-161
^{233}U, ^{235}U, ^{238}Pu, ^{239}Pu, ^{241}Pu	ICP/MS	LA-506-101
Total beta reported as ^{90}Sr	Beta counting	LA-508-101
TOC	Furnace oxidation	LA-344-105
^{137}Cs and all detects	GEA	LA-548-121

Table B2-4. July/August 1998 Sample Analyses Summary [1] (2 sheets)

Parent Sample Number	Lab Sample Number	Preparation Method	Analyses
Supernatant			
2AN-98-47	S98T002854	Direct	Specific Gravity, TOC, $^{89/90}Sr$, ^{137}Cs
	S98T002854	Acid digest	ICP/MS: $^{233, 235, 238}U$, ^{239}Pu, $^{241}Pu/AM$, ICP: Al
Sludge - Centrifuged Solids Portion			
2AN-98-55	S98T002852	Direct	Bulk density, TOC
	S98T002899	Fusion digest	$^{89/90}Sr$, ^{137}Cs
	S98T002900	Acid digest	ICP/MS: $^{233, 235, 238}U$, ^{239}Pu, $^{241}Pu/AM$, ICP: Al
Sludge – Supernatant Portion			
2AN-98-55	S98T002851	Direct	Specific gravity, TOC, $^{89/90}Sr$, ^{137}Cs
	S98T002851	Acid digest	ICP/MS: $^{233, 235, 238}U$, ^{239}Pu, $^{241}Pu/AM$, ICP: Al

Table B2-4. July/August 1998 Sample Analyses Summary [1] (2 sheets)

Parent Sample Number	Lab Sample Number	Preparation Method	Analyses
Supernatant			
2AN-98-67	S98T002688	Direct	Specific gravity, TOC, $^{89/90}Sr$, ^{137}Cs
	S98T002688	Acid digest	ICP/MS: $^{233,235,238}U$, ^{239}Pu, $^{241}Pu/AM$, ICP: Al

Note:

[1]Esch (1998a)

B2.1.3 Analytical Results for July/August 1998 Grab Sampling

This section summarizes the sampling and analytical results associated with the July and August 1998 sampling and analysis of tank 241-AN-102. Table B2-5 shows the location of analytical sample results within this report. These results are documented in Esch (1998a).

Table B2-5. July/August 1998 Analytical Tables.

Analysis	Table Number
Inductively coupled plasma/atomic emission spectroscopy	B2-31 to B2-67
Bulk density	B2-68
Specific gravity (liquids)	B2-69
Gamma energy analysis	B2-70 and B2-71
Inductively coupled plasma/mass spectroscopy	B2-72 to B2-86
$^{89/90}Sr$	B2-87
Total organic carbon by furnace oxidation	B2-88
Total inorganic carbon by persulfate	B2-89
Total organic carbon by persulfate	B2-90

The quality control (QC) parameters assessed in conjunction with tank 241-AN-102 samples were standard recoveries, spike recoveries, duplicate analyses, relative percent difference (RPDs), and blanks. The QC criteria are specified in the LOIs (Seidel 1998 and Jo 1998a). Sample and duplicate pairs, in which any QC parameter was outside these limits, are footnoted in the sample mean column of the following data summary tables with an a, b, c, d, e, or f as follows.

- "a" indicates the standard recovery was below the QC limit.
- "b" indicates the standard recovery was above the QC limit.

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

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

B2.1.3.1 Bulk Density and Specific Gravity. The density of the samples was determined by measuring bulk density for the centrifuged solid and specific gravity for the liquid subsamples. The specific gravity analysis was performed in duplicate on the liquid subsamples, and the results ranged from 1.44 to 1.48. A single measurement of 1.64 was reported for the bulk density of the centrifuged solid subsample.

B2.1.3.2 Inductively Coupled Plasma. The ICP analysis was performed on all subsamples. The analyte of interest for shipping was aluminum. All other analytes were reported on an opportunistic basis and did not have specified QC acceptance criteria. Therefore, any anomalies in those results are not discussed in this report. However, these opportunistic results are shown in the summary data tables with qualifier flags, which assume the same quality control limits as specified for aluminum.

The liquid subsamples were analyzed directly, while the centrifuged solid subsample was prepared by acid digest before analysis. Duplicate analyses were performed on all subsamples. The aluminum results for the liquid ranged from 14,100 to 15,700 μg/mL. The aluminum reults for the solid were 9,820 and 10,100 μg/g.

B2.1.3.3 Inductively Coupled Plasma – Mass Spectrometry (ICP/MS). The ICP/MS analysis was performed in duplicate on all subsamples. The following isotopes were requested: ^{233}U, ^{235}U, ^{238}Pu, ^{239}Pu and ^{241}Pu. Atomic masses of 238 and 241 can be attributed to more than one isotope. Mass 238 has been identified as U. Because major plutonium isotopes of ^{239}Pu and ^{240}Pu were undetected, it is not likely for plutonium to be a significant contributor to the concentration reported for atomic mass 238. The result for atomic mass 241 is reported as AMU-241.

The QC review was restricted to ^{233}U, ^{235}U, ^{238}Pu, ^{239}Pu, and ^{241}Pu. Results for the other isotopes are considered opportunistic and do not have program-defined QC parameters. The qualifier flags presented for the opportunistic analytical data in the summary tables assume that the QC limits would have been the same as for the required analytes.

All isotopes were non-detects except AMU-232, ^{235}U and AMU-238, which were detected in the centrifuged solid subsample. The AMU-232 results were 6.94 and 7.11 μg/g, the ^{235}U results were 0.921 and 1.36 μg/g and the AMU-238 results were 148 and 213 μg/g.

B2.1.3.4 Strontium 90. The ^{90}Sr analysis was performed on all subsamples. Analyses were performed directly on the liquid subsamples, while the centrifuged solid subsample was prepared by fusion digest before analysis. Duplicate analyses were performed on all subsamples. The results on the liquid subsamples ranged from 85.7 to 91.4 μg/mL. The solid results were 88.2 and 91.3 μg/g.

B2.1.3.5 Gamma Energy Analysis. The GEA analysis was performed in duplicate on all subsamples. Cesium-137 was the only requested isotope for this method. All other isotopes were reported as opportunistic basis. Analyses were performed directly on the liquid subsamples, while the solid subsample was prepared by fusion digest before analysis. The liquid results ranged from 420 to 463 μCi/mL and the solid results were 226 and 227 μCi/g. The only other detected value was ^{60}Co at 0.103 μCi/g, which was observed in the centrifuged solid primary subsample. Cobalt-60 was not detected in the duplicate.

The laboratory also detected ^{154}Eu in the centrifuged solid. However, upon review of the data, the presence of ^{154}Eu was determined to be an artifact of the very high concentration of ^{137}Cs. These results do not appear in the tank characterization database, but they can be found in the Extraneous Peak Report included in Appendix A to Esch (1998a).

B2.1.3.6 Total Organic Carbon. The TOC analysis was performed using the furnace oxidation method for the supernatant samples and the persulfate oxidation method for the centrifuged solid. Duplicate analyses were performed on all analyses. The liquid results ranged from 26,900 to 32,500 μg C/mL. The solid results were 22,300 and 22,700 μg C/g.

B2.2 DESCRIPTION OF FEBRUARY 1998 GRAB SAMPLING EVENT

The intent of the February 1998 grab-sampling was to obtain supernatant and sludge samples to support privatization efforts in accordance with the *Tank 241-AN-102 Privatization Grab Sampling and Analysis Plan* (SAP) (Jo 1998b) the *Low Activity Waste Feed Data Quality Objective* (LAW DQO) (Wiemers and Miller 1997), and the *Data Quality Objectives for TWRS-Privatization Phase I: Confirm Tank T is an Appropriate Feed Source for Low-Activity Waste Feed Batch X* (Confirm Tank T DQO) (Certa 1998). Tank 241-AN-102 has been identified as one of the early tanks to be retrieved for low-level waste pretreatment and immobilization. Because retrieval of the tank waste may require dilution, a series of solids solubility screening tests were requested to determine the effects of dilution on the mass of solids and their composition.

The SAP directed grab sampling of tank 241-AN-102 to obtain thirty-five supernatant samples, seven sludge samples, and a field blank. Forty-two grab samples and a field blank were taken from riser 20 between February 3, 1998 and February 5, 1998. Because of sampling error, the lowest level grab samples were not taken from the sludge level. Therefore, all 42 grab samples were supernatant.

A vapor reading was taken with a combustible gas meter in the tank headspace before sampling. Further discussion of this measurement is provided in Section B2.4.

B2.2.1 Sample Handling for February 1998 Grab Samples

The samples were received at the 222-S Laboratory between February 3 and 6, 1998. A field blank was collected and received with the samples from this sampling event. However, it was inadvertently overlooked. After consultation with the tank coordinator, it was agreed that no analyses would be performed on the field blank as the oversight was discovered too late for the analysis to be performed and the results included in the final report (Esch 1998b).
The samples were subsampled, composited, and analyzed in accordance with the SAP (Jo 1998b) and the LAW DQO (Wiemers and Miller 1997). The solids solubility screening was performed on dissolution composites in accordance with the *Test Plan for Tank 241-AN-102 Solubility Screening Tests* (Test Plan) (Person 1998) and the LAW DQO (Wiemers and Miller 1997). The samples that were taken in support of the Confirm Tank T DQO (Certa 1998) were not analyzed with the rest of the data package, rather they were archived for later analysis by the Retrieval Program. Analysis is tentatively scheduled for fiscal year 2000.

The samples were observed for appearance and determination of the percent settled solids. The appearance information is a visual description of the samples after they were placed in the hot cell and were allowed to stand for several days. All of the samples were very dark opaque liquids. Some of the samples contained a small amount of settled solids. The percent settled solids measurements were obtained by comparing the height (in mm) of settled solids to the height of the entire sample in the 125-mL bottles. No full sludge samples were obtained.

Table B2-6 identifies the sampling elevation, the percent settled solids, and the characteristics of each sample. Some of the samples were not taken at the elevation designated in the process memorandum. Samples 2AN-98-8 through 2AN-98-14 were collected at 714 cm (281 in.) rather than 711 cm (280 in.). Samples 2AN-98-22 through 2AN-98-26 were collected at 257 cm (101 in.), not 254 cm (100 in.); samples 2AN-98-27 and 2AN-98-28 at 226 cm (89 in.), not 254 cm (100 in.); and samples 2AN-98-36 through 2AN-98-42 were collected at 127 cm (50 in.) instead of 25 cm (10 in.).

Samples 2AN-98-2, 2-AN-98-9, 2AN-98-16, and 2AN-98-23 were set aside for the Retrieval Program. Esch (1998b) states that sample 2AN-98-30 was also set aside for the Retrieval Program; however, this sample was actually analyzed with the remaining samples. Samples 2AN-98-36, 2AN-98-39, 2AN-98-41, and 2AN-98-42 were archived because they duplicated other samples taken at the same sampling elevation. Of the remaining samples, all those containing more than 5 percent settled solids were separated by centrifugation.

Table B2-6. Tank 241-AN-102 Sample Description.[1] (3 sheets)

Sample ID	Sampling Elevation[2] cm (in.)	% Settled Solids[3]	Sample Characteristics
2AN-98-1	965 (380)	0	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-2	965 (380)	0	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-3	965 (380)	0	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-4	965 (380)	0	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-5	965 (380)	0	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-6	965 (380)	<1.2	Bottle full. Black, opaque liquid; no organic layer, trace quantity of tan solids.
2AN-98-7	965 (380)	0	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-8	714 (281)	0	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-9	714 (281)	0	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-10	714 (281)	0	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-11	714 (281)	0	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-12	714 (281)	0	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-13	714 (281)	0	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-14	714 (281)	0	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-15	457 (180)	0	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-16	457 (180)	0	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-17	457 (180)	<1.2	Bottle full. Black, opaque liquid; no organic layer, trace quantity of tan solids.

Table B2-6. Tank 241-AN-102 Sample Description.[1] (3 sheets)

Sample ID	Sampling Elevation[2] cm (in.)	% Settled Solids[3]	Sample Characteristics
2AN-98-18	457 (180)	13.1	No etched number on bottle. Bottle full. Black, opaque liquid; no organic layer, tan solids.
2AN-98-19	457 (180)	<1.2	Bottle full. Black, opaque liquid; no organic layer, trace quantity of tan solids.
2AN-98-20	457 (180)	0	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-21	457 (180)	6	Bottle full. Black, opaque liquid; no organic layer, tan solids.
2AN-98-22	257 (101)	6	Bottle full. Black, opaque liquid; no organic layer, tan solids.
2AN-98-23	257 (101)	0	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-24	257 (101)	0	Bottle full. Black, opaque liquid; no organic layer, no solids.
2AN-98-25	257 (101)	5	Bottle full. Black, opaque liquid; no organic layer, tan solids.
2AN-98-26	257 (101)	<1.2	Bottle full. Black, opaque liquid; no organic layer, trace quantity of tan solids.
2AN-98-27	226 (89)	6	No etched number on bottle. Bottle full. Black, opaque liquid; no organic layer, tan solids.
2AN-98-28	226 (89)	9	Bottle full. Black, opaque liquid; no organic layer, tan solids.
2AN-98-29	127 (50)	17	Bottle full. Black, opaque liquid; no organic layer, tan solids.
2AN-98-30	127 (50)	18	Bottle full. Black, opaque liquid; no organic layer, tan solids.
2AN-98-31	127 (50)	<1.7	Bottle ¾ full. Black, opaque liquid; no organic layer, trace quantity of tan solids.
2AN-98-32	127 (50)	13	Bottle full. Black, opaque liquid; no organic layer, tan solids.
2AN-98-33	127 (50)	21	Bottle full. Black, opaque liquid; no organic layer, tan solids.
2AN-98-34	127 (50)	18	Bottle full. Black, opaque liquid; no organic layer, tan solids.
2AN-98-35	127 (50)	18	Bottle full. Black, opaque liquid; no organic layer, tan solids.
2AN-98-36	127 (50)	12	Bottle full. Black, opaque liquid; no organic layer, tan solids.
2AN-98-37	127 (50)	16	Bottle full. Black, opaque liquid; no organic layer, tan solids.

Table B2-6. Tank 241-AN-102 Sample Description.[1] (3 sheets)

Sample ID	Sampling Elevation[2] cm (in.)	% Settled Solids[3]	Sample Characteristics
2AN-98-38	127 (50)	21	Bottle full. Black, opaque liquid; no organic layer, tan solids.
2AN-98-39	127 (50)	12	Bottle full. Black, opaque liquid; no organic layer, tan solids.
2AN-98-40	127 (50)	22	Bottle full. Black, opaque liquid; no organic layer, tan solids.
2AN-98-41	127 (50)	13	Bottle full. Black, opaque liquid; no organic layer, tan solids.
2AN-98-42	127 (50)	6	Bottle full. Black, opaque liquid; no organic layer, tan solids.
2AN-98-FB	1,097 (432)	0	Bottle ¾ full. Clear, colorless liquid; no organic layer, no solids.

Notes:

[1]Esch 1998b.

[2]Converted from depth measurements given in Esch (1998b).

[3]The percent settled solids measurements were obtained by comparing the height (in mm) of settled solids to the height of the entire sample in the 125-mL bottles.

B2.2.1.1 Formation of Solid and Supernatant Composites. The parent samples containing more than 5 percent settled solids were centrifuged. The centrifuged liquids were used to form the liquid composite, while the centrifuged solids were used to form the solids composite. Insufficient solids were collected during the sampling event to provide enough material to prepare a solid composite using representative fractions of solids from each tank level that was sampled. Instead, the centrifuged solid composite was prepared by combining all of the solids collected from samples 2AN-98-29, 2AN-98-32, 2AN-98-33, 2AN-98-34, 2AN-98-35, 2AN-98-37, 2AN-98-38, and 2AN-98-40. The weights of each sample added to the solid composite can be found in Attachment 2 to Esch (1998b).

Because the supernatant was found to be homogeneous, one supernatant composite was prepared by combining the supernatant from all samples except those previously indicated as being set aside or archived. This composite was formed from the centrifuged liquid (described above) and the remaining supernate samples that were not centrifuged.

B2.2.1.2 Formation of Solubility Screening (Dissolution) Composites. Five dissolution composites were built as described in the *Test Plan for Tank 241-AN-102 Solubility Screening Tests* (Person 1998). Varying amounts of diluent were added to three of the five composites; the two remaining composites were left undiluted. The solubility screening tests indicated that as the amount of diluent was increased, there was a corresponding decrease in the weight percent solids in the composite. A more detailed discussion of the solid solubility screening is provided in the *Solubility Screening Tests for Tank 241-AN-102* report, included as Attachment 2 to Esch (1998b). After mixing and settling, the solids and liquids were separated by centrifugation and subsamples were submitted for analysis.

B2.2.2 Sample Analysis

Samples, subsamples, and composites from the February 1998 grab samples were analyzed based on privatization and solubility screening issues. Table B2-7 lists the approved analytical procedures used for reported analyses. Tables B2-8, B2-9, and B2-10 identify the sample portions, sample numbers, and analyses performed on the homogeneity check samples, liquid and solid composites, and solubility screening composites, respectively. The following sections summarize these analyses.

B2.2.2.1 Homogeneity Check. The supernatant from samples 2AN-98-1, 2AN-98-15, 2AN-98-22, and 2AN-98-29 was subsampled and a limited set of analytes (total alpha, total beta, nitrate, aluminum, and sodium) was measured to determine the homogeneity of the supernatant layer. The results indicate that the supernatant was homogeneous from top to bottom. The supernatant from sample 2AN-98-8 was archived. The homogeneity data can be reviewed in Attachment 1 of Esch (1998b).

B2.2.2.2 Supernatant Composite. The chemical and physical analyses required by the LAW DQO for the liquid analyses include: Ag, Al, As, Ba, Ca, Cd, Cr, Fe, Mn, Ni, P, Pb, Se, S, Sr, Si, U, K, and La by ICP/AES; NO_2, NO_3, PO_4, and SO_4 by ion chromatography (IC); CN by colorimetry; Sb and Tl by graphite furnance atomic absorption (GFAA); Hg by CVAA; F and Cl by ISE or IC; NH_4/NH_3 by ISE; potentiometric titration for OH; TIC/TOC by both persulfate oxidation and furnace combustion; PCBs by GC/MS and gravimetric weight percent solids. Radionuclide analyses include: ^{90}Sr by isotopic specific separation/beta count; ^{237}Np by TTA extraction; ^{237}Np, Pu isotopes, atomic mass units–241, -243, -244, total Cs, and ^{126}Sn by ICP/MS; ^{99}Tc by ICP/MS and isotopic specific separation/AEA; ^{241}Am, ^{243}Cm, and ^{244}Cm by separation/AEA; ^{137}Cs, ^{60}Co, ^{125}Sb, ^{154}Eu, ^{155}Eu, ^{231}Pa, ^{233}U, ^{234}U, ^{235}U, ^{236}U and ^{238}U by GEA; ^{3}H, ^{14}C by separation/liquid scintillation; ^{79}Se by liquid scintillation; ^{129}I by separation/GEA; and total alpha.

In addition, analyses for organics, N-methyl-benzenamine, Pyrene, 1,2-trans-dichloroethene, dioxins, and furans were requested for the liquid analyses. However, Sieracki (1998) directed that these analyses not be performed.

The supernatant composite was split into nine subsamples so that smaller volumes could be handled to reduce the radiological exposure to personnel and still provide enough liquid to perform all of the required analyses. Each requested analysis was then performed on three of the nine subsamples. The supernatant composite analyses were performed on duplicate aliquots taken from each subsample provided. One spike analysis was performed per composite. Analytical results for the supernatant composite are discussed in Section B2.2.3.

B2.2.2.3 Solid Composite. The LAW DQO required the following analyses for the solid composite analyses: Al, Na, Cr, P, S, and Si by ICP/AES; potentiometric titration for OH^-; TIC/TOC by both persulfate oxidation and furnace combustion; gravimetric weight percent solids; ^{90}Sr by isotopic specific separation/beta count; ^{137}Cs, ^{60}Co, ^{154}Eu, and ^{155}Eu by GEA; and total alpha.

The solid composite was split into nine subsamples so that smaller volumes could be handled to reduce the radiological exposure to personnel and still provide enough solid to perform all of the required analyses. Each requested analysis was then performed on three of the nine subsamples. A single aliquot was analyzed for each of the three centrifuged solid composite subsamples. One spike analysis was performed per composite. Analytical results for the solid composite are discussed in Section B2.2.3.

B2.2.2.4 Solubility Screening (Dissolution) Composites. The LAW DQO required the following analyses for the centrifuged solid portion of the dissolution composite: Al, Na, Cr, P, S, and Si by ICP/AES; potentiometric titration for OH^-; TIC/TOC by persulfate and combustion furnace; gravimetric weight percent solids; ^{90}Sr by isotopic specific separation/beta count; ^{137}Cs, ^{60}Co, ^{154}Eu, and ^{155}Eu by GEA; and total alpha.

Solubility screening using the centrifuged liquid portion of the dissolution composite was also required by the DQO. However, the SAP stated an exception to the DQO requirements and did not request the current supernatant in the tank be used for solubility screening, because the supernatant from the tank will be pumped out and different types of waste will be added to the tank changing the supernatant composition. Despite this exception, the laboratory performed the solubility screening liquid analyses. Only the analytical results for the centrifuged liquid and centrifuged solid portions of the undiluted composites have been included in this report. The analytical results for all the dissolution composites are provided as Attachment 1 to Esch (1998b).

Table B2-7. Analytical Procedures. (3 sheets)

Analysis	Method	Procedure
Solid Composite/Solubility Screening Solid and Liquid Composites		
Total alpha	Alpha counting	LA-508-101
TOC	Furnace oxidation	LA-344-105
TIC, TOC	Persulfate	LA-342-100
OH^-	Potentiometric titration	LA-211-102
Wt % solid	Gravimetry	LA-564-101

Table B2-7. Analytical Procedures. (3 sheets)

Analysis	Method	Procedure
Solid Composite/Solubility Screening Solid and Liquid Composites (Cont'd)		
Al, Cr, P, Na, S, Si	ICP/AES	LA-505-161
^{90}Sr	Beta counting	LA-220-101
^{154}Eu, ^{155}Eu, ^{137}Cs, ^{60}Co, ^{125}Sb	GEA	LA-548-121
PCB	GCMS	LA-523-136
Vol % solids	Centrifugation	LA-519-132
Specific gravity	Gravimetry	LA-510-112
Liquid Composite		
ICP/AES analytes[1]	ICP/AES	LA-505-151 LA-505-161
ICP/MS analytes[1]	ICP/MS	LA-506-101
IC anions[2]		LA-533-105 LA-533-115
Ammonium	Ion selective electrode	LA-631-001
Hg-Cold Vapor	Atomic absorption	LA-325-104
Sb, Tl	GFAA	LA-505-102
CN	Colorimetric	LA-695-102
PCB	GCMS	LA-523-136
Centrifugation	Volume % solid	LO-519-132
Wt % solid	Gravimetry	LA-564-101
^{90}Sr	Beta counting separation	LA-220-101
Total alpha	Alpha counting	LA-508-101
^{243}Cm,^{244}Cm,^{241}Am	Separation/AEA	LA-953-104
TOC	Furnace oxidation	LA-344-105
TIC, TOC	Persulfate	LA-342-100
OH^-	Potentiometric titration	LA-211-102
^{3}H	Liquid scintillation	LA-218-114
^{79}Se	Liquid scintillation	LA-365-132
^{14}C	Liquid scintillation	LA-348-104
^{99}Tc	Liquid scintillation	LA-438-101

Table B2-7. Analytical Procedures. (3 sheets)

Analysis	Method	Procedure
Liquid Composite (Cont'd)		
^{237}Np	TTA extraction	LA-933-141
Full suite[3]	GEA	LA-548-121
^{129}I	Separation GEA	LA-378-103

Notes:

[1] ICP analytes of interest for Privatization (liquid composites) are: (ICP/AES) Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, La, Li, Mg, Mn, Mo, Na, Ni, P, Pb, Sb, S, Se, Sn, Si, Sr (total), Ta, Th, Ti, U, W, V, Y, Zn, Zr; (ICP/MS--duplicate methodology allowed with other analyses) Cs, ^{231}Pa, ^{126}Sn, ^{99}Tc, ^{237}Np, AMU-241, 243, U isotopes, Pu isotopes, Am isotopes, and Cm isotopes.

[2] Ion chromatography analytes of interest for Privatization (liquid composites) are: Br, Cl, F, NO_2, NO_3, PO_4, and SO_4.

[3] Gamma emitters of interest are: ^{137}Cs, ^{125}Sb, ^{60}Co, ^{154}Eu, and ^{155}Eu.

Table B2-8. Homogeneity Check Sample Analyses Summary.[1] (2 sheets)

Tank Portion	Sample Portion	Sample Number	Analyses
Top (2AN-98-1)	Centrifuged supernatant	S98T001773	Total alpha/total beta IC: NO_3 ICP: Al and Na gravimetric % solids
	Whole grab sample	S98T000379	volume % centrifuged solids
Middle (2AN-98-15)	Centrifuged supernatant	S98T001774	Total alpha/total beta IC: NO_3 ICP: Al and Na gravimetric % solids
	Whole grab sample	S98T000393	volume % centrifuged solids
Middle (2AN-98-22)	Centrifuged supernatant	S98T001775	Total alpha/total beta IC: NO_3 ICP: Al and Na gravimetric % solids
	Whole grab sample	S98T000402	volume % centrifuged solids

Table B2-8. Homogeneity Check Sample Analyses Summary.[1] (2 sheets)

Tank Portion	Sample Portion	Sample Number	Analyses
Bottom (2AN-98-29)	Centrifuged supernatant	S98T001776	Total alpha/total beta IC: NO_3 ICP: Al and Na gravimetric % solids
	Whole grab sample	S98T000418	volume % centrifuged solids

Note:

Esch (1998b)

Table B2-9. Sample Analysis Summary for Composite Samples.[1] (2 sheets)

Sample Type	Sample Number	Preparation Method	Analyses
Supernatant composite	S98T002200	Direct	TOC (furnace); TIC/TOC (persulfate); GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu, ^{125}Sb, gravimetric % solids, ^{90}Sr, ^{79}Se, ^{237}Np, ^{129}I, ^{3}H, ^{14}C, ^{241}Am, $^{243/244}Cm$, total alpha, total beta
	S98T002203	Direct	OH; Specific gravity; NH_3; Hg; IC: Br, F, Cl, NO_2, NO_3, PO_4, SO_4, I; ICP: Full Suite; ICP/MS: U isotopes, Pu isotopes, Am isotopes, Cm isotopes, total Cs, ^{231}Pa, ^{126}Sn, ^{99}Tc, ^{237}Np
	S98T002206	Direct	PCB
	S98T002201	Direct	TOC (furnace); TIC/TOC (persulfate); GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu, ^{125}Sb, gravimetric % solids, ^{90}Sr, ^{79}Se, ^{237}Np, ^{129}I, ^{3}H, ^{14}C, ^{241}Am, $^{243/244}Cm$, total alpha, total beta
	S98T002204	Direct	OH; Specific gravity; NH_3; Hg; IC: Br, F, Cl, NO_2, NO_3, PO_4, SO_4, I; ICP: Full Suite; ICP/MS: U isotopes, Pu isotopes, Am isotopes, Cm isotopes, total Cs, ^{231}Pa, ^{126}Sn, ^{99}Tc, ^{237}Np
	S98T002207	Direct	PCB
	S98T002202	Direct	TOC (furnace); TIC/TOC (persulfate); GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu, ^{125}Sb, gravimetric % solids, ^{90}Sr, ^{79}Se, ^{237}Np, ^{129}I, ^{3}H, ^{14}C, ^{241}Am, $^{243/244}Cm$, total alpha, total beta

Table B2-9. Sample Analysis Summary for Composite Samples.[1] (2 sheets)

Sample Type	Sample Number	Preparation Method	Analyses
Supernatant composite (Cont'd)	S98T002205	Direct	OH; Specific gravity; NH_3; Hg; IC: Br, F, Cl, NO_2, NO_3, PO_4, SO_4, I; ICP: Full Suite; ICP/MS: U isotopes, Pu isotopes, Am isotopes, Cm isotopes, total Cs, ^{231}Pa, ^{126}Sn, ^{99}Tc, ^{237}Np
	S98T002208	Direct	PCB
	S99T000236	Direct	CN
	S99T000240	Acid digest	GFAA: Sb
	S99T000243	Acid digest	GFAA: Tl
	S99T000237	Direct	CN
	S99T000241	Acid digest	GFAA: Sb
	S99T000244	Acid digest	GFAA: Tl
	S99T000238	Direct	CN
	S99T000242	Acid digest	GFAA: Sb
	S99T000245	Acid digest	GFAA: Tl
Centrifuged solid composite	S98T002194	Direct	TIC/TOC; gravimetric % solids
	S98T002210	Fusion digest	GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; total alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si
	S98T002213	Acid digest	GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; total alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si
	S98T002217	Water digest	TOC (furnace ox.); OH
	S98T002197	Direct	PCB
	S98T002195	Direct	TIC/TOC; gravimetric % solids
	S98T002211	Fusion digest	GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; total alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si
	S98T002215	Acid digest	GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; total alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si
	S98T002218	Water digest	TOC (furnace ox.); OH
	S98T002198	Direct	PCB
	S98T002196	Direct	TIC/TOC; gravimetric % solids
	S98T002212	Fusion digest	GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; total alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si
	S98T002216	Acid digest	GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; total alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si
	S98T002219	Water digest	TOC (furnace ox.); OH
	S98T002199	Direct	PCB

Note:

[1]Esch (1998b)

Table B2-10. Solids Dissolution Testing/Sample Analyses Summary. [1] (3 sheets)

Sample Type	Sample Number	Preparation Method	Analyses
100 Parts Composite: 25 Parts Diluent			
Centrifuged liquid	S98T002278	Direct	TIC/TOC; TOC (furnace ox.); OH; gravimetric % solids; GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; total alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si
Centrifuged solid	S98T002287	Direct	TIC/TOC; gravimetric % solids
	S98T002292	Fusion digest	GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; total alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si
	S98T002297	Acid digest	GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; total alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si
	S98T002302	Water digest	TOC (furnace ox.); OH
100 Parts Composite: 75 Parts Diluent			
Centrifuged liquid	S98T002283	Direct	TIC/TOC; TOC (furnace ox.); OH; gravimetric % solids; GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; total alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si
Centrifuged solid	S98T002288	Direct	TIC/TOC; gravimetric % solids
	S98T002293	Fusion digest	GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; total alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si
	S98T002298	Acid digest	GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; total alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si
	S98T002303	Water digest	TOC (furnace ox.); OH
100 Parts Composite: 100 Parts Diluent			
Centrifuged liquid	S98T002284	Direct	TIC/TOC; TOC (furnace ox.); OH; gravimetric % solids; GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; total alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si

Table B2-10. Solids Dissolution Testing/Sample Analyses Summary. [1] (3 sheets)

Sample Type	Sample Number	Preparation Method	Analyses
100 Parts Composite: 100 Parts Diluent			
Centrifuged solid	S98T002289	Direct	TIC/TOC; gravimetric % solids
	S98T002294	Fusion digest	GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; total alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si
	S98T002299	Acid digest	GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; total alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si
	S98T002304	Water digest	TOC (furnace ox.); OH
100 Parts Composite: No Diluent – Test 4			
Centrifuged liquid	S98T002285	Direct	TIC/TOC; TOC (furnace ox.); OH; gravimetric % solids; GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; total alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si
Centrifuged solid	S98T002290	Direct	TIC/TOC; gravimetric % solids
	S98T002295	Fusion digest	GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; total alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si
	S98T002300	Acid digest	GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; Total Alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si
	S98T002305	Water digest	TOC (furnace ox.); OH
100 Parts Composite: No Diluent – Test 5			
Centrifuged liquid	S98T002286	Direct	TIC/TOC; ICP: Al, Cr, P, Na, S, Si
Centrifuged solid	S98T002291	Direct	TIC/TOC; gravimetric % solids
	S98T002296	Fusion digest	GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; total alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si

Table B2-10. Solids Dissolution Testing/Sample Analyses Summary. [1] (3 sheets)

Sample Type	Sample Number	Preparation Method	Analyses
100 Parts Composite: No Diluent – Test 5 (Cont'd)			
Centrifuged solid (Cont'd)	S98T002301	Acid digest	GEA: ^{60}Co, ^{137}Cs, ^{154}Eu, ^{155}Eu; Total Alpha; ^{90}Sr; ICP: Al, Cr, P, Na, S, Si
	S98T002306	Water digest	TOC (furnace ox.); OH

Note:

[1]Esch (1998b)

B2.2.3 Analytical Results for February 1998 Grab Samples

This section summarizes the sampling and analytical results associated with the February 1998 sampling and analysis of tank 241-AN-102. Table B2-11 shows the location of analytical sample results within this report. These results are documented in Esch (1998b).

Table B2-11. February 1998 Analytical Tables. (2 sheets)

Analysis	Table Number
Mercury by atomic absorption	B2-91
Graphite furnance atomic absorption	B2-92 and B2-93
Inductively coupled plasma/atomic emission spectroscopy	B2-94 to B2-135
Ion chromatography	B2-136 to B2-144
Cyanide	B2-145
Semi-volatiles	B2-146 to B2-152
Weight percent solids	B2-153
Specific gravity (liquids)	B2-154
Volume percent solids	B2-155
Total alpha	B2-156
Total beta	B2-157
^{241}Am	B2-158
$^{243/244}$Cm	B2-159
^{14}C	B2-160
Gamma energy analysis	B2-161 to B2-166
^{129}I	B2-167
Inductively coupled plasma/mass spectroscopy	B2-168 to B2-188

Table B2-11. February 1998 Analytical Tables. (2 sheets)

Analysis	Table Number
^{237}Np	B2-189
Tritium by scintillation	B2-190
^{79}Se	B2-191
$^{89/90}Sr$	B2-192
Total organic carbon by furnace oxidation	B2-193
Ammonia by ion selective electrode	B2-194
Hydroxide	B2-195
Total inorganic carbon	B2-196
Total organic carbon by persulfate	B2-197

The QC parameters assessed in conjunction with tank 241-AN-102 samples were standard recoveries, spike recoveries, duplicate analyses, RPDs, and blanks. The QC criteria are specified in the SAP (Jo 1998b). Sample and duplicate pairs, in which any QC parameter was outside these limits, are footnoted in the sample mean column of the following data summary tables with an a, b, c, d, e, or f as follows.

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

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

B2.2.3.1 Volume Percent Solids. Two separate determinations were made for volume percent solids. First, the volume percent settled solids in each parent jar were determined. The result was calculated as the height of the solids (in mm) divided by the height of the entire sample in the parent jar (in mm) times 100. The volume percent solids by centrifugation were also determined for samples that contained more than 5 percent settled solids. In this case the volumes of the solids and total sampler were read directly from the centrifuge cones, then the sample was centrifuged to separate the solid and liquid portions. The results from volume percent settled solids measured by centrifugation ranged from <0.5 to 15.1 percent.

B2.2.3.2 Weight Percent Solid. The weight percent solid was determined gravimetrically for all samples. The samples were dried at 105 °C, as requested in the LAW DQO (Wiemers and Miller 1997). The analysis was performed on the liquid samples to satisfy the request in the LAW DQO to measure the dissolved solids in the liquid fraction. The weight percent solid values ranged from 49.3 to 57.2 percent.

B2.2.3.3 Total Alpha Activity. The total alpha analysis was performed on all subsamples. The SAP (Jo 1998b) requested that the supernatant composite samples be prepared by acid digestion before total alpha analysis. However, because the samples were centrifuged before compositing, suspended solids were negligible. Therefore, the total alpha analysis was performed on the direct sample. The detected total alpha values ranged from 0.14 to 0.25 µCi/mL in the liquid samples and 0.375 to 0.808 µCi/g in the solid samples.

B2.2.3.4 Inductively Coupled Plasma. The ICP analysis was performed on all subsamples. The SAP (Jo 1998b) requested that the supernatant composite samples be prepared by acid digestion before the ICP analysis. However, because the samples were centrifuged before compositing, suspended solids were negligible. Therefore, an unheated acid dilution was performed before the ICP analysis.

Duplicate analyses were performed only on analytes identified in Esch (1998b) as Group 1 or Group 2 analytes. A more detailed discussion of Group 1 and 2 analytes is provided in Section B3.2. The primary metals observed were aluminum, chromium, iron, lead, phosphorous, potassium, sodium, and sulfur. Also detected were boron, cadmium, calcium, copper, manganese, and nickel.

B2.2.3.5 Inductively Coupled Plasma/Mass Spectrometry . The ICP/MS analysis was performed on the supernatant composite only. For this analysis, it was difficult to meet the minimum reportable quantities (MRQ) specified in the LAW DQO because of the large dilution required to reduce the concentration of dissolved solids. Sample aliquots were diluted to achieve a sodium concentration of at most 5 µg/mL. Concentrations higher than this will affect the analysis because of reduced ionization efficiencies and material buildup on the sample or skimmer cones at the interface to the mass spectrometer.

Duplicate analysis results are reported with all analytes except ^{231}Pa. The ^{231}Pa method was just recently developed. However, the QC criteria were never defined in the laboratory database. Therefore, for each sample only a single result was reported. The ICP/MS analytes detected were AMU-99, -232, -238, ^{133}Cs, ^{135}Cs, and ^{137}Cs. As explained in Esch (1998b), the ^{99}Tc results may be biased high because of ruthenium-99, therefore they are reported as AMU-99.

B2.2.3.6 Tritium. The ^{3}H analysis by liquid scintillation was performed only on the supernatant composite subsamples. The analyses were performed in duplicate and tritium was detected in all three samples; values ranged from 1.69E-04 to 0.002 µCi/mL. The sample results were biased high because of the contamination from the high concentration of cesium in the samples. The three samples were reanalyzed several times, but only the last set of results was included in this document. Even with the bias, only one result was more than ten times higher than the detection limit and no further reanalysis was requested.

With this method, it is difficult to avoid contamination from Cs, especially with the high concentration found in these samples. There is a new method being developed that will address this problem.

B2.2.3.7 Ion Chromatography. The ion chromatography (IC) analysis was performed only on the homogeneity check samples and the supernatant composite. A duplicate was performed on only one of the four homogeneity check samples, whereas duplicates were run with each of the three supernatant composite subsamples. The primary IC analytes detected were nitrate, nitrite, phosphate, and sulfate. Also detected were chloride, fluoride, bromide, and oxalate. Iodide was not detected in any of the samples. (Note: these analyses were performed on grab samples; therefore, the presence of bromide has no bearing to the hydrostatic head fluid issues that are associated with core sampling events.)

B2.2.3.8 Strontium-90. The ^{90}Sr analysis was performed on all subsamples except the homogeneity check samples. Duplicate analyses were performed on the supernatant composite only. Strontium-90 results for the supernatant composite ranged from 83.3 to 98.7 µCi/mL, while solid composite results ranged from 103 to 142 µCi/g.

B2.2.3.9 Gamma Energy Analysis. The GEA analysis was performed on all subsamples except for the homogeneity check samples. Duplicate analyses were only run with the supernatant composite subsamples. Cesium-137 was the major constituent detected. Also detected were ^{60}Co, ^{154}Eu, and ^{155}Eu.

B2.2.3.10 Carbon-14. The ^{14}C analysis was performed in duplicate on the supernatant composite subsamples. Results for ^{14}C ranged from 4.37E-04 to 7.84E-04 µCi/mL.

B2.2.3.11 Total Beta Activity. Total beta analysis was performed on the homogeneity check samples and the supernatant composite samples, with duplicates run only on the supernatant composite. The values for total beta ranged from 558 to 632 µCi/mL.

B2.2.3.12 Selenium-79. The ^{79}Se analysis was performed in duplicate on the supernatant composite subsamples. The ^{79}Se values ranged from 4.93E-04 to 6.43E-04 µCi/mL.

B2.2.3.13 Polychlorinated Biphenyls . The supernatant and sludge composites were both analyzed for PCBs. Only the liquid analyses were performed in duplicate. No PCBs were detected in the samples.

B2.2.3.14 Cyanide. The cyanide analysis by colorimetry was performed only on the supernatant composite subsamples. The analyses were performed in duplicate and cyanide was detected in all three samples; values ranged from 49.4 to 52.2 µg/mL.

B2.2.3.15 Graphite Furnace Atomic Absorption. The GFAA analysis was performed only on the supernatant composite. The requested analytes were antimony and thallium. The analyses were performed in duplicate and only antimony was detected. The results ranged from 0.167 to 0.246 μg/mL

B2.3 DESCRIPTION OF 1994/1995 GRAB SAMPLING EVENTS

This section describes the November/December 1995, February 1995, and October 1994 sampling events and associated analyses for tank 241-AN-102. The grab samples obtained in October 1994 and February 1995 were originally taken for process control and process development purposes. The sampling and analysis of the October 1994 samples were directed by *Letter of Instruction for Analysis of Double-Shell Tank 241-AN-102 Grab Samples* (Bratzel 1994), while the sampling and analysis of the February 1995 samples were performed in accordance with *Tank 241-AN-102 Tank Characterization Plan* (Schreiber 1995). The November/December 1995 grab samples were acquired to satisfy the requirements of the safety screening and waste compatibility DQOs. The SAP, *Tank 241-AN-102 Grab Sampling and Analysis Plan* (Jo 1996), summarized and integrated the requirements of these two DQOs. This SAP also directed the safety screening analyses performed on archived samples from the October 1994 and February 1995 grab samples. Caustic demand tests were also done on those samples (Herting 1996).

B2.3.1 Description of November/December 1995 Grab Sampling Event

Five grab samples were acquired from riser 21 on November 30, 1995. Three samples were expected to contain supernatant (2AN-95-1, 2AN-95-2, and 2AN-95-3), while the other two were expected to contain sludge (2AN-95-4 and 2AN-95-5). However, upon inspection at the 222-S Laboratory, it was discovered that the two supposed sludge samples actually contained supernatant. Consequently, two more grab samples (2AN-95-4A and 2AN-95-5A) were obtained on December 14, 1995, in an attempt to recover some sludge. The sample numbers for this second set of samples were appended with an "A" to differentiate them from the original samples with the same sample numbers. No analyses were performed on samples 2AN-95-4 and 2AN-95-5; therefore, they are not discussed further in this report. A field blank was collected with the first five grab samples. All of the grab samples from this sampling event were taken to support evaluation of the tank waste according to the safety screening and waste compatibility DQOs.

Table B2-12 presents sampling information concerning the November/December 1995 grab samples. Note that sample 2AN-95-2 was obtained at a lower elevation than sample 2AN-95-3 (Esch 1996a). These elevations were confirmed on the sample label, as well as by notes on the chain-of-custody forms. Before grab sampling, headspace measurements were taken (see Section B2.4).

Table B2-12. November/December 1995 Grab Sampling Event Information.[1]

Sample Number	Sample Type	Sample Elevation[2]	Contact Dose Rate (mR/hr)
2AN-95-1	Supernatant	767 cm (302 in.)	2,000
2AN-95-2	Supernatant	310 cm (122 in.)	1,000
2AN-95-3	Supernatant	538 cm (212 in.)	1,500
2AN-95-4	Supernatant[3]	45.7 cm (18 in.)	1,500
2AN-95-5	Supernatant[3]	12.7 cm (5 in.)	1,500
2AN-95-6	Field blank	1,100 cm (432 in.)	<0.5
2AN-95-4A	Sludge	45.7 cm (18 in.)	1,500
2AN-95-5A	Sludge	12.7 cm (5 in.)	1,000

Notes:

[1]Esch (1996b)

[2]Sample elevations were taken from Engineering (1995).

[3]Samples were expected to contain sludge. Because sludge was not recovered, the samples were retaken. No analyses were performed on these samples.

B2.3.1.1 Handling of November/December 1995 Grab Samples. Physical descriptions of the November/December 1995 grab samples are presented in Table B2-13. Samples 2AN-95-1, 2AN-95-2, 2AN-95-3, 2AN-95-4A, and 2-AN-95-5A were subsampled for analysis between January 5 and 11, 1996. For samples 2AN-95-1, 2AN-95-2, and 2AN-95-3, two unfiltered subsamples were removed from each for safety screening and waste compatibility analyses. A subsample was also archived for each of the three grab samples (Esch 1996a).

For samples 2AN-95-4A and 2AN-95-5A, the volume percent settled solids was first determined by visual estimation. The results of this measurement are given in Table B2-13. The samples were then shaken to suspend the settled solids. The resulting slurry for each sample was then transferred to three centrifuge cones for a volume percent solids determination (by centrifugation), and for separation of the solids and liquids. Bulk densities of the slurry, the centrifuged solids, and the centrifuged liquids were determined. Subsamples were created from both the centrifuged solid and liquid portions, and identical analyses were performed on each (Esch 1996a).

Table B2-13. Appearance of the November/December 1995 Grab Samples.[1,2] (2 sheets)

Grab Sample	Laboratory Identification	Appearance			
		Color	Clarity	Organic Layer	Solids
2AN-95-1	S95T003864	Dark yellow/brown	Translucent	None	None
2AN-95-2	S95T003865	Dark yellow/brown	Translucent	None	Trace; settled

Table B2-13. Appearance of the November/December 1995 Grab Samples.[1,2] (2 sheets)

Grab Sample	Laboratory Identification	Appearance			
		Color	Clarity	Organic Layer	Solids
2AN-95-3	S96T003866	Dark yellow/brown	Translucent	None	None
2AN-95-4A	S95T003959	Dark yellow/brown	Translucent	None	61.5%; tan; settled
2AN-95-5A	S95T003960	Dark yellow/brown	Translucent	None	61.5%; tan; settled
2AN-95-6 field blank	S95T003961	Colorless liquid	Clear	None	None

Notes:

[1]Esch (1996a)

[2]No description of samples 2AN-95-4 and 2AN-95-5 was provided in Esch (1996a).

