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Tank Characterization Report for Single-Shell Tank 241-TX-107

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Abstract: This document summarizes the information on the historical uses, present status, and the sampling and analysis results of waste stored in Tank 241-TX-107. This report supports the requirements of Tri-Party Agreement Milestone M-44-09.

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Tank Characterization Report for Single-Shell Tank 241-TX-107

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EXECUTIVE SUMMARY

This characterization report summarizes the information on the historical uses, current status, and sampling and analysis results of waste stored in single-shell underground tank 241-TX-107. This report supports requirements of the *Hanford Federal Facility Agreement and Consent Order* Milestone M-44-09 (Ecology et al. 1996).

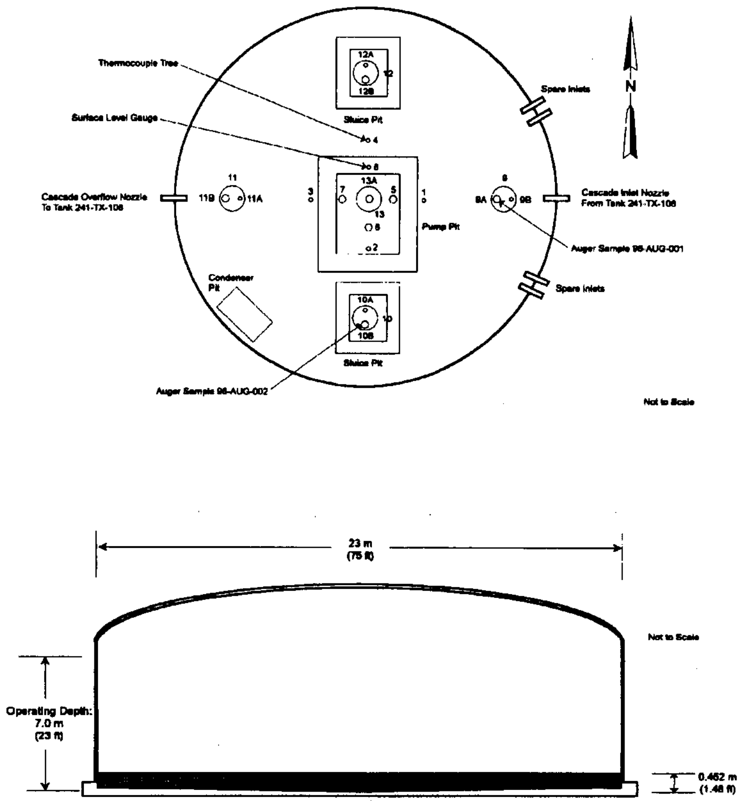
Tank 241-TX-107 is one of 18 single-shell underground waste storage tanks located in the 200 West Area TX Tank Farm on the Hanford Site. It is the third tank in a four-tank cascade series. The tank went into service in 1951, receiving metal waste from bismuth phosphate operations in T Plant. The tank continued to receive this waste type through 1955. The tank was sluiced in 1954/1955, refilled with metal waste in 1955, and sluiced again beginning in the third quarter of 1956. The tank was declared empty in the first quarter of 1957. Reduction-oxidation high-level waste was added in 1958 and 1965. Beginning in 1975 and continuing into 1976, tank 241-TX-107 received evaporator bottoms waste and N-(hydroxylethyl)-ethylenediaminetriacetic acid (HEDTA) destruction waste, both from the 242-T Evaporator. The final waste receipt consisted of partial neutralization feed waste from tank 241-SY-102 (Anderson 1990). Tank 241-TX-107 was removed from service in 1978 and administratively interim stabilized in October 1979; intrusion prevention was completed in August 1984. The tank was declared an assumed leaker in May 1984 with an approximate leak volume of 9.5 kL (2.5 kgal) (Hanlon 1996).

A description and the status of tank 241-TX-107 are summarized in Table ES-1 and Figure ES-1. The tank has an operating capacity of 2,870 kL (758 kgal), and presently contains an estimated 136 kL (36 kgal) of non-complexed waste. The waste is estimated to consist of 132 kL (35 kgal) of saltcake, with 3.8 kL (1 kgal) of supernatant (Hanlon 1996).

Table ES-1. Description and Status of Tank 241-TX-107.

TANK DESCRIPTION	
Type	Single-shell
Constructed	1947-1948
In-service	1951
Diameter	23 m (75 ft)
Maximum operating depth	7.0 m (23 ft)
Capacity	2,870 kL (758 kgal)
Bottom shape	Dish
Ventilation	Passive
TANK STATUS	
Waste classification	Non-complexed
Total waste volume	136 kL (36 kgal)
Supernatant volume	3.8 kL (1 kgal)
Saltcake volume	132 kL (35 kgal)
Waste surface level (1/91 - 1/96)	406 mm (16 in.) to 432 mm (17 in.)
Temperature (11/75 - 1/96)	12 °C (53.6 °F) to 40 °C (104 °F)
Integrity	Assumed leaker 1984
Watch List	None
SAMPLING DATES	
Auger samples	January 1996
SERVICE STATUS	
Removed from service	1978
Interim stabilization	October 1979
Intrusion prevention	August 1984

Figure ES-1. Profile of Tank 241-TX-107.



Total Tank Volume: 2,870 kL (758 kgal)
Waste Volume (January 1996): 136 kL (36 kgal)
Supernate Volume (January 1996): 3.8 kL (1 kgal)
Saltcake Volume (January 1996): 132 kL (35 kgal)

This report summarizes the collection and analysis of the auger samples acquired in January 1996. The sampling event was performed to satisfy the requirements of the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995). The sampling and analyses were performed in accordance with the *Tank 241-TX-107 Auger Sampling and Analysis Plan* (Bell 1996). The sampling effort involved taking two auger samples of the waste from widely spaced risers. Sample number 96-AUG-001 was obtained from riser 9A, while sample number 96-AUG-002 was collected from riser 10B. Recovery was low for both auger samples. Consequently, the samples were analyzed on a whole-auger basis instead of the half-auger basis required by the sampling and analysis plan (Bell 1996).

The safety screening data quality objective requires analysis for energetics using differential scanning calorimetry (DSC), percent water by thermogravimetric analysis (TGA), total alpha activity through alpha proportional counting, flammability, and bulk density. To determine flammability, monitoring within the tank headspace using a combustible gas meter was performed approximately three hours before auger sampling. Analyses for bulk density were not performed on the auger samples due to insufficient sample recovery.

No exothermic reactions were observed during the DSC analysis. The overall percent water value by TGA was 22.2 percent; the appearance of the sample and predicted water content both suggest that the water content is much higher. The total alpha activity results were well below the notification limit of 41 μCi/g. The total alpha activity overall mean was 4.52 μCi/g, with individual auger results of 3.675 and 5.37 μCi/g. Statistical calculation of 95 percent upper confidence limits for the two auger sample results means yielded results of

3.77 and 15.41 μCi/g, respectively. The flammability of the tank 241-TX-107 headspace gases was measured at 0 percent of the lower flammability limit. The average analytical values are presented in Table ES-2.

An estimate for the tank heat load was not calculated from analytical data, because the primary heat-producing radionuclides were not evaluated during the 1996 sampling and analysis event. An estimate of 57.7 W (197 Btu/hr) was available from the historical tank content estimate (Brevick et al. 1995a). Another estimate of 292 W (998 Btu/hr), based on headspace temperatures, was taken from Kummerer (1994). Both estimates were well below the 11,700 W (40,000 Btu/hr) threshold differentiating high-heat from low-heat tanks (Bergmann 1991).

The analytical results for the safety screening of the auger samples were all well below notification limits, confirming the tank's non-Watch List status. Based on the results of the analysis and the decision criteria of the safety screening DQO, the waste in tank 241-TX-107 may be categorized as "safe."

Table ES-2. Tank 241-TX-107 Data Summary.

