ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 635439

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 Assessment and Interpretation, R2-12, 376-3753	[] Yes [X] No	02/20/97
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[] 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

This ECN was generated in order to revise the document to the new format per Department of Energy performance agreements.

14a. Justification (mark one)

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

14b. Justification Details

This document was revised per Department of Energy performance agreements and direction from the Washington State Department of Ecology to revise 23 tank characterization reports (letter dated 7/6/95).

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

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1. ECN (use no. from pg. 1) ECN-635439

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*	3-14-97	PE	
Cog. Mgr. K.M. Hall *Kathleen M Hall*	3/18/97	QA	
QA		Safety	
Safety		Design	
Environ.		Environ.	
Other R.J. Cash *R J Cash*	3-14-97	Other	
N.W. Kirch *NWKirch*	3-18-97	DEPARTMENT OF ENERGY	
		Signature or a Control Number that tracks the Approval Signature	
		ADDITIONAL	

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Tank Characterization Report for Double-Shell Tank 241-AP-107

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

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Key Words: Waste Characterization, Double-Shell Tank, DST, Tank 241-AP-107, Tank AP-107, AP-107, AP 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-AP-107. This report supports the requirements of the Tri-Party Agreement Milestone M-44-05.

Kara J Broz 3/18/97
Release Approval Date

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Tank Characterization Report for Double-Shell Tank 241-AP-107

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Tank Characterization Report for Double-Shell Tank 241-AP-107

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Date Published
March 1997

Prepared for the U.S. Department of Energy
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Project Hanford Management Contractor for the
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LIST OF TERMS

AA	atomic absorption
AEA	alpha enery analysis
ANOVA	analysis of variance
Btu/hr	British thermal units per hour
Ci/L	curies per liter
Ci	curies
cm	centimeter
CVAA	cold vapor atomic absorption
df	degrees of freedom
DQO	data quality objectives
DSC	differential scanning calorimetry
FIC	Food Instrument Corporation
ft	feet
g	gram
GEA	gamma energy analysis
g/mL	grams per milliliter
g/L	grams per liter
HDW	Hanford defined waste
IC	ion chromatography
ICP	inductively coupled plasma
in.	inch
kg	kilogram
kgal	kilogallon
kL	kiloliter
LFL	lower flammability limit
LL	lower limit
m	meters
M	moles per liter
mL	milliliters
mm	millimeter
n/a	not applicable
N/D	not decided
nr	not reported
N/R	not reviewed
PHMC	Project Hanford Management Contractor
ppm	parts per million
PUREX	Plutonium-Uranium Extraction
QC	quality control
RPD	relative percent difference
df	degrees of freedom

LIST OF TERMS (Continued)

SpG	specific gravity
SVOA	semivolatile organic analysis
TC	total carbon
TCR	tank characterization report
TGA	thermal gravimetric analysis
TIC	total inorganic carbon
TOC	total organic carbon
TWRS	Tank Waste Remediation System
UL	upper limit
VOA	volatile organic analysis
W	watts
W/Ci	watts per curie
wt%	weight percent
°C	degrees Celsius
°F	degrees Fahrenheit
μCi/g	microcuries per gram
μCi/L	microcuries per liter
μCi/mL	microcuries per milliliter
μgC/mL	micrograms of carbon per milliliter
μg/mL	micrograms per milliliter
μg/L	micrograms per liter

1.0 INTRODUCTION

One major function of the Tank Waste Remediation System (TWRS) is to characterize wastes in support of waste management and disposal activities at the Hanford Site. Analytical data from sampling and analysis and other information about a tank are compiled and maintained in a tank characterization report (TCR). This report and its appendixes serve as the TCR for double-shell tank 241-AP-107.

The objectives of this report are 1) to use characterization data in response to technical issues associated with tank 241-AP-107 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 safety status and additional sampling needs. The appendixes provide supporting data and information. This report also supports the requirements of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1996), Milestone M-44-05.

1.1 SCOPE

The characterization information in this report originated from sample analyses and historical sources. Although data quality objectives (DQOs) required that technical issues be resolved using results from recent sampling events (see Table 1-1), other information could be used to support (or challenge) conclusions derived from these results. Historical information for tank 241-AP-107 (see Appendix A) includes surveillance information, records pertaining to waste transfers and tank operations, and expected tank contents derived from a process knowledge model.

Table 1-1 summarizes the 1995 and 1993 sampling events, and Appendix B shows the results. Although most waste in tank 241-AP-107 has been processed through to the 242-A Evaporator, the 1995 grab sampling event provides the most accurate and recent sampling information for the remaining tank waste. The results of the 1995 sampling event, which were reported in the final data report (Miller 1995), satisfy the data requirements specified in the tank characterization plan (Schreiber 1995). Appendix C reports on the statistical analysis and numerical manipulation of data used in issue resolution. Appendix D contains the evaluation to establish the best basis for the inventory estimate based on the statistical analysis performed for this evaluation. Appendix E is a bibliography that resulted from an in-depth literature search of all known information sources applicable to tank 241-AP-107 and its waste types. The reports listed in Appendix E can be found in the Tank Characterization Resource Center.

Table 1-1. Summary of Recent Sampling Event.

Sample/Date[1]	Phase	Location		Number of Samples	Percent Recovery
		Riser	Depth[2] cm		
Grab sample (1/30/95 to 2/2/95)	Liquid	1 (90°)	336 580	4 4	100
		1 (210°)	397 824	4 2	100
		1 (330°)	306 943	2 1	100
Grab sample (8/2/93)	Liquid	1 (330°)	366 152	1 1	100
		1 (90°)	518 61	1 1	100
		1 (210°)	579	2	100

Notes:

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

[2]Depth is from the tank bottom.

1.2 TANK BACKGROUND

Tank 241-AP-107 is located in the 200 East Area AP Tank Farm on the Hanford Site. The tank went into service in 1986 as a dilute receiver tank and received flush water from miscellaneous sources. The tank received PUREX ammonia scrubber feed in 1990, which was transferred to tank 241-AW-102 as 242-A Evaporator feed in 1994. During October 1994 and January 1995, the tank received waste from tanks 241-AW-103 and 241-AP-101. In May and June 1995, waste was transferred again to tank 241-AW-102. No further waste transfers have taken place.

Table 1-2 summarizes the description of tank 241-AP-107. The tank has an operating capacity of 4,390 kL (1,160 kgal) and presently contains an estimated 83 kL (22 kgal) of dilute noncomplexed waste (Hanlon 1996). The tank is not on a Watch List (Public Law 101-510).

Table 1-2. Description of Tank 241-AP-107.[1]

TANK DESCRIPTION	
Type	Double-shell
Constructed	1983 to 1986
In service	1986
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	Active
TANK STATUS	
Waste classification	Dilute noncomplexed
Total waste volume[2]	83 kL (22 kgal)
Supernatant volume	83 kL (22 kgal)
Saltcake volume	0 kL (0 kgal)
Sludge volume	0 kL (0 kgal)
Drainable interstitial liquid volume	83 kL (22 kgal)
Waste surface level (January 7, 1997)	18.5 cm (7.28 in.)
Temperature (July 1989 to January 1997)	8.9 °C to 38.9 °C
Integrity	Sound
Watch List	None
SAMPLING DATE	
Grab sample	August 1993
Grab sample	January and February 1995
SERVICE STATUS	
In service	1986 to present

Note:

[1]This is an active tank, any new waste transferred into this tank may change the data presented in this table.

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

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2.0 RESPONSE TO TECHNICAL ISSUES

The technical issue identified for tank 241-AP-107 (Brown et al. 1996) is:

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

Data from the recent analysis of grab samples and historical information provided the means to respond to this issue. This response is detailed in the sections below. Appendix B provides sample and analysis data for tank 241-AP-107.

Before the May and June 1995 transfer, the evaporator DQO (Von Bargen 1995) and compatibility DQO (Fowler 1995) applied to tank 241-AP-107. The evaporator DQO no longer applies because no additional waste is currently available for transfer to the 242-A Evaporator. The compatibility DQO no longer applies because compatibility analyses were completed and approved before the tank transfer. As a result, these issues are not addressed in this report.

2.1 SAFETY SCREENING

The data needed for screening the waste in tank 241-AP-107 for potential safety problems are documented in *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995). These potential safety problems include exothermic conditions in the waste, flammable gases in the waste and/or tank headspace, and criticality conditions in the waste. Each condition is addressed separately.

2.1.1 Exothermic Conditions (Energetics)

The first requirement in the safety screening DQO (Dukelow et al. 1995) is to ensure there are not sufficient exothermic constituents (organic or ferrocyanide) to cause a safety hazard. Because of this requirement, energetics in the tank 241-AP-107 waste were evaluated. The threshold limit for energetics is 480 J/g on a dry weight basis. No exothermic reaction was detected in any sample.

2.1.2 Flammable Gas

Testing for flammability in the headspace of tank 241-AP-107 was not required at the time of sampling and was not available; therefore, the safety screening DQO was not fully met. However, the lower flammability limit (LFL) is expected to be well below the notification limit of 25 percent of the LFL because the tank is actively ventilated and radionuclide and organic concentrations are very low.

2.1.3 Criticality

The safety threshold limit for criticality is 1 g ^{239}Pu per liter of waste. Assuming that all alpha activity is from ^{239}Pu and assuming a density of less than or equal to 1.5 g/mL, 1 g/L of ^{239}Pu is greater than or equivalent to 41 μCi/g of alpha activity. The density of the waste was 1.01 g/mL, and the alpha results were well below this limit. The maximum result for total alpha was <9.31E-04 μCi/mL (<9.4E-04 μCi/g). Because all results were below analytical detection limits and duplicate samples were not obtained, a 95 percent confidence interval was not calculated.

2.2 OTHER TECHNICAL ISSUES

A factor in assessing tank safety is heat generation from radioactive decay. The tank heat load calculated from the best-basis inventory data of Section 3.0 was 5.72 W (19.5 Btu/hr) (see Table 2-1). This is well below the 20,500-W (70,000-Btu/hr) operating specification limit for double-shell tanks (Harris 1994).

Table 2-1. Tank 241-AP-107 Radionuclide Inventory and Projected Heat Load.

Radionuclide	Projected Inventory (Ci)	Decay Heat Generation Rate (W/Ci)	Decay Heat Generation (W)
^{137}Cs	1,195	0.00472	5.64
$^{89/90}$Sr	12.5	0.00669	0.08
^{99}Tc	0.20	5.01E-04	0
Total Watts			5.72

2.3 SUMMARY

Most tank contents were transferred in May and June 1995, leaving only 83 kL (22 kgal) of waste. The analytical results of grab samples taken January and February 1995 from all analyses addressing potential safety issues showed no primary analyte exceeded safety decision threshold limits (see Table 2-2).

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

Issue	Sub Issue	Result
Safety	Fuel content/ Energetics	No exotherm was observed in any sample.
	Criticality	All analyses were below detection limits and well below the 41 μCi/g.
	Flammable gas accumulation	A vapor measurement was not performed. The LFL was expected to be near 0 percent because the tank was actively ventilated and radionuclide and organic concentrations were very low.

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3.0 BEST-BASIS INVENTORY ESTIMATE

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

Chemical and radiological inventory information generally is derived using three approaches: 1) component inventories are estimated using the results of sample analyses, 2) component inventories are predicted using the Hanford Defined Waste (HDW) (Agnew et al. 1996) 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, use, and other operating data.

An effort is underway to provide waste inventory estimates that will serve as the standard characterization for waste management activities (Hodgson and LeClair 1996). For the following reasons, the engineering assessment in this evaluation (see Appendix D) should serve as the basis for the best inventory estimate for tank 241-AP-107:

1. The February 1995 samples are the only representative samples of waste currently in tank 241-AP-107.

2. The HDW model estimate is outdated because of a large number of waste transfers that occurred after the date the HDW model estimate is valid.

Tables 3-1 and 3-2 are best-basis inventory estimates for tank 241-AP-107. Radionuclide values are decayed to January 1, 1994.

Table 3-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AP-107.

Analyte	Total Inventory (kg)	Basis (S, M, or E)[1,2]
Al	28.9	S
CO_3	178	S
F	368	S
Na	1,230	S
NO_2	263	S
NO_3	551	S
OH	575	S
TOC	26.0	S
U	0.630	S

Notes:

TOC = total organic carbon

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

[2]Based on a waste volume of 83 kL (22 kgal) and February 1995 grab sample results adjusted for evaporation losses (see Appendix B).

Table 3-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AP-107.

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1,2]
^{3}H	3.09	S
^{14}C	0.00192	S
^{90}Sr	16.3	S
^{90}Y	16.3	S
^{99}Tc	0.249	S
^{137}Cs	1,560	S
^{137m}Ba	1,480	S
^{237}Np	0.00284	S
^{239}Pu	0.00937	S

Notes:

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

[2]Based on a waste sample volume of 83 kL (22 kgal) and February 1995 grab sample results adjusted for evaporation losses (see Appendix B).

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4.0 CONCLUSIONS AND RECOMMENDATIONS

Tank 241-AP-107 was characterized primarily on grab samples obtained in January and February 1995. Additional analytical information was obtained from August 1993 grab samples. The samples were obtained to satisfy safety screening DQOs, and to support the 95-1 242-A Evaporator campaign. All analytical results for the safety screening DQO were well within the safety notification limits. Vapor analyses to determine the LFL of the tank headspace were not obtained. However, the LFL is expected to be well below the notification limits (near 0 percent) because the tank is actively ventilated and radionuclide and organic concentrations are very low. The tank currently contains 83 kL (22 kgal) of waste. Based on current waste contents and grab sample results, a best-basis inventory was developed. Tank 241-AP-107 is active, and additional transfers are anticipated to and from the tank.

Table 4-1 summarizes the status of the Project Hanford Management Contractor (PHMC) TWRS Program review and acceptance of the sampling and analysis results reported in this tank characterization report. The DQO issue required to be addressed by sampling and analysis is in column 1 of Table 4-1. Column 2 indicates whether the requirements of the DQO were met by the sampling and analysis activities. Column 3 indicates concurrence and acceptance by the program in TWRS that is responsible for the DQO that the sampling and analysis activities performed adequately meet the needs of the DQO. A "yes" or "no" in column 3 indicates acceptance or disapproval of the sampling and analysis information presented in the TCR. If the results/information have not yet been reviewed, "N/R" is shown in the column. If the results/information have been reviewed, but acceptance or disapproval has not been decided, "N/D" is shown.

Table 4-1. Acceptance of Tank 241-AP-107 Sampling and Analysis.

Issue	Sampling and Analysis Performed	TWRS[1] Program Acceptance
Safety screening DQO	Yes	Yes

Note:

[1]PHMC TWRS Program Office

Table 4-2 summarizes the status of the PHMC TWRS Program Office review and acceptance of the evaluations and other characterization information contained in this report. The evaluations outlined in this report are the best-basis inventory evaluation and the evaluation to determine whether the tank is safe, conditionally safe, or unsafe. Column 1 contains the different evaluations performed. Columns 2 and 3 are in the same format as Table 4-1. The manner in which concurrence and acceptance are summarized is the same as that in

Table 4-1. The safety categorization of the tank is "yes" in Table 4-2. Although tank headspace flammability was not determined, the tank is actively ventilated and no analysis indicated any safety problems (see Table 2-2).

Table 4-2. Acceptance of Evaluation of Characterization Data and Information for Tank 241-AP-107.

Issue	Evaluation Performed	TWRS[1] Program Acceptance
Safety categorization	Yes	Yes

Note:

[1]PHMC TWRS Program Office

5.0 REFERENCES

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APPENDIX A

HISTORICAL TANK INFORMATION

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APPENDIX A

HISTORICAL TANK INFORMATION

Appendix A describes tank 241-AP-107 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 may be useful for supporting or challenging conclusions based on sampling and analysis.

This appendix contains the following information:

- **Section A1**: Current status of the tank including the current waste levels.
- **Section A2**: Information about tank design.
- **Section A3**: Process knowledge of the tank, that is, the waste transfer history and estimated contents of the tank based on modeling data.
- **Section A4**: Surveillance data for tank 241-AP-107 including surface-level readings and temperatures.
- **Section A5**: References for Appendix A.

