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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-SY-101. This report supports the requirements of Tri-Party Agreement Milestone M-44-08.

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Revision 0

Tank Characterization Report for Double-Shell Tank 241-SY-101

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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 the waste stored in double-shell underground storage Tank 241-SY-101. The tank has been sampled numerous times over its service life. For the purposes of this report three sampling time frames were selected. The sampling time frames include November 1990, May 1991, and December 1991. These results from analyses of the tank waste were used to complete this characterization report, which supports *Hanford Federal Facility Agreement and Consent Order*[1] Milestone M-44-08.

Tank 241-SY-101 is located in the SY Tank Farm in the Hanford Site's 200 West Area. The tank was designed for use as a concentrated waste holding tank and went into service in 1977 with the receipt of double-shell slurry from the 242-S Evaporator/Crystallizer. In addition to periodic transfers of double-shell slurry, the tank has received concentrated complexant waste originally from B Plant and a small amount of water. Although the tank remains in service, it no longer receives waste due to its inclusion on the Flammable Gas Watch List and an associated unreviewed safety question. The tank has an operational capacity of 4,320 kiloliters (kL) (1,140 kilogallons [kgal]) and currently contains 4,160 kL (1,100 kgal) of waste. A description and status of the tank are summarized in Tables ES-1 and ES-2, and Figures ES-1 and ES-2.

[1]Ecology, EPA, and DOE, 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.

Soon after Tank 241-SY-101 began receiving waste, slurry growth due to the generation and retention of gases within the slurry was observed. Eventually, these gases were released. A pattern of waste volume increases, followed by a gas release event and subsequent waste volume decrease began. It was later discovered that these gases were potentially explosive (containing hydrogen and nitrous oxide) and that the concentration of hydrogen immediately following some of the gas release events had exceeded the lower flammability limit. This led to the declaration of an unreviewed safety question and the addition of Tank 241-SY-101 to the Flammable Gas Watch List. The slurry growth and gas release problem has currently been mitigated by the July 1993 installation of a mixing pump. The pump allows small volumes of generated gas to escape gradually from the tank and prevents the intermittent release of large volumes of gas.

The major constituents of Tank 241-SY-101 waste include water, aluminum, chloride, chromium, hydroxide, nitrate, nitrite, phosphate, potassium, sodium, sulfate, total inorganic carbon and total organic carbon. The major radionuclides present in the waste are ^{137}Cs and ^{90}Sr. Analytical results were obtained before the installation of a mixing pump. At the time, core sampling results and temperature profile measurements indicated the waste existed in three well-defined layers: the crust, convective, and non-convective layers.

The sampling of Tank 241-SY-101 occurred before the data quality objective (DQO) process was implemented. When the analytical results are compared with the *Tank Safety Screening Data Quality Objective*[2], the total fuel content limit (based on dry weight) of 481 joules per gram (J/g), measured by differential scanning calorimetry, is exceeded in about half the segments from the Window C sampling time frame and in 18 out of 21 segments from the Window E sampling time frame (see Section 3.1).

The tank heat load is 11,800 watts (40,300 British thermal units per hour [Btu/hr]), which is below the safety limit of 14,600 watts (50,000 Btu/hr) for this tank. The moisture content, total alpha, and total organic carbon levels also satisfy the safety criteria. The flammable gas concentrations in the tank dome space are presently below the lower flammability limit (LFL), and have exceeded the LFL in the past on only a few events of short duration. The gas inventory of Tank 241-SY-101 has been kept at historically low levels, as measured by slurry growth.

[2]Babad, H., and K.S. Redus, 1994, *Tank Safety Screening Data Quality Objective*, WHC-SD-WM-SP-004, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Table ES-1. Description and Status of Tank 241-SY-101.

TANK DESCRIPTION	
Type:	Double-Shell
Constructed	1976
In-Service:	1977
Diameter:	23 m (75 ft)
Operating Depth:	11 m (35 ft)
Operating Capacity:	4,320 kL (1,140 kgal)
Bottom Shape:	Flat
Ventilation:	Operating Exhauster
TANK STATUS	
Total Waste Volume:	4,160 kL (1,100 kgal)
FIC Surface Level (12/14/94):	10.1 m (399 inches)
Temperature (12/15/94):	48.7 °C (120 °F)
Integrity Category:	Sound
Watch List:	Flammable Gas
SAMPLING DATES	
Window A	November 1990
Window C	May 1991
Window E	December 1991
SERVICE STATUS	
In-Service	

Notes:
m = meter.
ft = feet.
kL = kiloliter.
kgal = kilogallon.
C = Celsius.
F = Fahrenheit.
FIC = Food Instrument Corporation.

Table ES-2. Tank 241-SY-101 Concentrations and Inventories for Major Analytes and Radionuclides of Concern.[1]

Physical Properties		
Water Content	3.50E+05 μg/g (2.37E+06 kg)	
Heat Load	11,800 watts (40,300 Btu/hr)	
Chemical Constituents	**Concentration (μg/g)**	**Bulk Inventory (kg)**
Aluminum (Al)	32,400	2.19E+05
Chromium (Cr)	3,650	24,600
Potassium (K)	3,370	22,800
Sodium (Na)	2.05E+05	1.39E+06
Total Uranium	39.1	265
Total Inorganic Carbon	7,460	50,400
Ions	**(μg/g)**	**(kg)**
Chloride (Cl^-)	8,330	56,300
Hydroxide (OH^-)	22,100	1.49E+05
Nitrate (NO_3^-)	1.26E+05	8.50E+05
Nitrite (NO_2^-)	1.10E+05	7.44E+05
Phosphate (PO_4^{3-})	6,600	44,600
Sulfate (SO_4^{2-})	3,930	26,600
Radionuclides	**(μCi/g)**	**(Ci)**
Cesium-137	342	2.31E+06
Strontium-90	19.4	1.31E+05
Plutonium-239/240	0.00689	46.6
Organics	**(μg/g)**	**(kg)**
Total Organic Carbon[2]	15,300	1.04E+05

Notes:
g/mL = gram per milliliter.
μg/g = microgram per gram.
μCi/g = microcurie per gram.
Ci = curie.
kg = kilogram.
W = watt.
Btu/hr = British thermal unit per hour.
[1] Data derived from Welsh 1995.
[2] Estimate based on Window E data only.

Figure ES-1. Tank 241-SY-101.

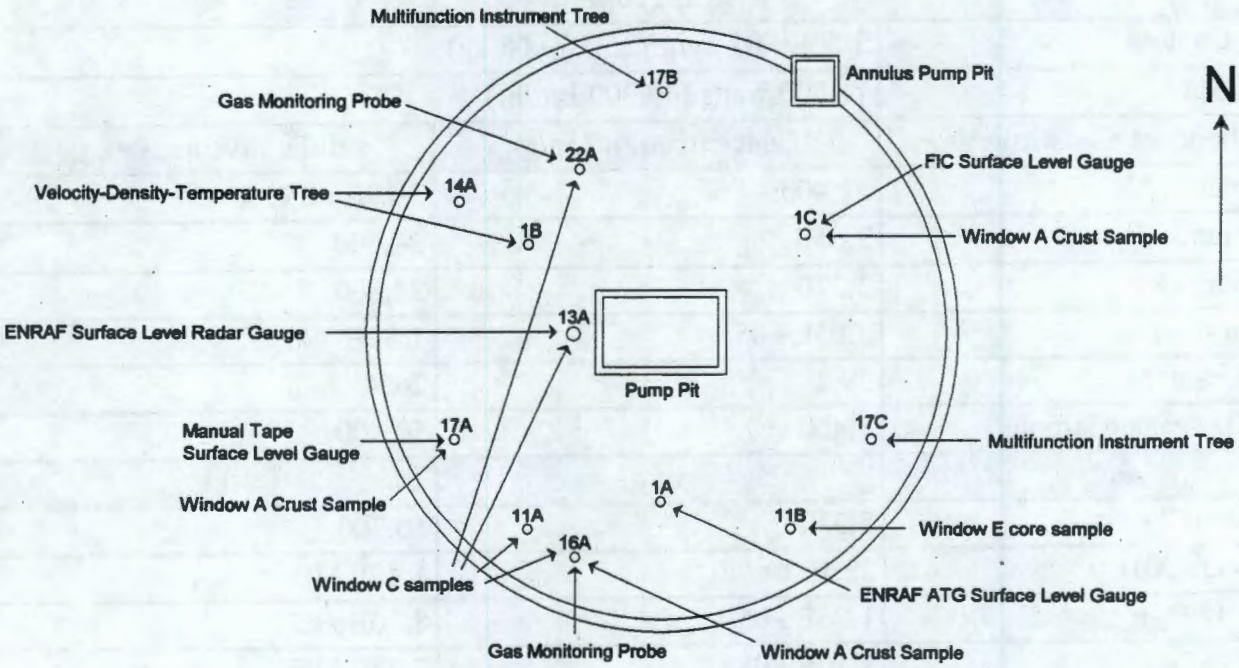
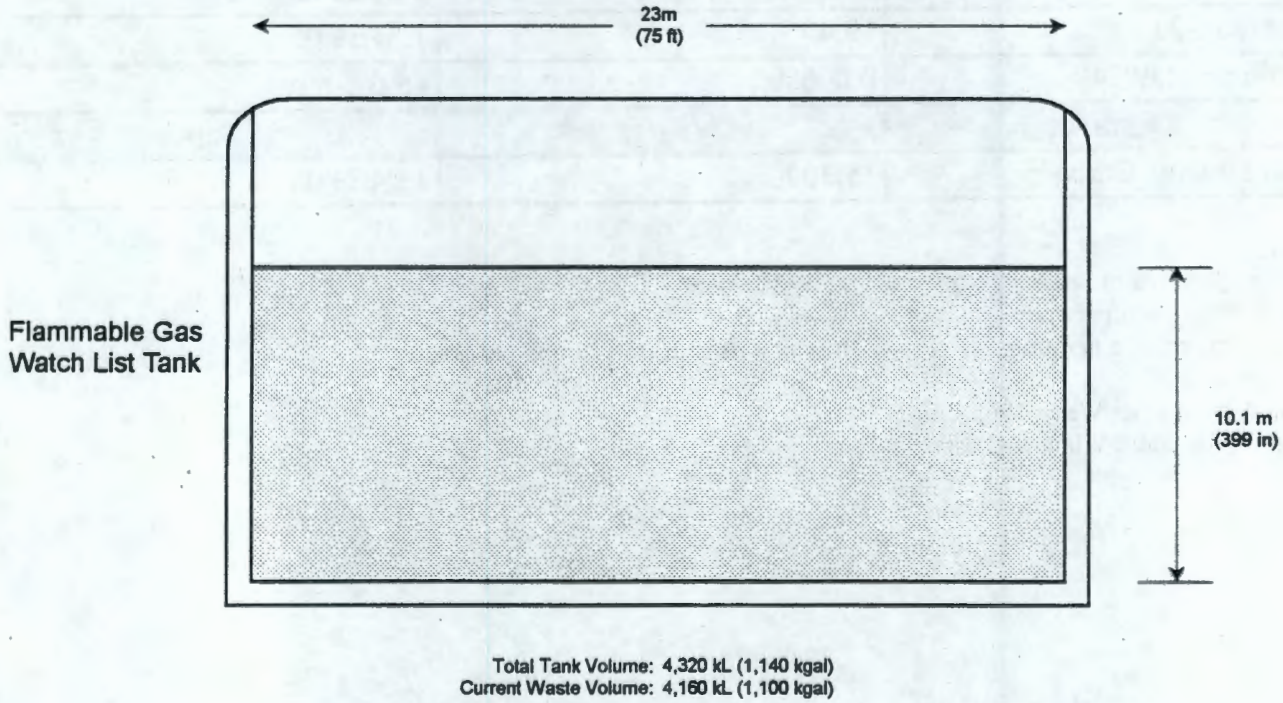


Figure ES-2. Waste Profile of Tank 241-SY-101.



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LIST OF TERMS

ANOVA	analysis of variance
CASS	Computer Automated Surveillance System
DL	detection limit
DOE	U.S. Department of Energy
DQO	data quality objectives
DSC	differential scanning calorimetry
EDTA	ethylenediaminetetraacetate
EPA	U.S. Environmental Protection Agency
FIC	Food Instrument Corporation
GEA	gamma energy analysis
GRE	gas release event
HEDTA	N-(2-hydroxyethyl)-ethylenediaminetriacetate
ICP	inductively coupled plasma
PNL	Pacific Northwest Laboratories
RPD	relative percent difference
RSD	relative standard difference
TGA	thermogravimetric analysis
TRAC	Track Radioactive Component
TWRS	Tank Waste Remediation System
USQ	unreviewed safety question
WHC	Westinghouse Hanford Company

1.0 INTRODUCTION

This tank characterization report presents an overview of double-shell Tank 241-SY-101 and its waste contents. It provides estimated concentrations and inventories for the waste components based on the latest sampling and analysis activities and background tank information available. Tank 241-SY-101 was sampled numerous times in 1990 and 1991. This tank characterization report for Tank 241-SY-101 describes the results of three sampling time frames: November 1990, May 1991, and December 1991. These samples were obtained following separate gas release events. This report supports the requirements of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1994).

1.1 PURPOSE

This report summarizes the information about the use and contents of Tank 241-SY-101. 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 more detailed information about Tank 241-SY-101.

1.2 SCOPE

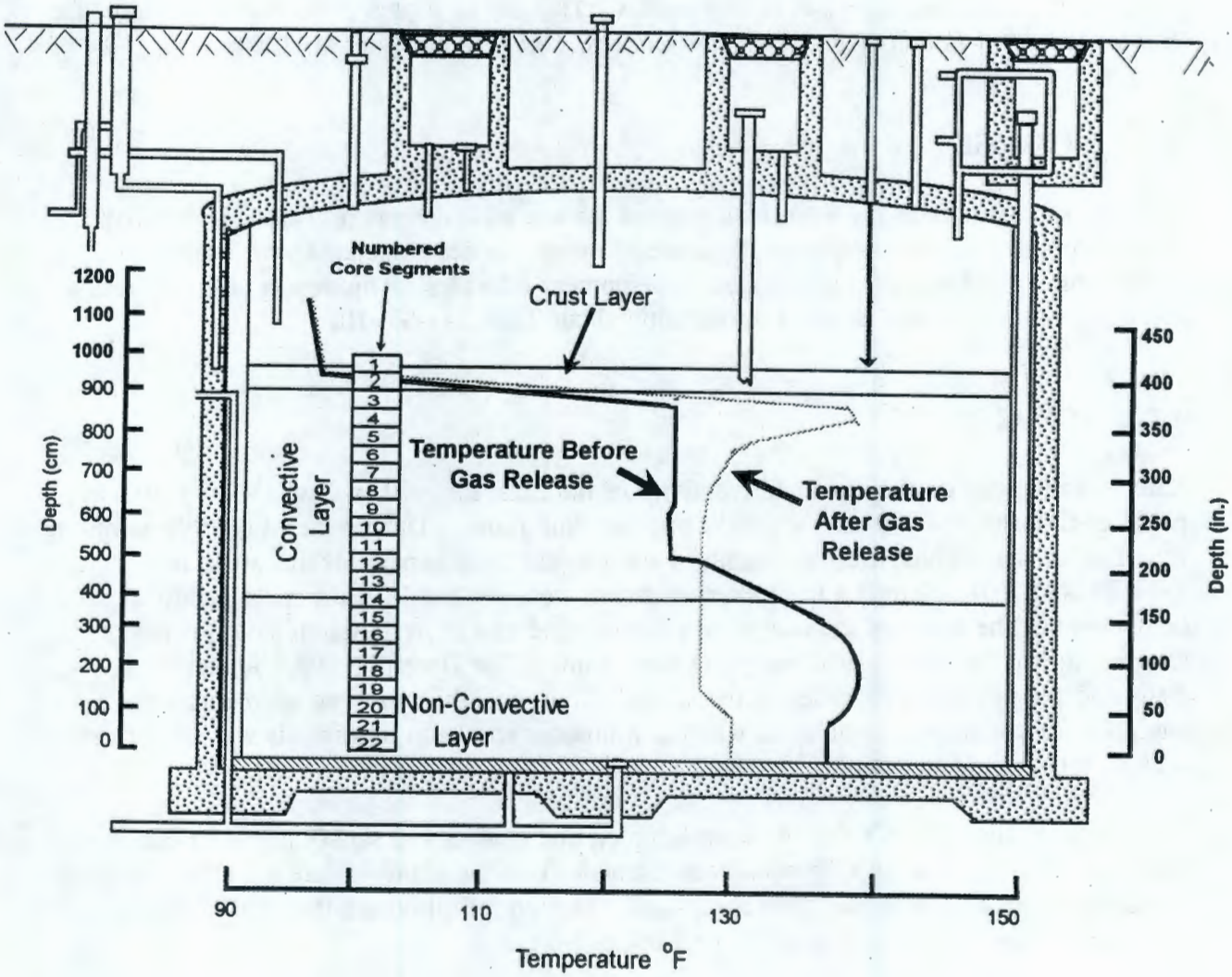
Safety evaluations on the chemical reactivity of the crust material in Tank 241-SY-101 were performed during the November 1990 sampling time frame. During the May 1991 sampling time frame, the analytical effort examined the vertical homogeneity of the waste in Tank 241-SY-101. Samples from every segment were analyzed for the main chemical components. The focus of the analytical effort shifted to a more in-depth study of fewer samples in the December 1991 sampling time frame. The December 1991 analysis evaluated the physical properties of the waste. Consequently, only two segments were analyzed for chemical constituents, whereas a broader spectrum of analysis was performed on each of the composite samples.

The waste in Tank 241-SY-101 was not sampled and analyzed to satisfy any data quality objective (DQO). The DQO process was introduced on the Hanford Site after the sampling and analysis for this tank had been completed. Section 5.5 discusses the relation of the Flammable Gas DQO (LeClair 1995) to Tank 241-SY-101.

Throughout the report, the terms convective and non-convective are used to describe layers within the Tank 241-SY-101 waste. In the convective layer, the temperature of the waste is chiefly uniform throughout the layer and is not depth dependent. In the non-convective layer, the temperature of the waste changes as a function of depth. Figure 1-1 illustrates how these layers relate to the tank waste and the changes in temperature following a gas release.

It should be noted that the analytical results used from the three sampling time frames were obtained from Tank 241-SY-101 prior to the installation of a mixer pump, which may have combined the convective and non-convective layers into a single slurry.

Figure 1-1. Tank 241-SY-101 In-tank Temperature Profile.



2.0 HISTORICAL TANK INFORMATION

Tank 241-SY-101 is in active service, although administrative controls placed on this Watch List tank limit waste transfers to and from the tank. The most current volume status of the tank is provided in reports that are routinely updated. This chapter includes tank design information, waste transfer history, and waste temperature and level surveillance information.

2.1 TANK STATUS

Tank 241-SY-101 is a double-shell underground storage tank containing 4,160 kiloliters (kL) (1,100 kilogallons [kgal]) of concentrated complexant waste (Hanlon 1995). The waste temperature profile at the time of sampling indicates that the waste existed in the tank in three well-defined layers: (1) the crust layer, (2) the convective layer, and (3) the non-convective layer. Tank 241-SY-101 is *in service*; however, operation has been restricted due to its placement on the Flammable Gas Watch List and an associated unreviewed safety question (USQ). The structural integrity of the tank is classified as *sound*. All monitoring systems are currently in compliance with established standards (Hanlon 1995). The highest temperature within Tank 241-SY-101 occurred on December 15, 1994, and was measured at 48.7 degrees Celsius (°C) (120 degrees Fahrenheit [°F]). Waste levels and tank temperatures are further discussed in Section 2.4.

Tank 241-SY-101 has been the most active Hanford Site tank for displaying the cyclical accumulation and release of gases. An unreviewed safety question regarding the gas releases was declared in March 1990 and this tank has been on the Flammable Gas Watch List since January 1991. A pump, installed in 1993 to mix the tank contents, has kept large volumes of flammable gases from accumulating within the waste (Hanlon 1995) (see Section 2.3).

2.2 TANK DESIGN

Tank 241-SY-101 is one of three double-shell tanks that comprise the SY Tank Farm in the Hanford Site's 200 West Area. The basic tank design is shown in Figure 2-1. Further information about the SY Tank Farm may be found in the *Tank Characterization Reference Guide* (De Lorenzo et al. 1994). The location of the SY Tank Farm is shown in Figure 2-2.

Figure 2-1. Basic Design of Tank 241-SY-101.

