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7. Abstract

This document summarizes the information on the historical uses, present status, and the sampling and analysis results of waste stored in tank 241-B-103. This report supports the requirements of Tri-Party Agreement Milestone M-44-08.

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Tank Characterization Report for Single-Shell Tank 241-B-103

J. M. Conner

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EXECUTIVE SUMMARY

This tank characterization report summarizes the information on the historical uses, present status, and the sampling and analysis results of waste stored in single-shell underground storage tank 241-B-103 at the Hanford Site in Washington State. This report supports the requirements of *Hanford Federal Facility Agreement and Consent Order* Milestone M-44-08[1].

Tank 241-B-103 is located in the B Tank Farm in the Hanford Site's 200 East Area. The maximum capacity of tank B-103 is 2,010 kiloliters (530 kilogallons). The tank began receiving waste cascaded from tank 241-B-102 in December 1945. During its operating history, the tank received metal waste, cladding waste, various supernate streams, and waste from unknown sources. Ion exchange waste and organic wash waste may have been added as well.

A description and status of the tank are summarized in Table ES-1 . The tank presently contains 190 kiloliters (51 kilogallons) of waste in the form of wet saltcake and metal waste sludge. The latest tank photographs (from 1988) show a dark, wet surface, with crust near the walls and isolated pools of liquid. The median temperature in the tank air space over the past 20 years has been 17 °C (62 °F). No thermocouples remain in the waste as the waste level is just 35 centimeters (14 inches).

[1]Ecology, 1994, *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.

Data from the May-June 1995 auger sampling event are described in this report. The auger samples were analyzed for safety screening[2] and organic[3] data quality objectives. One sample was retained for pretreatment studies. Data from previous samples (taken in the 1970s) are presented in Appendix B, but do not represent the current tank contents. Data from the February 1995 vapor sampling and analysis event are presented in *Tank 241-B-103 Vapor Sampling and Analysis Tank Characterization Report*[4].

The results of the auger sample tests indicate that the tank waste has negligible fuel value (no detectable exotherms and low concentrations of total organic carbon), and therefore the tank should be considered for removal from the Organics Watch List. The average moisture content of the solid auger samples was 45 percent, well above the minimum criterion of 17 percent stated in the safety screening data quality objective. The total alpha levels of the 1995 auger samples averaged 0.133 μCi/g, far below the safety screening limit of 41 μCi/g, indicating that there are no criticality concerns.

---

[2]Babad, H., and K. S. Redus, 1994, *Tank Safety Screening Data Quality Objective*, WHC-SD-WM-DQO-012, Westinghouse Hanford Company, Richland, Washington.

[3]Babad, H., S. M. Blacker, and K. S. Redus, 1994, *Data Quality Objective to Support Resolution of the Organic Fuel Rich Tank Safety Issue*, WHC-SD-WM-DQO-006, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

[4]Huckaby, J. L., 1995, *Tank 241-B-103 Vapor Sampling and Analysis Tank Characterization Report*, WHC-SD-WM-ER-438, Westinghouse Hanford Company, Richland, Washington.

The tank vapor space was screened prior to the 1995 vapor and auger sampling events; no flammability concerns were detected. Results of vapor sampling in February 1995[4] also indicate that there are no flammability concerns with the headspace gases in tank B-103.

Based on a review of the historical data and 1995 vapor and auger sampling results, the tank does not appear to have any immediate safety concerns.

The estimated tank inventory, taken from the Historical Tank Content Estimate report[5], is summarized in Table ES-2.

[5]Brevick, C. H., L. A. Gaddis, and W. W. Pickett, 1994, *Historical Tank Content Estimate for the North East Quadrant of the Hanford 200 East Area*, WHC-SD-WM-ER-349, Westinghouse Hanford Company, Richland, Washington.

Table ES-1. Tank 241-B-103 Summary Status.

Tank description	
Type	Single-shell
Constructed	1944-44
In-service	1945
Diameter	22.9 meters (75 feet)
Usable depth	4.78 meters (15.7 feet)
Operating capacity	2,010 kiloliters (530 kilogallons)
Bottom shape	Dish
Ventilation	Passive (breather filter)
Tank status	
Total waste volume (July 1995)	190 kiloliters (51 kilogallons)
Sludge volume	10 kiloliters (3 kilogallons)
Saltcake volume	180 kiloliters (48 kilogallons)
Supernatant volume	0 kiloliters (0 kilogallons)[1]
Surface level (manual tape)	35 centimeters (14 inches)
Temperature, 1974-1995 (vapor space)	17 °C (62 °F)
Integrity category	Assumed leaker
Watch List status	Organics Watch List
Sampling dates	
Two auger samples	May/June 1995
Vapor sampling	February 1995
Liquid sampling	May 1975 and September 1975
Service status	
Inactive (1978)	
Interim stabilized (1985)	
Intrusion prevention (1985)	

Note:

[1]Although historical estimates state that the tank contains no supernate, pools of liquid have been observed.

Table ES-2. Summary of Estimated Tank Contents (Major Constituents).

Physical properties			
Total solid waste	3.44E+05 kg		
Heat load	2.97E-02 kW (102 Btu/hr)		
Bulk density	1.54 (g/cm^3)		
Void fraction	0.611		
Water wt%	56.3		
TOC wt% C (wet)	0		
Chemical constituents	mole/L	ppm (μg/g)	kg
Na^{+1}	9.70	1.45E+05	4.98E+04
Al^{+3}	3.91E-02	685	236
Fe^{+3} (total Fe)	3.71E-02	1.34E+03	462
Cr^{+3}	1.20E-02	404	139
Bi^{+3}	5.83E-03	790	272
Zr [as $ZrO(OH)_2$]	1.17E-02	690	237
Ni^{+2}	1.98E-02	755	260
Ca^{+2}	0.148	3.86E+03	1.33E+03
OH^{-1}	0.724	7.99E+03	2.75E+03
$NO3^{-1}$	2.80	1.13E+05	3.87E+04
$NO2^{-1}$	0.181	5.42E+03	1.86E+03
$CO3^{-2}$	0.263	1.02E+04	3.52E+03
$PO4^{-3}$	1.40	8.60E+04	2.96E+04
$SO4^{-2}$	0.643	4.01E+04	1.38E+04
Si (as SiO_3^{-2})	7.78E-02	1.42E+03	488
F^{-1}	0.777	9.58E+03	3.30E+03
Cl^{-1}	5.90E-02	1.36E+03	467
Radiological constituents			
Pu		6.89E-03 (μCi/g)	3.95E-02 (kg)
U	5.41E-02 (M)	8.36E+03 (μg/g)	2.88E+03 (kg)
Cs	1.71E-02 (Ci/L)	11.1 (μCi/g)	3.82E+03 (Ci)
Sr	7.85E-03 (Ci/L)	5.09 (μCi/g)	1.75E+03 (Ci)

Table ES-2. Summary of Estimated Tank Contents (Major Constituents).

Notes:

Btu/hr	=	British thermal units per hour	kW	=	kilowatt
cm	=	centimeter	mole/L	=	moles per liter
g	=	gram	ppm	=	parts per million
kg	=	kilogram	TOC	=	total organic carbon
kgal	=	kilogallon	μg/g	=	micrograms per gram

Unknowns in tank inventory are assigned by tank layer model (TLM).

Table taken from the HTCE (Brevick et al. 1994b). Supernate not included.

TABLE OF CONTENTS

1.0 INTRODUCTION 1-1
1.1 PURPOSE 1-1
1.2 SCOPE 1-1

2.0 HISTORICAL TANK INFORMATION 2-1
2.1 TANK STATUS 2-1
2.2 TANK DESIGN AND BACKGROUND 2-2
2.3 PROCESS KNOWLEDGE 2-6
2.3.1 Waste Transfer History 2-6
2.3.2 Historical Estimation of Tank Contents 2-10
2.4 SURVEILLANCE DATA 2-12
2.4.1 Surface Level Readings 2-13
2.4.2 Internal Tank Temperatures 2-13
2.4.3 Tank 241-B-103 Photographs 2-13

3.0 TANK SAMPLING OVERVIEW 3-1
3.1 DESCRIPTION OF 1975 SAMPLING EVENT 3-1
3.1.1 Sample Handling (1975 Liquid Samples) 3-1
3.1.2 Sample Analysis (1975 Liquid Samples) 3-1
3.2 DESCRIPTION OF 1995 AUGER SAMPLING EVENT 3-1
3.2.1 Field Sampling Information 3-1
3.2.2 Sample Handling (1995 Auger Samples) 3-3
3.2.3 Sample Analysis (1995 Auger Samples) 3-3

4.0 ANALYTICAL RESULTS FROM 1995 AUGER SAMPLES
AND WASTE INVENTORY ESTIMATES 4-1
4.1 OVERVIEW 4-1
4.2 TOTAL ALPHA ACTIVITY 4-2
4.3 THERMODYNAMIC ANALYSES 4-3
4.3.1 Thermogravimetric Analysis 4-3
4.3.2 Differential Scanning Calorimetry 4-4
4.4. TOTAL ORGANIC CARBON ANALYSES 4-4
4.5 INORGANIC ANALYSES 4-6

5.0 INTERPRETATION OF CHARACTERIZATION RESULTS 5-1
5.1 ASSESSMENT OF SAMPLING AND ANALYTICAL RESULTS 5-1
5.1.1 Field/Laboratory Observations and Assessment of Sampler Bias . . . 5-1
5.1.2 Quality Control Assessment of Analytical Data 5-2
5.1.3 Data Consistency Checks 5-4
5.2 COMPARISON OF ANALYTICAL RESULTS 5-4
5.3 TANK WASTE PROFILE 5-4
5.4 COMPARISON OF ANALYTICAL AND TRANSFER
HISTORY INFORMATION 5-5

CONTENTS (Continued)

5.5 EVALUATION OF PROGRAM REQUIREMENTS 5-5
5.5.1 Safety Evaluation 5-5
5.5.2 Operational Evaluations 5-6
5.5.3 Environmental Evaluation 5-6
5.5.4 Process Development Evaluation 5-6

6.0 CONCLUSIONS AND RECOMMENDATIONS 6-1
6.1 CONCLUSIONS 6-1
6.2 RECOMMENDATIONS 6-1

7.0 REFERENCES 7-1

APPENDICES

A TYPICAL TGA AND DSC SCANS FOR TANK 241-B-103 . . . . . A-1

B HISTORICAL SAMPLING RESULTS B-1

LIST OF FIGURES

2-1 Tank 241-B-103 Riser Location 2-3

2-2 241-B-103 Tank Riser Section 2-5

2-3 Tank Layer Model 2-11

2-4 Tank Level and Transfer History 2-14

2-5 Tank Level History, 1981 Through 1985 2-15

2-6 Tank 241-B-103 Weekly High Temperature Plot 2-16

2-7 Tank 241-B-103 Photographic Montage 2-17

LIST OF TABLES

2-1 Summary Tank Contents Status 2-1

2-2 Tank 241-B-103 Risers 2-4

2-3 Tank 241-B-103 Major Transfers 2-6

2-4 Solids Composite Inventory Estimate - Single-Shell Tank 241-B-103 2-11

3-1 1995 Auger Sample Information 3-2

4-1 Data Presentation Tables for Tank 241-B-103 4-1

4-2 Tank B-103 Total Alpha Activity Results 4-2

4-3 Tank B-103 Thermogravimetric Analysis Results 4-4

4-4 Tank B-103 Differential Scanning Calorimetry Results 4-5

4-5 Total Organic Carbon Results for Tank B-103 Auger Samples 4-5

4-6 Tank B-103 Total Inorganic Carbon Results 4-6

5-1 Assessment of Sampler Bias for Selected Analytes 5-2

5-2 Quality Control Summary for Tank B-103 Auger Samples 5-3

LIST OF TERMS

CW	cladding waste (also called coating waste)
CWP	cladding waste - PUREX
DQO	data quality objective
DSC	differential scanning calorimetry
EB	evaporator bottoms
FIC	Food Instrument Corporation
HDW	Hanford Defined Waste list
HTCE	historical tank content estimate
MW	metal waste
OWW	organic wash waste
PUREX	plutonium-uranium extraction
RPD	relative percent difference
SU	supernatant
TCP	tank characterization plan
TGA	thermogravimetric analysis
TIC	total inorganic carbon
TLM	tank layer model
TOC	total organic carbon
TWRS	Tank Waste Remediation System
WSTRS	Waste Status and Transaction Record Summary
wt%	weight percent

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1.0 INTRODUCTION

This tank characterization report presents an overview of single-shell tank 241-B-103 and its waste contents. It provides estimated concentrations and inventories for the waste components based on the tank transfer history and assumed waste stream compositions. This report presents and interprets the results of the May-June 1995 auger sampling event. February 1995 vapor sampling results are reported by Huckaby (1995). Tank 241-B-103 is not in active service and no further transfers of waste are expected until the tank waste is retrieved (current waste management strategy is to retrieve all tank wastes, pretreat to separate into low- and high-level waste streams, and vitrify each stream prior to disposal). This report supports the requirements of *Hanford Federal Facility Agreement and Consent Order* Milestone M-44-08 (Ecology et al. 1994).