Analyte	Average Result
Energetics by DSC	No exothermic reactions
Total alpha activity	4.52 μCi/g
Percent water by TGA	22.2 wt% water
Headspace gas flammability	0 % of the lower flammability limit

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LIST OF TERMS

ANOVA	analysis of variance
Btu/hr	British thermal units per hour
Ci	curies
Ci/L	curies per liter
cps	counts per second
DQO	data quality objective
DSC	differential scanning calorimetry
FIC	Food Instrument Corporation
ft	feet
g	grams
g/L	grams per liter
g/mL	grams per milliliter
HEDTA	N-(hydroxylethyl)-ethylenediaminetriacetic acid
HDW	Hanford Defined Waste
HLW	high-level waste
HTCE	historical tank content estimate
in.	inches
J/g	joules per gram
kg	kilograms
kgal	kilogallons
kL	kiloliters
LFL	lower flammability limit
m	meters
mg	milligrams
mm	millimeters
mol/L	moles per liter
mrem/hr	millirem per hour
ppm	parts per million
QC	quality control
REDOX	reduction/oxidation plant
RSD	relative standard deviation
SAP	sampling and analysis plan
T2SltCk	242-T Evaporator/Crystallizer saltcake waste, 1955-1965
TLM	Tank Layer Model
TGA	thermogravimetric analysis
W	watts
WSTRS	Waste Status and Transaction Record Summary
wt%	weight percent
°C	degrees Celsius
°F	degrees Fahrenheit
μCi/g	microcuries per gram
μg/g	micrograms per gram

1.0 INTRODUCTION

This tank characterization report presents an overview of single-shell tank 241-TX-107 and its waste components. It provides estimated concentrations and inventories for the waste constituents based on the latest sampling and analysis activities, in combination with background tank information. The characterization of tank 241-TX-107 is based on the results from an auger sampling event in January 1996.

Tank 241-TX-107 was removed from service in 1978. Interim stabilization and intrusion prevention have since been completed; therefore, the composition of the waste should not change appreciably until pretreatment and retrieval activities commence. The analyte concentrations reported in this document reflect the best composition estimates of the waste based on the available analytical data and historical models. This report supports the requirements of the *Hanford Federal Facility Agreement and Consent Order* Milestone M-44-09 (Ecology et al. 1996).

1.1 PURPOSE

The purpose of this report is to summarize the information concerning the design, use and contents of tank 241-TX-107. When possible, this information will be used to assess issues associated with safety, operations, environmental, and process activities. This report also serves as a reference point for more detailed information about tank 241-TX-107.

1.2 SCOPE

The January 1996 auger sampling event for tank 241-TX-107 supported the evaluation of the tank waste according to the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995). As directed in the *Tank 241-TX-107 Auger Sampling and Analysis Plan* (Bell 1996), safety screening analyses were performed on the two auger samples to screen the tank for three safety issues: energetics, criticality, and headspace flammability. The required analyses were DSC (to evaluate fuel content and energetics), TGA (to determine moisture content), total alpha activity analysis (to evaluate criticality potential), and bulk density (for tank inventory estimates). Analyses for bulk density were not performed on the auger samples due to insufficient sample recovery. Combustible gas meter readings of the tank headspace vapors were taken to address flammability concerns.

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2.0 HISTORICAL TANK INFORMATION

This section describes tank 241-TX-107 based on historical information. The first part details the current condition of the tank. This is followed by discussions of the tank's design, transfer history, and the process sources that contributed to the tank waste, including an estimate of the current contents based on the process history. Events that may be related to tank safety issues, such as potentially hazardous tank contents or off-normal operating temperatures, are included. The final part summarizes available surveillance data for the tank. Solid and liquid level data are used to determine tank integrity (leaks) and to provide clues to internal activity in the solid layers of the tank. Temperature data are provided to evaluate the heat-generating characteristics of the waste.

2.1 TANK STATUS

As of February 29, 1996, tank 241-TX-107 contained an estimated 136 kL (36 kgal) of waste classified as non-complexed (Hanlon 1996). The liquids and solids volumes in the tank were estimated using a combination of photographic evaluation method and manual tape level measurements. The last solids volume estimate was made on January 20, 1984. The amounts of various waste phases existing in the tank are presented in Table 2-1.

Table 2-1. Estimated Tank Contents (Hanlon 1996).

Waste Form	Estimated Volume[1]	
	kL	kgal
Total waste	136	36
Supernatant liquid	3.8	1
Sludge	0	0
Saltcake	132	35
Drainable interstitial liquid	3.8	1
Drainable liquid remaining	7.6	2
Pumpable liquid remaining	0	0

Note:

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

Tank 241-TX-107 was declared an assumed leaker in May 1984 with a leak volume of approximately 9.5 kL (2.5 kgal). The tank was administratively interim stabilized in October 1979. Interim isolation (intrusion prevention) was completed in August 1984 (Welty 1988). Tank 241-TX-107 is passively ventilated, and is not on the Watch List (Public Law 101-510). All monitoring systems were in compliance with documented standards as of February 29, 1996 (Hanlon 1996).

2.2 TANK DESIGN AND BACKGROUND

Information for this section is taken from Anderson (1990), Alstad (1993), Leach and Stahl (1993) and tank construction drawings.

The 241-TX Tank Farm was constructed between 1947 and 1948 in the 200 West Area, and was designed for non-boiling waste with a maximum fluid temperature of 104 °C (220 °F). Tank 241-TX-107 is one of eighteen 100 series tanks in the TX Tank Farm. These tanks have a capacity of 2,870 kL (758 kgal), a diameter of 23 m (75 ft), and an operating depth of 7.0 m (23 ft). Tank 241-TX-107 first went into operation in the fourth quarter of 1951. Tank 241-TX-107 is the third tank in the four-tank cascade series that consists of tanks 241-TX-105 through 241-TX-108. 76-mm (3-in.)-diameter cascade overflow lines connect tank 241-TX-107 to tanks 241-TX-106 and 241-TX-108. Each tank in the cascade series is 0.30 m (1 ft) lower than the preceding tank. The cascade overflow height is approximately 7.19 m (23.6 ft) from the tank bottom and 0.6 m (2 ft) below the top of the steel liner.

This tank has a dished bottom with a 1.2-m (4-ft) radius knuckle. Similar to all other single-shell tanks, tank 241-TX-107 was built with a primary mild steel liner and a concrete dome with various risers. Tank 241-TX-107 is equipped with 22 risers through the tank dome ranging in diameter from 100 mm (4 in.) to 1,100 mm (42 in.). The tank is set on a reinforced concrete foundation and is covered with approximately 2.46 m (8.08 ft) of overburden.

A plan view that depicts the riser configuration is shown in Figure 2-1. Table 2-2 provides identification numbers, diameters, and descriptions of the risers and the tank nozzles. Risers 9A, 10A, and 11A, all 100 mm (4 in.) in diameter, and riser 10B, which is 300 mm (12 in.) in diameter, are available for use (Lipnicki 1996). A tank cross-section showing the approximate waste level along with a schematic of the tank equipment is found in Figure 2-2. Tank 241-TX-107 is out of service, as are all single-shell tanks.

Figure 2-1. Riser Configuration for Tank 241-TX-107.