A1.0 CURRENT TANK STATUS

As of September 30, 1996, tank 241-AP-107 contained 83 kL (22 kgal) of dilute noncomplexed waste (Hanlon 1996). This waste volume was estimated using a Food Instrument Corporation (FIC) surface-level gauge and a manual tape. Table A1-1 shows the volumes of the waste phases in the tank.

Tank 241-AP-107 is in service, categorized as sound, and is not on a Watch List. The tank is actively ventilated.

Table A1-1. Estimated Tank Contents.

Waste Form	Estimated Volume	
	kL	kgal
Total waste	83	22
Supernatant liquid	83	22
Sludge	0	0
Saltcake	0	0
Drainable interstitial liquid	0	0
Drainable liquid remaining	83	22
Pumpable liquid remaining	83	22

Note:

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

A2.0 TANK DESIGN AND BACKGROUND

The AP Tank Farm was constructed from 1983 to 1986 in the 200 East Area of the Hanford Site (Leach and Stahl 1996). The tank farm contains eight double-shell tanks. Each tank has a capacity of 4,390 kL (1,160 kgal), a diameter of 22.9 m (75.0 ft), and an operating depth of 10.7 m (35.2 ft). The tanks were designed to hold concentrated supernatant. The maximum design temperature for liquid storage is 149 °C (300 °F) (Brevick et al. 1995).

Tank 241-AP-107 was constructed with a primary carbon steel liner (heat-treated and stress-relieved), a secondary carbon steel liner (not heat-treated), and a reinforced concrete shell. The bottom of the primary liner is 13 mm (0.5 in.) thick, the lower portion of the sides is 19 mm (0.75 in.) thick, the upper portion of the sides is 13 mm (0.5 in.) thick, and the dome liner is 9.5 mm (0.375 in.) thick. The secondary liner is 9.5 mm (0.375 in.) thick. The concrete walls are 46.0 cm (1.5 ft) thick and the dome is 38.0 cm (1.25 ft) thick. The tank has a flat bottom where the bottom of the primary and secondary liners are separated by an insulating layer of concrete.

Tank 241-AP-107 has 71 risers, ranging in diameter from 100 mm (4 in.) to 1.1 m (42 in.), that provide access to the tank. Table A2-1 shows riser numbers, diameters, and a description of the risers (annular risers not included). Figure A2-1 is a plan view of the riser configuration. Seven 100-mm (4-in.) diameter risers (three number 1s, number 15, number 21, number 24, and number 28), and four 305-mm (12-in.) diameter risers (one number 1, two number 10s, and number 12), are available for sampling (Lipnicki 1996). Figure A2-2 shows the tank cross section, approximate waste level, and a schematic of the tank equipment.

Table A2-1. Tank 241-AP-107 Risers.[1,2,3] (2 sheets)

Riser Number	Diameter (mm)	Diameter (in.)	Description and Comments
1	100	4	Sludge measurement port
1	100	4	Sludge measurement port
1	100	4	Sludge measurement port
2	100	4	Automatic liquid indicator tape
3	305	12	Supernatant pump (central pump pit)
4	305	12	Thermocouple probe
5	1,100	42	Manhole (riser plug)
5	1,100	42	Manhole (riser plug)
5	1,100	42	Manhole (riser plug)
7	305	12	Primary tank exhaust
10	305	12	Spare (riser plug)
10	305	12	Spare (riser plug)
11	1,100	42	Slurry distributor (central pump pit)
12	305	12	Observation port - spare
13	305	12	Tank pressure
14	100	4	Supernatant return
15	100	4	Spare (riser plug)
16	305	12	Sludge measurement port
16	305	12	Sludge measurement port
16	305	12	Sludge measurement port
21	100	4	Spare (riser plug)

Table A2-1. Tank 241-AP-107 Risers.[1,2,3] (2 sheets)

Riser Number	Diameter (mm)	Diameter (in.)	Description and Comments
22	100	4	Sludge measurement port
24	100	4	Spare (riser plug)
25	100	4	High liquid level sensor
26	100	4	Liquid level indicator
27	100	4	Spare (riser plug)
27	100	4	Spare (riser plug)
27	100	4	Spare (riser plug)
28	100	4	Spare (riser plug)

Notes:

[1]Brevick et al. (1995) and Salazar (1994)
[2]Braun Hanford Company (1985)
[3]WHC (1994)

Figure A2-1. Riser Configuration for Tank 241-AP-107.

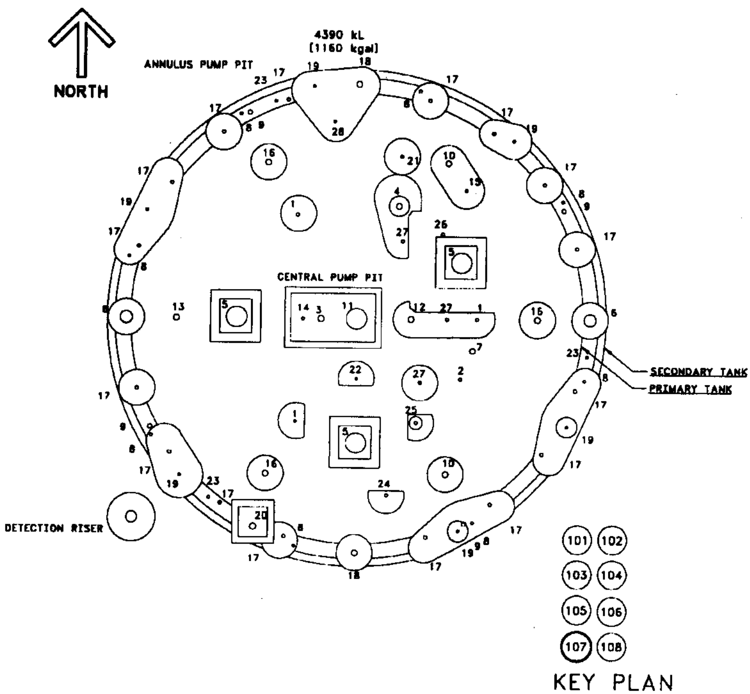
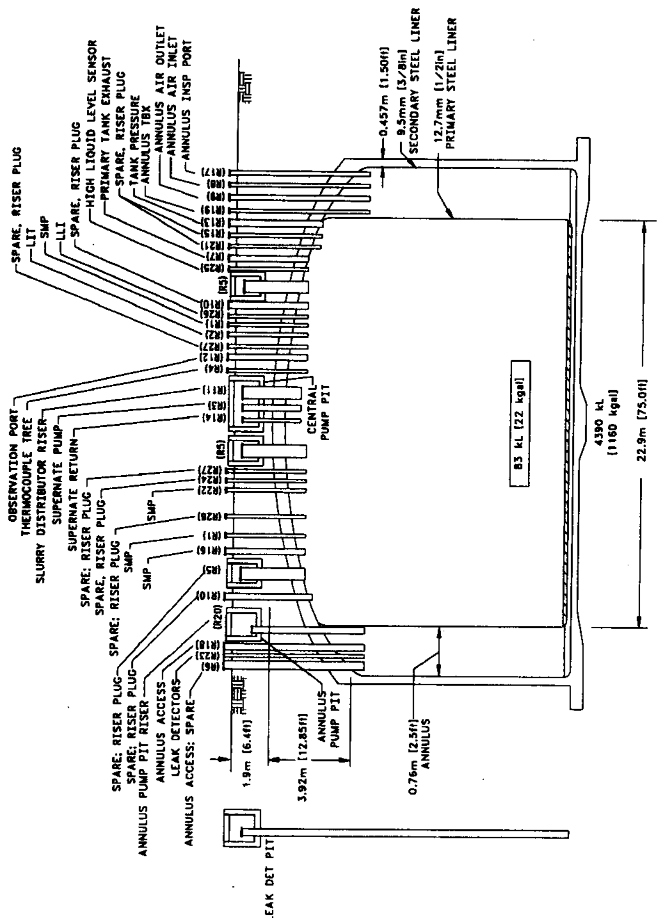


Figure A2-2. Tank 241-AP-107 Cross Section and Schematic.



A3.0 PROCESS KNOWLEDGE

The sections below 1) provide information about the transfer history of tank 241-AP-107, 2) describe process wastes that made up the transfers, and 3) give an estimate of the current tank contents based on transfer history.

A3.1 WASTE TRANSFER HISTORY

Table A3-1 summarizes the waste transfer history of tank 241-AP-107 from startup to the second quarter of 1994 based on Agnew et al. (1996b) and from 1994 to September 1996 based on the Hanford tank transfer database. The tank was brought into service during the third quarter of 1986 with the addition of approximately 72 kL (19 kgal) of flush water from miscellaneous sources. An additional 68 kL (18 kgal) of flush water was received through the first quarter of 1990. In the first quarter of 1990, tank 241-AP-107 also received PUREX ammonia scrubber feed from the PUREX Plant. In August 1943, grab samples were obtained. At the time of sampling, the tank contained 4,220 kL (1,115 kgal) of dilute noncomplexed waste.

The tank contents remained relatively static until the third and fourth quarters of 1994 when all but 106 kL (28 kgal) of waste was transferred to tank 241-AW-102 as part of the 242-A Evaporator Campaign 94-1 (Guthrie 1994). Dilute noncomplexed waste was received from tanks 241-AW-103 and 241-AP-101 during the fourth quarter of 1994 and the first quarter of 1995, respectively. In January 1995, grab samples were obtained. At the time of sampling, the tank contained 3,774 kL (997 kgal) of dilute noncomplexed waste. In the second quarter of 1995, dilute noncomplexed waste was again transferred to tank 241-AW-102 leaving the current tank 241-AP-107 inventory of approximately 83 kL (22 kgal).

As a 242-A Evaporator staging tank, additional transfers to and from tank 241-AP-107 are anticipated when the evaporator is in operation.

A3.2 HISTORICAL ESTIMATION OF TANK CONTENTS

The historical inventory estimate (Agnew 1996a) for tank 241-AP-107 indicates the tank contains 4,210 kL (1,110 kgal) of supernatant. As indicated previously, this estimated volume is outdated because tank 241-AP-107 has been involved in several tank-to-tank transfers since the second quarter of 1994 (the historical end date of the *Waste Status and Transaction Record Summary for the Southeast Quadrant* [Agnew et al. 1996b]).

Table A3-2 shows the estimated waste volume and constituents of the PUREX ammonia scrubber feed waste and flush water that was in the tank before the first major waste transfer in September, 1994. The tank waste is currently classified as a dilute noncomplexed supernatant.

Table A3-1. Summary of Tank 241-AP-107 Major Waste Transfers.[1,2]

Transfer Source	Transfer Destination	Waste Type	Time Period	Estimated Volume[1,2]	
				kL	kgal
Miscellaneous sources		Flush water	1986 to 1990	140	37
PUREX Plant		PUREX ammonia scrubber feed	1990	4,220	1,115
	241-AW-102	Dilute noncomplexed supernatant	1994 to 1995	-7,740	-2,050
241-AW-103		Dilute noncomplexed supernatant	1994	-500	-132
241-AP-101		Dilute noncomplexed supernatant	1995	3,160	836

Notes:

[1]Data are derived from Agnew et al. (1996b) through February 1994 and from the Operational Waste Volume Projection DataBase.

[2]Because only major transfers are listed and evaporation and other minor losses are not included, the sum of these transfers will not equal the current waste volume.

Table A3-2. Tank 241-AP-107 Historical Tank Inventory Estimate. (2 sheets)

Total Inventory Estimate[1]			
Physical Properties			
Total waste	4.21E+06 kg (1,110 kgal)		
Heat load	0 kW (0 Btu/hr)		
Bulk density[2]	1.00 (g/mL)		
Water wt%[2]	99.4		
TOC wt% C (wet)[2]	0		
Chemical Constituents	***M***	**ppm**	**kg**
Na^+	0.06	1,380	5,820
Al^{3+}	0	0	0
Fe^{3+} (total Fe)	2.01E-03	112	472
Cr^{3+}	0	0	0
Bi^{3+}	0	0	0
La^{3+}	0	0	0
Hg^{2+}	0	0	0
Zr (as $ZrO(OH)_2$)	0	0	0
Pb^{2+}	0	0	0
Ni^{2+}	0	0	0
Sr^{2+}	0	0	0
Mn^{4+}	0	0	0
Ca^{2+}	9.05E-03	362	1,520
K^+	2.01E-04	7.85	33
OH^-	0.016	273	1,150
NO_3^-	0.066	4,120	1.73E+04
NO_2^-	0	0	0
CO_3^{2-}	4.92E-04	29.4	124
PO_4^{3-}	0	0	0
SO_4^{2-}	0	0	0
Si (as SiO_3^{2-})	0	0	0

Table A3-2. Tank 241-AP-107 Historical Tank Inventory Estimate. (2 sheets)

Total Inventory Estimate[1]			
Chemical Constituents	*M*	ppm	kg
F^-	0	0	0
Cl^-	9.25E-04	32.7	138
$C_6H_5O_7^{3-}$	0	0	0
$EDTA^{4-}$	0	0	0
$HEDTA^{3-}$	0	0	0
$Glycolate^-$	0	0	0
$Acetate^-$	0	0	0
$Oxalate^{2-}$	0	0	0
DBP	0	0	0
Butanol	0	0	0
NH_3	0.050	853	3,590
$Fe(CN)_6^{4-}$	0	0	0
Radiological Constituents	Ci/L	μCi/g	Ci
Pu	---	0	0 (kg)
U	0 (*M*)	0 μg/g	0 (kg)
Cs	0	0	0
Sr	0	0	0

Notes:

wt% = weight percent

[1]Agnew et al. (1996a). These estimates are based on the sample volume of January 1, 1994. The estimates do not represent current tank contents.

[2]Volume average for density, mass average water (wt%) and TOC (wt% C).

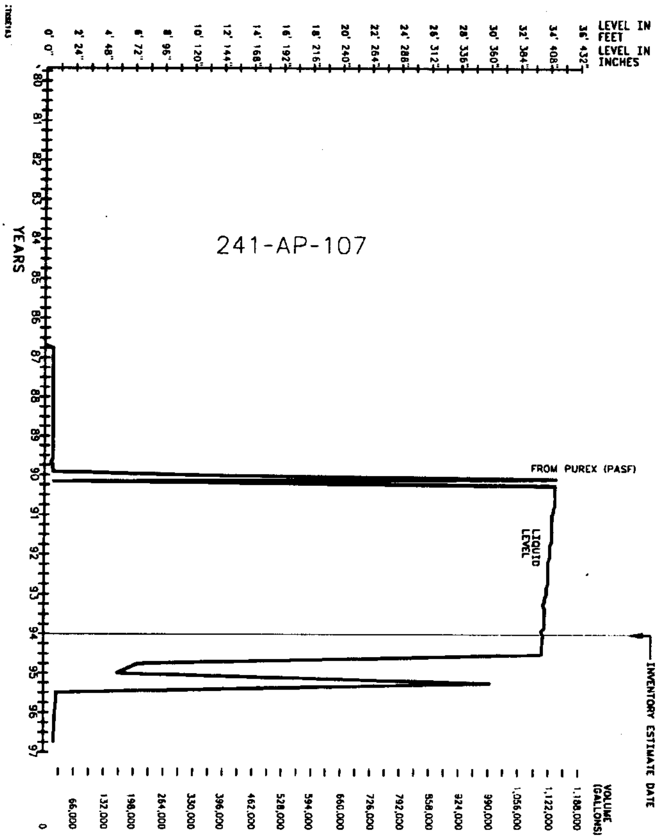
A4.0 SURVEILLANCE DATA

Tank 241-AP-107 surveillance data consist of surface-level measurements (liquid and solid), temperature monitoring inside the tank (waste and headspace), and leak detection well monitoring for radioactive liquids outside the tank. Surveillance data provide the basis for determining tank integrity.

A4.1 SURFACE-LEVEL READINGS

Waste surface-level monitoring in tank 241-AP-107 is performed with an automatic FIC gauge in riser 2 and a manual tape in riser 26. Because this is an active tank, the surface level is continually subject to change. The waste surface level measured with the FIC on January 7, 1997, was 185 mm (7.2 in.), which equals approximately 74.9 kL (19.8 kgal). This is slightly lower than the September 30, 1996 Hanlon estimate of 83 kL (22 kgal) based on tank transfer history, and it may be attributed to waste settling and minor evaporative losses since September 1996. Figure A4-1 is a level history graph of the volume measurements.