1.1 PURPOSE

The purpose of this report is to summarize information about the use and contents of tank 241-B-103. When possible, this information will be used to assess issues associated with safety, operations, environmental and process development activities. This report also provides a reference point for obtaining more detailed information about tank 241-B-103.

1.2 SCOPE

The design and configuration of the tank are described, along with the waste history and an estimate of the contents. The discussion of sampling data focuses on the auger samples taken in 1995. Results of the February 1995 vapor sampling event are presented in *Tank 241-B-103 Vapor Sampling and Analysis Tank Characterization Report* (Huckaby 1995).

The auger samples taken in 1995 were intended to support screening of the tank for potential safety issues, including total organic carbon (TOC) content. The pretreatment program had also requested sample material from tank 241-B-103 for washing and leaching tests (Kupfer et al. 1995). A limited selection of chemical and radiochemical properties were measured on these auger samples (Conner 1995). Test results were evaluated against the criteria in the *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994, subsequently revised) and the *Data Quality Objective to Support Resolution of the Organic Fuel Rich Tank Safety Issue* (Babad et al. 1994). The estimated chemical and radiochemical inventory of the tank (from models based on tank transfer history and waste streams assumed to remain in the tank) is presented.

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2.0 HISTORICAL TANK INFORMATION

This section describes the contents of tank 241-B-103 based on historical information. The first part of the section details the current condition of the tank, followed by discussions on the tank's background, transfer history, and waste sources, including an estimate of the current contents based on the process history. The final part of the section details any surveillance data available 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/crust layers of the tank (i.e., slurry growth from gas evolution with subsequent burping and collapse, or shrinkage due to drying). Drywell activity monitoring is noted where anomalies may suggest leaking of nearby tanks. Temperature data are provided to evaluate the heat-generating characteristics of the waste.

2.1 TANK STATUS

The *Waste Tank Status Summary Report for Month Ending January 31, 1995* (Hanlon 1995) reports that tank 241-B-103 contained 223 kL (59 kgal) of waste classified as non-complexed. However, recent tank level information (Figure 2-5) indicates that a more accurate estimate of the tank volume is 190 kL (51 kgal). The composition of the waste, is shown in Table 2-1. The estimated sludge volume is taken from Brevick et al. (1994b). The estimated saltcake volume is also taken from Brevick et al. (1994b), but revised to account for the decrease in volume noted above. Both Hanlon (1995) and Brevick et al. (1994b) report that the tank contains no supernate; however, in-tank photographs and observations from the May-June 1995 auger sampling event indicate that there are isolated pools of liquid.

Table 2-1. Summary Tank Contents Status.

Waste form	kL (kgal)
Total waste	190 (51)
Supernate	0 (0)
Drainable interstitial liquid	0 (0)
Drainable liquid remaining	0 (0)
Pumpable liquid remaining	0 (0)
Sludge	10 (3)
Saltcake	180 (48)

Tank 241-B-103 is on the Organics Watch List, as one document states that the tank has an organic content of 11.4 wt.% and 3.3 wt.% TOC (Hanlon 1995). However, Brevick et al. (1994b) estimates that the waste contains no TOC. Results of auger sampling in 1995

(presented in Section 4.4) indicate that the TOC content of the tank is very low. Tank 241-B-103 is categorized as an assumed leaker, with interim stabilization and intrusion prevention completed. Hanlon (1995) lists the primary sources of waste as first and second cycle waste from B Plant, and evaporator bottoms from in-tank solidification. However, the Tank Layer Model (Agnew et al. 1994), estimates that the tank contains mostly saltcake, with a small amount of metal waste.

2.2 TANK DESIGN AND BACKGROUND

The B Tank Farm is a first-generation tank farm, built between 1943-44, and consists of twelve 2,010-kL (530-kgal) tanks and four 208-kL (55-kgal) tanks. These tanks were designed for non-boiling waste with a maximum fluid temperature of 104° C (220 °F). As with all first-generation tank farms, equipment to monitor the waste is sparse.

Tank 241-B-103 entered service in December 1945. The single-shell tank is constructed of 300-mm (1-ft)-thick reinforced concrete with a 6.4-mm (0.25-in.) mild carbon steel liner (ASTM A283 Grade C) on the bottom and sides and a 380-mm (1.25-ft)-thick domed concrete top. The top of the steel liner is 550-cm (18-ft) above the bottom of the tank (at the side wall). The tank has a dished bottom, with a maximum depth of 30-cm (12-in) below the side wall of the tank and a 1.2-m (4-ft) radius knuckle. The tank is set on a reinforced concrete foundation. A three-ply cotton fabric waterproofing was applied over the foundation and steel tank. Four coats of primer paint were sprayed on all exposed interior tank surfaces. The tank ceiling dome was covered with three applications of magnesium zincfluorosilicate wash. Lead flashing was used to protect the joint where the steel liner met the concrete dome. Asbestos gaskets were used to seal the manholes in the tank dome. The tank was waterproofed on the sides and top with tar and gunnite. The tank was covered with approximately 2.2 m (7.25 ft) of overburden (See Figure 2-2).

Tank 241-B-103 is the last tank in a three-tank cascade. The bottom (sidewall) elevation of tank 241-B-101 is 187.8 m (616 ft) above mean sea level, cascading to tank 241-B-102 at 187.5 m (615 ft) which then cascades to tank 241-B-103 at 186.1 m (614 ft). The cascade overflow height is approximately 4.86 m (192 in.) from the tank bottom (at the sidewall) and 60-cm (2 ft) below the top of the steel liner.

The surface level is monitored through riser 1 with a Food Instrument Corporation (FIC) level gauge. The thermocouple tree is in riser 4. A list of tank 241-B-103 risers, showing the size and relative location, is provided in Table 2-2. A plan view that depicts the riser configuration is shown as Figure 2-1. This tank is passively ventilated.

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-B-103 has ten risers. Risers 2 and 7, both 300 mm (12 in.) in diameter, are free of obstructions. Both were used for auger sampling in 1995.

Figure 2-1. Tank 241-B-103 Riser Location.

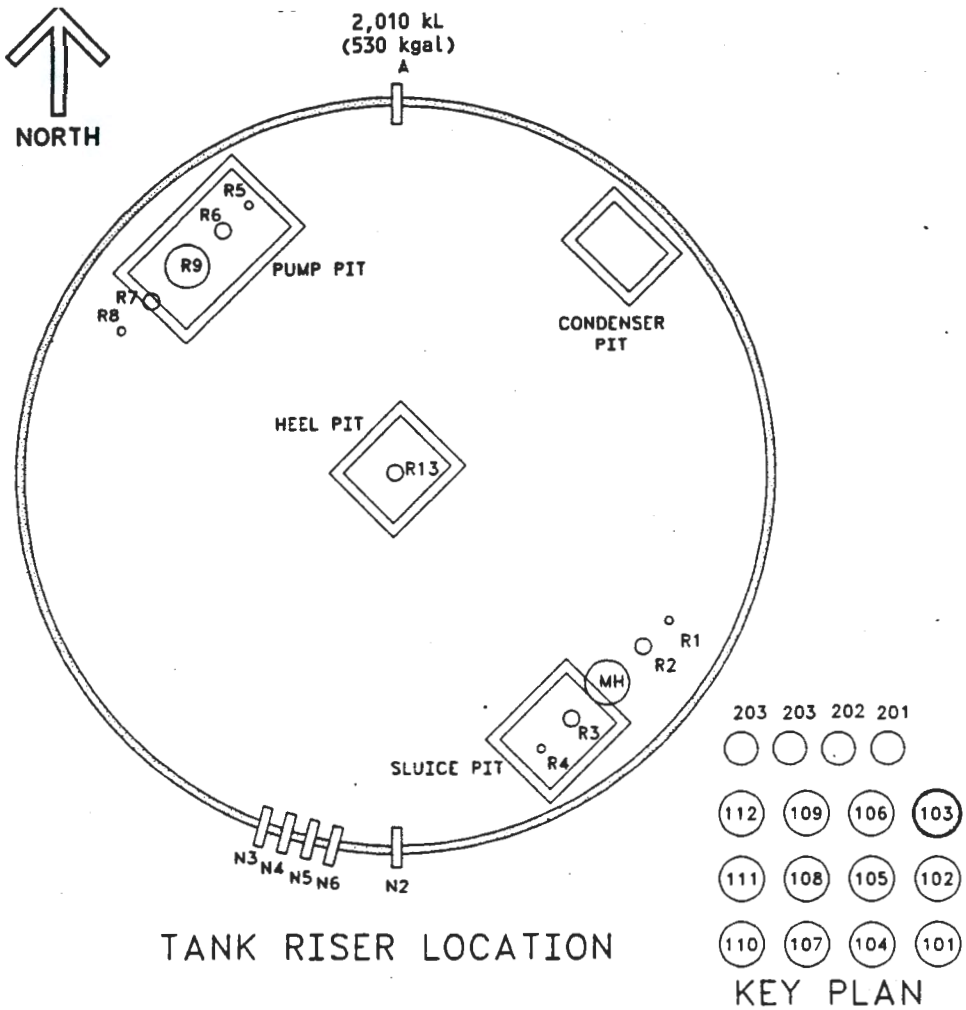


Table 2-2. Tank 241-B-103 Risers.

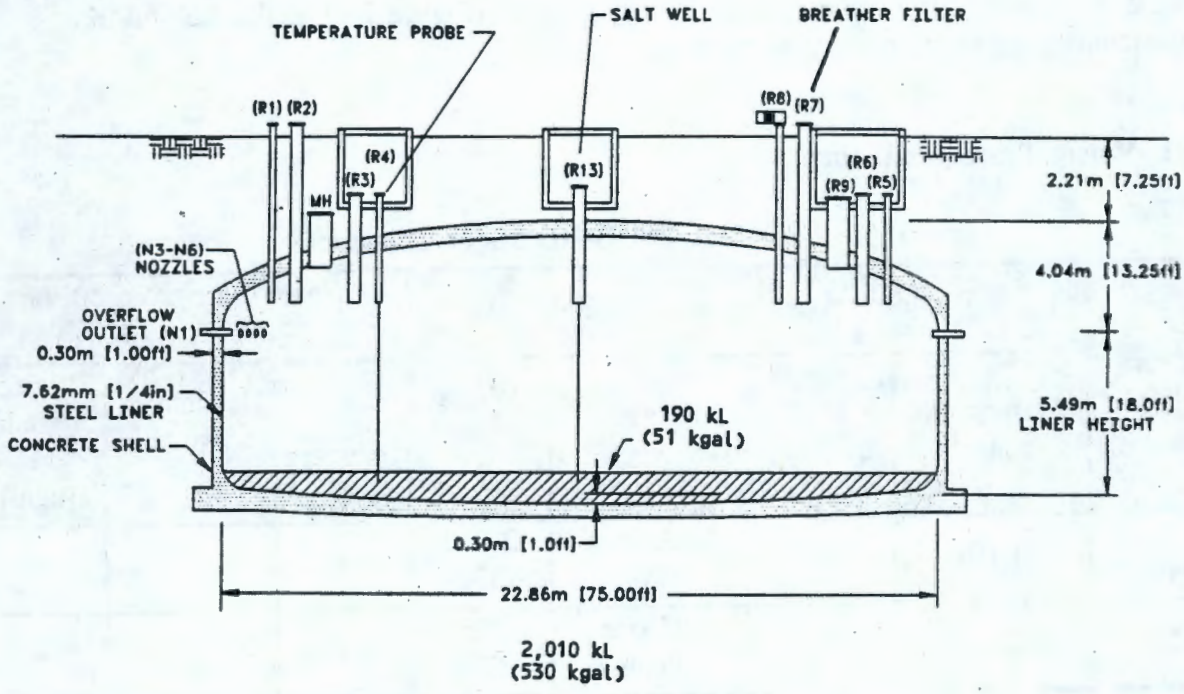
No.	Dia. (in.)	Description and comments
1	4	FIC level gauge
2	12	Flange/B-222 observation port
3	12	(Sluicing riser) WC
4	4	Temperature
5	4	(Dip leg) WC
6	12	(Sluicing riser) WC
7	12	Observation port, breather filter on "Y" adaptor
8	4	Unidentified obstruction*
9	42	(Sludge pump) WC
13	12	Saltwell screen WC

Notes:

FIC = Food Instrument Corporation
WC = weather covered

* When the breather filter was moved to riser 7 in 6/95, it was suggested in work package ES-95-192 that the obstruction was a Liquid Observation Well (LOW); however, no mention of an LOW has been found in historical documentation nor is an LOW being currently monitored for this tank.