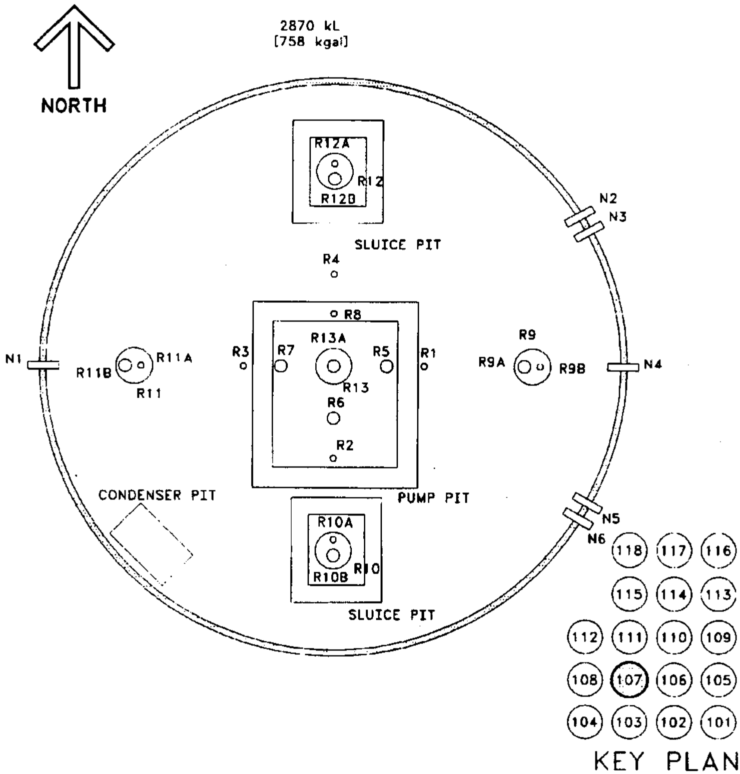


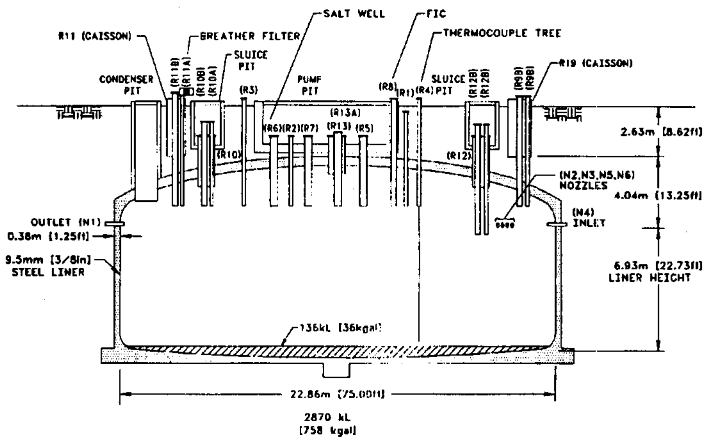
Table 2-2. Tank 241-TX-107 Risers.[1]

Riser Number	Diameter (inches)	Description and Comments
1	4	Below grade
2	4	Pit drain, weather cover
3	4	Below grade
4	4	Thermocouple tree
5	12	Spare, weather cover
6	12	Saltwell, weather cover
7	12	Spare, weather cover
8	4	Level gauge
9	42	Weather cover
9A	4	Blind flange, (benchmark 12-8-86)
9B	12	Blind flange
10	42	In pit bottom, weather cover
10A	4	Spare, weather cover
10B	12	Observation port, (benchmark 12-8-86)
11	42	In caisson, below grade
11A	4	Breather filter
11B	18	Blind flange
12	42	At pit bottom, weather cover
12A	4	Spare, weather cover
12B	14	Spare, weather cover
13	42	In pit bottom, weather cover
13A	12	Pipe capped
Nozzle Number	**Diameter (inches)**	**Description and Comments**
N1	3	Overflow nozzle
N2	3	Spare inlet nozzle
N3	3	Spare inlet nozzle
N4	3	Inlet nozzle
N5	3	Spare inlet nozzle
N6	3	Spare inlet nozzle

Notes:

[1]Alstad (1993); Vitro Engineering Corporation (1985)

Figure 2-2. Tank 241-TX-107 Cross-Section.



2.3 PROCESS KNOWLEDGE

These sections present the history of waste transfers for tank 241-TX-107. Section 2.3.1 and Table 2-3 summarize the major waste receipts for tank 241-TX-107 and a narrative describing these transfers. Principle sources for this information are Agnew et al. (1996) and Anderson (1990).

2.3.1 Waste Transfer History

Metal waste from $BiPO_4$ operations in T Plant was first added to tank 241-TX-107 in the fourth quarter of 1951. The additions continued until the fourth quarter of 1952, with waste cascading to tank 241-TX-108. Tank 241-TX-107 was sluiced from August 1954 to April 1955 to remove waste for uranium recovery (Rodenhizer 1987). The tank was refilled with metal waste during the second and third quarters of 1955. Sluicing was performed a second time from July 1956 to January 1957 (Rodenhizer 1987); the tank was declared empty in January 1957.

Information from *A History of the 200 Area Tank Farms* (Anderson 1990) indicates that 26 kL (7 kgal) of reduction-oxidation (REDOX) high-level waste (HLW) accumulated in the tank from the second quarter of 1957 to the first quarter of 1965, when 2,370 kL (627 kgal) of REDOX HLW supernatant from tank 241-TX-105 was added to tank 241-TX-107. The historical records do not indicate where the first 26 kL (7 kgal) of HLW was transferred from. Tank 241-TX-107 was maintained at near capacity until the first quarter of 1975, when 1,580 kL (418 kgal) of the supernatant was transferred to tank 241-SX-106.

Tank 241-TX-107 received a small amount of 242-T evaporator bottoms waste from tank 241-TX-109 in the first quarter of 1975. From the second quarter of 1975 to the first quarter of 1976, additional evaporator waste (2,226 kL [588 kgal]) was transferred from tank 241-TX-118 to tank 241-TX-107 in the form of N-(hydroxylethyl)-ethylenediaminetriacetic acid (HEDTA) destruction waste. During this period, 541 kL (143 kgal) of the evaporator waste was returned to tank 241-TX-118 from tank 241-TX-107.

In the second and third quarters of 1977, evaporator bottoms waste was sent from tank 241-TX-107 to tank 241-SY-102 for processing in the 242-S Evaporator. The final transfer of waste in the first quarter of 1978 was a receipt of 61 kL (16 kgal) of waste from tank 241-SY-102. This waste is assumed to be partial neutralization feed waste from the 242-S Evaporator.

Table 2-3. Summary of Tank 241-TX-107 Waste Input History.[1]

Transfer Source	Waste Type Received	Time Period	Estimated Waste Volume[2]	
			kL	kgal
T Plant	Metal waste from $BiPO_4$, generated 1944 to 1951	1951	1,696	448
T Plant	Metal waste from $BiPO_4$, generated 1952 to 1956	1952	4,047	1,069
Tank sluicing	Water from tank sluicing operations	1954	2,843	751
T Plant	Metal waste from $BiPO_4$, 1952 to 1956	1955	5,572	1,472
Unknown	REDOX HLW	1958	26	7
241-TX-105	REDOX HLW generated from 1952 to 1966	1965	2,374	627
241-TX-109	Evaporator bottoms waste from 242-T Evaporator	1975	68	18
241-TX-118	HEDTA destruction waste from 242-T Evaporator	1975 - 1976	2,226	588
241-SY-102	Partial neutralization feed for 242-S Evaporator	1978	61	16

Notes:

[1]Agnew et al. (1996)

[2]Waste volumes and types are best estimates based on historical data.

2.3.2 Historical Estimation of Tank Contents

The following is an estimate of the contents of tank 241-TX-107 based on historical transfer data. The historical data used for the estimate are the Waste Status and Transaction Record Summary (WSTRS) (Agnew et al. 1996), the Hanford Defined Wastes (HDW) list (Agnew 1996), and the Tank Layer Model (TLM) (Agnew et al. 1995) from the historical tank content estimate (HTCE) (Brevick et al. 1995a). The WSTRS is a compilation of available waste transfer and volume status data. The HDW provides the assumed typical compositions for all the separate waste types. In most cases, the available data are incomplete, reducing the reliability of the transfer data and the modeling results derived from them. These sources of data are used to model the waste deposition process and generate an estimate of the tank contents. The errors introduced in each step of the process make these model predictions only estimates that require further evaluation using analytical data.

Based on Agnew (1996), tank 241-TX-107 contains 3.8 kL (1 kgal) of supernatant waste, 102 kL (27 kgal) of T2SltCk waste (saltcake waste generated from the 242-T Evaporator-Crystallizer from 1955 to 1965), 26 kL (7 kgal) of an unknown waste, and a 3.8 kL (1 kgal) of metal waste. A graphical representation of the estimated waste types and their volumes can be seen in Figure 2-3. The T2SltCk waste should contain primarily sodium, nitrate, nitrite and carbonate, with lesser amounts of phosphate, sulfate, fluoride, chloride, calcium and chromium. Substantial amounts of ^{137}Cs and ^{90}Sr radiological constituents exist in the T2SltCk waste; as a result, radioactivity levels in this waste will be high. The metal waste (MW1) should contain sodium, carbonate and phosphate in the greatest concentration with lesser amounts of aluminum, nitrate, phosphate, sulfate, and iron. The MW1 will have much lower radioactivity levels due to the small amount of ^{137}Cs and ^{90}Sr present, as compared to T2SltCk. Because of its small volume and location in the tank, MW1 may not be sampled. The unknown waste could be REDOX HLW, although its exact origin is not traceable from the historical data. The specifics on the supernatant waste are not well defined, though the wastes should contain constituents similar to the T2SltCk waste. Table 2-4 shows an estimate of the expected waste constituents and their concentrations. This tank inventory estimate has not been validated and should be used with caution.