Figure A4-1. Tank 241-AP-107 Level History.



A4.2 INTERNAL TANK TEMPERATURES

In-tank temperature data for tank 241-AP-107 are recorded by 18 thermocouples on one thermocouple tree located in riser 4 (Tran 1993). The minimum temperature on January 6, 1997, was 9.3 °C (48.7 °F) on thermocouple 1; the maximum temperature on the same date was 9.9°C (49.8 °F) on thermocouple 11.

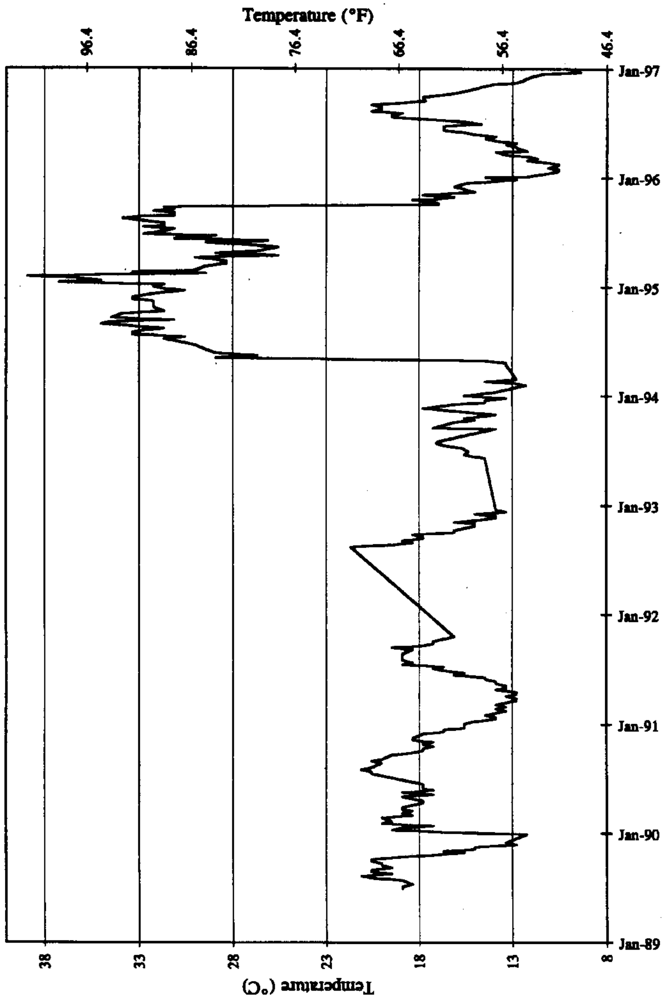
Temperature data, from the Computer Automated Surveillance System recorded from April 1994 to the present (for 16 thermocouples) and from July 1989 to March 1993 (for 12 thermocouples), were evaluated. Not all 12 thermocouples have data covering the entire period. Currently, data are recorded for thermocouples 1, 3, 5, 7, 11, and 17. From the data available in the Computer Automated Surveillance System, the average temperature between July 1989 and January 1997 was 18.4 °C (65.2 °F) with a minimum of 8.9 °C (48 °F) and a maximum of 38.9 °C (102 °F). Plots of thermocouple probes over time are in Brevick et al. (1995).

Figure A4-2 is a graph of the weekly high temperatures measured between January 1989 and January 1997.

A4.3 TANK 241-AP-107 PHOTOGRAPHS

No interior photographs are available for this tank.

Figure A4-2. Tank 241-AP-107 Weekly High Temperature Plot.



A5.0 APPENDIX A REFERENCES

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APPENDIX B

SAMPLING OF TANK 241-AP-107

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APPENDIX B

SAMPLING OF TANK 241-AP-107

Appendix B provides sampling and analysis information for each known sampling event for tank 241-AP-107, and it assesses grab sample results.

- **Section B1**: Tank Sampling Overview
- **Section B2**: Analytical Results

  B2.1: January and February 1995 grab sample
  B2.2: August 1993 grab sample
- **Section B3**: Assessment of Characterization Results
- **Section B4**: References for Appendix B.

Future sampling of tank 241-AP-107 will be appended to the above list.

B1.0 TANK SAMPLING OVERVIEW

This section describes the 1995 and 1993 grab sampling and analysis events for tank 241-AP-107. Seventeen grab samples were taken in January and February 1995 to satisfy safety screening requirements and the *Data Quality Objectives for Tank Farms Waste Compatibility Program* (Fowler 1995). Sampling and analyses were performed according to the *Tank 241-AP-107 Tank Characterization Plan* (Schreiber 1995).

Grab samples were also taken in August 1993 to determine whether the waste was acceptable feed for the 242-A Evaporator. Sampling and analyses procedures were in accordance with De Lorenzo et al. (1994). The 1993 grab sample results do not represent current tank contents because several tank transfers have occurred since August 1993 (see Appendix A).

No other samples have been taken.

Table B1-1 summarizes sampling and analytical requirements for tank 241-AP-107.

Table B1-1. Integrated Requirements for Tank 241-A-107.[1]

Sampling Event	Applicable DQOs	Sampling Requirements	Applicable References
Grab sampling	Safety screening - Energetics - Total Alpha - Flammable Gas	Core samples from a minimum of two risers separated radially to the maximum extent possible.	Dukelow et al. (1995)
	Evaporator		Von Bargen (1995)

Note:

[1]Schreiber (1995)

B2.0 DESCRIPTION OF SAMPLING EVENTS

This section describes the 1995 and 1993 grab sampling events. Tables B2-9 through B2-72 show the analytical results. The 1995 grab sample analyses and analytical results were used to satisfy the safety screening DQO and to characterize current tank contents. No sample was taken before August 1993.

B2.1 1995 GRAB SAMPLE

Tank 241-AP-107 was sampled between January 30 and February 2, 1995. Seventeen samples were taken from risers 1 (330°), 1 (210°) and 1 (90°). The "bottle-on-a-string" method (ASTM 1973) was used to collect the samples. Each glass sample bottle collected approximately 100 mL of liquid.

Analyses were performed by the Westinghouse Hanford Company 222-S Laboratory. Table B2-1 summarizes sample numbers, dates, and locations.

Table B2-1. Tank 241-AP-107 Sample Information.

Riser Number[1] Angle	Sample Date[2]	Depth[3] (cm.)	Sample Number	Laboratory Sample Number
1, 90°	1/30/95	336	107-AP-1A	S95V000001
	1/30/95	336	107-AP-1B	S95V000007
	1/31/95	336	107-AP-1C	S95V000011 S95V000014
	1/31/95	336	107-AP-1D	S95V000017
	1/31/95	580	107-AP-2A	S95V000002
	1/31/95	580	107-AP-2B	S95V000008
	1/31/95	580	107-AP-2C	S95V000012 S95V000015
	1/31/95	580	107-AP-2D	S95V000018
1, 210°	2/1/95	397	107-AP-3A	S95V000003
	2/1/95	397	107-AP-3B	S95V000009
	2/1/95	397	107-AP-3C	S95V000013 S95V000016
	2/1/95	397	107-AP-3D	S95V000019
	2/1/95	824	107-AP-4A	S95V000004 S95V000027
	2/1/95	824	107-AP-4B	S95V000020
1, 330°	2/1/95	306	107-AP-5A	S95V000005 S95V000028
	2/1/95	306	107-AP-5B	S95V000021
	2/2/95	943 (surface sample)	107-AP-6	S95V000022

Notes:

[1]Riser 1 (90° is located east of the tank 241-AP-107 central pump pit (90° from north direction). Riser 1 (210° is located southwest of the tank 241-AP-107 central pump pit (210° from north direction). Riser 1 (330° is located northwest of the tank 241-AP-107 central pump pit (330° from north direction).

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

[3]Sample depth is the distance from the tank bottom to the top of the sample bottle.

B2.1.1 Sample Handling

Samples were received by the 222-S Laboratory between January 31 and February 3, 1995. Three field blanks and two trip blanks were prepared for analysis. Samples were not preserved (acidification or refrigeration) at the time of sampling.

The samples were clear yellow liquids with no turbidity or solids present and no separable phases.

B2.1.2 Sample Analysis

All analyses were performed according to approved laboratory procedures. The analyses performed on the grab samples were those required by the sampling and analysis plan (Schreiber 1995). Table B2-1 lists the analyses. Four samples were composited with tank 241-AP-106 and tank 241-AW-106 samples for batch boildown tests. Results were summarized in Le (1995). Table B2-2 lists the analytical procedures by title and number. No deviations or modifications were noted by the laboratory.

Detailed quality control (QC) data were included in the final laboratory report (Miller 1995). Tables B2-9 to B2-37 show QC results for each sample. Duplicate or spike analyses were performed on samples as specified in Schreiber (1995). Check standards were evaluated before and after each evaluation to verify instrument calibration and analytical performance. Section B3.2 assesses the QC procedures and data.

Table B2-2. Summary of Samples and Requested Analytes. (2 sheets)

Sample Number	Laboratory Sample Numbers	Requested Analytes
107-AP-1A	S95V000001	Acetone, 1-Butanol, 2-Butanone, 2-Hexanone, 4-Methyl-2-Pentanone, 2-Pentanone, Tetrahydrofuran
107-AP-1B	S95V000007	2-Butoxyethanol, n-Tributylphosphate
107-AP-1C	S95V000011	DSC, TGA, SpG, pH, OH, IC, TC, TIC, TOC, NH_3, U, ^{14}C, ^{129}I, ^{237}Np,
	S95V000014	ICP (Al, Na), Alpha, Beta, ^{137}Cs, ^{134}Cs, $^{144}Ce/Pr$, ^{60}Co, ^{154}Eu, ^{155}Eu, ^{94}Ni, $^{106}Ru/Rh$, ^{226}Ra, ^{3}H, ^{79}Se, $^{89/90}Sr$, ^{99}Tc, $^{239/240}Pu$, ^{238}Pu, ^{241}Am, $^{243/244}Cm$,
107-AP-1D	S95V000017	Mixing/Boildown
107-AP-2A	S95V000002	Acetone, 1-Butanol, 2-Butanone, 2-Hexanone, 4-Methyl-2-Pentanone, 2-Pentanone, Tetrahydrofuran
107-AP-2B	S95V000008	2-Butoxyethanol, n-Tributylphosphate
107-AP-2C	S95V000012	DSC, TGA, SpG, pH, OH, IC, TC, TIC, TOC, NH_3, U, ^{14}C, ^{129}I, ^{237}Np,
	S95V000015	ICP (Al, Na), Alpha, Beta, ^{137}Cs, ^{134}Cs, $^{144}Ce/Pr$, ^{60}Co, ^{154}Eu, ^{155}Eu, ^{94}Ni, $^{106}Ru/Rh$, ^{226}Ra, ^{3}H, ^{79}Se, $^{89/90}Sr$, ^{99}Tc, $^{239/240}Pu$, ^{238}Pu, ^{241}Am, $^{243/244}Cm$,
107-AP-2D	S95V000018	Mixing/boildown
107-AP-3A	S95V000003	Acetone, 1-Butanol, 2-Butanone, 2-Hexanone, 4-Methyl-2-Pentanone, 2-Pentanone, Tetrahydrofuran
107-AP-3B	S95V000009	2-Butoxyethanol, n-Tributylphosphate
107-AP-3C	S95V000013	DSC, TGA, SpG, pH, OH, IC, TC, TIC, TOC, NH_3, U, ^{14}C, ^{129}I, ^{237}Np,
	S95V000016	ICP (Al, Na), Alpha, Beta, ^{137}Cs, ^{134}Cs, $^{144}Ce/Pr$, ^{60}Co, ^{154}Eu, ^{155}Eu, ^{94}Ni, $^{106}Ru/Rh$, ^{226}Ra, ^{3}H, ^{79}Se, $^{89/90}Sr$, ^{99}Tc, $^{239/240}Pu$, ^{238}Pu, ^{241}Am, $^{243/244}Cm$,
107-AP-3D	S95V000019	Mixing/boildown
107-AP-4A	S95V000004	Acetone
	S95V000027 (subsample)	Mixing/boildown

Table B2-2. Summary of Samples and Requested Analytes. (2 sheets)

Sample Number	Laboratory Sample Numbers	Requested Analytes
107-AP-4B	S95V000020	OH, NH_3
107-AP-5A	S95V000005	Acetone
	S95V000028	Mixing/boildown
107-AP-5B	S95V000021	OH, NH_3
107-AP-6	S95V000022	TOC
107-AP-IB	S95V000024 (field blank)	OH, IC, TC, TIC, TOC, NH_3, U, ^{3}H, ^{14}C, ^{129}I, ^{237}Np
	S95V000025 (field blank)	ICP (Al, Na), Alpha, Beta, ^{137}Cs, ^{134}Cs, $^{144}Ce/Pr$, ^{60}Co, ^{154}Eu, ^{155}Eu, ^{94}Ni, $^{106}Ru/Rh$, ^{226}Ra, ^{79}Se, $^{89/90}Sr$, ^{99}Tc, $^{239/240}Pu$, ^{238}Pu, ^{241}Am, $^{243/244}Cm$
107-AP-OB1	S95V000006 (field blank)	Acetone, 1-Butanol, 2-Butanone, 2-Hexanone, 4-Methyl-2-Pentanone, 2-Pentanone, Tetrahydrofuran
107-AP-OB2	S95V000010 (field blank)	2-Butoxyethanol, n-Tributylphosphate
107-AP-TB1	not used (trip blank)	n/a
107-AP-TB2	S95V000026 (trip blank)	2-Butoxyetanol, n-Tributylphosphate

Notes:

DSC = differential scanning calorimetry
TGA = thermogravimetri analysis
IC = ion chromatography
ICP = inductively coupled plasma
n/a = not applicable
TC = total carbon
TIC = total inorganic carbon
TOC = total organic carbon
SpG = specific gravity

Table B2-3. General Analytical Methods.

Analyte	Method	Procedure
F^-, Cl^-, NO_2^-, NO_3^-, SO_4^{2-}, PO_4^{3-}	IC	LA-533-105
NH_3	Selective ion electrode	LA-631-001
OH^-	Titration	LA-661-102
TIC	Coulometry	LA-622-102
TC, TOC	Combustion/CO_2 detection by coulometry	LA-344-105
Total U	Kinetic phosphorescence	LA-925-009
Al, Na	ICP[2]	LA-505-161
^{134}Cs, ^{137}Cs, ^{94}Nb, $^{106}Ru/Rh$, $^{144}Ce/Pr$, ^{60}Co, $^{154/155}Eu$, ^{226}Ra, ^{113}Sn	Gamma energy analysis (GEA)	LA-548-121
^{3}H ^{14}C	Liquid scintillation	LA-218-114 LA-348-104
^{79}Se ^{99}Tc	Liquid scintillation	LA-365-131 LA-438-101
$^{89/90}Sr$	Separation/beta[1]	LA-220-101
^{129}I	Low energy gamma analysis	LA-378-103
^{237}Np	Extraction/alpha[2]	LA-933-141
$^{239/240}Pu$, ^{241}Am, $^{234/235}U$, ^{238}U	Separation/alpha energy analysis (AEA)[3]	LA-503-156
pH	Direct	LA-212-102
Specific gravity	Direct	LA-510-112
Energetics	DSC	LA-514-113
Percent water	TGA - Mettler[1]	LA-560-112
Volatile organic Semivolatile organic	Gas chromatography/mass spectroscopy	LA-523-405 LA-523-406

Notes:

[1]Chemical separation along with beta proportional counting
[2]Extraction followed by alpha proportional counting
[3]Chemical separation followed by alpha energy analysis

[1]Mettler is a trademark of the Mettler Instrument Corporation, Anaheim, California.

B2.1.3 Analytical Results

This section summarizes the sampling and analytical results associated with the 1995 grab sampling and analysis of tank 241-AP-107. Table B2-4 shows the chemical, radiochemical, physical, and organic results associated with tank 241-AP-107. These results are documented in Miller (1995).

Table B2-4. 1995 Analytical Data Tables.