Figure 2-2. 241-B-103 Tank Riser Section.



TANK RISER SECTION

2.3 PROCESS KNOWLEDGE

These sections present the transfer history and estimated contents of tank 241-B-103. Section 2.3.1 and Table 2-3 present some major transfers of waste that involved tank 241-B-103, along with a narrative describing the transfers. The main source of transfer information is the *Waste Status and Transaction Record Summary for the Northeast Quadrant* (Agnew et al. 1994), supplemented with information from *A History of the 200 Area Tank Farms* (Anderson 1990). Some transfers are unaccounted for, resulting in discrepancies in Table 2-3. The tank level and transfer history graphic (Figure 2-4) is also helpful in understanding the waste history of the tank.

2.3.1 Waste Transfer History

Table 2-3. Tank 241-B-103 Major Transfers.

Year: Qtr	Waste received by tank 241-B-103				Waste transferred out of tank 241-B-103		
	Transaction source	# of transfers	Waste type	Waste amount kL (kgal)	# of transfers	Destination (waste type)	Waste amount kL (kgal)
1945:4-1946:1	B-102	4	Unknown (MW?)	2,010 (530)	-	-	-
1953:1	BY-102	1	SU (for sluicing?)	265 (70)	-	-	-
1953:1	B-101	1	Sludge (MW?)	2,010 (530)	-	-	-
1953:1	B-102	1	Sludge (MW?)	2,010 (530)	-	-	-
1953:1-1953:2	-	-	-	-	4	UR (Sludge)	6,240 (1,649)
1954:1	B-105	2	SU	2,050 (542)	-	-	-
1957:2	-	-	-	-	1	B-106 (SU)	269 (71)
1957:3	-	-	-	-	1	C-109 (T19)	1,030 (271)
1963:3-1963:4	B-102	2	Unknown	810 (214)	-	-	-
1963:3	Unknown	1	CW	1,060 (281)	-	-	-

Table 2-3. Tank 241-B-103 Major Transfers.

Year: Qtr	Waste received by tank 241-B-103				Waste transferred out of tank 241-B-103		
	Transaction source	# of transfers	Waste type	Waste amount kL (kgal)	# of transfers	Destination (waste type)	Waste amount kL (kgal)
1964:2	Unknown	1	CWP	125 (33)	-	-	-
1969:1-1969:2	B-108	3	SU	3,160 (836)	-	-	-
1969:2-1969:3	-	-	-	-	3	BY-103 (SU)	19,780 (5,226)
1969:2	B-104	1	SU	469 (124)	-	-	-
1969:2-1971:4	B-112	3	SU	5,400 (1,426)	-	-	-
1969:2-1969:3	BX-103	2	SU (OWW?)	8,631 (2,280)	-	-	-
1969:3	B-107	1	SU	1,238 (327)	-	-	-
1969:3-1975:3	B-106	2	SU	1,329 (351)	-	-	-
1969:3-1976:1	B-109	3	SU	3,903 (1,031)	-	-	-
1970:1-1972:2	B-110	3	SU	2,748 (726)	-	-	-
1970:1-1972:1	B-111	3	SU	2,748 (726)	-	-	-
1971:4-1972:1	-	-	-	-	2	TX-101 (SU)	5,213 (1,377)
1972:1	-	-	-	-	1	BY-109 (SU)	1,234 (326)
1972:1	-	-	-	-	1	C-105 (SU)	999 (264)
1973:2	BX-104	1	SU	697 (184)	-	-	-
1973:4	C-104	1	SU	1,162 (307)	-	-	-

Table 2-3. Tank 241-B-103 Major Transfers.

Year: Qtr	Waste received by tank 241-B-103				Waste transferred out of tank 241-B-103		
	Transaction source	# of transfers	Waste type	Waste amount kL (kgal)	# of transfers	Destination (waste type)	Waste amount kL (kgal)
1973:4-1976:1	B-109	3	SU	1,434 (379)	-	-	-
1975:3	B-106	1	SU	549 (145)	-	-	-
1974:3-1976:1	B-102	2	SU	750 (198)	-	-	-
1975:4-1976:2	Unknown	4	Water	125 (33)	-	-	-
1975:4-1976:2	-	-	-	-	2	SX-110 (SU)	3,922 (1,036)

Notes:

CW - Cladding waste

CWP - Cladding waste from the PUREX plant

MW - Metal waste [Waste that originated from the extraction of plutonium using the $BiPO_4$ process. This type of waste contained 90% of the fission products, 1% of the plutonium, and all of the uranium inherent in an irradiated fuel slug.]

UR - Uranium recovery in U-Plant

EB - Evaporator bottoms

SU - Supernate (liquid considered free of contamination to the extent it could be pumped to a crib).

T19 - Waste sent to tank 241-C-109 for in-tank or in-farm scavenging by ferrocyanide.

OWW - Organic Wash Waste (this waste originated from the washing of the solvent used in the PUREX process).

Waste was initially added to tank 241-B-103 in December of 1945 with the cascade of waste of an unknown type (there is a strong probability that the waste was MW) from tank 241-B-102. The cascades of waste from tank 241-B-102 continued until the first quarter of 1946. In March 1946, the tank was declared full.

During the first quarter of 1953, the waste was sluiced and transferred to U Plant for uranium recovery. Tank 241-B-103 received additional waste (presumably MW) from B-102 and B-101 and supernate from tank 241-BY-102. This waste was also sluiced for uranium recovery. Water left over from sluicing was transferred to tank 241-BY-102 in the fourth quarter of 1953, leaving just 45 kL (12 kgal) of waste in tank 241-B-103.

Tank 241-B-103 received supernate from tank 241-B-105 in the first quarter of 1954. Supernate was transferred from tank 241-B-103 to tank 241-B-106 during the second quarter of 1957 (there is evidence from historical records that suggests that this may have been EB waste). Waste designated as T19 was sent from tank 241-B-103 to tank 241-C-109 during the third quarter of 1957. This transfer was conducted so that the cesium in the waste could be in-farm scavenged with nickel ferrocyanide. During the third and fourth quarters of 1963, waste of an unknown type cascaded to tank 241-B-103 from tank 241-B-102. Also, during the third quarter of 1963, tank 241-B-103 received CW waste from an unknown source. During the second quarter of 1964, tank 241-B-103 received CWP waste. No tank transfers were reported over the next few years. The tank was essentially full. Anderson (1990) indicates that the tank contained EB and CW wastes at this time.

Transfers into and out of the tank resumed in 1969. All subsequent transfers into the tank are reported to be supernate, flushwater, or water additions (Agnew et al. 1994). Numerous transfers occurred during the first three quarters of 1969. During the first quarter of 1969, tank 241-B-103 received supernate intermittently from tank 241-B-108. In the second quarter of 1969 supernate was transferred from tank 241-B-103 to 241-BY-103. In the second quarter of 1969, tank 241-B-103 received supernate from tanks 241-B-104 and 241-B-112. During the second and third quarters of 1969, tank 241-B-103 received supernate from tank 241-BX-103. This waste may have been OWW, perhaps the reason that the tank was put on the Organics Watch List. During the third quarter of 1969, tank 241-B-103 received supernate from tanks 241-B-107 and 241-B-106. In the third quarter of 1969, large volumes of waste were transferred to tank 241-BY-103, leaving just 208 kL (55 kgal) in tank 241-B-103.

From 1970 on, the tank received waste from a number of other tanks, such as tank 241-B-110, 241-B-111, 241-B-109, 241-B-108, 241-BX-104, 241-C-104, 241-B-102, and 241-B-106. Transfers were made to tanks 241-TX-101, 241-BY-109, 241-C-105, 241-B-109, and 241-SX-110. The waste types being transferred into and out of the tank were described as SU, ion exchange waste, water, and other non-complexed liquid streams. Supernate was pumped from the tank for interim stabilization in 1985.

Tank 241-B-103 was declared inactive in 1978. Tank 241-B-103 is categorized as an assumed leaker (with a leak volume of approximately 30.3 kL [8 kgal] in 1978) and is interim stabilized with intrusion prevention completed. The waste in tank 241-B-103 waste is classified as non-complexed.

2.3.2 Historical Estimation of Tank Contents

The following is an estimate of the contents for tank 241-B-103 based on historical transfer data. The historical data used for the estimate are from the Waste Status and Transaction Record Summary (WSTRS) (Agnew 1994a), the Hanford defined waste (HDW) (Agnew 1994b) list, the tank layer model (TLM) (Agnew et al. 1994), and the historical tank content estimate (HTCE) (Brevick et al. 1994b). The WSTRS is a compilation of available waste transfer and volume status data. The HDW list provides the assumed typical compositions for (50) separate waste types. In some cases the available HDW data are incomplete, reducing the usability of the transfer data and the modeling results derived from it. The TLM takes the WSTRS data, models the waste deposition processes, and uses additional data from the HDW (which may introduce more error), to generate an estimate of the tank contents. Thus, these model predictions can only be considered estimates that require further evaluation using analytical data.

Based on the historical tank content estimate (HTCE) and the tank layer model, tank 242-B-103 contains 212 kL (56 kgal) of B saltcake waste and 11 kL (3 kgal) of MW. Figure 2-3 shows a graphical representation of the estimated waste type and volumes for the tank layers. The bottom layer has been determined to be MW, and the top layer is B saltcake. The bottom layer should contain large amounts of sodium, uranium, carbonate, phosphate, sulfate, and hydroxide. Also present will be quantities of strontium and cesium (the amount of strontium is significantly larger than the amount of cesium); therefore, this layer will have slight activity. To further identify MW, aluminum, iron, bismuth, nickel, lead, and TOC will be totally absent, or present in only very low concentrations. The top layer (B saltcake) should be mostly soluble and contain large amounts of sodium, nitrate, nitrite, sulfate, phosphate, carbonate, and hydroxide. Also present will be aluminum, iron, and bismuth. Cesium and strontium quantities will be low; therefore, the activity should be low. Both waste types, MW and B saltcake, do not contain organics, but tank 241-B-103 is on the Organics Watch List. Historical records contain evidence that OWW waste was added to tank 241-B-103. This waste type contains sodium and organics. Table 2-4, taken from the HTCE, shows an estimate of the expected waste constituents and their concentrations.

Figure 2-3. Tank Layer Model.

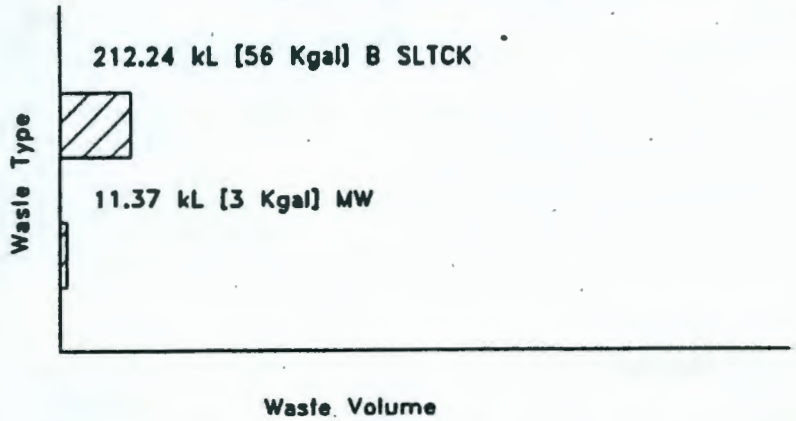


Table 2-4. Solids Composite Inventory Estimate - Single-Shell Tank 241-B-103.

Physical properties			
Total solid waste	3.44E+05 kg		
Heat load	2.97E-02 kW (102 Btu/hr)		
Bulk density	1.54 (g/cm^3)		
Void fraction	0.611		
Water wt%	56.3		
TOC wt% C (wet)	0		
Chemical constituents	mole/L	ppm	kg
Na^{+1}	9.70	1.45E+05	4.98E+04
Al^{+3}	3.91E-02	685	236
Fe^{+3} (total Fe)	3.71E-02	1.34E+03	462
Cr^{+3}	1.20E-02	404	139
Bi^{+3}	5.83E-03	790	272
Zr [as $ZrO(OH)_2$]	1.17E-02	690	237
Ni^{+2}	1.98E-02	755	260
Ca^{+2}	0.148	3.86E+03	1.33E+03
OH^{-1}	0.724	7.99E+03	2.75E+03
$NO3^{-1}$	2.80	1.13E+05	3.87E+04
$NO2^{-1}$	0.181	5.42E+03	1.86E+03
$CO3^{-2}$	0.263	1.02E+04	3.52E+03
$PO4^{-3}$	1.40	8.60E+04	2.96E+04
$SO4^{-2}$	0.643	4.01E+04	1.38E+04
Si (as SIO_3^{-2})	7.78E-02	1.42E+03	488
F^{-1}	0.777	9.58E+03	3.30E+03
Cl^{-1}	5.90E-02	1.36E+03	467

Table 2-4. Solids Composite Inventory Estimate - Single-Shell Tank 241-B-103.