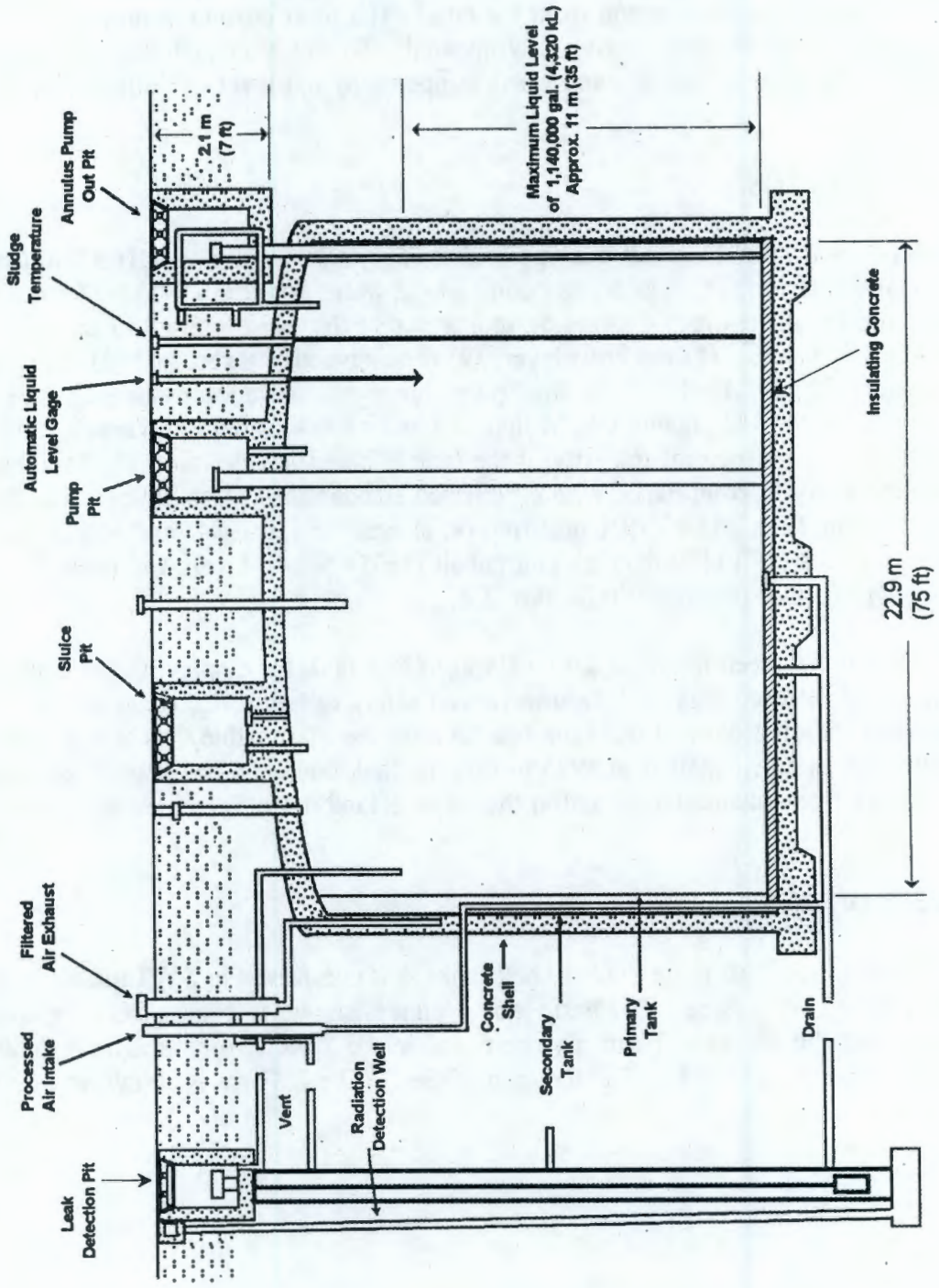
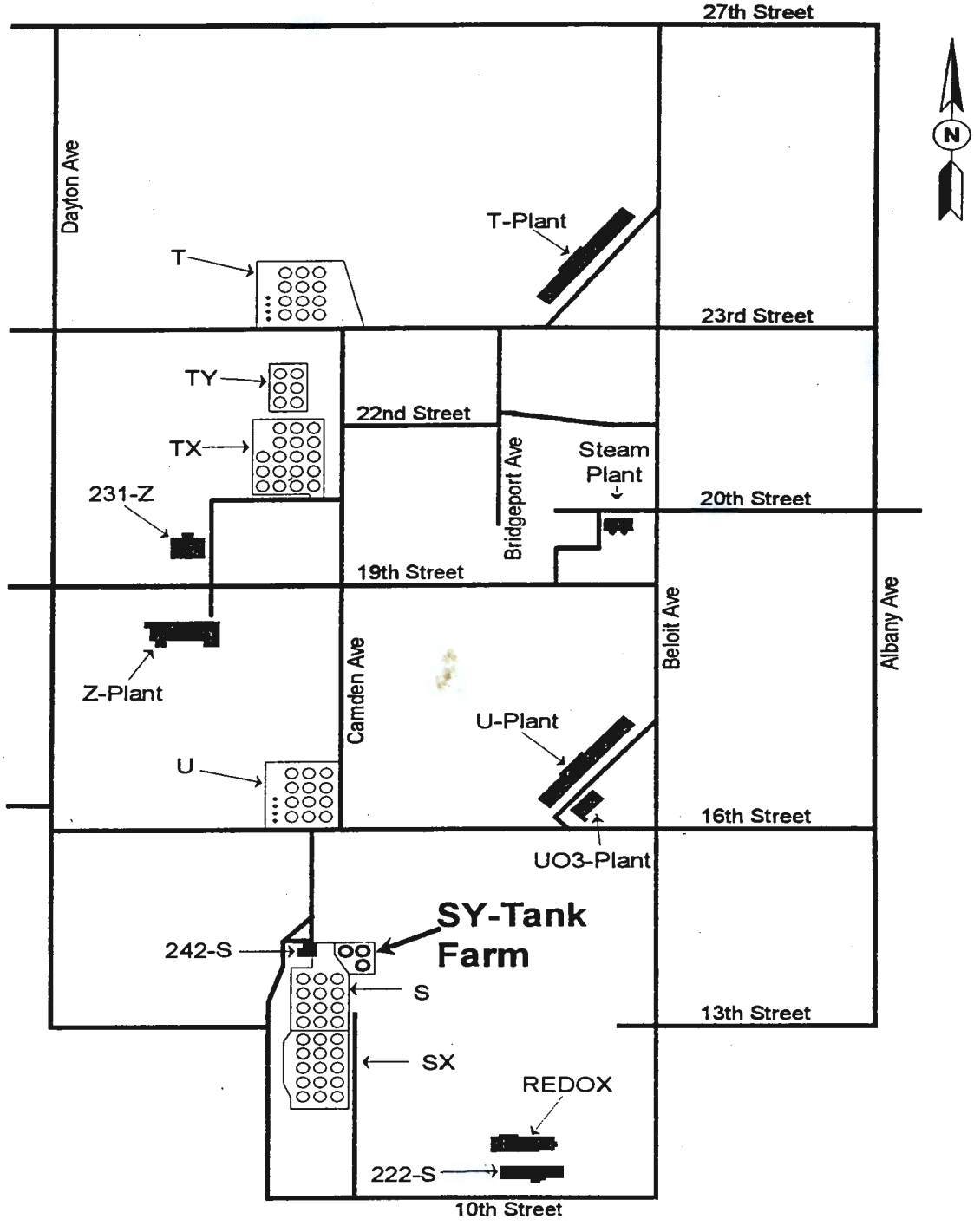


Figure 2-2. Location of SY Tank Farm.



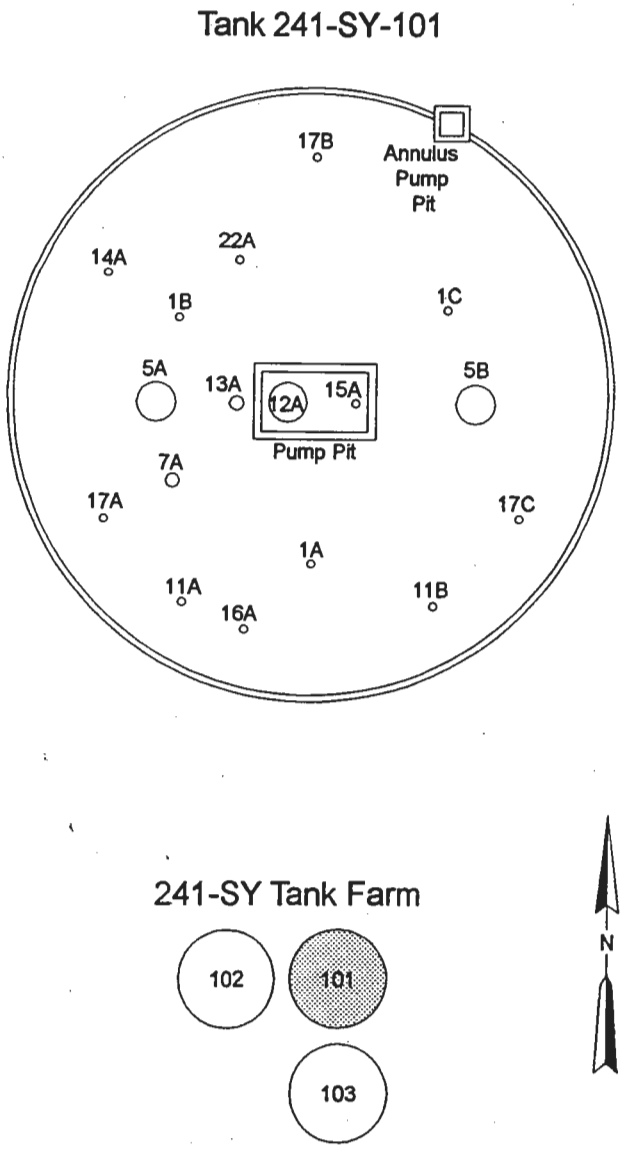
The construction of Tank 241-SY-101 was completed in 1976. The tank is constructed of two steel liners within a protective shell. The protective shell is constructed of reinforced concrete designed to sustain soil loads and temperature gradients generated by the contained radioactive waste. The inner wall of the concrete shell is lined with a carbon-steel liner, referred to as the secondary steel tank. The primary tank, also constructed of carbon-steel, is completely enclosed within the secondary tank. The primary tank is free standing and is positioned on an insulated concrete pad. The insulated concrete pad protects the structural concrete foundation from excessive temperatures during annealing or stress relief treatment of the primary tank. The insulating pad is also cast with air distribution and drain grids to provide for leak detection, maintain a uniform tank bottom temperature, facilitate heat removal, and eliminate pockets of water condensation. An annular space separates the two steel liners and serves as a containment barrier for the primary tank leakage. The tanks are actively vented to the environment using fan-driven ventilation. The primary ventilation system removes vapors from the primary tank. The annulus ventilation system is used to cool the primary tank, remove moisture accumulation from the annular space, and aid in the detection of radioactive leakage.

Instruments access the tank through risers and monitor pressure, temperature, waste level, and other bulk tank characteristics (Anderson 1992). Figure 2-3 shows the riser positions and associated equipment for Tank 241-SY-101. The waste temperature is monitored by thermocouples attached to two multifunction instrument trees. Also, two velocity-density-temperature trees are equipped with a number of instruments to measure waste temperature, pressure, and movement. A pressure sensor transmits dome-space pressure data. Tank 241-SY-101 is equipped with gas sampling systems that provide air-stream samples to a gas chromatograph, a mass spectrometer, three electrochemical hydrogen detectors, and a Fourier transform infrared spectrometer (Wilkins 1993). The waste surface level can be measured by four instruments: automatic probes (a Food Instrument Corporation [FIC] gauge and an ENRAF liquid-level gauge), a manual tape, and a radar gauge. In May 1991, a remote video camera and lights were installed in risers 5A and 5B, respectively. Waste can be introduced and removed from the tank through risers in the central pump pit. Active ventilation is used to keep the tank contents cool and to minimize the potential for release of airborne contaminants to the environment.

In July 1993, a mixer pump was installed in Tank 241-SY-101. The mixer pump was installed in an attempt to mitigate episodic releases of hydrogen and other gases trapped in the non-convective layer. It is also assumed that the mixer pump blended the convective and non-convective layers into a fairly homogeneous slurry throughout the tank.

Tank 241-SY-101 has a maximum design capacity of 4,390 kL (1,160 kgal) of waste; however, safety considerations restrict the maximum operating capacity to 4,320 kL (1,140 kgal) (WHC 1994; Welty 1988). The tank has a diameter of 23 meters (m) (75 feet [ft]) and a usable depth of 11 m (35 ft).

Figure 2-3. Tank 241-SY-101 Riser Configuration.



No.	Dia.	Description and Comments
1A	4"	ENRAF 854 ATG Level Gauge
1B	4"	Velocity-Density-Temperature Tree
1C	4"	FIC Level Gauge
5A	42"	Multiport Riser Assembly, Video Camera
5B	42"	Camera Assembly
7A	12"	Vessel Exhaust Port
11A	4"	Spare
11B	4"	Tank Pressure Port
12A	42"	Mixer Pump
13A	12"	ENRAF Radar Gauge
14A	4"	Velocity-Density-Temperature Tree
15A	4"	Dropleg Nozzle
16A	4"	Gas Monitoring Probe
17A	4"	Manual Tape
17B	4"	Multifunction Instrument Tree
17C	4"	Multifunction Instrument Tree
22A	4"	Gas Monitoring Probe

Sources: Anderson 1992
U.S. DOE 1994

2.3 PROCESS KNOWLEDGE

Tank 241-SY-101 was originally designed for use as a concentrated waste holding tank. The tank was put into operation in April 1977 with the introduction of double-shell slurry from the 242-S Evaporator/Crystallizer (Alleman et al. 1993; Simpson 1984). Subsequent additions of complexant concentrate waste and double-shell slurry nearly filled the tank by 1980.

Shortly after the first waste was added to Tank 241-SY-101, the waste began to exhibit slurry growth. This phenomenon involves the generation and retention of gases within the slurry, causing an increase in the overall waste volume. Slurry growth continued to be observed in Tank 241-SY-101 after it received its last waste additions in 1980. The waste then followed a pattern of steady volume increase from slurry growth with episodic volume decreases as large volumes of gas were released (Alleman et al. 1993). Figure 2-4 illustrates this cyclic change of slurry growth and gas release events (GREs). Recent GREs are summarized in Table 2-1. An explanation of the mechanisms of gas accumulation and release in Tank 241-SY-101 can be found in the *Assessment of Gas Accumulation and Retention - Tank 241-SY-101* (Alleman et al. 1993) and *Understanding of Cyclic Venting Phenomena in Hanford Site High-Level Waste Tanks: The Evaluation of Tank 241-SY-101* (Babad et al. 1992).

In an effort to understand and control the slurry growth phenomenon, laboratory studies were conducted in 1978 and 1979 by the Chemical Sciences Group using waste simulants. This study was summarized in *Synthetic Double Shell Slurry Gas Identification* (Lane 1979). The study showed that the slurry growth was caused by gases being trapped within the slurry. Experimentation concluded that hydrogen gas levels were well above the lower explosion limit (4 percent hydrogen) and, in fact, contained nearly 12 percent hydrogen. Further studies determined that gas generation was dependent on the presence of certain chemicals, including organics, nitrite, aluminate, and hydroxide (Delegard 1980). Air or water was injected into the Tank 241-SY-101 waste from 1986 to 1989 in an attempt to liberate the accumulating gas (Babad et al. 1992). This lancing process was discontinued in 1989 because it did not stop the cycle of slurry growth and episodic gas release. In fact, the surface level reached 10.8 m (35.4 ft), which exceeds the 10.7 m (35.1 ft) operating specification that is in place to prevent the overfilling and overstressing of the tank.

Concern over slurry growth was heightened in 1989, when it was recognized that the gases generated and released included a mixture of hydrogen (a fuel) and nitrous oxide (an oxidizer) that was flammable and potentially explosive even if not mixed with air (Alleman et al. 1993, Babad et al. 1992). Because this condition had not been considered in the applicable safety analysis report, a USQ was declared in March 1990. Although the USQ was the result of concern over the generation and release of a hydrogen/nitrous oxide gas mixture, extensive analytical and experimental work has since demonstrated the need to consider other flammable gases, such as ammonia and methane (LeClair 1995).

Figure 2-4. Waste Volume History of Tank 241-SY-101.

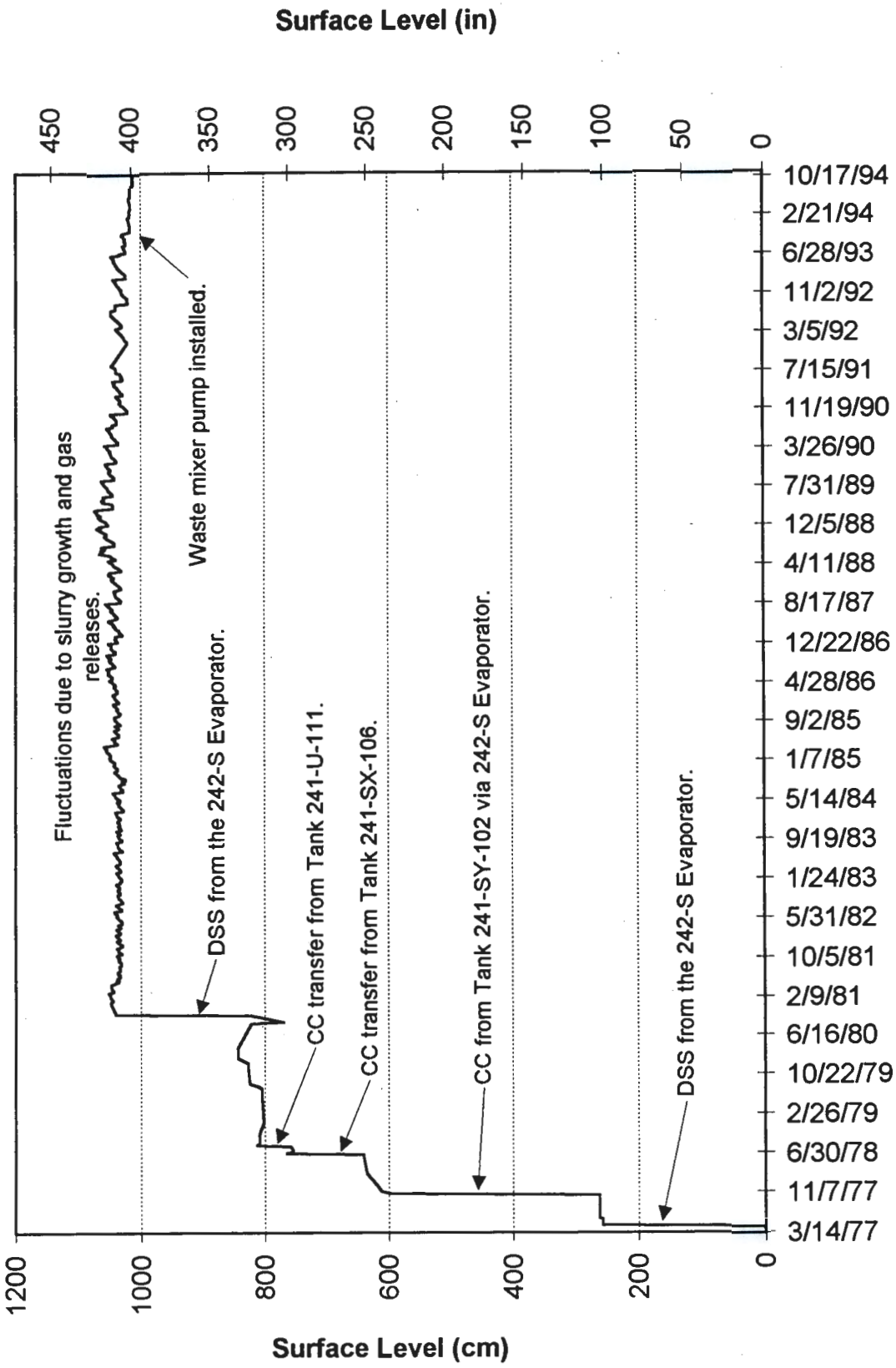


Table 2-1. Tank 241-SY-101 Gas Release Events Between October 1990 and February 1993.[1]

Event Date	10/24/90	2/16/91	5/16/91	8/27/91	12/04/91	4/20/92	9/03/92	2/02/93
Days Since Previous Event	80	116	89	103	101	138	136	152
Surface Level Drop (cm)	25.9	12.7	18.3	15.4	33.0	18.3	33.5	21.6
Estimated Slurry Gas Released (m^3) *	238	104	150	114	270	130	297	184

Notes:
cm = centimeter.
m^3 = cubic meter.
*Using 20.6 m^3/cm.
[1]Data derived from Wilkins 1993.

A waste mixing pump was installed in Tank 241-SY-101 in July 1993 to mitigate the gas retention problem. The mixer pump allows a continual release of gas, preventing accumulation and a large GRE. Pump testing was completed in 1994 and its long-term operation began. Operation of the pump has maintained the gas inventory in Tank 241-SY-101, as measured by slurry growth, at historically low levels. The waste surface level has remained between 1,012 centimeters (cm) (398.5 inches [in.]) and 1,015 cm (399.7 in.) (Hanlon 1995).