Analysis	Table Number
Summary data for inorganic analyses	B2-9 through B2-17
Summary data for organic analyses	B2-18 through B2-23
Summary data for pH analyses	B2-24
Summary data for specific gravity analyses	B2-25
Summary data for percent water (TGA) analyses	B2-26
Summary data for radiochemical analyses	B2-27 through B2-34
Summary data for ammonium analyses	B2-35
Summary data for total inorganic carbon analyses	B2-36

The four QC parameters assessed in conjunction with tank 241-AP-107 samples were standard recoveries, spike recoveries, duplicate analyses, and blanks. The QC criteria applied to the data were 75 to 125 percent recovery for standards, 75 to 125 percent for spikes, and 20 percent for the relative percent difference (RPD) between duplicates. Spike recoveries could not be performed for TGA, pH, specific gravity, OH, and radionuclide analyses because spike standards were not available. The only QC parameter for which limits are not specified is blank contamination. The limits for blanks are set forth in guidelines followed by the laboratory, and all data results in this report have met the guidelines. Sample and duplicate pairs in which any QC parameters were outside limits are footnoted in the sample mean column of the data summary tables with an a, b, c, d, e, or f:

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

B2.1.3.1 Inductively Coupled Plasma Spectroscopy. Only aluminum and sodium analyses were conducted. An acid predigestion was performed before analysis. Aluminum and sodium were analyzed according to procedure LA-505-161. No analytical anomalies or difficulties were encountered. Aluminum concentrations ranged from 267 to 278 μg/mL. Sodium concentrations ranged from 11,400 to 11,700 μg/mL.

B2.1.3.2 Ion Chromatography. The following anions were determined by according to procedure LA-533-105: fluoride, nitrate, nitrite, phosphate, and sulfate. No analytical anomalies or difficulties were encountered. Fluoride, nitrate, and nitrite concentrations were between 0.1 and 1.0 weight percent. Phosphate and sulfate concentrations were below 0.1 weight percent.

B2.1.3.3 Ammonia Analysis. Ammonia analyses were performed according to procedure LA-631-001. The laboratory analyst indicated that ammonia concentrations could be biased low because of sample degradation resulting from the high pH of the samples (Miller 1995). Sample concentrations ranged from 1,010 μg/mL to 1,060 μg/mL.

B2.1.3.4 Titration. Hydroxide was determined using procedure LA-212-102. No anomalies or difficulties were encountered. Sample results were within a close range, 5,250 μg/mL to 5,630 μg/mL.

B2.1.3.5 Total Carbon. Total carbon analyses were performed according to procedure LA-344-105. No anomalies or difficulties were encountered. Total carbon concentrations ranged from 561 μg/mL to 586 μg/mL.

B2.1.3.6 Total Inorganic Carbon. Total inorganic carbon was determined according to procedure LA-622-102. No anomalies or difficulties were encountered. Concentrations ranged from 330 μg C/mL to 340 μg C/mL.

B.2.1.3.7 Total Organic Carbon. Total organic carbon was determined according to procedure LA-344-105. No anomalies or difficulties were encountered. TOC results, including the tank surface sample, ranged from 239 μg C/mL to 263 μg C/mL.

B2.1.3.8 Volatile Organic Compounds. These analyses were conducted according to procedure LA-523-405 using a gas chromatograph-mass spectrophotometer. Of the compounds analyzed, no target analyte was observed above notification limits. The only tentatively identified compound was 1-Butanol.

B2.1.3.9 Semivolatile Organic Compounds. Samples were extracted according to procedure LA-523-105 and analyzed according to procedure LA-523-406 using a gas chromatograph-mass spectrophotometer. Tributyl phosphate was the only analyte detected at low levels, well below the notification limit.

B2.1.3.10 Total Alpha Analysis. Total alpha analyses were performed on acid predigested samples according to procedure LA-508-101. No analytical anomalies or difficulties were encountered. All total analytical results were below laboratory detection levels with a maximum reading of <0.00093 μCi/mL.

B2.1.3.11 Total Beta Analysis. Total beta analyses were performed on acid predigested samples according to procedure LA-508-101. No analytical anomalies or difficulties were encountered. Total beta activity ranged from 9.61 μCi/mL to 10.2 μCi/mL.

B2.1.3.12 Gamma Energy Analysis. The activities of the following radionuclides were determined by GEA according to procedure LA-548-121: ^{144}Ce/Pr, ^{134}Cs, ^{137}Cs, ^{60}Co, $^{154/155}$Eu, ^{94}Nb, ^{226}Ra, ^{106}Ru/Rh, and ^{113}Sn. The activity of ^{129}I was determined by low energy gamma analysis according to procedure LA-378-103. No anomalies or difficulties were encountered. The only radionuclides detected by the GEA analysis was ^{137}Cs.

B2.1.3.13 Alpha Energy Analysis. The following radionuclides were evaluated by AEA according to procedure LA-503-156: ^{238}Pu, $^{239/240}$Pu, $^{243/244}$Cm and ^{241}Am. No analytical difficulties were encountered. Only $^{239/240}$Pu was detected above analytical levels with values ranging from 8.34E-05 μCi/mL to 9.19E-05 μCi/mL.

B2.1.3.14 Liquid Scintillation. Tritium, ^{14}C, ^{79}Se, and ^{99}Tc were analyzed by liquid scintillation according to procedures LA-218-114, LA-348-104, LA-365-132, and LA-438-101, respectively. An anomaly was noted for ^{14}C analyses; the spike duplicate value was low because of leaking distillation glassware. This did not impact the result. No other anomaly was noted. All analytes were detected at low concentrations.

B2.1.3.15 Total Uranium. Total uranium was analyzed by kinetic phosphorescence according to procedure LA-925-009. No analytical difficulties were encountered. Analytical values ranged from 5.54 Ci/mL to 6.52 Ci/mL.

B2.1.3.16 $^{89/90}$Sr. The activity of $^{89/90}$Sr was evaluated using acid digestions of samples by beta proportional counting according to procedure LA-220-101. No analytical difficulties were wncountered. The $^{89/90}$Sr analytical results ranged from <0.0134 μCi/mL to 0.338 μCi/mL.

B2.1.3.17 ^{237}Np. The activity of ^{237}Np was evaluated using direct samples according to procedure LA-933-141. Acceptable spike recoveries could not be obtained for this sample. This is attributed to interference by fluoride in the sample. Most sample results were below detection limits and are probably biased low.

B2.1.3.18 Specific Gravity.

Specific gravity analyses were performed on direct samples according to procedure LA-510-112. No difficulties were encountered. Results ranged from 1.010 to 1.015.

B2.1.3.19 Differential Scanning Calorimetry.

Analyses were performed on direct samples according to procedure LA-514-113. No anomalies or difficulties were encountered.

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

No exotherms were observed in any sample or sample duplicate. Endotherms ranged from 1,347 J/g to 1,473 J/g.

B.2.1.3.20 Thermogravimetric Analysis. Thermogravimetric analyses were performed in a nitrogen atmosphere in duplicate on the direct sample according to procedure LA-560-112. These analyses were conducted to determine percent water in the samples. No difficulties occurred during the analyses. The weight percent water ranged between 93.8 and 95.4 percent.

B2.2 1993 GRAB SAMPLE

Grab samples were taken August 2, 1993, to support the 242-A Evaporator 94-1 Campaign. Seventeen samples were obtained from risers 1 (330°), 1 (210°) and 1 (90°). The "bottle-on-a-string" method (ASTM 1973) was used to collect the samples. Each glass sample bottle collected approximately 100 mL of liquid.

Analyses were performed by the Westinghouse Hanford Company 222-S Laboratory. Table B2-5 summarizes sample numbers, dates, and locations.

B2.2.1 Sample Handling

One set of samples was received by the 222-S Laboratory on August 2, 1993. One field blank was prepared for analysis. Samples were not preserved (acidification or refrigeration) at the time of sampling. A second set of samples was sent to the Pacific Northwest Laboratory on August 3, 1993, for volatile organic analysis (VOA) and semivolatile organic analysis (SVOA). All samples were received at room temperature. Extractions of samples and spiked samples were performed for SVOA, then all samples were refrigerated. For a discussion on sample preservation, refer to the *Tank Characterization Reference Guide* (De Lorenzo et al. 1994).

The samples were reported by the 222-S Laboratory as clear colorless liquids, with no solids or multiple phases present. However, the Analytical Chemistry Laboratory reported some white precipitate in the form of small flaked shapes, and deep maroon-colored masses were found in all but one sample.

Table B2-5. Tank 241-AP-107 Sample Information.

Riser Number[1], Angle	Sample Date	Depth[2] (cm.)	Sample Number	Laboratory Sample Number
1, 330°	August 1, 1993	366	R3621	V-23 (107-AP-B)
			R3622	93-08652
	August 1, 1993	152	R3619	V-21 (107-AP-A)
			R3620	93-08651
1, 90°	August 1, 1993	518	R3623	V-26 (107-AP-C)
			R3624	93-08653
	August 1, 1994	61	R3625	V-27 (107-AP-D)
			R3626	93-08654
1, 210°	August 1, 1993	579	R3627	V-28 (107-AP-E)
			R3629	93-08656
	August 1, 1993	579	R3630	V-31 (107-AP-FB[3])
			R3628	93-08655
Composite of all samples				V-34 (107-AP-COM)
Field blank			R3631	93-08657

Notes:

[1]Riser 1 (330° is located northwest of the tank 241-AP-107 central pump pit (330° from north direction). Riser 1 (90° is located east of the tank 241-AP-107 central pump pit (90° from north direction). Riser 1 (210° is located southwest of tank 241-AP-107 central pump pit (210° from north direction).

[2]Sample depth is the length from the tank bottom to the sample bottle top.

[3]Sample V-31 (107-AP-FB) was used for internal, non-characterization purposes.

B2.2.2 Sample Analysis

All analyses were performed according to approved laboratory procedures and the *Tank Waste Remediation System Tank Waste Analysis Plan* (Bell 1994). Table B2-5 lists the analyses performed for each sample. Table B2-6 displays the analytical procedures by title and number. All VOA and SVOA samples exceeded holding times before analysis. Because the tank is actively ventilated, VOA and SVOA compounds are not expected to be present in the waste.

The data tables show QC results for each sample. Check standards were evaluated before and after each evaluation to verify instrument calibration and analytical performance. Section B3.2 provides an assessment of the QC procedures and data.

Table B2-6. Summary of Samples and Requested Analytes.

Sample Number	Laboratory Sample Numbers	Requested Analytes
R3619 R3621 R3623 R3625 R3627	V-21 (107-AP-A) V-23 (107-AP-B) V-26 (107-AP-C) V-27 (107-AP-D) V-28 (107-AP-E)	Al, As, Ba, Cd, Ca, Cr, Fe, Mg, Mn, Hg, Pb, Se, Ag, Na, U, Zn, NH_3, Cl, CN, F, OH, NO_2, NO_3, PO_4, SO_4, SpG, TIC
R3630	V-31 (107-AP-COM)	^{241}Am, ^{14}C, ^{144}Ce/Pr, ^{137}Cs, ^{134}Cs, ^{60}Co, $^{243/244}$Cm, ^{154}Eu, ^{155}Eu, ^{3}H, ^{129}I, ^{94}Nb, ^{237}Np, $^{239/240}$Pu, ^{238}Pu, ^{226}Ra, ^{106}Ru/Rh, ^{79}Se, ^{90}Sr, ^{99}Tc, total alpha, total beta
R3620 R3622 R3624 R3626 R3628 R3629 R3631	93-08651 93-08652 93-08653 93-08654 93-08655 93-08656 93-08657	Volatile organic compounds, semivolatile organic compounds, TOC

Table B2-7. General Analytical Methods.

Analyte	Method	Procedure
Hg	Cold Vapor Atomic Absorption (CVAA)	LA-325-104
As	Gaseous hydride atomic absorption	LA-355-131
$^{238, 239, 240}Pu$, ^{241}Am, ^{244}Cm	Separation/AEA	LA-365-131
Ag, Ba, Cd, Cr, Na, Pb, Al, Fe, Ca, Mg, Mn, Zn	ICP	LA-505-151
CO_3	TIC	LA-622-102
U	Laser Fluorimetry	LA-925-106
NH_3	Kjeldahl[1]	LA-634-102
CN	Spectrometric analysis	LA-695-102
F, Cl, NO_2, NO_3, SO_4, PO_4	IC	LA-533-105
^{79}Se ^{99}Tc ^{14}C	Liquid scintillation	LA-365-131 LA-438-101 LA-348-104
^{90}Sr	Separation/Beta proportional counting	LA-220-101
^{129}I	Low energy gamma analysis	LA-378-103
^{237}Np	Extraction/Alpha proportional counting	LA-933-141
^{134}Cs, ^{137}Cs, ^{94}Nb, $^{144}Ce/Pr$, ^{60}Co, ^{144}Cr, ^{155}Eu, ^{226}Ra, ^{106}Ru	Separation/AEA	LA-503-156
Specific gravity	Direct	LA-510-112
Energetics	DSC	LA-514-113
Volatile organic Semivolatile organic	Gas chromatography/mass spectroscopy	PNL-ALO-335 PNL-ALO-344/345

Note:

[1]Ammonia analysis was performed by caustic addition, distillation, and capture in a boric acid solution.

B2.2.3 Analytical Results

This section summarizes the sampling and analytical results associated with the 1993 grab sampling and analysis of tank 241-AP-107. Table B2-4 shows the locations of chemical, radiochemical, physical, and organic grab sample results.

Table B2-8. 1993 Analytical Data Presentation Tables.

Analysis	Table number
Summary data for inorganic analyses	B2-37 through B2-53
Summary data for organic analyses	B2-54 through B2-60
Summary data for specific gravity analyses	B2-61
Summary data for radiochemical analyses	B2-62 through B2-69
Summary data for TIC analyses	B2-70 and B2-71

Data were validated to ensure the usability and defensibility of the data. The four QC parameters assessed in conjunction with tank 241-AP-107 samples were standard recoveries, spike recoveries, duplicate analyses, and blanks. The QC criteria applied to the data were 75 to 125 percent recovery for standards, 75 to 125 percent for spikes, and 20 percent for the RPD between duplicates. Sample and duplicate pairs, in which QC parameters were outside the limits, are footnoted in the sample mean column of the following data summary tables with an a, b, c, d, e, or f:

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

B2.2.3.1 Inductively Coupled Plasma Spectroscopy. The following analytes were analyzed by ICP Atomic Emission Spectroscopy according to procedure LA-505-151: Al, Ba, Ca, Cr, Fe, Pb, Mg, Mn, Ag, Na, and Zn. Because the original spike solution did not contain some metals, sample 107-AP-B was reevaluated to obtain necessary QC parameters. Arsenic and selenium were determined by gaseous hydride absorption spectroscopy, and mercury was analyzed by CVAA spectroscopy. The laser fluorimetry method was used for uranium analysis.

Sodium was determined to be the major metal constituent; there were lesser amounts of calcium. Calcium results may be biased high because of sample contamination by talcum powder from rubber gloves worn by laboratory personnel. Aluminum, Ba, Cr, Pb, Mg, Mn, and Zn were detected at <2 μg/mL; As, Cd, Fe, Hg and Se were not detected.

B2.2.3.2 Ion Chromatography. The following anions were determined according to procedure LA-533-105: fluoride, chloride, nitrate, nitrite, phosphate, and sulfate. An unidentified compound interfered with fluoride results. A rerun after further dilution did not detect fluoride; therefore, fluoride results are probably biased high. Chloride and phosphate were not detected.

B2.2.3.3 Ammonia Analysis. Ammonia analyses were performed according to the Kjeldahl method. Ammonia was not detected, but sample results may be biased low because samples were not preserved by acidification, and some ammonia may have dissipated before analysis.

B2.2.3.4 Titration. Hydroxide was determined using procedure LA-212-102. Only one value yielded a detectable result of 2.66E+05 μg/L.

B2.2.3.5 Total Carbon, Total Inorganic Carbon and Total Organic Carbon. These tests were performed by the Pacific Northwest National Laboratory. Total carbon and total inorganic carbon were performed using ultraviolet light catalyzed persulfate oxidation, and the carbon dioxide oxidation product was measured directly by a nondispersive infrared analyzer. The 222-S Laboratory conducted a total inorganic analysis by coulometry. Results from the two laboratories were within a relative percent difference of 9. Most carbon present in tank 241-AP-107 is inorganic and assumed to be in the form of carbonate. Total organic carbon were calculated by subtracting TIC from total carbon. The result was 52,000 μg/L.