Radiological constituents			
Pu		6.89E-03 (μCi/g)	3.95E-02 (kg)
U	5.41E-02 (M)	8.36E+03 (μg/g)	2.88E+03 (kg)
Cs	1.71E-02 (Ci/L)	11.1 (μCi/g)	3.82E+03 (Ci)
Sr	7.85E-03 (Ci/L)	5.09 (μCi/g)	1.75E+03 (Ci)

Notes:

Btu/hr	=	British thermal units per hour	kW	=	kilowatt
cm	=	centimeter	mole/L	=	moles per liter
g	=	gram	ppm	=	parts per million
kg	=	kilogram	TOC	=	total organic carbon
kgal	=	kilogallon			

Unknowns in tank inventory are assigned by tank layer model (TLM).

Table taken from the HTCE (Brevick et al. 1994b). Supernate not included.

2.4 SURVEILLANCE DATA

Tank 241-B-103 surveillance consists of surface level measurements, temperature monitoring inside the tank, and leak detection well (drywell) monitoring for radioactivity outside the tank. The data are significant because they provide the basis for determining tank integrity.

Liquid level measurements provide an indication of any major leak from a tank. Solid surface level measurements provide an indication of physical changes and consistency of the solid layers of a tank. Five drywells are located around the perimeter of the tank to detect increased radioactivity in the event of a leak to the soil. Drywells 20-03-03 and 20-03-06 had readings greater than the 50 counts per second background radiation. Readings are no longer taken routinely, but can be taken if requested.

2.4.1 Surface Level Readings

Tank 241-B-103 surface level is monitored with a Food Instrument Corporation (FIC) gauge through riser 1. The gauge is set in the intrusion mode for a 25 mm (1 in.) increase. The maximum allowable increase from the 442 mm (17.4 in.) baseline is 50 mm (2 in.). Manual field measurements are conducted quarterly. Recent surface level data, presented in Figure 2-5, indicate that the measured surface level has dropped since the tank was interim stabilized in 1985. The tank photographs show a crust layer near the wall of the tank under the FIC plummet. The drop in level may be due to settling or compaction of the crust under the FIC probe, or possibly a long term evaporative trend. The latest surface level readings of approximately 350 mm (14 in.) correspond to a waste volume of 190 kL (51 kgal).

There is no documentation to suggest that tank 241-B-103 ever had a liquid observation well (LOW) installed. However, an obstruction in riser 8, detected during vapor sampling in 1995, appeared to field personnel to be an LOW. Surveillance personnel had no record of an LOW in the tank, but will investigate the situation.

2.4.2 Internal Tank Temperatures

The single thermocouple tree in tank 241-B-103 has 14 thermocouples to monitor tank temperature data in riser 4. Thermocouples are spaced at 600 mm (2 ft) intervals with thermocouple 1 located 400 mm (1.33 ft) off the bottom. Review of the tank 241-B-103 level history indicates that from September 1974 to April 1977, thermocouples 8 through 14 were in the vapor space. From April 1977 until January 1985, only thermocouple 1 was in the waste. Following interim stabilization in 1985, all the thermocouples appear to have been in the vapor space.

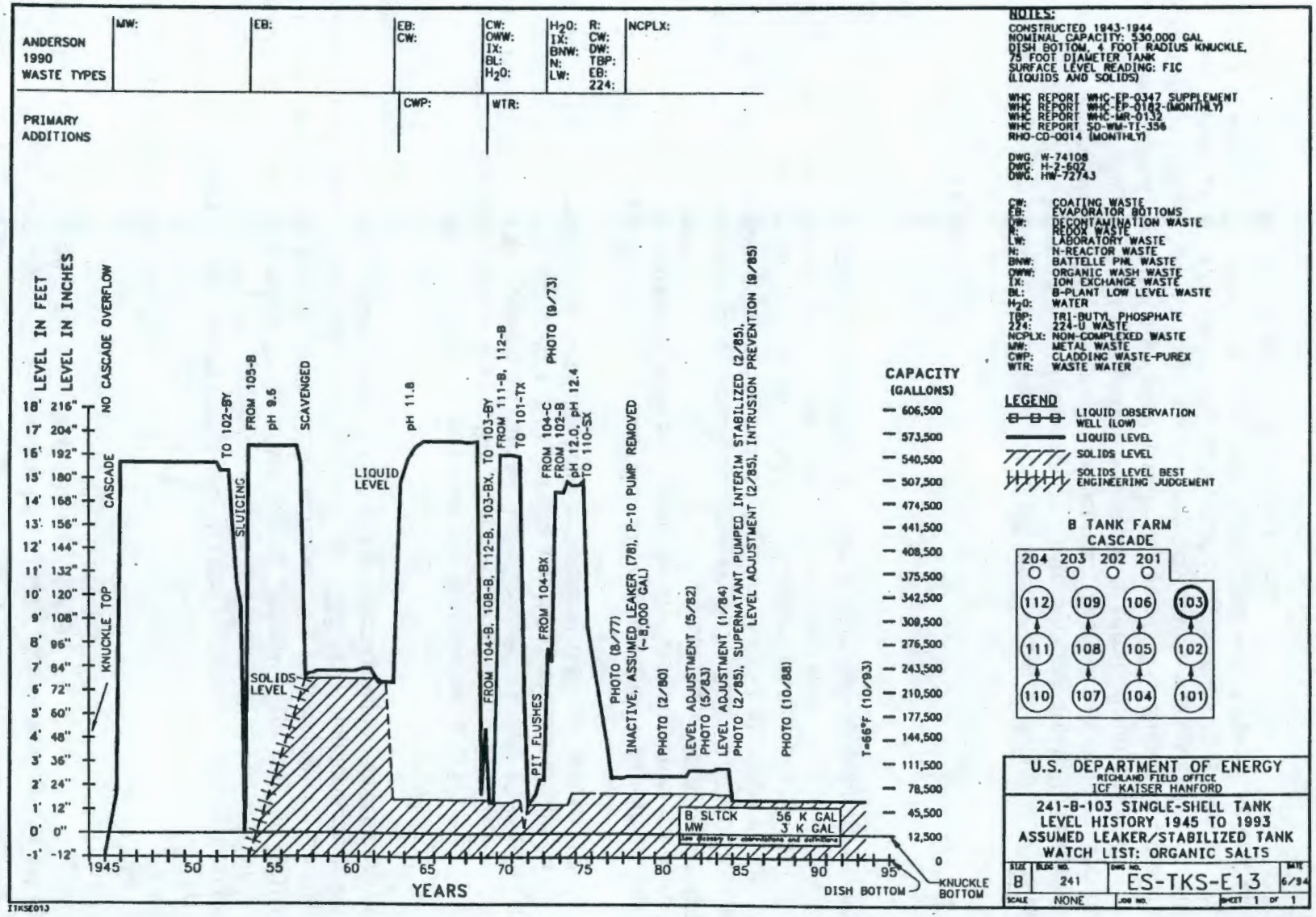
Very few temperature readings are available from tank startup to 1974. Thermocouples 1 through 12 have very similar temperature readings that span from October 1973 to the present. Limited data are available for thermocouples 13 and 14. Two data points are available for thermocouple 13 and only one data point is available for thermocouple 14. No readings are available between February 1984 and January 1990.

The mean temperature of the first data taken for thermocouples 1 through 12 was 24.7 °C (76.5 °F). From September 1974 to present, the median temperature has been 16.7 °C (62 °F) with a minimum of 4.4 °C (40 °F) and a maximum of 28.3 °C (83 °F). Annual temperature undulations are apparent after January 1991. Tank 241-B-103 requires weekly temperature monitoring because it is on the Organics Watch List. Plots of the thermocouple readings for the tank can be found in the *Supporting Document for the Northeast Quadrant Historical Tank Content Estimate for B Tank Farm* (Brevick et al. 1994a). A graphical representation of the weekly high temperature can be found in Figure 2-6.

2.4.3 Tank 241-B-103 Photographs

The 1988 photo montage of the tank 241-B-103 interior (Figure 2-7) is hazy, so the waste surface is somewhat undefined. It appears that there is a crust around the edges of the tank, a black sludge surface with little pools of supernate. These details are more apparent in the individual photographs. Picture quality is adequate to permit identification of equipment and nozzles; those that are visible have been labeled. The temperature probe in the background is encrusted with solids about halfway between the waste surface and the riser. Other than evaporation of water, or possibly further leaks, there have been no changes in the tank that would affect the waste since these photographs were taken; therefore, the picture should represent the current tank contents fairly well.

Figure 2-4. Tank Level and Transfer History.



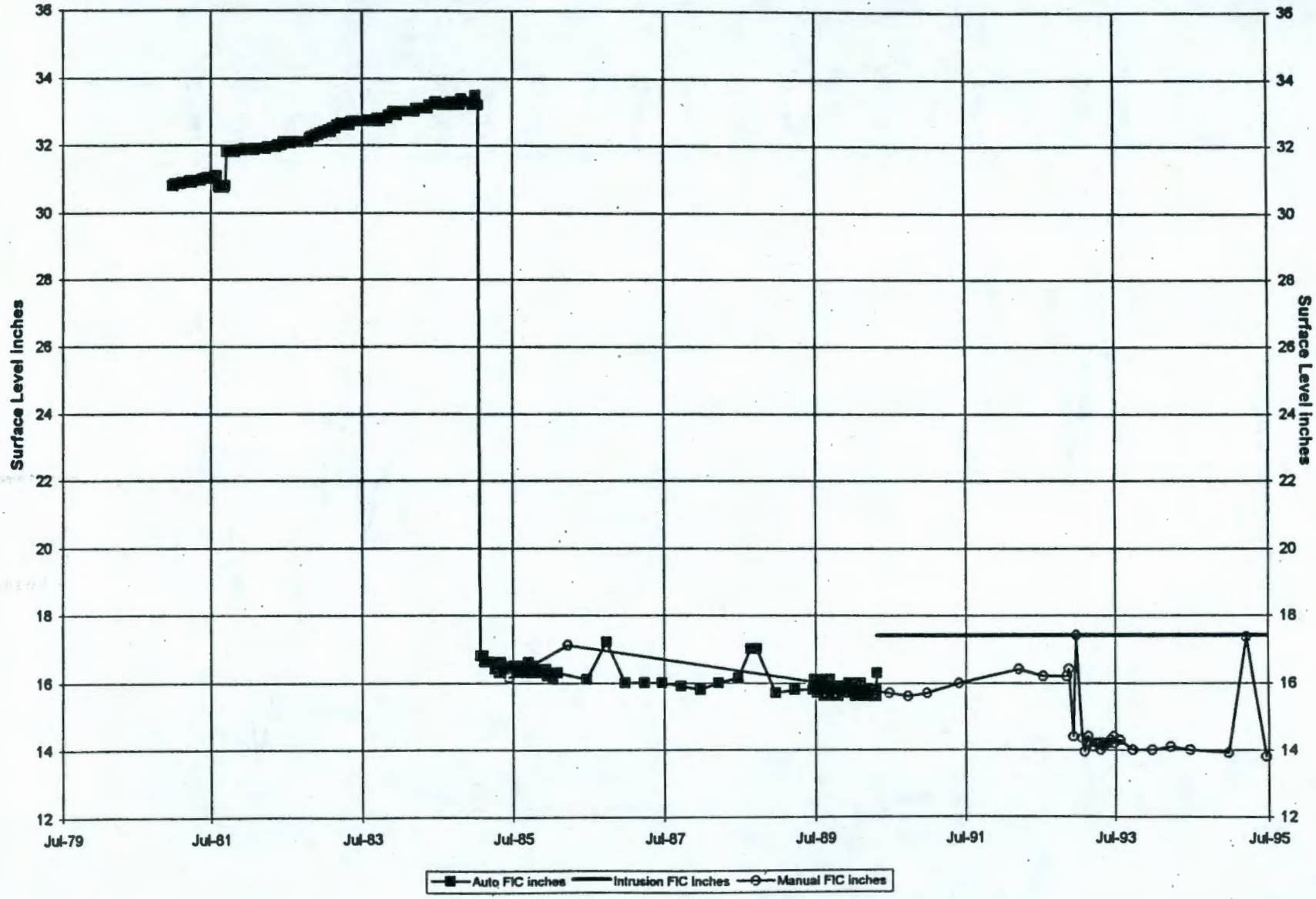
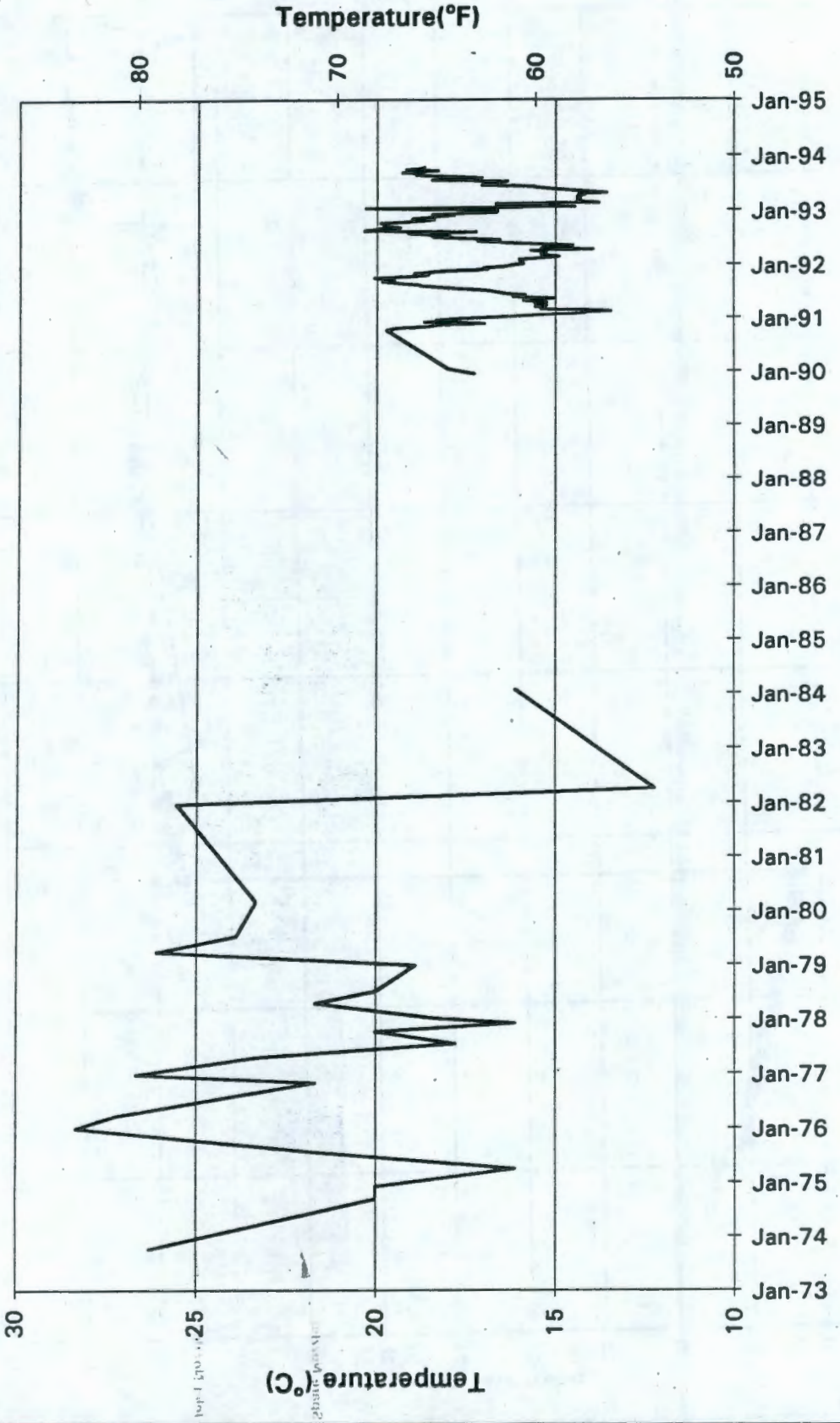