Figure 2-3. Tank Layer Model for Tank 241-TX-107.

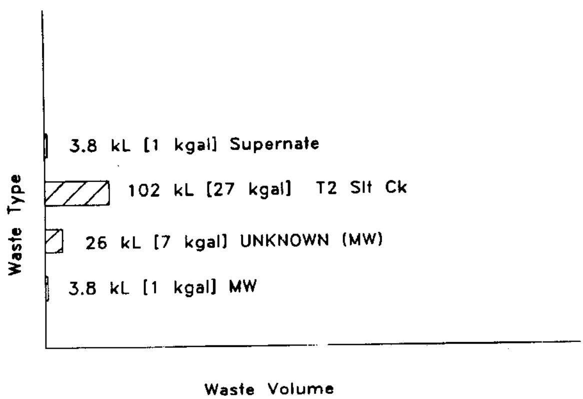


Table 2-4. Tank 241-TX-107 Historical Inventory Estimate.[1,2] (2 sheets)

Solids Composite Inventory Estimate			
Physical Properties			
Total solid waste	1.67E+05 kg (36.00 kgal)		
Heat load	29.1 W (99.3 Btu/hr)		
Bulk density	1.22 g/mL		
Water wt%	73.7		
Total organic carbon wt% carbon (wet)	0.155		
Chemical Constituents	**mol/L**	**ppm**	**kg**
Na^{+}	2.40	45,100	7,530
Al^{3+}	0.149	3,290	548
Fe^{3+} (total Fe)	0.0273	1,240	207
Cr^{3+}	0.00525	223	37.2
Bi^{3+}	2.37E-04	40.5	6.76
La^{3+}	1.81E-10	2.06E-05	3.43E-06
Hg^{2+}	1.30E-06	0.214	0.0356
Zr (as $ZrO(OH)_2$)	1.76E-04	13.1	2.18
Pb^{2+}	1.18E-04	19.9	3.32
Ni^{2+}	8.83E-04	42.3	7.06
Sr^{2+}	6.05E-11	4.33E-06	7.22E-07
Mn^{4+}	3.09E-04	13.9	2.31
Ca^{2+}	0.0227	745	124
K^{+}	0.00632	202	33.7
OH^{-}	3.39	47,000	7,850
NO_3^{-}	0.618	31,300	5,220
NO_2^{-}	0.202	7,590	1,270
CO_3^{2-}	0.474	23,200	3,880
PO_4^{3-}	0.102	7,890	1,320
SO_4^{2-}	0.0473	3,710	619
Si (as SiO_3^{2-})	0.00876	201	33.5
F^{-}	0.0135	209	34.9
Cl^{-}	0.0245	708	118
citrate	0.00221	341	56.9

Table 2-4. Tank 241-TX-107 Historical Inventory Estimate.[1,2] (2 sheets)

Solids Composite Inventory Estimate			
Chemical Constituents (Cont'd)	**mol/L**	**ppm**	**kg**
$EDTA^{4-}$	0.00326	767	128
$HEDTA^{3-}$	0.00641	1,430	239
glycolate	0.0136	835	139
acetate	3.50E-04	16.9	2.81
oxalate	1.55E-10	1.12E-05	1.86E-06
DBP	0.00169	367	61.3
butanol	0.00169	102	17.1
NH_3	6.67E-03	92.6	15.5
$Fe(CN)_6^{4-}$	0	0	0
Radiological Constituents	**Ci/L**	**μCi/g**	**Ci**
Pu	---	0.0089	0.0249 (kg)
U	0.443 (M)	86,200 (μg/g)	14,400 (kg)
Cs	0.0268	21.9	3,650
Sr	0.0134	11.0	1,780

Notes:

[1]Agnew (1996)

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

2.4 SURVEILLANCE DATA

Tank 241-TX-107 surveillance consists of surface level measurements (liquid and solid), temperature monitoring inside the tank (waste and headspace), and leak detection well (drywell) monitoring for radioactivity outside the tank. The data provide the basis for determining tank integrity.

Liquid level measurements may indicate a major leak from the tank. Solid surface level measurements provide an indication of physical changes and consistency of the solid layers of waste. Drywells located in the soil around the perimeter of the tank may show increased radioactivity caused by a leak.

2.4.1 Surface Level

In the past, the waste surface level was monitored daily with an automatic Food Instrument Corporation (FIC) gauge through riser 8. Currently the automatic FIC gauge is not in service; thus, the waste surface level is monitored by a manual FIC gauge on a quarterly basis. The maximum allowed deviations from the 432-mm (17-in.) baseline established for tank 241-TX-107 are a 50-mm (2-in.) increase and a 254-mm (10-in.) decrease (Barnes 1993). The surface level readings have varied from 406 mm (16 in.) to 432 mm (17 in.) between January 1991 and January 1996. A graphical representation of the tank volume history is presented in Figure 2-4. The surface level on January 1, 1996, was 452 mm (17.8 in.).

2.4.2 Drywells

Seven drywells are identified for tank 241-TX-107. Radioactivity was observed in drywells 51-07-18 and 51-07-07 beginning in 1977. The radioactivity peaked at 9,015 counts per second (cps) on July 1983 for drywell 51-07-07 and 10,190 cps on June 1980 for drywell 51-07-18. Radioactivity continues to decrease for both drywells (Anderson 1990).

2.4.3 Internal Tank Temperatures

Tank 241-TX-107 has a single thermocouple tree with 14 thermocouples in riser 4 to monitor waste temperature. Thermocouple 1 is located 308 mm (1.01 ft) above the tank bottom, and thermocouples 2 through 12 are located at 600-mm (2-ft) intervals above thermocouple 1. Thermocouples 13 and 14 are located at 1.2-m (4-ft) intervals above thermocouple 12. No temperature data are available prior 1975. A gap in the data exists between January 1984 and January 1993.

The mean temperature for data recorded between November 1975 and January 1996 was 25 °C (76.9 °F) with a minimum of 12 °C (53.6 °F) and a maximum of 40 °C (104 °F). Temperature data are currently recorded quarterly. On January 3, 1996, the high temperature was 20.2 °C (68.4 °F) recorded by thermocouple 1, and the low temperature was 13.9 °C (57.1 °F) recorded on thermocouple 4. The mean temperature for data recorded between January 1995 and January 1996 was 19.3 °C (66.8 °F) with a minimum of 13.9 °C (57.1 °F) and a maximum of 22.5 °C (72.5 °F). A graph of the weekly high temperature is provided as Figure 2-5. Plots of the individual thermocouple readings can be found in Brevick et al. (1995b).

Figure 2-4. Tank 241-TX-107 Level History.