B2.2.3.6 Volatile and Semivolatile Organic Compounds. These analyses were conducted according to procedure LA-523-405 using a gas chromatograph-mass spectrometer. Of the compounds analyzed, no target analyte was observed above detection limits.

Samples were extracted according to procedure LA-523-105 and analyzed according to procedure LA-523-406 using a gas chromatograph-mass spectrometer. The only SVOA detected was 1-butanol. Two tentatively identified compounds were cyclohexene and tributylphosphate. No other SVOAs were detected.

B2.2.3.7 Radiochemical Analyses. All radionuclide results were derived from composite waste samples. The activities of the following radionuclides were determined by GEA: ^{144}Ce/Pr, ^{134}Cs, ^{137}Cs, ^{60}Co, $^{154/155}$Eu, ^{94}Nb, ^{226}Ra, ^{106}Ru/Rh. Tritium and ^{14}C were analyzed after distillation by liquid scintillation. The ^{79}Se isotope was separated by ion exchange and distillation techniques before evaluation by scintillation, and ^{99}Tc samples were digested and separated before scintillation counting. Acid digestion and separation followed by beta proportional counting were used to determine ^{90}Sr activity, and ^{129}I was analyzed by low energy photon spectroscopy. Neptunium-237 was determined by alpha proportional counting as a separation fraction. The following were analyzed using alpha energy analysis: $^{239/240}$Pu, ^{241}Am, $^{243/244}$Cm. Total alpha and beta were determined by gas flow proportional counting.

Quality control problems are noted in the data tables.

B2.2.3.8 Specific Gravity. Specific gravity analyses were performed on direct samples according to procedure LA-510-112. No difficulties occurred during the analysis. Specific gravity was determined to be 0.989.

B2.2.3.9 Differential Scanning Calorimetry. Analyses were performed on direct samples using procedure LA-514-113. No anomalies or difficulties were encountered.

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

No exotherm was observed in any sample or sample duplicate.

B2.3 DESCRIPTION OF HISTORICAL SAMPLING EVENT

No sample was taken before August 1993.

Table B2-9. Tank 241-AP-107 Analytical Results: Aluminum (ICP).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: acid digest		cm	µg/mL	µg/mL	µg/mL
S95V000014	Riser 1, 90°	336	275		275$^{QC:f}$
S95V000015	Riser 1, 90°	580	267		267$^{QC:f}$
S95V000016	Riser 1. 210°	397	278		278$^{QC:f}$

Table B2-10. Tank 241-AP-107 Analytical Results: Sodium (ICP).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: acid digest		cm	µg/mL	µg/mL	µg/mL
S95V000014	Riser 1, 90°	336	11,400		11,400
S95V000015	Riser 1, 90°	580	11,400		11,400
S95V000016	Riser 1, 210°	397	11,700		11,700

Table B2-11. Tank 241-AP-107 Analytical Results:
Total Uranium (Kinetic Phosphorescence).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
S95V000011	Riser 1, 90°	336	5.54		5.54[QC:f]
S95V000012	Riser 1, 90°	580	5.63		5.63[QC:f]
S95V000013	Riser 1, 210°	397	6.52	6.07	6.295[QC:f]

Table B2-12. Tank 241-AP-107 Analytical Results: Fluoride (IC).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
S95V000011	Riser 1, 90°	336	4,630		4,630
S95V000012	Riser 1, 90°	580	4,560		4,560
S95V000013	Riser 1, 210°	397	2,340		2,340

Table B2-13. Tank 241-AP-107 Analytical Results: Nitrate (IC).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
S95V000011	Riser 1, 90°	336	6,780		6,780
S95V000012	Riser 1, 90°	580	6,840		6,840
S95V000013	Riser 1, 210°	397	3,590		3,590

Table B2-14. Tank 241-AP-107 Analytical Results: Nitrite (IC).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
S95V000011	Riser 1, 90°	336	1,590		1,590
S95V000012	Riser 1, 90°	580	1,610		1,610
S95V000013	Riser 1, 210°	397	1,570		1,570
S95V000020	Riser 1, 210°	824	6,050		6,050
S95V000021	Riser 1, 330°	306	1,570		1,570

Table B2-15. Tank 241-AP-107 Analytical Results: Phosphate (IC).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
S95V000011	Riser 1, 90°	336	175		175
S95V000012	Riser 1, 90°	580	<606		<606
S95V000013	Riser 1, 210°	397	<606		<606

Table B2-16. Tank 241-AP-107 Analytical Results: Sulfate (IC).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
S95V000011	Riser 1, 90°	336	336		336
S95V000012	Riser 1, 90°	580	<606		<606
S95V000013	Riser 1, 210°	397	<606		<606

Table B2-17. Tank 241-AP-107 Analytical Results: Hydroxide (OH Direct).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
S95V000011	Riser 1, 90°	336	5,530		5,530
S95V000012	Riser 1, 90°	580	5,630	5,590	5,610
S95V000013	Riser 1, 210°	397	5,250		5,250
S95V000020	Riser 1, 210°	824	5,390		5,390
S95V000021	Riser 1, 330°	306	5,390		5,390

Table B2-18. Tank 241-AP-107 Analytical Results: Total Carbon (Furnace Oxidation).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
S95V000011	Riser 1, 90°	336	586		586
S95V000012	Riser 1, 90°	580	577		577
S95V000013	Riser 1, 210°	397	561		561

Table B2-19. Tank 241-AP-107 Analytical Results: Total Organic Carbon (Furnace Oxidation).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	μg/mL	μg/mL	μg/mL
S95V000011	Riser 1, 90°	336	239		239
S95V000012	Riser 1, 90°	580	239		239
S95V000013	Riser 1, 210°	250	250		250

Table B2-20. Organic Compounds Below Analytical Detection Levels.

Analyte	Maximum Nondetected Value	Analyte	Maximum Nondetected Value
Liquids	(μg/mL)	Liquids	(μg/mL)
2-Butoxyethanol	< 2.0	4-Methyl-2-Pentanone	< 0.5
2-butanone	< 0.5	2-Pentanone	< 0.5
2-Hexanone	< 0.5	Tetrahydrofuran	< 0.5

Table B2-21. Tank 241-AP-107 Analytical Results: Tributyl Phosphate (SVOA).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	μg/mL	μg/mL	μg/mL
S95V000007	Riser 1, 90°	336	1.4		1.4
S95V000008	Riser, 1, 90°	580	1.9		1.9
S95V000009	Riser 1, 210°	397	1.6		1.6

Table B2-22. Tank 241-AP-107 Analytical Results: 1-Butanol (VOA).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
S95V000001	Riser 1, 90°	336	22		22
S95V000002	Riser 1, 90°	580	21		21
S95V000003	Riser 1, 210°	397	22		22

Table B2-23. Tank 241-AP-107 Analytical Results: Acetone (VOA).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
S95V000001	Riser 1, 90°	336	4.1		4.1
S95V000002	Riser 1, 90°	580	3.9		3.9
S95V000003	Riser 1, 210°	397	4		4
S95V000004	Riser 1, 210°	824	4.2		4.2
S95V000005	Riser 1, 330°	306	4		4

Table B2-24. Tank 241-AP-107 Analytical Results: pH Measurement (pH).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	unitless	unitless	unitless
S95V000011	Riser 1, 90°	336	13.39	13.41	13.4
S95V000012	Riser 1, 90°	580	13.42		13.42
S95V000013	Riser 1, 210°	397	13.42		13.42

Table B2-25. Tank 241-AP-107 Analytical Results: Specific Gravity.

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	unitless	unitless	unitless
S95V000011	Riser 1, 90°	336	1.01	1.01	1.01
S95V000012	Riser 1, 90°	580	1.02		1.02
S95V000013	Riser 1, 210°	397	1.01		1.01

Table B2-26. Tank 241-AP-107 Analytical Results: Percent Water (TGA).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	%	%	%
S95V000011	Riser 1, 90°	336	94.31	94.67	94.49
S95V000012	Riser 1, 90°	580	95.12	92.52	93.82
S95V000013	Riser 1, 210°	397	95.05	95.82	95.435

Table B2-27. Tank 241-AP-107 Analytical Results:
Radionuclides Below Detection Levels.

Analyte	Maximum Nondetected Value	Analyte	Maximum Nondetected Value
Liquids	(μCi/mL)	Liquids	(μCi/mL)
Am-241	<3.110E-04	Ce/Pr-144	<0.56
Cm-243/244	<3.110E-04	Cesium-134	<0.06
Total Alpha	<9.310E-04	Cobalt-60	<0.035
Europium-154	<0.092	Europium-155	<0.144
Niobium-94	<0.032	Radium-226	<1.5
Ruthenium/Rhodium-106	<0.947	Iodine-129	<1.4E-04
Selenium-79	<5.03E-07	Plutonium-238	<3.89E-05

Table B2-28. Tank 241-AP-107 Analytical Results: Total Beta (Beta).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: acid digest		cm	µCi/mL	µCi/mL	µCi/mL
S95V000014	Riser 1, 90°	336	9.61		9.61
S95V000015	Riser 1, 90°	580	9.8		9.8
S95V000016	Riser 1, 210°	397	10.2		10.2

Table B2-29. Tank 241-AP-107 Analytical Results: Carbon-14.

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µCi/mL	µCi/mL	µCi/mL
S95V000011	Riser 1, 90°	336	1.880E-05		1.880E-05[QC:f]
S95V000012	Riser 1, 90°	580	1.740E-05		1.740E-05[QC:f]
S95V000013	Riser 1, 210°	397	1.820E-05		1.820E-05[QC:f]

Table B2-30. Tank 241-AP-107 Analytical Results: Cesium-137 (GEA).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: acid digest		cm	µCi/mL	µCi/mL	µCi/mL
S95V000014	Riser 1, 90°	336	23.4	24.2	23.8
S95V000015	Riser 1, 90°	580	9.63	9.44	9.535
S95V000016	Riser 1, 210°	397	9.86	9.83	9.845

Table B2-31. Tank 241-AP-107 Analytical Results: Neptunium-237.

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µCi/mL	µCi/mL	µCi/mL
S95V000011	Riser 1, 90°	336	2.590E-05		2.590E-05[QC:a]
S95V000012	Riser 1, 90°	580	<2.930E-05		<2.930E-05[QC:a]
S95V000013	Riser 1, 210°	397	2.520E-05		2.520E-05[QC:a]

Table B2-32. Tank 241-AP-107 Analytical Results: Tritium (Liquid Scintillation).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µCi/mL	µCi/mL	µCi/mL
S95V000011	Riser 1, 90°	336	0.0757		0.0757[QC:f]
S95V000012	Riser 1, 90°	580	0.00398		0.00398[QC:f]
S95V000013	Riser 1, 210°	397	0.00308		0.00308

Table B2-33. Tank 241-AP-107 Analytical Results: Strontium-90.

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: acid digest		cm	µCi/mL	µCi/mL	µCi/mL
S95V000014	Riser 1, 90°	336	0.338		0.338
S95V000015	Riser 1, 90°	580	<0.0134		<0.0134
S95V000016	Riser 1, 210°	397	0.0978		0.0978

Table B2-34. Tank 241-AP-107 Analytical Results: Technetium-99.

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: acid digest			µCi/mL	µCi/mL	µCi/mL
S95V000014	Riser 1, 90°	336	0.00187		0.00187[QC:f]
S95V000015	Riser 1, 90°	580	0.00194		0.00194[QC:f]
S95V000016	Riser 1, 210°	397	0.0028		0.0028[QC:f]

Table B2-35. Tank 241-AP-107 Analytical Results: Ammonium (Ion Selective Electrode).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
S95V000011	Riser 1, 90°	336	1,060		1,060[QC:f]
S95V000012	Riser 1, 90°	580	1,020		1,020[QC:f]
S95V000013	Riser 1, 210°	397	1,010		1,010[QC:f]
S95V000020	Riser 1, 210°	824	1,040		1,040[QC:f]
S95V000021	Riser 1, 330°	306	1,060		1,060[QC:f]

Table B2-36. Tank 241-AP-107 Analytical Results: Total Inorganic Carbon.

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
S95V000011	Riser 1, 90°	336	339		339
S95V000012	Riser 1, 90°	580	340		340
S95V000013	Riser 1, 210°	397	330		330

1993 Grab Sample Results

Table B2-37. Nondetected Metals and Anions.

Nondetected Metals	Maximum Nondetected Value	Nondetected Metals	Maximum Nondetected Value
Liquids	μg/mL	Liquids	μg/mL
Arsenic (AA)	<0.013	Cadmium (ICP)	<0.004
Mercury (AA)	<0.003	Chromium (ICP)	<0.055
Selenium (AA)	<0.013	Iron (ICP)	<0.055
Ammonium (NH_3)	<80	Phosphate (IC)	<10
Chloride (IC)	<22		

Note:

AA = atomic absorption

Table B2-38. Tank 241-AP-107 Analytical Results: Aluminum (ICP).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: acid digest		cm	μg/mL	μg/mL	μg/mL
V26	Riser 1, 90°	518	1.15	1.05	1.1[QC:f]
V27	Riser 1, 90°	61	1.29	0.878	1.084[QC:e,f]
V21	Riser 1, 330°	152	0.794	0.935	0.865[QC:f]
V23	Riser 1, 330°	366	1.54	1.29	1.415[QC:f]
V23	Riser 1, 330°	366	0.941	1.01	0.976[QC:f]
V28	Riser 1, 210°	579	1.26	0.835	1.048[QC:e,f]

Table B2-39. Tank 241-AP-107 Analytical Results: Barium (ICP).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: acid digest		cm	µg/mL	µg/mL	µg/mL
V26	Riser 1, 90°	518	0.0186	0.0206	0.0196
V27	Riser 1, 90°	61	0.0158	<0.015	<0.0154
V21	Riser 1, 330°	152	<0.015	<0.015	<0.015
V23	Riser 1, 330°	366	<0.03	<0.03	<0.03
V23	Riser 1, 330°	366	0.0162	0.0219	0.01905[QC:e]
V28	Riser 1, 210°	579	0.0524	0.0368	0.0446[QC:e]

Table B2-40. Tank 241-AP-107 Analytical Results: Calcium (ICP).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: acid digest		cm	µg/mL	µg/mL	µg/mL
V26	Riser 1, 90°	518	<0.008	19.7	<9.854[QC:e,f]
V27	Riser 1, 90°	61	<0.008	12.2	<6.104[QC:e,f]
V21	Riser 1, 330°	152	20.5	8.99	14.745[QC:e,f]
V23	Riser 1, 330°	366	2.59	1.9	2.245[QC:e,f]
V23	Riser 1, 330°	366	47.1	68.1	57.6[QC:e,f]
V28	Riser 1, 210°	579	113	9.97	61.485[QC:e,f]

Table B2-41. Tank 241-AP-107 Analytical Results: Lead (ICP).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: acid digest		cm	µg/mL	µg/mL	µg/mL
V26	Riser 1, 90°	518	0.232	<0.19	<0.211
V27	Riser 1, 90°	61	<0.19	<0.19	<0.19
V21	Riser 1, 330°	152	<0.19	0.353	<0.2715[QC:e]
V23	Riser 1, 330°	366	<0.32	<0.32	<0.32
V23	Riser 1, 330°	366	0.507	<0.19	<0.3485[QC:e]
V28	Riser 1, 210°	579	0.2	0.245	0.2225[QC:e]

Table B2-42. Tank 241-AP-107 Analytical Results: Magnesium (ICP).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: acid digest		cm	µg/mL	µg/mL	µg/mL
V26	Riser 1, 90°	518	<0.008	1.36	<0.684[QC:e,f]
V27	Riser 1, 90°	61	1.46	1.66	1.56[QC:f]
V21	Riser 1, 330°	152	0.875	0.836	0.8555[QC:f]
V23	Riser 1, 330°	366	<0.005	0.0979	<0.05145[QC:e,f]
V23	Riser 1, 330°	366	1.99	1.37	1.68[QC:e,f]
V28	Riser 1, 210°	579	6.9	0.688	3.794[QC:e,f]