2.3.1 Waste Transfer History

This section presents the transfer history of Tank 241-SY-101 and describes the process wastes that made up these transfers. The information in this section is taken from an internal memo detailing a study of the tank's fill history (Simpson 1984) and a later paper concerning Tank 241-SY-101 (Babad et al. 1992). Table 2-2 details the transfer history of Tank 241-SY-101. The "Volume" entries in Table 2-2 indicate the cumulative volume of transfers of a specific waste type over the indicated time period.

Table 2-2. Transfer History of Tank 241-SY-101.[1]

Month/year	Waste Type	Waste Source	Volume kL (kgal)
4/77	DSS	242-S Evaporator	1,044 (276)
11/77	CC	Tank 241-SY-102 via 242-S	1,384 (366)
6/78	CC	Tank 241-SX-106	505 (133)
8/78	CC	Tank 241-U-111	225 (59.5)
10/80	DSS	242-S Evaporator	876 (231)
9/84 - 5/88	Water	Water Lancing	30.3 (8)

Notes:
kL = kiloliter.
kgal = kilogallon.
DSS = Double-shell slurry.
CC = Complexant Concentrate waste.
[1]Data derived from Simpson 1984 and Babad et al. 1992.

The first waste received was double-shell slurry from the 242-S Evaporator/Crystallizer. Double-shell slurry is the most concentrated product that the Hanford Site evaporators produced (Strode et al. 1988). This waste, concentrated beyond the aluminate precipitation boundary, is highly viscous. The degree of evaporation is limited only by the ability of the slurry to be pumped. Double-shell slurry has high concentrations of hydroxide, nitrate, and aluminate (Babad et al. 1992).

During 1977-78, complexant concentrate waste was placed on top of the heavier double-shell slurry. Complexant concentrate is an evaporated waste originating from the B Plant cesium/strontium recovery process. It is rich in complexing agents such as sodium salts of ethylenediaminetetraacetate (EDTA), N-(2-hydroxyethyl)ethylenediaminetriacetate (HEDTA), and citric and glycolic acid. Unlike double-shell slurry, complexant concentrate has not been concentrated beyond the aluminate precipitation boundary (Babad et al. 1992).

More double-shell slurry was added to Tank 241-SY-101 in 1980. Finally, a relatively small amount of water was added to the tank during water-lancing activities in the late 1980s. The process history of Tank 241-SY-101 is presented graphically in Figure 2-4. Table 2-3 estimates the total volumes of the specific waste types that were added to the tank. There have been no transfers out of the tank.

Table 2-3. Cumulative Waste Volume Received by Tank 241-SY-101.[1]

Waste Type	Estimated Volume kL (kgal)	Years Received
DSS	1,919 (507)	1977, 1980
CC	2,112 (558)	1977 - 1978
Water	30.3 (8)	1984 - 1988

Notes:
kL = kiloliter.
kgal = kilogallon.
DSS = Double-shell slurry.
CC = Complexant Concentrate waste.
[1]Data derived from Simpson 1984 and Babad et al. 1992.

2.3.2 Historical Estimation of the Contents of Tank 241-SY-101

A preliminary estimate of the waste constituents of Tank 241-SY-101 can be developed from historical transfer and process records. Two models developed to predict the chemical content of Hanford Site waste tanks are the Track Radionuclide Constituents Model (TRAC) (Jungfleisch 1984) and the Tank Layer Model (Agnew et al. 1995).

The TRAC model represented the Hanford Site waste management system and predicted selected waste constituent inventories for each tank by performing a mass balance. Historical records from production and treatment facilities, a waste transaction record of inter-tank transfers, and models to simulate reactors, chemical processes, and waste management operations through 1980 formed the basis of the project. The input data, computer code, and resultant waste composition predictions have neither been verified nor validated. Special circumstances encountered in a localized area may not have been incorporated into the TRAC model. TRAC predictions for chemical constituent and radionuclide inventories for Tank 241-SY-101 are presented in Table 2-4.

Table 2-4. Tank 241-SY-101 TRAC Inventory Estimates.[1]

Chemical Constituents			
Analyte	kg	Analyte	kg
Al^{3+}	54,000	K^{+}	391
$C_2H_3O_3^{-}$	750	Mn^{2+}	220
$C_6H_5O_7^{3-}$	18,900	NO_2^{-}	46,000
CO_3^{2-}	6,000	NO_3^{-}	3.72E+05
Cr^{3+}	1.04	Na^{+}	69,000
$EDTA^{4-}$	5,760	Ni^{2+}	0.0117
F^{-}	950	OH^{-}	13.6
Fe^{2+}	1,680	PO_4^{3-}	1,900
$HEDTA^{3-}$	8,250	SO_4^{2-}	5,760
Radiological Constituents			
Analyte	Ci	Analyte	Ci
^{241}Am	400	^{90}Sr	3.00E+05
^{14}C	30.0	^{99}Tc	200
^{137}Cs	3.00E+05	—	—

Notes:
kg = kilogram.
Ci = curie.
$C_2H_3O_3^{-}$ = Glycolate.
$C_6H_5O_7^{3-}$ = Citrate.
EDTA = Ethylenediaminetetraacetate.
HEDTA = N-(2-hydroxyethyl)ethylenediaminetriacetate.
[1]Data derived from Jungfleisch 1984.

The Tank Layer Model (Agnew et al. 1995) was developed at Los Alamos National Laboratory and its predictions are presented in Historical Tank Content Estimates. Historical transfer records are used to estimate the volume of each waste type in each tank. The volume data are combined with waste stream chemistry data to derive an estimate of the composition of a tank's current contents. It should be noted that this model has not been validated. The Tank 241-SY-101 Historical Tank Content Estimate was not yet available at the time this report was compiled.

2.4 SURVEILLANCE DATA

2.4.1 Surface Level Readings

The surface level of the waste in Tank 241-SY-101 is measured using two automatic gauges, a radar gauge, and a manual tape (see Figure 2-3 for equipment locations). The manual tape and FIC gauge use conductivity probes that are lowered until an electrical circuit is completed as the probe contacts the waste surface. As its name denotes, the manual tape must be lowered by an operator. The FIC gauge, which is the primary surface-level measurement device for the tank, can be operated manually or automatically. The ENRAF liquid-level gauge employs a displacer that is lowered until a change in the weight of the displacer is detected as it contacts the waste surface. Tank 241-SY-101 is also equipped with an ENRAF radar-level gauge. The radar gauge measures the surface level using electromagnetic energy; the gauge is not sensitive to local surface variations and is not subject to incorrect readings due to the buildup of waste on equipment contacting the surface level (Wilkins 1993). The FIC gauge readings are sent to the Computer Automated Surveillance System (CASS). Available readings from all the gauges are entered into the Surveillance Analysis Computer System database.

Surface level readings are currently being taken from the FIC gauge daily (Hanlon 1995). A surface level measurement of 10.1 m (399 in.) was recorded on December 14, 1994. As Figure 2-4 depicts, the waste level in Tank 241-SY-101 has fluctuated somewhat even though no waste has been added since 1986 (the FIC gauge has a precision of ± 0.5 in. for measuring surface levels of floating solids [Johnson 1995]). Gains and losses during this time have been attributed to gas accumulation and releases, changes in instrumentation, and unknown causes.

2.4.2 Internal Tank Temperatures

Local tank temperatures within Tank 241-SY-101 are monitored by thermocouples in two multifunction instrument trees that enter the tank through risers 17B and 17C. The thermocouples (type K with a standard average error of ± 3 °C [16 °F] [Scaief 1991]) monitor temperatures at 22 levels within the primary tank. A temperature of 48.7 °C (120 °F) recorded from thermocouples 7, 8, 11, 12, 15, and 16 at riser 17C on December 15, 1994, was the highest temperature measured in the tank on that date.

Waste layers in the tank were initially defined from vertical temperature profiles. That is, the crust exhibits thermal insulating properties relative to the liquid layer beneath; the convective layer lies beneath the crust; and a non-convective layer of liquid and settled solids particles lies below the convective layer. An examination of historical temperature records shows that during GREs waste temperatures demonstrate an axial reversal of their profile for a time as the waste "rolls over" (Alleman et al. 1993). This reversal is depicted in Figure 2-5 with temperature data gathered during the October 24, 1990, GRE (Barker et al. 1991). Data gathered from the beginning of the GRE are plotted from three elevations within the waste: (1) in the upper part of the convective region (thermocouple 19), (2) in the lower part of the convective region (thermocouple 10), and (3) in the non-convective region (thermocouple 5).

Historical data provided by Tank Farm Surveillance were limited to data from March to November 1994. The minimum temperature was 21.4 °C (70.5 °F) at thermocouple 22 in riser 17B on June 26, 1994; at the time of the reading this thermocouple was in the vapor space about 4.5 cm above the waste. The maximum temperature was 48.7 °C (120 °F) at thermocouples 7, 8, 11, 12, 13, 15, and 16 in riser 17C on November 5, 1994. The average temperature for the time period was 44.2 °C (112 °F). Data from identical elevations in Figure 2-5 are plotted in Figure 2-6 using the 1994 data. The data tend to converge a number of times during mixing pump operations, especially in the latter part of the year.

After the pump was installed, it went through a prolonged testing period during which it was operated for short bursts. It was approximately one year after the pump was installed before it was operated for a long enough period to mix the contents of the tank sufficiently to result in waste temperature convergence.

2.4.3 Tank 241-SY-101 Photographs

Figure 2-7 presents photographs taken within Tank 241-SY-101 during April 1989. The tank waste surface shows substantial differences in surface texture, uniformity, and elevation. Two probes shown in the photograph that penetrate the waste are splattered, as are the tank wall surfaces. These splash marks may be the result of an energetic disturbance of the waste and illustrate some of the dynamic history of the tank (Brager 1993). Another plausible explanation to the markings is that there may have been a considerable amount of splashing during transfers into the tank.

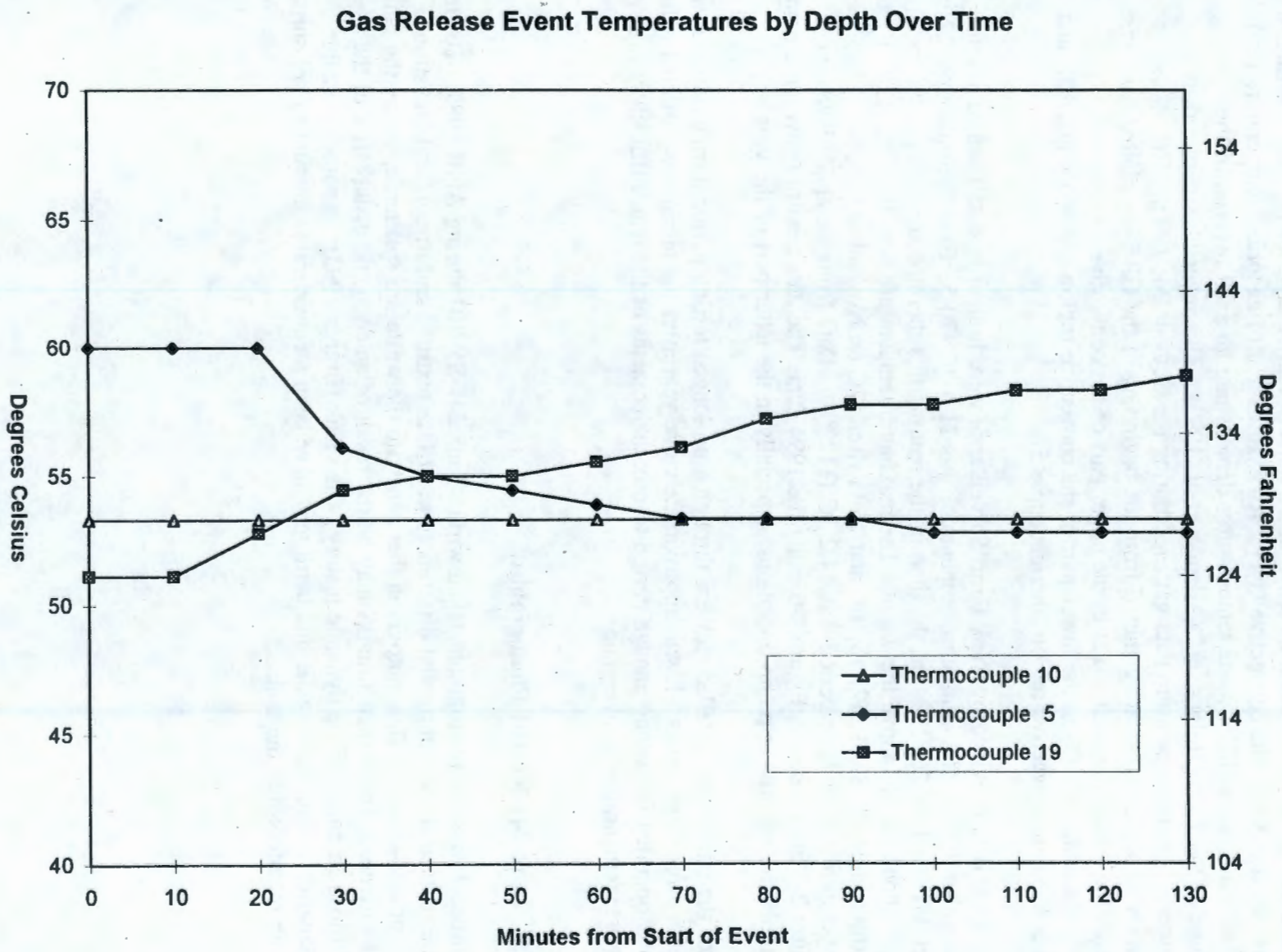
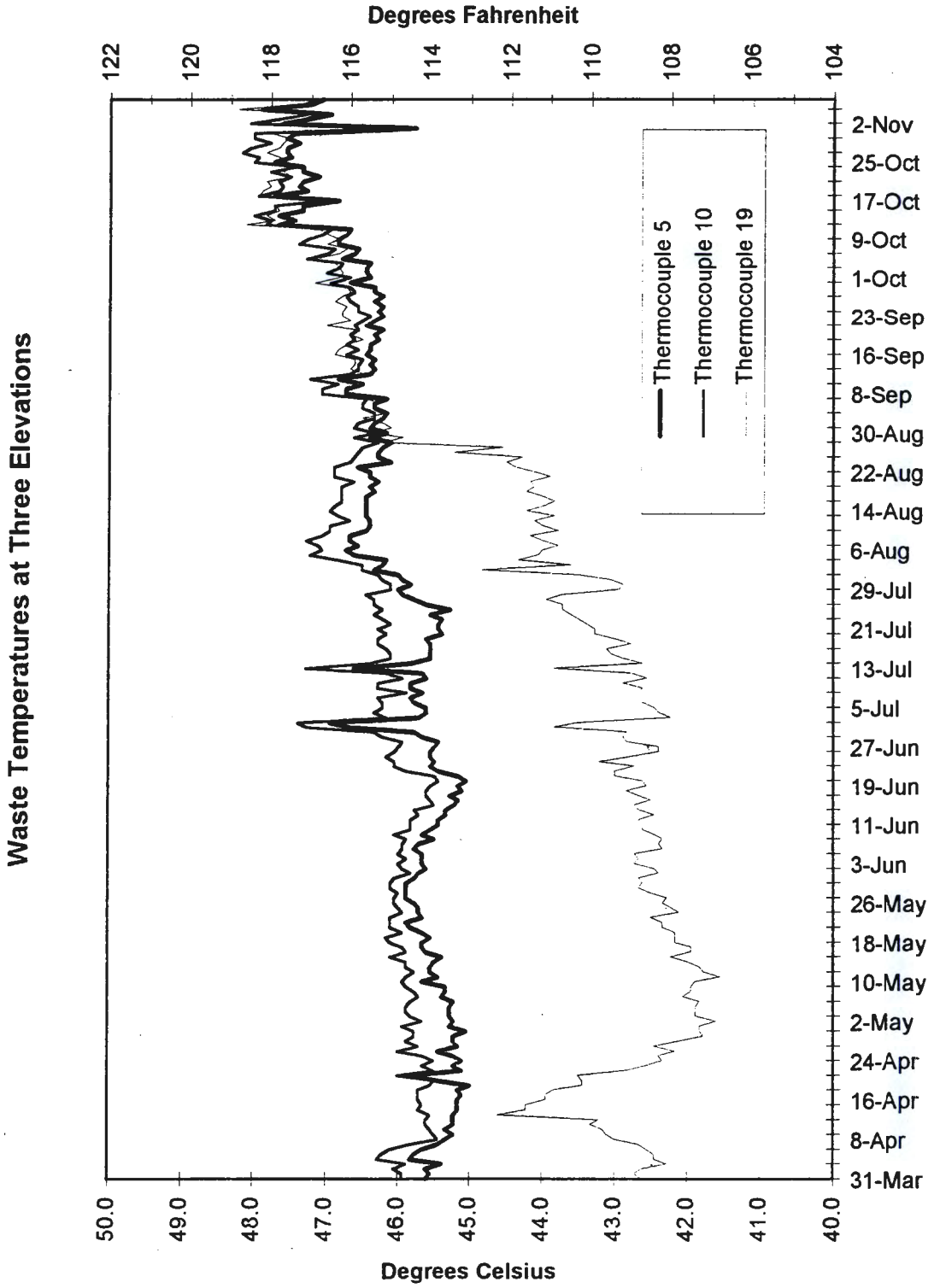


Figure 2-5. Temperature Data from October 24, 1990, Gas Release Event. (Barker et al. 1991).

Figure 2-6. Tank 241-SY-101 1994 Temperature Data.



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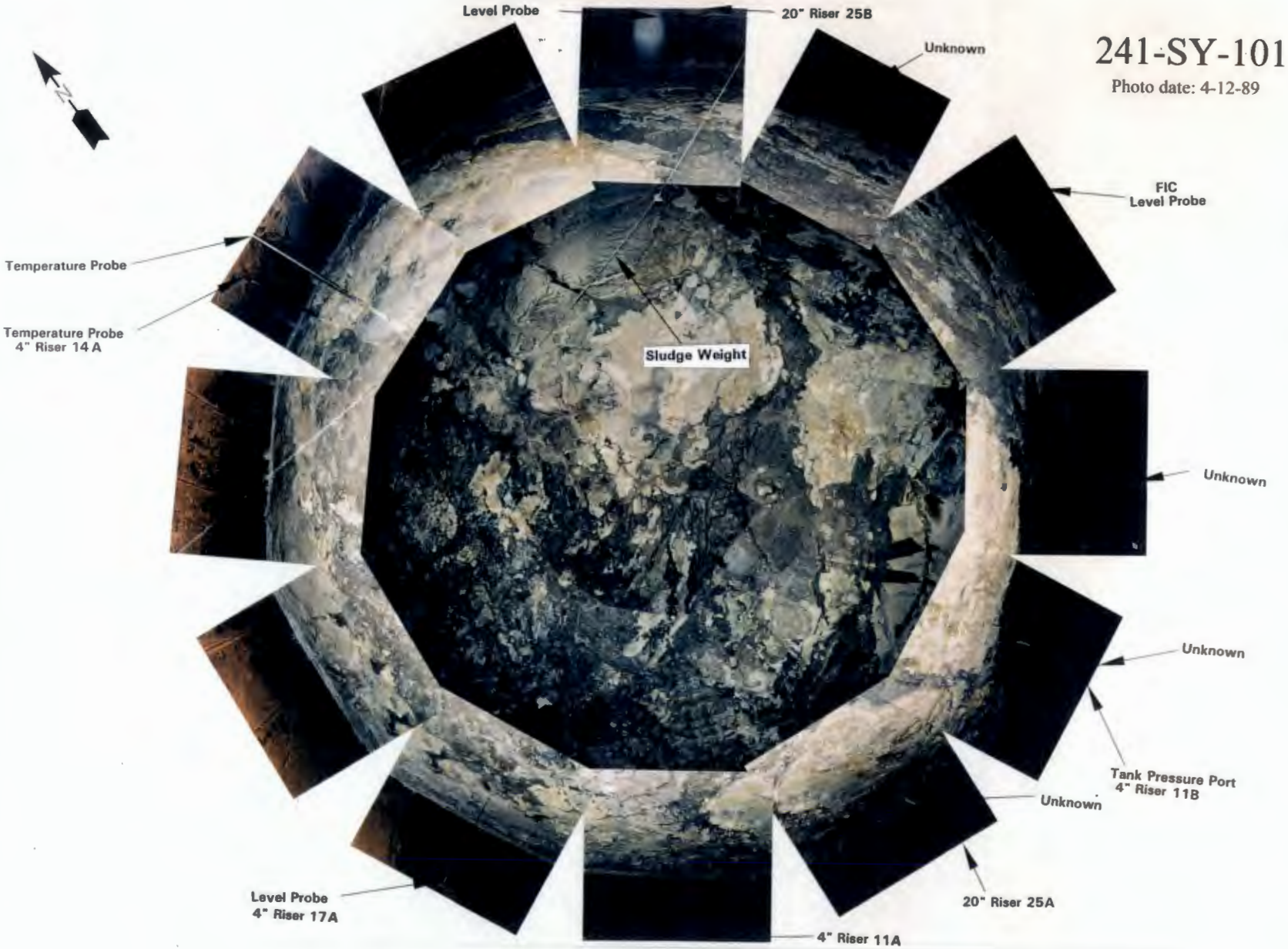

Figure 2-7. In-Tank Photo Montage of Tank 241-SY-101.