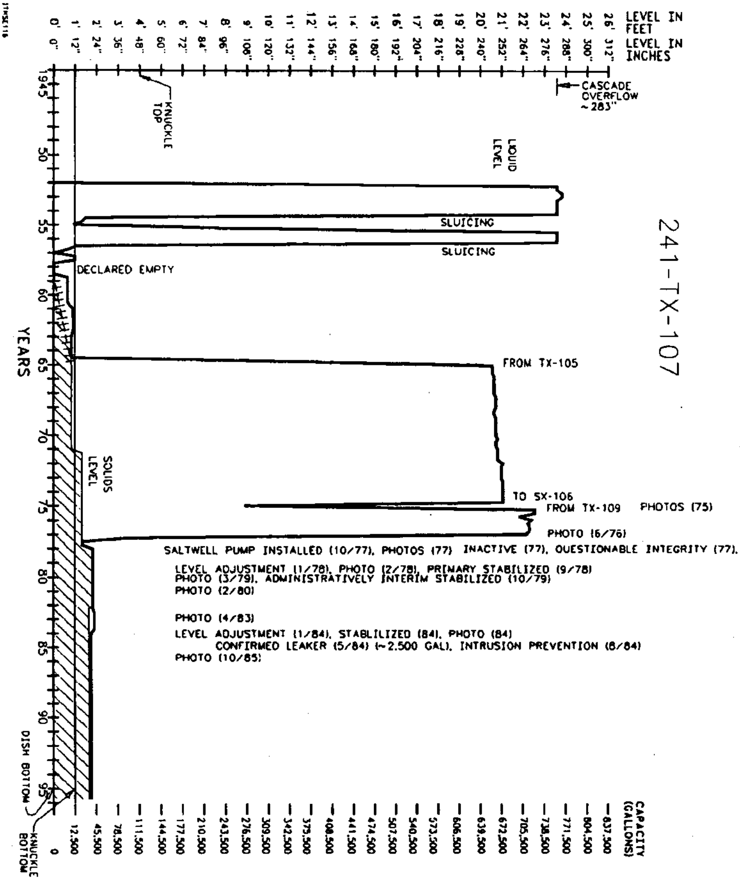
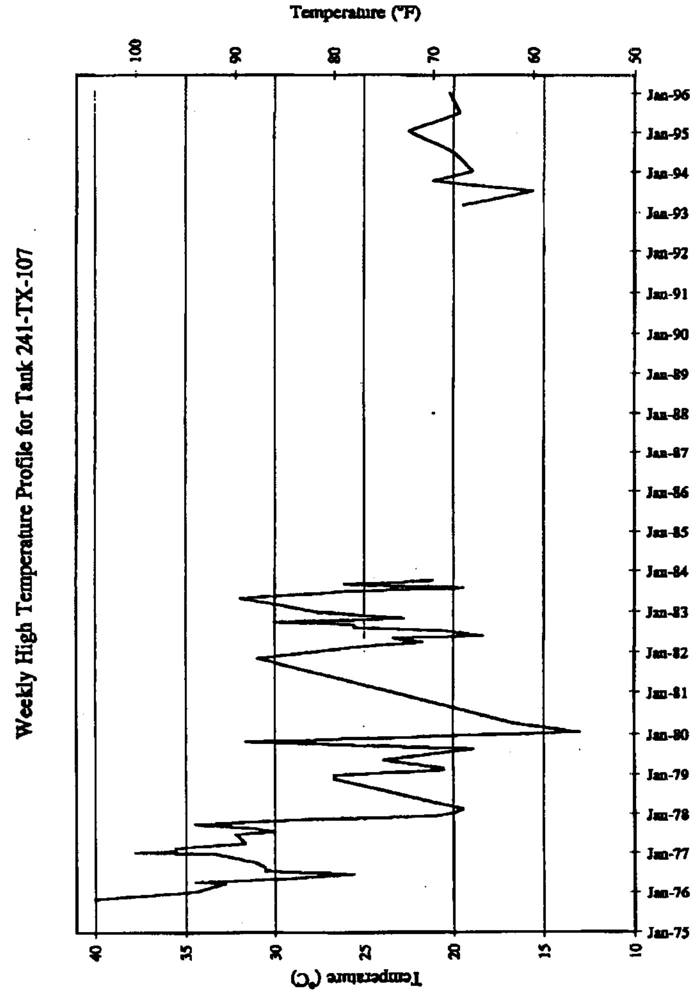


Figure 2-5. Tank 241-TX-107 Weekly High Temperature Plot.



2.4.4 Tank 241-TX-107 Photographs

The 1985 photographic montage of the tank 241-TX-107 interior indicated a thin supernatant surface with a tan-colored precipitant beneath. Picture quality is poor and the tank details are hazy. Some nozzles can be seen and have been identified. Earlier photographs showed objects lying on the surface that are no longer visible, although these objects may now lie beneath the surface. This photograph should reflect the current tank contents, because no transfers have taken place since this photograph was taken.

3.0 TANK SAMPLING OVERVIEW

This section describes the January 1996 sampling and analysis event for tank 241-TX-107. Auger samples were taken to satisfy the requirements of the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995). Sampling and analyses were performed in accordance with the *Tank 241-TX-107 Auger Sampling and Analysis Plan* (Bell 1996). Further discussion of the sampling and analysis procedures can be found in the *Tank Characterization Reference Guide* (DeLorenzo et al. 1994).

3.1 DESCRIPTION OF SAMPLING EVENT

Auger samples from two risers were collected from tank 241-TX-107. Auger sample 96-AUG-001 was collected from riser 9A on January 9, 1996, using a 20-in. auger with flutes spaced 0.5 in. apart. The auger sample had to be manually retrieved from the tank because a zip cord had wrapped around the auger bit during sampling (Raphael 1996). Auger number 96-AUG-002 was obtained from riser 10B on January 16, 1996, using a 20-in. auger with flutes spaced 1 in. apart. No problems were noted during the acquisition of this auger sample.

Prior to auger sampling, monitoring of the tank headspace vapors was performed as required by the safety screening DQO. Approximately 3 hours before sampling, combustible gas meter readings were taken at the breather filter, above the sampling risers, in the riser (3 ft below the top of the riser) and within the tank headspace at 6 m (20 ft) below the top of the riser (Raphael 1996). Monitoring was performed through risers 9A and 10B. Results for total organic carbon, oxygen, ammonia, and the lower flammability limit (LFL) of the flammable gases were obtained.

As mentioned previously, the sampling and analysis of tank 241-TX-107 were performed to satisfy requirements of the safety screening DQO (Dukelow et al. 1995). Table 3-1 summarizes these requirements.

Table 3-1. Data Quality Objective Requirements for Tank 241-TX-107.[1]

Sampling Event	Applicable DQOs	Sampling Requirements	Analytical Requirements
Auger sampling	Safety screening (Dukelow et al. 1995)	Auger samples from a minimum of two risers separated radially to the maximum extent possible	▸ Energetics ▸ Moisture content ▸ Total alpha activity ▸ Bulk density ▸ Flammable gas concentration

Note:

[1]Bell (1996)

3.2 SAMPLE HANDLING

Auger number 96-AUG-001 was received by the Westinghouse Hanford Company 222-S Laboratory on January 19, 1996, and extruded on January 24. When the auger was removed from its sleeve, a zip cord was found wrapped around the top flutes. The zip cord was easily freed and discarded. Most of the waste material was spread from the bottom flutes to approximately 17 in. up the auger (Raphael 1996). The waste was a wet, dark brown to black sludge. Not enough material was available to permit partitioning into half augers as required by the sampling and analysis plan (SAP). Also, the SAP required that at least 10 mL of sample be archived; less than 2 g of material could be set aside for archiving. Less than 5 mL of liquid dripped onto the sampling tray during extrusion; the amount was insufficient for recovery.

Auger number 96-AUG-002 was also received by the 222-S Laboratory on January 19, 1996, and extruded on January 24. Sample recovery was poor; only 3.7 g of material was obtained. The waste was distributed in a thin layer on the bottom 5.5 in. of the auger (Raphael 1996). The waste appeared similar to that on the other auger: wet, dark brown to black sludge. Because the sample was less than 25 cm (10 in.) in length, partitioning into half augers was not required. There was not enough sample to permit archiving. When the waste material was collected from the auger flutes, less than 5 mL of liquid dripped onto the sampling tray, none of which was recovered.

Table 3-2 presents the extrusion data, dose rates, and hot cell observations.

Table 3-2. Tank 241-TX-107 Auger Extrusion Data.[1] (2 sheets)

Riser	Auger Number	Labcore Number	Dose Rate (mrem/hr)	Sample Amount (g)	Hot Cell Physical Observations
9A	96-AUG-001	S96T000393	1,000	54.3	A thin layer of waste was collected on the auger flutes. Waste appeared as a wet, homogeneous sludge, dark brown/black in color; waste displayed adhesive properties. Less than 5 mL of liquid were observed.