Table B2-43. Tank 241-AP-107 Analytical Results: Manganese (ICP).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: acid digest		cm	µg/mL	µg/mL	µg/mL
V26	Riser 1, 90°	518	<0.015	0.0352	<0.0251[QC:e,f]
V27	Riser 1, 90°	61	<0.015	0.0158	<0.0154[QC:f]
V21	Riser 1, 330°	152	<0.015	<0.015	<0.015[QC:f]
V23	Riser 1, 330°	366	<0.015	<0.015	<0.015
V23	Riser 1, 330°	366	0.0635	0.075	0.06925[QC:f]
V28	Riser 1, 210°	579	0.189	0.015	0.102[QC:e,f]

Table B2-44. Tank 241-AP-107 Analytical Results: Silver (ICP).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: acid digest		cm	µg/mL	µg/mL	µg/mL
V26	Riser 1, 90°	518	0.0509	0.0602	0.05555[QC:f]
V27	Riser 1, 90°	61	0.05	0.0368	0.0434[QC:e,f]
V21	Riser 1, 330°	152	<0.03	<0.03	<0.03
V23	Riser 1, 330°	366	<0.006	0.071	<0.0385[QC:e]
V23	Riser 1, 330°	366	<0.03	<0.03	<0.03
V28	Riser 1, 210°	579	0.0519	0.0456	0.04875[QC:f]

Table B2-45. Tank 241-AP-107 Analytical Results: Sodium (ICP).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: acid digest		cm	µg/mL	µg/mL	µg/mL
V26	Riser 1, 90°	518	2,310	2,230	2,270[QC:f]
V27	Riser 1, 90°	61	2,450	2,430	2,440[QC:f]
V21	Riser 1, 330°	152	1,980	2,180	2,080[QC:f]
V23	Riser 1, 330°	366	2,260	2,190	2,225[QC:c,f]
V23	Riser 1, 330°	366	2,230	2,230	2,230[QC:f]
V28	Riser 1, 210°	579	2,340	2,290	2,315[QC:f]

Table B2-46. Tank 241-AP-107 Analytical Results: Zinc (ICP).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: acid digest		cm	µg/mL	µg/mL	µg/mL
V26	Riser 1, 90°	518	<0.003	0.877	<0.44[QC:e,f]
V27	Riser 1, 90°	61	0.234	0.43	0.332[QC:e,f]
V21	Riser 1, 330°	152	0.56	0.178	0.369[QC:e,f]
V23	Riser 1, 330°	366	0.071	0.0633	0.06715[QC:f]
V23	Riser 1, 330°	366	2.1	2.37	2.235[QC:f]
V28	Riser 1, 210°	579	5.02	0.301	2.6605[QC:e,f]

Table B2-47. Tank 241-AP-107 Analytical Results: Total Uranium (Laser Fluorimetry).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
V26	Riser 1, 90°	518	0.0163	0.0192	0.01775
V27	Riser 1, 90°	61	0.0224	0.0212	0.0218
V21	Riser 1, 330°	152	0.0224	0.0211	0.02175
V21	Riser 1, 330°	152	0.0179	0.0168	0.01735
V21	Riser 1, 330°	152	0.0383	0.0293	0.0338[QC:e]
V23	Riser 1, 330°	366	0.0168	0.0334	0.0251[QC:e]
V23	Riser 1, 330°	366	0.015	0.0125	0.01375
V23	Riser 1, 330°	366	0.0285	0.0341	0.0313
V28	Riser 1, 210°	579	0.0322	0.0298	0.031

Table B2-48. Tank 241-AP-107 Analytical Results: Cyanide (CN).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: water digest		cm	µg/mL	µg/mL	µg/mL
V26	Riser 1, 90°	518	0.464	0.58	0.522[QC:e]
V27	Riser 1, 90°	61	0.6	0.62	0.61
V21	Riser 1, 330°	152	0.575	0.575	0.575
V23	Riser 1, 330°	366	0.625	0.675	0.65
V28	Riser 1, 210°	579	0.54	0.54	0.54

Table B2-49. Tank 241-AP-107 Analytical Results: Fluoride (IC).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: water digest		cm	µg/mL	µg/mL	µg/mL
V26	Riser 1, 90°	518	147	144	145.5
V27	Riser 1, 90°	61	145	144	144.5
V21	Riser 1, 330°	152	<11	<11	<11
V21	Riser 1, 330°	152	<11	<11	<11
V21	Riser 1, 330°	152	137	135	136[QC:c]
V23	Riser 1, 330°	366	143	134	138.5
V28	Riser 1, 210°	579	142	144	143

Table B2-50. Tank 241-AP-107 Analytical Results: Nitrate (IC).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: water digest		cm	µg/mL	µg/mL	µg/mL
V26	Riser 1, 90°	518	1,020	1,010	1,015
V27	Riser 1, 90°	61	1,060	1,060	1,060
V21	Riser 1, 330°	152	979	995	987
V23	Riser 1, 330°	366	1,010	1,030	1,020
V28	Riser 1, 210°	579	1,020	1,000	1,010

Table B2-51. Tank 241-AP-107 Analytical Results: Nitrite (IC).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: water digest		cm	µg/mL	µg/mL	µg/mL
V26	Riser 1, 90°	518	23,100	22,500	22,800
V27	Riser 1, 90°	61	25,600	25,100	25,350
V21	Riser 1, 330°	152	22,900	22,900	22,900
V23	Riser 1, 330°	366	23,200	22,500	22,850
V28	Riser 1, 210°	579	23,900	23,400	23,650

Table B2-52. Tank 241-AP-107 Analytical Results: Sulfate (IC).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids: water digest		cm	µg/mL	µg/mL	µg/mL
V26	Riser 1, 90°	518	204	203	203.5
V27	Riser 1, 90°	61	<10	<10	<10
V21	Riser 1, 330°	152	<10	<10	<10
V23	Riser 1, 330°	366	<10	<10	<10
V28	Riser 1, 210°	579	<10	<10	<10

Table B2-53. Tank 241-AP-107 Analytical Results: Hydroxide (OH Automatic).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
V26	Riser 1, 90°	518	<250	<250	<250
V27	Riser 1, 90°	61	<250	<250	<250
V21	Riser 1, 330°	152	<250	<250	<250
V23	Riser 1, 330°	366	<250	266	258
V28	Riser 1, 210°	579	<250	<250	<250

Table B2-54. Tank 241-AP-107 Analytical Results: Total Carbon (Persulfate Oxidation).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
93-08653	Riser 1, 90°	518	350	340	345
93-08654	Riser 1, 90°	61	350	350	350
93-08651	Riser 1, 330°	152	360	340	350
93-08652	Riser 1, 330°	366	360	350	355
93-08655	Riser 1, 210°	579	350	350	350
93-08656	Riser 1, 210°	579	410	400	405

Table B2-55. Tank 241-AP-107 Analytical Results: Total Organic Carbon (Persulfate Oxidation).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
93-08653	Riser 1, 90°	518	40	0	20[QC:e]
93-08654	Riser 1, 90°	61	70	60	65
93-08651	Riser 1, 330°	152	80	60	70[QC:e]
93-08652	Riser 1, 330°	366	60	50	55
93-08655	Riser 1, 210°	579	100	90	95
93-08656	Riser 1, 210°	579	10	0	5[QC:e]

Table B2-56. Nondetected Semivolatile Organics. (2 sheets)

Analyte	Maximum Nondetected Value	Analyte	Maximum Nondetected Value
Liquids	µg/mL	Liquids	µg/mL
1,2,4-Trichlorobenzene	<2	1,2-Dichlorobenzene	<2
1,3-Dichlorobenzene	<2	1,4-Dichlorobenzene	<2
2,4,5-Trichlorophenol	<2	2,4,6-Trichlorophenol	<2
2,4-Dichlorophenol	<2	2,4-Dimethylphenol	<2
2,4-Dinitrophenol	<2	2,4-Dinitrotoluene	<2
2,6-Dinitrotoluene	<2	2-Butoxyethanol	<2
2-Chloronaphthalene	<2	2-Chlorophenol	<2
2-Methylnaphthalene	<2	2-Methylphenol	<2
2-Nitroaniline	<2	2-Nitrophenol	<2
3,3-Dichlorobenzidine	<2	3-Nitroaniline	<2
4,6-Dinitro-o-cresol	<2	4-Bromophenylphenyl ether	<2
4-Chloro-3-methylphenol	<2	4-Chloroaniline	<2

Table B2-56. Nondetected Semivolatile Organics. (2 sheets)

Analyte	Maximum Nondetected Value	Analyte	Maximum Nondetected Value
4-Chlorophenylphenyl ether	<2	4-Methylphenol	<2
4-Nitroaniline	<2	4-Nitrophenol	<2
Acenaphthene	<2	Acenaphthylene	<2
Anthracene	<2	Benzo(a)anthracene	<2
Benzo(a)pyrene	<2	Benzo(ghi)perylene	<2
Benzo(k)fluoranthene	<2	Benzoic acid	<2
Benzyl alcohol	<2	Bis(2-Chloroethoxy)methane	<2
Bis(2-chloroethyl) ether	<2	Bis(2-Chloroisopropyl) ether	<2
Bis(2-ethylhexyl) phthalate	<2	Butylbenzylphthalate	<2
Chrysene	<2	Cyclohexene	<2
Di-n-butylphthalate	<2	Di-n-octylphthalate	<2
Dibenz[a,h]anthracene	<2	Dibenzofuran	<2
Diethylphthalate	<2	Dimethyl phthalate	<2
Fluoranthene	<2	Fluorene	<2
Hexachlorobenzene	<2	Hexachlorobutadiene	<2
Hexachlorocyclopentadiene	<2	Hexachloroethane	<2
Indeno(1,2,3-cd)pyrene	<2	Isophorone	<2
N-Nitroso-di-n-dipropylamine	<2	N-Nitrosodiphenylamine	<2
Naphthalene	<2	Nitrobenzene	<2
Pentachlorophenol	<2	Phenanthrene	<2
Phenol	<2	Pyrene	<2

Table B2-57. Tank 241-AP-107 Analytical Results: 1-Butanol (SVOA).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
93-08653	Riser 1, 90°	518	15	18	16.5
93-08654	Riser 1, 90°	61	7.8	4.8	6.3[QC:e]
93-08652	Riser 1, 330°	152	14	14	14
Sample blank	Riser 1, 330°	366	2	2	2
93-08655	Riser 1, 210°	579	6.4	<2	<4.2[QC:e]

Table B2-58. Tank 241-AP-107 Analytical Results: Tributyl Phosphate (SVOA).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
93-08653	Riser 1, 90°	518	2.3	2.3	2.3
93-08654	Riser 1, 90°	61	4.7	3.3	4[QC:e]
93-08652	Riser 1, 330°	152	2.2	1.8	2
Sample blank	Riser 1, 330°	366	3.2	2.5	2.85
93-08655	Riser 1, 210°	579	2.6	2	2.3[QC:e]

Table B2-59. Nondetected Volatile Organics.

Analyte	Maximum Nondetected Value	Analyte	Maximum Nondetected Value
Liquids	µg/mL	Liquids	µg/mL
1,1,1-Trichloroethane	<0.25	1,1,2,2-Tetrachloroethane	<0.25
1,1,2-Trichloroethane	<0.25	1,1-Dichloroethane	<0.25
1,1-Dichloroethene	<0.25	1,2,3-Trimethylbenzene	<0.25
1,2,4-Trimethylbenzene	<0.25	1,2-Dichloroethane	<0.25
1,2-Dichloroethylene	<0.25	1,2-Dichloropropane	<0.25
1,3,5-Trimethylbenzene	<0.25	2-butanone	<0.5
2-Hexanone	<0.5	Acetone	<0.5
Benzene	<0.25	Bromodichloromethane	<0.25
Bromoform	<0.25	Bromomethane	<0.25
Carbon disulfide	<0.25	Carbon tetrachloride	<0.25
Chlorobenzene	<0.25	Chloroethane	<0.5
Chloroform	<0.25	Chloromethane	<0.5
cis-1,2-Dichloroethene	<0.25	cis-1,3-Dichloropropene	<0.25
Dibromochloromethane	<0.25	Ethylbenzene	<0.25
Hexone	<0.5	Isopropylbenzene	<0.25
Methylenechloride	<0.25	Styrene	<0.25
Tetrachloroethene	<0.25	Tetrahydrofuran	<0.5
trans-1,3-Dichloropropene	<0.25	Trichloroethene	<0.25
Vinyl acetate	<0.5	Vinyl chloride	<0.5
Xylenes	<0.5		

Table B2-60. Tank 241-AP-107 Analytical Results: Toluene (VOA).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
93-08653	Riser 1, 90°	518	0.12	0.13	0.125
93-08654	Riser 1, 90°	61	0.13	0.12	0.125
93-08652	Riser 1, 330°	152	0.14	0.13	0.135
Sample blank	Riser 1, 330°	366	0.13	0.13	0.13
93-08655	Riser 1, 579°	579	0.13	0.14	0.135

Table B2-61. Tank 241-AP-107 Analytical Results: Specific Gravity.

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	unitless	unitless	unitless
V26	Riser 1, 90°	518	0.991	0.991	0.991[QC:f]
V27	Riser 1, 90°	61	0.984	0.993	0.9885[QC:f]
V21	Riser 1, 330°	152	0.987	0.991	0.989[QC:f]
V23	Riser 1, 330°	366	0.989	0.992	0.9905[QC:f]
V28	Riser 1, 210°	579	0.985	0.989	0.987[QC:f]

Table B2-62. Tank 241-AP-107 Analytical Results: Total Alpha (Alpha Radiation).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids: acid digest			µCi/mL	µCi/mL	µCi/mL
V34	Tank composite	Liquid composite	<7.140E-07	<1.720E-06	<1.217E-06[QC:e]
V34		Liquid composite	<1.960E-06	<1.960E-06	<1.960E-06

Table B2-63. Tank 241-AP-107 Analytical Results: Total Beta (Beta).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids: acid digest			μCi/mL	μCi/mL	μCi/mL
V34	Tank composite	Liquid composite	3.300E-04	3.150E-04	3.225E-04
V34		Liquid composite	8.200E-05	1.170E-04	9.950E-05[QC:e]

Table B2-64. Nondetected Radionuclides.

Analyte	Maximum Nondetected Value	Analyte	Maximum Nondetected Value
Liquids	μCi/mL	Liquids	μCi/mL
Ce/Pr-144	<4.190E-04	Cesium-134	<5.800E-05
Cobalt-60	<6.900E-05	Europium-154	<1.920E-04
Europium-155	<1.290E-04	Niobium-94	<4.960E-05
Radium-226	<0.0012	Ruthenium/Rhodium-106	<9.500E-04
Iodine-129	<4.350E-05	Neptunium-237	<1.480E-05
Americium-241	<6.370E-05	Cm-243/244	<6.37E-05
Technetium-99	<2.050E-05	Plutonium-238	<6.510E-04
Plutonium-239/40	<5.340E-04		

Table B2-65. Tank 241-AP-107 Analytical Results: Carbon-14.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μCi/mL	μCi/mL	μCi/mL
V34	Tank composite	Liquid composite	<2.180E-06	3.180E-06	<2.680E-06[QC:e]

Table B2-66. Tank 241-AP-107 Analytical Results: Cesium-137 (GEA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids: acid digest			μCi/mL	μCi/mL	μCi/mL
V34	Tank composite	Liquid composite	<8.350E-05	<7.250E-05	<7.800E-05
V34		Liquid composite	1.230E-04	<6.150E-05	<9.225E-05[QC:e]

Table B2-67. Tank 241-AP-107 Analytical Results: Tritium (Liquid Scintillation).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids: fusion			μCi/mL	μCi/mL	μCi/mL
V34	Tank composite	Liquid composite	0.0353	0.0351	0.0352
V34		Liquid composite	0.0335	0.0337	0.0336[QC:d]

Table B2-68. Tank 241-AP-107 Analytical Results: Selenium-79.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids: acid digest			μCi/mL	μCi/mL	μCi/mL
V34	Tank composite	Liquid composite	5.380E-06	<5.380E-06	<5.380E-06

Table B2-69. Tank 241-AP-107 Analytical Results: Strontium-90.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids: acid digest			µCi/mL	µCi/mL	µCi/mL
V34	Tank composite	Liquid composite	1.140E-04	1.220E-04	1.180E-04[QC:f]

Table B2-70. Tank 241-AP-107 Analytical Results: Total Inorganic Carbon (Persulfate Oxidation).