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3.0 TANK SAMPLING OVERVIEW

A stratum is a contiguous portion of a tank's contents that has similar properties throughout. A stratum may be represented by a single segment or a portion thereof, or several contiguous segments. Three strata were identified in Tank 241-SY-101 prior to the installation of the mixing pump: (1) a crust, (2) a convective slurry stratum, and (3) a non-convective sludge stratum.

The crust (stratum 1) is the uppermost cohesive layer within the tank. A crust may be solid or semi-solid and may have liquid on top and/or below. The convective layer, or stratum 2, is so named due to its temperature profile; the temperature of the waste is reasonably uniform throughout this region of the tank, except for a few days immediately after a gas release event (GRE). The non-convective layer (stratum 3) is that region of waste that appears, from thermocouple data, to be thermally non-convective; that is, the temperature of the waste changes as a function of depth.

This chapter describes the acquisition and handling of the waste samples for Tank 241-SY-101 that took place between November 1990 and December 1991.

3.1 DESCRIPTION OF SAMPLING (Windows A, C, and E)

Tank 241-SY-101 was sampled several times in 1990 and 1991 following separate releases of an accumulated quantity of hydrogen and other gases in turbulent mixing events. Gas venting inside the dome is a phenomenon that has historically occurred approximately every 90 to 100 days. The gas releases associated with the sampling endeavors discussed in this report occurred on October 24, 1990, May 16, 1991, and December 4, 1991.

Each gas release triggered a planned sampling activity aimed at physically and chemically characterizing the tank waste. As soon as the post-venting safety criteria were met, a time frame during which sampling was deemed safe was declared open. The November 1990 open time frame was identified as Window A; the May 1991 time frame was designated Window C; and the December 1991 open time frame was designated Window E.

Table 3-1 lists the sample locations by riser along with the sample numbers and date of sampling for the Windows A, C, and E open time frames. Figures 3-1 and 3-2 present a visual representation of the sampling locations, numbered segment locations, and assumed layering within the tank during the sampling time frames.

Table 3-1. Tank 241-SY-101 Sample Locations, Sampling Dates, and Numbers. (2 sheets)

WINDOW A			WINDOW E [1]		
Riser: Device	Sample Number	Sample Date	Riser:Core: Segment	Sample Number	Date Sampled
17A:MT	R8423	11-18-90	11B:028:01	91-058	12-14-91
1C:FIC	R8521	11-18-90	11B:028:02	91-059	12-14-91
16A:SW	R8422	11-18-90	11B:028:03	91-060	12-15-91
WINDOW C			11B:028:04	91-061	12-14-91
Riser:Core: Segment	Sample Number	Date Sampled	11B:028:05	91-062	12-14-91
22A:022:01	91-001	05-22-91	11B:028:06	91-063	12-14-91
22A:022:02	91-002	05-22-91	11B:028:07	91-064	12-14-91
22A:022:03	91-003	05-22-91	11B:028:08	91-065	12-15-91
22A:022:04	91-004	05-22-91	11B:028:09	91-066	12-15-91
22A:022:05	91-005	05-22-91	11B:028:10	91-067	12-15-91
22A:022:06	91-006	05-21-91	11B:028:11	91-068	12-15-91
22A:022:07	91-007	05-23-91	11B:028:12	91-069	12-15-91
22A:022:08	91-008	05-23-91	11B:028:13	91-070	12-15-91
22A:022:09	91-009	05-23-91	11B:028:14	91-071	12-15-91
22A:022:10	91-010	05-23-91	11B:028:14R	91-071R	12-19-91
22A:022:11	91-011	05-23-91	11B:028:15	91-072	12-15-91
22A:022:12	91-012	05-23-91	11B:028:16	91-073	12-16-91
22A:022:13	91-013	05-23-91	11B:028:17	91-074	12-16-91
22A:022:14	91-014	05-23-91	11B:028:18	91-075	12-16-91
22A:022:15	91-015	05-24-91	11B:028:19	91-076	12-16-91
22A:022:16	91-016	N/A[2]	11B:028:20	91-077	12-16-91
22A:022:16R	91-016R	05-26-91	11B:028:21	91-078	12-16-91
22A:022:17	91-017	05-26-91	11B:028:21R	91-078R	12-16-91
22A:022:18	91-018	05-26-91	11B:028:22	91-079	12-16-91
22A:022:19	91-019	05-26-91	11B:028:22R	91-079R	12-16-91
22A:022:20	91-020	05-26-91	---	---	---
22A:022:21	91-021	05-26-91	---	---	---
22A:022:22	91-022	05-26-91	---	---	---
22A:023:1	91-023	06-04-91	---	---	---

Table 3-1. Tank 241-SY-101 Sample Locations, Sampling Dates, and Numbers. (2 sheets)

WINDOW C (continued)			WINDOW E [1] (continued)		
Riser:Core: Segment	Sample Number	Date Sampled	Riser:Core: Segment	Sample Number	Date Sampled
22A:023:2	91-024	06-04-91	---	---	---
22A:023:3	91-025	06-04-91	---	---	---

Notes:
[1]At the time this report was written several chain-of-custody records for Window E were missing.
[2]The chain-of-custody noted that the sampling truck had malfunctioned on this sample and determined that this may or may not have been a good sample.
MT = Manual Tape Plummet.
FIC = Food Instrument Company Plummet.
SW = Sludge Weight.

3.1.1 Window A

On November 18, 1990, three crust samples were obtained from Tank 241-SY-101. The samples were collected from the material adhering to three waste level detectors that were removed from the tank. The detectors were the sludge weight (riser 16A), the manual tape plummet (Riser 17A), and the FIC plummet (riser 1C) (Herting and Bechtold 1992).

Sludge weights have been used in the Hanford Site waste tanks for many years as probes to determine the height of sludge in a tank. However, Tank 241-SY-101 has a distinct crust layer that the sludge weight was unable to penetrate. Therefore, the sludge weight remained embedded in the crust material for several years, until it was extracted during the Window A sampling time frame. The sludge weight sample was divided prior to analysis into three subsamples according to physical appearance and origin. The subsamples were identified as SW/Wet, SW/Dry, and SW/Loose. The amount of solids recovered from the manual tape plummet and the FIC plummet was very small; therefore only partial characterization was possible.

Figure 3-1. Tank 241-SY-101 Sampling Locations for Windows A, C, and E.

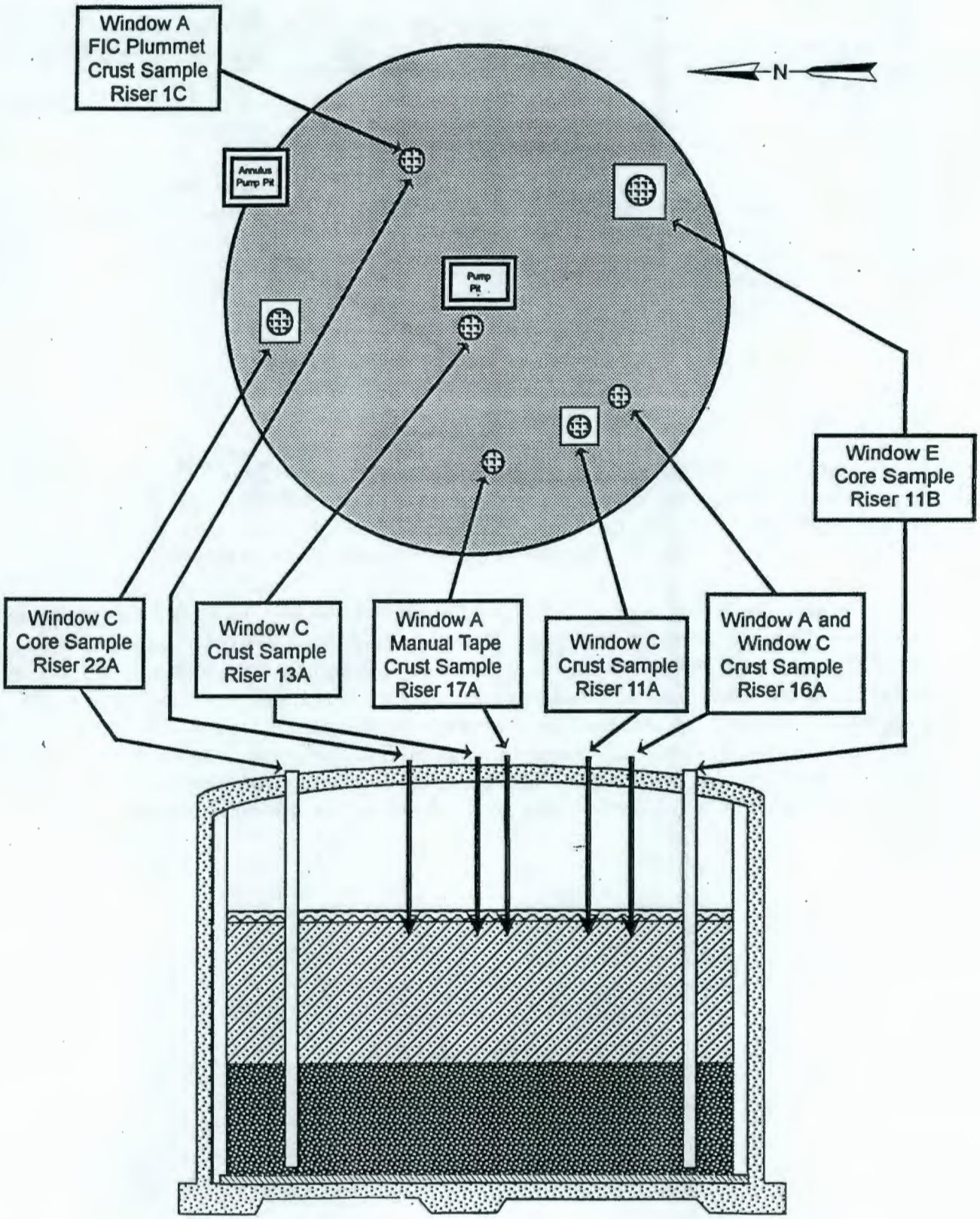
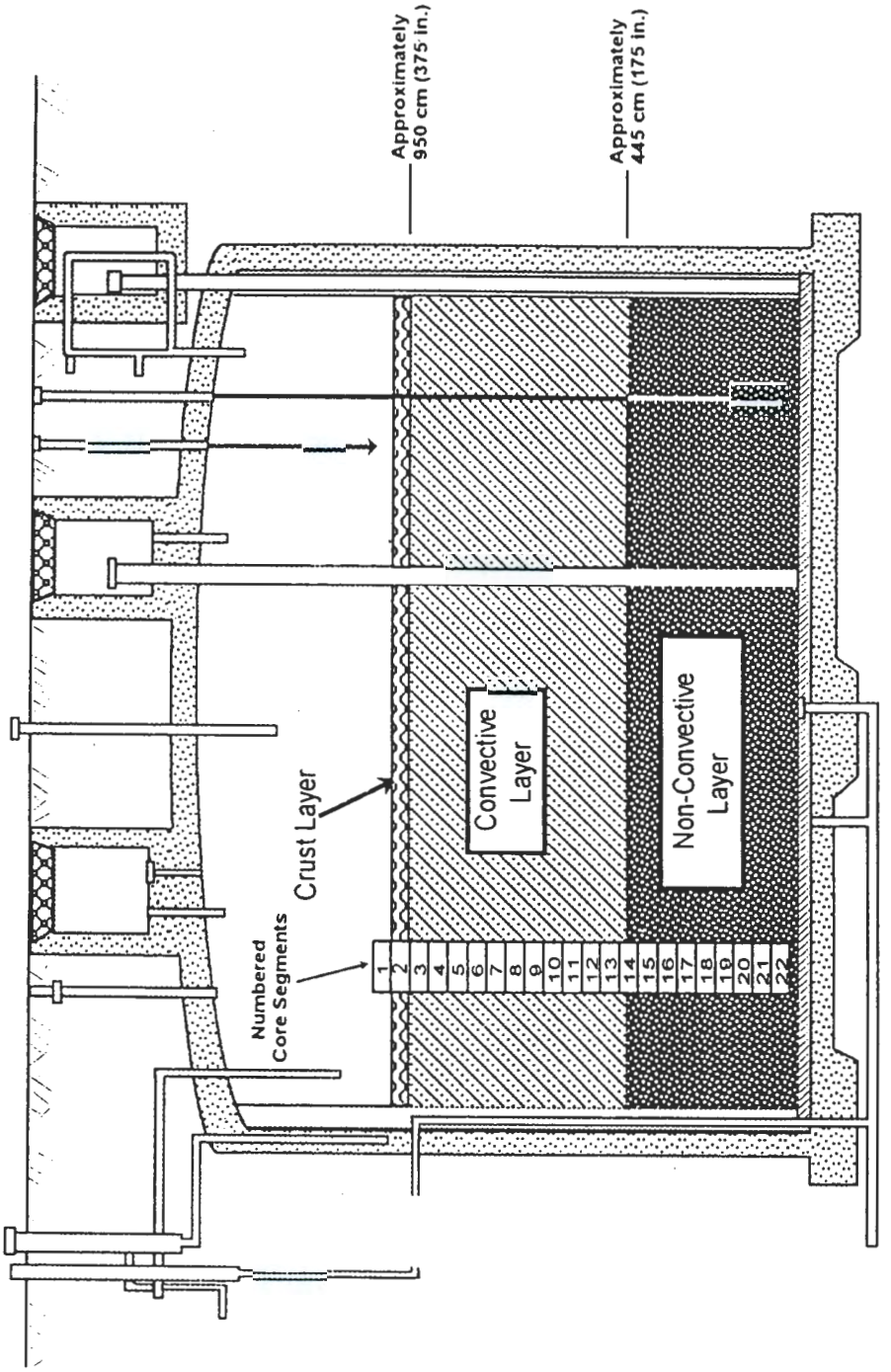


Figure 3-2. Tank 241-SY-101 Numbered Segment Locations and In-Tank Layering.



NOTE: The specific location of the core in this figure is generic and represents neither the Window C core nor the Window E core.

In general, all five of the crust samples recovered during Window A had similar chemical composition. They also were similar to the slurry samples taken in 1986 (Herting and Bechtold 1992). The Window A samples provided the first opportunity to evaluate the nature of the crust in Tank 241-SY-101 through analyses of chemical, radiochemical, and thermal constituents. The results of these analyses were used to perform safety evaluations on the chemical reactivity of the crust (Herting and Bechtold 1992). The total amounts of sample recovered were:

- Manual Tape Plummet - 0.70 gram (g) of dry, chunky, dark gray solids.
- FIC Plummet - 0.27 g of dry, powdery, yellow solids.
- SW/Wet - 67 g of dark brown, moist, sticky solids removed from the "donut hole" of the sludge weight.
- SW/Dry - 11 g of very dark brown, dry, flaky solids, scraped off the outer surfaces of the sludge weight
- SW/Loose - 4.8 g of dark brown, dry, chunky solids, recovered from the inside of the sludge weight retrieval device.

3.1.2 Window C

The samples obtained during the Window C sampling time frame consisted of eight crust samples (four auger samples and four modified sludge weight samples) and 26 core segment samples. Photographs of core segment samples representative of the convective and non-convective layers are shown in Figures D-1 and D-2, respectively. The samples were taken through risers 11A, 13A, 16A, and 22A for the sludge weight device and auger samples (Herting et al. 1992a).

Sludge Weight Sample

The design of a standard waste tank sludge weight was modified in order to make it functional as a sample retrieval device. The sludge weight sampler is an inverted weighted cone, which is dropped from about 0.3 m (1 ft) above the waste surface level. Ideally, the tip of the cone penetrates the waste surface, allowing fluid material to enter the top side of the sampler. Since waste material must be displaced by penetration before it can enter the sampler, dense material is difficult to retrieve by this method.

The sludge weight sampler was first dropped in riser 22A. An in-tank video of this effort showed that the cone stuck deep enough into the material to hold the weighted cone upright but did not penetrate deep enough to allow any material to enter the cone. This effort gave the first indication that the location directly beneath riser 22A had a fairly hard crust layer. Weighted sludge sampling was more successful at the other sampling locations.

Riser 22A Sludge Weight Sample R9226 - The sludge weight sampler penetrated the crust by approximately 1 cm (2.5 in.), which does not allow for material to enter the sampler. Upon visual examination at the laboratory, it was determined that a small amount (0.18 g) of sample adhered to the exterior of sampler. This sample was recovered for thermal analysis only.

Riser 13A Sludge Weight Sample R9218 - Tank Farm Operators observed via an in-tank video camera that the sludge weight sank through the crust and disappeared from view. Therefore, the sample was expected to be quite moist.

Upon examination in the laboratory, all outer surfaces of the sludge weight were covered with a thin film of wet, olive gray sample material. There were also several droplets of liquid and semi-liquid material. The total weight of the sample recovered was 6.0 g.

In order to recover additional sample, the sampler was washed with deionized water, and the rinsate was collected. It was determined (by weighing the sampler prior to and after rinsing) that an additional 9.9 g of sample was collected in 103 g of water (total rinsate weight 113 g). The rinsate was centrifuged and separated as centrifuged liquid and centrifuged solid.

Riser 11A Sludge Weight Sample R9258 - The upper surfaces of the riser 11A sludge weight were clean and shiny, with the exception of a few rust-colored smudges that were too small in amount to recover. The cone at the bottom of the sludge weight contained one large chunk (1 cm diameter and 2 cm long) of material, with the color and consistency of cement (Herting et al. 1992a). The outer surface of the cone was coated with material resembling the large chunk. The chunk (3.3 g) and exterior surface material (0.6 g) were recovered for chemical and thermal analyses.

Riser 16A Sludge Weight Sample R9256 - The outer surface of the riser 16A sludge weight cone was coated with material similar to the riser 11A sludge weight. The inside of the cone was clean with the exception of one side (it appears that the sampler laid on its side on top of the crust), which was coated with the same material as the exterior. All the sample (3.0 g) was collected for thermal and chemical analyses.

Auger Sample

The second sampling method utilized to acquire waste from the tank consisted of auger sampling. This device was designed to collect primarily solid samples. Any liquid collected is held within the solid material by capillary forces or may enter the hollow auger center tube. This sampler uses an auger to drill into the waste material to recover a sample on the flutes of the auger. A full sample was removed from Tank 241-SY-101 with this method in one out of four cases (Herting et al. 1992a).

Riser 13A Auger Crust Sample R9217 - Tank Farm operators made visual observations via a video monitor. The operators recorded the appearance of the material to be "of the consistency of oatmeal, and probably containing some liquid" (Herting et al. 1992a). The sample was removed from the auger in a hot cell. Only 28.6 g of sample were recovered from the auger.

Riser 22A Auger Crust Sample R9221 - This riser was also used for auger sampling during Window C. The observations recorded by the Tank Farm operators indicated that the material on this auger was drier and harder than the riser 13A auger sample. The auger contained a large amount of sample, more than on any previous crust sample from this tank. The top five flutes of the auger were nearly filled with material. The bottom six flutes were between 10 percent to 30 percent full and were more "paste-like" than the drier upper flutes (Herting et al. 1992a).

After a small sample (0.52 g) was taken from the first flute for thermal analysis, the remaining material was split into two separate fractions, with the division being made based on the physical appearance of the material. A sample from the top two flutes of the auger was collected to represent the "crumbly" fraction of the auger sample, and the remainder of the material on the lower flutes was collected to represent the "paste-like" material (Herting et al. 1992a). These fractions are henceforth referred to as Auger 22A top and Auger 22A bottom.

The total weight of the top sample was determined to be 87.1 g and the bottom sample weight was 189.1 g. The top sample could not be homogenized due to the dryness of the sample.

Riser 11A Auger Crust Sample R9257 - A very wet sample (21.9 g) was collected from the lower threads of the auger. Approximately 50 percent of the sample drained from inside of the screw during the sample recovery operation.

Riser 16A Auger Crust Sample R9255 - The auger contained a small amount of sample, with the top 20 cm of thread being completely devoid of material. The lower portion of the auger contained 24.0 g of a cohesive but grainy material that had a tendency to crumble under pressure.