Table 3-2. Tank 241-TX-107 Auger Extrusion Data.[1] (2 sheets)

Riser	Auger Number	Labcore Number	Dose Rate (mrem/hr)	Sample Amount (g)	Hot Cell Physical Observations
10B	96-AUG-002	S96T000392	50	3.7	A thin layer of waste was collected on the auger flutes. Waste appeared as a wet, homogeneous sludge, dark brown/black in color; waste displayed adhesive properties. Less than 5 mL of liquid were observed.

Note:
[1]Raphael (1996)

3.3 SAMPLE ANALYSIS

The analyses performed on the auger samples were limited to those required by the safety screening DQO (Dukelow et al. 1995). These included analyses for energetics by DSC, moisture by TGA, and fissile content by total alpha activity analysis. The density measurements could not be performed due to an insufficient amount of sample. The results of the analyses are included in Section 4 of this report and were originally reported in *45-Day Safety Screening Results and Final Report for Tank 241-TX-107, Auger Samples 96-AUG-001 and 96-AUG-002* (Raphael 1996).

Following extrusion, the two auger samples were subsampled for analysis and archiving. Prior to analyzing for total alpha activity, the samples were dissolved by fusing with potassium hydroxide in a nickel crucible and dissolving the flux in nitric and hydrochloric acids. A liquid aliquot of the fused sample was then dried on a counting planchet and measured for alpha activity using an alpha proportional counter.

Laboratory control standards, matrix spikes, and duplicate analysis quality control (QC) checks were applied to the total alpha activity analysis. Laboratory control standards and duplicate analysis QC checks were used for the TGA and the DSC analyses. An assessment of the QC data is presented in Section 5.1.2.

All reported analyses were performed in accordance with approved laboratory procedures. A list of the sample numbers and applicable analyses is presented in Table 3-3. Table 3-4 displays the analytical procedures by title and number.

Table 3-3. Tank 241-TX-107 Sample Analysis Summary.[1]

Auger	Auger Portion/Type	Sample Number	Analyses
96-AUG-001	Whole auger; Solids	S96T000394	DSC, TGA
		S96T000398	Total alpha activity
		S96T000395	Archive
96-AUG-002	Whole auger; Solids	S95T000392	DSC, TGA
		S96T000397	Total alpha activity

Note:

[1]Raphael (1996)

Table 3-4. Analytical Procedures.[1]

Analysis	Instrument	Preparation Procedure[3]	Analytical Procedure[3]
Energetics by DSC	Mettler™	N/A	LA-514-113, Rev. C-1
Percent water by TGA	Perkin-Elmer™	N/A	LA-560-112, Rev. C-1
Flammable gas	Combustible gas analyzer	N/A	WHC-IP-0030 IH 1.4 and IH 2.1[2]
Total alpha activity	Alpha proportional counter	LA-549-141, Rev. E-0	LA-508-101, Rev. D-2

Notes:

N/A = not applicable

Rev. = revision

Mettler™ is a registered trademark of Mettler Electronics, Anaheim, California.

Perkin-Elmer™ is a registered trademark of Perkins Research and Manufacturing Company, Inc., Canoga Park, California.

[1]Raphael (1996)

[2]Safety department administrative manuals, Westinghouse Hanford Company, Richland, Washington:
IH 1.4, Industrial Hygiene Direct Reading Instrument Survey
IH 2.1, Standard Operating Procedure, MSA Model 260 Combustible Gas and Oxygen Analyzer.

[3]All procedures are from Westinghouse Hanford Company, Richland, Washington.

3.4 DESCRIPTION OF HISTORICAL SAMPLING EVENTS

The supernatant in tank 241-TX-107 was sampled five times in September and October 1975 to evaluate batch boildowns of the tank contents. The boildown samples were used to determine if the tank contents were suitable for use in the 242-Evaporator during campaigns to reduce water in the tanks. During these sampling events, the tank contained a large amount of supernatant (approximately 2,650 kL [700 kgal]). All supernatant was removed during the second and third quarters of 1977. In the first quarter of 1978, 61 kL (16 kgal) of waste (solids) from tank 241-SY-102 were received. Currently, the tank contains 4 kL (1 kgal) of supernatant. The origin of this supernatant is not documented in the historical records. It could have been left from the removal of supernatant in 1977, but it more likely entered the tank with the 1978 waste receipt. Because the 1975 supernatant samples are not thought to be representative of the supernatant currently in the tank, the results are not included in this report. The results from the 1975 sampling events are documented in Perez (1975), Wheeler (1975a), and Wheeler (1975b).

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4.0 ANALYTICAL RESULTS

4.1 OVERVIEW

This section presents the analytical results associated with the January 1996 auger sampling of tank 241-TX-107. The total alpha activity, weight percent water, energetics, and tank headspace flammability results are presented as indicated in Table 4-1. The samples from which these results were derived were collected as discussed in Section 3.0, and were reported in Raphael (1996).

Table 4-1. Analytical Data Presentation Tables.

Data Type	Tabulated Location
Total alpha activity results	Table 4-2
Thermogravimetric analysis results	Table 4-3
Differential scanning calorimetry results	Table 4-4
Headspace flammability screening results	Table 4-5

Overall tank means were calculated for the total alpha activity and weight percent water data. To determine the overall mean, auger means were first calculated by averaging the sample and duplicate pair results within each auger sample. The two auger means were then averaged to obtain an overall tank mean. The relative standard deviation (RSD) of the mean, defined as the standard deviation of the mean divided by the mean, multiplied by 100, was also calculated for both analytes. The RSDs are a measure of variability, and were determined by using standard analysis of variance (ANOVA) statistical techniques.

4.2 TOTAL ALPHA ACTIVITY

Table 4-2 displays the total alpha activity analytical results. The samples were prepared by a fusion digestion and measured using an alpha proportional counter. The fusion digestions were performed according to method LA-549-141, Rev. E-0, and counted for total alpha activity using method LA-508-101, Rev. D-2. All results were below the safety screening limit of 41 μCi/g, with a mean of 4.52 μCi/g and an RSD (mean) of 18.7 percent. The upper limits of the one-sided 95 percent confidence intervals for the two auger samples were 15.41 and 3.77 μCi/g (Raphael 1996).

Table 4-2. Tank 241-TX-107 Total Alpha Activity Results.[1]

Sample Number	Auger	Result μCi/g	Duplicate μCi/g	Sample Mean μCi/g	Overall Mean μCi/g	RSD (Mean) %
S96T000398	96-AUG-001	3.69	3.66	3.675	4.52	18.7
S96T000397	96-AUG-002	6.96	3.78	5.37[2]		

Note:

[1]Raphael (1996)

[2]The relative percent difference between primary and duplicate samples is greater than the criterion defined in the SAP.

4.3 PHYSICAL DATA SUMMARY

Physical analyses performed on the tank 241-TX-107 auger samples to satisfy the requirements of the safety screening DQO (Dukelow et al. 1995) included TGA and DSC. Bulk density analyses were not performed because of insufficient sample recovery. Densities for these types of materials typically range from 1.4 to 1.8 g/mL.

4.3.1 Thermogravimetric Analysis

In TGA, the mass of a sample is measured while its temperature is increased at a constant rate. Any decrease in the weight of a sample represents a loss of gaseous matter from the sample, either through evaporation or through a reaction that forms gas phase products. The moisture content is estimated by assuming that all TGA sample weight loss up to a certain temperature (typically 150 °C) is due to water evaporation. Weight percent water by TGA was performed by the 222-S Laboratory on a Perkin-Elmer™ instrument using procedure LA-560-112, Rev. C-1.

The TGA data for tank 241-TX-107 is presented in Table 4-3. All samples exhibited a large weight loss due to loss of water between ambient temperature and 170 °C. All four TGA scans showed a second weight loss transition. For sample 96-AUG-001, this second transition began at approximately 230 °C and continued beyond the 500 °C upper limit of the TGA instrument. For sample 96-AUG-002, the second transition began at approximately 250 °C and ended at about 370 °C (Raphael 1996). The overall mean weight percent water for the tank was 22.2 percent, with an RSD (mean) of 25.1 percent.

Because the auger samples appeared wet, the result of 22.2 wt% water is unexpected. Some drying of the sample may have occurred to the subsamples prior to analysis; however, all four TGA runs produced results below 30 wt% water.