B2.3.1.2 Analysis of November/December 1995 Grab Samples. All six grab samples listed in Table B2-13 were analyzed according to the safety screening DQO (Dukelow et al. 1995), which required analyses for energetics, moisture content, total alpha activity, and bulk density. In addition, the supernatant grab samples (2AN-95-1, 2AN-95-2, and 2AN-95-3) and the field blank (2AN-95-6) were subjected to a waste compatibility evaluation. The waste compatibility DQO requires analyses for energetics, moisture content, TOC, TIC, total alpha activity, ^{137}Cs, $^{239/240}$Pu, ^{241}Am, ^{90}Sr, metals (iron, manganese, uranium, chromium, nickel, aluminum, sodium, and silicon) by inductively coupled plasma spectroscopy (ICP), anions (chloride, fluoride, phosphate, sulfate, nitrate, and nitrite) by IC, hydroxide, pH, specific gravity, and percent solids, along with a visual check for an organic layer. In addition, a cyanide analysis was required if the DSC results exceeded the decision threshold.
For the sludge grab samples (2AN-95-4A and 2AN-95-5A), the only additional analytes were volume percent solids, TOC, and cyanide. The TOC and cyanide evaluations were secondary analyses of the safety screening DQO, and were required because exothermic reactions greater than the 480 J/g decision threshold were found.

All reported analyses were performed in accordance with approved laboratory procedures. An assessment of the QC data is presented in Section B3.2. Two deviations from the SAP (Jo 1996) were noted by the laboratory. Because of the absence of solids in the supernatant samples, the volume percent solids determination by centrifugation was not performed on those samples. Although the SAP (Jo 1996) required a cyanide analysis on both the solid and liquid matrices, it was decided by the tank coordinator to perform the cyanide analyses only on the solids. If cyanide is present, it is expected to be in much higher quantities in the solids than in the liquids. Because the cyanide results for the solids were approximately three orders of magnitude below the established notification limit, a cyanide analysis on the liquids was deemed unnecessary. The procedure for the evaluation of $^{239/240}$Pu changed during analysis of the samples. Samples S95T003871 and S95T003872 were analyzed using procedure LA-943-127. On February 1, 1996, the laboratory began using procedure LA-943-128, which was used in the analysis of samples S95T003870 and S95T003963. The use of an extraction resin (as used in procedure

LA-943-128), rather than an anion resin (as used in procedure LA-943-127), yields better tracer recovery and therefore, better accuracy (Esch 1996b).

A list of the analytical procedures by title and number is presented in Table B2-14. Table B2-15 displays the sample numbers and applicable analyses from this analytical event (and the October 1994 and February 1995 sampling and analytical events).

Table B2-14. Analytical Procedures for 1994/1995 Grab Sampling Events.[1]

Analyte	Instrument or Analysis	Analytical Procedure
Energetics	Differential scanning calorimetry	LA-514-113, Rev. C-1 LA-514-114, Rev. C-1
Percent water	Thermogravimetric analysis	LA-560-112, Rev. B-1 LA-514-114, Rev. C-1
Solid bulk density	n/a	LO-160-103, Rev. B-0
Liquid specific gravity	n/a	LA-510-112, Rev. C-3
pH	Electrode	LA-212-106, Rev. A-0
Organic layer	Visual and over-the-top reading	LA-519-151, Rev. E-2
Hydroxide	Potentiometric titration	LA-211-102, Rev. C-0
Cyanide	Microdistillation	LA-695-102, Rev. E-0
Anions by IC	Ion chromatograph	LA-533-105, Rev. D-1
Metals by ICP	Inductively coupled plasma spectrometer	LA-505-161, Rev. B-0
TIC	Furnace oxidation	LA-622-102, Rev. C-0[2]
TOC	Furnace oxidation	LA-344-105, Rev. C-0[2] (supernatant) LA-342-100, Rev. C-0 (solids)
Total alpha activity	Alpha proportional counter	LA-508-101, Rev. D-2
^{137}Cs	Gamma energy analysis	LA-548-121, Rev. D-1
^{90}Sr	Separation and beta counting	LA-220-101, Rev. D-1
^{241}Am	Separation and alpha counting	LA-953-103, Rev. A-4
$^{239/240}Pu$	Separation and alpha counting	LA-943-127, Rev. B-1[3] LA-943-128, Rev. A-0
Flammable gas, oxygen	Combustible gas meter	WHC-IP-0030, IH 1.4
Ammonia, total organic vapor	Total organic monitor	WHC-IP-0030, IH 2.1

Notes:

[1]Esch (1996b)

[2]This is the correct procedure. The procedure listed in the SAP was incorrect.

[3]Procedure LA-943-127, listed in the SAP, was used for the analysis of samples S95T003871 and S95T003872. On February 1, 1996, the laboratory began using procedure LA-943-128. This new procedure was used to analyze samples S95T003870 and S95T003963 (Esch 1996b).

Table B2-15. Summary of Samples and Analyses for 1994/1995 Grab Sampling Event.[1]
(2 sheets)

Grab Sample	Laboratory Identification	Waste Matrix	Subsample Labcore Number	Analysis
102-AN-1(A)	n/a	Centrifuged liquid from supernatant sample	n/a	TGA, density, pH, metals, anions, TOC, TIC, total alpha, ^{137}Cs, ^{90}Sr
102-AN-2(A)	n/a	Centrifuged liquid from supernatant sample	n/a	TGA, density, pH, metals, anions, TOC, TIC, total alpha, ^{137}Cs, ^{90}Sr
102-AN-3(A)	S96T000001	Centrifuged liquid from sludge sample	S96T000005	DSC, TGA, density, total alpha
		Centrifuged solids from sludge sample	S96T000003	DSC, TGA, density, volume % solids
			S96T000007	total alpha
102-AN-4	n/a	Centrifuged liquid from supernatant sample	n/a	TGA, density, pH, metals, anions, TOC, TIC, total alpha, ^{137}Cs, ^{90}Sr
	S95T003926	Supernatant	S95T003984	DSC, TGA, total alpha, SpG, TOC
102-AN-1(B)	S95T003924	Supernatant	S95T003982	DSC, TGA, total alpha, SpG, TOC
102-AN-2(B)	S95T003925	Supernatant	S95T003983	DSC, TGA, total alpha, SpG, TOC
102-AN-3(B)	S96T000002	Centrifuged liquid from sludge sample	S96T000006	DSC, TGA, density, total alpha
		Centrifuged solids from sludge sample	S96T000004	DSC, TGA, density, volume % solids
			S96T000008	total alpha
2AN-95-1	S95T003864	Supernatant	S95T003867	DSC, TGA, SpG, pH, OH, metals, anions, TOC, TIC
			S95T003870	radionuclides (including total alpha)
2AN-95-2	S95T003865	Supernatant	S95T003868	DSC, TGA, SpG, pH, OH, metals, anions, TOC, TIC
			S95T003871	radionuclides (including total alpha)

Table B2-15. Summary of Samples and Analyses for 1994/1995 Grab Sampling Event.[1] (2 sheets)

Grab Sample	Laboratory Identification	Waste Matrix	Subsample Labcore Number	Analysis
2AN-95-3	S95T003866	Supernatant	S95T003869	DSC, TGA, SpG, pH, OH, metals, anions, TOC, TIC
			S95T003872	radionuclides (including total alpha)
2AN-95-4A	S95T003959	Slurry (after shaking of the sample)	S95T003959	Density, volume % solids
		Centrifuged liquid from sludge sample	S95T004133	DSC, TGA, density, total alpha, TOC
		Centrifuged solids from sludge sample	S95T004137	DSC, TGA, density, TOC, cyanide
			S95T004141	total alpha
2AN-95-5A	S95T003960	Slurry (after shaking of the sample)	S95T003960	Density, volume % solids
		Centrifuged liquid from sludge sample	S95T004135	DSC, TGA, density, total alpha, TOC
		Centrifuged solids from sludge sample	S95T004139	DSC, TGA, density, TOC, cyanide
			S95T004142	total alpha
2AN-95-6	S95T003961	Field blank	S95T003962	DSC, TGA, SpG, pH, metals, anions, TOC, TIC
			S95T003963	radionuclides (including total alpha)

Notes:

SpG = specific gravity

[1]Esch (1996b)

B2.3.2 Description of February 1995 Grab Sampling Event

Three grab samples were obtained from riser 22 on February 15, 1995. Two of the grab samples were primarily supernatant, while the third contained both sludge and supernatant. Sampling elevations and sample numbers are presented in Table B2-16. To differentiate these samples from those taken in October 1994, a "(B)" has been appended to the sample numbers. The sampling event was a follow-up to the 1994 grab sampling event. During the 1994 sampling event, it was discovered that the free hydroxide concentration was out of the tank operating specification limit. The February 1995 samples were taken to use in experiments to determine the effects of adding hydroxide to the tank. At the time of sampling, no DQOs were applicable to the sampling event. No problems were noted during the sampling event.

Table B2-16. February 1995 Grab Sampling Event Information.

Sample Number	Sample Type	Sample Elevation	Contact Dose Rate (mR/hr)
102-AN-1(B)	Supernatant	721 cm (284 in.)	2,200
102-AN-2(B)	Supernatant	244 cm (96 in.)	2,000
102-AN-3(B)	Sludge	175 cm (69 in.)	2,500

B2.3.2.1 Handling of February 1995 Grab Samples. After sampling, the three grab samples were archived. They remained archived until January 8, 1996, when they were subsampled for analysis. One unfiltered subsample was recovered from both samples 102-AN-1(B) and 102-AN-2(B) for safety screening analyses. Sample 102-AN-3(B) was first subjected to a volume percent settled solids determination, the results of which are reported in Table B2-17. Then, the supernatant above the settled solids was removed and discarded, and the remaining sludge was centrifuged for a volume percent solids measurement. Centrifuging also separated the solids from the remaining liquids. Bulk densities were evaluated on both the centrifuged solid and liquid phases. Subsamples were created from both the centrifuged solid and liquid portions, and identical analyses were performed on each (Esch 1996a). Descriptions of the February 1995 grab samples are presented in Table B2-17.

Table B2-17. Appearance of the February 1995 Grab Samples.[1]

Grab Sample	Laboratory Identification	Appearance			
		Color	Clarity	Organic Layer	Solids
102-AN-1(B)	S95T003924	Dark yellow/brown	Translucent	None	Trace; settled
102-AN-2(B)	S95T003925	Dark yellow/brown	Translucent	None	Trace; settled
102-AN-3(B)	S96T000002	Dark yellow/brown	Translucent	None	18.8 volume %; red/tan; settled

Note:

[1]Esch (1996a)

B2.3.2.2 Analysis of February 1995 Grab Samples. All three grab samples from the February 1995 sampling event were analyzed according to the safety screening DQO. Because of the presence of exothermic reactions greater than the DQO decision threshold, TOC was also analyzed on samples 102-AN-1(B) and 102-AN-2(B). Both the solid and liquid fractions of sample 102-AN-3(B) were subjected to a safety screening analysis. As stated previously, a volume percent solids determination was made on the solids portion after centrifuging.

All reported analyses were performed in accordance with approved laboratory procedures. An assessment of the QC data is presented in Section B3.2. A list of the analytical procedures by title and number is presented in Section B2.3.1, Table B2-14. Table B2-15 displays the sample numbers and applicable analyses from this analytical event (and the October 1994 and November/December 1995 sampling and analytical events).

B2.3.3 Description of October 1994 Grab Sampling Event

Four grab samples (three supernatant and one sludge), were obtained from riser 22 of tank 241-AN-102 on October 21, 1994 (Herting 1994, Jones 1994). Sampling elevations and sample numbers are presented in Table B2-18. To differentiate these samples from those taken in February 1995, an "(A)" has been appended to the sample numbers. An "(A)" was not needed for sample 102-AN-4, because a similarly labeled sample was not taken during the February 1995 sampling event. The immediate objective of the sampling was to determine whether the free-hydroxide concentration of the waste was within tank corrosion control specifications. Because the sampling was performed for process control purposes, no tank characterization plan was required and no DQOs were applicable. For the same reason, no field/trip blank was required. No problems were noted with the sampling event.

The four grab samples were delivered to the 222-S Laboratory in 120-mL sample bottles on October 24, 1994. The characterization of these samples was performed in two phases. The initial phase occurred in late 1994, when the sludge sample was archived and the three supernatant samples were analyzed. In early 1996, archived samples of the sludge sample (102-AN-3(A)) and one supernatant sample (102-AN-4) were retrieved for safety screening and waste compatibility analyses.

Table B2-18. October 1994 Grab Sampling Event Information.

Sample Number	Sample Type	Sample Elevation	Contact Dose Rate (mR/hr)
102-AN-1(A)	Supernatant	884 cm (348 in.)	Not given
102-AN-2(A)	Supernatant	541 cm (213 in.)	Not given
102-AN-3(A)	Sludge	15 cm (6 in.)	1,000
102-AN-4	Supernatant	127 cm (50 in.)	1,000

B2.3.3.1 Handling Of October 1994 Grab Samples.

Sample Handling (1994). Upon receipt by the 222-S Laboratory, the sludge sample [102-AN-3(A)] was archived, while observations were recorded for the three supernatant samples. No observations were made of the sludge sample. The three supernatant samples were described as being very dark brown, almost black (Herting 1994).

The samples were agitated by shaking before two 15-mL aliquots were removed from each bottle. The aliquots were then transferred into separate centrifuge cones. Each aliquot was centrifuged for 1 hr, after which the liquids were clear. The liquid phase was decanted from each cone into a sample vial. All of the six cones contained two distinct layers of solids of roughly equal volume. The weight percent centrifuged solids for the cones ranged from 1.1 to 1.3 percent. The top layer was dark brown and the bottom layer was white. Each layer of solids was analyzed by polarized light microscopy and by x-ray diffraction. The white solids were composed mostly of octahedral crystals of sodium fluoride diphosphate. There was also a trace of sodium carbonate crystals. The dark brown solids were made up of submicron-sized particles that could not be identified by either method (Herting 1994).

Although not discussed in Herting (1994), at some point during the sample handling, waste material from the supernatant samples was archived.

Sample Handling (1996). Two of the archived samples from the October 1994 grab sampling event [102-AN-3(A) and 102-AN-4], were retrieved and subjected to safety screening and waste compatibility analyses in 1996. On January 8, 1996, the two samples were subsampled for analysis. For sample 102-AN-4, one unfiltered subsample was retrieved for safety screening analyses only. Immediately after retrieving sample 102-AN-3(A), the volume percent settled solids was measured. The results of this measurement are presented in Table B2-19. The supernatant above the settled solids was then removed and discarded, and the remaining sludge was transferred to two centrifuge cones for a volume percent solids determination (by centrifugation), and separation of the solids from the remaining liquid. Individual bulk density measurements of the centrifuged solids and liquids were made. Subsamples were created from both the centrifuged solid and liquid portions, and identical analyses were performed on each (Esch 1996a).

Physical descriptions of the two retrieved samples are listed in Table B2-19. Note that these are descriptions of the samples after archival for over one year, and they differ from the original observations noted in 1994.

Table B2-19. Appearance of the October 1994 Grab Samples Analyzed in January 1996.[1]

Grab Sample	Laboratory Identification	Appearance			
		Color	Clarity	Organic Layer	Solids
102-AN-3(A)	S96T000001	Dark yellow/brown	Translucent	None	74.1 volume %; Red/tan; settled
102-AN-4	S95T003926	Dark yellow/brown	Translucent	None	Trace; settled

Note:

[1]Esch (1996a)

B2.3.3.2 Analysis of October 1994 Grab Samples

Sample Analysis (1994). In addition to physical measurements (density, percent water, and pH), the centrifuged supernatant samples were analyzed for eight metals, seven anions, TOC, TIC, two radionuclides, and total alpha activity (Jones 1994). No specific quality control (QC) information was provided in Herting (1994), although results with QC problems were flagged and not included in mean calculations. Analysis procedure numbers were not reported with the analytical results.

Sample Analysis (1996). As stated in Section B2.3.3.1, safety screening analyses were performed on grab sample 102-AN-4. These included analyses for energetics by DSC, moisture content by TGA, fissile content by total alpha activity analysis, and bulk density. Although the DSC runs did not exhibit changes in enthalpy greater than the 480 J/g safety screening DQO limit, a TOC analysis was run because most of the other tank grab samples did show changes in enthalpy that exceeded the limit.

Both the centrifuged solid and liquid portions of sample 102-AN-3(A) were subjected to a safety screening analysis. In addition, a volume percent solids determination was made on the solids fraction after centrifuging. No analyses for TOC were performed.

All reported analyses were performed in accordance with approved laboratory procedures. An assessment of the QC data is presented in Section B3.2. A list of the analytical procedures by title and number is presented in Section B2.3.1, Table B2-14. Table B2-15 displays the sample numbers and applicable analyses from this analytical event (including February 1995, November/ December 1995 sampling and analytical events).

B2.3.4 Analytical Results

This section presents a summary of the analytical results associated with the October 1994, February 1995, and November/December 1995 grab sampling events of tank 241-AN-102. Analysis of the grab samples was performed at the 222-S Laboratory.

Table B2-20 denotes the location of analytical results within this report. These results are documented in the *Final Report for Tank 241-AN-102, Grab Samples 2AN-95-1 through 2AN-95-6 and 102-AN-1 through 102-AN-4* (Esch 1996b). Additional data from the October 1994 sampling event were reported in *Characterization of Supernatant Samples from Tank 102-AN* (Herting 1994). As noted in Table B2-20, the complete analytical data set can be found in Section B2.7.3. Only analyte overall means are reported here.

Table B2-20. 1994/1995 Analytical Tables.

Data Type	Tabulated Location
Inductively coupled plasma/spectrometry	B2-198 to B2-205 and B2-230 to B2-237
Cyanide	B2-206
Ion chromatography	B2-207 to B2-212 and B2-239 to B2-244
Hydroxide	B2-227 and B2-238
Bulk density	B2-213
Energetics by differential scanning calorimetry	B2-214
Exotherms (dry weight)	B2-215
Percent water by thermogravimetric analysis	B2-216
pH	B2-217
Specific gravity	B2-218
Volume percent solids	B2-219
Total alpha	B2-220 and B2-247
^{241}Am	B2-221
Gamma energy analysis	B2-222 and B2-223
$^{239/240}$Pu	B2-224
$^{89/90}$Sr	B2-225 and B2-246
Total organic carbon by furnace oxidation	B2-226 and B2-249
^{137}Cs	B2-245
Total inorganic carbon by furnace oxidation	B2-248

B2.3.4.1 Chemical Data Summary. Data from the 1994/1995 grab samples were combined to derive an overall mean for all analytes with the exception of DSC, which did not require the calculation of a mean. The supernatant overall means were calculated by first averaging the primary and duplicate results for each grab sample to obtain a sample mean. These sample means were then simply averaged to derive the overall mean. The data for silicon, uranium, and fluoride contained nondetected results. For silicon, the overall mean was considered nondetected because over 50 percent of the individual primary and duplicate results were nondetected. Because the use of nondetected data in the mean and inventory estimates causes a bias in those estimates, those particular results should be used with caution. The magnitude of the bias is unknown. The overall mean for uranium was nondetected because all of the results were below the detection limit. Because the nondetected results for fluoride were considered suspect, they were not included in the derivation of the overall mean. Table B2-21 presents the supernatant chemical data.

The sludge means were derived by combining centrifuged solids and centrifuged liquid results. The combining was done on a weighted basis according to the masses of each centrifuged portion. Following are the weighting factors used in calculating the sludge means:

Sample 102-AN-3(A)
Solids = 62.3 percent
Liquids = 37.7 percent

Sample 102-AN-3(B)
Solids = 17.5 percent
Liquids = 82.5 percent

Sample 2AN-95-4A
Solids = 57.2 percent
Liquids = 42.8 percent

Sample 2AN-95-5A
Solids = 49.9 percent
Liquids = 50.1 percent

Table B2-22 displays the sludge chemical data. The cyanide and volume percent solids means are actually based solely on the centrifuged solids results, because the analytes were not analyzed on the centrifuged liquid. The slurry results are from the analyses before centrifuging.

All information contained in Tables B2-21 and B2-22 were taken from the data tables in Section B2.7.3. The first two columns of each table contain the analyte and overall mean. The third column displays the relative standard deviation (RSD) of the mean, defined as the standard deviation (of the mean) divided by the mean, multiplied by 100. The RSDs were determined by using the standard one-way analysis of variance (ANOVA) statistical technique, and were computed only for analytes that had detected results.

The QC parameters assessed in conjunction with tank 241-AN-102 samples were standard recoveries, spike recoveries, duplicate analyses, RPDs, and blanks. The QC criteria are specified in the SAP (Jo 1998b). Sample and duplicate pairs, in which any QC parameter was outside these limits, are footnoted in the sample mean column of the following data summary tables with an a, b, c, d, e, or f as follows.

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

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

Table B2-21. Supernatant Chemical Data Summary.[1]

Analyte	Overall Mean	RSD (Mean)
Metals	**µg/mL**	**%**
Aluminum	15,100	1.48
Calcium	434	1.53
Chromium	297	2.62
Iron	50.9	10.30
Manganese	39.1	23.67
Nickel	381	2.95
Phosphorus	1,610	0.86
Potassium	3,880	6.76
Silicon	<20.2	n/a
Sodium	2.40E+05	3.72
Sulfur	4,750	1.01
Uranium	<200	n/a
Anions	**µg/mL**	**%**
Chloride	3,810	6.18
Fluoride	1,860	8.24
Hydroxide	3,610	4.78
Nitrate	2.25E+05	7.11
Nitrite	82,600	6.96
Phosphate	4,820	6.80
Sulfate	13,800	5.88
Radionuclides	**µCi/mL**	**%**
^{241}Am	0.138	10.58
^{137}Cs	351	3.96
^{60}Co	0.148	1.87
$^{239/240}$Pu	0.00582	6.71
$^{89/90}$Sr	74.5	1.21
Total alpha	0.163	4.63
Carbon	**µg C/mL**	**%**
TIC	13,200	1.46
TOC	26,200	0.97
Physical Properties		**%**
Specific gravity	1.41	0.67
pH	13.2	0.39
Wt% water	49.7 wt%	0.27

Note:

[1]Esch (1996b)

Table B2-22. Sludge Chemical Data Summary.[1]

Analyte	Overall Mean	RSD (Mean)
Anions	**µg/g**	**%**
Cyanide[2]	20.9	0.92
Radionuclides	**µCi/g**	**%**
Total alpha	0.296	8.47
Carbon	**µg C/g**	**%**
TOC	24,400	6.00
Physical Properties		
Density (sludge)[3]	1.47 g/mL	1.23
Density (slurry)[4]	1.49 g/mL	1.01
Wt% water	44.6 wt%	3.00
Volume % solids[2]	55.6 vol%	10.07
Volume % solids (slurry)[4]	50.1 vol%	6.99

Notes:

[1]Esch (1996b)

[2]Mean based on two centrifuged solids results from 2AN-95-4A and 2AN-95-5A.

[3]The result for the analyte denoted as "sludge" was derived by combining weighted fractions of the centrifuged solids and centrifuged liquid portions.

[4]For those analytes with the "slurry" designation, the analyses were performed on the grab samples after shaking to suspend the settled solids.

B2.3.4.2 Thermogravimetric Analysis. During a thermogravimetric analysis (TGA), the mass of a sample is measured while its temperature is increased at a constant rate. Nitrogen is passed over the sample during the heating to remove any released gases. Any decrease in the weight of a sample 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) is because of water evaporation. The TGA was performed directly on the supernatant and the centrifuged solid and liquid samples.

The TGA results for tank 241-AN-102 are presented in Section B2.7.3. All centrifuged solids and liquid samples exhibited a large weight loss between the ambient temperature and 205 °C, and the supernatant samples exhibited this large weight loss between ambient temperature and 235 °C. This weight loss is associated with the first endothermic transition, and was attributed to the evaporation of water. The overall mean percent water for the supernatant was 49.7 weight percent and the mean percent water for the sludge was 44.6 weight percent.

B2.3.4.3 Differential Scanning Calorimetry. During a DSC analysis, heat absorbed or emitted by a substance is measured while the temperature of the substance changed at a constant rate. While the substance is being heated, nitrogen is passed over the waste material to remove any gases being released. The onset temperature for an endothermic (characterized by or causing the absorption of heat) or an exothermic (characterized by or causing the release of heat) event is determined graphically.

The DSC results (wet-weight basis) are presented in Section B2.7.3. The peak temperature and maximum enthalpy change are given for each transition. For all samples, the first transition was endothermic and represented the evaporation of free and interstitial water. All but one of the liquid samples had two transitions, with the second being exothermic. One sample had three transitions, with the third being exothermic. Two of the four centrifuged solid samples contained exothermic reactions in the second transition.

An interference was observed with the DSC scans for samples 2AN-95-1 and 102-AN-3(A), which created unacceptable baseline curvature that biased the integration. These samples were reanalyzed on a different instrument and a better baseline was observed. The second instrument yielded results that were more consistent with those obtained for the other samples analyzed. Therefore, the first set of results were not used and the raw data scans can be found in Esch (1996b). The RPDs between primary and duplicate runs for one sludge and four supernatant samples were outside the QC parameter of $\leq$10 percent. Under these circumstances, a triplicate analysis is typically conducted for these samples. However, no additional analyses were performed because one sample was below the decision threshold, and statistics conducted on the other four showed that even with a third analysis, the upper limit to a one-sided 95 percent confidence interval on the mean would still exceed 480 J/g.

B2.3.4.4 Density/Specific Gravity. Specific gravity measurements were performed on the supernatant and centrifuged liquid samples, while density evaluations were run on the centrifuged solids. The supernatant samples were analyzed in duplicate, but not the centrifuged solids or liquids. For the sludge samples from the November/December 1995 sampling event (2AN-95-4A and 2AN-95-5A), a density measurement was made on the parent samples after they had been shaken to suspend the settled solids (denoted as "slurry" in the tables). The average densities were 1.47 g/mL for the sludge (see Table B2-22), 1.41 g/mL for the supernatant (see Table B2-21), and 1.49 g/mL for the slurry (see Table B2-22). The results are presented in Section B2.7.3.

B2.3.4.5 Volume Percent Solids. Volume percent solids determinations were made on centrifuged solids from the sludge samples from the October 1994 and February 1995 sampling events. In addition, the two sludge samples from the November/December 1995 sampling event were subjected to a volume percent solids measurement after the samples had been shaken to suspend the settled solids (denoted as "slurry" in the table). The average volume percent solids for the centrifuged solids and the slurry were 55.6 and 50.1 percent, respectively (see Table B2-22). Results from these analyses are presented in Section B2.7.3.

B2.3.4.6 pH. Measurements for pH were performed on the supernatant samples from the October 1994 and November/December 1995 sampling events. The pH data is presented in

Section B2.7.3. The overall mean was 13.2 (see Table B2-21). Results greater than 12.5 are suspect and should be considered estimates, because the highest calibration buffer available was 12.5, and the pH electrode performance degrades at values higher than this.

B2.3.4.7 Visual Check for an Organic Layer. A visual check for an organic layer was made in accordance with the safety screening and waste compatibility DQOs. An organic layer was not observed in any of the samples.

B2.4 VAPOR PHASE MEASUREMENT

Before the July/August 1998 grab sampling of tank 241-AN-102, vapor phase measurements were taken from riser 22. Additional measurements were taken from riser 20 before the February 1998 grab sampling event. Vapor phase measurements were also taken before the 1994/1995 grab sampling event through riser 21. Esch (1996a) provides the results of the 1994/1995 vapor headspace measurements but does not indicate the date these measurements were taken. The vapor phase measurements were taken 20 ft below the respective riser in the dome space of the tank and results were obtained in the field (that is, no gas sample was sent to the laboratory for analysis). The results of the vapor phase measurements are provided in Table B2-23.

Table B2-23. Results of Headspace Measurements of Tank 241-AN-102.

	Result			
Measurement	**August 10-12, 1998[1,2]**	**July 21-23, 1998[1,2]**	**February 3-5, 1998[1,2]**	**1994/1995[3]**
TOC	26 ppm	29 ppm[4]	0 ppm	19 ppm[4]
Flammability as percent of the LFL	0.0%	0.0%	0.0%	0.0%
Volume percent oxygen gas	21.0%	20.9 %	21.0%	20.9%
Ammonia	400 ppm	400 ppm	350 ppm	300 ppm

Notes:

[1]LMHC (1999)

[2]Vapor measurements were taken each day before sampling. The highest reading observed for each sampling period is reported.

[3]Esch (1996a)

[4]Reported as total organic vapor.

B2.5 DESCRIPTION OF 1990 CORE SAMPLING EVENT

Two three-segment core samples of the tank sludge were obtained from riser 10 of tank 241-AN-102 on May 24, 1990 as directed by *Analysis of Tank 102-AN Core Sample* (Nguyen 1990). Sludge levels at the time of the sampling event indicated that almost two full segments of sludge could be expected from each core (Strasser 1990). To ensure that the entire sludge was core-sampled, three segments were obtained. One core was shipped to the Pacific Northwest National Laboratory for extrusion and chemical, radiochemical, and physical analyses. The other was extruded at the 222-S Process Chemistry Laboratory and archived. No chain-of-custody forms are available, so drill string dose rates are not reported.

B2.5.1 1990 Core Sample Handling

During August, 1990, the three segments delivered to the Pacific Northwest National Laboratory were extruded from the core sample collected from tank 241-AN-102. The segment descriptions presented in Table B2-24 come from laboratory core characterization worksheets. Douglas (1996) describes the subsequent sample preparation, analytical methods, and analytical results. A composite was prepared from the three segments. Some of the composite was archived for future analyses. Extrusion information for the segments extruded at the 222-S Process Chemistry Laboratory is provided in WHC (1990).

Table B2-24. Tank 241-AN-102 PNNL Extruded Core Segments.[1] (2 sheets)

Segment	Length cm (in.)	Sample Recovery[2] (%)	Liner Liquid (mL)	Gross Weight (g)	Description
1	Nominally 38 (15)	79	0	282	The bottom of the segment was 1.25 cm (0.5 in.) of solids, this was followed by a 5 cm (2 in.) void space, followed by another 1.25 cm (0.5 in.) of solids, another 5 cm (2 in.) of void space, and finally 35.5 cm (14 in.) of a flowing slurry. The solids were sticky. The bottom two 1.25 cm (0.5 in.) sections were gray to tan and the remainder was medium brown.

Table B2-24. Tank 241-AN-102 PNNL Extruded Core Segments.[1] (2 sheets)

Segment	Length cm (in.)	Sample Recovery[2] (%)	Liner Liquid (mL)	Gross Weight (g)	Description
2	48.3 (19)	100	20.8	285	The bottom 12.7 cm (5 in.) flowed like a viscous liquid. The next 17.8 cm (7 in.) partially held its shape and the final 17.8 cm (7 in.) flowed, but was slurry like in appearance. The liquid was light brown.
3	48.3 (19)	100	0	323	The first 3.8 cm (1.5 in.) partially held its shape, the remainder of the sample flowed when extruded. The sample was dark brown.

Notes:

[1]Douglas (1996)

[2]Sample recovery is an approximation derived by dividing the length of the recovered segment by the length of the sampler (48 cm [19 in.]).

B2.5.2 1990 Core Sample Analysis

The balance of the composite sample was either analyzed directly, or centrifuged into liquid and solids fractions that were analyzed for physical, chemical, and radiochemical properties (the laboratory identified the centrifuged solids fraction as AN-102-SOL and the liquid fraction as AN-102-SUP). Rheological analysis was also performed on the centrifuged solids fraction. Physical and rheological analyses performed include: percent solid, oxides, particle size, shear strength penetration, resistance, and DSC.

Concentration of the metals in both the liquid and solids core composite fractions was determined using ICP. Before analysis, solids centrifuged from the core composite were chemically fused using two separate fusions. A sodium peroxide fusion was run in a zirconium crucible, while a potassium hydroxide fusion was run in a nickel crucible. The fused solid material was then dissolved in hydrochloric acid. All metals were prepared for analysis using the sodium peroxide fusion, except for sodium and zirconium. Analyses for sodium and zirconium, along with additional determinations for aluminum, calcium, chromium, iron, manganese, potassium, and phosphorus, were performed after digestion with a potassium hydroxide fusion. Anion determinations in water leachates of the solids fraction were made using IC. The IC analysis of the liquid fraction was performed by direct column injection of the liquid.

Both the liquid and solids fractions were analyzed for their TRU element content. Concentrations were determined using both mass spectrometry and alpha energy analysis.

Separation of americium and curium fractions from plutonium was accomplished using standard ion exchange techniques. The plutonium and americium/curium fractions were then analyzed by alpha counting, followed by alpha energy analysis. Concentrations of plutonium and uranium were found to be too low for mass spectrometry determination.

Carbon-14 activity was measured on both the composite core solids and supernatant materials by scintillation counting. Before analysis, oxidation (hot acidic persulfate method) and extraction of the carbon were accomplished using an acidification module. Tritium activity was measured using scintillation counting on water leachates of the solids samples. Activity in the supernatant samples was determined directly. Precipitation or ion exchange methods were used to purify ^{63}Ni, ^{79}Se, and ^{99}Tc, and activities were determined using beta or liquid scintillation counting. Activity for ^{237}Np was measured directly by alpha energy analysis.

The analytical data that were obtained from analysis of the core sample are tabulated in Section B2.5.3. The sludge recovered was composited and then centrifuged, creating two fractions: a centrifuged solids sample and a centrifuged liquid sample. These two samples were chemically analyzed separately, and the two separate sets of results are presented in two separate tables. A third table combines the data from the first two tables to present an estimate of the overall sludge concentration and a total inventory for the sludge layer. Although small quantities of dilute non-complexed waste and water were added to the tank after the 1990 core sample was taken, they did not contribute substantially to the contents of the sludge layer.

B2.5.3 Analytical Results for 1990 Core Sampling

This section summarizes the sampling and analytical results associated with the 1990 core sampling of tank 241-AN-102. These results are documented in Douglas (1996). The data from this sampling event should be used with caution. Douglas (1996) compiles the analytical results, but the source documents for Douglas (1996) are incomplete, and at times contradictory. In addition, no QC information was provided in the source documents, and there is no way to assess the reliability of the analytical results.

The centrifuged solids and centrifuged liquid results are provided in Tables B2-25 and B2-26, respectively. Table B2-27 combines the results presented in Tables B2-25 and B2-26 to estimate the total concentration of a given analyte in the sludge layer. A weighted mean was calculated using the results from each centrifuged fraction and multiplying by the respective weight percent that each fraction represented in the composite. The total calculated sludge concentration was derived by multiplying the centrifuged solids concentration by the value of weight percent centrifuged solids (55.4 percent). Similarly, the centrifuged liquid concentration was multiplied by 44.6 percent. These two values were then added to arrive at the overall sludge number, listed in Table B2-27. For example, using the values for aluminum in Table B2-27, column four would be derived by the following calculation:

$$\text{Sludge Aluminum Concentration} = \left(\frac{14{,}600\ \mu g}{g}\right) * (0.554) + \left(\frac{9{,}250\ \mu g}{g}\right) * (0.446)$$

Table B2-25. Centrifuged Solids Results from the 1990 Sampling Event for Tank 241-AN-102. (3 sheets)

Analyte	Concentration	Concentration
Metals	**mmol/g**[1]	**µg/g**[1]
Ag	<1.8E-04	<1.94
Al	0.54	14,600
As	<0.0039	<292
B	<0.13	<1,410
Ba	3.2E-04	43.9
Be	<1.3E-04	<1.17
Ca	0.087	3,490
Cd	<2.4E-04	<27.0
Ce	<0.0051	<715
Co	<0.017	<1,000
Cr	0.043	2,240
Cu	0.0014	89.0
Dy	<1.5E-04	<24.4
Fe	0.051	2,850
K	<0.052	<2,030
La	<3.2E-04	<44.5
Li	<0.023	<160
Mg	0.0084	204
Mn	0.015	824
Mo	4.6E-04	44.1
Na	14[2]	3.22E+05[2]
Nd	<2.3E-04	<33.2
Ni	0.0098[3]	575[3]
P	<0.097	<3,000
Pb	<0.0018	<373
Re	<5.6E-04	<104
Rh	<0.0051	<525
Ru	<0.0039	<394
Sb	<0.0076	<925
Se	<0.014	<1,110
Si	0.084	2,360
Sr	3.9E-04	34.2
Te	<0.0027	<345
Th	<0.0020	<464
Ti	<9.4E-04	<45.0
Tl	<0.055	<11,200
U[4]	0.012	2,860

Table B2-25. Centrifuged Solids Results from the 1990 Sampling Event for Tank 241-AN-102. (3 sheets)

Analyte	Concentration	Concentration
Metals (Cont'd)	**mmol/g[1]**	**µg/g[1]**
V	<5.2E-04	<26.5
Zn	0.0021	137
Zr	0.011[2]	1,000[2]
Ions	**mmol/g**	**µg/g**
SO_4^{2-}	0.46	44,200
Cr^{6+}	<5.8E-04	<30.2
Br^-	<0.01	<799
Cl^-	0.081	2,870
F^-	<0.01[5]	<190[5]
NO_3^-	2.89	1.79E+05
NO_2^-	1.37	63,000
PO_4^{3-}	0.038	3,610
Radionuclides		**µCi/g[6]**
^{241}Am		0.76 (0.99[7])
^{14}C		0.0019
^{144}Ce		<1.8
^{242}Cm		Not Detected
$^{243/244}$Cm		0.059
^{60}Co		0.43
^{134}Cs		<0.22
^{137}Cs		400
^{152}Eu		<0.17
^{154}Eu		1.6
^{155}Eu		1.7
^{153}Gd		<0.66
^{3}H		0.0035
^{94}Nb		3.1E-04
^{237}Np		0.0017
^{238}Pu		0.029
$^{239/240}$Pu		0.087
^{106}Ru		<2.0
^{125}Sb		<1.3
^{79}Se		0.0035
^{113}Sn		1.5
^{90}Sr		280
^{99}Tc		0.16
Total beta		940

Table B2-25. Centrifuged Solids Results from the 1990 Sampling Event for Tank 241-AN-102. (3 sheets)

Analyte	Concentration	Concentration
Carbon	**mmol C/g**	**µg C/g**
TIC	1.72	20,700
TOC	2.24	26,900
Physical Properties		
% Water By TGA		35 wt%
Density		1.7 g/mL

Notes:

[1]For ICP analytes, result is an average of two independent solid analyses prepared by two separate fusions.
[2]Single analysis from the KOH fusion in a nickel crucible.
[3]Single analysis from the NaOH fusion in a zirconium crucible.
[4]Reported uranium concentration determined by fluorescence.
[5]Matrix interference noted.
[6]Concentrations of fission products and total beta content decay corrected to January 1, 1991.
[7]Second concentration determined using gamma energy analysis.

Table B2-26. Centrifuged Liquid Results from the 1990 Sampling Event for Tank 241-AN-102. (3 sheets)

Analyte	Concentration	Concentration
Metals	***M***	**µg/g**
Ag	<1.5E-05	<1.16
Al	0.48	9,250
As	1.9E-04	10.2
B	0.0032	24.7
Ba	2.6E-05	2.55
Be	2.2E-05	0.142
Ca	0.011	315
Cd	4.5E-04	36.1
Ce	<1.6E-04	<16.0
Co	<7.3E-04	<30.7
Cr	0.0077	286
Cu	4.6E-04	20.9
Dy	<8.6E-06	<0.998
Fe	0.0053	211
K	0.049	1,370
La	1.1E-04	10.9
Li	<1.6E-04	<0.793
Mg	3.3E-04	5.73
Mn	0.0013	51.0
Mo	4.9E-04	33.6

Table B2-26. Centrifuged Liquid Results from the 1990 Sampling Event for Tank 241-AN-102. (3 sheets)

Analyte	Concentration	Concentration
Metals (Cont'd)	***M***	**µg/g**
Na	7.6	1.25E+05
Nd	2.1E-04	21.6
Ni	0.0057	239
P	0.052	1,150
Pb	9.9E-04	147
Re	<8.6E-06	<1.14
Rh	<1.2E-04	<8.82
Ru	2.2E-04	15.9
Sb	<9.0E-05	<7.83
Se	<1.4E-04	<7.90
Si	0.0056	112
Sr	3.4E-05	2.13
Te	9.8E-05	8.93
Th	1.8E-04	29.8
Ti	<2.5E-05	<0.855
Tl	<0.0016	<234
U[1]	2.9E-05	4.93
V	<2.2E-05	<0.801
Zn	2.6E-04	12.1
Zr	1.6E-05	1.04
Ions	***M***	**µg/g**
Cr^{6+}	<8.6E-05	<3.19
Br^-	<0.0002	<11.4
Cl^-	0.042	1,060
F^-	0.13	1,760
NO_3^-	0.66	28,800
NO_2^-	0.30	9,860
PO_4^{3-}	0.034[2]	2,310
SO_4^{2-}	0.045	3,090
Ammonia	***M***	**µg/g**
NH_3	0.0026	31.6
Radionuclides	**µCi/mL[3]**	**µCi/g[3]**
^{241}Am	0.089 (0.11[4])	0.0636 (0.0786[4])
^{14}C	7.1E-04	5.07E-04
^{14}Ce	<0.26	<0.186
^{242}Cm	5.0E-04	3.57E-04
$^{243/244}cm$	0.0068	0.00486
^{60}Co	0.14	0.100

Table B2-26. Centrifuged Liquid Results from the 1990 Sampling Event for Tank 241-AN-102. (3 sheets)

Analyte	Concentration	Concentration
Radionuclides (cont'd)	µCi/mL[3]	µCi/g[3]
^{134}Cs	<0.026	<0.0186
^{137}Cs	200	143
^{152}Eu	<0.0076	<0.00543
^{154}Eu	0.30	0.214
^{155}Eu	0.33	0.236
^{153}Gd	<0.10	<0.0714
^{3}H	0.0018	0.00129
^{94}Nb	6.5E-06	4.64E-06
^{237}Np	<2.3E-06	<1.64E-06
^{238}Pu	0.024	0.0171
$^{239/240}Pu$	0.070	0.0500
^{106}Ru	<0.28	<0.200
^{125}Sb	<0.15	<0.107
^{79}Se	1.7E-04	1.21E-04
^{113}Sn	<0.42	<0.300
^{90}Sr	45	32.1
^{99}Tc	0.030	0.0214
Total beta	2,700	1,930
Carbon	***M***	**µg C/g**
TIC	0.23	1,970
TOC	0.37	3,170
Physical Properties		
Density		1.4 g/mL

Notes:

[1]Reported uranium concentration determined by fluorescence.
[2]Matrix interference noted.
[3]Concentrations of fission products and total beta content decay corrected to January 1, 1990.
[4]Second concentration determined using gamma energy analysis.

Table B2-27. Calculated Sludge Results for Tank 241-AN-102. (3 sheets)

Analyte	Centrifuged Solids Concentration	Centrifuged Liquid Concentration	Calculated Sludge Concentration
Metals	**µg/g**	**µg/g**	**µg/g**
Ag	<1.94	<1.16	<1.59
Al	14,600	9,250	12,200
As	<292	10.2	<166
B	<1,410	24.7	<792
Ba	43.9	2.55	25.5
Be	<1.17	0.142	<0.712
Ca	3,490	315	2,070
Cd	<27.0	36.1	<31.1
Ce	<715	<16.0	<403
Co	<1,000	<30.7	<568
Cr	2,240	286	1,370
Cu	89.0	20.9	58.6
Dy	<24.4	<0.998	<14.0
Fe	2,850	211	1,670
K	<2,030	1,370	<1,740
La	<44.5	10.9	<29.5
Li	<160	<0.793	<89.0
Mg	204	5.73	116
Mn	824	51.0	479
Mo	44.1	33.6	39.4
Na	3.22E+05	1.25E+05	2.34E+05
Nd	<33.2	21.6	<28.0
Ni	575	239	425
P	<3,000	1,150	<2,170
Pb	<373	147	<272
Re	<104	<1.14	<58.1
Rh	<525	<8.82	<295
Ru	<394	15.9	<225
Sb	<925	<7.83	<516
Se	<1,110	<7.90	<618
Si	2,360	112	1,360
Sr	34.2	2.13	19.9
Te	<345	8.93	<195
Th	<464	29.8	<270
Ti	<45.0	<0.855	<25.3
Tl	<11,200	<234	<6,310
U[1]	2,860	4.93	1,590

Table B2-27. Calculated Sludge Results for Tank 241-AN-102. (3 sheets)

Analyte	Centrifuged Solids Concentration	Centrifuged Liquid Concentration	Calculated Sludge Concentration
Metals (Cont'd)	**μg/g**	**μg/g**	**μg/g**
V	<26.5	<0.801	<15.0
Zn	137	12.1	81.3
Zr	1,000	1.04	554
Ions	**μg/g**	**μg/g**	**μg/g**
Br^-	<799	<11.4	<448
Cl^-	2,870	1,060	2,060
Cr^{6+}	<30.2	<3.19	<18.2
F^-	<190	1,760	<890
NO_3^-	1.79E+05	28,800	1.12E+05
NO_2^-	63,000	9,860	39,300
PO_4^{-3}	3,610	2,310	3,030
SO_4^{-2}	44,200	3,090	25,900
Radionuclides	**μCi/g**	**μCi/g**	**μCi/g**
^{241}Am	0.99[2]	0.0786[2]	0.584
^{14}C	0.0019	5.07E-04	0.00128
^{144}Ce	<1.8	<0.186	<1.08
^{242}Cm	Not Detected	3.57E-04	1.59E-04
$^{243/244}Cm$	0.059	0.00486	0.0349
^{60}Co	0.43	0.100	0.283
^{134}Cs	<0.22	<0.0186	<0.130
^{137}Cs	400	143	285
^{152}Eu	<0.17	<0.00543	<0.0966
^{154}Eu	1.6	0.214	0.982
^{155}Eu	1.7	0.236	1.05
^{153}Gd	<0.66	<0.0714	<0.397
^{3}H	0.0035	0.00129	0.00251
^{94}Nb	3.1E-04	4.64E-06	1.74E-04
^{237}Np	0.0017	<1.64E-06	<9.43E-04
^{238}Pu	0.029	0.0171	0.0237
$^{239/240}Pu$	0.087	0.0500	0.0705
^{106}Ru	<2.0	<0.200	<1.20
^{125}Sb	<1.3	<0.107	<0.768
^{79}Se	0.0035	1.21E-04	0.00199
^{113}Sn	1.5	<0.300	<0.965
^{90}Sr	280	32.1	169
^{99}Tc	0.16	0.0214	0.0982
Total beta	940	1,930	1,380

Table B2-27. Calculated Sludge Results for Tank 241-AN-102. (3 sheets)

Analyte	Centrifuged Solids Concentration	Centrifuged Liquid Concentration	Calculated Sludge Concentration
Physical Properties			
Percent water		40.3[3]	
Density	1.7 g/mL	1.4 g/mL	1.5[4] g/mL
Carbon	**µg C/g**	**µg C/g**	**µg C/g**
TIC	20,700	1,970	12,300
TOC	26,900	3,170	16,300

Notes:

[1]Reported uranium concentration determined by fluorescence.