Core Sample

The first Window C push-mode core sample (Core 22) was taken between May 22 and May 26, 1991, through riser 22A. This sample extended from the surface of the waste to approximately 5 cm (2 in.) from the bottom of the tank. The full core was planned to consist of 21 full segments, each 48 cm (19 in.) in length, and one 5-cm (12.7-in.-) long partial segment at the top of the crust layer. The sampling procedure followed the safety standards outlined in *Push Mode Core Sampling Safety Assessment* (Marusich 1991). Routine core sampling procedures are contained in the *Tank Characterization Reference Guide* (De Lorenzo et al. 1994).

The crust composes the top portion of waste (segments 1 through 3). Prior to sampling, approximately 30 L (8 gal) of water was dripped down the outside of the drill string. The intent of this procedure was to reduce the possibility for sparking or heating the crust material. The integrity of the crust samples was deemed compromised by the addition of water; however, the addition was necessary for safety reasons.

Segment 1 was expected to contain 5 cm (2 in.) of crust material. However, upon extrusion in the hot cell, only a liquid phase (15 mL) was recovered. A portion of centrifuged supernatant liquid was submitted for limited analysis.

Segment 2 was expected to be a full 48 cm (19 in.) segment of crust material. Upon extrusion, 11 cm of a mud-like, cohesive solid was recovered, along with about 40 mL of liquid. The total volume (solid plus liquid) of 55 mL is far short of the 240 mL expected for a full sampler. A portion of the liquid was centrifuged and submitted for limited chemical analysis, which demonstrated that the liquid was similar to the liquid in segment 1. The solid fraction was treated as a unique waste layer and was later submitted for analysis as composite 5.

Segment 3 contained a full 240-mL sample of liquid, but no significant amount of solids. Analysis of the centrifuged liquid indicated that the sample was substantially diluted, presumably by the water used inside of the drill string to maintain hydrostatic head pressure. A fraction of the liquid was sent to Pacific Northwest Laboratory (PNL) for volatile organic analysis.

Due to the water dilution issues that occurred in the first three segments, it is not possible to accurately define a boundary between the crust and the convective stratum that underlies the crust.

Based on the laboratory observations made during extrusion, the segment samples were categorized as compromised/diluted crust samples from segments 1 through 3; convective layer samples from segments 4 through the top of segment 14; and non-convective layer samples from segment 14 bottom through segment 22. Segment 16 was resampled due to drill string concerns. Both the original and duplicate samples were sent to the laboratory for analysis (Herting et al. 1992a).

Segment 12 was completely empty. When the sampler was mounted on the extruder, it was noted that the ball valve was in the open position. Apparently, the valve had failed to close when the sampler was removed from the tank.

A second core (core 23) from riser 22A was taken on June 4, 1991, nine days after the first from the same region. This second core consisted of three segments from the bottom of the tank. The three samples from this second sampling time frame are designated 20A, 21A, and 22A, and the sample locations correspond with segments 20, 21, and 22 of the first core, respectively.

Table 3-2 summarizes the Window C cores 22 and 23 sample recovery.

Table 3-2. Summary of Window C (Core 22 and 23) Recovery from Segment Samples.

Segment	Date Sampled	Total Weight (g)	Physical Description
1	05/22/91	18.2	100% drainable liquid. Liquid poured out when valve opened.
2		133.3	22% recovery. 35% drainable liquid/65% slush
3		221.3	100% drainable liquid.
4		360.9	100% recovery. 42% drainable liquid/58% slush
5		342.5	100% recovery. 38% drainable liquid/62% slush
6	05/21/91	366.7	100% recovery. 37% drainable liquid/63% slush
7	05/23/91	372.5	100% recovery. 44% drainable liquid/56% slush
8		348.8	100% recovery. 40% drainable liquid/60% slush
9		363.3	100% recovery. 42% drainable liquid/58% slush
10		378.1	100% recovery. 40% drainable liquid/60% slush
11		346.3	100% recovery. 38% drainable liquid/62% slush
12		0	0% recovery. No material recovered due to open valve.
13		376.5	100% recovery. 29% drainable liquid/71% slush
14 top		99.21	100% recovery. 83% sludge/17% slush
14 bot		256.3	
15	05/24/91	391.4	100% recovery. 100% sludge
16		382.4	100% recovery. 100% sludge. C-O-C questions integrity of sample.
16R	05/26/91	397.2	100% recovery. 100% sludge
17		400.7	100% recovery. 100% sludge
18		389.3	100% recovery. 100% sludge
19		382.8	100% recovery. 100% sludge
20		397.9	100% recovery. 100% sludge
21		401.5	100% recovery. 100% sludge
22		371.9	100% recovery. 100% sludge
20A	6/4/91	376.2	100% recovery. 100% sludge
21A		380.3	100% recovery. 100% sludge
22A		399.94	100% recovery. 100% sludge

Notes:
g = gram.
bot = bottom.
C-O-C = chain-of-custody.

3.1.3 Window E

The Window E push-mode core sample (core 28) was taken from Tank 241-SY-101 between December 14 and December 19, 1991, and was obtained through riser 11B, which is on the opposite side of the tank from the Window C sampling points. The core sample was planned to consist of 21 full segments, each 48 cm (19 in.) long, and one 5-cm-(12.7-in.-) long partial segment at the top of the crust layer. Duplicate samples of segments 21 and 22 were taken on the same day as the original segment 21 and 22 samples. In addition, a duplicate sample (14R) of segment 14 was planned to be acquired four days after the original sample to evaluate the movement of the convective and non-convective layer interface over the four day period (Herting et al. 1992b). The interface actually appeared to be lower in the Window E core (segment 15) than the observed interface in the Window C core sample.

The data presented in Table 3-3 indicate that all the segments produced satisfactory tank samples with the exceptions of Segments 1, 2, 20, 21, 21R, and 22. Segment 1 was completely void of sample. Segment 2 appeared to have been diluted with water, again as in Window C. The core sampler evidently encountered some difficulty near the bottom of the tank, with only partial recovery and/or water dilution problems occurring in the last three segments. The samples from segments 20 and 21 are probably valid samples in terms of composition, but the samplers were partially empty (see Table 3-3). The samples in segments 21R and 22 were compromised by dilution with water (presumably from hydrostatic fluid in the drill string) and were not used for analysis (Herting et al. 1992b).

Table 3-3. Summary of Window E (Core 28) Sample Recovery from Segment Samples.[1] (2 sheets)

Segment	Date	Total	Physical Description
1	12/14/91	0	empty
2		330.3	45% slush/55% liquid
3		338.0	90% slush/10% liquid
4		324.8	100% slush/no drainable liquid
5		335.9	100% slush/no drainable liquid
6		340.5	90% slush/10% liquid
7		350.4	100% slush/no drainable liquid
8	12/15/91	353.4	100% slush/no drainable liquid
9		338.7	100% slush/no drainable liquid
10		352.6	100% slush/no drainable liquid
11		336.0	100% slush/no drainable liquid
12		339.8	100% slush/no drainable liquid
13		333.5	100% slush/no drainable liquid
14		337.4	100% slush/no drainable liquid
14R	12/19/91	325.0	100% slush/no drainable liquid
15	12/15/91	391.9	100% cohesive sludge

Table 3-3. Summary of Window E (Core 28) Sample Recovery from Segment Samples.[1] (2 sheets)

Segment	Date	Total	Physical Description
16	12/16/91	382.2	100% cohesive sludge
17		396.9	100% cohesive sludge
18		399.8	100% cohesive sludge
19		401.0	100% cohesive sludge
20		269.6	70% cohesive sludge/30% empty
21		116.4	30% cohesive sludge/70% empty
21R		181.8	60% liquid/40% empty
22		40.9	2% sludge/10% liquid/88% empty
22R		385.5	100% cohesive sludge

Notes:
g = gram.
[1]Herting et al. 1992b.

Segments 3 through 14 were all virtually identical in appearance and represented the convective layer of waste in Tank 241-SY-101. All the convective layer samples from the Window E sampling time frame were more cohesive and contained less drainable liquid than the corresponding segments from the Window C samples. Segments 15 through 22R all appeared identical to each other and to the corresponding Window C segments. These samples from the Window E time frame were quite cohesive and represent the non-convective layer.

3.2 SAMPLE HANDLING (Windows A, C, and E)

The Window A sampling time frame produced three crust samples from Tank 241-SY-101. These samples were shipped to the 222-S Laboratory in separate 55-gal drums and were received on November 19, 1990. In 1990, an official test plan for the Window A samples did not exist. However, there were two Westinghouse Hanford Company (WHC) internal memos which guided the work. These memos, *Crust Sample Analysis Plan* (Johnson 1990) and *Tank 101-SY Sample Breakdown* (Herting 1990), were based on an external letter, *Safety Improvement Plan - Hydrogen in Waste Tanks* (Legett 1990). There was also an extensive amount of guidance from the WHC Senior Chemists Panel.

Four auger samples, four modified sludge weight samples, and 26 core segment samples were taken from Tank 241-SY-101 during the Window C sampling event and delivered to the 222-S Laboratory between May 23 and June 5, 1991. During the Window E sampling event 25 core segment samples were obtained from the tank and delivered to the 222-S Laboratory between December 23, 1991, and January 8, 1992.

A chain-of-custody record was kept during the sampling efforts for all segments sampled in Windows C and E. However, no chain-of-custody records were available for the Window A samples. The chain-of-custody record ensures proper transport and maintains a record of personnel involved in sampling and transportation of the sample to the laboratory. For a further discussion of chain-of-custody functions see the *Tank Characterization Reference Guide* (De Lorenzo et al. 1994).

The Window C chain-of-custody records indicate that sampling occurred in an orderly manner with few delays. On one occasion (involving segment 16), a problem developed with the core-sampling truck and sampling was delayed for 48 hours. In most cases, the segment casks were shipped to the 222-S Laboratory the day following sample retrieval. The Window C chain-of-custody records also indicated that segment 6 was obtained one day prior to segments 1 through 5.

The Window E chain-of-custody records contained several discrepancies. These errors included the recording of incorrect sample and shipment numbers, incorrect sample dates, and incorrect cask serial numbers. The sampling team made corrections to the chain-of-custody records using internal records and the 222-S Laboratory signed off on these corrections. Poor cask handling, documentation, and extended storage periods created confusion, but no sample cask identification labels were interchanged.

Dose rates measured by the health physics technician for the Window A samples are given in Table 3-4. Drill string dose rates for Windows C and E, which were measured after core sample acquisition, are listed in Table 3-5. The smearable contamination was less than the detection limit for alpha/beta-gamma in all core sample segments.

Table 3-4. Tank 241-SY-101 Window A Sample Radiation Dose Rates.[1]

Sample	Dosimeter Location	Dose Rate[2]
Manual Tape R8423	Outside of shipping drum At end cap Open end of the device	20 mR/hr 300 mR/hr 200 mR/hr
FIC Plummet R8421	Shipping drum Through side of jar Through open end of jar	25 mR/hr 30 mR/hr 200 mR/hr
Sludge Weight R8422	At contact without shielding At the device surface	200 mR/hr 300 mR/hr

Notes:
mR/hr = milliroentgen per hour.
[1]Data derived from Herting and Bechtold 1992.
[2]All dose rates are proportional counter readings with window open.

Table 3-5. Tank 241-SY-101 Drill String Dose Rates.

Window C Riser 22 A				Window E Riser 11B [1]			
Core:Seg	Dose	Core:Seg	Dose	Core:Seg	Dose	Core:	Dose
22A:1	300 mR/hr	22A:15	2.3 R/hr	---	---	28:14R	2.8 R/hr
22A:2	1.2 R/hr	22A:16	2.3 R/hr	28:2	1.4 R/hr	---	---
22A:3	60 mR/hr	22A:16R	1.7 R/hr	---	---	28:16	2.5 R/hr
22A:4	2.4 R/hr	22A:17	1.9 R/hr	28:4	2.9 R/hr	28:17	2.5 R/hr
22A:5	1.6 R/hr	22A:18	1.8 R/hr	28:5	2.8 R/hr	28:18	2.6 R/hr
22A:6	2.2 R/hr	22A:19	1.6 R/hr	28:6	2.8 R/hr	---	---
22A:7	2.5 R/hr	22A:20	2.0 R/hr	---	---	---	---
22A:8	2.3 R/hr	22A:21	2.2 R/hr	---	---	---	---
22A:9	2.6 R/hr	22A:22	2.1 R/hr	28:9	2.7 R/hr	---	---
22A:10	2.5 R/hr			---	---	28:21R	2.0 R/hr
22A:11	2.4 R/hr	23:1	1.8 R/hr	28:11	2.5 R/hr	28:22	2.0 R/hr
22A:12	100 mR/hr	23:2	2.0 R/hr	---	---	28:22R	2.5 R/hr
22A:13	2.7 R/hr	23:3	1.9 R/hr	---	---	---	---
22A:14	2.5 R/hr			28:14	2.8 R/hr	---	---

Notes:
mR/hr = milliroentgen per hour.
Seg = segment.
R/hr = roentgen per hour.
[1]At the time this report was written several chain-of-custody records for Window E were missing.

Segments 1 through 3 of Windows C and E were identified as a crust layer within Tank 241-SY-101. In Window C, segments 4 through 13 appeared essentially similar to one another and uniform throughout the length of each individual segment. The only exception was segment 12, which was found to be empty, apparently due to a ball valve failure when the sample was removed from the tank. The top portion of segment 14 appeared to have the same consistency and appearance as segments 4 through 13; therefore, segments 4 through the top of segment 14 were categorized as the convective layer. The Window E event indicates the boundary to be slightly lower and is exhibited to be between segments 14 and 15.

The non-convective region ranges from the bottom of segment 14 through segment 22 in Window C, and from segment 15 through segment 22 in Window E. These segments appeared essentially similar to one another and basically uniform throughout the length of each individual segment. The consistency of the samples was similar to very thick mud or clay, though somewhat more granular, and very cohesive. There were no drainable liquids in any of the segments from the non-convective layer (Herting et al. 1992b).

From thermocouple data, one would have incorrectly predicted the interface between the convective and non-convective layers to occur near segment 11. It is worth noting that the visual inspection of extruded segments found the actual interface to occur at segment 14.

The flow diagram shown in Figure 3-3 describes the generic sample breakdown for the Window C and Window E samples submitted for analysis.

3.3 SAMPLE ANALYSIS (Windows A, C, and E)

Analysis and characterization of the Window C cores were performed according to *Analytical Chemistry Plan for Tank 241-SY-101 Core Sample* (Herting 1991) and *101-SY Tank Waste Characterization Test Plan* (Crawford 1991). *Analytical Plan and Test Plan for Chemical Analysis and Characterization of the Window "E" Core of Tank 241-SY-101* (Jewett 1992) guided the analysis of the Window E core. Rheological and physical tests, organic analyses, and certain radionuclide analyses were performed at the PNL 325 Laboratory. Noble metal analyses were completed at Westinghouse Savannah River Company. All other analyses were done at the WHC 222-S Laboratory.

The analytical effort for the Window C core sample was directed largely at examining the vertical homogeneity of the waste in Tank 241-SY-101. Samples from every segment were analyzed for the main chemical components. The analytical results showed that the waste was homogeneous within each of the major waste layers, convective and non-convective, and that there were differences between the two layers.

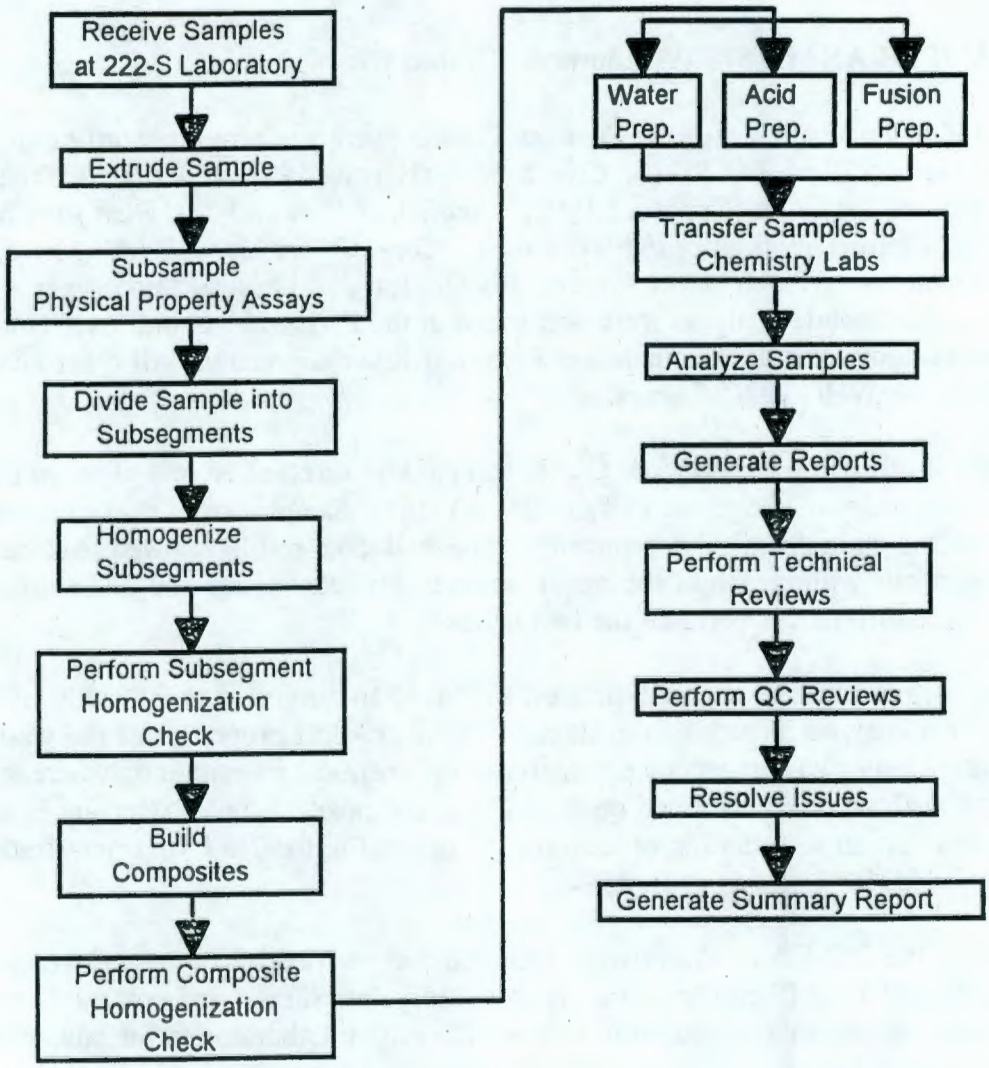
In Window E, the focus of the analytical effort shifted to a more in-depth study of fewer samples. This analysis included an evaluation of the physical properties of the waste. Consequently, only two segments were analyzed for chemical constituents, whereas a broader spectrum of analysis was performed on each of the composite samples (Herting et al. 1992b). A further description of sampling procedures is provided in the *Tank Characterization Reference Guide* (De Lorenzo et al. 1994).

All data from the 222-S Laboratory were recorded and verified by Process Development Support and Analytical Chemistry on analytical cards, data sheets, and controlled notebooks. The data were subsequently released to Process Chemistry Laboratories for tabulation and issuance of a final report.

Liquids from segments 1, 2, and 3 of the Window C core 22 were centrifuged and submitted for gamma energy analysis.

Segments 4, 5, 7 through 11, 13, and the top of segment 14 were subsampled for differential scanning calorimetry (DSC), and thermogravimetric analysis (TGA). Selected segments were subsampled for rheology and physical tests from the homogenized bulk liquids and solids. Selected samples were centrifuged, heated or diluted, and divided into centrifuged solid and liquid phases.

Figure 3-3. Generic Flowchart for Sample Derivatives from Tank 241-SY-101.



The samples routinely precipitated during handling, making the acquisition of a representative sample difficult. Segment 6 was used as a test case to determine the best way to obtain a representative sample of waste. The samples were subjected to various procedures for determination of the best handling method for a liquid/solid sample in a delicate chemical equilibrium. However, in the best interests of time and in the best judgment of the chemists in charge, a decision was made to heat all the remaining segment samples, and perform the liquid/solid separations at tank temperature. Figure 3-4 describes the procedures. The procedures chosen were those used in handling of fractions 3 and 4.

Samples taken from the bottom of segment 14 through segment 22A for the Window C core involved homogenization and direct sampling of the homogenized tank solids.

Five composite samples were formed from the segment samples from Window C. Composite 1 was formed from segments 4 through 8, and composite 2 was derived from segments 9, 10, 11, 13, and the top of 14. Samples were acquired from the bulk composites for semivolatile and cyanide analyses. Centrifuged solid samples were then acquired by heating the composite sample and centrifuging. Dilute liquid samples were obtained by decanting from the top of the sample, diluting the supernate, and then centrifuging.