Table 4-3. Thermogravimetric Analysis Results for Tank 241-TX-107.[1]

Sample Number	Auger	Temp. Range[2] (°C)	Result % H_2O	Duplicate % H_2O	Mean % H_2O	Overall Mean % H_2O	RSD (Mean) %
S96T000394	96-AUG-001	35-150 (35-150)	15.09	18.24	16.66	22.2	25.1
S96T000392	96-AUG-002	35-120 (35-170)	25.71	29.91	27.81		

Notes:

Temp. = temperature

[1]Raphael (1996)

[2]First temperature range is for the sample result, and range in parentheses is for the duplicate result.

4.3.2 Differential Scanning Calorimetry

In the DSC analysis, heat absorbed or emitted by a substance is measured while the substance is exposed to a linear increase in temperature. The onset temperature for an endothermic (characterized by or causing the absorption of heat) or an exothermic (characterized by or causing the release of heat) event is determined graphically. Analyses by DSC were performed by the 222-S Laboratory on a Mettler™ instrument using procedure LA-514-113, Rev. C-1.

The DSC results are presented in Table 4-4. All reactions were endothermic; thus, none of the samples exceeded the safety screening action limit of an enthalpy change of -480 J/g (dry weight basis). The peak temperature for the endothermic reactions are provided at maximum enthalpy change, and the magnitude of the enthalpy changes is provided for each transition. The first transition represents the endothermic reaction associated with the evaporation of free and interstitial water. The second and third transitions probably represent the energy (heat) required to remove bound water from hydrated compounds such as aluminum hydroxide or to melt salts such as sodium nitrate. The results reported in Table 4-4 are on a wet weight basis.

Table 4-4. Differential Scanning Calorimetry Results for Tank 241-TX-107.[1]

Sample Number[2]	Auger	Run	Sample Weight mg	Transition 1 Peak Temp (°C)	Transition 1 ΔH (J/g)	Transition 2 Peak Temp (°C)	Transition 2 ΔH (J/g)	Transition 3 Peak Temp (°C)	Transition 3 ΔH (J/g)
0394	96-AUG-001	1	10.08	101.8	392.0	304.1	505.7	---	---
		2	24.68	113.7	313.9	297.3	393.4	399.1	10.3
0392	96-AUG-002	1	16.14	116.0	909.7	303.1	301.8	---	---
		2	22.29	120.5	1,129	303.1	213.4	---	---

Notes:

ΔH = change in enthalpy (negative sign denotes exothermic reaction)

[1]Raphael (1996)
[2]All sample numbers begin with 'S96T00'.

4.4 HEADSPACE FLAMMABILITY SCREENING RESULTS

As requested in the SAP (Bell 1996), the tank headspace was sampled and analyzed for the presence of flammable gases. The safety screening DQO upper threshold for flammable gas concentration is 25 percent of the LFL. Also measured were the volume percent oxygen gas, total organic vapor, and ammonia gas. Prior to auger sampling, all gases were monitored for approximately 3 hours at the breather filter, above the risers to be sampled (breathing zone), in the riser (0.91 m [3 ft] below the top of the riser), and within the headspace (6 m [20 ft] below the top of the riser). The results of the combustible gas monitoring are presented in Table 4-5, and show that the flammable vapor concentration in the tank headspace is 0 percent of the lower flammability limit (LFL).

Table 4-5. Vapor Flammability Screening for Tank 241-TX-107.[1] (2 sheets)

Riser	Location	Flammable Vapor Concentration as a Percent of LFL	Volume Percent Oxygen Gas	Total Organic Vapor Range (ppm)	Ammonia Gas Range (ppm)
9A	Breather filter	0 %	~ 21 %	0 - 5.2	0 - 85
	Riser (0.91 m [3 ft] below top of riser)	0 %	~ 21 %	3.3 - 5.2	40 - 85
	Tank headspace (6 m [20 ft] below top of riser)	0 %	~ 21 %	6.7 - 12.1	85 - 250
	Breathing zone	0 %	~ 21 %	3	40
10B	Breather filter	0 %	~ 21 %	0 - 10	0 - 200
	Riser (0.91 m [3 ft] below top of riser)	0 %	~ 21 %	0 - 15.2	10 - 200
	Tank headspace (6 m [20 ft] below top of riser)	0 %	~ 21 %	0 - 15	~ 200
	Breathing zone	0 %	~ 21 %	0	0

Note:
[1]Raphael (1996)

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5.0 INTERPRETATION OF CHARACTERIZATION RESULTS

The purpose of this chapter is to discuss the overall quality and consistency of the current sampling results for tank 241-TX-107, and to assess and compare these results against historical information and program requirements.

5.1 ASSESSMENT OF SAMPLING AND ANALYTICAL RESULTS

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

5.1.1 Field Observations

The safety screening DQO objective that vertical profiles be obtained from at least two widely spaced risers was fulfilled. When auger sample 96-AUG-001 was extruded, a zip cord was found wrapped around the top flutes. This was easily freed and disposed of, and did not interfere with recovery of the sample. Thirty-eight centimeters (15 in.) of sample were expected to be recovered from auger sample 96-AUG-001. Waste material was found on the bottom 17 inches of the auger (54.3 g), but there was only a thin coating of material, indicating that the overall recovery was poor. The waste in tank 241-TX-107 may be very soft or runny and not easily sampled with an auger sampler. The recovery from auger 96-AUG-002 was markedly less. Nineteen centimeters (7.5 in.) of waste was expected to be recovered; only a thin coating of material was observed, this time on the lower 14 cm (5.5 in.) of the auger. Just 3.7 g of waste was recovered.

The photographs of the auger samples show that liquid had dripped from the auger, indicating that the samples were very wet. However, the mean weight percent water result was only 22.2 percent, indicating a fairly dry sample. The discrepancy between the sample appearance and the analytical results suggests that the sample may have dried out prior to analysis.

5.1.2 Quality Control Assessment

The usual QC assessment includes an evaluation of the appropriate standard recoveries, spike recoveries, duplicate analyses, and blanks that were performed in conjunction with the chemical analyses. All the pertinent QC tests were conducted on the 1996 auger samples, allowing a full assessment regarding the accuracy and precision of the data. The SAP (Bell 1996) referred to the laboratory quality assurance project plans for the specific QC criteria.

Standard and spike recoveries for the three primary analytes tested were within the limits specified in the SAP (Bell 1996). The precision (estimated by the relative percent difference, defined as the absolute value of the difference between the primary and duplicate samples, divided by their mean, times one hundred) for the total alpha analysis of 96-AUG-002 was above the target level. However, reruns were not required because the results were well below the safety screening limit for total alpha and improving the precision would not have changed any conclusions about the waste.

5.1.3 Data Consistency Checks

Comparisons of different analytical methods can help to assess the consistency and quality of the data. Examples would be the calculation of mass and charge balances, and the comparison of the inductively coupled plasma atomic emission spectroscopy phosphorus and sulfur results with the ion chromatography phosphate and sulfate results. Because of the small number of analytes, no data consistency checks were possible.

5.2 COMPARISON OF HISTORICAL WITH ANALYTICAL RESULTS

The only historical analytical data available for tank 241-TX-107 were from several supernatant samples taken in 1975. Because the 1975 samples are not thought to be representative of the supernatant currently in the tank, and the 1996 sampling event only retrieved solids, no comparisons were attempted between the two data sets.

5.3 TANK WASTE PROFILE

Visual descriptions of the samples from both augers were the same (wet, homogeneous sludge, dark brown to black, with adhesive properties), indicating possible vertical and horizontal uniformity in the waste. Information on the vertical disposition of the tank contents was also available from two other sources. Hanlon (1996) predicts a small amount of supernatant overlying the solid portion (all saltcake) of the tank contents, whereas the TLM (Agnew et al. 1995) predicts a small amount of supernatant overlying three different types of solid waste (see Section 2). Thus, the waste sample descriptions and the TLM both indicate that a thin supernatant layer overrides the solids layer, and the waste descriptions alone imply a possible vertical homogeneity within the solids layer.