[2]Based on gamma energy analysis data in order to provide the most conservative estimate.

[3]The weight percent water for the sludge was taken from a percent solids determination on the core composite (done by drying at 105 °C [221 °F] for 24 hr). A weight percent water mean based on TGA data could not be calculated because TGA was not performed on the centrifuged liquid.

[4]The reported density value is from a density determination on the core composite; it was not calculated by taking a weighted mean from the centrifuged solids and centrifuged liquid results.

B2.6 DESCRIPTION OF HISTORICAL SAMPLING EVENTS

Three historical data sets exist for tank 241-AN-102: supernatant grab sample results obtained in 1989, supernatant and sludge grab samples taken in 1988, and sludge and supernatant sample results obtained in 1984. These data have not been validated and should be used with caution.

B2.6.1 Description of 1989 Sampling Event

A supernatant sample was obtained from tank 241-AN-102 in 1989. Other than the sample status report included as an attachment to Herting (1994), no other information, such as sampling location or collection technique, was available. Because the sample is supernatant, it was most likely collected using the bottle-on-a-string method. The sample was described as being dark brown and aqueous with solids present.

The sample was analyzed for density and pH, 11 metals, 4 anions, TOC, and 6 radionuclides. The analytical results are presented in Table B2-28 as reported by the laboratory in the original Sample Status Report (Herting 1994).

Table B2-28. Analytical Results for 1989 Supernatant Sample.[1]

Analyte	Concentration
Metals	***M***
Al	0.460
B	0.00270
Ca	0.0101
Cr	0.00605
Cu	3.27E-04
Fe	0.00193
K	0.0407
La	1.26E-04
Na	7.65
Ni	0.00577
P	0.0497
Anions	***M***
CO_3^{2-}	1.10
NO_2^-	1.36
NO_3^-	3.54
OH^-	0.445
Radionuclides	**µCi/L**
^{241}Am	140
^{60}Co	324
^{137}Cs	4.00E+05
^{154}Eu	539
^{155}Eu	616
$^{239/240}Pu$	8.52
Carbon	**g C/L**
TOC	27.3
Properties	
Density	1.34 g/mL
pH	14

Note:

[1]The data are not validated and should be used with caution.

B2.6.2 Description of 1988 Sampling Event

Two grab samples were taken from tank 241-AN-102 in May and June of 1988. These samples were taken in support of caustic addition requirements and concentrated complexant pretreatment studies (Prignano 1988). The samples were taken at depths of 16.8 and 11.9 m (55 and 39 ft), and upon reaching the 222-S Laboratory, were assigned the sample numbers

R-8373 and R-8568, respectively. Visual descriptions were recorded, and the percent solids were estimated from observations of the sample bottle. The sample from 11.9 m (39 ft) contained approximately 50 mL of a brown amber liquid; no solids were observed. The sample from 16.8 m (55 ft) was 98 percent solids and had a dark chocolate color. Approximately 110 mL (0.0291 gal) were recovered for this sample. Viscosity, specific gravity, and percent settled solids determinations were performed on the samples. Analysis was performed at the 222-S Laboratory.

A percent settled solids determination was performed only on sample R-8568. Cooling the sample to 8 °C (46 °F) did not result in any solids formation. The specific gravity of this sample was 1.4. A specific gravity measurement could not be performed on sample R-8373 because of a lack of liquid sample material. Viscosities were determined for various shear rates at 30, 18, and 7 °C (86, 65, and 45 °F). Table B2-29 presents the viscosity data. The decrease in viscosity with increasing shear rate indicates a pseudoplastic liquid. This shear thinning effect was found to be reversible, i.e., the samples regained their original higher viscosity when the shearing was slowed down (Prignano 1988).

Table B2-29. 1988 Viscosity Data for Tank 241-AN-102.[1,2]

Sample Number	Temperature (°C)	Viscosity (cP) at Various Rotor Speeds (RPM) and Shear Stresses (1/sec)				
		16 RPM 86.6 1/sec	32 RPM 173 1/sec	64 RPM 346 1/sec	128 RPM 692 1/sec	256 RPM 1385 1/sec
R-8568	30	---	12.0	10.8	9.3	8.1
	18	---	18.2	17.6	14.0	---
	7	---	29.2	25.2	---	---
R-8373	30	---	34.5	29.5	20.8	---
	18	---	47.5	41.4	---	---
	7	81.9	72.7	---	---	---

Notes:
[1]Prignano (1988)
[2]The data are not validated and should be used with caution.

B2.6.3 Description of 1984 Sampling Event

Two samples were collected from tank 241-AN-102 in 1984 and analyzed at the 222-S Laboratory (Bratzel 1985a, 1985b). A sludge sample (R-3640) was obtained from the bottom of the tank and a supernatant sample (R-3639) was obtained from 4.5 m (15 ft) above the tank bottom. However, a description of the techniques used to extract the samples was not available. It was most likely a grab sample. The supernatant sample (R-3639) had 0 percent settled solids and the sludge sample (R-3640) had 100 percent settled solids and 82.0 percent centrifuged solids. The samples were centrifuged to separate suspended solids and aliquots were then analyzed. Solids were weighed, dried, and dissolved in 12*M* HNO_3/0.2*M* HF. A pretreatment procedure was used to destroy organics in the sample that had the potential to interfere with plutonium and americium determinations. The plutonium and americium activities were determined using scintillation counting. Metal cation analyses were determined by ICP, and anions were determined by IC. The TOC content was determined by coulometric titration. Analytical results are presented in Table B-30 and show that the waste stored in tank 241-AN-102 approached the TRU categorization threshold of 100 nCi/g (Bratzel 1985a).

The sludge sample was taken from the bottom of the tank while the supernatant sample was obtained from 4.5 m (15 ft) above the tank bottom. Analyses were performed at the 222-S Laboratory, and the results were published in Bratzel (1985a, 1985b). Table B2-30 contains the results from analyses of these samples. The second column displays the supernatant results, while the third and fourth columns tabulate the results from centrifuged fractions of the sludge sample. The centrate is the centrifuged liquid, while the solids are centrifuged solids. The units used are those reported by the laboratory. Please note the sodium value reported by Bratzel (1985a) is too high. A molarity of 40.6 converts to 934g Na/L of liquid or 67 wt% of the liquid.

Table B2-30. 1984 Analytical Results for Tank 241-AN-102.[1] (2 sheets)

Analyte	Supernatant	Centrate	Solids
Metals	***M***	***M***	**wt%**
Al	0.537	0.538	1.4
Ba	<1.25E-04	1.33E-04	<0.0021
Ca	0.0123	0.0203	0.11
Cd	5.03E-04	4.48E-04	<0.0085
Cr	0.00796	0.0101	0.085
Cu	<5.41E-04	<4.33E-04	0.0030
Fe	0.00180	0.00468	0.071
K	0.0531	0.0468	---
La	<0.00114	<9.10E-04	<0.0085
Mg	3.57E-04	0.00378	0.0090
Mn	0.0184	<0.0155	<0.085
Mo	<0.00895	<0.00718	<0.030
Na	10.4	40.6	3.5
Nd	---	---	<0.017
Ni	0.00643	0.0655	0.037
Pb	<0.00114	0.00105	---
Si	<0.00561	<0.00450	<0.0085
Sr	---	---	5.8E-04
Zn	<4.22E-04	7.00E-04	<0.0038
Zr	<0.00173	<0.00139	<0.026

Table B2-30. 1984 Analytical Results for Tank 241-AN-102.[1] (2 sheets)

Analyte	Supernatant	Centrate	Solids
Ions	***M***	***M***	**wt%**
Cl^-	0.0949	0.0903	<0.23
CO_2^{3-}	0.840	1.46	3.13
F^-	<0.118	<0.132	---
NO_3^-	3.61	3.38	---
NO_2^-	1.32	1.28	---
OH^-	0.201	0.648	---
PO_4^{3-}	0.0473	0.0480	---
SO_4^{2-}	0.114	0.0196	---
Radionuclides	**µCi/L**	**µCi/L**	**µCi/g**
$^{239/240}Pu$	13.8	24.6	0.060 (Pu)
^{241}Am	147	268	0.38 (Am)
^{60}Co	551	635	---
^{137}Cs	3.10E+05	4.48E+05	410
^{154}Eu	850	---	---
^{155}Eu	1,260	---	---
$^{89/90}Sr$	1.24E+05	1.01E+05	160
U	0.0247 g/L	<0.107 g/L	0.090 wt %
Physical Properties	**g/mL**	**g/mL**	**g/mL**
Specific gravity	1.39	1.39	---
Carbon	**g C/L**	**g C/L**	**wt%**
TOC	33.7	29.8	7.17

Note:

[1]The data are not validated and should be used with caution.

B2.7 DATA TABLES

The following tables provide the data for the 1998 grab samples and composites and the 1994/1995 grab samples. The data for the July/August 1998 grab sampling event are included in Section B2.7.1, Section B2.7.2 provides the data for the February 1998 data, and Section B2.7.3 displays the data from the 1994/1995 grab sampling events. The data for the 1990 core samples were provided previously in Section B2.5. The historical data were provided in Section B2.6.

B2.7.1 July/August 1998 Grab Sample Data Tables

Table B2-31. Tank 241-AN-102 Analytical Results: Aluminum (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	9,820	10,100	9,960[QC:d]
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	15,700	14,700	15,200[QC:c]
S98T002851		Centrifuged supernatant	14,300	14,200	14,300
S98T002854		Centrifuged supernatant	14,500	14,100	14,300[QC:c]

Table B2-32. Tank 241-AN-102 Analytical Results: Antimony (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<23.1	<24.1	<23.6
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<36.1	<36.1	<36.1
S98T002851		Centrifuged supernatant	<36.1	<36.1	<36.1
S98T002854		Centrifuged supernatant	<36.1	<36.1	<36.1

Table B2-33. Tank 241-AN-102 Analytical Results: Arsenic (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<38.6	<40.2	<39.4
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<60.1	<60.1	<60.1
S98T002851		Centrifuged supernatant	<60.1	<60.1	<60.1
S98T002854		Centrifuged supernatant	<60.1	<60.1	<60.1

Table B2-34. Tank 241-AN-102 Analytical Results: Barium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<19.3	<20.1	<19.7
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<30.1	<30.1	<30.1
S98T002851		Centrifuged supernatant	<30.1	<30.1	<30.1
S98T002854		Centrifuged supernatant	<30.1	<30.1	<30.1

Table B2-35. Tank 241-AN-102 Analytical Results: Beryllium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<1.93	<2.01	<1.97
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<3	<3	<3
S98T002851		Centrifuged supernatant	<3	<3	<3
S98T002854		Centrifuged supernatant	<3	<3	<3

Table B2-36. Tank 241-AN-102 Analytical Results: Bismuth (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<38.6	<40.2	<39.4
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<60.1	<60.1	<60.1
S98T002851		Centrifuged supernatant	<60.1	<60.1	<60.1
S98T002854		Centrifuged supernatant	<60.1	<60.1	<60.1

Table B2-37. Tank 241-AN-102 Analytical Results: Boron (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	146	134	140
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	43.4	39.8	41.6
S98T002851		Centrifuged supernatant	34.6	38.7	36.7
S98T002854		Centrifuged supernatant	40.9	37.9	39.4

Table B2-38. Tank 241-AN-102 Analytical Results: Cadmium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	38.4	38.6	38.5
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	65.8	60.9	63.3
S98T002851		Centrifuged supernatant	60	60	60
S98T002854		Centrifuged supernatant	61.2	59.9	60.5

Table B2-39. Tank 241-AN-102 Analytical Results: Calcium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	340	350	345
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	507	490	499
S98T002851		Centrifuged supernatant	466	458	462
S98T002854		Centrifuged supernatant	469	471	470

Table B2-40. Tank 241-AN-102 Analytical Results: Cerium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<38.6	<40.2	<39.4
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<60.1	<60.1	<60.1
S98T002851		Centrifuged supernatant	<60.1	<60.1	<60.1
S98T002854		Centrifuged supernatant	<60.1	<60.1	<60.1

Table B2-41 Tank 241-AN-102 Analytical Results: Chromium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	303	366	335
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	298	280	289
S98T002851		Centrifuged supernatant	275	273	274
S98T002854		Centrifuged supernatant	277	274	276

Table B2-42. Tank 241-AN-102 Analytical Results: Cobalt (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<7.71	<8.04	<7.88
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<12	<12	<12
S98T002851		Centrifuged supernatant	<12	<12	<12
S98T002854		Centrifuged supernatant	<12	<12	<12

Table B2-43. Tank AN-102 Analytical Results: Copper (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	16	15.8	15.9
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	25.3	24.3	24.8
S98T002851		Centrifuged supernatant	23.6	23.5	23.6
S98T002854		Centrifuged supernatant	23.8	22.9	23.4

Table B2-44. Tank 241-AN-102 Analytical Results: Iron (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	148	204	176[QC:e]
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	44.5	42.4	43.5
S98T002851		Centrifuged supernatant	45.9	45.6	45.8
S98T002854		Centrifuged supernatant	42.3	41.4	41.8

Table B2-45. Tank 241-AN-102 Analytical Results: Lanthanum (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<19.3	<20.1	<19.7
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<30.1	<30.1	<30.1
S98T002851		Centrifuged supernatant	<30.1	<30.1	<30.1
S98T002854		Centrifuged supernatant	<30.1	<30.1	<30.1

Table B2-46. Tank 241-AN-102 Analytical Results: Lead (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	121	128	125
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	192	179	186
S98T002851		Centrifuged supernatant	174	176	175
S98T002854		Centrifuged supernatant	187	177	182

Table B2-47. Tank 241-AN-102 Analytical Results: Lithium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<3.86	<4.02	<3.94
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<6.01	<6.01	<6.01
S98T002851		Centrifuged supernatant	<6.01	<6.01	<6.01
S98T002854		Centrifuged supernatant	<6.01	<6.01	<6.01

Table B2-48. Tank 241-AN-102 Analytical Results: Magnesium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<38.6	<40.2	<39.4
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<60.1	<60.1	<60.1
S98T002851		Centrifuged supernatant	<60.1	<60.1	<60.1
S98T002854		Centrifuged supernatant	<60.1	<60.1	<60.1

Table B2-49. Tank 241-AN-102 Analytical Results: Manganese (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	35.8	47.2	41.5[QC:e]
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	25.6	24.4	25
S98T002851		Centrifuged supernatant	21.8	21.5	21.6
S98T002854		Centrifuged supernatant	22.4	22.1	22.3

Table B2-50. Tank 241-AN-102 Analytical Results: Molybdenum (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	31.6	31.8	31.7
Liquids			**µg/mL**	**µg/Ml**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	54.3	50.2	52.3
S98T002851		Centrifuged supernatant	50.7	50.2	50.5
S98T002854		Centrifuged supernatant	51.2	49.8	50.5

Table B2-51. Tank 241-AN-102 Analytical Results: Neodymium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<38.6	<40.2	<39.4
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<60.1	<60.1	<60.1
S98T002851		Centrifuged supernatant	<60.1	<60.1	<60.1
S98T002854		Centrifuged supernatant	<60.1	<60.1	<60.1

Table B2-52. Tank 241-AN-102 Analytical Results: Nickel (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	257	256	257
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	431	405	418
S98T002851		Centrifuged supernatant	399	399	399
S98T002854		Centrifuged supernatant	408	397	403

Table B2-53. Tank 241-AN-102 Analytical Results: Phosphorus (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	1,060	1,060	1,060
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	1,810	1,740	1,780[QC:c]
S98T002851		Centrifuged supernatant	1,720	1,730	1,730
S98T002854		Centrifuged supernatant	1,670	1,660	1,670

Table B2-54. Tank 241-AN-102 Analytical Results: Potassium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	1,460	1,440	1,450[QC:c]
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	2,420	2,190	2,310[QC:c]
S98T002851		Centrifuged supernatant	2,190	2,160	2,180
S98T002854		Centrifuged supernatant	2,190	2,080	2,140[QC:c]

Table B2-55. Tank 241-AN-102 Analytical Results: Samarium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<38.6	<40.2	<39.4
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<60.1	<60.1	<60.1
S98T002851		Centrifuged supernatant	<60.1	<60.1	<60.1
S98T002854		Centrifuged supernatant	<60.1	<60.1	<60.1

Table B2-56. Tank 241-AN-102 Analytical Results: Selenium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<38.6	<40.2	<39.4
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<60.1	60.9	<60.5
S98T002851		Centrifuged supernatant	<60.1	65.6	<62.8
S98T002854		Centrifuged supernatant	<60.1	<60.1	<60.1

Table B2-57. Tank 241-AN-102 Analytical Results: Silicon (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	44.8	58.6	51.7[QC:b,e]
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<30.1	<30.1	<30.1
S98T002851		Centrifuged supernatant	<30.1	<30.1	<30.1
S98T002854		Centrifuged supernatant	<30.1	<30.1	<30.1

Table B2-58. Tank 241-AN-102 Analytical Results: Silver (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	10.2	11	10.6
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	16.6	16.3	16.5
S98T002851		Centrifuged supernatant	15.2	15.4	15.3
S98T002854		Centrifuged supernatant	15.6	14.5	15.1

Table B2-59. Tank 241-AN-102 Analytical Results: Sodium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	1.40E+05	1.44E+05	1.42E+05[QC:d]
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	2.26E+05	2.11E+05	2.19E+05[QC:c]
S98T002851		Centrifuged supernatant	2.07E+05	2.04E+05	2.06E+05
S98T002854		Centrifuged supernatant	2.07E+05	2.01E+05	2.04E+05[QC:c]

Table B2-60. Tank 241-AN-102 Analytical Results: Strontium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<3.86	<4.02	<3.94
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<6.01	<6.01	<6.01
S98T002851		Centrifuged supernatant	<6.01	<6.01	<6.01
S98T002854		Centrifuged supernatant	<6.01	<6.01	<6.01

Table B2-61. Tank 241-AN-102 Analytical Results: Sulfur (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	3,870	4,200	4,040[QC:d]
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	5,610	5,130	5,370[QC:c]
S98T002851		Centrifuged supernatant	4,950	4,870	4,910
S98T002854		Centrifuged supernatant	5,130	4,990	5,060[QC:c]

Table B2-62. Tank 241-AN-102 Analytical Results: Thallium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<77.1	<80.4	<78.8
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<120	<120	<120
S98T002851		Centrifuged supernatant	<120	<120	<120
S98T002854		Centrifuged supernatant	<120	<120	<120

Table B2-63. Tank 241-AN-102 Analytical Results: Titanium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<3.86	<4.02	<3.94
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<6.01	<6.01	<6.01
S98T002851		Centrifuged supernatant	<6.01	<6.01	<6.01
S98T002854		Centrifuged supernatant	<6.01	<6.01	<6.01

Table B2-64. Tank 241-AN-102 Analytical Results: Total Uranium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<193	<201	<197
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<300	<300	<300
S98T002851		Centrifuged supernatant	<300	<300	<300
S98T002854		Centrifuged supernatant	<300	<300	<300

Table B2-65. Tank 241-AN-102 Analytical Results: Vanadium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<19.3	<20.1	<19.7
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<30.1	<30.1	<30.1
S98T002851		Centrifuged supernatant	<30.1	<30.1	<30.1
S98T002854		Centrifuged supernatant	<30.1	<30.1	<30.1

Table B2-66. Tank 241-AN-102 Analytical Results: Zinc (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	4.9	5.46	5.18
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<6.01	<6.01	<6.01
S98T002851		Centrifuged supernatant	<6.01	<6.01	<6.01
S98T002854		Centrifuged supernatant	<6.01	<6.01	<6.01

Table B2-67. Tank 241-AN-102 Analytical Results: Zirconium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	12.4	15.5	13.9[QC:e]
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	9.77	8.78	9.27
S98T002851		Centrifuged supernatant	9.34	8.93	9.13
S98T002854		Centrifuged supernatant	9.39	9.61	9.5

Table B2-68. Tank 241-AN-102 Analytical Results: Bulk Density.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**g/mL**	**g/mL**	**g/mL**
S98T002852	Riser 22	Centrifuged solids	1.64	n/a	1.64

Table B2-69. Tank 241-AN-102 Analytical Results: Specific Gravity.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**unitless**	**unitless**	**unitless**
S98T002688	Riser 22	Centrifuged supernatant	1.46	1.48	1.47
S98T002851		Centrifuged supernatant	1.46	1.48	1.47
S98T002854		Centrifuged supernatant	1.45	1.44	1.45

Table B2-70. Tank 241-AN-102 Analytical Results: Cesium-137 (GEA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: fusion			**µCi/g**	**µCi/g**	**µCi/g**
S98T002899	Riser 22	Centrifuged solids	226	227	227
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S98T002688	Riser 22	Centrifuged supernatant	447	463	455
S98T002851		Centrifuged supernatant	426	436	431
S98T002854		Centrifuged supernatant	420	421	421

Table B2-71. Tank 241-AN-102 Analytical Results: Cobalt-60 (GEA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: fusion			**µCi/g**	**µCi/g**	**µCi/g**
S98T002899	Riser 22	Centrifuged solids	0.103	<0.0696	<0.0862[QC:e]
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S98T002688	Riser 22	Centrifuged supernatant	<1.87	<1.84	<1.86
S98T002851		Centrifuged supernatant	<1.88	<2.04	<1.96
S98T002854		Centrifuged supernatant	<1.51	<2.58	<2.05

Table B2-72. Tank 241-AN-102 Analytical Results: Atomic Mass Unit 232 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	6.94	7.11	7.02

Table B2-73. Tank 241-AN-102 Analytical Results: Atomic Mass Unit 241 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<0.78	<0.813	<0.797
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<0.363	<0.363	<0.363
S98T002851		Centrifuged supernatant	<0.363	<0.363	<0.363
S98T002854		Centrifuged supernatant	<0.363	<0.363	<0.363

Table B2-74. Tank 241-AN-102 Analytical Results: Atomic Mass Unit 242 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<0.452	<0.471	<0.461
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<0.458	<0.458	<0.458
S98T002851		Centrifuged supernatant	<0.458	<0.458	<0.458
S98T002854		Centrifuged supernatant	<0.458	<0.458	<0.458

Table B2-75. Tank 241-AN-102 Analytical Results: Atomic Mass Unit 243 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<1.12	<1.16	<1.14
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<0.531	<0.531	<0.531
S98T002851		Centrifuged supernatant	<0.531	<0.531	<0.531
S98T002854		Centrifuged supernatant	<0.531	<0.531	<0.531

Table B2-76. Tank 241-AN-102 Analytical Results: Atomic Mass Unit 244 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<0.712	<0.742	<0.727
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<0.262	<0.262	<0.262
S98T002851		Centrifuged supernatant	<0.262	<0.262	<0.262
S98T002854		Centrifuged supernatant	<0.262	<0.262	<0.262

Table B2-77. Tank 241-AN-102 Analytical Results: Neptunium-237 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<1.43	<1.49	<1.46

Table B2-78. Tank 241-AN-102 Analytical Results: Plutonium-239 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<0.779	<0.812	<0.795
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<0.227	<0.227	<0.227
S98T002851		Centrifuged supernatant	<0.227	<0.227	<0.227
S98T002854		Centrifuged supernatant	<0.227	<0.227	<0.227

Table B2-79. Tank 241-AN-102 Analytical Results: Plutonium-240 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<1.18	<1.22	<1.2
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<0.299	<0.299	<0.299
S98T002851		Centrifuged supernatant	<0.299	<0.299	<0.299
S98T002854		Centrifuged supernatant	<0.299	<0.299	<0.299

Table B2-80. Tank 241-AN-102 Analytical Results: Thorium-229 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<0.95	<0.99	<0.97

Table B2-81. Tank 241-AN-102 Analytical Results: Thorium-230 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<1.96	<2.04	<2

Table B2-82. Tank 241-AN-102 Analytical Results: U-233 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<0.305	<0.317	<0.311
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<1.51	<1.51	<1.51
S98T002851		Centrifuged supernatant	<1.51	<1.51	<1.51
S98T002854		Centrifuged supernatant	<1.51	<1.51	<1.51

Table B2-83. Tank 241-AN-102 Analytical Results: U-234 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<0.254	<0.265	<0.259
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<1.55	<1.55	<1.55
S98T002851		Centrifuged supernatant	<1.55	<1.55	<1.55
S98T002854		Centrifuged supernatant	<1.55	<1.55	<1.55

Table B2-84. Tank 241-AN-102 Analytical Results: U-235 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	0.921	1.36	1.14
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<1.63	<1.63	<1.63
S98T002851		Centrifuged supernatant	<1.63	<1.63	<1.63
S98T002854		Centrifuged supernatant	<1.63	<1.63	<1.63

Table B2-85. Tank 241-AN-102 Analytical Results: U-236 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	<0.28	<0.292	<0.286
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	<0.982	<0.982	<0.982
S98T002851		Centrifuged supernatant	<0.982	<0.982	<0.982
S98T002854		Centrifuged supernatant	<0.982	<0.982	<0.982

Table B2-86. Tank 241-AN-102 Analytical Results: Uranium-238 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002900	Riser 22	Centrifuged solids	148	213	181
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	21.4	21.4	21.4
S98T002851		Centrifuged supernatant	20.1	21.1	20.6
S98T002854		Centrifuged supernatant	20.4	19.8	20.1

Table B2-87. Tank 241-AN-102 Analytical Results: Strontium-89/90.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: fusion			**µCi/g**	**µCi/g**	**µCi/g**
S98T002899	Riser 22	Centrifuged solids	88.2	91.3	89.8
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S98T002688	Riser 22	Centrifuged supernatant	91.4	90.5	91
S98T002851		Centrifuged supernatant	90.1	86.9	88.5
S98T002854		Centrifuged supernatant	85.7	88	86.8

Table B2-88. Tank 241-AN-102 Analytical Results: Total Organic Carbon (Furnace Oxidation).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002688	Riser 22	Centrifuged supernatant	27,800	26,900	27,400
S98T002851		Centrifuged supernatant	30,600	32,500	31,600
S98T002854		Centrifuged supernatant	30,000	32,000	31,000

Table B2-89. Tank 241-AN-102 Analytical Results: Total Inorganic Carbon (Persulfate Oxidation).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**µg/g**	**µg/g**	**µg/g**
S98T002852	Riser 22	Centrifuged solids	15,300	15,900	15,600

Table B2-90. Tank 241-AN-102 Analytical Results: Total Organic Carbon (Persulfate Oxidation).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**µg/g**	**µg/g**	**µg/g**
S98T002852	Riser 22	Centrifuged solids	22,300	22,700	22,500

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Table B2-91. Tank 241-AN-102 Analytical Results: Mercury (AA CLP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002203	Riser 20	Liquid composite	<0.05	<0.05	<0.05
S98T002204		Liquid composite	<0.05	<0.05	<0.05
S98T002205		Liquid composite	<0.05	<0.05	<0.05

Table B2-92. Tank 241-AN-102 Analytical Results: Antimony (GFAA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids: acid digest			**µg/mL**	**µg/mL**	**µg/mL**
S99T000240	Riser 20	Liquid composite	0.201	0.212	0.206
S99T000241		Liquid composite	0.214	0.246	0.23
S99T000242		Liquid composite	0.194	0.167	0.181

Table B2-93. Tank 241-AN-102 Analytical Results: Thallium (GFAA)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids: acid digest			**µg/mL**	**µg/mL**	**µg/mL**
S99T000243	Riser 20	Liquid composite	<1.9	<1.9	<1.9
S99T000244		Liquid composite	<1.9	<1.9	<1.9
S99T000245		Liquid composite	<1.9	<1.9	<1.9

Table B2-94. Tank 241-AN-102 Analytical Results: Aluminum (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	17,300	---	17,300[QC:d]
S98T002215		Solid composite	17,600	---	17,600
S98T002216		Solid composite	17,600	---	17,600
S98T002300		Solid composite	14,100	---	14,100
S98T002301		Solid composite	14,100	---	14,100
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	16,700	---	16,700
S98T002211		Solid composite	16,800	---	16,800
S98T002212		Solid composite	16,500	---	16,500
S98T002295		Solid composite	14,000	---	14,000
S98T002296		Solid composite	14,100	---	14,100
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	14,500	14,700	14,600
S98T001774		Centrifuged supernatant	14,900	14,300	14,600
S98T001775		Centrifuged supernatant	15,000	14,700	14,900
S98T001776		Centrifuged supernatant	14,700	14,500	14,600
S98T002203		Liquid composite	16,100	14,700	15,400[QC:c]
S98T002204		Liquid composite	15,900	16,400	16,200
S98T002205		Liquid composite	15,500	16,800	16,200
S98T002285		Liquid composite	15,300	---	15,300

Table B2-95. Tank 241-AN-102 Analytical Results: Antimony (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	<34.5	---	<34.5
S98T002215		Solid composite	<35.3	---	<35.3
S98T002216		Solid composite	<35.3	---	<35.3
S98T002300		Solid composite	<23.4	---	<23.4
S98T002301		Solid composite	<22.4	---	<22.4
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<1,200	---	<1,200
S98T002211		Solid composite	<1,230	---	<1,230
S98T002212		Solid composite	<1,200	---	<1,200
S98T002295		Solid composite	<1,040	---	<1,040
S98T002296		Solid composite	<1,080	---	<1,080
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	<24.1	<24.1	<24.1
S98T001774		Centrifuged supernatant	<24.1	<24.1	<24.1
S98T001775		Centrifuged supernatant	<24.1	<24.1	<24.1
S98T001776		Centrifuged supernatant	<24.1	<24.1	<24.1
S98T002203		Liquid composite	<36.1	<36.1	<36.1
S98T002204		Liquid composite	<36.1	<36.1	<36.1
S98T002205		Liquid composite	<36.1	<36.1	<36.1
S98T002285		Liquid composite	<36.1	---	<36.1

Table B2-96. Tank 241-AN-102 Analytical Results: Arsenic (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	<57.6	---	<57.6
S98T002215		Solid composite	<58.9	---	<58.9
S98T002216		Solid composite	<58.8	---	<58.8
S98T002300		Solid composite	<39	---	<39
S98T002301		Solid composite	<37.3	---	<37.3

Table B2-96. Tank 241-AN-102 Analytical Results: Arsenic (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<2,000	---	<2,000
S98T002211		Solid composite	<2,040	---	<2,040
S98T002212		Solid composite	<2,000	---	<2,000
S98T002295		Solid composite	<1,740	---	<1,740
S98T002296		Solid composite	<1,800	---	<1,800
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	<40.1	<40.1	<40.1
S98T001774		Centrifuged supernatant	<40.1	<40.1	<40.1
S98T001775		Centrifuged supernatant	<40.1	<40.1	<40.1
S98T001776		Centrifuged supernatant	<40.1	<40.1	<40.1
S98T002203		Liquid composite	<60.1	<60.1	<60.1
S98T002204		Liquid composite	<60.1	<60.1	<60.1
S98T002205		Liquid composite	<60.1	<60.1	<60.1
S98T002285		Liquid composite	<60.1	---	<60.1

Table B2-97. Tank 241-AN-102 Analytical Results: Barium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	<28.8	---	<28.8
S98T002215		Solid composite	<29.5	---	<29.5
S98T002216		Solid composite	<29.4	---	<29.4
S98T002300		Solid composite	<19.5	---	<19.5
S98T002301		Solid composite	<18.7	---	<18.7
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<1,000	---	<1,000
S98T002211		Solid composite	<1,020	---	<1,020
S98T002212		Solid composite	<1,000	---	<1,000
S98T002295		Solid composite	<870	---	<870
S98T002296		Solid composite	<899	---	<899

Table B2-97. Tank 241-AN-102 Analytical Results: Barium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	<20.1	<20.1	<20.1
S98T001774		Centrifuged supernatant	<20.1	<20.1	<20.1
S98T001775		Centrifuged supernatant	<20.1	<20.1	<20.1
S98T001776		Centrifuged supernatant	<20.1	<20.1	<20.1
S98T002203		Liquid composite	<30.1	<30.1	<30.1
S98T002204		Liquid composite	<30.1	<30.1	<30.1
S98T002205		Liquid composite	<30.1	<30.1	<30.1
S98T002285		Liquid composite	<30.1	---	<30.1

Table B2-98. Tank 241-AN-102 Analytical Results: Beryllium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	<2.88	---	<2.88
S98T002215		Solid composite	<2.95	---	<2.95
S98T002216		Solid composite	<2.94	---	<2.94
S98T002300		Solid composite	<1.95	---	<1.95
S98T002301		Solid composite	<1.87	---	<1.87
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<100	---	<100
S98T002211		Solid composite	<102	---	<102
S98T002212		Solid composite	<100	---	<100
S98T002295		Solid composite	<87	---	<87
S98T002296		Solid composite	<89.9	---	<89.9
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	<2	<2	<2
S98T001774		Centrifuged supernatant	<2	<2	<2
S98T001775		Centrifuged supernatant	<2	<2	<2
S98T001776		Centrifuged supernatant	<2	<2	<2
S98T002203	Riser 20	Liquid composite	<3	<3	<3
S98T002204		Liquid composite	<3	<3	<3
S98T002205		Liquid composite	<3	<3	<3
S98T002285		Liquid composite	<3	---	<3

Table B2-99. Tank 241-AN-102 Analytical Results: Bismuth (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	<57.6	---	<57.6
S98T002215		Solid composite	<58.9	---	<58.9
S98T002216		Solid composite	<58.8	---	<58.8
S98T002300		Solid composite	<39	---	<39
S98T002301		Solid composite	<37.3	---	<37.3
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<2,000	---	<2,000
S98T002211		Solid composite	<2,040	---	<2,040
S98T002212		Solid composite	<2,000	---	<2,000
S98T002295		Solid composite	<1,740	---	<1,740
S98T002296		Solid composite	<1,800	---	<1,800
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	<40.1	<40.1	<40.1
S98T001774		Centrifuged supernatant	<40.1	<40.1	<40.1
S98T001775		Centrifuged supernatant	<40.1	<40.1	<40.1
S98T001776		Centrifuged supernatant	<40.1	<40.1	<40.1
S98T002203	Riser 20	Liquid composite	<60.1	<60.1	<60.1
S98T002204		Liquid composite	<60.1	<60.1	<60.1
S98T002205		Liquid composite	<60.1	<60.1	<60.1
S98T002285		Liquid composite	<60.1	---	<60.1

Table B2-100. Tank 241-AN-102 Analytical Results: Boron (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	136	---	136
S98T002215		Solid composite	153	---	153
S98T002216		Solid composite	136	---	136
S98T002300		Solid composite	120	---	120
S98T002301		Solid composite	114	---	114
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<1,000	---	<1,000
S98T002211		Solid composite	<1,020	---	<1,020
S98T002212		Solid composite	<1,000	---	<1,000
S98T002295		Solid composite	<870	---	<870
S98T002296		Solid composite	<899	---	<899
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	39.5	41.4	40.5
S98T001774		Centrifuged supernatant	40.4	38.8	39.6
S98T001775		Centrifuged supernatant	40.8	37.2	39
S98T001776		Centrifuged supernatant	41.2	38.5	39.9
S98T002203		Liquid composite	45.2	40.4	42.8
S98T002204		Liquid composite	42.2	43	42.6
S98T002205		Liquid composite	43.3	44.4	43.8
S98T002285		Liquid composite	45	---	45

Table B2-101. Tank 241-AN-102 Analytical Results: Cadmium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	38.4	---	38.4
S98T002215		Solid composite	39.4	---	39.4
S98T002216		Solid composite	38.1	---	38.1
S98T002300		Solid composite	36.6	---	36.6
S98T002301		Solid composite	36.9	---	36.9

Table B2-101. Tank 241-AN-102 Analytical Results: Cadmium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<100	---	<100
S98T002211		Solid composite	<102	---	<102
S98T002212		Solid composite	<100	---	<100
S98T002295		Solid composite	<87	---	<87
S98T002296		Solid composite	<89.9	---	<89.9
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	60	59.2	59.6
S98T001774		Centrifuged supernatant	61.7	59.4	60.5
S98T001775		Centrifuged supernatant	61.4	59.7	60.5
S98T001776		Centrifuged supernatant	62.8	61.4	62.1
S98T002203		Liquid composite	68.3	61.2	64.8
S98T002204		Liquid composite	66.7	69.8	68.3
S98T002205		Liquid composite	65.3	69.9	67.6
S98T002285		Liquid composite	63.2	---	63.2

Table B2-102. Tank 241-AN-102 Analytical Results: Calcium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	487	---	487
S98T002215		Solid composite	408	---	408
S98T002216		Solid composite	461	---	461
S98T002300		Solid composite	416	---	416
S98T002301		Solid composite	396	---	396
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<2,000	---	<2,000
S98T002211		Solid composite	<2,040	---	<2,040
S98T002212		Solid composite	<2,000	---	<2,000
S98T002295		Solid composite	<1,740	---	<1,740
S98T002296		Solid composite	<1,800	---	<1,800

Table B2-102. Tank 241-AN-102 Analytical Results: Calcium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	463	460	462
S98T001774		Centrifuged supernatant	476	458	467
S98T001775		Centrifuged supernatant	475	464	470
S98T001776		Centrifuged supernatant	483	474	479
S98T002203		Liquid composite	539	475	507
S98T002204		Liquid composite	512	540	526
S98T002205		Liquid composite	503	537	520
S98T002285		Liquid composite	502	---	502

Table B2-103. Tank 241-AN-102 Analytical Results: Cerium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	<57.6	---	<57.6
S98T002215		Solid composite	<58.9	---	<58.9
S98T002216		Solid composite	<58.8	---	<58.8
S98T002300		Solid composite	<39	---	<39
S98T002301		Solid composite	<37.3	---	<37.3
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<2,000	---	<2,000
S98T002211		Solid composite	<2,040	---	<2,040
S98T002212		Solid composite	<2,000	---	<2,000
S98T002295		Solid composite	<1,740	---	<1,740
S98T002296		Solid composite	<1,800	---	<1,800
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	<40.1	<40.1	<40.1
S98T001774		Centrifuged supernatant	<40.1	<40.1	<40.1
S98T001775		Centrifuged supernatant	<40.1	<40.1	<40.1
S98T001776		Centrifuged supernatant	<40.1	<40.1	<40.1
S98T002203	Riser 20	Liquid composite	<60.1	<60.1	<60.1
S98T002204		Liquid composite	<60.1	<60.1	<60.1
S98T002205		Liquid composite	<60.1	<60.1	<60.1
S98T002285		Liquid composite	<60.1	---	<60.1

Table B2-104. Tank 241-AN-102 Analytical Results: Chromium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	2,110	---	2,110
S98T002215		Solid composite	2,170	---	2,170
S98T002216		Solid composite	2,250	---	2,250
S98T002300		Solid composite	1,320	---	1,320
S98T002301		Solid composite	1,280	---	1,280
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	2,080	---	2,080
S98T002211		Solid composite	2,020	---	2,020
S98T002212		Solid composite	2,060	---	2,060
S98T002295		Solid composite	1,240	---	1,240
S98T002296		Solid composite	1,300	---	1,300
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	274	276	275
S98T001774		Centrifuged supernatant	282	273	278
S98T001775		Centrifuged supernatant	283	278	281
S98T001776		Centrifuged supernatant	263	261	262
S98T002203		Liquid composite	305	278	292
S98T002204		Liquid composite	299	313	306
S98T002205		Liquid composite	293	314	304
S98T002285		Liquid composite	283	---	283

Table B2-105. Tank 241-AN-102 Analytical Results: Cobalt (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	<11.5	---	<11.5
S98T002215		Solid composite	<11.8	---	<11.8
S98T002216		Solid composite	<11.8	---	<11.8
S98T002300		Solid composite	<7.8	---	<7.8
S98T002301		Solid composite	<7.47	---	<7.47
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<400	---	<400
S98T002211		Solid composite	<409	---	<409
S98T002212		Solid composite	<400	---	<400
S98T002295		Solid composite	<348	---	<348
S98T002296		Solid composite	<360	---	<360
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	<8.02	<8.02	<8.02
S98T001774		Centrifuged supernatant	<8.02	<8.02	<8.02
S98T001775		Centrifuged supernatant	<8.02	<8.02	<8.02
S98T001776		Centrifuged supernatant	<8.02	<8.02	<8.02
S98T002203		Liquid composite	<12	<12	<12
S98T002204		Liquid composite	<12	<12	<12
S98T002205		Liquid composite	<12	<12	<12
S98T002285		Liquid composite	<12	---	<12

Table B2-106. Tank 241-AN-102 Analytical Results: Copper (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	15.4	---	15.4
S98T002215		Solid composite	16.3	---	16.3
S98T002216		Solid composite	15.5	---	15.5
S98T002300		Solid composite	15.7	---	15.7
S98T002301		Solid composite	17.4	---	17.4

Table B2-106. Tank 241-AN-102 Analytical Results: Copper (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<200	---	<200
S98T002211		Solid composite	<204	---	<204
S98T002212		Solid composite	<200	---	<200
S98T002295		Solid composite	<174	---	<174
S98T002296		Solid composite	<180	---	<180
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	23.1	23.5	23.3
S98T001774		Centrifuged supernatant	23.7	22.7	23.2
S98T001775		Centrifuged supernatant	23.6	23.4	23.5
S98T001776		Centrifuged supernatant	24.2	24.3	24.3
S98T002203		Liquid composite	26.5	24.7	25.6
S98T002204		Liquid composite	26.5	27.8	27.1
S98T002205		Liquid composite	25.7	27.6	26.6
S98T002285		Liquid composite	25.7	---	25.7

Table B2-107. Tank 241-AN-102 Analytical Results: Iron (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	3,300	---	3,300[QC:c]
S98T002215		Solid composite	1,830	---	1,830
S98T002216		Solid composite	1,980	---	1,980
S98T002300		Solid composite	1,050	---	1,050
S98T002301		Solid composite	1,010	---	1,010
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	1,670	---	1,670
S98T002211		Solid composite	1,440	---	1,440
S98T002212		Solid composite	1,500	---	1,500
S98T002295		Solid composite	872	---	872
S98T002296		Solid composite	924	---	924

Table B2-107. Tank 241-AN-102 Analytical Results: Iron (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	41.1	42.1	41.6
S98T001774		Centrifuged supernatant	42.2	41.7	42
S98T001775		Centrifuged supernatant	42.2	42.6	42.4
S98T001776		Centrifuged supernatant	41.4	42.5	42
S98T002203		Liquid composite	52.1	45.7	48.9
S98T002204		Liquid composite	49.8	52.4	51.1
S98T002205		Liquid composite	49.9	52.5	51.2
S98T002285		Liquid composite	44.7	---	44.7

Table B2-108. Tank 241-AN-102 Analytical Results: Lanthanum (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	41.9	---	41.9
S98T002215		Solid composite	43.3	---	43.3
S98T002216		Solid composite	44.1	---	44.1
S98T002300		Solid composite	29.2	---	29.2
S98T002301		Solid composite	28.1	---	28.1
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<1,000	---	<1,000
S98T002211		Solid composite	<1,020	---	<1,020
S98T002212		Solid composite	<1,000	---	<1,000
S98T002295		Solid composite	<870	---	<870
S98T002296		Solid composite	<899	---	<899
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	<20.1	<20.1	<20.1
S98T001774		Centrifuged supernatant	<20.1	<20.1	<20.1
S98T001775		Centrifuged supernatant	<20.1	<20.1	<20.1
S98T001776		Centrifuged supernatant	<20.1	<20.1	<20.1

Table B2-108. Tank 241-AN-102 Analytical Results: Lanthanum (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids (Cont'd)			**μg/mL**	**μg/mL**	**μg/mL**
S98T002203	Riser 20	Liquid composite	<30.1	<30.1	<30.1
S98T002204		Liquid composite	<30.1	<30.1	<30.1
S98T002205		Liquid composite	<30.1	<30.1	<30.1
S98T002285		Liquid composite	<30.1	---	<30.1

Table B2-109. Tank 241-AN-102 Analytical Results: Lead (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**μg/g**	**μg/g**	**μg/g**
S98T002213	Riser 20	Solid composite	265	---	265
S98T002215		Solid composite	280	---	280
S98T002216		Solid composite	278	---	278
S98T002300		Solid composite	195	---	195
S98T002301		Solid composite	194	---	194
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S98T002210	Riser 20	Solid composite	<2,000	---	<2,000
S98T002211		Solid composite	<2,040	---	<2,040
S98T002212		Solid composite	<2,000	---	<2,000
S98T002295		Solid composite	<1,740	---	<1,740
S98T002296		Solid composite	<1,800	---	<1,800
Liquids			**μg/mL**	**μg/mL**	**μg/mL**
S98T001773	Riser 20	Centrifuged supernatant	166	163	165
S98T001774		Centrifuged supernatant	175	162	169
S98T001775		Centrifuged supernatant	170	169	170
S98T001776		Centrifuged supernatant	170	170	170
S98T002203		Liquid composite	189	173	181
S98T002204		Liquid composite	183	198	191
S98T002205		Liquid composite	181	187	184
S98T002285		Liquid composite	178	---	178

Table B2-110. Tank 241-AN-102 Analytical Results: Lithium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	<5.76	---	<5.76
S98T002215		Solid composite	<5.89	---	<5.89
S98T002216		Solid composite	<5.88	---	<5.88
S98T002300		Solid composite	<3.9	---	<3.9
S98T002301		Solid composite	<3.73	---	<3.73
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<200	---	<200
S98T002211		Solid composite	<204	---	<204
S98T002212		Solid composite	<200	---	<200
S98T002295		Solid composite	<174	---	<174
S98T002296		Solid composite	<180	---	<180
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	<4.01	<4.01	<4.01
S98T001774		Centrifuged supernatant	<4.01	<4.01	<4.01
S98T001775		Centrifuged supernatant	<4.01	<4.01	<4.01
S98T001776		Centrifuged supernatant	<4.01	<4.01	<4.01
S98T002203		Liquid composite	<6.01	<6.01	<6.01
S98T002204		Liquid composite	<6.01	<6.01	<6.01
S98T002205		Liquid composite	<6.01	<6.01	<6.01
S98T002285		Liquid composite	<6.01	---	<6.01