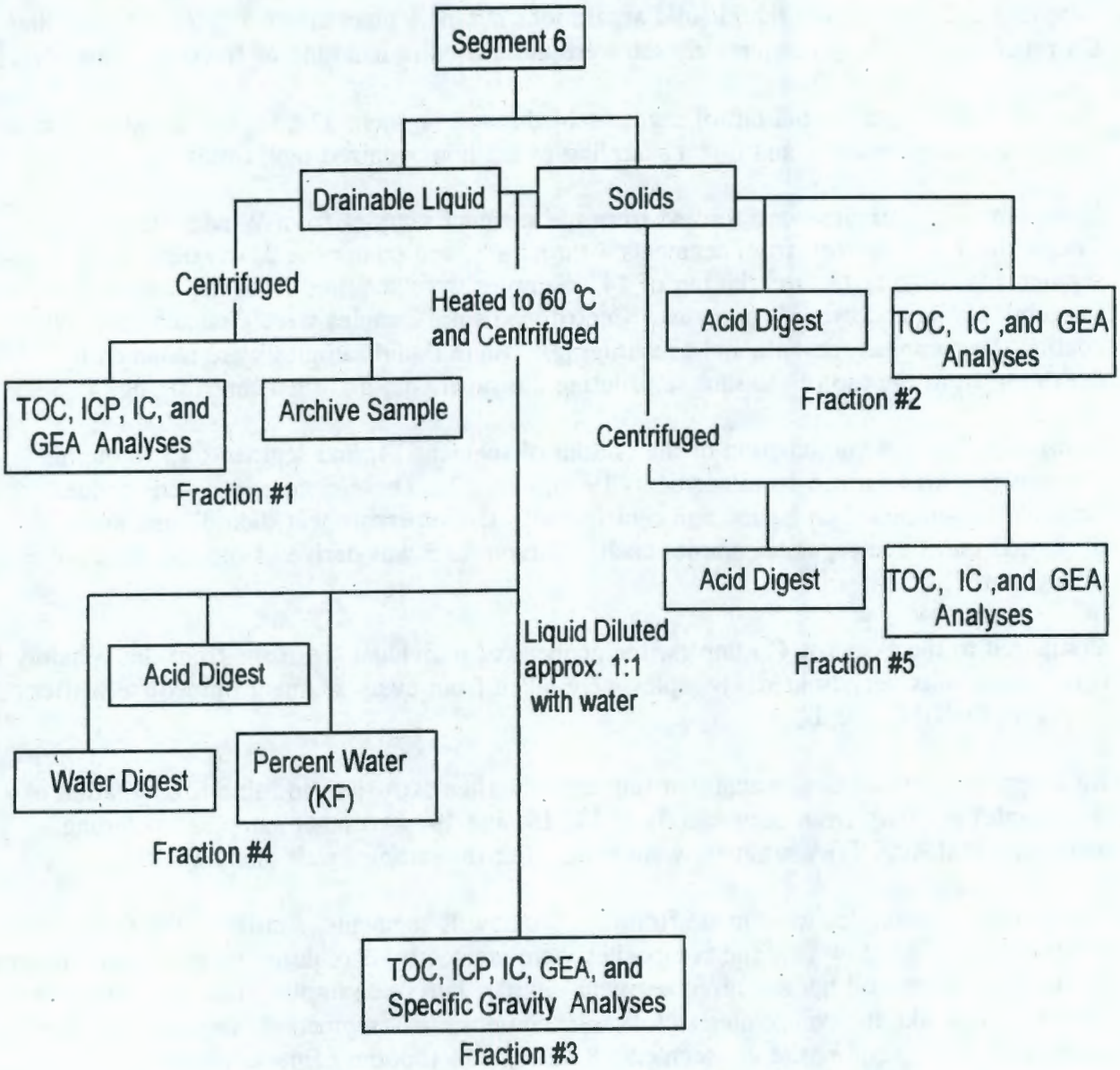
Composite 3 was a combination of the bottom of segment 14, and segments 15 through 18. Composite 4 was formed from segments 19 through 22. These composites were divided into six bulk subsamples then heated and centrifuged. The supernate was then diluted and dispensed into three separate samples each. Composite 5 was derived from the solid phase of segment 2.

Compared to the Window C samples, the analysis of individual segments from the Window E core sample was very limited. Samples were taken from every segment immediately after extrusion for DSC and TGA.

Rheology samples were also acquired immediately after extrusion (to minimize agitation of the sample) but only from segments 3, 8, 13, 15, and 19. All other samples, including additional DSC and TGA samples, were taken after the samples were homogenized.

Five composite samples were made from the Window E segments, similar to the five composites for Window C. The composites were created by combining proportional amounts (by weight) of several homogenized segment samples into one sample. The segments were combined to make the composites as follows: composite 1 - segments 3 through 8 (top of convective layer); composite 2 - segments 8 through 14 (bottom of the convective layer); composite 3 - segments 16 through 18 (top of non-convective layer), composite 4 - segments 19 through 21 and 22R (bottom of non-convective layer); and composite 5 - segment 2 (crust layer diluted with water) (Herting et al. 1992b).

Figure 3-4. Tank 241-SY-101 Segment 6 Flowchart.



Analyses of Window E segments 3, 8, 13, and 15 were limited to a few physical tests and thermal analysis. Analyses of segments 19 and 22R were comparable to the analyses performed on all the Window C segments. Composites 1 and 2 were subjected to extensive analysis of centrifuged solid and liquid phases, with some analysis of bulk (not centrifuged) samples. Composites 3 and 4 were subjected to thorough analysis of the bulk samples and the centrifuged liquid phase, but no analyses were done on the centrifuged solids. Minimal analyses were performed on composite 5 because the sample had been compromised (Herting et al. 1992b).

All drainable liquid, core composite, segment, and homogenized test samples are clearly identified for Windows C and E in the Appendix A tables. Aliquots were either directly evaluated or analyzed after subjection to a digestion, extraction, or other preparation methods as indicated in the Appendix A tables. For a complete discussion of sample preparation procedures consult the Tank Characterization Reference Guide (De Lorenzo et al. 1994).

3.3.1 Direct

Direct samples were taken immediately from all extruded segments for thermal analyses (DSC/TGA). Direct samples were obtained from selected Window E and non-convective Window C segments for rheological and physical property testing, as well as volatile organic analysis.

The Window C convective layer segments contained a significant amount of drainable liquid. Several days after the extrusion of the Window C segments, it was noted that additional phase separation due to settling occurred within each convective layer liquid and solids container. The material in the solids and drainable liquid sample containers appeared identical, although different proportions of solids versus liquids were present within the two jars. Therefore, the contents within each container were combined before further sample preparation. The combined samples were gently agitated to suspend solids while subsamples were extracted (selected segments only) for shipment to the PNL 325 Laboratory to perform rheological and physical property testing. The only exclusion from this procedure was segment 6, since it was used as a test case to determine the optimal method for obtaining subsamples.

3.3.2 Digestion of Samples

Preparing samples for analysis may include water, acid, or fusion digestion. The water digest preparation procedure, LA-504-101, is performed by placing an aliquot of a solid sample into a glass jar and adding Q-water in the ratio of 100 mL/g solids. The jar is capped, placed in an ultrasonic bath for one hour, and then let stand overnight. The supernate is then filtered and distributed for the appropriate sample analyses. In the case of liquid samples, some of the "water digest analyses" may be performed directly on the liquid sample, while others may require dilution of the liquid sample with water. The list of water digest analyses includes gamma energy analysis (GEA), NH_3/NH_4^+ (total ammonia), total organic carbon, Dionex ion chromatography (fluoride, chloride, nitrate, nitrite, phosphate, and sulfate), and carbonate (Herting et al. 1992a).

The acid digest procedure, LA-505-159, is taken directly from U.S. Environmental Protection Agency SW-846 Method 3050. A portion of solid sample is digested in nitric acid and hydrogen peroxide. The digestate is then refluxed in a mixture of nitric acid and diluted with water to a final volume and concentration appropriate for the analysis to be performed.

In the case of liquid samples, a simple pH adjustment is made by acid addition, followed by a dilution to a known volume. The list of analyses performed on acid digested solutions is limited to inductively coupled plasma spectrometry (ICP) metals and GEA (Herting et al. 1992a).

In order to achieve total dissolution of solid sample for fusion analyses, an aliquot of sample is placed into a metal crucible and dried, if necessary. An alkali metal hydroxide and nitrate (usually potassium hydroxide and potassium nitrate) are added to the crucible, and the mixture is fluxed on a hot plate. The sample is placed in a furnace to complete the fusion. After cooling, the material is leached from the crucible with water and dilute hydrochloric acid and diluted to a known volume.

Fusion pretreatment is typically used for radionuclide analyses because the radionuclides are often present in refractory oxide phases that are very difficult to dissolve in acid. The acid digest solution is preferred for ICP analysis because the dilution factor is much smaller and because it does not suffer the interference from the large added dose of alkali metal (potassium). However, in some cases, ICP analysis is also performed on the fusion-dissolved sample in order to check for metal values that the acid digestion might have missed (Herting et al. 1992a).

3.3.3 Compositing

Five composite samples were created for each of the Window C and E cores. After direct subsampling of extruded segments, each segment sample was individually homogenized. Proportional amounts (by weight) were extracted from several of the homogenized segment samples, combined, and homogenized into a single composite sample. Both cores were composited in a similar manner as presented in Table 3-6.

Table 3-6. Composite Fabrication for Tank 241-SY-101 Windows C and E.

Window C		Window E	
Composite	Segments	Composite	Segments
C1	4 through 8	E1	3 through 8
C2	9, 10, 11, 13, and the top of 14	E2	9 through 14
C3	bottom of 14, and 15 through 18	E3	16 through 18
C4	19 through 22	E4	19 through 21, and 22R
C5	solids from 2	E5	2

Several analyses were performed on samples to evaluate the hazardous or toxic chemicals in the waste. These include arsenic, selenium, mercury, cyanide, chromium (VI), noble metals, and semivolatile organics.

Appendix E lists all procedure numbers and methods used to evaluate the waste in Tank 241-SY-101. Additional information on analytical methods can be obtained in the *Tank Characterization Reference Guide* (De Lorenzo et al. 1994).

3.4 1986 SAMPLING TIME FRAME

Three bottle-on-a-string samples were acquired in 1986. Results from this sampling event are tabulated in Appendix C. For a description of routine sampling procedures, see the *Tank Characterization Reference Guide* (De Lorenzo et al. 1994).

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4.0 ANALYTICAL RESULTS AND WASTE INVENTORY

4.1 OVERVIEW

This chapter summarizes the sampling and analytical results associated with Tank 241-SY-101, Windows A, C, and E. Data from Statistical Analysis of Tank 241-SY-101 Data (Welsh 1995) are used. This statistical analysis included data from the three sampling time frames.

The chemical, radiochemical, physical, and organic results associated with the tank are presented within this document as indicated in Table 4-1. The samples from which these results were derived were collected on November 18, 1990 (Window A); May 20 and June 4, 1991 (Window C); and December 14 to 16 and 19, 1991 (Window E). These sampling time frames were the most recent regarding Tank 241-SY-101 and reflect the most accurate characterization of the tank at the present time. A detailed description of the sampling process was presented in Chapter 3.0.

Table 4-1. Analytical Data Presentation Tables for Double-Shell Tank 241-SY-101.

Analysis	Tabulated Result Location
Estimated Layer Chemical Composition Data Summary	Table 4-2
Estimated Overall Waste Concentration and Inventory	Table 4-3
Window C and E Analytical Data	Appendix A
Window A Analytical Data	Appendix B

The Appendix A tables present the data acquired from Windows C and E liquid, solid, and bulk composites, along with segment analyses. Data from all digestion methods are listed. These tables are to be used only as information concerning the individual sample sources and concentrations. The segment data, which are used to determine the vertical distribution of the waste component, can also be found in the Appendix A tables. However, since the mixer pump was installed in July 1993, the vertical distribution of the waste is no longer an issue. It is assumed that the waste has been blended into a slurry that is fairly homogenous throughout the tank.

Tables 4-2 and 4-3 present the statistical combination of Windows C and E composite data that are to be used to determine the estimated concentration of the analytes in Tank 241-SY-101 at the time of sampling. The statistical values used in these tables were derived from Welsh (1995).

Weighted mean and relative standard deviation values for most analytes were calculated from a statistical model by WHC personnel. The model is discussed in Welsh (1995). The projected tank inventory value for each Tank 241-SY-101 constituent was calculated by multiplying the statistical or weighted mean by the volume of waste in the tank at the time of sampling:

- Crust - 208 kL (58 kgal)
- Convective layer - 2,290 kL (608 kgal)
- Non-convective layer - 1,670 kL (442 kgal).

The appropriate conversion factors were included in the calculations to obtain the reported units (Welsh 1995).

4.2 DATA PRESENTATION

The chemical composition of Tank 241-SY-101, derived from the composite data, is summarized in Tables 4-2 and 4-3. No data from segment analyses were used to construct the tables (segment data are available in Appendix A). Table 4-2 has been divided according to the three layers (crust, convective, and non-convective).

Table 4-3 gives overall estimates for analyte concentrations, based on Window C and Window E data. All data reported in this table were derived from Welsh (1995). The weighted average bulk concentration column was derived by dividing the inventory estimate for each analyte by the volume of the waste in the tank. The data for chloride and total alpha are reported with outliers removed.

Table 4-2. Tank 241-SY-101 Estimated Layer Chemical Composition Data Summary.[1] (2 sheets)

Analyte	Crust Layer Estimate	Convective Layer Estimate	Non-convective Layer Estimate
METAL	µg/g	µg/g	µg/g
Aluminum (Al)	36,400	29,800	35,500
Calcium (Ca)	260	352	375
Chromium (Cr)	4,620	1,300	6,590
Iron (Fe)	640	107	529
Nickel (Ni)	200[2]	79.9	240
Potassium (K)	3,300[2]	3,700	2,950
Sodium (Na)	2.28E+05	1.95E+05	2.15E+05
Total Uranium	83.2	21.9	56.4
Zinc (Zn)	---	46.3	30.4
ION	µg/g	µg/g	µg/g
NH_3/NH_4^+	537[4]	1,100[4]	2,790[4]
Cl^-	11,700	8,520[3]	7,680
OH^-	8,200[2]	22,200	23,600
NO_3^-	1.48E+05	1.35E+05	1.11E+05
NO_2^-	1.18E+05	1.20E+05	95,700
PO_4^{3-}	8,840	4,970	8,440
SO_4^{2-}	13,100	1,070	6,570
RADIONUCLIDE	µCi/g	µCi/g	µCi/g
^{241}Am	0.134	0.0288	0.174
^{137}Cs	376	368	305
$^{239/240}Pu$	0.0130	0.00201	0.0125
^{90}Sr	26.0	7.78	33.8
^{99}Tc	0.360	0.143[5]	0.295[5]
Total Alpha	0.530	0.0819	0.227[3]
Total Beta	608	538	554
PHYSICAL PROPERTY			
Percent Water	25.6 wt %	38.4 wt %	31.7 wt %

Table 4-2. Tank 241-SY-101 Estimated Layer Chemical Composition Data Summary.[1] (2 sheets)

Analyte	Crust Layer Estimate	Convective Layer Estimate	Non-convective Layer Estimate
TOTAL CARBON	μg/g	μg/g	μg/g
TIC	13,000	5,100	9,870
TOC	18,100	11,700[5]	19,700[5]

Notes:
μg/g = microgram per gram.
μCi/g = microcurie per gram.
TIC = total inorganic carbon.
TOC = total organic carbon.
[1]Data derived from Welsh 1995, unless otherwise noted.
[2]Data for Window A derived from Herting and Bechtold 1992.
[3]Data recorded with possible outlier removed.
[4]Data not included in Welsh 1995 but in Herting et al. 1992b.
[5]Data obtained from Window E (Herting et al. 1992b).

Table 4-3. Tank 241-SY-101 Estimated Chemical Concentration and Inventory.[1] (2 sheets)

Analyte	Weighted Average Bulk Concentration [2]	Inventory Estimate
METAL	μg/g	kg
Aluminum (Al)	32,400	2.19E+05
Calcium (Ca)	357	2,410
Chromium (Cr)	3,650	24,600
Iron (Fe)	307	2,080
Nickel (Ni)	152	1,030
Potassium (K)	3,370	22,800
Sodium (Na)	2.05E+05	1.39E+06
Total Uranium	39.1	265
Zinc (Zn)	37.5[3]	253[3]
ION	μg/g	kg
Chloride (Cl^-)	8,330	56,300
Hydroxide (OH^-)	22,100	1.49E+05
Nitrate (NO_3^-)	1.26E+05	8.50E+05
Nitrite (NO_2^-)	1.10E+05	7.44E+05
Phosphate (PO_4^{3-})	6,600	44,600
Sulfate (SO_4^{2-})	3,930	26,600

Table 4-3. Tank 241-SY-101 Estimated Chemical Concentration and Inventory.[1] (2 sheets)

Analyte	Weighted Average Bulk Concentration [2]	Inventory Estimate
RADIONUCLIDE	μCi/g	Ci
^{241}Am	0.0939	635
^{137}Cs	342	2.31E+06
$^{239/240}$Pu	0.00689	46.6
^{90}Sr	19.4	1.31E+05
^{99}Tc	0.216[5]	1,460[5]
Total Alpha[4]	0.164	1,110
Total Beta	548	3.70E+06
PHYSICAL PROPERTY	μg/g	kg
Water[5]	3.50E+05	2.37E+06
TOTAL CARBON	μg/g	kg
TIC	7,460	50,400
TOC[5]	15,300	1.04E+05

Notes:
μg/g = microgram per gram.
kg = kilogram.
μCi/g = microcurie per gram.
Ci = curie.
TIC = total inorganic carbon.
TOC = total organic carbon.
[1]Data derived from Welsh 1995.
[2]Weight average bulk concentration = Inventory estimate/total volume of tank.
[3]Crust data not included.
[4]Data recorded with possible outliers removed.
[5]Data from Window E only (Welsh 1995).

4.3 PHYSICAL MEASUREMENTS

Physical properties (e.g., shear strength, viscosity, particle size, and settling properties) were measured. These measurements are necessary for the design and fabrication of retrieval, pretreatment, and final waste disposal systems.

Subsamples were taken at the 222-S Laboratory from selected segments from Windows C and E cores. The samples were transported to the PNL 325 Laboratory and used for physical and rheological characterization of the waste. The physical and rheological properties, measured at four temperatures (32 degrees Celsius [°C], 50 °C, 65 °C, and 80 °C), included density, settling rate, volume percent settled solids, viscosity, and volume and weight percent centrifuged solids.

Other physical tests were performed on direct segment samples at the 222-S Laboratory, including particle size distribution, polarized light microscopy, heating and dilution tests, x-ray diffraction, and adiabatic calorimetry.

4.3.1 Density

Waste densities are important in understanding the gas venting and rollover phenomena as well as how the tank stratifies. Density values are also needed to convert analyte concentrations from weight percent to volume-based units such as molarity.

Subsamples from Windows C and E were used to estimate the density of Tank 241-SY-101. The Window C core segment samples were collected from segments 4, 8, and 13 (the convective slurry) and from segments 15, 19, and 22 (the non-convective sludge). Window E density samples were derived from the convective layer segments 3, 8, and 13, and the non-convective layer segments 15 and 19. Bulk sample densities (total weight divided by the total volume of each segment) were available from the data collected during sample extrusion. From the physical test data, the density of the bulk and centrifuged waste samples were found to be independent of temperature. There also appears to be little dependence on depth within the layers; however, the density increases approximately 0.1 g/mL over the depth of the layers. The high density of the auger sample after compaction indicates the presence of a crust that exists in the tank as a porous solid with entrained gas.

Density averages with respect to characteristic phases in the waste are given in Table 4-4. The lower bulk density in the Window C convective layer is linked with lower weight percent solids.

Table 4-4. Density Measurements for Tank 241-SY-101 Windows C and E.[1]

Sample Identification	Temperature			
	32 °C	50 °C	65 °C	80 °C
Window:Segment	g/mL	g/mL	g/mL	g/mL
Bulk Sample				
C:8	1.53	1.54	1.54	1.48
C:19	1.68	1.66	1.66	1.74
C:22	1.71	1.71	1.71	1.70
E:3	1.60	1.59	1.60	1.59
E:8	1.59	1.60	1.62	1.58
E:13	1.61	1.59	1.59	1.57
E:15	1.65	1.64	1.62	1.60
E:19	1.72	1.75	1.74	1.72
Centrifuged Supernatant Liquid				
C:8	1.46	1.45	1.47	1.43
C:19	1.50	1.46	1.44	1.44
C:22	1.46	1.51	1.52	1.53
E:3	1.49	1.51	1.51	1.51
E:8	1.52	1.50	1.51	1.50
E:13	1.51	1.47	1.50	1.53
E:15	1.55	1.51	1.52	1.49
E:19	1.57	1.51	1.54	1.52
Centrifuged Solids (including interstitial liquid)				
C:8	1.93	1.85	1.82	2.16
C:19	1.75	1.75	1.73	2.03
C:22	1.78	1.82	1.79	1.79
E:3	1.80	1.73	1.71	1.73
E:8	1.70	1.75	1.85	1.81
E:13	1.72	1.75	1.77	1.66
E:15	1.72	1.78	1.74	1.82
E:19	1.76	1.82	1.84	1.85

Notes:
°C = degrees Celsius.
g/mL = gram per milliliter.
[1]Data derived from Herting et al. 1992a and Herting et al. 1992b.