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
93-08653	Riser 1, 90°	518	310	340	325
93-08654	Riser 1, 90°	61	280	290	285
93-08651	Riser 1, 330°	152	280	280	280
93-08652	Riser 1, 330°	366	300	300	300
93-08655	Riser 1, 210°	579	250	260	255
93-08656	Riser 1, 210°	579	400	400	400

Table B2-71. Tank 241-AP-107 Analytical Results: Total Inorganic Carbon.

Sample Number	Sample Location	Sample Depth	Result	Duplicate	Mean
Liquids		cm	µg/mL	µg/mL	µg/mL
V26	Riser 1, 90°	518	301	303	302[QC:f]
V26	Riser 1, 90°	518	238	253	245.5[QC:f]
V27	Riser 1, 90°	61	232	232	232[QC:f]
V27	Riser 1, 90°	61	245	279	262[QC:f]
V21	Riser 1, 330°	152	280	280	280[QC:f]
V21	Riser 1, 330°	152	210	255	232.5[QC:f]
V23	Riser 1, 330°	366	285	287	286[QC:f]
V23	Riser 1, 330°	366	454	464	459[QC:f]
V28	Riser 1, 210°	579	249	251	250[QC:f]
V28	Riser 1, 210°	579	251	249	250[QC:f]

B3.0 ASSESSMENT OF CHARACTERIZATION RESULTS

This section discusses the overall quality and consistency of the current sampling results for tank 241-AP-107. 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

The safety screening DQO requirement to sample at least two widely spaced risers was fulfilled, allowing a horizontal comparison of analytical results.

B3.2 QUALITY CONTROL ASSESSMENT

The usual quality control assessment includes evaluating appropriate standard recoveries, spike recoveries, duplicate analyses, and blanks that are performed in conjunction with the chemical analyses. All pertinent QC tests were conducted on 1995 and 1993 grab samples, allowing a full assessment of data accuracy and precision. Samples with one or more QC results outside the specified criteria were identified by footnotes in data summary tables.

The standard and matrix 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. No standards were available to assess recovery for many radionuclides. Spikes were not available for TGA, pH, specific gravity, hydroxide, and many radionuclides. The analytical precision was estimated by the RPD between the primary and duplicate samples or spike and spike duplicates (Miller 1995).

The majority of QC results were within specified boundaries. Discrepancies are footnoted in data summary tables and applicable results are described in Section B2.0. The discrepancies should not impact data validity or use.

B3.3 DATA CONSISTENCY CHECKS

Comparing different analytical methods can be helpful in assessing data consistency and quality. Mass and charge balance calculations were not made because of the limited IC and ICP analyses performed. However, water accounted for 94.7 percent of the waste mass. The major analytes were sodium, ammonium, nitrate, nitrite, fluoride, and hydroxide which accounted for another 3.1 percent of the waste mass.

The only checks that could be made for the 1995 grab sample data were to compare total alpha and isotopic alpha and to compare total beta and isotopic beta. A close agreement between the two methods strengthens the credibility of results, but a poor agreement brings the reliability of the data into question. All mean results were taken from tables in Section B3.4 and data summary tables. The 1993 sample results were not assessed because this data does not represent current tank contents.

B3.3.1 Gross Alpha vs. Alpha Isotope

Gross alpha composite analyses were compared to the sum of $^{239/240}$Pu and ^{241}Am and composite analyses. Table B3-1 shows the maximum gross alpha result below analytical detection levels was <9.31E-04 μCi/mL, and the sum of the isotopic radionuclides was <3.99E-04 μCi/mL. Differences are attributed to comparing maximum nondetected values to the low level of alpha in the sample.

Table B3-1. Comparison of Gross Alpha and Alpha Isotopes.

Analyte	Concentration (μCi/mL)
$^{239/240}$Pu	8.84E-05
^{241}Am	<3.11E-04
$^{239/240}$Pu + ^{241}Am	<3.99E-4
Gross alpha	<9.31E-04

B3.3.2 Gross Beta vs. Beta Isotopes

Gross beta composite analyses were compared to the sum of ^{137}Cs and twice ^{90}Sr composite analyses. Table B3-2 shows the gross beta result was 9.94 μCi/mL, and the sum of the isotopic radionuclides was 14.7 μCi/mL. Differences are attributed to instrument error for the low level of beta in the sample.

Table B3-2. Comparison of Gross Beta and Beta Isotopes.

Analyte	Concentration (μCi/mL)
^{137}Cs	14.4
^{90}Sr	0.15
^{137}Cs + ^{90}Sr X 2	14.7
Gross beta	9.94

B3.4 MEAN CONCENTRATIONS AND CONFIDENCE LEVELS

Analysis of variance (ANOVA) models were fit to the 1995 grab sample data obtained from tank 241-AP-107. The models were used to compute an estimate of mean concentration, the variance of the mean, and 95 percent confidence intervals on the mean. Because an inventory estimate was needed without comparing it to a threshold value, two-sided confidence intervals were computed.

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

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

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

The mean, $\hat{\mu}$, and the standard deviation, $\hat{\sigma}_{\hat{\mu}}$, were estimated using Restricted Maximum Likelihood Estimation methods. The degrees of freedom for tank 241-AP-107 is the number of risers sampled minus one.

B3.4.1 Statistical Means

The results given below are ANOVA estimates based on grab sample data from three risers for tank 241-AP-107. Table B3-3 provides estimates of the mean concentration and confidence interval on the mean concentration. The LL to a 95 percent confidence interval can be negative. Because an actual concentration of less than zero is not possible, the LL is reported as zero whenever this occurred.

Table B3-3. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Grab Sample Data. (2 sheets)

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	LL	UL
^{137}Cs	µCi/mL	1.44E+01	4.70E+00	1	0.00E+00	7.42E+01
OH	µg/mL	5.43E+03	7.86E+01	2	5.09E+03	5.77E+03
SpG	unitless	1.01E+00	1.53E-03	1	9.93E-01	1.03E+00
U	µg/mL	5.94E+00	3.55E-01	1	1.43E+00	1.05E+01
Water.TGA	Percent	9.47E+01	6.32E-01	1	8.67E+01	1.00E+02
pH	pH	1.34E+01	7.54E-03	1	1.33E+01	1.35E+01
Acetone[1]	µg/mL	4.04E+03	5.10E+01	2	3.82E+03	4.26E+03
Al by ICP.A[1]	µg/mL	2.73E+02	3.31E+00	1	2.31E+02	3.15E+02
^{14}C[1]	µCi/mL	1.81E-05	4.06E-07	1	1.30E-05	2.33E-05
F by IC	µg/mL	3.47E+03	1.13E+03	1	0.00E+00	1.78E+04

Table B3-3. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Grab Sample Data. (2 sheets)

Analyte	Units	$\hat{\mu}$	$\hat{\sigma}_{\hat{\mu}}$	df	LL	UL
^{3}H[1]	µCi/mL	2.76E-02	2.41E-02	1	0.00E+00	3.33E-01
Na by ICP.A	µg/mL	1.16E+04	1.50E+02	1	9.64E+03	1.35E+04
NH_4[1]	µg/mL	1.04E+03	1.02E+01	2	9.94E+02	1.08E+03
NO_2 by IC	µg/mL	2.48E+03	8.93E+02	2	0.00E+00	6.32E+03
NO_3 by IC	µg/mL	5.20E+03	1.61E+03	1	0.00E+00	2.57E+04
^{237}Np[1]	µCi/mL	2.68E-05	1.27E-06	1	1.07E-05	4.29E-05
$^{239/240}Pu$[1]	µCi/mL	8.84E-05	3.10E-06	1	4.90E-05	1.28E-04
^{90}Sr[1]	µCi/mL	1.50E-01	9.72E-02	1	0.00E+00	1.39E+00
TC[1]	µg/mL	5.72E+02	1.02E+01	1	4.42E+02	7.02E+02
^{99}Tc[1]	µCi/mL	2.35E-03	4.47E-04	1	0.00E+00	8.04E-03
TIC[1]	µg/mL	3.35E+02	4.75E+00	1	2.74E+02	3.95E+02
TOC[1,2]	µg/mL	2.45E+02	5.50E+00	1	1.75E+02	3.14E+02
Beta[1]	µCi/mL	9.94E+00	2.47E-01	1	6.80E+00	1.31E+01

Notes:

[1]No duplicates were sampled.
[2]Wet basis

B3.4.2 Analysis of Variance Model

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

The statistical model used to fit to the grab sampling data is as follows:

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

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

where

Y_{ijk}	=	laboratory results from the k[th] duplicate in the j[th] sample in the i[th] riser in the tank
μ	=	the grand mean
R_i	=	the effect of the i[th] riser
S_{ij}	=	the effect of the j[th] sample from the i[th] riser
A_{ijk}	=	the effect of the k[th] analytical result in the j[th] sample in the i[th] riser
a	=	the number of risers
b_i	=	the number of samples in the i[th] riser
c_{ij}	=	the number of analytical results from the j[th] sample in the i[th] riser

The variables R_i and S_{ij} are assumed to be random effects. These variables and A_{ijk} are assumed to be uncorrelated and normally distributed with means zero and variances $\sigma^2(R)$, $\sigma^2(S)$, and $\sigma^2(A)$, respectively. The variables S_{ij} and A_{ijk} are confounded if no duplicates were sampled. Estimates of $\sigma^2(R)$, $\sigma^2(S)$, and $\sigma^2(A)$ were obtained using Restricted Maximum Likelihood Estimation techniques. This method, applied to variance component estimation, is described in Harville (1977). The statistical results were obtained using statistical analysis package S-PLUS[2] (Statistical Sciences 1993).

After the sample means are calculated for the tank for each analyte, the sampling-based inventory may be calculated. Because the analyte concentrations above are given in terms of a mass basis concentration, the total mass of waste in the tank is needed to estimate inventories. The total mass of waste was derived multiplying by a tank volume 83 kL (Hanlon 1996). Appendix D shows the inventory for each analyte.

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

B4.0 APPENDIX B REFERENCES

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APPENDIX C

STATISTICAL ANALYSIS FOR ISSUE RESOLUTION

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APPENDIX C

STATISTICAL ANALYSIS FOR ISSUE RESOLUTION

Appendix C includes the analyses required to evaluate applicable DQOs for tank 241-AP-107. Specifically, statistical and other numerical manipulations are performed and documented. The analyses required for tank 241-AP-107 are documented in the following sections:

- **Section C1**: Statistical analysis and numerical manipulations supporting the safety screening DQO (Dukelow et al. 1995).

- **Section C2**: References for Appendix C.

C1.0 STATISTICS FOR SAFETY SCREENING DQO

The safety screening DQO (Dukelow et al. 1995) defines acceptable decision confidence limits in terms of one-sided 95 percent confidence intervals. All data in this section are from the final laboratory data package for the 1995 grab sampling event for tank 241-AP-107 (Miller 1995).

No duplicate analyses were sampled for total alpha; therefore, no confidence interval can be constructed. All DSC results were zero; therefore, no confidence intervals were computed. Table C1-1 shows the laboratory results for total alpha. These results show that although confidence intervals could not be constructed, the total alpha concentration is probably below the threshold value of 61.5 μCi/mL for liquid.

Table C1-1 also shows the laboratory results from Pu-239. No duplicate analytes were available for Pu-239. However, these results show that although confidence intervals could not be constructed, the Pu-239 concentration is probably below the threshold value of 1 g/L.

Table C1-1. 1995 Grab Sample Total Alpha and Pu-239 Laboratory Results for Tank 241-AP-107.

Laboratory Sample Number	Total Alpha (µg/mL)	Pu-239 (g/L)
S95V000014	<5.90E-04	1.42E-06
S95V000015	<9.31E-04	1.35E-06
S95V000016	<5.05E-04	1.48E-06

C2.0 APPENDIX C REFERENCES

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.

APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR DOUBLE-SHELL TANK 241-AP-107

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR DOUBLE-SHELL TANK 241-AP-107

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

Chemical and radiological inventory information generally is derived using three approaches: 1) component inventories are estimated using the results of sample analyses, 2) component inventories are predicted using a 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, use, and other operating data.

An effort is underway to provide waste inventory estimates that will serve as standard characterization source terms for waste management activities (Hodgson and LeClair 1996). As part of this effort, an evaluation of available chemical information for tank 241-AP-107 was performed, and a best-basis inventory was established. This work follows the methodology that was established by the standard inventory task.

The following evaluation provides a best-basis inventory estimate for chemical and radionuclide components in tank 241-AP-107.

The waste type is expected to be dilute noncomplexed.

D1.O CHEMICAL INFORMATION SOURCES

The 1995 sample data (see Appendix B) (Kupfer et al. 1997) are the only sources of composition information used in this engineering evaluation.

D2.0 COMPARISON OF COMPONENT INVENTORY VALUES

Typically, best-basis inventory documents compare sample-based inventories derived from analytical concentration data to inventories generated by the HDW model (Agnew et al. 1996). However, the HDW model estimates for all tanks are valid as of January 1, 1994. Since that time tank 241-AP-107 has been emptied, filled, and emptied again. The 1995 analytical data should represent the 83 kL (22 kgal) of waste remaining in the tank. No comparisons to the HDW model estimates were made. The sample-based density is 1.01 g/mL. No solids are expected to be in the tank.

D3.0 COMPONENT INVENTORY EVALUATION

There is little justification or incentive to dispute the analytical results for the small volume of dilute liquid in tank 241-AP-107. Tank 241-AP-107 remains in service and has been designated as the receiver tank for most of the 3,070 kL (810 kgal) of supernatant in tank 241-AY-102 in preparation of that tank for retrieval of tank 241-C-106 solids (Strode and Koreski 1996). Tank 241-AP-107 probably will continue to be the receiver of the dilute noncomplexed waste that will eventually be concentrated in the 242-A Evaporator.

D3.1 CONTRIBUTING WASTE TYPES

Before 1994, tank 241-AP-107 contained 4,310 kL (1,140 kgal) of diluted PUREX ammonia scrubber waste. In the fall of 1994, tank 241-AP-107 was pumped down to a 106 kL (28 kgal) heel before receiving 500 kL (132 kgal) of dilute noncompelxed waste from tank 241-AW-103 and 3,270 kL (863 kgal) of dilute noncomplexed waste from tank 241-AP-101 in the first quarter of fiscal year 1995. These wastes consisted mostly of PUREX ammonia scrubber waste and other PUREX low-level miscellaneous waste streams. In May and June 1995, all but 106 kL (28 kgal) of waste in tank 241-AP-107 was sent to the 242-A Evaporator.

D3.2 INVENTORY EVALUATION

The last sampling event for tank 241-AP-107 was completed February 2, 1995. At that time, tank 241-AP-107 contained approximately 3,770 kL (996 kgal) of unstratified, low-level PUREX miscellaneous wastes. It was assumed that after the tank was pumped down to 106 kL (28 kgal), the remaining heel had the same composition as the February 1995 samples. Further losses of 23 kL (6.0 kgal) were also reported (Koreski 1996). Because the tank was classified as a non-leaker and the uncertainty of the FIC level gauge was restricted to ± 2.6 kL (0.70 kgal), losses were assumed the result of in-tank evaporation.

Accordingly, the February 1995 sample concentrations were assumed to increase by a ratio of 106/83 kL (28/22 kgal) as a result of in-tank evaporation without the precipitation of salts. Table D3-1 shows adjusted concentrations. The average error of available density correlations (Agnew and Watkin 1996) are too large to be useful in calculating a new specific gravity. A specific gravity of 1.01 was assumed for the adjusted sample concentrations. A weight percent water value for a specific gravity of 1.01 g/mL was calculated to be 92.6.

Table D3-1. January 1997 Analyte Concentrations for Tank 241-AP-107[1]

Analyte	Concentration (µg/mL)
OH	6,910
U	7.56
Acetone	5.14
Al	347
F	4,420
Na	14,800
NH_4	1,320
CO_3	2,130
NO_2	3,160
NO_3	6,620
^{3}H	0.0371
^{14}C	2.30E-05
^{137}Cs	0.187
^{237}Np	3.41E-05
$^{239/240}Pu$	1.13E-04
^{90}Sr	0.191
TOC	312
Percent water[2]	92.6
SpG[3]	1.01

Notes:

[1]Based on February 1995 grab sample results, adjusted for evaporation losses (see Section D3.2).
[2]Based on an assumed SpG of 1.01 g/mL.
[3]An assumed value.