Table B2-111. Tank 241-AN-102 Analytical Results: Magnesium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	<57.6	---	<57.6
S98T002215		Solid composite	<58.9	---	<58.9
S98T002216		Solid composite	<58.8	---	<58.8
S98T002300		Solid composite	<39	---	<39
S98T002301		Solid composite	<37.3	---	<37.3

Table B2-111. Tank 241-AN-102 Analytical Results: Magnesium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<2,000	---	<2,000
S98T002211		Solid composite	<2,040	---	<2,040
S98T002212		Solid composite	<2,000	---	<2,000
S98T002295		Solid composite	<1,740	---	<1,740
S98T002296		Solid composite	<1,800	---	<1,800
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	<40.1	<40.1	<40.1
S98T001774		Centrifuged supernatant	<40.1	<40.1	<40.1
S98T001775		Centrifuged supernatant	<40.1	<40.1	<40.1
S98T001776		Centrifuged supernatant	<40.1	<40.1	<40.1
S98T002203		Liquid composite	<60.1	<60.1	<60.1
S98T002204		Liquid composite	<60.1	<60.1	<60.1
S98T002205		Liquid composite	<60.1	<60.1	<60.1
S98T002285		Liquid composite	<60.1	---	<60.1

Table B2-112. Tank 241-AN-102 Analytical Results: Manganese (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	347	---	347
S98T002215		Solid composite	346	---	346
S98T002216		Solid composite	360	---	360
S98T002300		Solid composite	211	---	211
S98T002301		Solid composite	209	---	209
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	340	---	340
S98T002211		Solid composite	349	---	349
S98T002212		Solid composite	344	---	344
S98T002295		Solid composite	222	---	222
S98T002296		Solid composite	248	---	248

Table B2-112. Tank 241-AN-102 Analytical Results: Manganese (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S98T001773	Riser 20	Centrifuged supernatant	23.7	22.9	23.3
S98T001774		Centrifuged supernatant	19.9	18.8	19.4
S98T001775		Centrifuged supernatant	23.2	22.6	22.9
S98T001776		Centrifuged supernatant	23.2	22.8	23
S98T002203		Liquid composite	27.5	23.3	25.4
S98T002204		Liquid composite	28.5	26.4	27.4
S98T002205		Liquid composite	26.4	26.8	26.6
S98T002285		Liquid composite	20.9	---	20.9

Table B2-113. Tank 241-AN-102 Analytical Results: Molybdenum (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			µg/g	µg/g	µg/g
S98T002213	Riser 20	Solid composite	30.8	---	30.8
S98T002215		Solid composite	31.2	---	31.2
S98T002216		Solid composite	31.1	---	31.1
S98T002300		Solid composite	31.2	---	31.2
S98T002301		Solid composite	31.6	---	31.6
Solids: fusion			µg/g	µg/g	µg/g
S98T002210	Riser 20	Solid composite	<1,000	---	<1,000
S98T002211		Solid composite	<1,020	---	<1,020
S98T002212		Solid composite	<1,000	---	<1,000
S98T002295		Solid composite	<870	---	<870
S98T002296		Solid composite	<899	---	<899
Liquids			µg/mL	µg/mL	µg/mL
S98T001773	Riser 20	Centrifuged supernatant	48.3	48.2	48.3
S98T001774		Centrifuged supernatant	48.4	48.6	48.5
S98T001775		Centrifuged supernatant	49.6	48.3	49
S98T001776		Centrifuged supernatant	50.7	50.1	50.4

Table B2-113. Tank 241-AN-102 Analytical Results: Molybdenum (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids (Cont'd)			**µg/mL**	**µg/mL**	**µg/mL**
S98T002203	Riser 20	Liquid composite	57.8	51.5	54.6
S98T002204		Liquid composite	55	57.9	56.5
S98T002205		Liquid composite	53	58.2	55.6
S98T002285		Liquid composite	54.9	---	54.9

Table B2-114. Tank 241-AN-102 Analytical Results: Neodymium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	78.8	---	78.8
S98T002215		Solid composite	82.9	---	82.9
S98T002216		Solid composite	84.9	---	84.9
S98T002300		Solid composite	55.1	---	55.1
S98T002301		Solid composite	53.3	---	53.3
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<2,000	---	<2,000
S98T002211		Solid composite	<2,040	---	<2,040
S98T002212		Solid composite	<2,000	---	<2,000
S98T002295		Solid composite	<1,740	---	<1,740
S98T002296		Solid composite	<1,800	---	<1,800
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	<40.1	<40.1	<40.1
S98T001774		Centrifuged supernatant	<40.1	<40.1	<40.1
S98T001775		Centrifuged supernatant	<40.1	<40.1	<40.1
S98T001776		Centrifuged supernatant	<40.1	<40.1	<40.1
S98T002203		Liquid composite	<60.1	<60.1	<60.1
S98T002204		Liquid composite	<60.1	<60.1	<60.1
S98T002205		Liquid composite	<60.1	<60.1	<60.1
S98T002285		Liquid composite	<60.1	---	<60.1

Table B2-115. Tank 241-AN-102 Analytical Results: Nickel (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	259	---	259
S98T002215		Solid composite	263	---	263
S98T002216		Solid composite	255	---	255
S98T002300		Solid composite	243	---	243
S98T002301		Solid composite	250	---	250
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	1,330	---	1,330
S98T002211		Solid composite	997	---	997
S98T002212		Solid composite	1,050	---	1,050
S98T002295		Solid composite	<348	---	<348
S98T002296		Solid composite	382	---	382
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	405	396	401
S98T001774		Centrifuged supernatant	410	391	401
S98T001775		Centrifuged supernatant	408	402	405
S98T001776		Centrifuged supernatant	416	412	414
S98T002203		Liquid composite	450	421	436
S98T002204		Liquid composite	445	459	452
S98T002205		Liquid composite	430	466	448
S98T002285		Liquid composite	426	---	426

Table B2-116. Tank 241-AN-102 Analytical Results: Phosphorus (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	1,250	---	1,250[QC:c]
S98T002215		Solid composite	1,290	---	1,290
S98T002216		Solid composite	1,300	---	1,300
S98T002300		Solid composite	1,070	---	1,070
S98T002301		Solid composite	1,100	---	1,100

Table B2-116. Tank 241-AN-102 Analytical Results: Phosphorus (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<4,000	---	<4,000
S98T002211		Solid composite	<4,090	---	<4,090
S98T002212		Solid composite	<4,000	---	<4,000
S98T002295		Solid composite	<3,480	---	<3,480
S98T002296		Solid composite	<3,600	---	<3,600
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	1,630	1,680	1,660
S98T001774		Centrifuged supernatant	1,650	1,610	1,630
S98T001775		Centrifuged supernatant	1,670	1,660	1,670
S98T001776		Centrifuged supernatant	1,720	1,700	1,710
S98T002203		Liquid composite	1,810	1,700	1,760
S98T002204		Liquid composite	1,770	1,890	1,830
S98T002205		Liquid composite	1,730	1,900	1,820
S98T002285		Liquid composite	1,790	---	1,790

Table B2-117. Tank 241-AN-102 Analytical Results: Potassium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	1,470	---	1,470
S98T002215		Solid composite	1,440	---	1,440
S98T002216		Solid composite	1,370	---	1,370
S98T002300		Solid composite	1,340	---	1,340
S98T002301		Solid composite	1,340	---	1,340
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	2,180	2,250	2,220
S98T001774		Centrifuged supernatant	2,190	2,120	2,160
S98T001775		Centrifuged supernatant	2,290	2,120	2,210
S98T001776		Centrifuged supernatant	2,240	2,250	2,250

Table B2-117. Tank 241-AN-102 Analytical Results: Potassium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids (Cont'd)			**µg/mL**	**µg/mL**	**µg/mL**
S98T002203	Riser 20	Liquid composite	2,400	2,270	2,340[QC:c]
S98T002204		Liquid composite	2,320	2,480	2,400
98T002205		Liquid composite	2,320	2,430	2,380
S98T002285		Liquid composite	2,330	---	2,330

Table B2-118. Tank 241-AN-102 Analytical Results: Samarium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	<57.6	---	<57.6
S98T002215		Solid composite	<58.9	---	<58.9
S98T002216		Solid composite	<58.8	---	<58.8
S98T002300		Solid composite	<39	---	<39
S98T002301		Solid composite	<37.3	---	<37.3
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<2,000	---	<2,000
S98T002211		Solid composite	<2,040	---	<2,040
S98T002212		Solid composite	<2,000	---	<2,000
S98T002295		Solid composite	<1,740	---	<1,740
S98T002296		Solid composite	<1,800	---	<1,800
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	<40.1	<40.1	<40.1
S98T001774		Centrifuged supernatant	<40.1	<40.1	<40.1
S98T001775		Centrifuged supernatant	<40.1	<40.1	<40.1
S98T001776		Centrifuged supernatant	<40.1	<40.1	<40.1
S98T002203		Liquid composite	<60.1	<60.1	<60.1
S98T002204		Liquid composite	<60.1	<60.1	<60.1
S98T002205		Liquid composite	<60.1	<60.1	<60.1
S98T002285		Liquid composite	<60.1	---	<60.1

Table B2-119. Tank 241-AN-102 Analytical Results: Selenium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	<57.6	---	<57.6
S98T002215		Solid composite	<58.9	---	<58.9
S98T002216		Solid composite	<58.8	---	<58.8
S98T002300		Solid composite	<39	---	<39
S98T002301		Solid composite	<37.3	---	<37.3
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<2,000	---	<2,000
S98T002211		Solid composite	<2,040	---	<2,040
S98T002212		Solid composite	<2,000	---	<2,000
S98T002295		Solid composite	<1,740	---	<1,740
S98T002296		Solid composite	<1,800	---	<1,800
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	<40.1	47.7	<43.9
S98T001774		Centrifuged supernatant	<40.1	50.6	<45.4[QC:e]
S98T001775		Centrifuged supernatant	<40.1	47.3	<43.7
S98T001776		Centrifuged supernatant	<40.1	45.4	<42.8
S98T002203		Liquid composite	<60.1	<60.1	<60.1
S98T002204		Liquid composite	<60.1	<60.1	<60.1
S98T002205		Liquid composite	<60.1	<60.1	<60.1
S98T002285		Liquid composite	<60.1	---	<60.1

Table B2-120. Tank 241-AN-102 Analytical Results: Silicon (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	60.3	---	60.3[QC:a,c]
S98T002215		Solid composite	84.7	---	84.7[QC:a]
S98T002216		Solid composite	63.5	---	63.5[QC:a]
S98T002300		Solid composite	54.5	---	54.5[QC:a]
S98T002301		Solid composite	52.2	---	52.2[QC:a]

Table B2-120. Tank 241-AN-102 Analytical Results: Silicon (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: fusion			µg/g	µg/g	µg/g
S98T002210	Riser 20	Solid composite	<1,000	---	<1,000
S98T002211		Solid composite	<1,020	---	<1,020
S98T002212		Solid composite	<1,000	---	<1,000
S98T002295		Solid composite	<870	---	<870
S98T002296		Solid composite	<899	---	<899
Liquids			µg/mL	µg/mL	µg/mL
S98T001773	Riser 20	Centrifuged supernatant	<20.1	<20.1	<20.1
S98T001774		Centrifuged supernatant	<20.1	<20.1	<20.1
S98T001775		Centrifuged supernatant	<20.1	<20.1	<20.1
S98T001776		Centrifuged supernatant	<20.1	<20.1	<20.1
S98T002203		Liquid composite	30.8	<30.1	<30.5
S98T002204		Liquid composite	<30.1	<30.1	<30.1
S98T002205		Liquid composite	<30.1	<30.1	<30.1
S98T002285		Liquid composite	<30.1	---	<30.1

Table B2-121. Tank 241-AN-102 Analytical Results: Silver (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			µg/g	µg/g	µg/g
S98T002213	Riser 20	Solid composite	10.6	---	10.6[QC:a,c]
S98T002215		Solid composite	15.2	---	15.2[QC:a]
S98T002216		Solid composite	10.5	---	10.5[QC:a]
S98T002300		Solid composite	10.7	---	10.7[QC:a]
S98T002301		Solid composite	10.7	---	10.7[QC:a]
Solids: fusion			µg/g	µg/g	µg/g
S98T002210	Riser 20	Solid composite	<200	---	<200
S98T002211		Solid composite	<204	---	<204
S98T002212		Solid composite	<200	---	<200
S98T002295		Solid composite	<174	---	<174
S98T002296		Solid composite	<180	---	<180

Table B2-121. Tank 241-AN-102 Analytical Results: Silver (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	<4.01	<4.01	<4.01
S98T001774		Centrifuged supernatant	<4.01	<4.01	<4.01
S98T001775		Centrifuged supernatant	<4.01	<4.01	<4.01
S98T001776		Centrifuged supernatant	<4.01	<4.01	<4.01
S98T002203		Liquid composite	<6.01	<6.01	<6.01
S98T002204		Liquid composite	<6.01	<6.01	<6.01
S98T002205		Liquid composite	<6.01	<6.01	<6.01
S98T002285		Liquid composite	16	---	16

Table B2-122. Tank 241-AN-102 Analytical Results: Sodium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	1.55E+05	---	1.55E+05[QC:c]
S98T002215		Solid composite	1.58E+05	---	1.58E+05
S98T002216		Solid composite	1.51E+05	---	1.51E+05
S98T002300		Solid composite	1.44E+05	---	1.44E+05[QC:b]
S98T002301		Solid composite	1.47E+05	---	1.47E+05[QC:b]
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	1.54E+05	---	1.54E+05
S98T002211		Solid composite	1.51E+05	---	1.51E+05
S98T002212		Solid composite	1.52E+05	---	1.52E+05
S98T002295		Solid composite	1.46E+05	---	1.46E+05
S98T002296		Solid composite	1.47E+05	---	1.47E+05
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	2.10E+05	2.12E+05	2.11E+05
S98T001774		Centrifuged supernatant	2.12E+05	2.03E+05	2.08E+05
S98T001775		Centrifuged supernatant	2.14E+05	2.11E+05	2.13E+05
S98T001776		Centrifuged supernatant	2.17E+05	2.15E+05	2.16E+05

Table B2-122. Tank 241-AN-102 Analytical Results: Sodium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids (Cont'd)			µg/mL	µg/mL	µg/mL
S98T002203	Riser 20	Liquid composite	2.17E+05	2.13E+05	2.15E+05
S98T002204		Liquid composite	2.27E+05	2.33E+05	2.30E+05
S98T002205		Liquid composite	2.11E+05	2.13E+05	2.12E+05
S98T002285		Liquid composite	2.22E+05	---	2.22E+05

Table B2-123. Tank 241-AN-102 Analytical Results: Strontium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			µg/g	µg/g	µg/g
S98T002213	Riser 20	Solid composite	<5.76	---	<5.76
S98T002215		Solid composite	<5.89	---	<5.89
S98T002216		Solid composite	<5.88	---	<5.88
S98T002300		Solid composite	<3.9	---	<3.9
S98T002301		Solid composite	<3.73	---	<3.73
Solids: fusion			µg/g	µg/g	µg/g
S98T002210	Riser 20	Solid composite	<200	---	<200
S98T002211		Solid composite	<204	---	<204
S98T002212		Solid composite	<200	---	<200
S98T002295		Solid composite	<174	---	<174
S98T002296		Solid composite	<180	---	<180
Liquids			µg/mL	µg/mL	µg/mL
S98T001773	Riser 20	Centrifuged supernatant	<4.01	<4.01	<4.01
S98T001774		Centrifuged supernatant	<4.01	<4.01	<4.01
S98T001775		Centrifuged supernatant	<4.01	<4.01	<4.01
S98T001776		Centrifuged supernatant	<4.01	<4.01	<4.01
S98T002203		Liquid composite	<6.01	<6.01	<6.01
S98T002204		Liquid composite	<6.01	<6.01	<6.01
S98T002205		Liquid composite	<6.01	<6.01	<6.01
S98T002285		Liquid composite	<6.01	---	<6.01

Table B2-124. Tank 241-AN-102 Analytical Results: Sulfur (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	3,650	---	3,650
S98T002215		Solid composite	3,690	---	3,690
S98T002216		Solid composite	3,580	---	3,580
S98T002300		Solid composite	3,410	---	3,410
S98T002301		Solid composite	3,540	---	3,540
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	3,560	---	3,560
S98T002211		Solid composite	3,260	---	3,260
S98T002212		Solid composite	3,620	---	3,620
S98T002295		Solid composite	3,350	---	3,350
S98T002296		Solid composite	3,520	---	3,520
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	4,960	4,880	4,920
S98T001774		Centrifuged supernatant	5,070	4,800	4,940
S98T001775		Centrifuged supernatant	5,080	4,930	5,010
S98T001776		Centrifuged supernatant	5,100	4,950	5,030
S98T002203		Liquid composite	5,820	5,170	5,500[QC:c]
S98T002204		Liquid composite	5,680	5,850	5,770
S98T002205		Liquid composite	5,550	5,970	5,760
S98T002285		Liquid composite	5,460	---	5,460

Table B2-125. Tank 241-AN-102 Analytical Results: Tantalum (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002203	Riser 20	Liquid composite	<30.1	<30.1	<30.1
S98T002204		Liquid composite	<30.1	<30.1	<30.1
S98T002205		Liquid composite	<30.1	<30.1	<30.1

Table B2-126. Tank 241-AN-102 Analytical Results: Thallium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	<115	---	<115
S98T002215		Solid composite	<118	---	<118
S98T002216		Solid composite	<118	---	<118
S98T002300		Solid composite	<78	---	<78
S98T002301		Solid composite	<74.7	---	<74.7
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<4,000	---	<4,000
S98T002211		Solid composite	<4,090	---	<4,090
S98T002212		Solid composite	<4,000	---	<4,000
S98T002295		Solid composite	<3,480	---	<3,480
S98T002296		Solid composite	<3,600	---	<3,600
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	<80.2	<80.2	<80.2
S98T001774		Centrifuged supernatant	<80.2	<80.2	<80.2
S98T001775		Centrifuged supernatant	<80.2	<80.2	<80.2
S98T001776		Centrifuged supernatant	<80.2	<80.2	<80.2
S98T002203		Liquid composite	<120	<120	<120
S98T002204		Liquid composite	<120	<120	<120
S98T002205		Liquid composite	<120	<120	<120
S98T002285		Liquid composite	<120	---	<120

Table B2-127. Tank 241-AN-102 Analytical Results: Thorium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002203	Riser 20	Liquid composite	<30.1	<30.1	<30.1
S98T002204		Liquid composite	<30.1	<30.1	<30.1
S98T002205		Liquid composite	<30.1	<30.1	<30.1

Table B2-128. Tank 241-AN-102 Analytical Results: Tin (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002203	Riser 20	Liquid composite	<30.1	46.1	<38.1[QC:e]
S98T002204		Liquid composite	<30.1	37.4	<33.8[QC:e]
S98T002205		Liquid composite	<30.1	<30.1	<30.1

Table B2-129. Tank 241-AN-102 Analytical Results: Titanium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	<5.76	---	<5.76
S98T002215		Solid composite	<5.89	---	<5.89
S98T002216		Solid composite	<5.88	---	<5.88
S98T002300		Solid composite	<3.9	---	<3.9
S98T002301		Solid composite	<3.73	---	<3.73
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<200	---	<200
S98T002211		Solid composite	<204	---	<204
S98T002212		Solid composite	<200	---	<200
S98T002295		Solid composite	<174	---	<174
S98T002296		Solid composite	<180	---	<180
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	<4.01	<4.01	<4.01
S98T001774		Centrifuged supernatant	<4.01	<4.01	<4.01
S98T001775		Centrifuged supernatant	<4.01	<4.01	<4.01
S98T001776		Centrifuged supernatant	<4.01	<4.01	<4.01
S98T002203		Liquid composite	<6.01	<6.01	<6.01
S98T002204		Liquid composite	<6.01	<6.01	<6.01
S98T002205		Liquid composite	<6.01	<6.01	<6.01
S98T002285		Liquid composite	<6.01	---	<6.01

Table B2-130. Tank 241-AN-102 Analytical Results: Total Uranium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	<288	---	<288
S98T002215		Solid composite	<295	---	<295
S98T002216		Solid composite	<294	---	<294
S98T002300		Solid composite	<195	---	<195
S98T002301		Solid composite	<187	---	<187
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<10,000	---	<10,000
S98T002211		Solid composite	<10,200	---	<10,200
S98T002212		Solid composite	<10,000	---	<10,000
S98T002295		Solid composite	<8,700	---	<8,700
S98T002296		Solid composite	<8,990	---	<8,990
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	<200	<200	<200
S98T001774		Centrifuged supernatant	<200	<200	<200
S98T001775		Centrifuged supernatant	<200	<200	<200
S98T001776		Centrifuged supernatant	<200	<200	<200
S98T002203		Liquid composite	<300	<300	<300
S98T002204		Liquid composite	<300	<300	<300
S98T002205		Liquid composite	<300	<300	<300
S98T002285		Liquid composite	<300	---	<300

Table B2-131. Tank 241-AN-102 Analytical Results: Tungsten (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002203	Riser 20	Liquid composite	212	189	201
S98T002204		Liquid composite	214	199	207
S98T002205		Liquid composite	191	199	195

Table B2-132. Tank 241-AN-102 Analytical Results: Vanadium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			µg/g	µg/g	µg/g
S98T002213	Riser 20	Solid composite	<28.8	---	<28.8
S98T002215		Solid composite	<29.5	---	<29.5
S98T002216		Solid composite	<29.4	---	<29.4
S98T002300		Solid composite	<19.5	---	<19.5
S98T002301		Solid composite	<18.7	---	<18.7
Solids: fusion			µg/g	µg/g	µg/g
S98T002210	Riser 20	Solid composite	<1,000	---	<1,000
S98T002211		Solid composite	<1,020	---	<1,020
S98T002212		Solid composite	<1,000	---	<1,000
S98T002295		Solid composite	<870	---	<870
S98T002296		Solid composite	<899	---	<899
Liquids			µg/mL	µg/mL	µg/mL
S98T001773	Riser 20	Centrifuged supernatant	<20.1	<20.1	<20.1
S98T001774		Centrifuged supernatant	<20.1	<20.1	<20.1
S98T001775		Centrifuged supernatant	<20.1	<20.1	<20.1
S98T001776		Centrifuged supernatant	<20.1	<20.1	<20.1
S98T002203		Liquid composite	<30.1	<30.1	<30.1
S98T002204		Liquid composite	<30.1	<30.1	<30.1
S98T002205		Liquid composite	<30.1	<30.1	<30.1
S98T002285		Liquid composite	<30.1	---	<30.1

Table B2-133. Tank 241-AN-102 Analytical Results: Ytrium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S98T002203	Riser 20	Liquid composite	<6.01	<6.01	<6.01
S98T002204		Liquid composite	<6.01	<6.01	<6.01
S98T002205		Liquid composite	<6.01	<6.01	<6.01

Table B2-134. Tank 241-AN-102 Analytical Results: Zinc (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	25.4	---	25.4
S98T002215		Solid composite	24.3	---	24.3
S98T002216		Solid composite	25.2	---	25.2
S98T002300		Solid composite	15.3	---	15.3
S98T002301		Solid composite	15	---	15
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S98T002210	Riser 20	Solid composite	<200	---	<200
S98T002211		Solid composite	<204	---	<204
S98T002212		Solid composite	<200	---	<200
S98T002295		Solid composite	<174	---	<174
S98T002296		Solid composite	<180	---	<180
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	<4.01	<4.01	<4.01
S98T001774		Centrifuged supernatant	4.19	4.57	4.38
S98T001775		Centrifuged supernatant	<4.01	<4.01	<4.01
S98T001776		Centrifuged supernatant	<4.01	<4.01	<4.01
S98T002203		Liquid composite	<6.01	<6.01	<6.01
S98T002204		Liquid composite	<6.01	<6.01	<6.01
S98T002205		Liquid composite	<6.01	<6.01	<6.01
S98T002285		Liquid composite	<6.01	---	<6.01

Table B2-135. Tank 241-AN-102 Analytical Results: Zirconium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µg/g**	**µg/g**	**µg/g**
S98T002213	Riser 20	Solid composite	72.5	---	72.5[QC:c]
S98T002215		Solid composite	74.8	---	74.8
S98T002216		Solid composite	77.2	---	77.2
S98T002300		Solid composite	45.3	---	45.3
S98T002301		Solid composite	43.9	---	43.9

Table B2-135. Tank 241-AN-102 Analytical Results: Zirconium (ICP). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: fusion			µg/g	µg/g	µg/g
S98T002210	Riser 20	Solid composite	<200	---	<200
S98T002211		Solid composite	<204	---	<204
S98T002212		Solid composite	<200	---	<200
S98T002295		Solid composite	<174	---	<174
S98T002296		Solid composite	<180	---	<180
Liquids			µg/mL	µg/mL	µg/mL
S98T001773	Riser 20	Centrifuged supernatant	8.67	8.36	8.52
S98T001774		Centrifuged supernatant	8.8	8.37	8.59
S98T001775		Centrifuged supernatant	8.79	8.58	8.68
S98T001776		Centrifuged supernatant	8.76	8.46	8.61
S98T002203		Liquid composite	10.4	8.81	9.61
S98T002204		Liquid composite	9.97	9.85	9.91
S98T002205		Liquid composite	9.28	9.46	9.37
S98T002285		Liquid composite	8.83	---	8.83

Table B2-136. Tank 241-AN-102 Analytical Results: Bromide (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S98T001773	Riser 20	Centrifuged supernatant	<1,280	---	<1,280
S98T001774		Centrifuged supernatant	<1,280	---	<1,280
S98T001775		Centrifuged supernatant	1,800	1,880	1,840
S98T001776		Centrifuged supernatant	1,400	---	1,400
S98T002203		Liquid composite	<1,280	<1,280	<1,280
S98T002204		Liquid composite	<644	<644	<644
S98T002205		Liquid composite	1,930	1,980	1,960

Table B2-137. Tank 241-AN-102 Analytical Results: Chloride (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	5,080	---	5,080
S98T001774		Centrifuged supernatant	4,100	---	4,100
S98T001775		Centrifuged supernatant	3,760	3,930	3,840
S98T001776		Centrifuged supernatant	4,500	---	4,500
S98T002203		Liquid composite	4,350	4,310	4,330
S98T002204		Liquid composite	3,470	4,220	3,840
S98T002205		Liquid composite	4,350	4,370	4,360

Table B2-138. Tank 241-AN-102 Analytical Results: Fluoride (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	2,000	---	2,000
S98T001774		Centrifuged supernatant	1,860	---	1,860
S98T001775		Centrifuged supernatant	1,890	1,790	1,840
S98T001776		Centrifuged supernatant	<122	---	<122
S98T002203		Liquid composite	1,950	1,880	1,920
S98T002204		Liquid composite	1,730	1,720	1,730
S98T002205		Liquid composite	1,880	1,860	1,870

Table B2-139. Tank 241-AN-102 Analytical Results: Iodide (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002203	Riser 20	Liquid composite	<424	<424	<424
S98T002204		Liquid composite	<424	<424	<424
S98T002205		Liquid composite	<424	<424	<424

Table B2-140. Tank 241-AN-102 Analytical Results: Nitrate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	2.44E+05	---	2.44E+05
S98T001774		Centrifuged supernatant	2.38E+05	---	2.38E+05
S98T001775		Centrifuged supernatant	2.11E+05	2.08E+05	2.10E+05
S98T001776		Centrifuged supernatant	2.52E+05	---	2.52E+05
S98T002203		Liquid composite	2.39E+05	2.37E+05	2.38E+05
S98T002204		Liquid composite	2.32E+05	2.33E+05	2.32E+05
S98T002205		Liquid composite	2.29E+05	2.31E+05	2.30E+05

Table B2-141. Tank 241-AN-102 Analytical Results: Nitrite (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	88,600	---	88,600
S98T001774		Centrifuged supernatant	82,100	---	82,100
S98T001775		Centrifuged supernatant	81,700	84,700	83,200
S98T001776		Centrifuged supernatant	82,400	---	82,400
S98T002203		Liquid composite	93,800	93,100	93,400
S98T002204		Liquid composite	95,800	93,900	94,900
S98T002205		Liquid composite	89,900	91,200	90,600

Table B2-142. Tank 241-AN-102 Analytical Results: Phosphate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	5,730	---	5,730
S98T001774		Centrifuged supernatant	5,760	---	5,760
S98T001775		Centrifuged supernatant	5,780	5,890	5,840
S98T001776		Centrifuged supernatant	5,840	---	5,840
S98T002203		Liquid composite	6,400	6,290	6,350
S98T002204		Liquid composite	5,520	5,770	5,650
S98T002205		Liquid composite	6,260	6,240	6,250

Table B2-143. Tank 241-AN-102 Analytical Results: Sulfate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	14,900	---	14,900
S98T001774		Centrifuged supernatant	14,400	---	14,400
S98T001775		Centrifuged supernatant	14,400	14,300	14,400
S98T001776		Centrifuged supernatant	15,000	---	15,000
S98T002203		Liquid composite	15,800	16,000	15,900
S98T002204		Liquid composite	15,100	14,900	15,000
S98T002205		Liquid composite	15,600	15,800	15,700

Table B2-144. Tank 241-AN-102 Analytical Results: Oxalate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T001773	Riser 20	Centrifuged supernatant	<1,070	---	<1,070
S98T001774		Centrifuged supernatant	<1,070	---	<1,070
S98T001775		Centrifuged supernatant	1,230	1,310	1,270
S98T001776		Centrifuged supernatant	<1,070	---	<1,070
S98T002203		Liquid composite	1,140	1,110	1,130
S98T002204		Liquid composite	924	1,020	972
S98T002205		Liquid composite	1,200	1,210	1,210

Table B2-145. Tank 241-AN-102 Analytical Results: Cyanide (Spec).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S99T000236	Riser 20	Liquid composite	49.4	51	50.2
S99T000237		Liquid composite	49.9	50.5	50.2
S99T000238		Liquid composite	51.6	52.2	51.9

Table B2-146. Tank 241-AN-102 Analytical Results: Aroclor 1016 (SVOA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**µg/g**	**µg/g**	**µg/g**
S98T002197	Riser 20	Solid composite	<0.599	---	<0.599
S98T002198		Solid composite	<0.442	---	<0.442
S98T002199		Solid composite	<0.55	---	<0.55
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002206	Riser 20	Liquid composite	<0.01	<0.01	<0.01
S98T002207		Liquid composite	<0.012	<0.012	<0.012
S98T002208		Liquid composite	<0.012	<0.012	<0.012

Table B2-147. Tank 241-AN-102 Analytical Results: Aroclor 1221 (SVOA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**µg/g**	**µg/g**	**µg/g**
S98T002197	Riser 20	Solid composite	<0.599	---	<0.599
S98T002198		Solid composite	<0.442	---	<0.442
S98T002199		Solid composite	<0.55	---	<0.55
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002206	Riser 20	Liquid composite	<0.01	<0.01	<0.01
S98T002207		Liquid composite	<0.012	<0.012	<0.012
S98T002208		Liquid composite	<0.012	<0.012	<0.012

Table B2-148. Tank 241-AN-102 Analytical Results: Aroclor 1232 (SVOA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**µg/g**	**µg/g**	**µg/g**
S98T002197	Riser 20	Solid composite	<0.599	---	<0.599
S98T002198		Solid composite	<0.442	---	<0.442
S98T002199		Solid composite	<0.55	---	<0.55
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002206	Riser 20	Liquid composite	<0.01	<0.01	<0.01
S98T002207		Liquid composite	<0.012	<0.012	<0.012
S98T002208		Liquid composite	<0.012	<0.012	<0.012

Table B2-149. Tank 241-AN-102 Analytical Results: Aroclor 1242 (SVOA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**µg/g**	**µg/g**	**µg/g**
S98T002197	Riser 20	Solid composite	<0.599	---	<0.599
S98T002198		Solid composite	<0.442	---	<0.442
S98T002199		Solid composite	<0.55	---	<0.55
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002206	Riser 20	Liquid composite	<0.01	<0.01	<0.01
S98T002207		Liquid composite	<0.012	<0.012	<0.012
S98T002208		Liquid composite	<0.012	<0.012	<0.012

Table B2-150. Tank 241-AN-102 Analytical Results: Aroclor 1248 (SVOA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**µg/g**	**µg/g**	**µg/g**
S98T002197	Riser 20	Solid composite	<0.599	---	<0.599
S98T002198		Solid composite	<0.442	---	<0.442
S98T002199		Solid composite	<0.55	---	<0.55
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002206	Riser 20	Liquid composite	<0.01	<0.01	<0.01
S98T002207		Liquid composite	<0.012	<0.012	<0.012
S98T002208		Liquid composite	<0.012	<0.012	<0.012

Table B2-151. Tank 241-AN-102 Analytical Results: Aroclor 1254 (SVOA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**µg/g**	**µg/g**	**µg/g**
S98T002197	Riser 20	Solid composite	<0.599	---	<0.599
S98T002198		Solid composite	<0.442	---	<0.442
S98T002199		Solid composite	<0.55	---	<0.55[QC:c]
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002206	Riser 20	Liquid composite	<0.01	<0.01	<0.01
S98T002207		Liquid composite	<0.012	<0.012	<0.012
S98T002208		Liquid composite	<0.012	<0.012	<0.012

Table B2-152. Tank 241-AN-102 Analytical Results: Aroclor 1260 (SVOA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**µg/g**	**µg/g**	**µg/g**
S98T002197	Riser 20	Solid composite	<0.599	---	<0.599
S98T002198		Solid composite	<0.442	---	<0.442
S98T002199		Solid composite	<0.55	---	<0.55
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002206	Riser 20	Liquid composite	<0.01	<0.01	<0.01
S98T002207		Liquid composite	<0.012	<0.012	<0.012
S98T002208		Liquid composite	<0.012	<0.012	<0.012

Table B2-153. Tank 241-AN-102 Analytical Results: Weight Percent Solids. (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**%**	**%**	**%**
S98T002194	Riser 20	Solid composite	56.8	---	56.8
S98T002195		Solid composite	56.9	---	56.9
S98T002196		Solid composite	57.2	---	57.2
S98T002290		Solid composite	55.1	---	55.1
S98T002291		Solid composite	56.6	---	56.6

Table B2-153. Tank 241-AN-102 Analytical Results: Weight Percent Solids. (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**%**	**%**	**%**
S98T001773	Riser 20	Centrifuged supernatant	50.5	---	50.5
S98T001774		Centrifuged supernatant	50.4	---	50.4
S98T001775		Centrifuged supernatant	50.5	---	50.5
S98T001776		Centrifuged supernatant	50.4	---	50.4
S98T002200		Liquid composite	49.3	49.8	49.5
S98T002201		Liquid composite	50.6	50.5	50.5
S98T002202		Liquid composite	50.6	50.6	50.6
S98T002285		Liquid composite	51	---	51

Table B2-154. Tank 241-AN-102 Analytical Results: Specific Gravity.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**unitless**	**unitless**	**unitless**
S98T002203	Riser 20	Liquid composite	1.48	1.47	1.48
S98T002204		Liquid composite	1.38	1.38	1.38
S98T002205		Liquid composite	1.45	1.42	1.43

Table B2-155. Tank 241-AN-102 Analytical Results: Volume Percent Solids. (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**%**	**%**	**%**
S98T000411	Riser 20	Whole	15.1	---	15.1
S98T000415		Whole	11.6	---	11.6
S98T000425		Whole	7.4	---	7.4
S98T002281		Solid composite	15	---	15
S98T002282		Solid composite	14.9	---	14.9
Liquids			**%**	**%**	**%**
S98T000379	Riser 20	Centrifuged supernatant	<0.5	---	<0.5
S98T000393		Centrifuged supernatant	<0.5	---	<0.5
S98T000397		Centrifuged supernatant	0.7	---	0.7
S98T000401		Centrifuged supernatant	0.6	---	0.6
S98T000402		Centrifuged supernatant	<0.5	---	<0.5
S98T000405		Centrifuged supernatant	0.7	---	0.7

Table B2-155. Tank 241-AN-102 Analytical Results: Volume Percent Solids. (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids (Cont'd)			**%**	**%**	**%**
S98T000414	Riser 20	Centrifuged supernatant	0.6	---	0.6
S98T000416		Centrifuged supernatant	11.4	---	11.4
S98T000417		Centrifuged supernatant	0.6	---	0.6
S98T000418		Centrifuged supernatant	7.5	---	7.5
S98T000422		Centrifuged supernatant	11.1	---	11.1
S98T000423		Centrifuged supernatant	7.8	---	7.8
S98T000424		Centrifuged supernatant	7.7	---	7.7

Table B2-156. Tank 241-AN-102 Analytical Results: Total Alpha.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µCi/g**	**µCi/g**	**µCi/g**
S98T002213	Riser 20	Solid composite	0.747	---	0.747
S98T002215		Solid composite	0.69	---	0.69
S98T002216		Solid composite	0.808	---	0.808
S98T002300		Solid composite	0.505	---	0.505
S98T002301		Solid composite	0.465	---	0.465
Solids: fusion			**µCi/g**	**µCi/g**	**µCi/g**
S98T002210	Riser 20	Solid composite	0.636	---	0.636
S98T002211		Solid composite	0.737	---	0.737
S98T002212		Solid composite	0.637	---	0.637
S98T002295		Solid composite	0.388	---	0.388
S98T002296		Solid composite	0.375	---	0.375
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S98T001773	Riser 20	Centrifuged supernatant	0.19	---	0.19
S98T001774		Centrifuged supernatant	0.202	---	0.202
S98T001775		Centrifuged supernatant	0.209	---	0.209
S98T001776		Centrifuged supernatant	0.18	---	0.18
S98T002200		Liquid composite	0.136	0.159	0.148
S98T002201		Liquid composite	0.174	0.183	0.179
S98T002202		Liquid composite	0.197	0.184	0.191
S98T002285		Liquid composite	0.245	---	0.245

Table B2-157. Tank 241-AN-102 Analytical Results: Total Beta.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S98T001773	Riser 20	Centrifuged supernatant	597	---	597
S98T001774		Centrifuged supernatant	582	---	582
S98T001775		Centrifuged supernatant	597	---	597
S98T001776		Centrifuged supernatant	594	---	594
S98T002200		Liquid composite	558	588	573
S98T002201		Liquid composite	573	589	581
S98T002202		Liquid composite	632	576	604

Table B2-158. Tank 241-AN-102 Analytical Results: Americium-241.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S98T002200	Riser 20	Liquid composite	0.162	0.17	0.166
S98T002201		Liquid composite	0.153	0.164	0.159
S98T002202		Liquid composite	0.158	0.159	0.159

Table B2-159. Tank 241-AN-102 Analytical Results: Cm-243/244.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S98T002200	Riser 20	Liquid composite	<0.014	<0.0155	<0.0148
S98T002201		Liquid composite	<0.0148	<0.0152	<0.015
S98T002202		Liquid composite	<0.0157	<0.0144	<0.0151

Table B2-160. Tank 241-AN-102 Analytical Results: Carbon-14.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S98T002200	Riser 20	Liquid composite	7.38E-04	7.61E-04	7.50E-04
S98T002201		Liquid composite	7.58E-04	7.48E-04	7.53E-04
S98T002202		Liquid composite	7.84E-04	4.37E-04	6.11E-04[QC:e]

Table B2-161. Tank 241-AN-102 Analytical Results: Americium-241 (GEA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µCi/g**	**µCi/g**	**µCi/g**
S98T002213	Riser 20	Solid composite	<1.16	---	<1.16
S98T002215		Solid composite	<1.17	---	<1.17
S98T002216		Solid composite	<1.15	---	<1.15
S98T002300		Solid composite	<0.714	---	<0.714
S98T002301		Solid composite	<0.691	---	<0.691
Solids: fusion			**µCi/g**	**µCi/g**	**µCi/g**
S98T002210	Riser 20	Solid composite	<1.12	---	<1.12
S98T002211		Solid composite	<1.14	---	<1.14
S98T002212		Solid composite	<1.14	---	<1.14
S98T002295		Solid composite	<1.09	---	<1.09
S98T002296		Solid composite	<1.15	---	<1.15
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S98T002200	Riser 20	Liquid composite	<0.174	<0.157	<0.165
S98T002201		Liquid composite	<0.148	<0.207	<0.177
S98T002202		Liquid composite	<0.175	<0.23	<0.203
S98T002285		Liquid composite	<0.217	---	<0.217

Table B2-162. Tank 241-AN-102 Analytical Results: Antimony-125 (GEA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µCi/g**	**µCi/g**	**µCi/g**
S98T002300	Riser 20	Solid composite	<0.489	---	<0.489
S98T002301		Solid composite	<0.479	---	<0.479
Solids: fusion			**µCi/g**	**µCi/g**	**µCi/g**
S98T002295	Riser 20	Solid composite	<0.643	---	<0.643
S98T002296		Solid composite	<0.668	---	<0.668
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S98T002200	Riser 20	Liquid composite	<0.064	---	<0.064
S98T002201		Liquid composite	<0.628	---	<0.628
S98T002202		Liquid composite	<0.666	---	<0.666
S98T002285		Liquid composite	<0.151	---	<0.151

Table B2-163. Tank 241-AN-102 Analytical Results: Cesium-137 (GEA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µCi/g**	**µCi/g**	**µCi/g**
S98T002213	Riser 20	Solid composite	248	---	248
S98T002215		Solid composite	249	---	249
S98T002216		Solid composite	241	---	241
S98T002300		Solid composite	244	---	244
S98T002301		Solid composite	245	---	245
Solids: fusion			**µCi/g**	**µCi/g**	**µCi/g**
S98T002210	Riser 20	Solid composite	237	---	237
S98T002211		Solid composite	239	---	239
S98T002212		Solid composite	249	---	249
S98T002295		Solid composite	222	---	222
S98T002296		Solid composite	238	---	238
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S98T002200	Riser 20	Liquid composite	378	406	392
S98T002201		Liquid composite	363	395	379
S98T002202		Liquid composite	407	373	390
S98T002285		Liquid composite	107	---	107

Table B2-164. Tank 241-AN-102 Analytical Results: Cobalt-60 (GEA). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µCi/g**	**µCi/g**	**µCi/g**
S98T002213	Riser 20	Solid composite	0.0881	---	0.0881
S98T002215		Solid composite	0.0845	---	0.0845
S98T002216		Solid composite	0.102	---	0.102
S98T002300		Solid composite	0.102	---	0.102
S98T002301		Solid composite	0.0808	---	0.0808
Solids: fusion			**µCi/g**	**µCi/g**	**µCi/g**
S98T002210	Riser 20	Solid composite	0.0659	---	0.0659
S98T002211		Solid composite	0.0892	---	0.0892
S98T002212		Solid composite	0.112	---	0.112
S98T002295		Solid composite	0.0904	---	0.0904
S98T002296		Solid composite	0.0772	---	0.0772

Table B2-164. Tank 241-AN-102 Analytical Results: Cobalt-60 (GEA). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S98T002200	Riser 20	Liquid composite	0.126	0.151	0.139
S98T002201		Liquid composite	0.123	0.136	0.13
S98T002202		Liquid composite	0.12	0.113	0.116
S98T002285		Liquid composite	0.0371	---	0.0371

Table B2-165. Tank 241-AN-102 Analytical Results: Europium-154 (GEA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µCi/g**	**µCi/g**	**µCi/g**
S98T002213	Riser 20	Solid composite	0.848	---	0.848
S98T002215		Solid composite	0.868	---	0.868
S98T002216		Solid composite	0.948	---	0.948
S98T002300		Solid composite	0.624	---	0.624
S98T002301		Solid composite	0.622	---	0.622
Solids: fusion			**µCi/g**	**µCi/g**	**µCi/g**
S98T002210	Riser 20	Solid composite	0.684	---	0.684
S98T002211		Solid composite	0.658	---	0.658
S98T002212		Solid composite	0.82	---	0.82
S98T002295		Solid composite	0.501	---	0.501
S98T002296		Solid composite	0.513	---	0.513
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S98T002200	Riser 20	Liquid composite	0.354	0.411	0.382
S98T002201		Liquid composite	0.324	0.3	0.312
S98T002202		Liquid composite	0.337	0.21	0.274[QC:e]
S98T002285		Liquid composite	0.105	---	0.105

Table B2-166. Tank 241-AN-102 Analytical Results: Europium-155 (GEA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µCi/g**	**µCi/g**	**µCi/g**
S98T002213	Riser 20	Solid composite	0.777	---	0.777
S98T002215		Solid composite	<0.739	---	<0.739
S98T002216		Solid composite	<0.613	---	<0.613
S98T002300		Solid composite	<0.414	---	<0.414
S98T002301		Solid composite	<0.42	---	<0.42
Solids: fusion			**µCi/g**	**µCi/g**	**µCi/g**
S98T002210	Riser 20	Solid composite	<0.649	---	<0.649
S98T002211		Solid composite	<0.598	---	<0.598
S98T002212		Solid composite	<0.635	---	<0.635
S98T002295		Solid composite	<0.362	---	<0.362
S98T002296		Solid composite	<0.376	---	<0.376
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S98T002200	Riser 20	Liquid composite	<0.172	<0.179	<0.176
S98T002201		Liquid composite	<0.169	<0.175	<0.172
S98T002202		Liquid composite	<0.178	<0.171	<0.175
S98T002285		Liquid composite	<0.0913	---	<0.0913

Table B2-167. Tank 241-AN-102 Analytical Results: Iodine-129.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S98T002200	Riser 20	Liquid composite	1.45E-04	1.30E-04	1.37E-04[QC:a]
S98T002201		Liquid composite	1.41E-04	<1.12E-04	<1.27E-04[QC:a,e]
S98T002202		Liquid composite	1.22E-04	1.27E-04	1.24E-04[QC:a]

Table B2-168. Tank 241-AN-102 Analytical Results: Atomic Mass Unit 232 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002203	Riser 20	Liquid composite	1.97	1.99	1.98
S98T002204		Liquid composite	1.92	1.83	1.88
S98T002205		Liquid composite	2.24	2.21	2.22

Table B2-169. Tank 241-AN-102 Analytical Results: Atomic Mass Unit 238 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002203	Riser 20	Liquid composite	6.08	6.27	6.17
S98T002204		Liquid composite	5.64	5.93	5.78
S98T002205		Liquid composite	6.77	6.95	6.86