Because the sample recovery was small, the material recovered was not partitioned into half augers and was analyzed on a whole-auger basis. As a result, an evaluation of vertical stratification in the tank was not possible. However, it was possible to assess horizontal variability between the two auger samples. This was done using an analysis of variance (ANOVA) statistical technique. Calculations were performed on the weight percent water and total alpha activity results. The ANOVA generates a p-value which is compared with a standard significance level ($\alpha = 0.05$). If a p-value is below 0.05, there is sufficient evidence to conclude that the sample means are significantly different from each other.

The results of the ANOVA indicated that there may be significant differences between the two augers for the weight percent water data (p-value = 0.051) because the p-value is right at the threshold level. However, the total alpha activity data (p-value = 0.398) did not exhibit horizontal differences. This information, coupled with the visual description of the samples, suggests that the tank contents may be uniform horizontally. Additional analytical results are needed to determine horizontal uniformity of the tank.

5.4 COMPARISON OF TRANSFER HISTORY WITH ANALYTICAL RESULTS

The Agnew (1996) predictions (Table 2-4) for weight percent water and total alpha activity can be compared with the analytical results of the 1996 auger sampling event. This comparison is presented for informational purposes only. The HTCE values have not been validated and thus should be used with caution. Large differences exist between the analytical results and the HTCE estimates. The analytical result for weight percent water was 22.2 percent, as compared to the Agnew (1996) estimate of 73.7 percent. The HTCE estimate of 73.7 percent water is consistent with the fact that liquid was present in the sampling tray (see Section 5.1.1); this agreement is an additional reason for believing that the sample had dried out prior to the TGA analysis. (Because the waste was distributed as a thin coating on the auger samplers, moisture may have evaporated from the samples while they were exposed to the hot cell environment.)

The Agnew value for total alpha activity was assumed to be the same as plutonium, because no other alpha emitters were given. The analytical result for total alpha activity was 4.52 μCi/g, while the HTCE plutonium estimate was 0.00894 μCi/g. The plutonium concentration may have been underestimated by the HTCE. According to Agnew et al. (1996), a number of transfers of HEDTA destruction waste were made between tank 241-TX-118 and tank 241-TX-107 during 1975 and 1976. During this time, tank 241-TX-118 was also receiving high-plutonium Z Plant waste. While the TLM indicates that tank 241-TX-107 contains no Z Plant waste, some carryover of plutonium from tank 241-TX-118 to tank 241-TX-107 may have occurred during this period.

5.5 EVALUATION OF PROGRAM REQUIREMENTS

The two auger samples retrieved from tank 241-TX-107 in January 1996 were taken to meet the requirements of the safety screening DQO (Dukelow et al. 1995) and to determine whether this tank has been appropriately categorized for safety issues. A discussion of the specific requirements of this DQO and a comparison of the analytical data to defined concentration limits is presented in this section.

5.5.1 Safety Evaluation

Data criteria identified in the safety screening DQO are used to assess the safety of the waste in tank 241-TX-107. For a proper safety assessment, vertical profiles of the waste from at least two widely spaced risers are required. This requirement was met. However, sample 96-AUG-001 could not be divided into half-augers as required by the DQO. Of the five primary analyses required by the DQO, three have decision criteria thresholds which, if exceeded, could warrant further investigation to ensure tank safety. These three analyses include DSC to evaluate the fuel content, a determination of the total alpha activity to evaluate the criticality potential, and a measurement of the flammability of the tank headspace gases. Table 5-1 lists the applicable safety issues, decision variables and thresholds, and the mean analytical results from the 1995 sampling event.

The safety screening DQO established a notification limit of -480 J/g (dry weight basis) for the DSC analyses (Dukelow et al. 1995). No exothermic reactions were observed in any of the tank 241-TX-107 samples.

The potential for criticality can be assessed from the total alpha activity data. The safety screening notification limit is 1 g/L, or 41 μCi/g as specified in the SAP (Bell 1996). The calculated overall mean was 4.52 μCi/g, well below the 41 μCi/g limit. The statistical calculation of a 95 percent upper confidence limit for the two sample/duplicate pairs yielded results of 15.41 μCi/g and 3.77 μCi/g, both of which were also below the DQO limit. The 41 μCi/g limit is based on an assumed density of 1.5 g/mL; the limit would be lower for wastes with densities above 1.5 g/mL. Although densities were not measured for the tank 241-TX-107 auger samples, the total alpha results are low enough that the lack of density measurements is not a concern (the bulk density would have to be 4 g/mL for the 95 percent confidence limit to reach the DQO limit).

Although density measurements were not made, this had no impact on results, except that total alpha inventory was not determined.

The flammability of the gas in the tank headspace is an additional safety screening DQO consideration. The notification limit for flammable gas concentration is 25 percent of the LFL. The analytical result was 0 percent of the LFL (see Section 4.4), satisfying the DQO limit.

Table 5-1. Safety Screening Data Quality Objective Decision Variables and Criteria.

Safety Issue	Primary Decision Variable	Decision Criteria Threshold	Mean Analytical Result
Ferrocyanide/organics	Total fuel content	-480 J/g	No exothermic reactions
Criticality	Total alpha activity	41 μCi/g	4.52 μCi/g
Flammable gas	Flammable gas	25 % of the LFL	0 % of the LFL

Another factor in assessing tank safety is the heat generation and temperature of the waste. Heat is generated in the tanks from radioactive decay. No estimate of the tank heat load was possible from the analytical data because the primary heat-producing radionuclides were not evaluated. However, (Brevick 1995a) estimates a heat load of 57.7 W (197 Btu/hr). Another estimate, based on the tank headspace temperature, was 292 W (998 Btu/hr) (Kummerer 1994). Both of these estimates are well below the limit of 11,700 W (40,000 Btu/hr) that separates high- and low-heat load tanks (Bergmann 1991).

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6.0 CONCLUSIONS AND RECOMMENDATIONS

The waste in tank 241-TX-107 was auger sampled in January 1996 to meet requirements of the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995). As mandated by this DQO, analyses for energetics, total alpha activity, flammability and weight percent water were performed on the recovered waste. Although required by the safety screening DQO, density analyses were not performed due to insufficient sample recovery. The missing density measurement did not impact data interpretation. Of the five safety screening analytes, three (energetics, total alpha activity, and flammable gas) have decision criteria thresholds which, if exceeded, could warrant further investigation to ensure the tank safety. These decision criteria and the pertinent analytical results are summarized below. All samples were analyzed at the Westinghouse Hanford Company 222-S Laboratory.

All analytical results satisfied the requirements of the safety screening DQO. No exothermic reactions were observed in the DSC analysis. The maximum total alpha activity was 6.96 μCi/g, with a mean of 4.52 μCi/g and a maximum upper limit of the one-sided 95 percent confidence interval of 15.41 μCi/g. All results and the upper 95 percent confidence interval were lower than the notification limit of 41 μCi/g. Finally, the concentration of flammable gas in the tank headspace was 0 percent of the LFL, well below the DQO limit of 25 percent of the LFL. Based on the results of the analyses and the decision criteria of the safety screening DQO, the waste in this tank may be categorized as "safe."

Another factor in assessing the safety of the tank is the heat load. Because radionuclide analyses were not conducted, it was not possible to calculate tank heat load based on analytical results. The heat load estimate in HTCE was 57.7 W (197 Btu/hr), and the heat load based on headspace temperature was 292 W (998 Btu/hr) (Kummerer 1994). Both of these values are well below the 11,700-W (40,000-Btu/hr) limit separating high- and low-heat load tanks.

Data consistency checks and mass balance calculations were not possible because only a limited number of analyses were performed. Due to the small amount of waste in the tank and the limited sample recovery an assessment of vertical variability or tank layering was not possible. Based on the very limited data obtained from the two auger samples, statistical analyses suggest that the tank may be uniform horizontally. Additional data would be necessary to verify this and to determine the extent of any heterogeneity.

The TGA analysis indicated a water content of 22.2 wt%. However, the waste may have dried out prior to analysis and the actual water content may be much higher. Both the appearance of the auger samples and the HTCE estimate suggest that the waste should have a high water content.

Should it become necessary to resample tank 241-TX-107, core sampling is recommended. Core sampling may result in better sample recoveries than auger sampling.

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