Figure 2-5. Tank Level History, 1981 Through 1995.

Figure 2-6. Tank 241-B-103 Weekly High Temperature Plot.



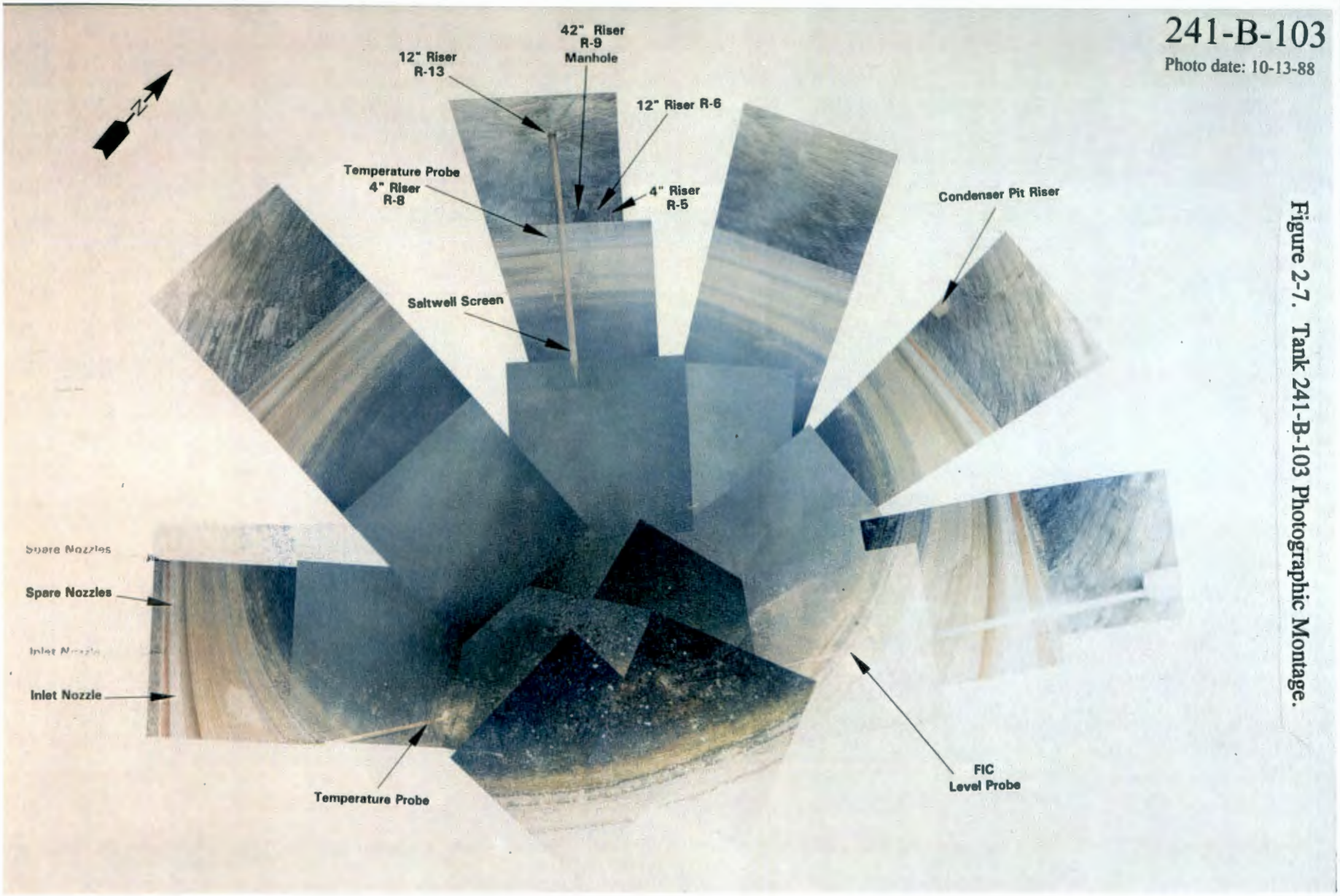


Figure 2-7. Tank 241-B-103 Photographic Montage.

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3.0 TANK SAMPLING OVERVIEW

Historically, single-shell tank waste samples have been analyzed to characterize the supernatant, sludge, and/or saltcake in each tank. Data were compiled for samples obtained from the late 1950s to the present. Data have been located for two tank 241-B-103 samples, one obtained on May 9, 1975 and one obtained on September 8, 1975. The analysis results were released on October 24, 1975 and October 20, 1975, respectively, for these samples. The data are presented in Appendix B.

3.1 DESCRIPTION OF 1975 SAMPLING EVENTS

A description of the technique used to extract samples from tank 241-B-103 was not available. The samples were of supernatant with no solids, and both were yellow in color. These samples should not be assumed to represent the present composition within the tank, as transfers were made after these samples were taken.

3.1.1 Sample Handling (1975 Liquid Samples)

No procedures or explanations for the samples are available.

3.1.2 Sample Analysis (1975 Liquid Samples)

The samples consisted primarily of sodium nitrate. The dominant radionuclide was cesium-137. The samples give no indication of the tank's primary waste receiving assignments. The tank is assumed to have received B Plant process waste, though the analyzed samples cannot confirm this assumption.

3.2 DESCRIPTION OF 1995 AUGER SAMPLING EVENT

3.2.1 Field Sampling Information

Two auger samples were obtained from tank 241-B-103 in May and June 1995. Tank vapors were screened for potential flammability and airborne radiological concerns prior to each auger sample being taken, with no concerns detected. Sample 95-AUG-031 was recovered from riser 7 on May 24 with a 51 cm (20 in.) auger. The auger has 18 flutes: flute 1 begins at the auger shaft, and flute 18 ends at the tip. Riser 7 is 30 cm (12 in.) in diameter. Field personnel observed liquid below riser 7 during preparations for sampling. A zip cord reading was performed, indicating solids 11.58 m (38 ft, 0 in.) below the riser. In spite of the liquid, the field sampling cognizant engineer and tank sample coordinator agreed that auger sampling should be attempted. The expected sample length was 38 cm (15 in.).

The sampling crew reported that after augering 2.5 to 4 cm (1 to 1.5 in.), the auger spun freely for the next 7.6 cm (3 in.) of travel until a very hard layer was encountered. The sampling crew made the conservative decision that the bottom of the tank may have been reached, and extracted the sample.

Sample 95-AUG-032 was recovered from riser 2 on June 1 with a 25-cm (10-in.) auger, which has 9 flutes. No observations of the waste beneath riser 2 were noted. Riser 2 contained a heated vapor probe (used for vapor sampling in February 1995), which was removed prior to auger sampling. A zip cord reading identified tank solids at 11.71 m (38 ft, 5 in.) below the riser. This reading caused some confusion as this level was below the (presumably) detected bottom of the tank at riser 7. Auger sampling was initiated, and proceeded for 23 cm (9 in.) of travel (25 cm [10 in.] below the detected tank bottom elevation from riser 7). The waste consistency was described as very soupy.

The most likely explanation for this discrepancy in the detected tank bottom elevation is that an obstruction (debris) was encountered below riser 7, and the bottom of the tank was not reached. Table 3-1 summarizes the sample, cask, and riser numbers, the total amount of material recovered from each of the two samples, and the measured drill string dose rate.

Insufficient tank waste material was recovered to perform all analyses and comply with all requests for sample material in the Tank Characterization Plan (TCP [Schreiber 1995]). Section 3.2.2 presents the explanation for not performing all requested analyses. All customers (Tank Safety and Pretreatment Programs) were contacted, and all accepted the sampling event. No additional samples from tank 241-B-103 were requested.

Table 3-1. 1995 Auger Sample Information (Conner 1995)[1].

Sample number	Sampling location	Tank waste solids recovered (grams)	Drill string dose rate (mR/hr)
95-AUG-031	Riser 7	45.0	32
95-AUG-032	Riser 2	6.7	10

Notes:

[1]Conner, J. M., 1995, *45-Day Safety Screening Results and Final Report for Tank 241-B-103, Auger Samples 95-AUG-031 and 95-AUG-032*, WHC-SD-WM-DP-134, Westinghouse Hanford Company, Richland, Washington.

g = gram
mR/hr = milliroentgen/hour

3.2.2 Sample Handling (1995 Auger Samples)

Sample 95-AUG-031 was received at the 222-S Laboratory on May 26 and extruded on May 30. A few drops of drainable liquid dropped onto the extrusion tray and were not recovered. Approximately 10 cm (4 in.) of wet solids were recovered from auger flutes 15 through 18. The solids were described as damp, gray/black crystals, shaped like short fibers. Photographs and videotape of the extruded auger were taken. Because the sample was confined to just a few flutes, and only a limited amount of sample was recovered (45 g), the sample was not subsampled into half-segments per the TCP, but was homogenized and submitted for analysis on a whole-segment basis. A portion of the sample (16.6 g) was segregated for pretreatment testing, and a small archive sample (12.4 g) was retained in the hot cell.

Sample 95-AUG-032 was received at the 222-S Laboratory on June 2 and extruded on June 8. A small amount of solids (6.7 g) was recovered from flutes 4 through 8. The material was described as moist yellow and brown solids. Photographs and videotape of the extruded auger were taken. The sample material was collected into one vial for homogenization and analysis at the whole-segment level. Due to insufficient sample, no material was made available for pretreatment testing, and no archive material could be retained in the 222-S Laboratory.