Table B2-170. Tank 241-AN-102 Analytical Results: Atomic Mass Unit 241 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002203	Riser 20	Liquid composite	<0.104	<0.104	<0.104
S98T002204		Liquid composite	<0.104	<0.104	<0.104
S98T002205		Liquid composite	<0.104	<0.104	<0.104

Table B2-171. Tank 241-AN-102 Analytical Results: Atomic Mass Unit 242 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002203	Riser 20	Liquid composite	<0.127	<0.127	<0.127
S98T002204		Liquid composite	<0.127	<0.127	<0.127
S98T002205		Liquid composite	<0.127	<0.127	<0.127

Table B2-172. Tank 241-AN-102 Analytical Results: Atomic Mass Unit 243 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002203	Riser 20	Liquid composite	<0.101	---	<0.101
S98T002204		Liquid composite	<0.101	<0.101	<0.101
S98T002205		Liquid composite	<0.101	<0.101	<0.101

Table B2-173. Tank 241-AN-102 Analytical Results: Atomic Mass Unit 244 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S98T002203	Riser 20	Liquid composite	<0.0823	<0.0823	<0.0823
S98T002204		Liquid composite	<0.0823	<0.0823	<0.0823
S98T002205		Liquid composite	<0.0823	<0.0823	<0.0823

Table B2-174. Tank 241-AN-102 Analytical Results: Atomic Mass Unit 99 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S98T002203	Riser 20	Liquid composite	8.38	8.18	8.28
S98T002204		Liquid composite	8.25	8.12	8.18
S98T002205		Liquid composite	8.29	8.18	8.23

Table B2-175. Tank 241-AN-102 Analytical Results: Cesium 133 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S98T002203	Riser 20	Liquid composite	11.9	11.8	11.9
S98T002204		Liquid composite	11.5	11.3	11.4
S98T002205		Liquid composite	11.4	11.5	11.4

Table B2-176. Tank 241-AN-102 Analytical Results: Cesium 135 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S98T002203	Riser 20	Liquid composite	3.14	3.01	3.08
S98T002204		Liquid composite	2.94	2.95	2.95
S98T002205		Liquid composite	2.96	3.08	3.02

Table B2-177. Tank 241-AN-102 Analytical Results: Cesium-137 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S98T002203	Riser 20	Liquid composite	5.69	5.68	5.69
S98T002204		Liquid composite	5.44	5.32	5.38
S98T002205		Liquid composite	5.48	5.57	5.53

Table B2-178. Tank 241-AN-102 Analytical Results: Neptunium-237 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S98T002203	Riser 20	Liquid composite	<0.277	<0.277	<0.277
S98T002204		Liquid composite	<0.277	<0.277	<0.277
S98T002205		Liquid composite	<0.277	<0.277	<0.277

Table B2-179. Tank 241-AN-102 Analytical Results: Plutonium-239 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S98T002203	Riser 20	Liquid composite	<0.161	<0.161	<0.161
S98T002204		Liquid composite	<0.161	<0.161	<0.161
S98T002205		Liquid composite	<0.161	<0.161	<0.161

Table B2-180. Tank 241-AN-102 Analytical Results: Plutonium-240 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S98T002203	Riser 20	Liquid composite	<0.0787	<0.0787	<0.0787
S98T002204		Liquid composite	<0.0787	<0.0787	<0.0787
S98T002205		Liquid composite	<0.0787	<0.0787	<0.0787

Table B2-181. Tank 241-AN-102 Analytical Results: Protactinium-231 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002203	Riser 20	Liquid composite	<0.118	---	<0.118
S98T002204		Liquid composite	<0.118	---	<0.118
S98T002205		Liquid composite	<0.118	---	<0.118

Table B2-182. Tank 241-AN-102 Analytical Results: Thorium-229 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002203	Riser 20	Liquid composite	<0.143	<0.143	<0.143
S98T002204		Liquid composite	<0.143	<0.143	<0.143
S98T002205		Liquid composite	<0.143	<0.143	<0.143

Table B2-183. Tank 241-AN-102 Analytical Results: Thorium-230 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002203	Riser 20	Liquid composite	<0.283	<0.283	<0.283
S98T002204		Liquid composite	<0.283	<0.283	<0.283
S98T002205		Liquid composite	<0.283	<0.283	<0.283

Table B2-184. Tank 241-AN-102 Analytical Results: Tin 126 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002203	Riser 20	Liquid composite	<0.887	<1.18	<1.03
S98T002204		Liquid composite	<1.11	<0.741	<0.926
S98T002205		Liquid composite	<0.664	<0.802	<0.733

Table B2-185. Tank 241-AN-102 Analytical Results: Uranium-233 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S98T002203	Riser 20	Liquid composite	<0.206	<0.206	<0.206
S98T002204		Liquid composite	<0.206	<0.206	<0.206
S98T002205		Liquid composite	<0.206	<0.206	<0.206

Table B2-186. Tank 241-AN-102 Analytical Results: Uranium-234 (ICP/MS.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S98T002203	Riser 20	Liquid composite	<0.126	<0.126	<0.126
S98T002204		Liquid composite	<0.126	<0.126	<0.126
S98T002205		Liquid composite	<0.126	<0.126	<0.126

Table B2-187. Tank 241-AN-102 Analytical Results: Uranium-235 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S98T002203	Riser 20	Liquid composite	<0.329	<0.329	<0.329
S98T002204		Liquid composite	<0.329	<0.329	<0.329
S98T002205		Liquid composite	<0.329	<0.329	<0.329

Table B2-188. Tank 241-AN-102 Analytical Results: Uranium-236 (ICP/MS).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S98T002203	Riser 20	Liquid composite	<0.192	<0.191	<0.191
S98T002204		Liquid composite	<0.192	<0.191	<0.191
S98T002205		Liquid composite	<0.192	<0.191	<0.191

Table B2-189. Tank 241-AN-102 Analytical Results: Neptunium-237.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S98T002200	Riser 20	Liquid composite	<0.00197	<0.00197	<0.00197[QC:a]
S98T002201		Liquid composite	<0.00228	<0.00213	<0.00221[QC:a]
S98T002202		Liquid composite	<0.00197	<0.00243	<0.0022[QC:a]

Table B2-190. Tank 241-AN-102 Analytical Results: Tritium (Scintillation).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S98T002200	Riser 20	Liquid composite	2.44E-04	1.69E-04	2.06E-04[QC:e]
S98T002201		Liquid composite	5.89E-04	3.01E-04	4.45E-04[QC:e]
S98T002202		Liquid composite	0.002	0.00109	0.00155[QC:e]

Table B2-191. Tank 241-AN-102 Analytical Results: Selenium-79 (Se79).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S98T002200	Riser 20	Liquid composite	6.28E-04	4.93E-04	5.61E-04[QC:e]
S98T002201		Liquid composite	6.38E-04	6.43E-04	6.41E-04
S98T002202		Liquid composite	6.25E-04	5.97E-04	6.11E-04

Table B2-192. Tank 241-AN-102 Analytical Results: Strontium-89/90. (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: acid digest			**µCi/g**	**µCi/g**	**µCi/g**
S98T002213	Riser 20	Solid composite	132	---	132
S98T002215		Solid composite	130	---	130
S98T002216		Solid composite	142	---	142
S98T002300		Solid composite	107	---	107
S98T002301		Solid composite	105	---	105

Table B2-192. Tank 241-AN-102 Analytical Results: Strontium-89/90. (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: fusion			**µCi/g**	**µCi/g**	**µCi/g**
S98T002210	Riser 20	Solid composite	133	---	133
S98T002211		Solid composite	131	---	131
S98T002212		Solid composite	134	---	134
S98T002295		Solid composite	104	---	104
S98T002296		Solid composite	103	---	103
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S98T002200	Riser 20	Liquid composite	83.3	86.6	84.9
S98T002201		Liquid composite	98.7	87.9	93.3
S98T002202		Liquid composite	95	88.4	91.7
S98T002285		Liquid composite	83.8	---	83.8

Table B2-193. Tank 241-AN-102 Analytical Results: Total Organic Carbon (Furnace Oxidation).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002200	Riser 20	Liquid composite	25,300	25,300	25,300
S98T002201		Liquid composite	25,400	24,900	25,200
S98T002202		Liquid composite	25,400	27,400	26,400
S98T002285		Liquid composite	24,300	---	24,300
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S98T002217	Riser 20	Solid composite	24,000	---	24,000
S98T002218		Solid composite	25,300	---	25,300
S98T002219		Solid composite	25,500	---	25,500
S98T002305		Solid composite	34,600	---	34,600
S98T002306		Solid composite	37,400	---	37,400

Table B2-194. Tank 241-AN-102 Analytical Results: Ammonia (Ion Sel. Electrode).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002203	Riser 20	Liquid composite	109	108	109
S98T002204		Liquid composite	150	140	145
S98T002205		Liquid composite	146	141	144

Table B2-195. Tank 241-AN-102 Analytical Results: Hydroxide (OH Direct).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S98T002217	Riser 20	Solid composite	<24,700	---	<24,700
S98T002218		Solid composite	<24,600	---	<24,600
S98T002219		Solid composite	<24,800	---	<24,800
S98T002305		Solid composite	<42	---	<42
S98T002306		Solid composite	<42	---	<42
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002203	Riser 20	Liquid composite	2,540	2,410	2,480
S98T002204		Liquid composite	2,620	2,580	2,600
S98T002205		Liquid composite	2,710	2,600	2,660
S98T002285		Liquid composite	2,730	---	2,730

Table B2-196. Tank 241-AN-102 Analytical Results: Total Inorganic Carbon (Persulfate). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**µg/g**	**µg/g**	**µg/g**
S98T002194	Riser 20	Solid composite	10,300	---	10,300
S98T002195		Solid composite	10,400	---	10,400
S98T002196		Solid composite	10,600	---	10,600
S98T002290		Solid composite	10,300	---	10,300
S98T002291		Solid composite	9,100	---	9,100

Table B2-196. Tank 241-AN-102 Analytical Results: Total Inorganic Carbon (Persulfate). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002200	Riser 20	Liquid composite	12,800	12,500	12,700
S98T002201		Liquid composite	13,400	16,100	14,800
98T002202		Liquid composite	14,900	13,600	14,300
S98T002285		Liquid composite	14,400	---	14,400

Table B2-197. Tank 241-AN-102 Analytical Results: Total Organic Carbon (Persulfate).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**µg/g**	**µg/g**	**µg/g**
S98T002194	Riser 20	Solid composite	25,800	---	25,800
S98T002195		Solid composite	27,200	---	27,200
S98T002196		Solid composite	26,300	---	26,300
S98T002290		Solid composite	23,100	---	23,100
S98T002291		Solid composite	21,500	---	21,500
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S98T002200	Riser 20	Liquid composite	22,300	22,100	22,200
S98T002201		Liquid composite	23,800	28,600	26,200
S98T002202		Liquid composite	26,500	24,100	25,300
S98T002285		Liquid composite	22,400	---	22,400

B2.7.3 1994/1995 Grab Sample Data Tables

Because the 1994 supernatant data resides in the historical database, it can not be found in the Tank Characterization Database. Consequently, this data will not be included during generation of the AutoTCR. For this reason, the data have been presented separately from the remainder of the 1994/1995 data. Section B2.7.3.1 displays the 1995 grab sample data and the 1994 sludge data, while Section B2.7.3.2 shows the 1994 supernatant data.

B2.7.3.1 1994 Sludge/1995 Grab Sample Data Tables

Table B2-198. Tank 241-AN-102 Analytical Results: Aluminum (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S95T003867	Riser 21A	Centrifuged supernatant	15,200	14,800	15,000
S95T003868		Centrifuged supernatant	14,400	14,800	14,600
S95T003869		Centrifuged supernatant	16,300	16,000	16,200

Table B2-199. Tank 241-AN-102 Analytical Results: Chromium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S95T003867	Riser 21A	Centrifuged supernatant	327	297	312
S95T003868		Centrifuged supernatant	283	287	285
S95T003869		Centrifuged supernatant	336	320	328

Table B2-200. Tank 241-AN-102 Analytical Results: Iron (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S95T003867	Riser 21A	Centrifuged supernatant	65.7	47.3	56.5[QC:e]
S95T003868		Centrifuged supernatant	41	39.9	40.5
S95T003869		Centrifuged supernatant	61.3	50.4	55.9

Table B2-201. Tank 241-AN-102 Analytical Results: Manganese (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S95T003867	Riser 21A	Centrifuged supernatant	68.3	24	46.1[QC:e]
S95T003868		Centrifuged supernatant	21.3	20.2	20.8
S95T003869		Centrifuged supernatant	66.8	34	50.4[QC:e]

Table B2-202. Tank 241-AN-102 Analytical Results: Nickel (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S95T003867	Riser 21A	Centrifuged supernatant	403	381	392
S95T003868		Centrifuged supernatant	381	381	381
S95T003869		Centrifuged supernatant	429	422	426

Table B2-203. Tank 241-AN-102 Analytical Results: Silicon (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S95T003867	Riser 21A	Centrifuged supernatant	20.9	<20	<20.5
S95T003868		Centrifuged supernatant	<20	<20	<20
S95T003869		Centrifuged supernatant	20.1	<20	<20.1

Table B2-204. Tank 241-AN-102 Analytical Results: Sodium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S95T003867	Riser 21A	Centrifuged supernatant	2.21E+05	2.16E+05	2.19E+05
S95T003868		Centrifuged supernatant	2.11E+05	2.16E+05	2.14E+05
S95T003869		Centrifuged supernatant	2.37E+05	2.34E+05	2.36E+05

Table B2-205. Tank 241-AN-102 Analytical Results: Total Uranium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S95T003867	Riser 21A	Centrifuged supernatant	<200	<200	<200
S95T003868		Centrifuged supernatant	<200	<200	<200
S95T003869		Centrifuged supernatant	<200	<200	<200

Table B2-206. Tank 241-AN-102 Analytical Results: Cyanide.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**µg/g**	**µg/g**	**µg/g**
S95T004137	Riser 21A	Centrifuged solid	21.7	20.3	21
S95T004139		Centrifuged solid	20.7	20.9	20.8

Table B2-207. Tank 241-AN-102 Analytical Results: Chloride (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S95T003867	Riser 21A	Centrifuged supernatant	2,980	3,320	3,150
S95T003868		Centrifuged supernatant	4,720	4,880	4,800
S95T003869		Centrifuged supernatant	3,460	3,610	3,530

Table B2-208. Tank 241-AN-102 Analytical Results: Fluoride (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S95T003867	Riser 21A	Centrifuged supernatant	<133	<133	<133[QC:d]
S95T003868		Centrifuged supernatant	<133	<133	<133
S95T003869		Centrifuged supernatant	1,450	1,450	1,450

Table B2-209. Tank 241-AN-102 Analytical Results: Nitrate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S95T003867	Riser 21A	Centrifuged supernatant	1.63E+05	1.93E+05	1.78E+05
S95T003868		Centrifuged supernatant	2.83E+05	2.99E+05	2.91E+05
S95T003869		Centrifuged supernatant	1.96E+05	1.97E+05	1.96E+05[QC:d]

Table B2-210. Tank 241-AN-102 Analytical Results: Nitrite (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S95T003867	Riser 21A	Centrifuged supernatant	60,400	71,400	65,900
S95T003868		Centrifuged supernatant	1.04E+05	1.10E+05	1.07E+05
S95T003869		Centrifuged supernatant	73,200	72,700	72,900

Table B2-211. Tank 241-AN-102 Analytical Results: Phosphate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S95T003867	Riser 21A	Centrifuged supernatant	3,530	4,150	3,840
S95T003868		Centrifuged supernatant	6,230	5,990	6,110
S95T003869		Centrifuged supernatant	4,220	4,170	4,200

Table B2-212. Tank 241-AN-102 Analytical Results: Sulfate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S95T003867	Riser 21A	Centrifuged supernatant	10,500	12,200	11,300
S95T003868		Centrifuged supernatant	16,800	17,400	17,100
S95T003869		Centrifuged supernatant	12,700	12,800	12,800

Table B2-213. Tank 241-AN-102 Analytical Results: Bulk Density.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**g/mL**	**g/mL**	**g/mL**
S95T003960	Riser 21A	Slurry	1.5	n/a	1.5
S95T004137		Centrifuged solid	1.57	n/a	1.57
S95T004139		Centrifuged solid	1.58	n/a	1.58
S95T003959	Riser 22A	Slurry	1.35	n/a	1.35
S96T000003		Centrifuged solid	1.64	n/a	1.64
S96T000004		Centrifuged solid	1.56	n/a	1.56
Liquids			**g/mL**	**g/mL**	**g/mL**
S95T004133	Riser 21A	Centrifuged supernatant	1.35	n/a	1.35
S95T004135		Centrifuged supernatant	1.39	n/a	1.39
S96T000005	Riser 22A	Centrifuged supernatant	1.28	n/a	1.28
S96T000006		Centrifuged supernatant	1.39	n/a	1.39

Table B2-214. Tank 241-AN-102 Analytical Results: Exotherm (DSC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**J/g**	**J/g**	**J/g**
S95T004137	Riser 21A	Centrifuged solid	280	263	271
S95T004139		Centrifuged solid	283	328	305
Liquids			**J/g**	**J/g**	**J/g**
S95T003869	Riser 21A	Centrifuged supernatant	277	283	280
S95T004133		Centrifuged supernatant	258	252	255
S95T004135		Centrifuged supernatant	280	300	290
S96T000006	Riser 22A	Centrifuged supernatant	---	27.5	27.5
S95T003982		Centrifuged supernatant	284	317	301
S95T003983		Centrifuged supernatant	361	281	321[QC:e]
S95T003984		Centrifuged supernatant	223	197	210
S96T000005		Centrifuged supernatant	237	230	234

Table B2-215. Tank 241-AN-102 Analytical Results: Exotherms - Calculated Dry Weight (DSC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**J/g DW**	**J/g DW**	**J/g DW**
S95T004137	Riser 21A	Centrifuged solid	488	---	488
S95T004139		Centrifuged solid	492	---	492
Liquids			**J/g DW**	**J/g DW**	**J/g DW**
S95T003867	Riser 21A	Centrifuged supernatant	558	---	558
S95T003868		Centrifuged supernatant	1,200	---	1,200
S95T003869		Centrifuged supernatant	555	---	555
S95T004133		Centrifuged supernatant	487	---	487
S95T004135		Centrifuged supernatant	556	---	556
S95T003982	Riser 22A	Centrifuged supernatant	564	629	597
S95T003983		Centrifuged supernatant	720	560	640[QC:e]
S95T003984		Centrifuged supernatant	441	389	415
S96T000005		Centrifuged supernatant	466	452	459
S96T000006		Centrifuged supernatant	---	52.2	52.2

Note:

DW = dry weight

Table B2-216. Tank 241-AN-102 Analytical Results: Percent Water (TGA). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**%**	**%**	**%**
S95T004137	Riser 21A	Centrifuged solid	43.4	42.1	42.7
S95T004139	Riser 21A	Centrifuged solid	43.5	41.4	42.4
S96T000003	Riser 22A	Centrifuged solid	35.6	36	35.8
S96T000004		Centrifuged solid	44.3	43.7	44
Liquids			**%**	**%**	**%**
S95T003867	Riser 21A	Centrifuged supernatant	49.7	48.5	49.1
S95T004133		Centrifuged supernatant	45.3	48.8	47
S95T004135		Centrifuged supernatant	48.5	51	49.7
S95T003868		Centrifuged supernatant	48.6	49.4	48.7
S95T003869		Centrifuged supernatant	50.1	50	50.1

Table B2-216. Tank 241-AN-102 Analytical Results: Percent Water (TGA). (2 sheets)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids (Cont'd)			**%**	**%**	**%**
S95T003982	Riser 22A	Centrifuged supernatant	50.1	49.1	49.6
S95T003983		Centrifuged supernatant	49.8	49.9	49.8
S95T003984		Centrifuged supernatant	49.3	49.4	49.4
S96T000005		Centrifuged supernatant	49.1	49.1	49.1
S96T000006		Centrifuged supernatant	47.6	47.2	47.4

Table B-217. Tank 241-AN-102 Analytical Results: pH.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**unitless**	**unitless**	**unitless**
S95T003867	Riser 21A	Centrifuged supernatant	13.3	13.3	13.3
S95T003868		Centrifuged supernatant	13.3	13.3	13.3
S95T003869		Centrifuged supernatant	13.3	13.3	13.3

Table B2-218. Tank 241-AN-102 Analytical Results: Specific Gravity.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**unitless**	**unitless**	**unitless**
S95T003867	Riser 21A	Centrifuged supernatant	1.39	1.38	1.39
S95T003868		Centrifuged supernatant	1.43	1.4	1.42
S95T003869		Centrifuged supernatant	1.39	1.38	1.39
S95T003982	Riser 22A	Centrifuged supernatant	1.44	1.43	1.44
S95T003983		Centrifuged supernatant	1.39	1.51	1.45
S95T003984		Centrifuged supernatant	1.37	1.48	1.43

Table B2-219. Tank 241-AN-102 Analytical Results: Volume Percent Solids.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			**%**	**%**	**%**
S95T003960	Riser 21A	Slurry	46.6	---	46.6
S95T003959	Riser 22A	Slurry	53.6	---	53.6
S96T000003		Centrifuged solid	61.2	---	61.2
S96T000004		Centrifuged solid	50	---	50

Table B2-220. Tank 241-AN-102 Analytical Results: Total Alpha.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids: fusion			**µCi/g**	**µCi/g**	**µCi/g**
S95T004141	Riser 21A	Centrifuged solid	0.459	0.464	0.462[QC:c]
S95T004142		Centrifuged solid	0.329	0.333	0.331
S96T000007	Riser 22A	Centrifuged solid	0.306	0.332	0.319
S96T000008		Centrifuged solid	0.952	0.778	0.865[QC:e]
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S95T003870	Riser 21A	Centrifuged supernatant	0.175	0.173	0.174
S95T003871		Centrifuged supernatant	0.182	0.169	0.176
S95T003872		Centrifuged supernatant	0.169	0.202	0.186
S95T004133		Centrifuged supernatant	0.168	0.171	0.17
S95T004135		Centrifuged supernatant	0.137	0.153	0.145
S95T003982	Riser 22A	Centrifuged supernatant	0.144	0.156	0.15
S95T003983		Centrifuged supernatant	0.116	0.116	0.116
S95T003984		Centrifuged supernatant	0.159	0.174	0.167
S96T000005		Centrifuged supernatant	0.175	0.208	0.192
S96T000006		Centrifuged supernatant	0.239	0.218	0.229

Table B2-221. Tank 241-AN-102 Analytical Results: Americium-241.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S95T003870	Riser 21A	Centrifuged supernatant	0.167	0.163	0.165
S95T003871		Centrifuged supernatant	0.123	0.108	0.115
S95T003872		Centrifuged supernatant	0.129	0.135	0.132

Table B2-222. Tank 241-AN-102 Analytical Results: Cesium-137 (GEA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S95T003870	Riser 21A	Centrifuged supernatant	322	323	323
S95T003871		Centrifuged supernatant	313	312	313
S95T003872		Centrifuged supernatant	323	328	326

Table B2-223. Tank 241-AN-102 Analytical Results: Cobalt-60 (GEA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S95T003870	Riser 21A	Centrifuged supernatant	0.143	0.151	0.147
S95T003871		Centrifuged supernatant	0.148	0.157	0.153
S95T003872		Centrifuged supernatant	0.142	0.144	0.143

Table B2-224. Tank 241-AN-102 Analytical Results: Plutonium-239/240.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S95T003870	Riser 21A	Centrifuged supernatant	0.00652	0.00658	0.00655
S95T003871		Centrifuged supernatant	0.00519	0.00524	0.00522
S95T003872		Centrifuged supernatant	0.00568	0.00571	0.0057

Table B2-225. Tank 241-AN-102 Analytical Results: Strontium-89/90.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µCi/mL**	**µCi/mL**	**µCi/mL**
S95T003870	Riser 21A	Centrifuged supernatant	71.3	75.1	73.2
S95T003871		Centrifuged supernatant	74.4	73.9	74.2
S95T003872		Centrifuged supernatant	78.2	79.4	78.8

Table B2-226. Tank 241-AN-102 Analytical Results: Total Organic Carbon (Furnace Oxidation).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S95T003867	Riser 21A	Centrifuged supernatant	27,900	25,700	26,800
S95T003868		Centrifuged supernatant	24,800	26,500	25,700
S95T003869		Centrifuged supernatant	26,500	25,100	25,800
S95T003982	Riser 22A	Centrifuged supernatant	26,900	26,200	26,600
S95T003983		Centrifuged supernatant	25,700	27,500	26,600
S95T003984		Centrifuged supernatant	25,700	25,100	25,400
S95T004133	Riser 21A	Centrifuged supernatant	24,100	25,900	25,000
S95T004135		Centrifuged supernatant	24,300	25,100	24,700

Table B2-227. Tank 241-AN-102 Analytical Results: Hydroxide (OH Direct).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S95T003867	Riser 21A	Centrifuged supernatant	3,310	3,080	3,200
S95T003868	---	Centrifuged supernatant	3,310	3,240	3,280
S95T003869		Centrifuged supernatant	3,100	3,310	3,210

Table B2-228. Tank 241-AN-102 Analytical Results: Total Inorganic Carbon.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Liquids			µg/mL	µg/mL	µg/mL
S95T003867	Riser 21A	Centrifuged supernatant	12,200	12,500	12,400
S95T003868		Centrifuged supernatant	13,100	13,500	13,300
S95T003869		Centrifuged supernatant	13,000	13,400	13,200

Table B2-229. Tank 241-AN-102 Analytical Results: Total Organic Carbon (Persulfate).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Average
Solids			µg/g	µg/g	µg/g
S95T004137	Riser 21A	Centrifuged solid	26,000	27,000	26,500
S95T004139		Centrifuged solid	19,700	22,600	21,200

B2.7.3.2 1994 Supernatant Data Tables

Table B2-230. Tank 241-AN-102 Analytical Results: Aluminum (ICP).

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				µg/mL	µg/mL	µg/mL
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	15,100	14,600	14,900
n/a	102-AN-2(A)		Centrifuged supernatant	15,700	14,000	14,900
n/a	102-AN-4		Centrifuged supernatant	15,100	14,900	15,000

Table B2-231. Tank 241-AN-102 Analytical Results: Calcium (ICP).

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				µg/mL	µg/mL	µg/mL
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	441	441	441
n/a	102-AN-2(A)		Centrifuged supernatant	441	401	421
n/a	102-AN-4		Centrifuged supernatant	441	441	441

Table B2-232. Tank 241-AN-102 Analytical Results: Chromium (ICP).

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				µg/mL	µg/mL	µg/mL
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	312	260	286
n/a	102-AN-2(A)		Centrifuged supernatant	312	260	286
n/a	102-AN-4		Centrifuged supernatant	312	260	286

Table B2-233. Tank 241-AN-102 Analytical Results: Nickel (ICP).

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				µg/mL	µg/mL	µg/mL
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	352	352	352
n/a	102-AN-2(A)		Centrifuged supernatant	411	352	382
n/a	102-AN-4		Centrifuged supernatant	352	352	352

Table B2-234. Tank 241-AN-102 Analytical Results: Phosphorus (ICP).

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				µg/mL	µg/mL	µg/mL
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	1,610	1,580	1,600
n/a	102-AN-2(A)		Centrifuged supernatant	1,700	1,550	1,630
n/a	102-AN-4		Centrifuged supernatant	1,610	1,610	1,610

Table B2-235. Tank 241-AN-102 Analytical Results: Potassium (ICP).

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				µg/mL	µg/mL	µg/mL
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	2,420	4,500	3,460[QC:e]
n/a	102-AN-2(A)		Centrifuged supernatant	3,280	4,340	3,810[QC:e]
n/a	102-AN-4		Centrifuged supernatant	4,030	4,690	4,360

Table B2-236. Tank 241-AN-102 Analytical Results: Sodium (ICP).

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				µg/mL	µg/mL	µg/mL
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	2.52E+05	2.89E+05	2.71E+05
n/a	102-AN-2(A)		Centrifuged supernatant	2.58E+05	2.36E+05	2.47E+05
n/a	102-AN-4		Centrifuged supernatant	2.78E+05	2.32E+05	2.55E+05

Table B2-237. Tank 241-AN-102 Analytical Results: Sulfur (ICP).

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				µg/mL	µg/mL	µg/mL
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	4,870	4,650	4,760
n/a	102-AN-2(A)		Centrifuged supernatant	4,940	4,460	4,700
n/a	102-AN-4		Centrifuged supernatant	4,840	4,740	4,790

Table B2-238. Tank 241-AN-102 Analytical Results: Hydroxide.

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				µg/mL	µg/mL	µg/mL
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	3,910	4,080	4,000
n/a	102-AN-2(A)		Centrifuged supernatant	3,910	4,080	4,000
n/a	102-AN-4		Centrifuged supernatant	4,250	3,740	4,000

Table B2-239. Tank 241-AN-102 Analytical Results: Chloride (IC).

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				µg/mL	µg/mL	µg/mL
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	4,610[1]	3,550	3,550
n/a	102-AN-2(A)		Centrifuged supernatant	3,900	3,550	3,730
n/a	102-AN-4		Centrifuged supernatant	4,250	3,900	4,080

Note:

[1]Value was not used in the mean calculations as directed by Herting (1994).

Table B2-240. Tank 241-AN-102 Analytical Results: Fluoride (IC).

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				**µg/mL**	**µg/mL**	**µg/mL**
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	2,470[1]	1,900	1,900
n/a	102-AN-2(A)		Centrifuged supernatant	1,900	1,900	1,900
n/a	102-AN-4		Centrifuged supernatant	2,280	2,090	2,190

Note:

[1]Value was not used in the mean calculations as directed by Herting (1994).

Table B2-241. Tank 241-AN-102 Analytical Results: Nitrate (IC).

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				**µg/mL**	**µg/mL**	**µg/mL**
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	2.65E+05	2.20E+05	2.43E+05
n/a	102-AN-2(A)		Centrifuged supernatant	2.32E+05	2.10E+05	2.21E+05
n/a	102-AN-4		Centrifuged supernatant	2.31E+05	2.15E+05	2.23E+05

Table B2-242. Tank 241-AN-102 Analytical Results: Nitrite (IC).

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				**µg/mL**	**µg/mL**	**µg/mL**
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	97,500[1]	82,300	82,300
n/a	102-AN-2(A)		Centrifuged supernatant	87,900	78,700	83,300
n/a	102-AN-4		Centrifuged supernatant	86,900	81,900	84,400

Note:

[1]Value was not used in the mean calculations as directed by Herting (1994).

Table B2-243. Tank 241-AN-102 Analytical Results: Phosphate (IC).

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				µg/mL	µg/mL	µg/mL
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	5,890[1]	4,750	4,750
n/a	102-AN-2(A)		Centrifuged supernatant	4,940	4,650	4,800
n/a	102-AN-4		Centrifuged supernatant	5,410	5,030	5,220

Note:

[1]Value was not used in the mean calculations as directed by Herting (1994).

Table B2-244. Tank 241-AN-102 Analytical Results: Sulfate (IC).

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				µg/mL	µg/mL	µg/mL
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	17,300[1]	13,400	13,400
n/a	102-AN-2(A)		Centrifuged supernatant	13,400	13,400	13,400
n/a	102-AN-4		Centrifuged supernatant	15,400	14,400	14,900

Note:

[1]Value was not used in the mean calculations as directed by Herting (1994).

Table B2-245. Tank 241-AN-102 Analytical Results: Cesium-137.

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				µCi/mL	µCi/mL	µCi/mL
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	383	381	382
n/a	102-AN-2(A)		Centrifuged supernatant	392	378	385
n/a	102-AN-4		Centrifuged supernatant	384	372	378

Table B2-246. Tank 241-AN-102 Analytical Results: Strontium-89/90.

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				µCi/mL	µCi/mL	µCi/mL
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	74.4	74.2	74.3
n/a	102-AN-2(A)		Centrifuged supernatant	74.5	74.0	74.3
n/a	102-AN-4		Centrifuged supernatant	73.8	71.2	72.5

Table B2-247. Tank 241-AN-102 Analytical Results: Total Alpha Activity.

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				µCi/mL	µCi/mL	µCi/mL
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	0.164	0.175	0.170
n/a	102-AN-2(A)		Centrifuged supernatant	0.160	0.169	0.165
n/a	102-AN-4		Centrifuged supernatant	0.164	0.167	0.166

Table B2-248. Tank 241-AN-102 Analytical Results: Total Inorganic Carbon (Furnance Oxidation).

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				µg C/mL	µg C/mL	µg C/mL
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	14,300	13,300	13,800
n/a	102-AN-2(A)		Centrifuged supernatant	13,300	13,400	13,400
n/a	102-AN-4		Centrifuged supernatant	13,600	13,000	13,300

Table B2-249. Tank 241-AN-102 Analytical Results: Total Organic Carbon (Furnace Oxidation).

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				µg C/mL	µg C/mL	µg C/mL
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	26,800	27,400	27,100
n/a	102-AN-2(A)		Centrifuged supernatant	33,300[1]	25,000	25,000
n/a	102-AN-4		Centrifuged supernatant	25,900	26,400	26,200

Note:

[1]Value was not used in the mean calculations as directed by Herting (1994).

Table B2-250. Tank 241-AN-102 Analytical Results: Density/Specific Gravity.

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				**g/mL**	**g/mL**	**g/mL**
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	1.397	1.403	1.400
n/a	102-AN-2(A)		Centrifuged supernatant	1.394	1.409	1.402
n/a	102-AN-4		Centrifuged supernatant	1.406	1.399	1.403

Table B2-251. Tank 241-AN-102 Analytical Results: pH.

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant						
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	12.97	13.15	13.06
n/a	102-AN-2(A)		Centrifuged supernatant	13.06	13.13	13.10
n/a	102-AN-4		Centrifuged supernatant	13.09	13.15	13.12

Table B2-252. Tank 241-AN-102 Analytical Results: Weight Percent Water.

Sample Number	Grab Sample	Sample Location	Sample Portion	Result	Duplicate	Average
Supernatant				**% H_2O**	**Temperature Range (°C)**	**% H_2O**
n/a	102-AN-1(A)	Riser 22	Centrifuged supernatant	50.0	n/a	50.0
n/a	102-AN-2(A)		Centrifuged supernatant	49.9	n/a	50.0
n/a	102-AN-4		Centrifuged supernatant	50.0	n/a	50.0

B3.0 ASSESSMENT OF CHARACTERIZATION RESULTS

This section discusses the overall quality and consistency of the current sampling results for tank 241-AN-102.

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

B3.1 FIELD OBSERVATIONS

No problems were observed while taking the 1998 supernatant grab samples. However, several problems were noted while collecting the 1998 sludge samples. These sampling problems are discussed below as well as the sludge level measurements made in February 1998.

The intended sludge grab samples from the February 1998 sampling event were taken at the wrong depth; the samples were taken from an elevation of 127 cm (50 in.) rather than 25 cm (10 in.), and supernatant was obtained instead of sludge.

Only two of the three July 1998 sludge grab samples were taken at an elevation of 36 cm (14 in.); the third sample was taken at an elevation of 38 cm (15 in.). The first two samples had 66 and 72 percent solids, respectively; while the third sample contained 12 percent solids. The laboratory analyzed just one (the 12 percent solid sample) rather than all three as requested by Jo (1998a).

Following the February 1998 grab sampling, a sludge level measurement was requested to determine if the sludge level had changed from the 81 cm (32 in.) depth measured in 1989 (Hanlon 1999). The February reading indicated a "hard sludge" layer at 76 cm (30 in.) and a "soft sludge" layer at 107 cm (42 in.). It should be noted that this reading was taken from the same riser as the samples (riser 20), following the removal of 42 grab samples. It is possible the sampling activity disturbed the strata of that region of the tank. In addition, this reading was taken from a single point, whereas the value reported in Hanlon (1999) is the average of readings taken from three separate points. For the purpose of this report, the Hanlon (1999) reading of 81 cm (32 in.) taken in 1989 will be used when reporting sludge level measurements for tank 241-AN-102. Further discussion of sludge volumes and distribution within the tank is provided in Section D1.0.

No problems were noted during the October 1994 and February 1995 sampling events, and recoveries were good. During the November/December 1995 sampling event, it was discovered that the two samples expected to contain sludge actually contained supernatant. The samples were retaken, with satisfactory results. It should also be noted that the sampling elevations for the 2AN-95-2 and 2AN-95-3 were switched. There is little information regarding the 1990 core sampling. No problems with this event were recorded in Douglas (1996).

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. Sample and duplicate pairs with one or more QC results outside the specified criteria were identified by footnotes in the data summary tables.

The standard and spike recovery results provide an estimate of analysis accuracy. If a standard or spike recovery is above or below the given criterion, the analytical results may be biased high or low, respectively. The precision is estimated by the RPD, which is defined as the absolute value of the difference between the primary and duplicate samples, divided by their mean, times 100.

The QC results are summarized by sampling event in the following sections.

B3.2.1 July/August 1998 Grab Sampling Event

The grab samples taken from tank 241-AN-102 in July and August 1998 were analyzed at the 222-S laboratory. Other than the few instances noted below, the quality control criteria associated with these samples met the minimum requirements stated in the *222-S Laboratory Quality Assurance Plan* (LABQAPP) (Markel 1998).

The standard recoveries met the minimum recoveries stated in LABQAPP (Markel 1998). Spike recoveries for all analytes except aluminum met the specified limits. The aluminum spike recovery failure was because of the high concentration of analyte in the sample. A post-digestion spike analysis was performed for the solid samples and a spike analysis on a higher dilution was performed for the supernatant samples. These additional spike analyses had recoveries that were within the LABQAPP limits.

The RPD for AMU-238 for the centrifuged solid was greater than 20 percent. A reanalysis was performed with no improvement of the RPD. The reanalysis results were consistent with the original and are the only results reported. The high RPD for AMU-238 may be attributed to analyte specific problems such as inhomogeneity of the sludge. No repreparation or further reanalysis was performed.

The RPD for the required ICP analyte (aluminum) was within the LABQAPP limits. Results for other non-requested ICP/AES analytes determined from the same acid preparation were evaluated to determine whether the digestion was satisfactory. Many analytes had acceptable RPDs (<20 percent). However, five analytes were noted to have elevated RPDs (chromium, iron, manganese, silicon, and zirconium). When the results were compared to those previously reported (Esch 1998b), it appeared that the sludge may be non-homogeneous for these analytes in particular. Other detected analyte results were consistent with previously reported results.

Contamination was detected in the preparation blanks for Al and ^{137}Cs, and in the method blank for ^{90}Sr. However, the detected concentrations were less than 5 percent of the concentrations reported for the samples. Therefore, the contamination was considered insignificant and no repreparation or reanalysis was requested.

In summary, the vast majority of QC results were within the boundaries specified in the LOIs (Seidel 1998 and Jo 1998a). The discrepancies mentioned here and footnoted in the data summary tables should not impact data validity or use.

B3.2.2 February 1998 Grab Sampling Event

The review of QC data associated with the February 1998 grab samples was limited to those analytes identified in Table 5 of Esch (1998b) as Group 1 or Group 2 analytes. All other ICP results are considered "opportunistic" and do not have specified QC acceptance criteria. Therefore any anomalies were not discussed in this report. However, these "opportunistic" results are shown in the summary tables with qualifier flags, which assume the same quality control limits as specified for the Group 1 and Group 2 analytes.

The analytes are divided into Group 1 and Group 2, as required by the LAW DQO (Wiemers and Miller 1997). The LAW DQO requires repreparation and/or reanalysis only for Group 1 analytes that fail to meet the QC criteria specified in the SAP (Jo 1998b). Group 2 analytes that fail to meet the specified QC criteria do not require reanalysis. In addition, repreparation and/or reanalysis of Group 1 analytes were only required if the reported results were within the sensitivity bounds as defined in Table 6 of Esch (1998b).

The standard recoveries for all of the required analytes met the requirements stated in the SAP (Jo 1998b), except for Si and ^{237}Np. Because the ^{237}Np recovery (129.4 percent) was within the method control limits of 70 to 130 percent, no reanalysis was requested. For Si, the centrifuged solid composite and the solids from the solubility screening standard recoveries were outside the limits of 80 to 120 percent recovery stated in the SAP (Jo 1998b). Because of problems obtaining consistent results for Si from acid digested samples, the acceptance limits for the digested standard were set at a fixed administrative range of 50 to 500 percent recovery. In both cases, the low recovery was within these limits. Because this analyte is not included in the envelope limits, no repreparation or reanalysis was requested.

Spike recovery results were outside of the requested limits of 75 to 125 percent recovery for several of the required analytes: Al, K, Na, P, Si, and S. For all of the analytes but Si, the failure was because of the high concentration of analyte in the sample. With analyte concentrations higher than 100 µg/mL it is difficult to add sufficient spike to perform a meaningful analysis. A post-digestion spike analysis was performed for the solid samples and a spike analysis on a higher dilution was performed for the supernatant samples. For all analytes, these additional spike recoveries were within the requested limits. The cause for the low spike recoveries for the Si analysis is unknown. However, because this analyte is not included in the contract envelope limit, repreparation and reanalysis were not required.

The spike recovery result for Na on the first analysis of the supernatant composite was outside of the limits of 75 to 125 percent recovery. However, the spike recovery on the higher dilution of the sample was acceptable. The serial dilution results were obtained from the data collected on the first analysis. They indicate that the accuracy of the analysis was acceptable. Therefore, when the samples were reanalyzed to improve the precision, an additional spike analysis was not requested. As a result, the spike recovery for the Na is reported as "n/a" in Esch (1998b). The results from the first analysis are included with the raw data.

The RPDs associated with the February 1998 grab samples met the requirements specified in the SAP (Jo 1998b) for all analytes except Na, ^{3}H, ^{154}Eu, ^{14}C, and ^{79}Se. The high RPD for one ^{14}C subsample (56.8 percent) may have been caused by a leak in the CO_2 collection system for the duplicate aliquot, resulting in low analyte recovery. Because ^{14}C, ^{154}Eu, and ^{79}Se were not included in the envelope limit, no reanalysis was required on these analytes.

Relative percent differences greater than 20 percent were reported for all three ^{3}H subsamples. The elevated RPDs were probably caused by contamination from the high concentration of cesium in the samples. The three samples were reanalyzed several times, but only the last set of results was included in this document. Even with the bias, only one result was more than ten times higher than the detection limit and no further reanalysis was requested. With this method, it is difficult to avoid contamination from Cs, especially with the high concentration found in these samples. There is a new method being developed that will address this problem.

Other than ^{3}H, the only other reanalysis requested was for a high RPD for sodium (Na) on two of the three supernatant composite subsamples. The RPDs for the first analysis were approximately 8 percent. Because the Na results are used to evaluate the envelope criteria for all of the Group 1 analytes, the SAP requires an RPD of $\leq$5 percent. The reported RPDs for the reanalysis were all $<$3 percent.

Contamination was detected in the method or preparation blanks for the following analytes: total alpha, total beta, Al, Na, Si, Cl, NO_3, ^{90}Sr, ^{137}Cs, and ^{79}Se. However, all of the detected concentrations were less than 5 percent of the concentration reported for those analytes in the samples. Therefore, the contamination was considered insignificant and no repreparation or reanalysis was requested.

It was difficult for the laboratory to meet the minimum reportable quantities specified by the LAW Feed DQO (Wiemers and Miller 1997) for a number of analytes because of dilutions that were required during the analyses.

Large dilutions of the ICP/MS samples were required to reduce the concentrations of dissolved solids. Sample aliquots were diluted to achieve a sodium concentration of at most 5 µg/mL. Concentrations higher than this would affect the analysis because of reduced ionization efficiencies and material buildup on the sample or skimmer cones at the interface to the mass spectrometer. Even though the detection limits did not meet the MRQ requirements, the sum of the "less than" values used for the determination of the TRU isotopes met the envelope criteria. TRU was at 50.93% of the contract envelope limit.

The minimum detectable activities reported for ^{155}Eu were more than a factor of ten higher than the minimum reportable quantities requested in the LAW Feed DQO (Wiemers and Miller 1997). However, since a smaller dilution could not be analyzed because of the high cesium concentration in the samples, no reanalysis was requested.

For the IC analyses, a large dilution was required to prevent column saturation from the high concentration of nitrate in the sample. It is unlikely that the laboratory would be able to analyze a smaller dilution to lower the detection limit for the Br For the ICP analyses, a large dilution was required because of high concentration of sodium in the sample. Here again, a smaller dilution might not be able to be analyzed. For both of these methods, if the analytes that are included in the envelope criteria were not within the sensitivity boundary, no reanalysis was attempted to improve QC or detection limits.

The results for all analytes were below the envelope C contract limits. Sulfate (SO_4) was the only analyte that fell within the sensitivity boundary (84.87 percent).

In summary, the vast majority of QC results were within the boundaries specified in the SAP (Jo 1998b). The discrepancies mentioned here and footnoted in the data summary tables should not impact data validity or use.

B3.2.3 1994/1995 Grab Sampling Event

All the pertinent QC tests were conducted on the grab samples from the November 1995, February 1995, and October 1994 grab sampling events that were subjected to the safety screening evaluation. The specific criteria for the QC checks on these grab samples were provided in the SAP (Jo 1996). Only limited QC information was available for the grab samples analyzed in 1994. One standard was run in conjunction with each analyte.

All standard recoveries were within the defined criteria. Fluoride, nitrate, and nitrite each had 1 out of 3 matrix spikes above the QC limits, while total alpha activity had 2 of 14 spikes below the QC limit. Low total alpha activity spike recoveries are common because of difficulties in preparing the sample mount, which can cause self-shielding. For total alpha activity, 1 out of 14 RPDs were outside the criterion, while TOC had 1 out of 10 RPDs exceed the criterion. Nine of the 21 samples with exothermic reactions had RPDs above the criterion. This was not unusual given the small sample sizes (8 to 60 mg) and possible sample heterogeneity problems. Manganese and potassium had 2 out of 3 RPDs outside the criterion, while iron had 1 out of 3 outside the limits. Finally, none of the samples exceeded the criteria for preparation blanks, and therefore contamination was not a problem for any of the analytes.

The only QC check performed in conjunction with the 1994 analyses was one standard for each analyte. Because no tank characterization plan governed this sampling event, no specific criterion was given to evaluate the standards. However, to maintain consistency, the same criteria applied to the other grab samples were applied to these samples (80 to 120 percent recovery for all analytes except DSC and TGA, which were 90 to 110 percent recovery). None of the standards conducted on the 1994 supernatant analytes violated the QC limits.