4.3.2 Percent Solids and Settling Behavior

Samples from Tank 241-SY-101 Windows C and E were delivered to PNL for physical measurements. These analyses included settling rate, volume percent settled solids, volume percent centrifuged solids, and weight percent centrifuged solids. A thorough discussion of the PNL results was issued for Window C (Gillespie 1992) and for Window E (Tingey 1992).

Table 4-5 shows the comparison between Windows C and E, segments 8 and 19, solids. The volume percent settled solids is reasonably constant with temperature and depth for the convective layer samples. Volume percent and weight percent centrifuged solids both show a clear decrease with increasing temperature. Although not shown in Table 4-5, a trend with depth was also noted for the non-convective layer (Gillespie 1992, Tingey 1992). The major difference between Windows C and E is in the amount of solids in segment 8 (convective layer), which confirms observations made during extrusion and sample preparation (see Section 3.1).

Table 4-5. Tank 241-SY-101 Solid Content.[1]

Volume Percent Settled Solids				
Window:Segment	32 °C	50 °C	65 °C	80 °C
C:8	44	48	54	56
E:8	65	66	69	72
C:19	100	100	100	100
E:19	100	95	100	100
Volume Percent Centrifuged Solids				
C:8	22	23	20	8
E:8	41	39	28	24
C:19	78	72	65	62
E:19	78	73	63	57
Weight Percent Centrifuged Solids				
C:8	28	27	24	10
E:8	44	43	33	28
C:19	79	76	67	72
E:19	80	77	67	62

Notes:
°C = degrees Celsius.
[1]Data derived from Herting et al. 1992a and Herting et al. 1992b.

The rate at which the solids in the convective liquid settled was difficult to measure with the existing procedure, since the solid-liquid interface was difficult to distinguish until after significant settling had occurred. Only minimal settling was observed in the non-convective slurry samples.

4.3.3 Particle Size

Particle size is determined as described in the *Tank Characterization Reference Guide* (De Lorenzo et al. 1994). The results of the Particle Size Distribution Analysis show that the mean particle size has no correlation to waste depth but differs between the two windows.

The Window E core sample Particle Size Distribution Analysis measured smaller and more consistent average particle diameters than in the Window C core. The average and standard deviation of the Window E samples are 2.5 microns (μm) and 3.6 μm, respectively. Data obtained were measured in two ranges: 0.5- to 150-μm and 2 to 300 μm. The first range was used for all samples, while the 2 to 300-μm range was used for Window C core segments only. Table 4-6 summarizes the particle size analysis results.

Table 4-6. Tank 241-SY-101 Particle Size Analysis Results for Windows C and E. (2 sheets)

Segment Number	Sample Number	0.5 to 150 μm		2.0 to 300 μm	
		Sauter Mean (μm)	Sauter Standard Deviation	Sauter Mean (μm)	Sauter Standard Deviation
WINDOW C[1]					
4	570	2.99	2.25	---	---
5	645	6.27	17.5	17.1	38.4
7	637	3.90	5.20	---	---
8	468	9.69	23.3	17.7	37.4
9	690	7.29	17.7	9.37	23.0
10	891	2.73	1.54	---	---
11	839	5.19	7.56	8.45	23.1
13	595	3.64	5.00	---	---
14 top	773	8.57	21.8	13.3	24.2
14 bottom	416	15.3	30.4	18.0	37.6
16	665	5.79	16.8	8.35	18.2
16R	664	14.5	33.0	---	---
19	528	8.87	22.6	17.5	42.9

Table 4-6. Tank 241-SY-101 Particle Size Analysis Results for Windows C and E. (2 sheets)

Segment Number	Sample Number	0.5 to 150 μm		2.0 to 300 μm	
		Sauter Mean (μm)	Sauter Standard Deviation	Sauter Mean (μm)	Sauter Standard Deviation
WINDOW E[2]					
3	1166	3.26	7.09	---	---
8	1165	2.37	2.10	---	---
13	1193	2.68	4.23	---	---
15	1192	1.41	0.95	---	---
19	1191	2.01	1.97	---	---
22R	1194	2.98	5.42	---	---

Notes:
Sauter Mean : equation 6-1 (Herting et al. 1992b).
Sauter Standard Deviation: equation 6-2 (Herting et al. 1992b).
μm = micron.
[1]Herting et al. 1992a.
[2]Herting et al. 1992b.

The larger mean particle size values in Window C are possibly due to superior centrifuging obtained during the Window E core sample separations. Alternatively (or in combination), differing mean particle sizes and standard deviation results are probably due to the presence of a small fraction of large diameter agglomerates that were not present during the Window E particle size tests. These large, easily disrupted particles were microscopically observed in the Windows C and E samples from which particle size distribution analysis aliquots were drawn. Apparently, between the two cores, some unknown factor affected the stability of the agglomerates in the Particle Size Distribution Analysis dispersion medium.

4.3.4 Rheology

The rheological properties of the 12 Tank 241-SY-101 samples were obtained by determining the viscosity of a sample as a function of shear rate using a Haake RV100 viscometer. Shear stresses were measured first with a uniformly increasing shear rate followed by a uniformly decreasing shear rate to detect any time-dependent behavior. The methodology used for measuring the shear strength of tank samples is described in the *Tank Characterization Reference Guide* (De Lorenzo et al. 1994).

All samples exhibited non-Newtonian behavior with the exception of the convective layer samples from Window C. These same non-Newtonian samples, except segment 19 from Window E, displayed a time-dependent behavior and were labeled as a thixotropic fluid. Thixotropy is exhibited by certain gels that go into the liquid state when stirred or shaken and return to the hardened state upon standing. The Window E, segment 19, displayed thixotropic behavior only at the highest temperature tested (i.e., 80 °C [176 °F]). The convective layer segment samples from Window C contained approximately 83 wt% liquid. Their viscosity is also highly temperature dependent. However, the viscosity levels of these "wet" samples were, in most cases, at least one order of magnitude lower than the "dryer" Window E segment samples and did not exceed 80 centipoise (cP). This caused the convective layer samples from Window E to behave rheologically more like the non-convective layer samples than their Window C counterparts. Figures 4-1 and 4-2 depict the rheological behavior for both the thixotropic non-Newtonian and Newtonian sample types.

Note that at the higher shear rates the non-Newtonian case has a level and behavior similar to the Newtonian case. In conclusion, the significant factors at a given shear rate are the percent solids present and the temperature of the sample. It would be expected that a small dilution of a non-convective layer sample would result in rheological properties similar to the Window C core convective layer sample.

4.3.5 Adiabatic Calorimetry

Samples from Windows C and E were used for adiabatic calorimetry tests. Adiabatic calorimetry reveals the temperature and extent at which a sample will self-heat due to a thermally induced exothermic decomposition reaction. The samples were pretreated by drying at 90 to 100 °C (194 to 212 °F) for 48 hours to drive off moisture and volatile organic species. A bomb calorimeter instrument produces a pseudo-adiabatic condition by active instrumental heater compensation for sample heat losses. A dried sample is heated at a constant rate (1 °C/minute [33.8 °F/minute]) while the time, sample temperature, calorimeter bomb pressure (initial pressure is 70 pounds per square inch gauge [psig]), and heater energy output are monitored. The initial sample weight and final sample weight are also recorded. These data allow the calculation of the rates of energy and gas production from the decomposition reactions.

Figure 4-3 plots temperature versus time and illustrates a variable gradient with respect to time for a constant heating rate. A derivative of this curve is shown in Figure 4-4. Figure 4-4 is plotted on a logarithmic scale with temperature and reveals the exotherm found in the DSC data. The sudden drop in the curve at 80 °C (176 °F) denotes the shift in heating rate. At 180 °C (356 °F), the curve rises dramatically as the temperature increases, indicating the occurrence of exothermic reactions. Prior to this point, a dip in the curve beginning at 140 °C (284 °F) marks an event that triggers the reaction. Evidence suggests that this endothermic event is a melt of nitrate and nitrite salt oxidants (some volatilization of residual and hydration moisture may also occur).

Figure 4-1. Thixotropic, Non-Newtonian Fluid Behavior (Core 22:Segment 15).

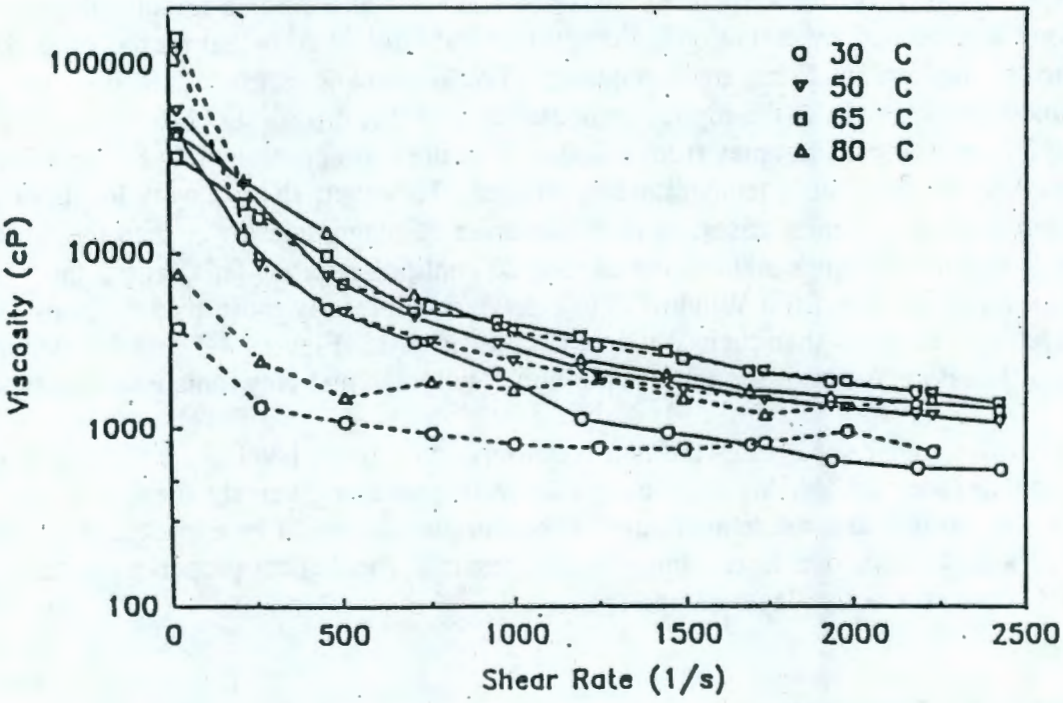


Figure 4-2. Newtonian Behavior (Core 22:Segment 4).

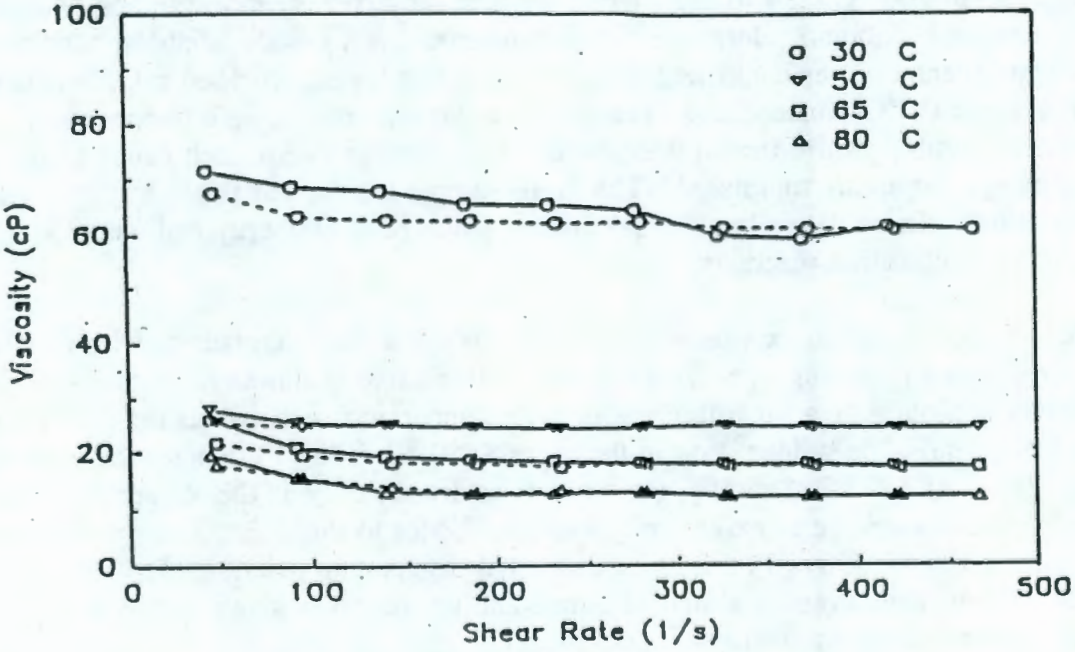


Figure 4-3. Adiabatic Calorimetry Results: Time versus Temperature.

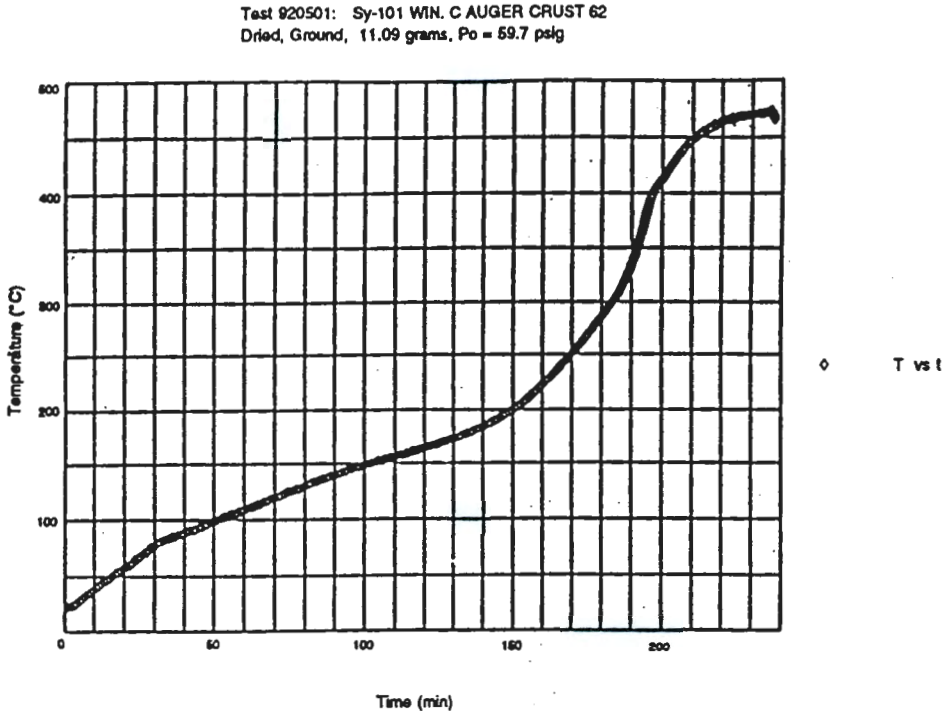
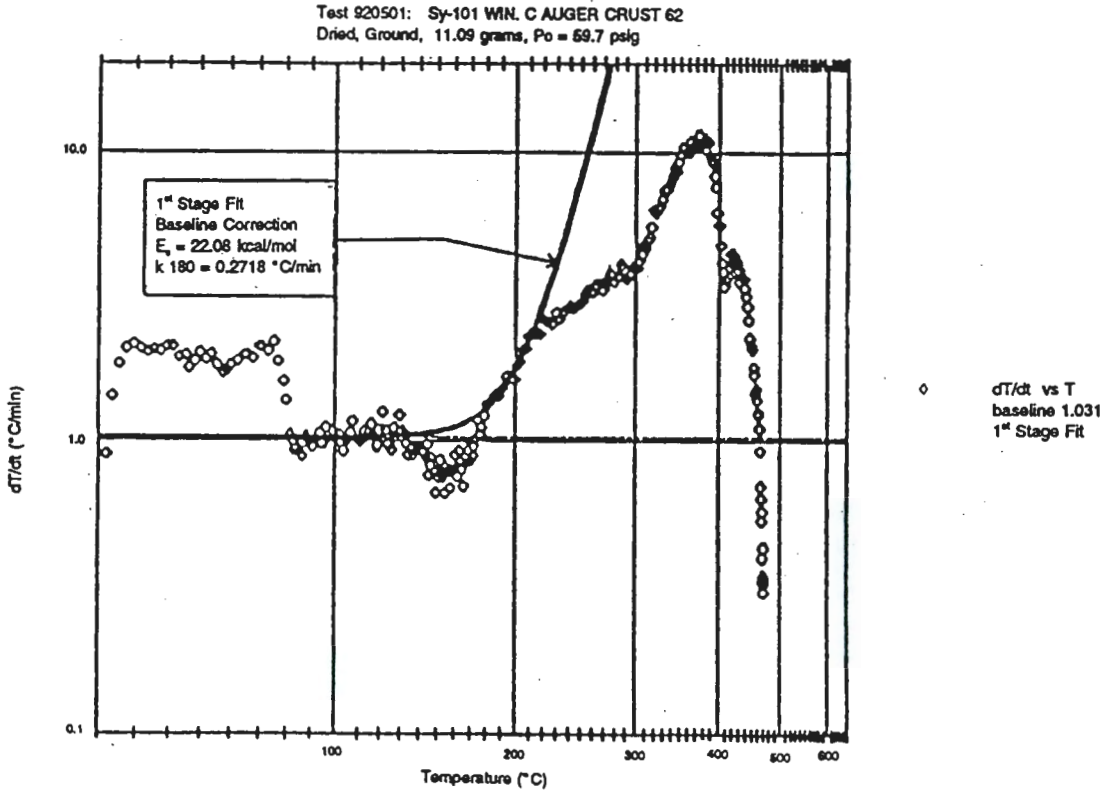


Figure 4-4. Fitting Kinetic Parameters.



4.4 THERMODYNAMIC ANALYSES

Thermogravimetric analysis and DSC were performed on crust and segment bulk samples from Tank 241-SY-101. These analyses yield information on the thermal stability or reactivity of a material.

Although the aliquots usually retained most of their shape, post-analysis visual observations of the Window A thermal analyses revealed that varying degrees of sintering, fusion, or melting had occurred. The DSC analysis of the samples produced one or more partially resolved endotherms from ambient up to nominally 130 °C (266 °F), a pause, then additional endotherms up to nominally 200 to 260 °C (392 to 500 °F). In this vicinity, there was an immediate transition to the first of two partially resolved exotherms which together continued up to nominally 450 °C (842 °F). After this, there is an indication of another endotherm, which terminates the exothermic activity (Herting and Bechtold 1992).

The TGAs of the Window A samples evidenced weight losses associated with the DSC events, though the degree of resolution was usually much poorer. In fact, the resolution was often so poor that individual events were no more than slight deviations from an otherwise continuous weight loss. There was also evidence of weight losses continuing past 450 °C (842 °F).

The cool-down curves and reheat curves in the DSC scans indicated definite interference of the observed exotherms with phase-change or "melting" endotherms on the low-temperature side. This results in considerable uncertainty when selecting the temperature ranges for integration of these DSC events. This uncertainty, combined with the sample inhomogeneity, made the interpretation of the Window A thermodynamic results nearly impossible (Herting and Bechtold 1992). Therefore, this report includes only the Window C and Window E data.

4.4.1 Thermogravimetric Analysis

The TGA measures the mass of a sample while the temperature of the sample is increased at a constant rate. A gas (e.g., nitrogen or air) is passed over the sample during heating. 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 (200 to 250 °C [392 to 482 °F]), is due to water vaporization. This is a rather tenuous assumption but has little effect on the thermal safety evaluation. Moisture and other volatile matter fractions can often be differentiated by inflection points in the rate of sample weight loss. Weight loss above this temperature is attributed to the evolution of reaction product gases (Herting et al. 1992a).

The TGA results for Tank 241-SY-101 occasionally displayed as many as three transitions. The first transition, as mentioned previously, is attributed to sample weight loss due to evaporation of free water and the dissociation of covalently bonded water molecules. The second transition occurs between the first transition ending temperature and approximately 300 °C (572 °F). This weight loss in this transition is likely due to the dehydration of aluminum hydroxide or the melting of sodium nitrate that occurs near 300 °C (572 °F). The final transition occurs between 250 and 450 °C (482 and 842 °F) and is associated with an exothermic (release of heat) reaction. The weight loss during this transitional episode represents the oxidation of organics in the sample by sodium nitrate and the subsequent loss of carbon dioxide. Additional chemical and thermal analyses would be required to confirm these potential reactions.