3.2.3 Sample Analysis (1995 Auger Samples)

The safety screening analyses for these tank waste solids consisted of differential scanning calorimetry (DSC), thermogravimetric analysis (TGA) to determine moisture content, and total alpha counting. Because the tank is on the Organics Watch List, TOC analyses were also requested in the TCP (Schreiber 1995). However, only one sample was analyzed for TOC (the sample from 95-AUG-032 was not analyzed for TOC due to insufficient sample). Organic Safety Program personnel suggested not running the TOC analysis for the sample from riser 2 in order to conserve sample for safety screening analyses. Also, the TCP requirements for providing material for pretreatment tests and archive samples were not complied with fully due to insufficient material. A small sample (16.6 g) of material from the riser 7 sample was segregated for pretreatment studies.

Analyses on the auger samples were reported in *45-Day Safety Screen Results and Final Report for Tank 241-B-103, Auger Samples 95-AUG-031 and 95-AUG-032* (Conner 1995). Results of the analyses are presented in Section 4 and evaluated in Section 5 of this report.

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4.0 ANALYTICAL RESULTS FROM 1995 AUGER SAMPLES AND WASTE INVENTORY ESTIMATES

4.1 OVERVIEW

The 1995 auger sampling and analysis event was performed to evaluate safety screening criteria defined in *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994). This data quality objective required determination of weight percent water by TGA, evaluation of fuel content and thermal output by DSC, and criticality evaluation by total alpha analysis. The fourth safety screening criterion, flammable gas concentration, may be addressed by vapor sampling (reported in Huckaby [1995]) and flammability screening tests (which are conducted whenever tank containment is broken [e.g., during sampling]).

Another objective of the event was to evaluate the tank for organic fuel content in accordance with *Data Quality Objective to Support Resolution of the Organic Fuel Rich Tank Safety Issue* (Babad et al. 1994). The primary analytes requested by this document are energetics and moisture content (both covered by safety screening analytes), total organic carbon (TOC) by persulfate oxidation, observation of the presence of a floating organic layer, and the tank temperature.

The final objective of the sampling event was to provide sample material to the Pretreatment Program for process development tests. Pretreatment and vitrification program requirements are stated in *Strategy for Sampling Hanford Site Tank Wastes for Development of Disposal Technology* (Kupfer et al. 1995).

The best available estimates for the chemical and radiochemical composition and inventory of the waste in tank 241-B-103 are derived from the tank layer model summarized in Table 2.4. Data from the 1975 liquid samples (presented in Appendix B) may be somewhat helpful in estimating the composition of any liquid in the tank. However, the WSTRS (Agnew 1994a) does indicate several transfers into and out of the tank since these samples were taken. Table 4-1 describes how the analytical and historical data are tabulated within this document.

Table 4-1. Data Presentation Tables for Tank 241-B-103.

Type of data/analysis	Location of tabulated results
Historical tank content estimate (HTCE)	Table 2-4
Total alpha (1995 auger samples)	Table 4-2
Thermogravimetric analyses (1995 auger samples)	Table 4-3
Differential scanning calorimetry (1995 auger samples)	Table 4-4
Total organic carbon (1995 auger samples)	Table 4-5
Total inorganic carbon (1995 auger samples)	Table 4-6
Historical sampling data (1975 liquid samples)	Appendix B

4.2 TOTAL ALPHA ACTIVITY

Analyses for total alpha activity were performed on two samples from tank 241-B-103. These samples were prepared by fusion using laboratory procedure LA-549-141, Rev. C-3, and analyzed using laboratory procedure LA-508-101, Rev. D-2. Two fusions were prepared for each sample (for duplicate analyses). Each fused dilution is analyzed twice; the results are averaged and reported as one value.

Table 4-2 presents the total alpha activity taken from the 45-day report for tank 241-B-103 (Conner 1995). The total alpha tank inventory was calculated using the mean value for total alpha (in μCi/g) and a total solid waste weight of 344,000 kg from Table 2-4.

The large difference between sample results indicates that the tank is heterogeneous. The riser 7 samples were described as gray/black crystals, while the riser 2 sample was described as yellow and brown sludge. All results are less than 1 percent of the safety screening action limit of 41 μCi/g. As discussed in Section 5.1.1, the auger sampler is biased towards retention of solids. As alpha emitters are expected to be concentrated largely in the solids (waste is non-complexed), this results in a conservative estimate of the total alpha concentration in the tank. Quality control considerations for these samples are discussed in Section 5.1.2.

Table 4-2. Tank B-103 Total Alpha Activity Results.

Sample identification	Result (μCi/g)	Duplicate (μCi/g)	Sample mean (μCi/g)	Overall mean (μCi/g)	Tank inventory (Ci)
Riser 7, S95T000973	0.0865	0.125	0.106	0.133	45.8
Riser 2, S95T001117	0.299	0.345	0.322		

Notes:

μCi/g = microcuries/gram
Ci = curies
g = gram
1 Ci = 3.7E+10 becquerel (Bq)

4.3 THERMODYNAMIC ANALYSES

Thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC) were performed on the auger samples from tank B-103. These analyses were used to assess the moisture content, thermal stability, and reactivity of the samples.

4.3.1 Thermogravimetric Analysis

Thermogravimetric analysis measures the mass of a sample while the temperature of the sample is increased at a constant rate. Nitrogen is passed over the sample during heating to provide an inert atmosphere. Any decrease in the weight of a sample during TGA represents a loss of gaseous matter from the sample, either through evaporation or through a reaction that forms gas phase products.

The moisture content is estimated by assuming that all TGA sample weight loss up to a certain temperature (typically 150 to 200 °C [300 to 390 °F]) is due to water evaporation. The temperature limit for moisture loss is chosen by the operator at an inflection point on the graph. Other volatile matter fractions can often be differentiated by inflection points as well. Figure A-1 of Appendix A presents a typical TGA scan for tank B-103.

The tank 241-B-103 samples were analyzed by TGA using procedure LA-560-112, Revision A-2. Analyses were performed in duplicate. All results were well above the safety screening action limit of 17 percent water by weight. Table 4-3 summarizes the TGA results. The samples exhibited a large weight loss between ambient and approximately 160 to 180 °C, assumed to be to a loss of water. The riser 2 sample (S95T001958) also exhibited a much smaller weight loss between approximately 230 to 300 °C (446 to 572 °F). These secondary endotherms are not reported in Table 4-3 because they do not correspond to water loss, but can be observed in the raw data scans (included in Conner [1995]). As with the total alpha results, the difference in the sample results is explained by the heterogeneity of the tank.

As discussed in Section 5.1.1, the auger sampler is biased towards retention of solids. Therefore, the percent moisture results for these samples will be conservative (actual moisture content is likely higher than indicated here). All moisture content results by TGA are well above the safety screening minimum value of 17 weight percent water. Quality control considerations for these samples are discussed in Section 5.1.2.

Table 4-3. Tank B-103 Thermogravimetric Analysis Results.

Sample identification	Temperature range (°C)	Result (%H_2O)	Duplicate (%H_2O)	Sample mean (%H_2O)	Overall mean (%H_2O)
Riser 7, S95T000972	ambient to approx. 180	50.08	50.26	50.17	44.83
Riser 2, S95T001058	ambient to 160	38.76	40.31	39.54	

4.3.2 Differential Scanning Calorimetry

The DSC analysis is performed by submitting the sample to a linear increase in temperature. Heat absorbed or emitted by the sample is measured as a function of time. Nitrogen is passed over the sample to remove any gases being released. The onset temperature for an endothermic or exothermic event is determined graphically. A typical DSC plot for the tank B-103 samples is shown in Appendix A, Figure A-2.

The DSC analyses for tank B-103 auger samples were performed using laboratory procedure LA-514-113, Rev. B-1. Table 4-4 summarizes the DSC results for the tank 241-B-103 auger samples. None of the samples exhibited exotherms. Sample results are characterized by large endotherms from ambient conditions up to approximately 160 °C (320 °F). Each sample also had a much smaller endotherm between approximately 220 °C (428 °F) and 320 °C (608 °F). The secondary endotherm corresponds well with a secondary weight loss observed in the TGA results for sample S95T001958 (riser 2), suggesting a decomposition reaction.

4.4. TOTAL ORGANIC CARBON ANALYSES

Total organic carbon (TOC) analyses were required to satisfy the requirements of the TCP (Schreiber 1995). As described in Section 3.2.2, only one sample was submitted for TOC analysis. The TOC analysis was performed by persulfate oxidation (222-S Laboratory procedure LA-342-100). The TOC result is presented and compared to the decision threshold (from Babad et al. [1994]) in Table 4-5. The decision threshold corresponds to 5 percent TOC on a dry basis. The adjusted dry sample result 0.136 percent TOC on a dry basis, or less than 3% percent of the action limit. Quality control results for these samples are presented in Section 5.1.2.

As discussed in Section 5.1.1, the auger sampler is biased towards recovery of solids. The effect that this has on the TOC results is indeterminate. It is not clear whether organics would be in greater concentration in the liquid or solids. The moisture content of the samples was approximately 40 to 50%. In this range, any significant concentration of TOC would be evident in the sample, whether attributable to a component of the interstitial liquid or solids.

Table 4-4. Tank B-103 Differential Scanning Calorimetry Results.

Sample identification	Run	Transition 1			Transition 2			Detectable exotherm?
		Temp. range (°C)	Peak temp. (°C)	ΔH (J/g)	Temp. range (°C)	Peak temp. (°C)	ΔH (J/g)	
Lab ID# S95T000971, riser 7	1	amb-160	113.3	881.8	220-315	272.3	121.4	no
	2	amb-160	127.3	932.4	220-310	281.9	182.5	no
Lab ID# S95T001058, riser 2	1	amb-165	115.3	875.4	205-310	281.0	39.4	no
	2	amb-175	113.3	903.0	210-315	278.8	46.8	no

Notes:

"Run" column: Result listed as run 1, duplicate as run 2.

amb = ambient
ΔH = change in enthalpy: positive change is endothermic.
J/g = joules/gram

Table 4-5. Total Organic Carbon Results for Tank B-103 Auger Samples.

Sample description	Result (μg C/g)	Duplicate (μg C/g)	Mean (μg C/g)	Adjusted dry mean (μg C/g)	Organic salts action limit (μg C/g, dry)
Riser 7 subsample, S95T000972	645	710	678	1360	50,000

Notes:

μg C/g = micrograms carbon per gram

Adjusted dry mean calculated by dividing sample mean by 0.4983, the dry mass fraction for this sample (derived from Table 4-3).

4.5 INORGANIC ANALYSES

The only inorganic analysis performed on the B-103 auger samples was total inorganic carbon (TIC). This analysis was not required, but was performed as an artifact of the TOC analysis (per procedure LA-342-100). The carbonate (inorganic carbon) component of the sample must first be removed before the organic carbon content can be determined. The TIC results are presented in Table 4-6. Quality control data for these samples are presented in Section 5.1.2.

Table 4-6. Tank B-103 Total Inorganic Carbon Results.

Sample description	Result (μg C/g)	Duplicate (μg C/g)	Mean (μg C/g)
Riser 7 subsample, S95T000972	1850	1840	1845

Notes:

μg C/g = micrograms carbon per gram

5.0 INTERPRETATION OF CHARACTERIZATION RESULTS

The purpose of this section is to evaluate the overall quality and consistency of the available results and to assess and compare these results against program requirements. As the tank's contents have changed significantly since the earlier sampling events, this section will focus on the results of the 1995 auger sampling event. Results of the 1995 vapor sampling and analysis are presented and discussed by Huckaby (1995).

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 quality and consistency of the data and to identify any limitations in the use of the data.

Due to the small number of analyses conducted on the tank 241-B-103 auger samples, the information gained is somewhat limited. The intent of the sampling event was to screen the tank for safety issues and provide material for pretreatment studies. Nonetheless, the information gathered was useful and some qualified statements regarding the tank contents can be made.

5.1.1 Field/Laboratory Observations and Assessment of Sampler Bias

Results of the auger sampling are biased as the auger sampler is biased towards recovery of materials that adhere to the auger, such as damp sludge. Free liquids are not retained by the auger sampler, but will run down the flutes of the auger and drain out the open bottom (except as retained interstitially in the recovered solids). Observations made during sampling activities indicate that the waste sampled was quite wet.

The bias of the sampling technique is not fatal to the results of these analyses conducted to address safety issues. If the analyte of concern is at higher concentrations in the solid phase than the liquid phase (e.g., alpha emitters), then the results of the analysis will be conservative. If the analyte of concern is expected to be at higher concentrations in the liquid phase (perhaps the case for TOC and energetics), then the results will not be conservative. A simple method for assessing the potential for error is described here.