In summary, practically all of the QC results associated with the 1994/1995 analyses were within the boundaries specified in the SAP (Jo 1996). The few discrepancies observed should not impact either the validity or the use of the data.

B3.2.4 1990 Core Sampling Event

No QC information was provided in the source documents used to compile the final report (Douglas 1996) for the 1990 core sampling event. Because there is no way to assess the reliability of the analytical results, the data from this sampling event should be used with caution. Douglas (1996) compiles the analytical results, but the source documents for Douglas (1996) are incomplete, and at times contradictory.

B3.3 DATA CONSISTENCY CHECKS

Comparing different analytical methods is helpful in assessing the consistency and quality of the data. Several comparisons were possible with the data set provided by the 1994/1995 grab samples: total alpha activity to the sum of the individual alpha emitters, the ICP phosphorus result with the IC phosphate number, and the ICP sulfur value with the IC sulfate result. The only comparison made on the 1990 core sample results was total beta activity with the sum of the individual beta emitters. In addition, mass and charge balances were calculated for the 1994/1995 grab data and the 1990 core data to help assess the overall data consistency.

B3.3.1 Comparison of Results from Different Analytical Methods

The following data consistency checks compare the results from two analytical methods. Agreement between the two methods strengthens the credibility of both results, but poor agreement brings the reliability of the data into question. The analytical mean results for the 1994/1995 supernatant were taken from Table B2-21 and the 1990 calculated sludge results are from Table B2-27.

B3.3.1.1 Comparison of 1994/1995 Supernatant Data. A comparison was made in Table B3-1 between the total alpha activity mean and the sum of the activity means of the individual alpha emitters for the supernatant data. The sum of the activities of the individual alpha emitters was determined by adding the ^{241}Am and $^{239/240}$Pu activities (0.138 and 0.00582 µCi/mL, respectively). The sum of these values is 0.144 µCi/mL. The total alpha activity measured was 0.163 µCi/mL. These two values agree well, as evidenced by the 12 percent RPD.

Table B3-1. Comparison of Total Alpha Activities with the Sum of the Individual Activities for the 1994/1995 Supernatant.

Sum of Alpha emitters ($^{241}Am + ^{239/240}Pu$)	Total Alpha Activity	RPD
µCi/mL	µCi/mL	%
0.144	0.163	12

Table B3-2 provides comparisons between the ICP phosphorus concentration means, and the concentration means for phosphate determined by IC analysis. The ICP phosphorus result, which represents total phosphorus, was 1,610 µg/mL, this converts to 4,950 µg/mL phosphate. Because the analyzed portion was supernatant, the majority of this amount would be expected to be water soluble. Therefore, because IC measures water soluble phosphorus in the form of phosphate, the ICP and IC values should be similar. The IC phosphate value was 4,820 µg/mL, which agreed extremely well with the ICP phosphate value (RPD of 3 percent).

Table B3-2. Comparison of Phosphorous by ICP with Phosphate by IC for the 1994/1995 Supernatant.

P (as PO_4) by ICP	PO_4 by IC	RPD
µg/mL	µg/mL	%
4,950	4,820	3

Table B3-3 provides comparisons between the ICP sulfur concentration means and the concentration means for sulfate determined by IC analysis. Like phosphorus, because of the waste matrix, sulfate is expected to be primarily water soluble. This prediction was borne out by the analytical results, because the sulfate value of 14,615 µg/mL (converted from the ICP sulfur value of 4,750 µg/mL) compared quite well with the IC sulfate result of 13,800 µg/mL (RPD of 6 percent).

Table B3-3. Comparison of Sulfur by ICP with Sulfate by IC for the 1994/1995 Supernatant.

S (as SO_4) by ICP	SO_4 by IC	RPD
µg/mL	µg/mL	%
14,615	13,800	6

B3.3.1.2 Comparison of 1990 Sludge Data. Table B3-4 compares the calculated sludge value for total beta activity with the sum of the activity of the individual beta emitters for the 1990 calculated sludge value. (Calculation of the sludge values were previously described in Section B2.5.3.) The sum of the activities of the individual beta emitters was determined according to the following equation: 2 * ^{90}Sr + ^{137}Cs (the ^{90}Sr concentration is doubled to account for ^{90}Y). Based on the analytical values of 285 µCi/g and 169 µCi/g for ^{137}Cs and ^{90}Sr, respectively, the sum of the individual beta emitters was 623 µCi/g.

The total beta activity result was 1,380 µCi/g. Poor consistency was observed, as indicated by the RPD of 76 percent. Cesium-137 and ^{90}Sr are expected to be the beta emitters present in the greatest quantities. This is certainly true of the beta-emitting radionuclides. However, this comparison shows that additional beta emitters may be present that were not analyzed.

Table B3-4. Comparison of Total Beta Activities With the Sum of the Individual Activities for the 1990 Sludge.

Sum of Beta Emitters	Total Beta Activity	RPD
µCi/g	µCi/g	%
623	1,380	76

B3.3.2 Mass and Charge Balance

The principle objective in performing mass and charge balances is to determine whether the measurements are consistent. Separate mass and charge balances were performed for the solids and the supernatant. In calculating the balances, only the analytes listed in Tables B2-21 and B2-27 that were detected at a concentration of 1,000 µg/g or greater were considered. The liquid analytical results were converted from µg/mL to µg/g (using the mean specific gravity of 1.41 g/mL) before use in the tables.

The solids mass and charge data are provided in Tables B3-5 and B3-6. Except for sodium, all cations listed in Table B3-5 were assumed to be in their most common hydroxide or oxide form, and the concentrations of the assumed species were calculated stoichiometrically. Because precipitates are neutral species, all positive charge was attributed to the sodium cation. The anions listed in Table B3-6 were assumed to be present as sodium salts and were expected to balance the positive charge exhibited by sodium. For the solids, phosphate (as determined by IC) is assumed to be completely water soluble and appears only in the anion mass and charge calculations.

The mass/charge balances for the cations and anions in the supernatant are presented in Tables B3-8 and B3-9, respectively. Sodium and potassium were the only cationic species detected in large quantities in the tank 241-AN-102 supernatant. Aluminum was assumed to be present as the aluminate anion. The carbonate data were derived from the TIC analyses and the acetate data were derived from the TOC analyses. The other anionic analytes listed in Table B3-9 were assumed to be present as sodium and potassium salts and expected to balance the positive charge exhibited by the cations.

The concentrations of cationic species, anionic species, and the percent water were ultimately used to calculate the mass balance. Table B3-7 shows the totals for the solids, while Table B3-10 presents the supernatant totals. The mass balances were 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}

For the solids, the total analyte concentration calculated from the above equation is 645,000 µg/g. The mean weight percent water (obtained from the gravimetric analyses reported in Table B3-7) is 40.3 percent or 403,000 µg/g. The mass balance resulting from adding the percent water to the total analyte concentration is 104.8 percent (see Table B3-7).

For the supernatant, the total analyte concentration calculated from the above equation is 527,000 µg/g. The mean weight percent water obtained from TGA (reported in Table B2-22) is 49.7 percent, or 497,000 µg/g. The mass balance resulting from adding the percent water to the total analyte concentration is 102 percent (see Table B3-10).

The following equations demonstrate the derivation of total cations and total anions; the charge balance is the ratio of these two values. (Note: the example is for the supernatant.)

Total cations (µeq/g) = $[Na^+]/23.0 + [K^+]/39.1$ = 7,460 µeq/g

Total anions (µeq/g) = $[AlO_2^-]/59.0 + [CO_3^{-2}]/30.0 + [C_2H_3O_2^-]/59.0 + [Cl^-]/35.5 + [F^-]/19.0 + [OH^-]/17.0 + [NO_3^-]/62.0 + [NO_2^-]/46.0 + [PO_4^{-3}]/31.7 + [SO_4^{-2}]/48.0$ = 7,190 µeq/g

For the solids, the charge balance based on measured waste constituents was 1.51, indicating that one or more anions were not measured during the analysis. It is assumed that the missing anion is hydroxide. As shown in Table B3-6, it would take 58,300 µg/g of hydroxide to balance the charge. The charge balance for the supernatant was 1.04, demonstrating excellent agreement.

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

Table B3-5. Solids Cation Mass and Charge Data.

Analyte	Concentration[1] (µg/g)	Assumed Species	Concentration of Assumed Species (µg/g)	Charge (µeq/g)
Aluminum	12,200	$Al(OH)_3$	35,200	0
Calcium	2,070	$Ca(OH)_2$	3,830	0
Chromium	1,370	$Cr(OH)_3$	2,770	0
Iron	1,670	FeO(OH)	2,650	0
Sodium	234,000	Na^+	234,000	10,200
Silicon	1,360	SiO_2	2,910	0
Uranium	1,590	UO_3	1,910	0
Totals			283,000	10,200

Note:

[1]Concentration values are taken from Table B2-27.

Table B3-6. Solids Anion Mass and Charge Data. (2 sheets)

Analyte	Concentration[1] (µg/g)	Assumed Species	Concentration of Assumed Species (µg/g)	Charge (µeq/g)
Chloride	2,060	Cl^-	2,060	58
Nitrate	112,000	NO_3^-	112,000	1,810
Nitrite	39,300	NO_2^-	39,300	854
Phosphate	3,030	PO_4^{-3}	3,030	96
Sulfate	25,900	SO_4^{-2}	25,900	540
TOC	16,300	$C_2O_4^{-2}$	59,800	1,360
TIC	12,300	CO_3^{-2}	61,500	2,050

Table B3-6. Solids Anion Mass and Charge Data. (2 sheets)

Analyte	Concentration[1] (µg/g)	Assumed Species	Concentration of Assumed Species (µg/g)	Charge (µeq/g)
Hydroxide[2]	58,300	OH^-	58,300	3,430
Totals			362,000	10,200

Notes:

[1]Concentration values are taken from Table B2-27.

[2]The hydroxide concentration is derived from the difference in charge between the cation and anion totals.

Table B3-7. Solids Mass and Charge Balance Totals.

Totals	Concentration (µg/g)	Charge (µeq/g)
Total from Table B3-5 (cations)	283,000	10,200
Total from Table B3-6 (anions)	362,000	-10,200
Water percent	403,000	0
Totals	1,048,000	0

Table B3-8. Supernatant Cation Mass and Charge Data.

Analyte	Concentration[1] (µg/g)	Assumed Species	Concentration of Assumed Species(µg/g)	Charge (µeq/g)
Potassium	2,750	K^+	2,750	70.3
Sodium	170,000	Na^+	170,000	7,390
Total			173,000	7,460

Note:

[1]Concentration values are taken from Table B2-21.

Table B3-9. Supernatant Anion Mass and Charge Data.

Analyte	Concentration[1] (µg/g)	Assumed Species	Assumed Species (µg/g)	Charge (µeq/g)
Aluminum	10,700	AlO_2^-	23,400	396
TIC	9,360	CO_3^{-2}	46,800	1,560
TOC	18,600	$C_2H_3O_2^-$	45,700	775
Chloride	2,700	Cl^-	2,700	76
Fluoride	1,320	F^-	1,320	69
Hydroxide	2,560	OH^-	2,560	150
Nitrate	160,000	NO_3^-	160,000	2,580
Nitrite	58,600	NO_2^-	58,600	1,270
Phosphate	3,420	PO_4^{-3}	3,420	108
Sulfate	9,790	SO_4^{-2}	9,790	204
Total			354,000	7,190

Note:

[1]Concentration values are taken from Table B2-27.

Table B3-10. Supernatant Mass and Charge Balance Totals.

Totals	Concentration (µg/g)	Charge (µeq/g)
Cation total from Table B3-8	173,000	7,460
Anion total from Table B3-9	354,000	7,190
Water	497,000	0
Grand total	1,020,000	270

B3.4 MEAN CONCENTRATIONS AND CONFIDENCE INTERVALS

Section B3.4 contains mean concentrations and confidence intervals for the 1998 data. Note that mean concentrations for the 1994/1995 and 1990 data are presented in Sections B2.3.4 and B2.5.3, respectively.

B3.4.1 Solid Data

An ANOVA model was fit to the replicate data from the solid portion of a sample. Mean analyte concentrations, and 95 percent confidence intervals on the mean, were estimated using results from the ANOVA. One variance component was used in the calculations. It represents concentration differences between analytical replicates.

The model is:

$$Y_i = \mu + A_i,$$

$$i=1, 2, ..., n;$$

where

Y_i	=	concentration from the i^{th} analytical result
μ	=	the mean
A_i	=	the analytical error
n	=	the number of analytical results.

The variables A_i are assumed to be uncorrelated and normally distributed with means zero and variance $\sigma^2(A)$. The estimate of μ is the sample mean and the estimate of $\sigma^2(A)$ is the sample variance.

Some analytes had results that were below the detection limit. In these cases the value of the detection limit was used for non-detected results. For analytes with a majority of results below the detection limit, a simple average is reported.

The lower and upper limits, LL(95%) and UL(95%), of a two-sided 95percent confidence interval on the mean were calculated using:

$$LL(95\%): \hat{\mu} - t_{(df,\ 0.025)} \times \hat{\sigma}(\hat{\mu})$$

$$UL(95\%): \hat{\mu} + t_{(df,\ 0.025)} \times \hat{\sigma}(\hat{\mu}).$$

In these equations, $\hat{\mu}$ is the estimate of the mean concentration, $\hat{\sigma}(\hat{\mu})$ is the estimate of the standard deviation of the mean, and $t_{(df,\ 0.025)}$ is the quantile from Student's *t* distribution with degrees of freedom (*df*). The *df* are the number of observations minus one. In cases where the lower limit of the confidence interval was negative, it was reported as zero.

Two sets of means were calculated for the solid data resulting from the 1998 sampling events of tank 241-AN-102: July 1998 solid sample means and February 1998 solid and dissolution composite means. Table B3-11 provides the means for the July 1998 solid sample results. This solid sample was centrifuged and the results provided are for the centrifuged solid sample. The centrifuged liquid portion results, along with the July/August non-centrifuged liquid data are provided in Table B3-15. The July 1998 sampling event is described in Section B2.1.

Table B3-11. Tank 241-AN-102 95 Percent Two-Sided Confidence Interval for the Mean Concentration for July 1998 Solid Sample Data. (2 sheets)

Analyte	Method	Mean	*df*	LL	UL	Units
Aluminum	ICP:A	9.96E+03	1	8.18E+03	1.17E+04	µg/g
Antimony*	ICP:A	<2.36E+01	n/a	n/a	n/a	µg/g
Arsenic*	ICP:A	<3.94E+01	n/a	n/a	n/a	µg/g
Barium*	ICP:A	<1.97E+01	n/a	n/a	n/a	µg/g
Beryllium*	ICP:A	<1.97E+00	n/a	n/a	n/a	µg/g
Bismuth*	ICP:A	<3.94E+01	n/a	n/a	n/a	µg/g
Boron	ICP:A	1.40E+02	1	6.38E+01	2.16E+02	µg/g
Bulk density	Bulk Density	1.64E+00	n/a	n/a	n/a	g/mL
Cadmium	ICP:A	3.85E+01	1	3.72E+01	3.98E+01	µg/g
Calcium	ICP:A	3.45E+02	1	2.81E+02	4.09E+02	µg/g
Cerium*	ICP:A	<3.94E+01	n/a	n/a	n/a	µg/g
Cesium-137	GEA:F	2.27E+02	1	2.22E+02	2.31E+02	µCi/g
Chromium	ICP:A	3.35E+02	1	0.00E+00	7.35E+02	µg/g
Cobalt*	ICP:A	<7.88E+00	n/a	n/a	n/a	µg/g
Cobalt-60*	GEA:F	8.62E-02	1	0.00E+00	2.97E-01	µCi/g
Copper	ICP:A	1.59E+01	1	1.46E+01	1.72E+01	µg/g
Iron	ICP:A	1.76E+02	1	0.00E+00	5.32E+02	µg/g
Lanthanum*	ICP:A	<1.97E+01	n/a	n/a	n/a	µg/g
Lead	ICP:A	1.25E+02	1	8.00E+01	1.69E+02	µg/g
Lithium*	ICP:A	<3.94E+00	n/a	n/a	n/a	µg/g
Magnesium*	ICP:A	<3.94E+01	n/a	n/a	n/a	µg/g
Manganese	ICP:A	4.15E+01	1	0.00E+00	1.14E+02	µg/g
Molybdenum	ICP:A	3.17E+01	1	3.04E+01	3.30E+01	µg/g
Neodymium*	ICP:A	<3.94E+01	n/a	n/a	n/a	µg/g
Nickel	ICP:A	2.57E+02	1	2.50E+02	2.63E+02	µg/g
Phosphorus	ICP:A	1.06E+03	1	1.06E+03	1.06E+03	µg/g
Potassium	ICP:A	1.45E+03	1	1.32E+03	1.58E+03	µg/g
Samarium*	ICP:A	<3.94E+01	n/a	n/a	n/a	µg/g

Table B3-11. Tank 241-AN-102 95 Percent Two-Sided Confidence Interval for the Mean Concentration for July 1998 Solid Sample Data. (2 sheets)

Analyte	Method	Mean	*df*	LL	UL	Units
Selenium*	ICP:A	<3.94E+01	n/a	n/a	n/a	µg/g
Silicon	ICP:A	5.17E+01	1	0.00E+00	1.39E+02	µg/g
Silver	ICP:A	1.06E+01	1	5.52E+00	1.57E+01	µg/g
Sodium	ICP:A	1.42E+05	1	1.17E+05	1.67E+05	µg/g
Strontium*	ICP:A	<3.94E+00	n/a	n/a	n/a	µg/g
Strontium-89/90	Sr:F	8.98E+01	1	7.01E+01	1.09E+02	µCi/g
Sulfur	ICP:A	4.04E+03	1	1.94E+03	6.13E+03	µg/g
Thallium*	ICP:A	<7.88E+01	n/a	n/a	n/a	µg/g
Titanium*	ICP:A	<3.94E+00	n/a	n/a	n/a	µg/g
Total inorganic carbon	TIC/TOC	1.56E+04	1	1.18E+04	1.94E+04	µg/g
Total organic carbon	TIC/TOC	2.25E+04	1	2.00E+04	2.50E+04	µg/g
Uranium*	ICP:A	<1.97E+02	n/a	n/a	n/a	µg/g
Vanadium*	ICP:A	<1.97E+01	n/a	n/a	n/a	µg/g
Zinc	ICP:A	5.18E+00	1	1.62E+00	8.74E+00	µg/g
Zirconium	ICP:A	1.39E+01	1	0.00E+00	3.36E+01	µg/g

Note:

*A less than value was used in the calculation.

Table B3-12 provides the means for the February 1998 solid and dissolution composites. For the purpose of characterizing the contents of tank 241-AN-102, only the results from the two undiluted composites have been included in this report. Data from these two composites were combined with data from the solid composites to derive one solid composite mean (called the "February 1998 solid and dissolution composite mean"). When calculating means for the solids, data from three solid composites and two undiluted dissolution composites were used. It should be noted that the dissolution composites were created to match the grab sample with the highest observed solid to liquid mass ratio, and therefore may be biased. The February 1998 sampling event is discussed in Section B2.2.

Table B3-12. Tank 241-AN-102 95 Percent Two-Sided Confidence Interval for the Mean Concentration for February 1998 Solid and Dissolution Composite Data. (4 sheets)

Analyte	Method	Mean	*df*	LL	UL	Units
Aluminum	ICP:A	1.61E+04	4	1.38E+04	1.85E+04	µg/g
Aluminum	ICP:F	1.56E+04	4	1.38E+04	1.74E+04	µg/g
Americium-241*	GEA:A	<9.75E-01	n/a	n/a	n/a	µCi/g
Americium-241*	GEA:F	<1.13E+00	n/a	n/a	n/a	µCi/g
Antimony*	ICP:A	<3.02E+01	n/a	n/a	n/a	µg/g
Antimony*	ICP:F	<1.15E+03	n/a	n/a	n/a	µg/g
Antimony-125*	GEA:A	<4.84E-01	n/a	n/a	n/a	µCi/g
Antimony-125*	GEA:F	<6.55E-01	n/a	n/a	n/a	µCi/g
Aroclor 1016*	SVOA:PCB	<5.30E+02	n/a	n/a	n/a	µg/kg
Aroclor 1221*	SVOA:PCB	<5.30E+02	n/a	n/a	n/a	µg/kg
Aroclor 1232*	SVOA:PCB	<5.30E+02	n/a	n/a	n/a	µg/kg
Aroclor 1242*	SVOA:PCB	<5.30E+02	n/a	n/a	n/a	µg/kg
Aroclor 1248*	SVOA:PCB	<5.30E+02	n/a	n/a	n/a	µg/kg
Aroclor 1254*	SVOA:PCB	<5.30E+02	n/a	n/a	n/a	µg/kg
Aroclor 1260*	SVOA:PCB	<5.30E+02	n/a	n/a	n/a	µg/kg
Arsenic*	ICP:A	<5.03E+01	n/a	n/a	n/a	µg/g
Arsenic*	ICP:F	<1.92E+03	n/a	n/a	n/a	µg/g
Barium*	ICP:A	<2.52E+01	n/a	n/a	n/a	µg/g
Barium*	ICP:F	<9.58E+02	n/a	n/a	n/a	µg/g
Beryllium*	ICP:A	<2.52E+00	n/a	n/a	n/a	µg/g
Beryllium*	ICP:F	<9.58E+01	n/a	n/a	n/a	µg/g
Bismuth*	ICP:A	<5.03E+01	n/a	n/a	n/a	µg/g
Bismuth*	ICP:F	<1.92E+03	n/a	n/a	n/a	µg/g
Boron	ICP:A	1.32E+02	4	1.13E+02	1.51E+02	µg/g
Boron*	ICP:F	<9.58E+02	n/a	n/a	n/a	µg/g
Cadmium	ICP:A	3.79E+01	4	3.65E+01	3.93E+01	µg/g
Cadmium*	ICP:F	<9.58E+01	n/a	n/a	n/a	µg/g
Calcium	ICP:A	4.34E+02	4	3.86E+02	4.82E+02	µg/g
Calcium*	ICP:F	<1.92E+03	n/a	n/a	n/a	µg/g
Cerium*	ICP:A	<5.03E+01	n/a	n/a	n/a	µg/g
Cerium*	ICP:F	<1.92E+03	n/a	n/a	n/a	µg/g
Cesium-137	GEA:A	2.45E+02	4	2.41E+02	2.49E+02	µCi/g
Cesium-137	GEA:F	2.37E+02	4	2.25E+02	2.49E+02	µCi/g
Chromium	ICP:A	1.83E+03	4	1.23E+03	2.43E+03	µg/g

Table B3-12. Tank 241-AN-102 95 Percent Two-Sided Confidence Interval for the Mean Concentration for February 1998 Solid and Dissolution Composite Data. (4 sheets)

Analyte	Method	Mean	*df*	LL	UL	Units
Chromium	ICP:F	1.74E+03	4	1.21E+03	2.27E+03	µg/g
Cobalt*	ICP:A	<1.01E+01	n/a	n/a	n/a	µg/g
Cobalt*	ICP:F	<3.83E+02	n/a	n/a	n/a	µg/g
Cobalt-60	GEA:A	9.14E-02	4	7.92E-02	1.04E-01	µCi/g
Cobalt-60	GEA:F	8.70E-02	4	6.55E-02	1.08E-01	µCi/g
Copper	ICP:A	1.61E+01	4	1.50E+01	1.71E+01	µg/g
Copper*	ICP:F	<1.92E+02	n/a	n/a	n/a	µg/g
Europium-154	GEA:A	7.82E-01	4	5.96E-01	9.68E-01	µCi/g
Europium-154	GEA:F	6.35E-01	4	4.71E-01	7.99E-01	µCi/g
Europium-155*	GEA:A	<5.93E-01	n/a	n/a	n/a	µCi/g
Europium-155*	GEA:F	<5.24E-01	n/a	n/a	n/a	µCi/g
Gross alpha	Alpha Rad:A	6.43E-01	4	4.56E-01	8.30E-01	µCi/g
Gross alpha	Alpha:F	5.55E-01	4	3.52E-01	7.57E-01	µCi/g
Hydroxide*	OH:W	<1.48E+04	n/a	n/a	n/a	µg/g
Iron	ICP:A	1.83E+03	4	6.78E+02	2.99E+03	µg/g
Iron	ICP:F	1.28E+03	4	8.34E+02	1.73E+03	µg/g
Lanthanum	ICP:A	3.73E+01	4	2.74E+01	4.72E+01	µg/g
Lanthanum*	ICP:F	<9.58E+02	n/a	n/a	n/a	µg/g
Lead	ICP:A	2.42E+02	4	1.88E+02	2.97E+02	µg/g
Lead*	ICP:F	<1.92E+03	n/a	n/a	n/a	µg/g
Lithium*	ICP:A	<5.03E+00	n/a	n/a	n/a	µg/g
Lithium*	ICP:F	<1.92E+02	n/a	n/a	n/a	µg/g
Magnesium*	ICP:A	<5.03E+01	n/a	n/a	n/a	µg/g
Magnesium*	ICP:F	<1.92E+03	n/a	n/a	n/a	µg/g
Manganese	ICP:A	2.95E+02	4	1.98E+02	3.91E+02	µg/g
Manganese	ICP:F	3.01E+02	4	2.25E+02	3.76E+02	µg/g
Molybdenum	ICP:A	3.12E+01	4	3.08E+01	3.15E+01	µg/g
Molybdenum*	ICP:F	<9.58E+02	n/a	n/a	n/a	µg/g
Neodymium	ICP:A	7.10E+01	4	5.17E+01	9.03E+01	µg/g
Neodymium*	ICP:F	<1.92E+03	n/a	n/a	n/a	µg/g
Nickel	ICP:A	2.54E+02	4	2.44E+02	2.64E+02	µg/g
Nickel*	ICP:F	8.21E+02	4	2.81E+02	1.36E+03	µg/g
Phosphorus	ICP:A	1.20E+03	4	1.07E+03	1.34E+03	µg/g
Phosphorus*	ICP:F	<3.83E+03	n/a	n/a	n/a	µg/g
Potassium	ICP:A	1.39E+03	4	1.32E+03	1.47E+03	µg/g

Table B3-12. Tank 241-AN-102 95 Percent Two-Sided Confidence Interval for the Mean Concentration for February 1998 Solid and Dissolution Composite Data. (4 sheets)

Analyte	Method	Mean	*df*	LL	UL	Units
Samarium*	ICP:A	<5.03E+01	n/a	n/a	n/a	µg/g
Samarium*	ICP:F	<1.92E+03	n/a	n/a	n/a	µg/g
Selenium*	ICP:A	<5.03E+01	n/a	n/a	n/a	µg/g
Selenium*	ICP:F	<1.92E+03	n/a	n/a	n/a	µg/g
Silicon	ICP:A	6.30E+01	4	4.70E+01	7.91E+01	µg/g
Silicon*	ICP:F	<9.58E+02	n/a	n/a	n/a	µg/g
Silver	ICP:A	1.15E+01	4	9.00E+00	1.41E+01	µg/g
Silver*	ICP:F	<1.92E+02	n/a	n/a	n/a	µg/g
Sodium	ICP:A	1.51E+05	4	1.44E+05	1.58E+05	µg/g
Sodium	ICP:F	1.50E+05	4	1.46E+05	1.54E+05	µg/g
Strontium*	ICP:A	<5.03E+00	n/a	n/a	n/a	µg/g
Strontium*	ICP:F	<1.92E+02	n/a	n/a	n/a	µg/g
Strontium-89/90	Sr:A	1.23E+02	4	1.03E+02	1.44E+02	µCi/g
Strontium-89/90	Sr:F	1.21E+02	4	1.01E+02	1.41E+02	µCi/g
Sulfur	ICP:A	3.57E+03	4	3.44E+03	3.71E+03	µg/g
Sulfur	ICP:F	3.46E+03	4	3.27E+03	3.65E+03	µg/g
Thallium*	ICP:A	<1.01E+02	n/a	n/a	n/a	µg/g
Thallium*	ICP:F	<3.83E+03	n/a	n/a	n/a	µg/g
Titanium*	ICP:A	<5.03E+00	n/a	n/a	n/a	µg/g
Titanium*	ICP:F	<1.92E+02	n/a	n/a	n/a	µg/g
Total inorganic carbon	TIC/TOC	1.01E+04	4	9.40E+03	1.09E+04	µg/g
Total organic carbon	Furnace Oxidation:W	2.94E+04	4	2.17E+04	3.70E+04	µg/g
Total organic carbon	TIC/TOC	2.48E+04	4	2.18E+04	2.77E+04	µg/g
Uranium*	ICP:A	<2.52E+02	n/a	n/a	n/a	µg/g
Uranium*	ICP:F	<9.58E+03	n/a	n/a	n/a	µg/g
Vanadium*	ICP:A	<2.52E+01	n/a	n/a	n/a	µg/g
Vanadium*	ICP:F	<9.58E+02	n/a	n/a	n/a	µg/g
Weight percent solids	Percent Solids	5.65E+01	4	5.55E+01	5.75E+01	%
Zinc	ICP:A	2.10E+01	4	1.43E+01	2.77E+01	µg/g
Zinc*	ICP:F	<1.92E+02	n/a	n/a	n/a	µg/g

Table B3-12. Tank 241-AN-102 95 Percent Two-Sided Confidence Interval for the Mean Concentration for February 1998 Solid and Dissolution Composite Data. (4 sheets)

Analyte	Method	Mean	df	LL	UL	Units
Zirconium	ICP:A	6.27E+01	4	4.21E+01	8.34E+01	µg/g
Zirconium*	ICP:F	<1.92E+02	n/a	n/a	n/a	µg/g

Note:

*A less-than value was used in the calculation

B3.4.2 Liquid Data

Three sets of means were calculated for the liquid data resulting from the 1998 sampling events. These means are the February 1998 supernatant and dissolution composite means, the February 1998 liquid sample means, and the July/August 1998 liquid sample means.

An ANOVA model was fit to the data from the liquid portion of the laboratory samples. The laboratory samples are grab samples. Mean analyte concentrations, and 95 percent confidence intervals on the mean, were estimated using results from the ANOVA. Two variance components were estimated and used in the computations. The variance components represent concentration differences between laboratory samples and between analytical replicates.

The model is:

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

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

where

Y_{ij} = concentration from the j^{th} analytical result from the i^{th} riser

μ = the mean

L_i = the effect of the i^{th} laboratory sample

A_{ij} = the analytical error

a = the number of laboratory samples

n_i = the number of analytical results from the i^{th} laboratory sample.

The variable L_i is a random effect. This variable and A_{ij} are assumed to be uncorrelated and normally distributed with means zero and variances $\sigma^2(L)$, and $\sigma^2(A)$, respectively.

The restricted maximum likelihood method (REML) was used to estimate the mean concentration and standard deviation of the mean for all analytes that had 50 percent or more of their reported values greater than the detection limit. The mean concentrations and standard deviations of the mean were used to calculate the 95 percent confidence intervals. The following table gives the estimate of the mean, degrees of freedom, and confidence interval on the mean.

Some analytes had results that were below the detection limit. In these cases the value of the detection limit was used for non-detected results. For analytes with a majority of results below the detection limit, a simple average is reported.

The lower and upper limits, LL(95%) and UL(95%), of a two-sided 95 percent confidence interval on the mean were calculated using:

$$LL(95\%): \hat{\mu} - t_{(df,\ 0.025)} \times \hat{\sigma}(\hat{\mu})$$

$$UL(95\%): \hat{\mu} + t_{(df,\ 0.025)} \times \hat{\sigma}(\hat{\mu}).$$

In these equations, $\hat{\mu}$ is the REML estimate of the mean concentration, $\hat{\sigma}(\hat{\mu})$ is the REML estimate of the standard deviation of the mean, and $t_{(df,\ 0.025)}$ is the quantile from Student's t distribution with *df* degrees of freedom. The degrees of freedom are the number of laboratory samples with data minus one. In cases where the lower limit of the confidence interval was negative, it was reported as zero.

Five composites were created for the solubility screening tests. For the purpose of characterizing the contents of tank 241-AN-102, only the results from the two undiluted composites have been included in this report. Data from these two composites were combined with data from the supernatant composites to derive one liquid composite mean (called the "February 1998 supernatant and dissolution composite mean"). When calculating means for the liquids, data from one of the undiluted dissolution composites (from which analytical samples S98T002286 and S98T002286D were taken) were excluded from the mean calculation. This data was excluded because of questions regarding its validity. Without exception, data from this composite were substantially different than that from the other undiluted dissolution composite. The reason for the inconsistencies could not be definitively determined. Unexpectedly, only a limited amount of material from the composite in question was available for analysis. It was hypothesized that some spillage of the composite may have occurred (Esch 1998b), which could account for the data problems. Because of the severe data inconsistencies, the chemist that performed the dissolution studies concluded that the results from the questionable dissolution composite should be discarded (Esch 1998b). Therefore, they were not used in the mean calculations or reported in the data tables in Section B2.7.

It should be noted that each of the liquid composite types (supernatant and dissolution) may contain biases. The supernatant composites were centrifuged before analysis, likely biasing the results by removing the solids. Conversely, the dissolution composites were created to match the grab sample with the highest observed solid to liquid mass ratio, and therefore may also be biased. Table B3-13 provides the means for the February 1998 supernatant and dissolution composites. The February 1998 sampling event is discussed in Section B2.2.

Table B3-13. Tank 241-AN-102 95 Percent Two-Sided Confidence Interval for the Mean Concentration for February 1998 Supernatant and Dissolution Composite Data. (4 sheets)

Analyte	Method	Mean	*df*	LL	UL	Units
Aluminum	ICP	1.58E+04	3	1.50E+04	1.67E+04	µg/mL
Americium-241	^{241}Am	1.61E-01	2	1.50E-01	1.72E-01	µCi/mL
Americium-241*	GEA	<1.87E-01	n/a	n/a	n/a	µCi/mL
Ammonia	Ion Sel. Electrode (NH3)	1.32E+02	2	8.10E+01	1.84E+02	µg/mL
Antimony*	ICP	<3.61E+01	n/a	n/a	n/a	µg/mL
Antimony*	GFAA	2.06E-01	2	1.45E-01	2.67E-01	µg/mL
Aroclor 1016*	SVOA:PCB	<1.13E-02	n/a	n/a	n/a	µg/mL
Aroclor 1221*	SVOA:PCB	<1.13E-02	n/a	n/a	n/a	µg/mL
Aroclor 1232*	SVOA:PCB	<1.13E-02	n/a	n/a	n/a	µg/mL
Aroclor 1242*	SVOA:PCB	<1.13E-02	n/a	n/a	n/a	µg/mL
Aroclor 1248*	SVOA:PCB	<1.13E-02	n/a	n/a	n/a	µg/mL
Aroclor 1254*	SVOA:PCB	<1.13E-02	n/a	n/a	n/a	µg/mL
Aroclor 1260*	SVOA:PCB	<1.13E-02	n/a	n/a	n/a	µg/mL
Arsenic*	ICP	<6.01E+01	n/a	n/a	n/a	µg/mL
Atomic Mass Unit 238	ICP/MS	6.27E+00	2	4.92E+00	7.62E+00	µg/mL
Atomic Mass Unit 241*	ICP/MS	<1.04E-01	n/a	n/a	n/a	µg/mL
Atomic Mass Unit 242*	ICP/MS	<1.27E-01	n/a	n/a	n/a	µg/mL
Atomic Mass Unit 243*	ICP/MS	<1.01E-01	n/a	n/a	n/a	µg/mL
Atomic Mass Unit 244*	ICP/MS	<8.23E-02	n/a	n/a	n/a	µg/mL
Barium*	ICP	<3.01E+01	n/a	n/a	n/a	µg/mL
Beryllium*	ICP	<3.00E+00	n/a	n/a	n/a	µg/mL
Bismuth*	ICP	<6.01E+01	n/a	n/a	n/a	µg/mL
Boron	ICP	4.34E+01	3	4.13E+01	4.54E+01	µg/mL

Table B3-13. Tank 241-AN-102 95 Percent Two-Sided Confidence Interval for the Mean Concentration for February 1998 Supernatant and Dissolution Composite Data. (4 sheets)

Analyte	Method	Mean	*df*	LL	UL	Units
Bromide*	IC	<1.29E+03	n/a	n/a	n/a	μg/mL
Cadmium	ICP	6.63E+01	3	6.24E+01	7.03E+01	μg/mL
Calcium	ICP	5.15E+02	3	4.86E+02	5.45E+02	μg/mL
Carbon-14	C14	7.04E-04	2	4.73E-04	9.36E-04	μCi/mL
Cerium*	ICP	<6.01E+01	n/a	n/a	n/a	μg/mL
Cesium 133 by ICP/MS	ICP/MS	1.16E+01	2	1.10E+01	1.22E+01	μg/mL
Cesium 135 by ICP/MS	ICP/MS	3.01E+00	2	2.85E+00	3.18E+00	μg/mL
Cesium-137	GEA	3.18E+02	3	9.61E+01	5.39E+02	μCi/mL
Cesium-137	ICP/MS	5.53E+00	2	5.15E+00	5.91E+00	μg/mL
Chloride	IC	4.18E+03	2	3.46E+03	4.90E+03	μg/mL
Chromium	ICP	2.98E+02	3	2.81E+02	3.15E+02	μg/mL
Cobalt*	ICP	<1.20E+01	n/a	n/a	n/a	μg/mL
Cobalt-60	GEA	1.06E-01	3	3.33E-02	1.79E-01	μCi/mL
Copper	ICP	2.64E+01	3	2.50E+01	2.77E+01	μg/mL
Curium-243/244*	^{241}Am	<1.49E-02	n/a	n/a	n/a	μCi/mL
Cyanide	Spec (CN)	5.08E+01	2	4.83E+01	5.32E+01	μg/mL
Europium-154	GEA	2.74E-01	3	9.60E-02	4.51E-01	μCi/mL
Europium-155*	GEA	<1.62E-01	n/a	n/a	n/a	μCi/mL
Fluoride	IC	1.84E+03	2	1.59E+03	2.08E+03	μg/mL
Gross alpha	Alpha Rad	1.90E-01	3	1.26E-01	2.54E-01	μCi/mL
Gross beta	Alpha Rad	5.86E+02	2	5.42E+02	6.30E+02	μCi/mL
Hydroxide	OH Direct	2.61E+03	3	2.44E+03	2.78E+03	μg/mL
Iodide*	IC	<4.24E+02	n/a	n/a	n/a	μg/mL
Iodine-129*	^{129}I	1.30E-04	2	1.08E-04	1.51E-04	μCi/mL
Iron	ICP	4.96E+01	3	4.57E+01	5.34E+01	μg/mL
Lanthanum*	ICP	<3.01E+01	n/a	n/a	n/a	μg/mL
Lead	ICP	1.84E+02	3	1.74E+02	1.94E+02	μg/mL
Lithium*	ICP	<6.01E+00	n/a	n/a	n/a	μg/mL
Magnesium*	ICP	<6.01E+01	n/a	n/a	n/a	μg/mL
Manganese	ICP	2.54E+01	3	2.14E+01	2.94E+01	μg/mL
Mercury*	AA CLP (Hg)	<5.00E-02	n/a	n/a	n/a	μg/mL
Molybdenum	ICP	5.55E+01	3	5.23E+01	5.86E+01	μg/mL
Neodymium*	ICP	<6.01E+01	n/a	n/a	n/a	μg/mL

Table B3-13. Tank 241-AN-102 95 Percent Two-Sided Confidence Interval for the Mean Concentration for February 1998 Supernatant and Dissolution Composite Data. (4 sheets)

Analyte	Method	Mean	*df*	LL	UL	Units
Neptunium-237*	ICP/MS	<2.77E-01	n/a	n/a	n/a	µg/mL
Neptunium-237*	^{237}Np	<2.13E-03	n/a	n/a	n/a	µCi/mL
Nickel	ICP	4.42E+02	3	4.22E+02	4.63E+02	µg/mL
Nitrate	IC	2.33E+05	2	2.23E+05	2.43E+05	µg/mL
Nitrite	IC	9.30E+04	2	8.75E+04	9.84E+04	µg/mL
Oxalate	IC	1.10E+03	2	8.06E+02	1.40E+03	µg/mL
Phosphate	IC	6.08E+03	2	5.14E+03	7.02E+03	µg/mL
Phosphorus	ICP	1.80E+03	3	1.71E+03	1.89E+03	µg/mL
Plutonium-239*	ICP/MS	<1.61E-01	n/a	n/a	n/a	µg/mL
Plutonium-240*	ICP/MS	<7.87E-02	n/a	n/a	n/a	µg/mL
Potassium	ICP	2.36E+03	3	2.28E+03	2.45E+03	µg/mL
Samarium*	ICP	<6.01E+01	n/a	n/a	n/a	µg/mL
Selenium*	ICP	<6.01E+01	n/a	n/a	n/a	µg/mL
Selenium-79	^{79}Se	6.04E-04	2	5.04E-04	7.05E-04	µCi/mL
Silicon*	ICP	<3.02E+01	n/a	n/a	n/a	µg/mL
Silver*	ICP	<7.44E+00	n/a	n/a	n/a	µg/mL
Sodium	ICP	2.20E+05	3	2.07E+05	2.33E+05	µg/mL
Specific gravity	SpG	1.43E+00	2	1.31E+00	1.55E+00	unitless
Strontium*	ICP	<6.01E+00	n/a	n/a	n/a	µg/mL
Strontium-89/90	Sr	8.90E+01	3	8.16E+01	9.64E+01	µCi/mL
Sulfate	IC	1.55E+04	2	1.44E+04	1.67E+04	µg/mL
Sulfur	ICP	5.64E+03	3	5.31E+03	5.97E+03	µg/mL
Tantalum*	ICP	<3.01E+01	n/a	n/a	n/a	µg/mL
Technetium-99	ICP/MS	8.23E+00	2	8.07E+00	8.40E+00	µg/mL
Thallium*	ICP	<1.20E+02	n/a	n/a	n/a	µg/mL
Thallium*	GFAA	<1.90E+00	2	n/a	n/a	µg/mL
Thorium*	ICP	<3.01E+01	n/a	n/a	n/a	µg/mL
Thorium-229*	ICP/MS	<1.43E-01	n/a	n/a	n/a	µg/mL
Thorium-230*	ICP/MS	<2.83E-01	n/a	n/a	n/a	µg/mL
Thorium-232	ICP/MS	2.03E+00	2	1.59E+00	2.47E+00	µg/mL
Tin*	ICP	<3.40E+01	n/a	n/a	n/a	µg/mL
Tin 126 by ICP/MS*	ICP/MS	<8.97E-01	n/a	n/a	n/a	µg/mL
Titanium*	ICP	<6.01E+00	n/a	n/a	n/a	µg/mL
Total inorganic carbon	TIC/TOC	1.40E+04	3	1.23E+04	1.56E+04	µg/mL

Table B3-13. Tank 241-AN-102 95 Percent Two-Sided Confidence Interval for the Mean Concentration for February 1998 Supernatant and Dissolution Composite Data. (4 sheets)

Analyte	Method	Mean	*df*	LL	UL	Units
Total organic carbon	Furnace Oxidation (TOC)	2.54E+04	3	2.41E+04	2.67E+04	µg/mL
Total organic carbon	TIC/TOC	2.42E+04	3	2.09E+04	2.75E+04	µg/mL
Tritium	Scintillation	7.32E-04	2	0.00E+00	2.51E-03	µCi/mL
Tungsten	ICP	2.01E+02	2	1.82E+02	2.19E+02	µg/mL
Uranium*	ICP	<3.00E+02	n/a	n/a	n/a	µg/mL
Uranium-233*	ICP/MS	<2.06E-01	n/a	n/a	n/a	µg/mL
Uranium-234*	ICP/MS	<1.26E-01	n/a	n/a	n/a	µg/mL
Uranium-235*	ICP/MS	<3.29E-01	n/a	n/a	n/a	µg/mL
Uranium-236*	ICP/MS	<1.91E-01	n/a	n/a	n/a	µg/mL
Vanadium*	ICP	<3.01E+01	n/a	n/a	n/a	µg/mL
Weight percent solids	Percent Solids	5.04E+01	3	4.94E+01	5.14E+01	%
Yttrium*	ICP	<6.01E+00	n/a	n/a	n/a	µg/mL
Zinc*	ICP	<6.01E+00	n/a	n/a	n/a	µg/mL
Zirconium	ICP	9.51E+00	3	8.80E+00	1.02E+01	µg/mL

Note:

SVOA = semivolatile organics

*A less-than value was used in the calculation.

The means for the February 1998 liquid samples appear in Table B3-14. The means were calculated using the four homogeneity check samples. The February 1998 sampling event is discussed in Section B2.2.