D4.0 DEFINE THE BEST BASIS AND ESTABLISH COMPONENT INVENTORIES

The engineering assessment in this evaluation should serve as the basis for the best-estimate inventory to tank 241-AP-107 for the following reasons:

1. The February 1995 samples are the only representative samples of waste currently in tank 241-AP-107.

2. The HDW model estimate is outdated because of a large number of waste transfers that have occurred subsequent to the date the HDW model estimate is valid.

Tables D4-1 and D4-2 show the best-basis inventory estimates for tank 241-AP-107. Radionuclide values are decayed to January 1, 1994.

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AP-107. (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, or E)[1, 2]
Al	28.9	S
Bi	nr	
Ca	nr	
Cl	nr	
CO_3	178	S
Cr	nr	
F	368	S
Fe	nr	
Hg	nr	
K	nr	
La	nr	
Mn	nr	
Na	1,230	S
Ni	nr	
NO_2	263	S

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AP-107. (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, or E)[1,2]
NO_3	551	S
OH	575	S
Pb	nr	
PO_4	nr	
Si	nr	
SO_4	nr	
Sr	nr	
TOC	26.0	S
U	0.630	S
Zr	nr	

Notes:

nr = not reported

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

[2]Sample inventories are based on a volume of 83 kL (22 kgal) and February 1995 grab samples (see Appendix B) adjusted for evaporation losses (see Section D2.3).

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AP-107. (2 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1,2]
^{3}H	3.09	S
^{14}C	0.00192	S
^{59}Ni	nr	
^{60}Co	nr	
^{63}Ni	nr	
^{79}Se	nr	
^{90}Sr	16.3	S
^{90}Y	16.3	S
^{93}Zr	nr	
^{93m}Nb	nr	
^{99}Tc	0.249	S
^{106}Ru	nr	
^{113m}Cd	nr	
^{125}Sb	nr	
^{126}Sn	nr	
^{129}I	nr	
^{134}Cs	nr	
^{137}Cs	1,560	S
^{137m}Ba	1,480	S
^{151}Sm	nr	
^{152}Eu	nr	
^{154}Eu	nr	
^{155}Eu	nr	
^{226}Ra	nr	
^{227}Ac	nr	
^{228}Ra	nr	

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AP-107. (2 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1,2]
^{229}Th	nr	
^{231}Pa	nr	
^{232}Th	nr	
^{232}U	nr	
^{233}U	nr	
^{234}U	nr	
^{235}U	nr	
^{236}U	nr	
^{237}Np	0.00284	S
^{238}Pu	nr	
^{238}U	nr	
^{239}Pu	0.00937	S
^{240}Pu	nr	
^{241}Am	nr	
^{241}Pu	nr	
^{242}Cm	nr	
^{242}Pu	nr	
^{243}Am	nr	
^{243}Cm	nr	
^{244}Cm	nr	

Notes:

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

[2]Sample inventories are based on a volume of 83 kL (22 kgal) and February 1995 grab samples (see Appendix B) adjusted for evaporation losses (see Section D2.3).

D5.0 APPENDIX D REFERENCES

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

Agnew, S. F., and Watkin, J. G., 1994, *Estimation of Limiting Solubilities for Ionic Species in Hanford Waste Tank Supernates*, LA-UR-94-3590, Los Alamos National Laboratory, Rev. 0, Los Alamos, New Mexico.

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

Koreski, G. M., 1996, *Waste Volume Projections: Thermocouple and Surface Level Readings*, Westinghouse Hanford Company, Richland, Washington.

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

Strode, J. N., and G. M. Koreski, 1996, *Operational Waste Volume Projection*, WHC-SD-WM-ER-029, Rev. 22, Westinghouse Hanford Company, Richland, Washington.

APPENDIX E

BIBLIOGRAPHY FOR TANK 241-AP-107

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APPENDIX E

BIBLIOGRAPHY FOR TANK 241-AP-107

Appendix E is a bibliography that supports the characterization of tank 241-AP-107. The 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-AP-107 and its respective waste types.

The references in this bibliography are separated into four categories. The bibliography is broken down into appropriate subgroups with an annotation describing each information source. Where possible, a reference is provided for information sources. A majority of this information can be found in the Tank Characterization Resource Center.

I. NON-ANALYTICAL DATA

Ia. Fill History/Waste Transfer Records
Ib. Surveillance/Tank Configuration
Ic. Sample Planning/Tank Prioritization
Id. Data Quality Objectives/Customers of Characterization Data

II. ANALYTICAL DATA

IIa. Sampling of Tank 241-AP-107 Waste
IIb. Sampling of 242-A Evaporator Streams
IIc. Sampling of PUREX Ammonia Scrubber Feed

III. COMBINED ANALYTICAL/NON-ANALYTICAL DATA

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

I. NON-ANALYTICAL DATA

Ia. Fill History/Waste Transfer Records

Agnew, S. F., R. A. Corbin, T. B. Duran, K. A. Jurgensen, T. P. Ortiz, and B. L. Young, 1996, *Waste Status and Transaction Record Summary for the Southeast Quadrant*, WHC-SD-WM-TI-689, Rev. 1, Los Alamos National Laboratory, Los Alamos, New Mexico.

- Contains spreadsheets showing available data on tank additions/transfers for the Southeast quadrant of the Hanford Site.

Kitchen, D. A., 1990, *PUREX Process Distillate Discharge Transfer to AP Tank Farm Material Balance Trending*, (internal memorandum 8234-90-100 to D. G. Baide, March 9, Westinghouse Hanford Company, Richland, Washington.

- Internal memorandum verifies transfer volumes to tank 241-AP-107.

Le, E. Q., 1994, *Process Control Plan for 241-A Evaporator Campaign 94-1*, WHC-SD-WM-PCP-008, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

- Contains process control information for the 242-A Evaporator 94-1 Campaign.

Koreski, G. M., 1991, *Operational Waste Volume Projection*, WHC-SD-WM-ER-029, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Contains spreadsheets showing available data on tank additions/transfers from 1981 up to 1991.

Ib. Surveillance/Tank Configuration

Harlow, D. G., 1980, *Heat Content in 241-AP Tank Farm*, (internal letter 65410-80-11 to R. B. Guenther, September 30), Rockwell Hanford Company, Richland, Washington.

- Contains anticipated heat loads in 241-AP tanks.

Harris, J. P., 1994, *Operating Specifications for the 241-AN, AP, AW, AY, AZ, & SY Tank Farms*, OSD-T-151-00007, Rev./Mod. H-8, Westinghouse Hanford Company, Richland, Washington.

- Contains operating specifications for listed double-shell tanks. This includes composition, liquid levels, dome loading, vapor space pressure, etc.

Leach, C. E., and S. M. Stahl, 1996, *Hanford Site Tank Farm Facilities Interim Safety Basis Volume I and II*, WHC-SD-WM-ISB-001, Rev. 0L, Westinghouse Hanford Company, Richland, Washington.

- Provides a ready reference to the tank farms safety envelope.

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

- Assesses all risers for each tank; not all tanks are included/completed.

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

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

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 information pertaining to thermocouple trees installed in Hanford Site underground waste tanks.

Ic. Sample Planning/Tank Prioritization

Bell, K. E., 1994, *Tank Waste Remediation System Tank Waste Analysis Plan*, WHC-SD-WM-PLN-077, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Early version of the characterization planning document.

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

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

Ecology, EPA, and DOE, 1996, *Hanford Federal Facility Agreement and Consent Order,* as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

- Contains agreement between the U.S. Environmental Protection Agency, U.S. Department of Energy, and Washington State Department of Ecology that sets milestones for completing work on the Hanford Site tank farms.

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.

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

Halgren, D. L., 1991, *Double-Shell Tank Waste Analysis Plan,* WHC-SD-WM-EV-053, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

- Outlines the methods for sampling and analysis needed to meet specific data requirements.

Miller, G. L., 1994, *Technical Project Plan for the 222-S Laboratory in Support of the 242-A Evaporator Waste Analysis Plan, WHC-SD-WM-EV-060, Rev. 2*, WHC-SD-WM-TPR-048, Rev. 0A, Westinghouse Hanford Company, Richland, Washington.

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Public Law 101-510, 1990, "Safety Measures for Waste Tanks at Hanford Nuclear Reservation," Section 3137 of *National Defense Authorization Act for Fiscal Year 1991*.

- Contains the Safety Watch List for the Hanford Site tank farms.

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- Discusses relevant DQOs and how they will be met for tank 241-AP-107.

Winkelman, W. D., J. W. Hunt, and L. J. Fergestrom, 1996, *Fiscal Year 1997 Tank Waste Analysis Plan*, WHC-SD-WM-PLN-120, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Identifies plans and requirements for tanks to be sampled and analyzed and tank characterization reports to be written during Fiscal Year 1997.

Id. Data Quality Objectives/Customers of Characterization Data

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

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.

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Von Bargen, B. H., 1995, *242-A Evaporator/Liquid Effluent Retention Facility Data Quality Objectives*, WHC-SD-WM-DQO-014, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

- Contains data needs and requirements for the evaporator program.

II. ANALYTICAL DATA

IIa. Sampling of Tank Waste and Waste Types

Biddle, B. D., 1994, *Analysis of Samples Results in Discovery of Out of Specification Levels of Hydroxide in 200E Area Waste Tanks 241-AN-104 and 241-AP-107 and 241-AP-108*, (internal memorandum TANKFARM-94-0046 to distribution, October 7), Westinghouse Hanford Company, Richland, Washington.

- Internal notification of the out of specification hydroxide results discovered during analysis of tank 241-AP-107 grab samples taken August 1993.

Miller, G. L., 1994, *Organic Verification Data for Evaporator Projects for Tanks 241-AP-101 and 241-AP-107*, WHC-SD-WM-DP-063, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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Miller, G. L., 1994, *Data Validation Report for 242-A Evaporator Analytical Services Project FY93 Tank 241-AP-107*, WHC-SD-WM-DP-053, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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IIb. Sampling of 242-A Evaporator Streams

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Dodd, R. A., 1994, *242-A Evaporator Campaign 95-1 Waste Compatibility Assessment of Tank 241-AW-103 and 241-AW-104 Waste with Tank 241-AP-107 Waste*, (internal memorandum 7CF10-042-094 to W. E. Ross, October 19), Westinghouse Hanford Company, Richland, Washington.

- Provides sampling data and justification for transferring waste from tanks 241-AW-103 and 241-AW-104 to tank 241-AP-107 in preparation for 242-A Evaporator Campaign 95-1.

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- Contains results of the 242-A Evaporator Campaign 94-1.

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- Statistical analysis of March 1993 samples for tank 241-AP-105.

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- Memorandum contains information on chemical concentration used as feed to test PUREX Ammonia Scrubber.

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- Contains a description and results for ammonia scrubber feed tests conted on samples P11722 and P11723.

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- Contains alternate methods of reducing ammonium concentrations in ammonia scrubber waste streams.

WHC, 1989, *PUREX Ammonia Scrubber Feed and Process Distillate Discharge*, (internal memorandum 13331-89-460, from Tank Farms Plant Engineering to distribution, November 29), Westinghouse Hanford Company, Richland, Washington.

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- Contains process and sample information for the PUREX ammonia scrubber distillate waste stream. This is one of 33 stream-specific reports in support of liquid effluent discharge at Hanford.

III. COMBINED ANALYTICAL/NON-ANALYTICAL DATA

IIIa. Inventories from Campaign and Analytical Information

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

- Contains waste type summaries, primary chemical compound/analyte and radionuclide estimates for sludge, supernatant, and solids; the supernatant mixing model and the tank layer model; and individual tank inventory estimates.

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

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

Jungfleisch, F. M., 1980, *Hanford High-Level Defense Waste Characterization - A Status Report*, RHO-CD-1019, Rev. 0, Rockwell Hanford Operations, Richland, Washington.

- Provides status information to a plan outlined by G. W. Grimes in 1977 containing a summary of sampling, characterization, and analysis data for the tanks sampled.

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

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

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

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

IIIb. Compendium of Data from Other Sources Physical and Chemical

Agnew, S. F., and J. G. Watkin, 1994, *Estimation of Limiting Solubilities for Ionic Species in Hanford Waste Tank Supernates*, LA-UR-94-3590, Rev. 0, Los Alamos National Laboratory, Los Alamos, New Mexico.

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

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

- Contains summary information from the supporting document for Tank Farms AN, AP, AW, AY, AZ, and SY and in-tank photo collages and solid (including the interstitial liquid) composite inventory estimates.

Brevick, C. H., L. A. Gaddis, and S. D. Consort, 1995, *Supporting Document for the Southeast Quadrant Historical Tank Content Estimate for AP Tank Farm*, WHC-SD-WM-ER-315, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Supporting document for the historical tank content estimate. This document contains summary tank farm and tank write-ups on historical data and solid supernatant mixing total inventory estimates and data appendices.

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

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

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

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

EPA, 1990, "Identification and Listing of Hazardous Wastes," *40 CFR 261*, U.S. Environmental Protection Agency, Washington, D.C.

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

Foster, J. L., 1988, *Tank 107-AP Startup Plan*, WHC-SD-WE01-SUP-001, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Final informal review for acceptance of waste into tank 241-AP-107.

Foster, J. L., 1989, *Ammonia Releases from Tank Farms*, (internal memorandum 13331-89-396 to D. D. Woodrich, October 10), Westinghouse Hanford Company, Richland, Washington.

- Contains locations of ammonia gas on the Hanford Site and background of the ammonia source.

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

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

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

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

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

- Assesses relative dryness among tanks.

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

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

Nicholson, R. S., 1990, *Flow Path Integrity Verification for Transfers of Process Distillate Discharge (PDD) from PUREX to 107-AP and to 108-AP*, (internal memorandum 010290 to shift managers, January 2), Westinghouse Hanford Company, Richland, Washington.

- Documents verification methods for transferring waste from PUREX to tank 241-107-AP.

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

- Contains a statistical evaluation to group tanks into classes having similar waste properties.

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

- Contains a tank inventory estimate based on analytical information.

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

- Contains a tank inventory estimate based on analytical information.

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

- Contains a tank inventory estimate based on analytical information.

Van Vleet, R. J., 1993, *Radionuclide and Chemical Inventories for the Double-Shell Tanks*, WHC-SD-WM-TI-543, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

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

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Sandia National Laboratory P.O. Box 5800 MS-0744, Dept. 6404 Albuquerque, NM 87815					
D. Powers		X			
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Los Alamos Technical Associates					
T. T. Tran	B1-44	X			
Tank Advisory Panel 102 Windham Road Oak Ridge, TN 37830					
D. O. Campbell		X			
ONSITE					
Department of Energy - Richland Operations					
J. F. Thompson	S7-54	X			
W. S. Liou	S7-54	X			
J. A. Poppiti	S7-54	X			
N. W. Willis	S7-54	X			
DE&S Hanford, Inc.					
R. J. Cash	S7-14	X			
W. L. Cowley	R2-54	X			
G. L. Dunford	A2-34	X			
G. D. Johnson	S7-14	X			
J. E. Meacham	S7-14	X			
Fluor Daniel Northwest					
J. L. Stroup	S3-09	X			
Lockheed Martin Hanford, Corp.					
J. G. Field	R2-12	X			
K. M. Hodgson	H0-34	X			
T. J. Kelley	S7-21	X			
L. M. Sasaki	R2-12	X			
B. C. Simpson	R2-12	X			
ERC (Environmental Resource Center)	R1-51	X			
Tank Characterization Resource Center	R2-12	5			
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J. S. Hertzel	H5-61	X			
D. L. Lamberd	H5-61	X			
<u>Pacific Northwest Laboratory</u>					
J. R. Gormsen	K7-28	X			
A. F. Noonan	K9-91	X			
<u>Rust Federal Services of Hanford, Inc.</u>					
C. T. Narquis	T6-16	X			
<u>SGN Eurisys Services Corp.</u>					
D. B. Engelman	L6-37	X			

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