The water content of the auger samples was determined to be a minimum of 39 weight percent (lowest value by TGA from Table 4-3). The water content of tank liquid and drainable liquid samples is typically in the range of 75 percent to 95 percent water by weight. If one assumes that the ratio of soluble aqueous phase components (e.g., salts, miscible organics) to water is constant (regardless of whether the waste is liquid or wet sludge), then the data can be adjusted by a simple ratio. The ratio for estimating a maximum analyte concentration in the liquid phase is 95 percent divided by 39 percent, or 2.4. Application of this maximum possible bias to the sample results for TOC and DSC is

presented in Table 5-1. This adjustment assumes that all the TOC and the exothermic potential is contained in the liquid portion of the sample (a conservative assumption). Because all the results were well below the limits (as discussed in Section 4), the adjusted values are still below the safety limits by a wide margin. Therefore, the bias introduced by the sampling technique does not change the conclusion that the tank is within the safety envelope.

Table 5-1. Assessment of Sampler Bias for Selected Analytes.

Analysis method	Mean result	Adjustment for maximum sampler bias	Adjusted result	Safety limit
TOC	678 μg C/g	2.4	1630 μg C/g	<50,000 μg C/g
DSC	0 J/g		0 J/g	<481 J/g

Notes:

μg C/g	=	micrograms carbon per gram
J/g	=	joules per gram
DSC	=	differential scanning calorimetry
TOC	=	total organic carbon

5.1.2 Quality Control Assessment of Analytical Data

A critical component of analytical work is an attempt to quantify the different possible sources of error that could occur during the chemical analysis of a sample. If one or more of the error estimates are outside the acceptable limits, the accuracy of the concentration estimate is drawn into question. Possible sources of error are sample contamination, matrix interferences, analytical method error, and poor instrument calibration. Error estimates are determined from the analysis of standards, spike recoveries, blank contamination, and sample duplicate variation.

5.1.2.1 Standards Recovery. Standards are used to estimate the accuracy of the analytical method, and are evaluated prior to or concurrent with the sample analysis. Standards contain the analytes of interest at known concentration. Standard solutions may or may not be independent of the standard used for calibration. The criterion for standard recovery for the 1995 sampling and analysis event was 100 ± 10 percent (Schreiber 1995). If a standard is above or below the criterion, then the analytical results will likely be biased high or low, respectively. As shown in Table 5-2, all samples had acceptable standards recoveries.

Table 5-2. Quality Control Summary for Tank B-103 Auger Samples.

Riser number & laboratory identification	Analyte	RPD %	Standard recovery (%)	Spike recovery (%)	Blank result
R7, S95T000972	DSC	0	101.2	-	-
R2, S95T001058		0	104.7	-	-
R7, S95T000972	% H_2O (TGA)	0.35	98.7	-	-
R2, S95T001058		3.8	101.2	-	-
R7, S95T000972	TOC	9.59	98.7	104.0	22.9 μg C/mL
R7, S95T000972	TIC	0.54	97.0	107.0	3.9 μg C/mL
R7, S95T000973	Total alpha	36.4	92.2	118.5	<5.24E-03 μCi/g
R2, S95T001117		14.3	109.6	85.9	<2.74E-03 μCi/g

Notes:

μCi/g = microcuries per gram
μg C/mL = micrograms carbon per milliliter

5.1.2.2 Spike Recovery. Matrix spikes are used to estimate the bias of the analytical method due to matrix interferences. Spike samples are prepared by splitting a sample into two aliquots, adding a known amount of a particular analyte to one aliquot, and calculating a percent recovery. The quality control criterion for matrix spikes was also 100 ± 10 percent recovery (Schreiber 1995). As with standards, if a spike is above or below the criterion, then the analytical results may be biased high or low, respectively. Spikes were conducted for two alpha analyses and one TIC/TOC analysis. The alpha spikes exceeded the ± 10 percent criterion; however, no reruns were requested, because the samples were far below the action limit (all results less than 1 percent of the screening limit of 41 μCi/g) and the test is performed for screening purposes (highly accurate results are not required as long as the results are well below the limit).

Method blanks document the contamination resulting from the routine sample handling and analytical process, and are prepared by filling sample containers with deionized, distilled water. They are carried through the complete sample preparation and analytical procedure, and all reagents used in the sample processing are added in the same volumes. Blanks were conducted on the total alpha analyses and on the TOC and TIC analyses. The total alpha

activity for each blank was below the detection limit, indicating that contamination was not a problem. The blank for the TOC analysis was 3.6 percent of the sample value. The blank for the TIC analysis was 0.2 percent of the sample value.

5.1.2.3 Duplicate Variability. Random analytical error provides an indication of laboratory precision and homogeneity of the sample. The random analytical error is estimated from the variation between duplicate samples. To estimate this error, a relative percent difference (RPD) is calculated for each duplicate pair. The RPD is defined as the absolute value of one duplicate minus the other, divided by their mean. The TCP for auger sampling of tank B-103 set the acceptable RPD at a target value of 10 percent (Schreiber 1995). Where samples exceed the RPD criterion, a triplicate analysis or rerun is often prescribed. In certain cases a high RPD is essentially unavoidable (e.g. if the sample cannot be homogenized, or if the results are near zero or near the detection limits). Both total alpha samples exceeded the $\pm$ 10 percent RPD criterion. However, no further action was taken, because the results were less than 1 percent of the action limit. Highly accurate results are not required when the results are far below the screening limit (Conner 1995).

5.1.3 Data Consistency Checks

When extensive chemical and radiochemical analyses are conducted, it is informative to cross-check certain analyses for consistency (e.g., compare sum of individual alpha emitters vs. total alpha, or conduct mass and charge balances). Due to the limited suite of analyses conducted on the 1995 auger samples, no such data consistency checks could be made.

5.2 COMPARISON OF ANALYTICAL RESULTS

The tank contents have changed somewhat since the 1975 liquid samples were taken, due to transfers into and out of the tank. Also, as different phases of waste were sampled (1975 liquid samples, 1995 auger solids samples, and 1995 vapor samples), and very different analyses were conducted, no comparison of results is relevant.

5.3 TANK WASTE PROFILE

The assessment of the tank profile is difficult because of the shallow waste depth, the small amount of material recovered, and the limited suite of analyses performed. Because the auger samples were analyzed on a whole-segment basis, no statistical assessment of the tank waste profile is possible. Nevertheless, some qualitative statements regarding the tank waste can be made. The tank is clearly heterogeneous, because both auger samples were quite different in appearance, moisture content, and total alpha concentration. The tank surface photographs show crust material near the walls, and a dark, wet, sludge surface, with isolated pools of liquid.

5.4 COMPARISON OF ANALYTICAL AND TRANSFER HISTORY INFORMATION

The limited amount of analytical data from auger sampling do not permit many comparisons to the historical predictions. The low TOC (0.14 percent, dry basis) and DSC results (no exotherms) compare well with the historical prediction that the tank contains no TOC (Brevick et al. 1994b). The high TOC value (3.3 percent) for tank 241-B-103 stated in the *Waste Tank Summary Report for Month Ending January 31, 1995* (Hanlon 1995) is evidently in error.

5.5 EVALUATION OF PROGRAM REQUIREMENTS

Data quality objectives (DQOs) have been developed to support the ongoing efforts of the Tank Waste Remediation System (TWRS) program to obtain information on waste tank contents and their characteristics. These DQOs identify the data requirements of various TWRS program elements. Three DQOs were applied to the 1995 auger sampling event: the safety screening DQO (Babad and Redus 1994), the organic DQO (Babad et al. 1994), and the pretreatment DQO (Kupfer et al. 1994). The information gathered is also considered from operational and environmental perspectives in the following sections.

5.5.1 Safety Evaluation

Results of auger sampling indicate that the waste is in "safe storage" conditions per the safety screening DQO (Babad and Redus 1994). All results from safety screening tests (DSC, TGA, and total alpha) on the auger samples were within the safety screening limits.

One TOC analysis was performed in support of the organic DQO (Babad et al. 1994). The second sample was not analyzed for TOC due to lack of sample. The low DSC and TOC results indicate that the tank should be considered for removal from the Organics Watch List. Other data requested by the organic DQO are the tank temperature and the presence of an organic phase. No thermocouples remain in the waste; however, the headspace temperature has averaged 17 °C (63 °F) over the past 20 years. No organic phase is visible, either in the tank photographs, in the liquid that dripped from the auger samples, or in the most recent liquid samples (1975 sample data presented in Appendix B).

Flammability screening performed prior to vapor sampling and auger sampling indicated that there were no flammability concerns with the tank vapor (screening tests performed on vapor inside the risers). Results of the 1995 vapor sampling event (reported in Huckaby 1995) also indicate that there are no flammability concerns. The only potential health concern identified from vapor sampling is that nitrous oxide was detected at a level approximately three times above the National Institute of Occupational Safety and Health 8-hour recommended exposure limit of 25 parts per million (by volume). It should be noted that this is the level measured inside the tank headspace, not in the working environment above the tank.

5.5.2 Operational Evaluations

Because tank 241-B-103 is a single-shell tank, waste compatibility issues are not a pressing concern as no transfers into or out of the tank are anticipated until the tank is retrieved for pretreatment and disposal.

5.5.3 Environmental Evaluation

The tank solids were not characterized to designate the waste nor for evaluation of any environmental compliance issues. No specific organic (volatile or semivolatile) analyses, inorganic analyses (e.g., heavy metals), corrosion analyses (pH), or toxicity testing have been performed on the tank solids.

The tank headspace has been sampled and analyzed for certain regulated organic gases. As reported in Huckaby (1995), the tank contains a moderate level of organic vapors compared to other tanks.

5.5.4 Process Development Evaluation

The Pretreatment Program requested sample material from tank 241-B-103, because the tank is expected to contain a waste type common to several other tanks. The current strategy for process development (Kupfer et al. 1995) is to analyze the washing and leaching characteristics of the waste in a few select tanks. The tanks are selected because they contain unique wastes, or contain wastes or waste layers common to other tanks. Results are then extrapolated to tanks with similar wastes. Unfortunately, insufficient material was recovered during auger sampling to provide all of the sample material desired by the Pretreatment Program. One small sample (16 g) from the riser 7 auger sample was segregated for the Pretreatment Program for washing and leaching studies.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

The waste in tank 241-B-103 was sampled and analyzed in 1995. Three DQOs were applied to the auger sampling event: the *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994), the *Data Quality Objective to Support Resolution of the Organic Fuel* Rich Tank Safety Issue (Babad et al. 1994), and the *Interim Data Quality Objective for Waste Pretreatment and Vitrification* (Kupfer et al. 1994). Sample analyses show that the tank meets all safety criteria (energetics, moisture content, total alpha activity, and organic content) by comfortable margins.

Tank B-103's headspace was sampled in 1995 and reported in Huckaby (1995). The results indicated that there were no flammability concerns with the tank headspace.

6.2 RECOMMENDATIONS

Based on the results of the 1995 auger samples, it is recommended that tank 241-B-103 be removed from the Organics Watch List. The data indicate that the waste has little or no fuel value (no exotherms in DSC results) and that the organic content of the tank is low (adjusted dry weight value of less than 3 percent of the decision threshold).

No further sampling of tank 241-B-103 is recommended, unless the tank is again selected for sampling by the retrieval or pretreatment programs. If resampled, another sampling technique (push core sampling or grab sampling for liquids) should be used.

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7.0 REFERENCES

Agnew, S. F., 1994a, *Waste Status and Transaction Record Summary for the Northeast Quadrant*, WHC-SD-WM-TI-615, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Agnew, S. F., 1994b, *Hanford Defined Wastes: Chemical and Radionuclide Compositions*, LA-UR-94-2657, Los Alamos National Laboratory, Los Alamos, New Mexico.

Agnew, S. F., P. Baca, R. Corbin, K. Jurgensen, and B. Young, 1994, *Tank Layer Model (TLM), Rev. 1 for Northeast, Southwest, and Northwest Quadrants*, LA-UR-94-4269, Los Alamos National Laboratory, Los Alamos, New Mexico.

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

Babad, H., and K. S. Redus, 1994, *Tank Safety Screening Data Quality Objective*, WHC-SD-WM-DQO-012, Westinghouse Hanford Company, Richland, Washington.

Babad, H., S. M. Blacker, and K. S. Redus, 1994, *Data Quality Objective to Support Resolution of the Organic Fuel Rich Tank Safety Issue*, WHC-SD-WM-DQO-006, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Brevick, C. H., L. A. Gaddis and E. D. Johnson, 1994a, *Supporting Document for the Northeast Quadrant Historical Tank Content Estimate for B Tank Farm*, WHC-SD-WM-ER-310, Westinghouse Hanford Company, Richland, Washington.

Brevick, C. H., L. A. Gaddis, and W. W. Pickett, 1994b, *Historical Tank Content Estimate for the North East Quadrant of the Hanford 200 East Area*, WHC-SD-WM-ER-349, Westinghouse Hanford Company, Richland, Washington.