Table B3-14. Tank 241-AN-102 95 Percent Two-Sided Confidence Interval for the Mean Concentration for February 1998 Liquid Sample Data. (3 sheets)

Analyte	Method	Mean	*df*	LL	UL	Units
Aluminum	ICP	1.47E+04	3	1.44E+04	1.49E+04	µg/mL
Antimony*	ICP	<2.41E+01	n/a	n/a	n/a	µg/mL
Arsenic*	ICP	<4.01E+01	n/a	n/a	n/a	µg/mL
Barium*	ICP	<2.01E+01	n/a	n/a	n/a	µg/mL
Beryllium*	ICP	<2.00E+00	n/a	n/a	n/a	µg/mL

Table B3-14. Tank 241-AN-102 95 Percent Two-Sided Confidence Interval for the Mean Concentration for February 1998 Liquid Sample Data. (3 sheets)

Analyte	Method	Mean	*df*	LL	UL	Units
Bismuth*	ICP	<4.01E+01	n/a	n/a	n/a	µg/mL
Boron	ICP	3.97E+01	3	3.81E+01	4.14E+01	µg/mL
Bromide*	IC	1.45E+03	3	1.02E+03	1.88E+03	µg/mL
Cadmium	ICP	6.07E+01	3	5.91E+01	6.23E+01	µg/mL
Calcium	ICP	4.69E+02	3	4.58E+02	4.80E+02	µg/mL
Cerium*	ICP	<4.01E+01	n/a	n/a	n/a	µg/mL
Chloride	IC	4.38E+03	3	3.52E+03	5.23E+03	µg/mL
Chromium	ICP	2.74E+02	3	2.61E+02	2.87E+02	µg/mL
Cobalt*	ICP	<8.02E+00	n/a	n/a	n/a	µg/mL
Copper	ICP	2.36E+01	3	2.28E+01	2.43E+01	µg/mL
Fluoride*	IC	1.45E+03	3	3.80E+01	2.87E+03	µg/mL
Gross alpha	Alpha Rad	1.95E-01	3	1.75E-01	2.16E-01	µCi/mL
Gross beta	Alpha Rad	5.93E+02	3	5.81E+02	6.04E+02	µCi/mL
Iron	ICP	4.20E+01	3	4.14E+01	4.26E+01	µg/mL
Lanthanum*	ICP	<2.01E+01	n/a	n/a	n/a	µg/mL
Lead	ICP	1.68E+02	3	1.63E+02	1.73E+02	µg/mL
Lithium*	ICP	<4.01E+00	n/a	n/a	n/a	µg/mL
Magnesium*	ICP	<4.01E+01	n/a	n/a	n/a	µg/mL
Manganese	ICP	2.21E+01	3	1.92E+01	2.51E+01	µg/mL
Molybdenum	ICP	4.90E+01	3	4.75E+01	5.06E+01	µg/mL
Neodymium*	ICP	<4.01E+01	n/a	n/a	n/a	µg/mL
Nickel	ICP	4.05E+02	3	3.95E+02	4.15E+02	µg/mL
Nitrate	IC	2.36E+05	3	2.06E+05	2.65E+05	µg/mL
Nitrite	IC	8.39E+04	3	7.98E+04	8.80E+04	µg/mL
Oxalate*	IC	<1.15E+03	n/a	n/a	n/a	µg/mL
Phosphate	IC	5.80E+03	3	5.71E+03	5.89E+03	µg/mL
Phosphorus	ICP	1.67E+03	3	1.61E+03	1.72E+03	µg/mL
Potassium	ICP	2.21E+03	3	2.13E+03	2.28E+03	µg/mL
Samarium*	ICP	<4.01E+01	n/a	n/a	n/a	µg/mL
Selenium*	ICP	4.39E+01	3	3.91E+01	4.88E+01	µg/mL
Silicon*	ICP	<2.01E+01	n/a	n/a	n/a	µg/mL
Silver*	ICP	<4.01E+00	n/a	n/a	n/a	µg/mL
Sodium	ICP	2.12E+05	3	2.06E+05	2.17E+05	µg/mL
Strontium*	ICP	<4.01E+00	n/a	n/a	n/a	µg/mL
Sulfate	IC	1.47E+04	3	1.41E+04	1.52E+04	µg/mL

Table B3-14. Tank 241-AN-102 95 Percent Two-Sided Confidence Interval for the Mean Concentration for February 1998 Liquid Sample Data. (3 sheets)

Analyte	Method	Mean	*df*	LL	UL	Units
Sulfur	ICP	4.97E+03	3	4.85E+03	5.09E+03	µg/mL
Thallium*	ICP	<8.02E+01	n/a	n/a	n/a	µg/mL
Titanium*	ICP	<4.01E+00	n/a	n/a	n/a	µg/mL
Uranium*	ICP	<2.00E+02	n/a	n/a	n/a	µg/mL
Vanadium*	ICP	<2.01E+01	n/a	n/a	n/a	µg/mL
Zinc*	ICP	<4.10E+00	n/a	n/a	n/a	µg/mL
Zirconium	ICP	8.60E+00	3	8.39E+00	8.81E+00	µg/mL

Note:

*A less-than value was used in the calculation.

The July/August 1998 liquid sample means are provided in Table B3-15. When calculating the means, three liquid samples were used. Two uncentrifuged supernatant samples, one each from July and August, and the centrifuged liquid portion of the July solid sample discussed earlier. This sampling event is described in Section B2.1.

Table B3-15. Tank 241-AN-102 95 Percent Two-Sided Confidence Interval for the Mean Concentration for July/August 1998 Liquid Sample Data. (3 sheets)

Analyte	Method	Mean	*df*	LL	UL	Units
Aluminum	ICP	1.46E+04	2	1.33E+04	1.59E+04	µg/mL
Antimony*	ICP	<3.61E+01	n/a	n/a	n/a	µg/mL
Arsenic*	ICP	<6.01E+01	n/a	n/a	n/a	µg/mL
Atomic Mass Unit 242*	ICP/MS	<4.58E-01	n/a	n/a	n/a	µg/mL
Atomic Mass Unit 244*	ICP/MS	<2.62E-01	n/a	n/a	n/a	µg/mL
Barium*	ICP	<3.01E+01	n/a	n/a	n/a	µg/mL
Beryllium*	ICP	<3.00E+00	n/a	n/a	n/a	µg/mL
Bismuth*	ICP	<6.01E+01	n/a	n/a	n/a	µg/mL
Boron	ICP	3.92E+01	2	3.31E+01	4.54E+01	µg/mL
Cadmium	ICP	6.13E+01	2	5.68E+01	6.58E+01	µg/mL
Calcium	ICP	4.77E+02	2	4.29E+02	5.24E+02	µg/mL
Cerium*	ICP	<6.01E+01	n/a	n/a	n/a	µg/mL
Cesium-137	GEA	4.36E+02	2	3.92E+02	4.79E+02	µCi/mL
Chromium	ICP	2.80E+02	2	2.59E+02	3.00E+02	µg/mL

Table B3-15. Tank 241-AN-102 95 Percent Two-Sided Confidence Interval for the Mean Concentration for July/August 1998 Liquid Sample Data. (3 sheets)

Analyte	Method	Mean	*df*	LL	UL	Units
Cobalt*	ICP	<1.20E+01	n/a	n/a	n/a	µg/mL
Cobalt-60*	GEA	<1.95E+00	n/a	n/a	n/a	µCi/mL
Copper	ICP	2.39E+01	2	2.19E+01	2.59E+01	µg/mL
Iron	ICP	4.37E+01	2	3.88E+01	4.86E+01	µg/mL
Lanthanum*	ICP	<3.01E+01	n/a	n/a	n/a	µg/mL
Lead	ICP	1.81E+02	2	1.68E+02	1.94E+02	µg/mL
Lithium*	ICP	<6.01E+00	n/a	n/a	n/a	µg/mL
Magnesium*	ICP	<6.01E+01	n/a	n/a	n/a	µg/mL
Manganese	ICP	2.30E+01	2	1.85E+01	2.74E+01	µg/mL
Molybdenum	ICP	5.11E+01	2	4.82E+01	5.40E+01	µg/mL
Neodymium*	ICP	<6.01E+01	n/a	n/a	n/a	µg/mL
Nickel	ICP	4.07E+02	2	3.81E+02	4.32E+02	µg/mL
Phosphorus	ICP	1.72E+03	2	1.58E+03	1.86E+03	µg/mL
Plutonium-240*	ICP/MS	<2.99E-01	n/a	n/a	n/a	µg/mL
Potassium	ICP	2.21E+03	2	1.98E+03	2.43E+03	µg/mL
Samarium*	ICP	<6.01E+01	n/a	n/a	n/a	µg/mL
Selenium*	ICP	<6.11E+01	n/a	n/a	n/a	µg/mL
Silicon*	ICP	<3.01E+01	n/a	n/a	n/a	µg/mL
Silver	ICP	1.56E+01	2	1.37E+01	1.75E+01	µg/mL
Sodium	ICP	2.09E+05	2	1.90E+05	2.29E+05	µg/mL
Specific gravity	SpG	1.46E+00	2	1.43E+00	1.49E+00	unitless
Strontium*	ICP	<6.01E+00	n/a	n/a	n/a	µg/mL
Strontium-89/90	Sr	8.88E+01	2	8.36E+01	9.39E+01	µCi/mL
Sulfur	ICP	5.11E+03	2	4.53E+03	5.70E+03	µg/mL
Thallium*	ICP	<1.20E+02	n/a	n/a	n/a	µg/mL
Titanium*	ICP	<6.01E+00	n/a	n/a	n/a	µg/mL
Total organic carbon	Furnace Oxidation (TOC)	3.00E+04	2	2.43E+04	3.56E+04	µg/mL
U-233 by ICP/MS*	ICP/MS	<1.51E+00	n/a	n/a	n/a	µg/mL
U-234 by ICP/MS*	ICP/MS	<1.55E+00	n/a	n/a	n/a	µg/mL
U-235 by ICP/MS*	ICP/MS	<1.63E+00	n/a	n/a	n/a	µg/mL
U-236 by ICP/MS*	ICP/MS	<9.82E-01	n/a	n/a	n/a	µg/mL
Uranium*	ICP	<3.00E+02	n/a	n/a	n/a	µg/mL
Uranium-238	ICP/MS	2.07E+01	2	1.91E+01	2.23E+01	µg/mL

Table B3-15. Tank 241-AN-102 95 Percent Two-Sided Confidence Interval for the Mean Concentration for July/August 1998 Liquid Sample Data. (3 sheets)

Analyte	Method	Mean	*df*	LL	UL	Units
Vanadium*	ICP	<3.01E+01	n/a	n/a	n/a	μg/mL
Zinc*	ICP	<6.01E+00	n/a	n/a	n/a	μg/mL
Zirconium	ICP	9.30E+00	2	8.63E+00	9.98E+00	μg/mL

Note:

*A less-than value was used in the calculation.

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APPENDIX C

STATISTICAL ANALYSIS FOR ISSUE RESOLUTION

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APPENDIX C

STATISTICAL ANALYSIS FOR ISSUE RESOLUTION

Appendix C documents the results of the analyses and statistical and numerical manipulations required by the DQOs applicable to tank 241-AN-102. The analyses required for tank 241-AN-102 are reported as follows:

- **Section C1.0**: Statistical analysis and numerical manipulations of the 1994/1995 grab sampling data (Esch 1996) supporting the safety screening DQO (Dukelow et al. 1995).

- **Section C2.0**: Appendix C references.

C1.0 STATISTICS FOR THE SAFETY SCREENING DATA QUALITY OBJECTIVE

Of the five primary analyses required by the safety screening DQO, three have decision criteria thresholds that could warrant further investigation to ensure tank safety, if they are exceeded. These three analyses include DSC (to measure the fuel content), a measurement of the total alpha activity (to determine the criticality potential), and a determination of the flammability of the tank headspace vapors. Only the data from the 1994 and 1995 grab samples were analyzed to safety screening requirements.

The safety screening DQO (Dukelow et al. 1995) defines decision limits in terms of one-sided 95 percent confidence intervals. The safety screening DQO limits are 480 J/g (dry-weight basis) for the DSC analyses (Dukelow et al. 1995).

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

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

In this equation, $\hat{\mu}$ is the arithmetic mean of the data, $\hat{\sigma}_{\mu}$ 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. The degrees of freedom equal the number of samples minus one.

Table C1-1 presents the samples that exhibited exothermic reactions. In order to compare the exothermic enthalpy changes with the safety screening DQO decision criteria threshold of

480 J/g (dry-weight basis), all exothermic reactions were first converted to a dry-weight basis using the respective sample weight percent water. Twelve of the 14 samples contained exothermic reactions, and 8 of these were greater than the DQO limit of 480 J/g. The upper limit to a one-sided 95 percent confidence interval on the mean for all but one of the samples exceeded the threshold. The highest individual sample result was 1,200 J/g (dry-weight), and the highest upper limit to a one-sided 95 percent confidence interval on the mean was 1,501 J/g (both from sample 2AN-95-2).

Total organic carbon analyses were performed as secondary analyses when the DSC notification limit was exceeded. The organic safety program has established a dry-weight TOC concentration limit of 4.5 weight percent, or 45,000 μg C/g. Results for three out of the ten samples analyzed for TOC were above this limit. Six of the ten samples had upper limits to a one-sided 95 percent confidence interval on the mean exceeding the threshold, with the highest being 57,900 μg C/g (from sample 2AN-95-4A). Table C1-2 presents the 95 percent confidence interval upper limits for the TOC data.

To investigate the relationship between DSC and the TOC content, the DSC dry-weight results for those samples that had exothermic reactions are compared with the corresponding dry-weight TOC results and the TOC energy equivalents in Table C1-3. This comparison may be biased because DSC reports net enthalpy change, and if endotherms are present, they could mask the full extent of the actual exothermic reactions. The TOC data were converted to their energy equivalents using the following equation. The 1,200 J/g value represents the energy equivalent of 4.5 weight percent TOC, based on a sodium acetate average energetics standard. Assuming that all of the TOC is present as sodium acetate may also bias this comparison.

$$\text{Energy Equivalent} = \text{wt\% TOC (dry weight)} \frac{(1{,}200 \text{ J/g})}{4.5}$$

Table C1-1. DSC Exothermic Results and 95 Percent Confidence Interval Upper Limits.

Sample Number	Grab Sample	Run	Wet Wt. Δ H (J/g)	Sample Wt% Water (%)	Dry Wt. Δ H (J/g)	Mean (J/g)	Upper Limits to a One-sided 95% Confidence Interval (J/g)
Supernatants							
S95T003982	102AN-1(B)	1	284.2	49.56	563.6	596.5	804.2
		2	317.4		629.4		
S95T003983	102AN-2(B)	1	361.3	49.83	720.3	640.2	1,146
		2	281.0		560.2		
S95T003984	102AN-4	1	223.2	49.36	440.8	415.0	577.9
		2	197.1		389.2		
S95T003867	2AN-95-1	1	283.9	49.14	558.2	558.3	558.9
		2	284.0		558.4		
S95T003868	2AN-95-2	1	616.1	48.97	1,200	1,150	1,501
		2	557.8		1,090		
S95T003869	2AN-95-3	1	277.2	50.08	555.3	560.7	594.8
		2	282.6		566.1		
Centrifuged liquids							
S96T000005[1]	102-AN-3(A)	1	237.0	49.09	465.6	459.0	500.9
		2	230.2		452.3		
S96T000006	102-AN-3(B)	1	0	47.39	0	26.11	190.9
		2	27.47		52.21		
S95T004133	2AN-95-4A	1	258.0	47.03	487.1	481.5	516.9
		2	252.1		475.9		
S95T004135	2AN-95-5A	1	279.7	49.74	556.5	577.0	706.4
		2	300.3		597.5		
S95T004137	2AN-95-4A	1	279.7	42.70	488.1	473.1	567.5
		2	262.5		458.2		
S95T004139	2AN-95-5A	1	283.2	43.75	492.1	530.6	773.7
		2	327.5		569.1		

Note:

[1]The exothermic reactions for this sample came from the third transition, whereas those for all other samples came from the second transition.

Table C1-2. 95 Percent Confidence Interval Upper Limits for the 1994/1995 Total Organic Carbon Data (Dry-Weight Basis).

Lab Sample ID	Description	$\hat{\mu}$	*df*	UL	Units
S95T003982	102-AN-1(B)	37,300	1	40,500	µg C/g
S95T003983	102-AN-2(B)	37,600	1	45,800	µg C/g
S95T003984	102-AN-4	35,600	1	38,100	µg C/g
S95T003867	2AN-95-1	37,350	1	47,100	µg C/g
S95T003868	2AN-95-2	35,650	1	42,900	µg C/g
S95T003869	2AN-95-3	36,600	1	42,900	µg C/g
S95T004133	2AN-95-4A	47,200	1	57,900	µg C/g
S95T004135	2AN-95-5A	49,100	1	54,200	µg C/g
S95T004137	2AN-95-4A	46,250	1	51,600	µg C/g
S95T004139	2AN-95-5A	37,600	1	54,000	µg C/g

Table C1-3. Comparison of DSC Analytical Results with TOC Energy Equivalents (Dry-Weight Basis). (2 sheets)

Sample Number	Grab Sample	Subsample	Run	TOC Analytical Result (µg C/g)	TOC Energy Equivalent (J/g)	DSC Analytical Result (J/g)
S95T003982	102-AN-1(B)	Supernatant	1	37,800	1,008	563.4
			2	36,800	981	629.3
S95T003983	102-AN-2(B)	Supernatant	1	36,300	968	720.3
			2	38,900	1,037	560.2
S95T003984	102-AN-4	Supernatant	1	36,000	960	440.8
			2	35,200	939	389.2
S95T003867	2AN-95-1	Supernatant	1	38,900	1,037	558.2
			2	35,800	955	558.4
S95T003868	2AN-95-2	Supernatant	1	34,500	920	1,220
			2	36,800	981	1,110
S95T003869	2AN-95-3	Supernatant	1	37,600	1,003	555.3
			2	35,600	949	566.1
S95T004133	2AN-95-4A	Centrifuged liquid	1	45,500	1,213	487.1
			2	48,900	1,304	475.9

Table C1-3. Comparison of DSC Analytical Results with TOC Energy Equivalents (Dry-Weight Basis). (2 sheets)

Sample Number	Grab Sample	Subsample	Run	TOC Analytical Result (μg C/g)	TOC Energy Equivalent (J/g)	DSC Analytical Result (J/g)
S95T004135	2AN-95-5A	Centrifuged liquid	1	48,300	1,288	556.5
			2	49,900	1,331	597.5
S95T004137	2AN-95-4A	Centrifuged solid	1	45,400	1,211	488.1
			2	47,100	1,256	458.1
S95T004139	2AN-95-5A	Centrifuged solid	1	35,000	933	492.1
			2	40,200	1,072	569.1

The potential for criticality can be assessed from the total alpha activity data. The safety screening decision threshold is 1 g/L, which can be converted to 61.5 μCi/mL using the specific activity of ^{239}Pu. The liquid total alpha results are compared to this threshold on a 95 percent confidence interval basis. The centrifuged liquid from grab sample 102-AN-3(A) had the highest 95 percent confidence interval upper limit, with a result of 0.296 μCi/mL. This result was over two orders of magnitude less than the safety screening limit.

For the solids, the 61.5 μCi/mL limit was converted to a μCi/g basis by dividing by the sludge density, 1.50 g/mL. This calculation yields a threshold of 41.0 μCi/g. The highest 95 percent confidence interval upper limit was from the centrifuged solids of sample 102-AN-3(B), which had a result of 1.41 μCi/g. Again, this value was well below the safety screening limit. Table C1-4 presents the total alpha activity 95 percent confidence interval upper limits.

Table C1-4. 95 Percent Confidence Interval Upper Limits for the 1994/1995 Total Alpha Data. (2 sheets)

Lab Sample ID	Description	$\hat{\mu}$	*df*	UL	Units
n/a	102-AN-1(A)	0.170	1	0.204	μCi/mL
n/a	102-AN-2(A)	0.165	1	0.193	μCi/mL
n/a	102-AN-4	0.166	1	0.175	μCi/mL
S95T003984		0.167	1	0.214	μCi/mL
S95T003982	102-AN-1(B)	0.150	1	0.188	μCi/mL
S95T003983	102-AN-2(B)	0.116	1	0.116	μCi/mL
S95T003870	2AN-95-1	0.174	1	0.180	μCi/mL
S95T003871	2AN-95-2	0.176	1	0.217	μCi/mL

Table C1-4. 95 Percent Confidence Interval Upper Limits for the 1994/1995 Total Alpha Data. (2 sheets)

Lab Sample ID	Description	$\hat{\mu}$	*df*	UL	Units
S95T003872	2AN-95-3	0.186	1	0.290	µCi/mL
S96T000005	102-AN-3(A)	0.192	1	0.296	µCi/mL
S96T000007		0.319	1	0.401	µCi/g
S96T000006	102-AN-3(B)	0.229	1	0.295	µCi/mL
S96T000008		0.865	1	1.41	µCi/g
S95T004133	2AN-95-4A	0.170	1	0.179	µCi/mL
S95T004141		0.462	1	0.477	µCi/g
S95T004135	2AN-95-5A	0.145	1	0.196	µCi/mL
S95T004142		0.331	1	0.344	µCi/g

C2.0 STATISTICS FOR THE LOW-ACTIVITY WASTE FEED DATA QUALITY OBJECTIVES

The *Low-Activity Waste (LAW) Feed Data Quality Objectives* (Truex and Wiemers 1998) identifies the statistical analyses that are required as part of the effort to characterize tank waste with respect to the Privatization Contract LAW feed envelope specification limits. The statistical requirements and methodology for performing the statistics are outlined in Section 7.7.2 and Appendix C of Truex and Wiemers (1998), respectively.

Of the statistical requirements outlined in the above-mentioned sections of Truex and Wiemers (1998), Kinzer (1999) directs that only the following statistical calculations are required at this time:

- the mean concentration ($\hat{\mu}$) of the composite subsample results,
- the standard deviation of the mean $SD(\hat{\mu}) = S/\sqrt{n}$, and
- the RSD associated with the mean ($RSD(\hat{\mu}) = (SD(\hat{\mu})/\hat{\mu}) \times 100$). Both $SD(\hat{\mu})$ and $RSD(\hat{\mu}) = (SD(\hat{\mu})/\hat{\mu}) \times 100$ represent the random variability associated with the analytical measurements.

Table C2-1 is a comparison of tank 241-AN-102 supernatant results to the envelope C contract limits as reported in Esch (1998). The mean (average) concentrations are carried over to Table C2-2, which also reports the standard deviation of the mean and the RSD associated with the mean for the applicable analytes.

Table C2-1. Comparison of Tank 241-AN-102 Supernatant Composite Results to the Envelope C Contract Limits.[1] (2 sheets)

Analyte	Subsamp I µg/mL	Subsamp II µg/mL	Subsamp III µg/mL	Average µg/mL	Average *M*	Ratio (Avg/Na) (moles analyte/moles Na) A	Envelope Specification (moles analyte/moles Na) B	Found Analyte/Envelope Specification [(Avg/Na)/Envelope Specification] A/B
Al	1.54E+04	1.62E+04	1.62E+04	1.59E+04	5.91E-01	6.20E-02	1.9E-01	32.63%
Ba	<3.01E+01	<3.01E+01	<3.01E+01	3.01E+01	2.19E-04	2.30E-05	1.0E-04	23.01%
Ca	5.07E+02	5.26E+02	5.20E+02	5.18E+02	1.29E-02	1.36E-03	4.0E-02	3.39%
Cd	6.48E+01	6.83E+01	6.76E+01	6.69E+01	5.95E-04	6.24E-05	4.0E-03	1.56%
Cl	4.33E+03	3.84E+03	4.36E+03	4.18E+03	1.18E-01	1.24E-02	3.7E-02	33.42%
Cr	2.92E+02	3.06E+02	3.04E+02	3.01E+02	5.78E-03	6.07E-04	6.9E-03	8.80%
F	1.92E+03	1.72E+03	1.87E+03	1.84E+03	9.67E-02	1.01E-02	9.1E-02	11.15%
Fe	4.89E+01	5.11E+01	5.12E+01	5.04E+01	9.02E-04	9.47E-05	1.0E-02	0.95%
Hg	<5.00E-02	<5.00E-02	<5.00E-02	5.00E-02	2.49E-07	2.62E-08	1.4E-05	0.19%
K	2.34E+03	2.40E+03	2.38E+03	2.37E+03	6.07E-02	6.37E-03	1.8E-01	3.54%
La	<3.01E+01	<3.01E+01	<3.01E+01	3.01E+01	2.17E-04	2.27E-05	8.3E-05	27.41%
Na	2.15E+05	2.30E+05	2.12E+05	2.19E+05	9.53E+00	1	1	100.00%
Ni	4.36E+02	4.52E+02	4.48E+02	4.45E+02	7.58E-03	7.96E-04	3.0E-03	26.54%
NO_2	9.34E+04	9.49E+04	9.06E+04	9.30E+04	2.02E+00	2.12E-01	3.8E-01	55.82%
NO_3	2.38E+05	2.32E+05	2.30E+05	2.33E+05	3.76E+00	3.95E-01	8.0E-01	49.38%
OH	2.48E+03	2.60E+03	2.66E+03	2.58E+03	1.52E-01	1.59E-02	7.0E-01	2.27%
Pb	1.81E+02	1.91E+02	1.84E+02	1.85E+02	8.94E-04	9.38E-05	6.8E-04	13.80%
PO_4	6.34E+03	5.65E+03	6.25E+03	6.08E+03	6.40E-02	6.72E-03	3.8E-02	17.69%
SO_4	1.59E+04	1.50E+04	1.57E+04	1.55E+04	1.62E-01	1.70E-02	2.0E-02	84.87%
TIC	1.26E+04	1.48E+04	1.42E+04	1.39E+04	1.15E+00	1.21E-01	3.0E-01	40.40%
TOC (F)	2.53E+04	2.52E+04	2.64E+04	2.56E+04	2.13E+00	2.24E-01	5.0E-01	44.81%
TOC (P)	2.22E+04	2.62E+04	2.53E+04	2.46E+04	2.05E+00	2.15E-01	5.0E-01	42.94%
U	7.03E+00	6.64E+00	7.71E+00	7.12E+00[2]	2.99E-05	3.14E-06	1.2E-03	0.26%

Table C2-1. Comparison of Tank 241-AN-102 Supernatant Composite Results to the Envelope C Contract Limits.[1] (2 sheets)

	Subsamp I	Subsamp II	Subsamp III	Average	Average	Ratio (Avg/Na) (moles analyte/moles Na)	Envelope Specification (moles analyte/moles Na)	Found Analyte/Envelope Specification [(Avg/Na)/Envelope Specification]
Analyte	µg/mL	µg/mL	µg/mL	µg/mL	*M*	A	B	A/B
Analyte	µCi/mL	µCi/mL	µCi/mL	µCi/mL	Bq/L	(Bq analyte/moles Na)		
Total alpha	1.48E-01	1.78E-01	1.91E-01	1.72E-01	6.38E+06	6.69E+05	3.0E+06	22.31%
^{237}Np	<1.97E-03	<2.28E-03	<1.97E-03	2.13E-03[2]	7.88E+04	n/a	n/a	n/a
^{239}Pu	<9.98E-03	<9.98E-03	<9.98E-03	9.98E-03	3.69E+05	n/a	n/a	n/a
^{240}Pu	<1.79E-02	<1.79E-02	<1.79E-02	1.79E-02	6.61E+05	n/a	n/a	n/a
^{241}Am	1.66E-01	1.59E-01	1.59E-01	1.61E-01	5.97E+06	n/a	n/a	n/a
^{242}Pu	<5.02E-04	<5.02E-04	<5.02E-04	5.02E-04	1.86E+04	n/a	n/a	n/a
$^{243/244}$Cm	<1.40E-02	<1.48E-02	<1.57E-02	1.49E-02[2]	5.51E+05	n/a	n/a	n/a
^{243}Am	<1.88E-01	<1.87E-01	<1.86E-01	2.01E-02[2,3]	7.44E+05	n/a	n/a	n/a
TRU				2.12E-01[2,4]	8.39E+06	8.80E+05	3.0E+06	29.33%
^{137}Cs	3.92E+02	3.79E+02	3.90E+02	3.87E+02	1.43E+10	1.50E+09	4.3E+09	34.96%
^{90}Sr	8.50E+01	9.33E+01	9.17E+01	9.00E+01	3.33E+09	3.50E+08	8.0E+08	43.69%
^{99}Tc	1.41E-01	1.39E-01	1.40E-01	1.40E-01	5.18E+06	5.44E+05	7.1E+06	7.66%

Notes:

TOC (F) = Total organic carbon by furnace oxidation method
TOC (P) = Total organic carbon by persulfate method

[1]Esch (1998)
[2]Values differ from Esch (1998)
[3]Am-243 = Am/Cm-243 (by ICP/MS) - $^{243/244}$Cm (by separation AEA)
[4]TRU = Sum of ^{237}Np, ^{239}Pu, ^{240}Pu, ^{241}Am, ^{242}Pu, $^{243/244}$Cm, and ^{243}Am results

Table C2-2. Variance Components For Tank 241-AN-102 Supernatant Composite Means. (2 sheets)

Constituent	Analysis Method Group	Units	Mean	SD (mean)	%RSD (mean)	nonU[1]	U[2]
Al	ICP	µg/mL	15,900	300	1.89	6	0
Ba	ICP	µg/mL	<30.1	n/a	n/a	0	6
Cd	ICP	µg/mL	66.9	1.35	2.01	6	0
Ca	ICP	µg/mL	518	10.6	2.06	6	0
Cl	IC	µg/mL	4,180	167	4.00	6	0
Cr	ICP	µg/mL	301	5.55	1.85	6	0
F	IC	µg/mL	1,840	57.3	3.12	6	0
OH	OH direct	µg/mL	2,580	53.3	2.07	6	0
Fe	ICP	µg/mL	50.4	1.06	2.11	6	0
La	ICP	µg/mL	<30.1	n/a	n/a	0	6
Pb	ICP	µg/mL	185	3.43	1.85	6	0
Hg	AA CLP (Hg)	µg/mL	<0.05	n/a	n/a	0	6
Ni	ICP	µg/mL	445	6.98	1.57	6	0
NO_2	IC	µg/mL	2.33E+05	2,330	1.00	6	0
NO_3	IC	µg/mL	93,000	1,260	1.36	6	0
PO_4	IC	µg/mL	6,080	21.9	3.60	6	0
K	ICP	µg/mL	2,370	32.5	1.37	6	0
Na	ICP	µg/mL	2.19E+05	5,570	2.54	6	0
SO_4	IC	µg/mL	15,500	270	1.74	6	0
TIC	TIC/TOC	µg/mL	13,900	633	4.56	6	0
TOC	Furnace oxidation	µg/mL	25,600	394	1.54	6	0
TIC	TIC/TOC	µg/mL	24,600	1,210	4.93	6	0
U_{TOTAL}	n/a	µg/mL	7.12[3]	n/a	n/a	n/a	n/a
Total alpha	Alpha rad	µCi/mL	0.172	0.0128	7.44	6	0
^{237}Np	^{237}Np	µCi/mL	<0.00213	n/a	n/a	0	6
^{239}Pu	ICP/MS	µCi/mL	<0.00998	n/a	n/a	0	6
^{240}Pu	ICP/MS	µCi/mL	<0.0179	n/a	n/a	0	
^{241}Am	^{241}Am	µCi/mL	0.161	0.00250	1.55	6	0
^{242}Pu	ICP/MS	µCi/mL	<5.02E-04	n/a	n/a	0	6
$^{243/244}Cm$	^{241}Am	µCi/mL	<0.0149	n/a	n/a	0	6
^{243}Am	ICP/MS	µCi/mL	<0.0052[4]	n/a	n/a	0	5
TRU	n/a	µCi/mL	0.212[5]	n/a	n/a	n/a	n/a
^{137}Cm	GEA	µCi/mL	387	7.48	1.93	6	0

Table C2-2. Variance Components For Tank 241-AN-102 Supernatant Composite Means. (2 sheets)

Constituent	Analysis Method Group	Units	Mean	SD (mean)	%RSD (mean)	nonU[1]	U[2]
$^{89/90}Sr$	$^{89/90}Sr$	µCi/mL	90.0	2.56	2.84	6	0
^{99}Tc	ICP/MS	µCi/mL	0.140	0.0646	0.46	6	0

Notes:

[1]Number of observations above detection limits.

[2]Number of observations below detection limits.

[3]Derived by summing results for the individual uranium isotopes as measured by ICP/MS. Approximately 88 percent of this total is from a detected result (^{238}U); the remainder is a sum of detection limits.

[4]Americium-243 = Am/Cm-243 (by ICP/MS) – Cm-243/244 (by separation AEA)
[5]Derived by summing the ^{237}Np, ^{239}Pu, ^{240}Pu, ^{241}Am, ^{242}Pu, $^{243/244}Cm$, and ^{243}Am results.

C3.0 APPENDIX C REFERENCES

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR DOUBLE-SHELL TANK 241-AN-102

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR DOUBLE-SHELL TANK 241-AN-102

An effort is underway to provide waste inventory estimates that will serve as standard characterization source terms for the various waste management activities at the Hanford Site (Hodgson and LeClair 1996). As part of this effort, an evaluation of available information for double-shell tank 241-AN-102 was performed, and a best-basis inventory was established. This work, detailed in the following sections, follows the methodology established by the standard inventory task.

D1.0 CHEMICAL INFORMATION SOURCES

Available composition information for tank 241-AN-102 is as follows:

- Chemical data from grab samples taken for privatization needs in February, July, and August of 1998 (Appendix B, Sections B2.1 and B2.2). Both supernatant and sludge grab samples were obtained. As described in Appendix B, a complex mixture of direct subsamples, composite subsamples, and homogeneity samples were analyzed.

- Chemical data from a series of grab sampling events in 1994 and 1995 that primarily focused on the tank supernatant (Appendix B, Section B2.4). Very limited results were obtained for the tank solids.

- Characterization results from a 1990 core sampling event (Appendix B, Section B2.5). The recovered sludge was composited and centrifuged before analysis, and the centrifuged portions were analyzed separately. To derive an overall sludge mean for each analyte, the centrifuged fraction results were recombined based on weighting factors. The weighting factors were the respective weight percents that each centrifuged fraction represented in the original composite.

- Analytical results from the 242-A Evaporator Campaign 84-4 Post-Run Document (Pontious 1984). This report provides characterization data for the waste in tank 241-AW-101 before it was sent to tank 241-AN-102. The material from tank 241-AW-101 comprises the vast majority of the waste now residing in tank 241-AN-102.

- Inventory estimates from the Hanford Defined Waste (HDW) Model (Agnew et al. 1997a).

- Data from historical grab sampling events in 1989 (Herting 1994) and 1984 (Bratzel 1985).

Hanlon (1999) estimates that tank 241-AN-102 currently contains a total of 4,027 kL (1,064 kgal) of waste, with 337 kL (89 kgal) existing as sludge and 3,690 kL (975 kgal) in the form of supernatant. The overall volume estimate is in close agreement with recent surface level measurements (Appendix A), which indicate that the tank contains between 4,023 kL (1,063 kgal) and 4,035 kL (1,066 kgal) of waste (based on the February 16, 1999, automatic FIC and manual tape readings, respectively). For the purposes of this best-basis inventory, the solids in tank 241-AN-102 have been characterized as saltcake rather than sludge based on analyte concentrations. Section D3.3.1.2 provides a discussion of this issue.

The supernatant best-basis inventory reported in the previous TCR used a supernatant volume of 3,755 kL (992 kgal). This volume differs from that reported in the current Hanlon (1999) report because of evaporative losses (i.e., no transfers have occurred). Although the volume is changing through a loss of water, conservation of mass requires that the inventories of the other waste constituents not change. Instead, these constituents would be present in higher concentrations. Therefore, no changes to the previous supernatant best-basis inventory values have been made as a result of the volume change.

The sludge volume reported in Hanlon (1999) is based on an average of three sludge measurements taken in June 1989 through three different risers (Sasaki 1989). The individual measurements are worth noting because of the substantial differences. Sludge levels of 39.25, 32.25, and 26.0 in. were taken from risers 20, 3, and 1, respectively. See Appendix A, Figure A2-1 for the riser configuration for tank 241-AN-102. From these measurements, it appears that the waste is uneven and is sloped downward towards the south to southwest direction. Unfortunately, no measurement was made in the southeast portion of the tank to shed light on the sludge depth in that region.

Since the 1989 measurements, two events have transpired which add information to the sludge-level assessment. However, both of these events only apply to the sludge level in the vicinity of riser 20 (which had the highest sludge-level reading in 1989). A sludge-level measurement was taken through riser 20 following the February 1998 grab sampling. At 42 in. from the tank bottom, it was recorded in the work package that the waste had a thick consistency (LMHC 1998). The consistency continued to get thicker, and at 30 in. the zipcord became completely slack, characteristic of a hard sludge layer. The region between the 42 and 30 in. levels may be indicative of a "soft" sludge layer. The second sludge-level indicator is the core recoveries from the 1990 core. This core was taken from riser 10, which is in close proximity to riser 20 (within 10 ft). Nearly three full segments were recovered, indicating that close to 57 in. of sludge may exist under riser 10. The top segment was described as a noncohesive slurry, while the bottom two segments were primarily described as semi-solid. The difference in sludge-level estimates from risers separated by less than 10 feet supports the 1989 observation that the sludge surface is uneven. Unfortunately, neither of these sludge-level indicators provides information on the sludge level in other areas of the tank.

Extrapolating information from the 1998 sludge level measurement to the remainder of the tank is impractical. It would be expected from descriptions of the top segment of the 1990 core that the sludge would tend to level out. However, if the sludge was to level out, it should have happened long before the 1989 sludge-level measurements. The sludge currently existing in the tank was received in 1984, and sat undisturbed for five years before the 1989 sludge-level measurements. A final explanation is that the surface of the sludge might not be uneven at all. Instead, an interface region of increasing viscosity may exist between the supernatant and the hard sludge. Measurement of the beginning of this layer may be difficult, enough so that a difference of approximately 13 in. could occur between two measurement points solely as a result of the interpretation of the zipcord operator.

Regardless, because the solids level has been known to be uneven in the past, and the recent sludge-level measurement and 1990 core recoveries only provided information for one region of the tank, neither is considered adequate for determining the overall tank sludge volume. Consequently, the sludge volume estimate based on the 1989 measurements is considered the best overall estimate available. Therefore, 337 kL (89 kgal) was used as the sludge volume for determining the sludge best-basis inventories.

D2.0 COMPARISON OF COMPONENT INVENTORY VALUES

The tank 241-AN-102 chemical and radionuclide inventories predicted from the HDW model estimates (Agnew et al. 1997a) and previous best-basis estimates are shown in Tables D2-1 and D2-2. The chemical species are reported without charge designation per the best-basis inventory convention. The HDW model estimates were generated using a predicted bulk density of 1.76 g/mL and a waste volume of 4,126 kL (1,090 kgal).

The previous best-basis estimates used a combination of the 1990 core sample results and data from the grab sampling events in 1994 and 1995. The 1990 core data were used to derive inventories for the sludge. As described in the previous section, results from the analysis of centrifuged solid and liquid composite fractions were mathematically combined to derive an overall mean for the sludge. The results for the fractions were combined based on their weight percent in the original composite (55.4 percent solids and 44.6 percent liquids). Inventories for the sludge were then derived using a measured density result of 1.5 g/mL and a sludge volume of 337 kL (89 kgal). The 1994 and 1995 grab samples were used to derive the supernatant inventory. A supernatant volume of 3,755 kL (992 kgal) was used to convert the concentrations to inventories. A total tank best-basis inventory was derived by adding the sludge and supernatant inventories. Tables D2-1 and D2-2 display these total tank inventories.

Table D2-1. Comparison of Inventory Estimates for Nonradioactive Components in Tank 241-AN-102.

Analyte	HDW[1] Inventory Estimate (kg)	Previous Best-Basis Estimate[2] (kg)
Al	2.36E+05	62,900
Bi	1,290	0
Ca	6,430	2,680
Cl	44,700	15,300
Cr	33,700	1,810
F	6,290	7,430
Fe	3,030	1,040
Hg	9.67	0
K	13,800	15,500
La	14.3	0
Mn	1,630	389
Na	1.68E+06	1.02E+06
Ni	1,760	1,650
NO_2	6.00E+05	3.30E+05
NO_3	1.44E+06	9.02E+05
OH_{TOTAL}	8.60E+05	2.62E+05
Pb	1,330	(Used HDW model estimate)
PO_4	49,100	19,600
Si	11,700	764
SO_4	1.45E+05	64,900
Sr	0	10.1
TIC as CO_3	1.74E+05	2.79E+05
TOC	1.06E+05	1.07E+05
U_{TOTAL}	11,200	1,560
Zr	76.6	280

Notes:
[1]Agnew et al. (1997a)
[2]Effective May 31, 1997 (LMHC 1999).

Table D2-2. Comparison of Inventory Estimates for Selected Radioactive Components in Tank 241-AN-102.

Analyte	HDW[1] Inventory Estimate (Ci)	Previous Best Basis Estimate[2] (Ci)
^{60}Co	274	759
^{90}Sr	6.56E+05	3.68E+05
^{99}Tc	1,640	162
^{137}Cs	1.40E+06	1.49E+06
^{232}U	5.33	0.746
^{233}U	20.4	2.86
^{234}U	4.22	0.590
^{235}U	0.168	0.0235
^{236}U	0.150	0.0210
^{237}Np	5.72	0.477
^{238}Pu	9.39	11.7
^{238}U	5.36	0.521
^{239}Pu	290	48.9
^{240}Pu	51.1	8.62
^{241}Am	350	813
^{241}Pu	672	113
^{242}Cm	0.975	0.513
^{242}Pu	0.00359	6.06E-04
^{243}Am	0.0138	0.0320
^{243}Cm	0.0928	0.00139
^{244}Cm	0.804	15.4

Notes:

[1]Agnew et al. (1997a); decayed to January 1, 1994.

[2]Effective May 31, 1997 (LMHC 1999); decayed to January 1, 1994.

D3.0 COMPONENT INVENTORY EVALUATION

The following evaluation of tank contents is performed in order to identify potential errors and/or missing information that would influence the various inventories, and to determine the most appropriate inventory for describing the tank waste components.

D3.1 WASTE HISTORY

Tank 241-AN-102 began service in September 1981. It periodically received dilute wastes that were later sent to the 242-A Evaporator. Tank 241-AN-102 also received noncomplexed double-shell slurry feed (DSSF) that was later transferred to tank 241-AN-107. In 1984, the tank was nearly emptied (leaving a heel of only 129 kL [34 kgal]) in preparation for receipt of concentrated complexant (CC) waste from tank 241-AW-101. This waste had been concentrated earlier in the 242-A Evaporator. A total of 4,099 kL (1,083 kgal) of CC waste was transferred from tank 241-AW-101, nearly filling tank 241-AN-102. Since that time, tank 241-AN-102 has received small amounts of miscellaneous waste from the plutonium-uranium extraction (PUREX) Plant and water. No waste removals have been recorded since the transfer from tank 241-AW-101. The surface level has steadily been decreasing at a rate of approximately 5 to 6.4 cm (2 to 2.5 in.) per year as a result of evaporation of the supernatant.

D3.2 CONTRIBUTING WASTE TYPES

The solids in tank 241-AN-102 precipitated primarily from the CC waste added in the second and third quarters of 1984 (Agnew et al. 1997b). There may have been some solids formation from the noncomplexed DSSF added earlier; however, Agnew et al. (1997b) does not show the presence of solids until the fourth quarter of 1984. Both Hanlon (1999) and Agnew et al. (1997a) estimate that the volume of the solids layer in tank 241-AN-102 is 337 kL (89 kgal), and both consider the concentrated evaporator waste received in 1984 to be the source of the solids. Different naming conventions are the reason the solids are called by different waste types in the two documents. Hanlon (1999) designates the solids as CC waste, while Agnew et al. (1997a) considers the solids to be supernatant mixing model waste (SMMA2).

The same waste types associated with the tank 241-AN-102 solids in Hanlon (1999) and Agnew et al. (1997a) are also given to the supernatant. The supernatant volumes between the documents (3,690 kL [975 kgal] for Hanlon [1999] versus 3,789 kL [1,001 kgal] for Agnew et al. [1997a]) differ only as a result of the evaporation losses discussed in the previous section.

D3.3 PREDICTED WASTE INVENTORIES

D3.3.1 Evaluation of 1998 Sampling Data

Tank 241-AN-102 was sampled in February, July, and August of 1998. All three sampling events were taken to address privatization needs. However, different handling and compositing methods were used on the different samples. In addition, as described below, there were several sampling anomalies, analytical problems, and data inconsistencies that affected the results from the 1998 samples.

Comparisons have been made on a waste phase basis between the different data sets from 1998 and the 1994/1995 and 1990 data. The comparisons were made on a concentration basis. All radionuclide data were decayed to a common date of January 1, 1994.

D3.3.1.1 Comparison for Liquid Waste Phase. Tables D3-1 and D3-2 present the comparisons for the liquid nonradioactive and radioactive components, respectively. The 1994/1995 grab concentration estimates are based on the combined results from supernatant samples taken in 1994 and 1995.

The values in column three of Tables D3-1 and D3-2 are a mean of supernatant and dissolution composite results from the February 1998 grab sampling event. The February 1998 grab samples were centrifuged before the composites were formed. Because all of the centrifuged solids went into a solids composite, the supernatant composite is composed solely of centrifuged liquid. The February 1998 dissolution composite was created to represent the sample with the highest amount of solids; in other words, the volume percent of solids and supernatant in the dissolution composite is representative of the grab sample with the highest volume of solids. The February 1998 grab supernatant homogeneity samples, listed in column four, were measured on direct subsamples after centrifuging (no composites). The results from the July and August 1998 sampling events have been combined into one mean, shown in column five. Each mean is an average of three data points: two from uncentrifuged supernatant samples (no composites), and one from a combination of decanted and centrifuged liquid.

As the comparison shows, excellent consistency was observed for virtually every analyte. As a result of some uncertainty regarding the representativeness of the 1998 grab samples, caused by the sample handling and compositing procedures, the 1994/1995 data set was used for deriving the best-basis inventory. Data from the February 1998 supernatant and dissolution composite samples were used when results were not available in the 1994/1995 data set. Only one analytical value (for ^{238}U) was used from the July/August 1998 grab supernatant and decanted sludge liquid samples.

Because manipulations of the original sample material were made prior to analysis, it is probably more appropriate to consider the results representative of the tank liquid instead of the supernatant. Therefore, throughout the remainder of this best-basis inventory section, data from the liquid samples will be called "liquid data". However, when referring to the original grab samples, the naming convention used by the laboratory will be maintained.

Table D3-1. Comparison of Tank 241-AN-102 1994/1995 and 1998 Liquid Data Sets for Nonradioactive Components. (2 sheets)

Analyte	1994/1995 Grab Samples[1]	February 1998 Grab Supernatant and Dissolution Composites	February 1998 Grab Supernatant Homogeneity Samples	July/August 1998 Grab Supernatant and Decanted Sludge Liquid Samples
	µg/mL	µg/mL	µg/mL	µg/mL
Al	15,100	15,800	14,700	14,600
Bi	n/r	<60.1	<40.1	<60.1
Ca	434	515	469	477
Cl	3,810	4,180	4,380	n/r
TIC	13,200	14,000	n/r	n/r
Cr	297	298	274	280
F	1,860	1,840	1,450	n/r
Fe	50.9	49.6	42.0	43.7
Hg	n/r	<0.05	n/r	n/r
K	3,880	2,360	2,210	2,210
La	n/r	<30.1	<20.1	<30.1
Mn	39.1	25.4	22.1	23.0
Na	2.40E+05	2.20E+05	2.12E+05	2.09E+05
Ni	381	442	405	407
NO_2	82,600	93,000	83,900	n/r
NO_3	2.25E+05	2.33E+05	2.36E+05	n/r
OH_{TOTAL}	3,610	2,610	n/r	n/r
Pb	n/r	184	168	181
PO_4	4,820	6,080	5,800	n/r
Si	<20.2	<30.2	<20.1	<30.1
SO_4	13,800	15,500	14,700	n/r
Sr	n/r	<6.01	<4.01	<6.01
TOC	26,200	25,400[2]	n/r	30,000

Table D3-1. Comparison of Tank 241-AN-102 1994/1995 and 1998 Liquid Data Sets for Nonradioactive Components. (2 sheets)

Analyte	1994/1995 Grab Samples[1]	February 1998 Grab Supernatant and Dissolution Composites	February 1998 Grab Supernatant Homogeneity Samples	July/August 1998 Grab Supernatant and Decanted Sludge Liquid Samples
	µg/mL	µg/mL	µg/mL	µg/mL
U_{TOTAL}	<200	<300	<200	20.9[3]
Zr	n/r	9.51	8.60	9.30
Specific gravity	1.41	1.43	n/r	1.46

Notes:

n/r = not reported

[1]See Table B2-21, Appendix B
[2]Derived using the furnace oxidation data.
[3]U_{TOTAL} was calculated from ^{238}U; the mass fraction of ^{238}U in U_{TOTAL} is 0.992586.

Table D3-2. Comparison of Tank 241-AN-102 1994/1995 and 1998 Liquid Data Sets for Radioactive Components.[1] (2 sheets)

Analyte	1994/1995 Grab Samples[2]	February 1998 Grab Supernatant and Dissolution Composites	February 1998 Grab Supernatant Homogeneity Samples	July/August 1998 Grab Supernatant and Decanted Sludge Liquid Samples
	µCi/mL	µCi/mL	µCi/mL	µCi/mL
^{3}H	n/r	9.47E-04	n/r	n/r
^{14}C	n/r	7.04E-04	n/r	n/r
^{60}Co	0.178	0.194	n/r	<3.60
^{90}Sr	77.0	99.3	n/r	99.2
^{99}Tc	n/r	0.140[3]	n/r	n/r
^{125}Sb	n/r	<1.19	n/r	n/r
^{126}Sn	n/r	<0.0254	n/r	n/r
^{129}I	n/r	1.3E-04	n/r	n/r
^{137}Cs	363	354	n/r	486
^{154}Eu	n/r	0.396	n/r	n/r
^{155}Eu	n/r	<0.307	n/r	n/r
^{233}U	n/r	<0.206 (µg/mL)	n/r	<1.51 (µg/mL)
^{234}U	n/r	<0.126 (µg/mL)	n/r	<1.55 (µg/mL)
^{235}U	n/r	<0.329 (µg/mL)	n/r	<1.63 (µg/mL)

Table D3-2. Comparison of Tank 241-AN-102 1994/1995 and 1998 Liquid Data Sets for Radioactive Components.[1] (2 sheets)

Analyte	1994/1995 Grab Samples[2]	February 1998 Grab Supernatant and Dissolution Composites	February 1998 Grab Supernatant Homogeneity Samples	July/August 1998 Grab Supernatant and Decanted Sludge Liquid Samples
	µCi/mL	µCi/mL	µCi/mL	µCi/mL
^{236}U	n/r	<0.191 (µg/mL)	n/r	<0.982 (µg/mL)
^{237}Np	n/r	<0.00213	n/r	n/r
^{238}U	n/r	n/r	n/r	20.7 (µg/mL)
$^{239/240}Pu$	0.00582	<0.0279	n/r	<0.0822
^{241}Am	0.138	0.161	n/r	n/r
$^{243/244}Cm$	n/r	<0.0149	n/r	n/r
Total alpha	0.163	0.190	0.195	n/r
Total beta	n/r	586	593	n/r

Notes:

[1]Decayed to a common date of January 1, 1994.

[2]Source data from Table B2-21, Appendix B. An analysis date of June 1, 1995, was assumed for decay purposes.

[3]Reported as AMU-99 in Appendix B data tables.

D3.3.1.2 Comparison for Solids Waste Phase. Tables D3-3 and D3-4 present the comparisons for the solids nonradioactive and radioactive components, respectively. The previous TCR labeled the solids in tank 241-AN-102 as sludge. The analytical results from the solids, however, were more representative of saltcake. Concentrations of the common insoluble metals, such as iron, bismuth, nickel, and manganese, were quite low. In addition, highly soluble species such as sodium and nitrate were present in large concentrations. Consequently, for the purposes of this best-basis inventory, the solids waste phase in tank 241-AN-102 has been designated as saltcake throughout the remainder of this section.

As described in Section B2.5.3, the 1990 core material was centrifuged, and the centrifuged fractions were analyzed separately. The data from the centrifuged fractions were recombined to derive an overall mean. The recombination was done using the respective weight percents that each centrifuged fraction represented in the original composite.

Consistency between the data sets varied. As would be expected, the analytical results from the acid and fusion digests on the February 1998 samples displayed good consistency. However, when comparing the February and July 1998 samples, a majority of the analytes did not display good consistency. In addition, approximately half of the 1990 core concentration estimates did not display good consistency with any of the 1998 data sets. As a result of the consistency discrepancies varing widely and not showing trends, drawing conclusions from these comparisons was difficult.

Some of the variability between the sampling events can be attributed to different sample preparation and handling techniques. The February 1998 intended solids grab samples were inadvertently taken at a higher depth than prescribed, and therefore primarily consisted of supernatant. The February 1998 grab solid composite was derived from these supernatant samples by centrifuging those that contained over 5 percent solids, and using all recovered solids in the composite. Consequently, the solid composite is more representative of the suspended solids in the supernatant, and may or may not represent the saltcake solids. Because the waste tank temperatures average around 35 °C (95 °F), and the ambient hotcell temperature is 20 to 30 °C (68 to 86 °F), there is also a concern that the solids in the February 1998 grab samples precipitated in the laboratory (Person 1998).

The solids data from the July 1998 grab sampling event are based on the analysis of a single grab sample. Three grab samples were requested at a depth of 1,671 cm (658 in.) (36 cm [14 in.] from the tank bottom). Two were taken at 1,671cm (658 in.), while a third was taken at 1,669 cm (657 in.) The two from the 1,671-cm (658-in.) depth contained 66 and 72 percent solids. The third sample taken 2.5 cm (one in.) higher contained only 12 percent solids. However, of the three samples, only the one with 12 percent solids was analyzed. Questions concerning the validity of the data have been raised caused by the extremely low concentrations of metals. For example, the iron concentration is an order of magnitude below the results from the other data sets. Chromium, manganese, and zirconium were also much less than the other data sets.

As a result of the questions regarding the 1998 solids data, only the 1990 core results were used to derive the best-basis inventories for the saltcake waste phase.

Table D3-3. Comparison of Tank 241-AN-102 1990 Core Sample and 1998 Solids Data Sets for Nonradioactive Components.

Analyte	1990 Core Sample[1]	February 1998 Grab Solid and Dissolution Composite (Acid Digest)	February 1998 Grab Solid and Dissolution Composite (Fusion Digest)	July 1998 Grab Solid Sample (Acid Digest)
	µg/g	µg/g	µg/g	µg/g
Al	12,200	16,100	15,600	9,960
Bi	n/r	<50.3	<1,920	<39.4
Ca	2,070	434	<1,920	345
Cl	2,060	n/r	n/r	n/r
TIC	12,300	10,100	n/r	1,560
Cr	1,370	1,830	1,740	335
F	<890	n/r	n/r	n/r
Fe	1,670	1,830	1,280	176
Hg	n/r	n/r	n/r	n/r
K	<1,740	1,390	n/r	1,450
La	<29.5	37.3	<958	<19.7
Mn	479	295	301	41.5
Na	2.34E+05	1.51E+05	1.50E+05	1.42E+05
Ni	425	254	821	257
NO_2	39,300	n/r	n/r	n/r
NO_3	1.12E+05	n/r	n/r	n/r
Pb	<272	242	<1,920	125
PO_4	3,030	3,680[2]	<11,700[2]	n/r
Si	1,360	63.0	<958	51.7
SO_4	25,900	10,700[3]	10,400[3]	n/r
Sr	19.9	<5.03	<192	<3.94
TOC	16,300	24,800	n/r	22,500
U_{TOTAL}	1,590	<252	<9,580	<197
Zr	554	62.7	<192	13.9
Density	1.5 g/mL[4]	n/r	n/r	1.64 g/mL

Notes:

[1]See Table B2-27, Appendix B

[2]Based on the phosphorus result obtained by ICP.

[3]Based on the sulfur result obtained by ICP.

[4]Result is from a direct measurement performed on the sludge, and was not calculated by recombining centrifuged liquid and solid fractions.

Table D3-4. Comparison of Tank 241-AN-102 1990 Core Sample and 1998 Solids Data Sets for Radioactive Components.[1]

Analyte	1990 Core Sample[2]	February 1998 Grab Solid and Dissolution Composite (Acid Digest)	February 1998 Grab Solid and Dissolution Composite (Fusion Digest)	July 1998 Grab Solid Sample (Acid Digest)
	µCi/g	µCi/g	µCi/g	µCi/g
^{3}H	0.00207	n/r	n/r	n/r
^{14}C	0.00128	n/r	n/r	n/r
^{60}Co	0.180	0.167	0.159	0.159[3]
^{79}Se	0.00199	n/r	n/r	n/r
^{90}Sr	156	137	135	100[2]
^{99}Tc	0.0982	n/r	n/r	n/r
^{125}Sb	0.326	<1.52	<2.06	n/r
^{134}Cs	<0.0412	n/r	n/r	n/r
^{137}Cs	263	272	263	253[3]
^{152}Eu	<0.0812	n/r	n/r	n/r
^{154}Eu	0.745	1.13	0.919	n/r
^{155}Eu	0.651	1.12	0.994	n/r
^{237}Np	<9.43E-04	n/r	n/r	<0.00103
^{238}Pu	0.023	n/r	n/r	n/r
$^{239/240}Pu$	0.0705	n/r	n/r	<0.323
^{241}Am	0.584	<0.974	<1.13	n/r
$^{243/244}Cm$	0.0349	n/r	n/r	n/r

Notes:

[1]Decayed to a common date of January 1, 1994.

[2]Source data from Table B2-27, Appendix B. An analysis date of August 1, 1990, was used for decay purposes.

[3]Fusion digest.

D3.3.1.3 Summary of Volumes and Densities for Each Data Set. Table D3-5 provides a summary of the volumes and densities/specific gravities applicable to each of the liquid and solids data sets used in deriving the best-basis inventory. The names assigned to the data sets by the laboratory have been preserved in the table. As described earlier, the supernatant volume has decreased slightly over the years as a result of evaporation.

Table D3-5. Volume and Density/Specific Gravity Summary for Each Tank 241-AN-102 Data Set.

Data Set	Volume kL (kgal)	Density/Specific Gravity
Liquid Data Sets		
1994/1995 Grab Samples	3,755 (992)	1.41
February 1998 Grab Supernatant and Dissolution Composites	3,709 (980)	1.43
July/August 1998 Grab Supernatant and Decanted Sludge Liquid Samples	3702 (978)	1.46
Solids Data Sets		
1990 Core Sample	337 (89)	1.5 g/mL

D3.3.2 Comparison of Tank 241-AN-102 Bulk Concentrations to Evaporator Campaign Data

A check of the 1994/1995 and 1990 results was possible by comparing them to data from the analysis of the product from the 1984 242-A Evaporator Campaign 84-4. As described in Section D3.1, the vast majority of waste in tank 241-AN-102 originated from this campaign.

Concentrations for the product of the 84-4 Evaporator Campaign were calculated from the data reported in Pontious (1984). The reported concentrations were based on an average of the results from samples R3641 and R3642 (called T3641 and T3642 on the data sheets) taken in May 1984 from tank 241-AW-101. (The evaporator campaign product was briefly staged in tank 241-AW-101 before transfer to tank 241-AN-102). Sample R3641 was taken near the top of the tank, while sample R3642 was taken four feet from the bottom of the tank. (All but 7.6 kL [2 kgal] of waste in tank 241-AW-101 at the time of sampling were from the evaporator campaign). Sample R3641 was described as very dark with no apparent solids, while it was noted that sample R3642 contained approximately 39 volume percent settled solids (Pontious 1984). Little is known about the procedures used to analyze these samples, and it is unknown if complete digestion was achieved or if solids were even included in the analysis.

Overall concentration estimates (aggregate of 1994/1995 liquid and 1990 solids estimates) were selected as the most appropriate data set on which to do the comparison. The tank 241-AW-101 samples were taken less than 10 days after the completion of the evaporator campaign (May 11, 1984), and the waste transfers to tank 241-AN-102 took place in June and July of 1984. The transfers to tank 241-AN-102 were made soon after the evaporator campaign, so it is assumed that most of the solids did not have time to precipitate in tank 241-AW-101, and were instead sent to tank 241-AN-102. Agnew et al. (1997b) supports this assumption, as no increase in solids is seen in tank 241-AW-101 during this period.

A substantial jump in the tank 241-AN-102 solids volume is observed in the fourth quarter of 1984, from cooling and settling of the solids in the evaporator product. A comparison with just the supernatant best-basis inventory estimates was deemed not appropriate resulting from the difference in solids content. The lower sample from 1984 contained a substantial amount of solids (approximately 39 volume percent), while the 1994/1995 supernatant samples contained no more than a trace of solids. However, as mentioned before, it is unknown if the solids in the 1984 sample were included in the analysis. A viscosity test on that sample did use a representative aliquot of the sample mixture.

To make a valid radionuclide comparison, all values were decayed to a common date of January 1, 1994. Table D3-6 presents the comparison.

Table D3-6. Comparison of Tank 241-AN-102 Bulk Concentrations and 242-A Evaporator Campaign 84-4 Product Compositions.

Analyte	**Evaporator Post-run Data[1] (*M*)**	**Tank 241-AN-102 Bulk Concentrations (*M*)**
Al	0.621	0.569
OH	1.85	3.75
CO_3	0.677	1.14
K	0.0415	0.0965
Na	8.60	10.8
NO_2	1.50	1.75
NO_3	4.08	3.55
PO_4	0.0517	0.0504
TOC	2.75	2.18
Radionuclides[2]	**(µCi/L)**	**(µCi/L)**
^{241}Am	224	199
^{137}Cs	4.11E+05	3.64E+05
^{90}Sr	1.04E+05	89,900
$^{239/240}Pu$	20.6[3]	14.1

Notes:

[1]Pontius (1984)

2Decayed to a common date of January 1, 1994. The decay time for the evaporator campaign data was assumed to be 10 years.

[3]Converted to µCi/L from g/L using the specific activity of ^{239}Pu.

Overall, the comparison displayed excellent agreement between the two data sets. Only a few analytes did not agree well, primarily carbonate, hydroxide, and potassium. The carbonate concentration is actually expected to increase as a result of the absorption of CO_2 from the air. In this context, the difference in the numbers is not unexpected. The hydroxide concentration unexpectedly increased between the two data sets. This is contrary to the anticipated behavior, as the concentration is expected to decrease because of consumption during the CO_2 absorption. The tank 241-AN-102 bulk hydroxide value is not an analytically determined value, and is instead calculated by performing a charge balance. Therefore, this value is influenced by the other analyte concentrations. It is possible that another anion is present in higher quantities than actually measured, which would decrease the hydroxide estimate. Also, as described earlier, it is unknown if the solids in the lower evaporator product sample were included in the analysis. Excluding the solids would likely introduce a low bias. The reason for the difference in the potassium concentrations is unclear.

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

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

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

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 chemical information for tank 241-AN-102 was performed, and a best basis inventory was established. This work, follows the methodology that was established by the standard inventory task.

The results from this evaluation support using a combination of the 1994/1995 and 1998 data sets for the liquid and the 1990 data set for the saltcake for the following reasons:

1. No waste has been added or removed since the 1994/1995 sampling events.

2. The 1994/1995 results compared well with the February, July, and August 1998 liquid grab data.

3. The 1998 data set did not replace the 1994/1995 data set because no new information was obtained. There was some uncertainty regarding the representativeness of the 1998 supernatant samples as a result of the sample handling and compositing procedures. The February 1998 supernatant and dissolution composite means were used to supplement the 1994/1995 data set as denoted in the following tables. The volume used to derive the inventories for the February 1998 data set was the supernatant volume at the time of sampling, 3,709 kL (980 kgal). The ^{238}U value from the July/August 1998 data set was used to derive the total uranium value for the supernatant. The volume used in the inventory calculation for total uranium was the volume at the time of the July/August 1998 sampling, 3,702 kL (978 kgal).

4. The saltcake solids best-basis solid inventories are based on data from the 1990 core sample. A small amount of waste was transferred into the tank in 1992; however, this waste is not expected to add to the solids volume.

5. The solid composite from the February 1998 grab sampling was formed from the recovered solids from supernatant samples, and was not actually representative of the saltcake layer. In addition, it is suspected that the solids may have precipitated in the laboratory as a result of the decrease in temperature from the tank to the hotcell.

6. Substantial uncertainty exists regarding the representativeness of the July 1998 solids sample because of the abnormally low metal concentrations in the sample.

Once the best-basis inventories were determined, the hydroxide inventory was calculated by performing a charge balance with the valences of other analytes. This charge balance approach is consistent with that used by Agnew et al. (1997a).

Best-basis tank inventory values are derived for 46 key radionuclides (as defined in Section 3.1 of Kupfer et al. 1999), all decayed to a common report date of January 1, 1994. Often, waste sample analyses have only reported ^{90}Sr, ^{137}Cs, $^{239/240}$Pu, and total uranium (or total beta and total alpha), while other key radionuclides such as ^{60}Co, ^{99}Tc, ^{129}I, ^{154}Eu, ^{155}Eu, ^{241}Am, etc., have been infrequently reported. For this reason, it has been necessary to derive most of the 46 key radionuclides by computer models. These models estimate radionuclide activity in batches of reactor fuel, account for the split of radionuclides to various separations plant waste streams, and track their movement with tank waste transactions. (These computer models are described in Kupfer et al. [1999], Section 6.1 and in Watrous and Wootan [1997].) Model generated values for radionuclides in any of 177 tanks are reported in the HDW Rev. 4 model results (Agnew et al. 1997a). The best-basis value for any one analyte may be either a model result or a sample or engineering assessment-based result, if available.

Best-basis inventory estimates for tank 241-AN-102 are presented in Tables D4-1 through D4-6. The inventory values reported in these tables are subject to change. Refer to the Tank Characterization Database for the most current inventory values. Concentrations reported as less-than values (below detection limit) were often used as actual values in Tables D4-5 and D4-6 if they were significantly lower than the corresponding HDW model values. Model generated values were used if the sample analytical data were based on high detection limits.

Table D4-1. Liquid Inventory Estimates for Nonradioactive Components in Tank 241-AN-102 Decayed to January 1, 1994 (Effective April 19, 1999). (2 sheets)

Analyte	Supernatant Inventory (kg)	Basis (S, M, E, or C)[1]	Comment
Al	56,700	S	
Ca	1,630	S	
Cl	14,300	S	
TIC as CO_3	2.48E+05	S	
Cr	1,120	S	
F	6,980	S	
Fe	191	S	
K	14,600	S	
Mn	147	S	
Na	9.01E+05	S	
Ni	1,430	S	
NO_2	3.10E+05	S	
NO_3	8.45E+05	S	
OH_{TOTAL}	2.10E+05	C	
Pb	682	S	Based on February 1998 supernatant and dissolution composites data
PO_4	18,100	S	IC analysis
Si	75.9	S/E	Upper bounding estimate
SO_4	51,800	S	IC analysis
Sr	7.07	S	Based on ^{90}Sr activity
TOC	98,400	S	

Table D4-1. Liquid Inventory Estimates for Nonradioactive Components in Tank 241-AN-102 Decayed to January 1, 1994 (Effective April 19, 1999). (2 sheets)

Analyte	Supernatant Inventory (kg)	Basis (S, M, E, or C)[1]	Comment
U_{TOTAL}	77.2	S	Based on July/August 1998 ^{238}U value
Zr	35.3	S	Based on February 1998 supernatant and dissolution composites data

Notes:

n/r = not reported

[1]S = sample-based; M = Hanford defined w model-based (Agnew et al.1997a); E = engineering assessment-based; and C = calculated by charge balance; includes oxides as hydroxides, not including CO_3, NO_2, NO_3, PO_4, SO_4, and SiO_3.

Table D4-2. Liquid Inventory Estimates for Radioactive Components in Tank 241-AN-102 Decayed to January 1, 1994. (Effective April 19, 1999) (2 sheets)

Analyte	Supernatant Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	3.51	S	Based on February 1998 supernatant and dissolution composites data
^{14}C	2.61	S	Based on February 1998 supernatant and dissolution composites data
^{60}Co	669	S	
^{79}Se	2.24	S	Based on February 1998 supernatant and dissolution composites data
^{90}Sr	2.89E+05	S	
^{90}Y	2.89E+05	S	Referenced to ^{90}Sr
^{99}Tc	519	S	Based on ICP/MS results from February 1998 supernatant and dissolution composites
^{137}Cs	1.36 E+06	S	
^{137m}Ba	1.29 E+06	S	Referenced to ^{137} Cs
^{154}Eu	1,470	S	Based on February 1998 supernatant and dissolution composites data
^{155}Eu	1,140	S/E	Upper bounding estimate; Based on February 1998 supernatant and dissolution composites data
^{232}U	0.0369	S/M	Based on U_{TOTAL} and HDW isotopic distribution

Table D4-2. Liquid Inventory Estimates for Radioactive Components in Tank 241-AN-102 Decayed to January 1, 1994. (Effective April 19, 1999) (2 sheets)

Analyte	Supernatant Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{233}U	0.142	S/M	Based on U_{TOTAL} and HDW isotopic distribution
^{234}U	0.0292	S/M	Based on U_{TOTAL} and HDW isotopic distribution
^{235}U	0.00116	S/M	Based on U_{TOTAL} and HDW isotopic distribution
^{236}U	0.00104	S/M	Based on U_{TOTAL} and HDW isotopic distribution
^{238}Pu	0.602	S/M	Based on ^{239}Pu and HDW isotopic distribution
^{238}U	0.0258	S	Based on July/August 1998 data
^{239}Pu	18.6	S/M	Based on $^{239/240}Pu$ and HDW isotopic distribution
^{240}Pu	3.28	S/M	Based on $^{239/240}Pu$ and HDW isotopic distribution
^{241}Am	518	S	
^{241}Pu	43.1	S/M	Based on ^{239}Pu and HDW isotopic distribution
^{242}Cm	1.44	S/M	Based on ^{241}Am and HDW isotopic distribution
^{242}Pu	2.30E-04	S/M	Based on ^{239}Pu and HDW isotopic distribution
^{243}Am	0.0204	S/M	Based on ^{241}Am and HDW isotopic distribution
^{243}Cm	0.137	S/M	Based on ^{241}Am and HDW isotopic distribution
^{244}Cm	1.19	S/M	Based on ^{241}Am and HDW isotopic distribution

Note:

[1]S = sample-based; M = Hanford defined waste model-based (Agnew et al. [1997a]); and E = engineering assessment-based.

Table D4-3. Saltcake Inventory Estimates for Nonradioactive Components in Tank 241-AN-102. (Effective April 19, 1999)

Analyte	Sludge Inventory (kg)	Basis (S, M, E, or C)[1]	Comment
Al	6,170	S	
Ca	1,050	S	
Cl	1,040	S	
TIC as CO_3	31,100	S	
Cr	693	S	
F	450	S/E	Upper bounding estimate
Fe	844	S	
K	880	S	Upper bounding estimate
Mn	242	S	
Na	1.18E+05	S	
Ni	215	S	
NO_2	19,900	S	
NO_3	56,600	S	
OH_{TOTAL}	51,400	C	
Pb	137	S	Upper bounding estimate
PO_4	1,530	S	IC analysis
Si	687	S	
SO_4	13,100	S	IC analysis
Sr	10.1	S	
TOC	8,240	S	
U_{TOTAL}	804	S	
Zr	280	S	

Note:

[1]S = sample-based; M = Hanford defined waste model-based (Agnew et al. [1997a]); E = engineering assessment-based; and C = calculated by charge balance - includes oxides as hydroxides, not including CO_3, NO_2, NO_3, PO_4, SO_4, and SiO_3.

Table D4-4. Saltcake Inventory Estimates for Radioactive Components in Tank 241-AN-102 Decayed to January 1, 1994. (Effective April 19, 1999) (2 sheets)

Analyte	Sludge Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	1.05	S	
^{14}C	0.647	S	
^{60}Co	91.2	S	
^{79}Se	1.01	S	
^{90}Sr	78,800	S	
^{90}Y	78,800	S	Referenced to ^{90}Sr
^{99}Tc	49.6	S	
^{137}Cs	1.33E+05	S	
^{137m}Ba	1.26E+05	S	Referenced to ^{137}Cs
^{154}Eu	377	S	
^{155}Eu	329	S	
^{232}U	0.384	S/M	Based on U_{TOTAL} and HDW isotopic distribution
^{233}U	1.47	S/M	Based on U_{TOTAL} and HDW isotopic distribution
^{234}U	0.304	S/M	Based on U_{TOTAL} and HDW isotopic distribution
^{235}U	0.0121	S/M	Based on U_{TOTAL} and HDW isotopic distribution
^{236}U	0.0108	S/M	Based on U_{TOTAL} and HDW isotopic distribution
^{238}Pu	11.7	S	
^{238}U	0.268	S/M	Based on U_{TOTAL} and HDW isotopic distribution
^{239}Pu	30.3	S/M	Based on $^{239/240}$Pu and HDW isotopic distribution
^{240}Pu	5.34	S/M	Based on $^{239/240}$Pu and HDW isotopic distribution
^{241}Am	295	S	
^{241}Pu	70.3	S/M	Based on ^{239}Pu and HDW isotopic distribution
^{242}Cm	0.821	S/M	Based on ^{241}Am and HDW isotopic distribution.
^{242}Pu	3.76E-04	S/M	Based on ^{239}Pu and HDW isotopic distribution

Table D4-4. Saltcake Inventory Estimates for Radioactive Components in Tank 241-AN-102 Decayed to January 1, 1994. (Effective April 19, 1999) (2 sheets)

Analyte	Sludge Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{243}Am	0.0116	S/M	Based on ^{241}Am and HDW isotopic distribution
^{243}Cm	0.706	S	Based on $^{243/244}Cm$ hybrid
^{244}Cm	16.9	S	Based on $^{243/244}Cm$ hybrid

Note:

[1]S = sample-based; M = Hanford defined waste model-based (Agnew et al. [1997a]); and E = engineering assessment-based.

Table D4-5. Best-Basis Total Inventory Estimates for Nonradioactive Components in Tank 241-AN-102. (Effective April 19, 1999) (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, E, or C)[1]	Comment
Al	62,900	S	
Bi	0	E	HDW model assumes 1,290 kg because of erroneous solubility assumption.
Ca	2,680	S	
Cl	15,300	S	
TIC as CO_3	2.79E+05	S	
Cr	1,810	S	
F	7,430	S	
Fe	1,040	S	
Hg	0	E	Majority of Hg in cladding waste (Simpson 1998).
K	15,400	S	
La	0	E	La is relatively insoluble in the supernatants added to tank 241-AN-102.
Mn	389	S	
Na	1.02E+06	S	
Ni	1,650	S	
NO_2	3.30E+05	S	
NO_3	9.01E+05	S	
OH_{TOTAL}	2.61E+05	C	

Table D4-5. Best-Basis Total Inventory Estimates for Nonradioactive Components in Tank 241-AN-102. (Effective April 19, 1999) (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, E, or C)[1]	Comment
Pb	820	S	Upper bounding estimate
PO_4	19,600	S	IC analysis
Si	763	S/E	Upper bounding estimate
SO_4	64,900	S	IC analysis
Sr	17.1	S	
TOC	1.07E+05	S	
U_{TOTAL}	881	S	
Zr	315	S	

Note:

[1]S = sample-based; M = Hanford defined waste model-based (Agnew et al. [1997a]); E = engineering assessment-based; and C = calculated by charge balance - includes oxides as hydroxides, not including CO_3, NO_2, NO_3, PO_4, SO_4, and SiO_3.

Table D4-6. Best-Basis Total Inventory Estimates for Radioactive Components in Tank 241-AN-102 Decayed to January 1, 1994. (Effective April 19, 1999) (3 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	4.56	S	
^{14}C	3.26	S	
^{59}Ni	11.5	M	
^{60}Co	760	S	
^{63}Ni	1,140	M	
^{79}Se	3.25	S	
^{90}Sr	3.68E+05	S	
^{90}Y	3.68E+05	S	Referenced to ^{90}Sr
^{93}Zr	103	M	
^{93m}Nb	73.8	M	
^{99}Tc	569	S	
^{106}Ru	0.0485	M	
^{113m}Cd	565	M	
^{125}Sb	1,260	M	
^{126}Sn	31.5	M	
^{129}I	3.17	M	
^{134}Cs	61.9	M	
^{137}Cs	1.49E+06	S	

Table D4-6. Best-Basis Total Inventory Estimates for Radioactive Components in Tank 241-AN-102 Decayed to January 1, 1994. (Effective April 19, 1999) (3 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{137m}Ba	1.41E+06	S	Referenced to ^{137}Cs
^{151}Sm	73,400	M	
^{152}Eu	27.3	M	
^{154}Eu	1,850	S	
^{155}Eu	1,470	S/E	Upper bounding estimate
^{226}Ra	7.95E-04	M	
^{227}Ac	0.00490	M	
^{228}Ra	1.72	M	
^{229}Th	0.0399	M	
^{231}Pa	0.0235	M	
^{232}Th	0.183	M	
^{232}U	0.421	S/M	Based on U_{TOTAL} and HDW Model isotopic distribution
^{233}U	1.62	S/M	Based on U_{TOTAL} and HDW Model isotopic distribution
^{234}U	0.333	S/M	Based on U_{TOTAL} and HDW Model isotopic distribution
^{235}U	0.0132	S/M	Based on U_{TOTAL} and HDW Model isotopic distribution
^{236}U	0.0118	S/M	Based on U_{TOTAL} and HDW Model isotopic distribution
^{237}Np	5.72	M	
^{238}Pu	12.3	S/M	Saltcake portion based on sample data; liquid portion based on ^{239}Pu and HDW Model isotopic distribution
^{238}U	0.294	S/M	Based on U_{TOTAL} and HDW Model isotopic distribution
^{239}Pu	48.9	S/M	Based on $^{239/240}Pu$ and HDW Model isotopic distribution
^{240}Pu	8.62	S/M	Based on $^{239/240}Pu$ and HDW Model isotopic distribution
^{241}Am	813	S	
^{241}Pu	113	S/M	Based on ^{239}Pu and HDW Model isotopic distribution
^{242}Cm	2.26	S/M	Based on ^{241}Am and HDW Model isotopic distribution

Table D4-6. Best-Basis Total Inventory Estimates for Radioactive Components in Tank 241-AN-102 Decayed to January 1, 1994. (Effective April 19, 1999) (3 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{242}Pu	6.06E-04	S/M	Based on ^{239}Pu and HDW Model isotopic distribution
^{243}Am	0.0320	S/M	Based on ^{241}Am and HDW Model isotopic distribution
^{243}Cm	0.843	S/M	Based on the 1990 core for the solids and the HDW Model isotopic distribution from ^{241}Am for the liquid.
^{244}Cm	18.1	S/M	Based on the 1990 core for the solids and the HDW Model isotopic distribution from ^{241}Am for the liquid.

Note:

[1]S = sample-based; M = Hanford Defined Waste Model-based (Agnew et al. [1997a]); E = engineering assessment-based

D5.0 APPENDIX D REFERENCES

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APPENDIX E

BIBLIOGRAPHY FOR TANK 241-AN-102

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APPENDIX E

BIBLIOGRAPHY FOR TANK 241-AN-102

Appendix E is a bibliography that supports the characterization of tank 241-AN-102. This bibliography represents an in-depth literature search of all known information sources that provide sampling, analysis, surveillance, modeling information, and processing occurrences associated with tank 241-AN-102 and its respective waste types.

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

I. NON-ANALYTICAL DATA

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

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

IIa. Sampling of Tank 241-AN-102
IIb. Sampling of 242-A Evaporator Streams

III. COMBINED ANALYTICAL/NON-ANALYTICAL DATA

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

This bibliography is broken down into the appropriate sections of material with an annotation at the end of each reference describing the information source. Most information listed below is available in the Lockheed Martin Hanford Corporation Tank Characterization and Safety Resource Center.

I. NON-ANALYTICAL DATA

Ia. Models/Waste Type Inventories/Campaign Information

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

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

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, Rev. 0, Los Alamos National Laboratory, Los Alamos, New Mexico.

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

Ic. Surveillance/Tank Configuration

Lipnicki, J., 1997, *Waste Tank Risers Available for Sampling*, HNF-SD-RE-TI-710, Rev. 4, Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

- Assesses riser locations for each tank; however, not all tanks are included or completed. Estimates of the risers available for sampling are also included.

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

- Contains riser information and riser tables for Hanford Site double shell waste tanks.

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

- Contains riser and thermocouple information for Hanford Site waste tanks.

Id. Sample Planning/Tank Prioritization

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- Contains Tri-Party Agreement (Ecology et al. 1997) requirement-driven RPP Characterization Program information.

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- Summarizes the 1998 technical basis for characterizing tank waste and assigns a priority number to each tank.

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- 1998 letter contains direction for Fluor Daniel Hanford to provide tank samples to BNFL for privatization.

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- Describes the organic solvents issue and other tank issues.

Engineering, 1995, *Request for Supernate and Sludge Samples from Tank 241-AN-102*, Process Memorandum 2E95-132, Westinghouse Hanford Company, Richland, Washington.

- Request for process samples.

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

- Early characterization planning document.

Jo, J., 1996, *Tank 241-AN-102 Grab Sampling and Analysis Plan*, WHC-SD-WM-TSAP-065, Rev. 1A, Westinghouse Hanford Company, Richland, Washington.

- Contains sampling and analysis requirements for tank 241-AN-102 based on safety screening DQOs.

Jo, J., 1998, *Tank 241-AN-102 Grab Sampling and Analysis Plan*, HNF-2158, Rev. 0, Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

- Contains sampling and analysis requirements for tank 241-AN-102 based on privatization DQOs.

Jo, J. 1998, *Request for Grab Samples from Tank 241-AN-102,* (LOI 2) (internal memorandum 7A120-98-038 to R. Akita, D. B. Hardy, W. J. Kennedy, C. M. Seidel, and G. A. Stanton, August 11), Lockheed Martin Hanford Corp., Richland, Washington.

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- Contains sampling and analysis requirements for tank 241-AN-102 waste based on privatization needs.

Jones, J. M., 1994, *Letter of Instruction for Analysis of Double-Shell Tank 241-AN-102 Grab Samples*, (internal memorandum 7E720-94-135 to J. R. Jewett and J. G. Kristofzski, dated October 21), Westinghouse Hanford Company, Richland, Washington.

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- Provides analysis scheme for the 1990 core sample.

Pauly, T. R., 1998, *Subcontract Number 80232764-9-K001: Direction on Performance Agreement TWR1.2.15 and Characterization Support to Privatization*, (letter FDH-9855862 to M. P. DeLozier, LMHC, July 13), Fluor Daniel Hanford, Inc., Richland, Washington.

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Person, J.C., 1998, *Test Plan for Tank 241-AN-102 Solubility Screening Tests*, HNF-2516, Rev. 1, Numatec Hanford, Corporation for Fluor Daniel Hanford, Inc., Richland Washington.

- Contains test plan to determine the effects of dilution on the mass of solids of tank 241-AN-102 based on privatization needs.

Schreiber, R. D., 1995, *Tank 241-AN-102 Tank Characterization Plan*, WHC-SD-WM-TP-216, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Contains sampling and analysis requirements for tank 241-AN-102 based on applicable DQOs.

Seidel, C. M., 1998, *Letter of Instruction Supporting Privatization Phase 1B PAS-1 Shipment,* (LOI 1) (internal memorandum 3110-98-101 to D. B. Hardy and J. E. Hyatt, July 31), Waste Management Federal Services of Hanford, Inc., Richland, Washington.

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Sieracki, S. A., 1998, (letter 9852961/98-SCD-027 to H. J. Hatch, FDH, April 1,) U.S. Department of Energy, Richland, Washington.

- Contains sampling and analysis clarification for requirements for tank 241-AN-102 based on privatization contract.

Stanton, G. A., 1998, Baseline Sampling Schedule, Change 98-03, (internal memorandum 79520-98-003 to distribution, October, 25), Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland Washington.

- Provides a tank waste sampling schedule through fiscal year 2004 and lists samples taken since 1994.

Ie. Data Quality Objectives (DQO) and Customers of Characterization Data

Certa, P. J., 1998, *Data Quality Objectives for TWRS Privatization Phase I: Confirm Tank T is an Appropriate Feed Source for Low-Activity Waste Feed Batch X*, HNF-1796, Rev. 0, Numatec Hanford Company, Richland, Washington.

- Described the DQO process undertaken to assure appropriate data will be collected to support privatization needs.

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

- Determines whether tanks are under safe operating conditions.

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

- Documents operational-related compatibility requirements for tank transfers.

Mulkey, C. H., and M. S. Miller, 1998, *Data Quality Objectives for Tank Farms Waste Compatibility Program*, WHC-SD-WM-DQO-001, Rev. 2A, Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

- Documents safety-related compatibility requirements for tank transfers.

Kinzer, J. E., 1999, *Revision to Statistical Approach Documented in the Low-Activity Waste Data Quality Objective*, (letter 9953720 to R. D. Hanson, June 3), U.S. Department of Energy-Office of River Protection, Richland, Washington.

- Contains direction for not performing certain statistical calculations requested by the Low-Activity Waste DQO.

Kupfer, M. J., W. W. Schultz, G. L. Borsheim, S. J. Eberlein, B. C. Simpson, and J. T. Slankas, 1995, *Strategy for Sampling Hanford Site Tank Wastes for Development of Disposal Technology*, WHC-SD-WM-TA-154, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

- Provides basis for selecting tanks for disposal needs.

Meacham, J. E., D. L. Banning, M. R. Allen, and L. D. Muhlestein, 1997, *Data Quality Objective to Support Resolution of the Organic Solvent Safety Issue*, HNF-SD-WM-DQO-026, Rev. 0, DE&S Hanford, Inc. for Fluor Daniel Hanford, Inc., Richland, Washington.

- Contains requirements for the organic solvents DQO.

Nguyen, D. M., 1999, *Data Quality Objectives for TWRS Privatization Phase I: Confirm Tank T is an Appropriate Feed Source for Low-Activity Waste Feed Batch X*, HNF-1796, Rev. 2, Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland Washington.

- Described the DQO process undertaken to assure appropriate data will be collected to support privatization needs.

Slankas, T. J., M. J. Kupfer, and W. W. Schulz, 1995, *Data Needs and Attendant Data Quality Objectives for Tank Waste Pretreatment and Disposal*, WHC-SD-WM-DQO-022, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Documents the needs of the pretreatment function in RPP.

Truex, M. J., and K. D. Wiemers, 1998, *Low Activity Waste Feed Data Quality Objectives*, PNNL 12064, Rev. 0, Pacific Northwest National Laboratory, Richland, Washington.

- Describes characterization requirements for the RPP Waste Disposal Program in support of the LAW treatment and immobilization.

Wiemers, K. D., and M. Miller, 1997, *Low Activity Waste Feed Data Quality Objectives*, WIT-98-010, Rev. 0, Pacific Northwest National Laboratory, Richland, Washington.

- Describes characterization requirements for the RPP Waste Disposal Program in support of the LAW treatment and immobilization

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

IIa. Sampling of Tank 241-AN-102

Bratzel, D. R., 1985, *Characterization of Complexant Concentrate Supernatant*, (internal memorandum 65453-85-041 to J. N. Appel, dated February 28), Rockwell Hanford Operations, Richland, Washington.

- Contains sampling and analysis results for supernatant taken in 1984.

Bratzel, D. R., 1985, *Characterization of Complexant Concentrated Solids from Tanks 107-AN, 102-AN, and 101-AY,* (internal memorandum 65453-85-053 to J. N. Appel, dated March 14), Westinghouse Hanford Company, Richland, Washington.

- Contains sampling and analysis results for solids taken in 1984.

Bratzel, D. R., 1994, *Letter of Instruction for Analysis of Double-Shell Tank 241-AN-102 Grab Samples*, (internal memorandum 7E720-94-135 [Reissue]), Westinghouse Hanford Company, Richland, Washington.

- Contains sampling and analysis request to the laboratory for grab samples taken in October 1994.

Esch, R. A., 1998, *Tank 241-AN-102 Low Activity Waste Envelope C Analytical Results for the Final Report*, HNF-SD-WM-DP-310, Rev. 0, Waste Management Service of Hanford, Inc., Richland, Washington.

- Contains sampling and analysis results from grab samples taken in February 1998 for privatization requests.

Esch, R. A., 1998, *Tank 241-AN-102 Low Activity Waste Envelope C Analytical Results for PAS-1 Shipping*, HNF-1660, Rev. 0, Waste Management of Hanford, Inc., Richland, Washington.

- Contains sampling and analysis results from grab samples taken in July and August of 1998 in response for shipping requirements.

Esch, R. A., 1996, *45-Day Safety Screening Results for Tank 241-AN-102, Grab Samples 2AN-95-1 through 2AN-95-6 and 102-AN-1 through 102-AN-4*, WHC-SD-WM-DP-165, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Contains the safety screening results from grab samples taken in October 1994, February 1995, and November 1995.

Esch, R. A., 1996, *Final Report for Tank 241-AN-102, Grab Samples 2AN-95-1 through 2AN-95-6 and 102-AN-1 through 102-AN-4*, WHC-SD-WM-DP-165, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

- Contains the final sampling and analysis results from grab samples taken in October 1994, February 1995, and November 1995.

Douglas, J. G., 1996, *Analytical Results for Double-Shell Tank 241-AN-102: June 1990, Push-Mode Core Sample*, WHC-SD-WM-TI-743, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Contains sampling and analysis results from core samples taken in 1990 and includes two draft characterization reports of PNNL.

Herting, D. L., 1994, *Characterization of Supernate Samples from Tank 102-AN,* (internal memorandum 8E110-PCL94-112 to J. M. Jones, December 28), Westinghouse Hanford Company, Richland, Washington.

- Contains results of supernatant sample analyses to determine concentration of free hydroxide from October 1994 sampling.

Prignano, A. L., 1998, *Tanks 102-AN and 107-AN Viscosity and Percent Settled Solids Determination,* (internal memorandum 12221-PCL88-55 to D. E. Scully, July 6), Westinghouse Hanford Company, Richland, Washington.

- Contains sampling and analysis results for samples taken in 1988.

Sasaki, L. M., 1989, *Core Sampling of Complexed Concentrate Solids in Tank102-AN,* (DSI to Jeff Biagini, June 29), Westinghouse Hanford Company, Richland Washington.

- Contains request for sampling and analyses.

Strasser, D. W., 1990, *Tank 102-AN Core Samples,* (internal memorandum 82316-90-053 to R.S. Edrington, July 3), Westinghouse Hanford Company, Richland, Washington.

- Contains results of sample analyses.

Welsh, T. L., and R. D. Cromar, 1996, *Statistical Analysis for Double-Shell Tank 241-AN-102,* (internal memorandum 75764-PCS96-077, July 25), Westinghouse Hanford Company, Richland, Washington.

- Contains statistical analysis of sampling data results from grab samples taken in October 1994, February 1995, and November 1995.

IIb. Sampling 242 A-Evaporator Waste Streams (1984)

Pontious, N. L., 1984, *242-A Evaporator/Crystallizer FY'84 Campaign Run 84-4 Post Run Document,* SD-WM-PE-017, Rev. 0, Rockwell Hanford Operations, Richland, Washington.

- This report provides characterization data for the waste in tank 241-AW-101 before the waste was transferred to tank 241-AN-102.

III. COMBINED ANALYTICAL/NON-ANALYTICAL DATA

IIIa. Inventories from Campaign and Analytical Information

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

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

Brevick, C. H., J. W. Funk, R. G. Hale, G. A. Lisle, C. V. Salois, and M. R. Umphrey, 1997, *Historical Tank Content Estimate for the Southeast Quadrant of the Hanford 200 East Areas*, WHC-SD-WM-ER-314, Rev. 1, Fluor Daniel Northwest for Fluor Daniel Hanford, Inc., Richland, Washington.

- Document contains summary information from the supporting document as well as in-tank photo collages and the solid composite inventory estimates Rev. 0 and Rev. 0A.

Kupfer, M. J., A. L. Boldt, and M. D. LeClair, 1998, *Standard Inventories of Chemicals and Radionuclides in Hanford Site Tank Wastes*, HNF-SD-WM-TI-740, Rev. 0B, Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

- Contains a global component inventory for major constituents in the 200 Area waste tanks.

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

- Document contains tank inventory information.

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

- Contains information for major constituents in the 200 Area waste tanks.

IIIb. Compendium of Data from Other Physical and Chemical Sources

Brevick, C. H., J. L. Stroup, and J. W. Funk, 1997, *Supporting Document for the Historical Tank Content Estimate for the AN Tank Farm*, WHC-SD-WM-ER-314, Rev.1, Fluor Daniel Northwest Inc. for Fluor Daniel Hanford, Inc., Richland, Washington.

- Document contains historical data and solid inventory estimates. The appendices contain the following information: level history AutoCAD sketches, temperature graphs, surface level graphs, cascade/drywell charts, riser configuration drawings and tables, in-tank photos, and Tank Layer Model bar charts and spreadsheets.

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.

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

Hanlon, B. M., 1999, *Waste Tank Summary Report for December 31, 1998*, HNF-EP-0182-129 Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

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

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

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

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

- Assesses relative dryness between tanks.

LMHC, 1998, *Tank Characterization Data Base*, Internet at http://twins.pnl.gov:8001/htbin/TCD/main.html.

- Contains analytical data for each of the 177 Hanford Site waste tanks.

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

- Contains a tank inventory estimate based on analytical information.

Van Vleet, R. J., 1993, *Radionuclide and Chemical Inventories*, WHC-SD-WM-TI-565, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

- Contains tank inventory information.