Conner, J. M., 1995, *45-Day Safety Screening Results and Final Report for Tank 241-B-103, Auger Samples 95-AUG-031 and 95-AUG-032*, WHC-SD-WM-DP-134, Westinghouse Hanford Company, Richland, Washington.

Ecology, 1994, *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.

Hanlon, B. M., 1995, *Waste Tank Summary Report for Month Ending January 31, 1995*, WHC-EP-0182-82, Westinghouse Hanford Company, Richland, Washington.

Huckaby, J. L., 1995, *Tank 241-B-103 Vapor Sampling and Analysis Tank Characterization Report*, WHC-SD-WM-ER-438, Westinghouse Hanford Company, Richland, Washington.

Kupfer, M. J., J. M. Conner, R. A. Kirkbride, and J. R. Mobley, 1994, *Interim Data Quality Objectives for Waste Pretreatment and Vitrification*, WHC-SD-WM-DQO-011, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Kupfer, M. J., W. W. Schulz, and J. T. Slankas, 1995, *Strategy for Sampling Hanford Site Tank Wastes for Development of Disposal Technology*, WHC-SD-WM-TA-154, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Schreiber, R. D., 1995, *Tank 241-B-103 Tank Characterization Plan*, WHC-SD-WM-TP-250, Rev. 0A, Westinghouse Hanford Company, Richland, Washington.

Laboratory Procedures, Westinghouse Hanford Company, Richland, Washington:

LA-342-100, 1994, *Determination of Carbon by Hot Persulfate Oxidation and Detection*

LA-508-101, Rev. D-2, 1994, *Alpha and Beta in Liquid Samples*

LA-514-113, Rev. B-1, 1994, *Differential Scanning Calorimetry (DSC)*

LA-549-141, Rev. C-3, 1995, *Fusion with Alkali Metal Hydroxide*

LA-560-112, Rev. A-2, 1994, *Determination of Weight Loss as Percent Water by Thermogravimetric Analysis (TGA) - Mettler TG 50*

APPENDIX A

TYPICAL TGA AND DSC SCANS FOR TANK 241-B-103

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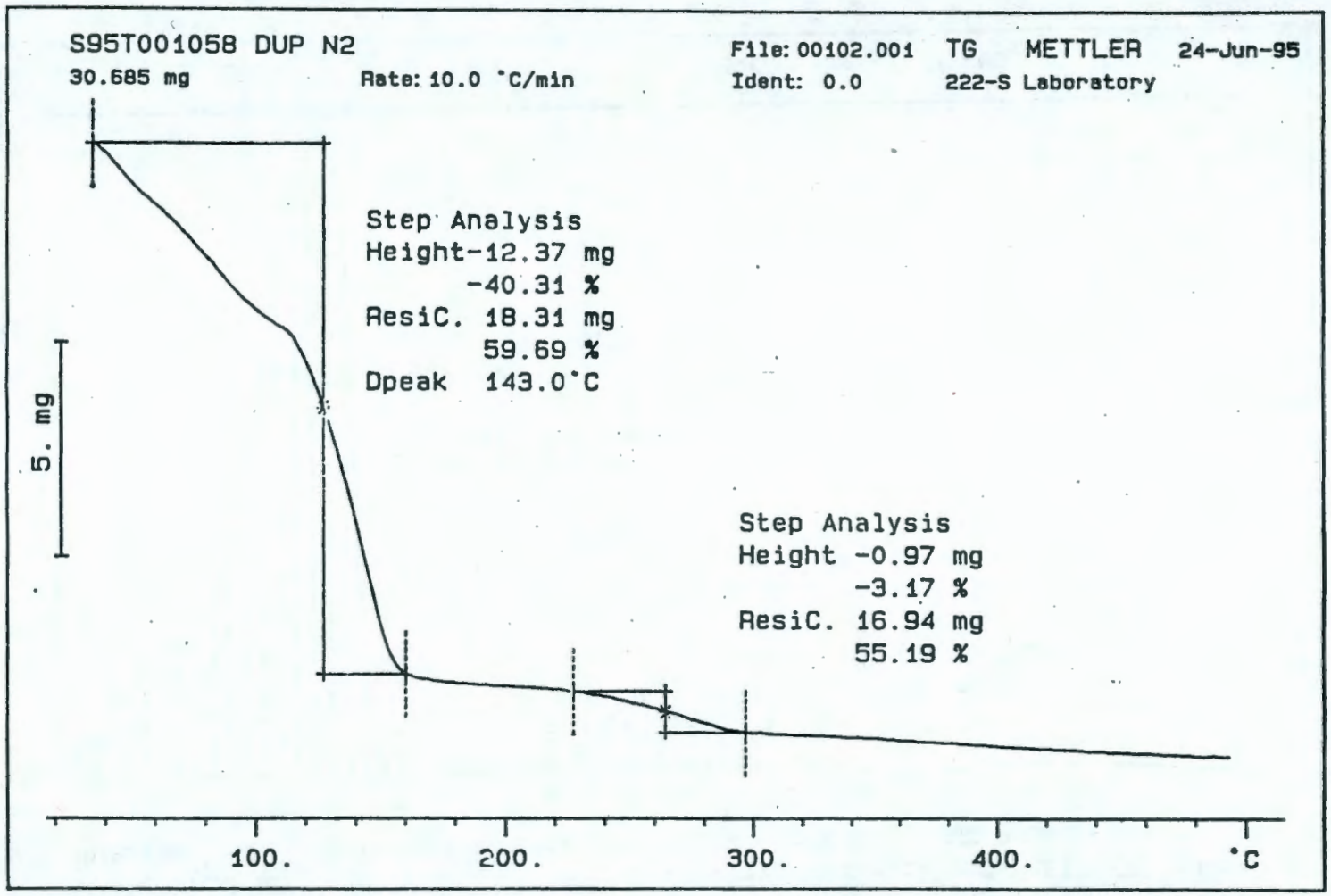

Figure A-1. Typical TGA Scan for Tank 241-B-103.

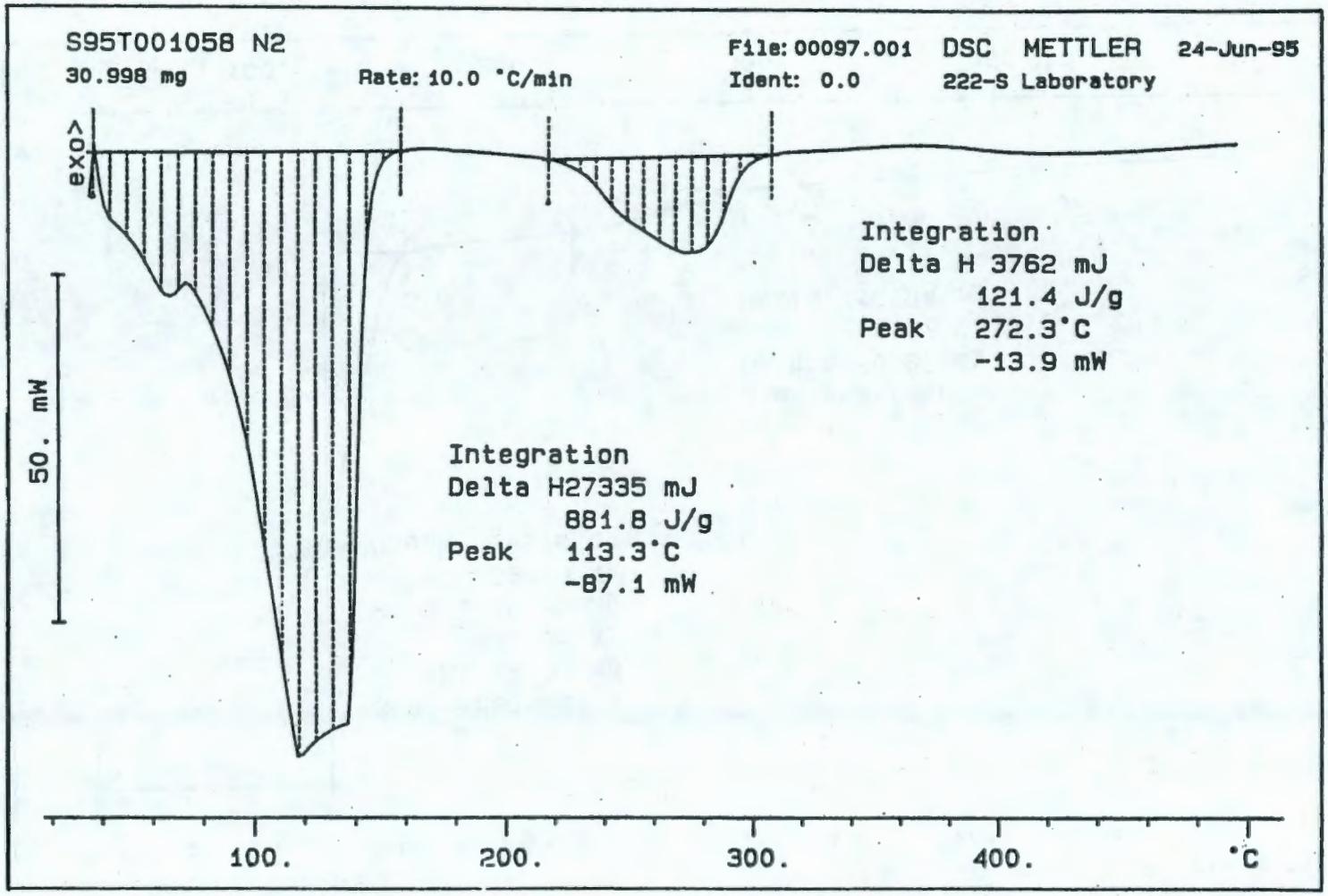

Figure A-2. Typical DSC Scan for Tank 241-B-103.

APPENDIX B

HISTORICAL SAMPLING RESULTS

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Table B-1. Analysis of Tank Farm Samples - Tank 241-B-103, Received May 9, 1975 (Sample T-4298).

Vis-OTR: Clear, Yellow No Solids 350 mrad/hr		
Component	Lab value	Lab unit
Physical data		
pH	12.0	
SpG	1.117	
Percent water	85.34	%
DTA	No exotherm below 200 °C	
Cooling Curve	25 °C for 45 min.	No solids
	20 °C for 45 min.	No solids
	15 °C for 45 min.	No solids
	10 °C for 60 min.	No solids
	5 °C for 60 min.	No solids
Chemical analysis		
OH	0.132	M/L
Al	4.54E-02	M/L
Na	2.47	M/L
NO_2	0.332	M/L
NO_3	1.06	M/L
SO_4	Cancelled	
PO_4	0.133	M/L
CO_3	0.18	M/L
F	6.99E-03	M/L
Radiological analysis		
Pu	7.02E-05	g/gal
Sr 89,90	4.40E+02	μCi/gal
GEA RuRh 106	1.91E+04	μCi/gal
GEA Cs 134	5.75E+02	μCi/gal
GEA Cs 137	1.64E+05	μCi/gal

Notes:

DTA	=	differential thermal analysis	g/gal	=	grams per gallon
GEA	=	gamma energy analysis	μCi/gal	=	microcuries per gallon
SpG	=	specific gravity	mrad/hr	=	millirads per hour
Vis-OTR	=	visual observations and over-the-top reading	M/L	=	moles per liter

Table B-2. Analysis of Tank Farm Samplesl - Tank 241-B-103, Received September 8, 1975 (Sample T-7809).

Vis-OTR: Clear Yellow No Solids 300 mrad/hr		
Component	Lab value	Lab unit
Physical data		
pH	12.4	
SpG	1.1253	
Water	91.61	%
DTA	No exothermic below 200 °C	
Cooling curve	25 °C for 45 min.	No Solids
	20 °C for 45 min.	No Solids
	15 °C for 45 min.	No Solids
	10 °C for 45 min.	No Solids
	5 °C for 45 min.	No Solids
Chemical analysis		
OH	0.128	M/L
Al	3.72E-02	M/L
Na	2.28	M/L
NO_2	0.350	M/L
NO_3	1.22	M/L
SO_4	Cancelled	
PO_4	0.104	M/L
Cl	3.36E-02	M/L
F	1.78E-03	M/L
CO_3	0.211	M/L
Radiological analysis		
Pu	2.23E-04	g/gal
GEA Cs 134	1.04E+03	μCi/gal
GEA Cs 137	1.86E+05	μCi/gal
		μCi/gal

Notes:

DTA	=	differential thermal analysis	g/gal	=	grams per gallon
GEA	=	gamma energy analysis	μCi/gal	=	microcuries per gallon
SpG	=	specific gravity	mrad/hr	=	millirads per hour
Vis-OTR	=	visual observations and over-the-top reading	M/L	=	moles per liter

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