The most important result of the Windows C and E TGA characterization was that the results were substantially the same, even though the details of the analysis were different in several important ways. The details of the analysis differences are outlined in Table 4-7.

The TGA percent water determinations are fairly consistent between the Windows C and E non-convective layer bulk samples. However, the Window E percent water data are constant in the convective layer, while the Window C data are not. The Window C data for the convective layer have a similar trend as the non-convective layer (Herting et al. 1992).

The results of the TGAs performed on Tank 241-SY-101, Windows C and E, are in Table 4-8. A typical TGA scan for a Tank 241-SY-101 waste sample is shown in Appendix F, Figure F-1.

Table 4-7. Tank 241-SY-101 Thermal Analysis Variations Between Windows C and E.[1]

Analytical Difference	Window C	Window E
Laboratory	Process Chemistry Laboratory	Analytical Services/Inorganic Chemistry
Inert Environment	Nitrogen Gas	Air
Instrumentation	Perkin Elmer Thermal Analysis System	Mettler Thermal Analysis System
Upper Temperature Limit	500 °C	450 °C
Interpretation	TGA exothermic weight losses treated separately from moisture loss	TGA first exotherm weight loss combined with moisture weight loss

Notes:
°C = degrees Celsius.
TGA = thermogravimetric analysis.
[1]Data derived from Herting et al. 1992a (Window C) and Herting et al. 1992b (Window E).

Table 4-8. Tank 241-SY-101 Windows C and E Thermogravimetric Analysis Results.[1] (2 sheets)

Sample	Window C	Window E		
	Average Water Weight Percent Loss (wt %)			
	Bulk	Bulk	Solid	Liquid
Riser 22A Auger Top	18.9	---	---	---
Riser 22A Auger Bottom	19.9	---	---	---
Riser 13A Auger	31.7	---	---	---
Riser 11A Auger	40.8	---	---	---
Riser 16A Auger	23.4	---	---	---
Riser 22A Sludge Weight	16.2	---	---	---
Riser 13A Sludge Weight	31.7	---	---	---
Riser 11A Sludge Weight	17.0	---	---	---
Riser 16A Sludge Weight	16.0	---	---	---
Segment 2	31.8	33.4	---	---
Segment 3	---	39.0	40.3	---
Segment 4	45.8	34.1	---	---
Segment 5	46.3	35.3	---	---
Segment 6	---	37.0	---	---
Segment 7	42.0	34.0	---	---
Segment 8	39.0	36.8	38.2	---
Segment 9	43.4	35.7	---	---
Segment 10	43.4	36.7	---	---
Segment 11	40.0	34.2	---	---
Segment 12	---	35.7	---	---
Segment 13	27.0	37.2	38.7	---
Segment 14 top	36.0	35.7	---	---
Segment 14 bottom	37.0	---	---	---
Segment 15	38.4	32.9	38.6	32.0
Segment 16	36.5	35.7	---	---
Segment 16R	35.0	---	---	---
Segment 17	36.1	35.5	---	---
Segment 18	34.0	44.1	---	---
Segment 19	33.6	32.0	28.0	33.5
Segment 19 Duplicate	34.0	---	---	---
Segment 20	34.4	32.3	---	---

Table 4-8. Tank 241-SY-101 Windows C and E Thermogravimetric Analysis Results.[1] (2 sheets)

Sample	Window C	Window E		
	Average Water Weight Percent Loss (wt %)			
	Bulk	Bulk	Solid	Liquid
Segment 21	31.0	41.8	---	---
Segment 22	31.0	30.8	27.4	78.4
Segment 20A	35.0	---	---	---
Segment 21A	32.0	---	---	---
Segment 22A	31.2	---	---	---

Notes:
wt% = weight percent.
[1]Data derived from Herting et al. 1992a and Herting et al. 1992b.

4.4.2 Differential Scanning Calorimetry

In DSC analysis, heat flow above the usual heat capacity of the substance is measured while the substance is exposed to a linear increase in temperature. While the substance is being heated, a gas (e.g., nitrogen or air) is passed over the waste material to remove any gases being released. The onset temperature for an endothermic (characterized by or causing the absorption of heat) or exothermic (releasing, as opposed to absorbing heat) event on a DSC is determined graphically.

The first DSC transition in each sample is endothermic and begins at the lower temperature limit of the analysis (ambient). The first transition is essentially complete between 180 and 264 °C (356 and 507 °F). The most probable phenomena occurring in this region are the release of the bulk and interstitial water in the sample material. Melting of the nitrate/nitrite salt mixture also contributes to this endotherm.

Table 4-9 presents the DSC results for Windows C and E from Tank 241-SY-101. The data show that exotherms and additional weight loss are routinely detected between 180 and 443 °C (356 and 507 °F). The weight losses can probably be attributed to the loss of gaseous products and waters of hydration. A typical DSC scan for a Tank 241-SY-101 waste sample is shown in Appendix F, Figure F-2.

Table 4-9. Tank 241-SY-101 Windows C and E Differential Scanning Calorimetry Results.[1] (2 sheets)

Sample	WINDOW C				WINDOW E			
	Endotherm		Exotherm		Endotherm		Exotherm	
	J/g	Temp. Range °C	J/g	Temp. Range °C	J/g	Temp. Range °C	J/g	Temp. Range °C
Riser 22A Auger Top	209	Amb-213	-175	208-402				
Riser 22A Auger Bottom	460	Amb-206	-250	206-411				
Riser 13A Auger	544	Amb-190	-276	190-423				
Riser 11A Auger	795	Amb-218	-117	218-422				
Riser 16A Auger	565	Amb-212	-155	212-412				
Riser 22A Sludge Weight	402	Amb-262	-264	262-433				
Riser 13A Sludge Weight	418	Amb-203	-192	203-402				
Riser 11A Sludge Weight	343	Amb-253	-184	253-427				
Riser 16A Sludge Weight	318	Amb-264	-180	264-421				
Segment 2	669	Amb-200	-205	200-415	705	53-203	-398	198-384
Segment 3	---	---	---	---	560	44-200	-561	198-391
Segment 4	795	Amb-197	-272	197-348	587	45-212	-240	212-434
Segment 5	837	Amb-189	-310	189-358	516	50-210	-289	201-437
Segment 6	---	---	---	---	628	44-209	-389	204-442
Segment 7	711	Amb-190	-322	190-352	463	44-210	-421	208-428
Segment 8	763	Amb-180	-360	180-360	574	44-212	-190	210-374
Segment 9	854	Amb-193	-314	193-380	588	44-207	-320	207-416
Segment 10	753	Amb-190	-335	190-360	578	44-209	-371	205-424
Segment 11	753	Amb-194	-322	194-377	609	44-204	-364	203-427
Segment 12	---	---	---	---	558	45-204	-382	204-434
Segment 13	377	Amb-180	-544	180-426	472	45-205	-367	205-443

Table 4-9. Tank 241-SY-101 Windows C and E Differential Scanning Calorimetry Results.[1] (2 sheets)

Sample	WINDOW C				WINDOW E			
	Endotherm		Exotherm		Endotherm		Exotherm	
	J/g	Temp. Range °C	J/g	Temp. Range °C	J/g	Temp. Range °C	J/g	Temp. Range °C
Segment 14 top	669	Amb-180	-356	180-360	576	43-205	-362	205-438
Segment 14 Bottom	502	Amb-192	-418	192-422	---	---	---	---
Segment 15	628	Amb-187	-414	187-417	445	47-207	-454	207-432
Segment 16	669	Amb-202	-369	202-419	434	56-208	-403	200-424
Segment 16R	502	Amb-200	-390	200-409	---	---	---	---
Segment 17	628	Amb-199	-285	199-374	687	43-205	-440	205-428
Segment 18	418	Amb-186	-502	186-419	488	52-223	-341	210-426
Segment 19	544	Amb-196	-348	196-405	467	52-212	-390	193-438
Segment 19 Dup.	669	Amb-208	-234	208-421	---	---	---	---
Segment 20	711	Amb-208	-222	208-421	475	43-201	-411	201-443
Segment 21	628	Amb-201	-351	201-420	672	41-210	-347	210-439
Segment 22	502	Amb-201	-247	201-410	598	44-200	-344	188-442
Segment 20A	711	Amb-214	-283	214-425	---	---	---	---
Segment 21A	586	Amb-207	-236	207-412	---	---	---	---
Segment 22A	669	Amb-188	-331	188-420	---	---	---	---

Notes:
Temp. = Temperature.
J/g = Joules per gram.
°C = degrees Celsius.
Amb = Ambient.
Dup = Duplicate.
[1]Data derived from Herting et al. 1992a (Window C) and Herting et al. 1992b (Window E).

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5.0 INTERPRETATION OF CHARACTERIZATION RESULTS

This chapter evaluates the overall quality and consistency of the available results for Tank 241-SY-101 and assesses and compares these results against historical information and program requirements.

5.1 ASSESSMENT OF ANALYTICAL RESULTS

Section 5.1 evaluates sampling and analysis factors that may impact data interpretation. These factors are used to (1) assess the overall quality and consistency of the data, (2) identify any limitations in the use of the data, and (3) compare the results against historical information and program requirements.

5.1.1 Field Observations

Several observations from the Windows A, C, and E sampling events may have impacted the interpretation and use of the data. The following paragraphs will discuss the field observations and their possible impact on the results.

Water was poured down the outside surface of the drill string to prevent possible sparks or heating of the crust during sampling. This probably diluted and compromised segments 1, 2, 3, and 16 from Window C and segment 2 from Window E.

One segment from each window was empty, and several others from both windows exhibited partial recovery. This may have been caused by surface irregularities in the crust layer, by flapper valves not closing, or by crust material plugging the core. This calls into question the representativeness of these particular segments and the composite formed from them.

The core 22 segment 16 Window C chain-of-custody form indicates that a problem developed with the core sampling truck and sampling was delayed for 48 hours. Also, the analytical results indicated that the interface of the convective and non-convective layers was in the range of the lower portion of segment 14 to segment 15, and the visual inspections found the interface at segment 14. This contradicted the thermocouple data, which indicated that the interface would be close to segment 11.

5.1.2 Quality Control Assessment

An attempt is always made to quantify the different sources of variability possible during the chemical analysis of a sample. When these uncertainties are summarized, they give a strong indication of data reliability. If one or more of the variability estimates are outside the acceptable limits, the validity of the concentration estimate becomes questionable. Examples

of possible sources of uncertainty are poor instrument calibration, matrix interferences, and sample contamination. Analytical variability involves both random and systematic error. Systematic variability estimates are determined from the analysis of reference standards and/or spike recoveries. Tables 5-1, 5-2, and 5-3 address these quality control measures. Random analytical variability is estimated from the differences between primary and duplicate samples and is discussed in Section 5.2.6.

Reference standards are samples used to estimate the accuracy of the analytical method and are analyzed in conjunction with the samples. They are prepared by adding a known amount of a particular analyte at a concentration other than that used for equipment calibration. As a general rule, recoveries on standards must be within three standard deviations of the historical mean in order to meet quality control criteria. If a standard is above or below the criterion, then the analytical result may be biased high or low, respectively. Table 5-1 lists the average standard recoveries for Windows C and E in columns 2 and 4, respectively. The recoveries were very good, with only the Window E ^{129}I results for both the fusion and direct digestion methods violating the criteria. Therefore, the ^{129}I results should be considered suspect.

Matrix spikes are used to estimate the bias of the analytical method due to matrix interferences. Spiked samples are prepared by splitting a sample into two aliquots and adding a known amount of a particular analyte to one aliquot to calculate a percent recovery. As with the standards, the analytical result may be biased high or low depending on whether the spike result is above or below the criterion. Columns 3 and 5 of Table 5-1 give the average spike recoveries for Windows C and E, respectively. The quality control criterion for spikes on Window C data was not mentioned in the laboratory report (Herting et al. 1992a). However, it was specified that iron, chromium, and sodium were suspect. A spike recovery was not reported for sodium as the sample concentrations exceeded four times the spike concentration. For Window E, the quality control criterion was established as a 95 percent confidence interval for each average spike recovery. If the 95 percent confidence interval for the mean does not contain 100 percent, either matrix interference or sample preparation contamination was possible. If the average spike recovery in Table 5-1 is marked with an asterisk (*), then the 95 percent confidence interval for the mean did not contain 100 percent (Herting et al. 1992a for Window C, and Herting et al. 1992b for Window E).

Table 5-1. Average Standard and Spike Percent Recoveries. (3 sheets)

Method/Analyte/Prep	Window C		Window E	
	% Standard Recovery	% Spike Recovery	% Standard Recovery	% Spike Recovery
ICP.Al.acid	103	---	120	112
ICP.Al.direct	102	---	99	---
ICP.Al.fusion	---	---	101	108
AAS.As.acid	---	---	99	88
ICP.Ca.acid	105	---	168	98
ICP.Ca.direct	101	104	99	---
ICP.Ca.fusion	---	---	97	102
ICP.Cr.acid	101	---	99	106
ICP.Cr.direct	102	114	101	---
ICP.Cr.fusion	---	---	100	110
ICP.Fe.acid	101	97	104	106
ICP.Fe.direct	100	114	100	---
ICP.Fe.fusion	---	---	98	101
CVAA.Hg.direct	---	---	105	101
ICP.K.acid	---	---	99	89
ICP.K.direct	---	---	101	---
ICP.Na.acid	100	---	135	---
ICP.Na.direct	98	---	98	---
ICP.Na.fusion	---	---	98	126
ICP.Ni.acid	---	---	98	93
ICP.Ni.direct	---	---	99	---
ICP.Ni.fusion	---	---	98	95
ICP.Se.acid	---	---	102	109
ICP.Zn.acid	---	---	102	92*
ICP.Zn.direct	---	---	99	---
ICP.Zn.fusion	---	---	98	99
NH_3/NH_4^+.water	97	97	100	95
NH_3/NH_4^+.direct	99	---	103	109
CN^-.direct	100	98	---	---
IC.F^-.water	104	89	97	92*
IC.F^-.direct	101	104	96	106
IC.Cl^-.water	100	101	99	104

Table 5-1. Average Standard and Spike Percent Recoveries. (3 sheets)

Method/Analyte/Prep	Window C		Window E	
	% Standard Recovery	% Spike Recovery	% Standard Recovery	% Spike Recovery
IC.Cl^-.direct	99	105	101	96
IC.NO_3^-.water	100	98	97	94
IC.NO_3^-.direct	99	92	95	94
IC.NO_2^-.water	100	99	99	104
IC.NO_2^-.direct	102	99	100	105
IC.PO_4^{-3}.water	102	104	99	102
IC.PO_4^{-3}.direct	98	107	98	100
IC.SO_4^{-2}.water	96	111	100	97
IC.SO_4^{-2}.direct	96	99	95	93*
Titrat.OH^-.water	---	---	100	---
Titrat.OH^-.direct	---	---	100	---
Coul.TIC.water	101	105	102	102
Coul.TIC.direct	---	---	101	107*
Coul.TOC.water	100	101	97	100
Coul.TOC.direct	99	---	98	101
Specific Gravity	99	---	99	---
pH	100	---	---	---
Grav.%water	99	---	101	---
TGA.%water	---	---	100	---
APC.^{241}Am.fusion	117	---	95	---
APC.^{241}Am.direct	111	---	98	---
LSC.^{14}C.water	---	---	92	91*
GEA.^{137}Cs.acid	100	102	102	103*
GEA.^{137}Cs.fusion	99	---	104	103*
GEA.^{137}Cs.water	100	98	104	102
GEA.^{137}Cs.direct	99	103	102	103
GEA.^{129}I.fusion	99	---	128	124*
GEA.^{129}I.direct	101	---	131	51
AEA.^{237}Np.acid	61	69	73	76
AEA.^{237}Np.fusion	78	80	71	68*
AEA.^{237}Np.direct	81	---	92	243
APC.$^{239/240}$Pu.fusion	107	---	97	---

Table 5-1. Average Standard and Spike Percent Recoveries. (3 sheets)

Method/Analyte/Prep	Window C		Window E	
	% Standard Recovery	% Spike Recovery	% Standard Recovery	% Spike Recovery
APC.$^{239/240}$Pu.direct	---	---	102	---
BPC.^{90}Sr.fusion	104	---	92	---
BPC.^{90}Sr.direct	102	---	101	---
LSC.^{99}Tc.fusion	103	---	100	---
LSC.^{99}Tc.direct	95	---	106	---
APC.total α.fusion	96	101	99	81*
APC.total α.direct	96	---	100	96
BPC.total β.fusion	92	106	95	98
BPC.total β.direct	90	---	96	114
LF.total U.fusion	100	91	97	96*
LF.total U.direct	96	---	102	98

Notes:
IC = ion chromatography.
Titrat = titration.
Coul = coulometry.
TIC = total inorganic carbon.
TOC = total organic carbon.
BPC = beta proportional counting.
Grav = gravimetry.
TGA = thermogravimetric analysis.
APC = alpha proportional counting.
LSC = liquid scintillation counting.
GEA = gamma energy analysis.
AEA = alpha energy analysis.
LF = laser fluorimetry.
*95% confidence interval for the mean does not contain 100%.

Method blanks document the contamination resulting from the analytical process and are prepared by filling sample containers with deionized, distilled water. The blanks are carried through the complete sample preparation and analytical procedure, and all reagents used in the sample processing are added in the same volumes. The blank values for most measurements were well below the detection limits, with just a few exceptions. For the Window C blanks that demonstrated values above the detection limit, the contamination was generally less than 10 percent of the analyte concentration for all but the total uranium value, which was closer to 20 percent of the analyte concentration. For the Window E data, only two analytes showed contamination greater than 10 percent of analyte concentration. These were calcium, with a blank value four times the analyte concentration, and zinc, with a blank value twice the analyte concentration. Therefore, contamination appears to be a problem for these last two analytes, and their estimated mean concentrations are questionable.

5.1.3 Data Consistency Checks

5.1.3.1 Comparison of Total Alpha and Beta Activities with Gross Alpha and Beta Activities. The sums of the gross beta and gross alpha activities were compared with the sum of the individual beta and alpha emitters. This was done as a check on the accuracy of the two analyses. A close agreement indicates that both analyses were probably representative of the tank contents. The activities of the individual alpha emitters were summed according to the following equation:

$$\text{Sum of Alpha Emitters} = {}^{241}\text{Am} + \text{total Pu}$$

Gross alpha values are typically higher than the sum of ^{241}Am and total Pu. This high bias is due to interference from the high beta content of the samples (see below) (Herting et al. 1992a).

The activities of the individual beta emitters were summed according to:

$$\text{Sum of Beta Emitters} = 1.42(2 * {}^{90}\text{Sr}) + 1.51({}^{137}\text{Cs})$$

The ^{90}Sr and ^{137}Cs analytical values were multiplied by "correction" factors prior to the comparison with gross beta data to allow for the counter efficiency factor used when converting from counts per minute to disintegrations per minute. This factor was determined by calibrating the counter with a ^{60}Co source of known activity. Since the counting efficiency determined from beta particles emitted by ^{60}Co is different than these emitted by ^{137}Cs and ^{90}Sr, the coefficients (1.42 and 1.51) are required to account for this source of uncertainty.

The comparisons of the beta and alpha emitters are given in Tables 5-2 and 5-3.

5.1.3.2 Mass and Charge Balance. A mass and charge balance is performed to determine if the measurements are self-consistent. In calculating the balances, only analytes listed in Table 4-3 that were detected at a concentration of 1,000 micrograms per gram (μg/g) or greater were considered.

Chromium was assumed to be present in its hydroxide form, and the concentration of the assumed species was calculated stoichiometrically (Table 5-4). Since precipitates are neutral species, all positive charge was attributed to the sodium and potassium cations. All aluminum was assumed to be present as the aluminate ion, as that is the predominant aluminum species. The acetate and carbonate data were derived from the total organic carbon and total inorganic carbon analyses, respectively. The other anionic analytes listed in Table 5-5 were assumed to be present as sodium salts and were expected to balance the positive charge exhibited by the cations. The concentrations of the assumed species in Table 5-4, the anionic species in Table 5-5, and the percent water were ultimately used to calculate the mass balance. The uncertainty estimates (relative standard deviation [RSD]) associated with each analyte, along with the uncertainty for the cation and anion totals, are also given in the tables.

Table 5-2. Tank 241-SY-101 Comparison of Gross Alpha Activities With the Total of the Individual Activities.

Analyte	Half-Life (years)	Crust (μCi/g)	Convective Layer (μCi/g)	Non-convective Layer (μCi/g)
^{241}Am	458	0.134	0.0288	0.174
Pu total	---	0.0130	0.00201	0.0125
Sum of Alpha Emitters (a)	---	0.147	0.0308	0.187
Gross Alpha (b)	---	0.530	0.0819	0.787 0.227[2]
[1]Relative Percent Difference (RPD)		113%	90.6%	123% 35.1%[2]

Notes:
μCi/g = microcurie per gram.
RPD = relative percent difference.
[1]Relative Percent Difference = the absolute difference of a and b, divided by their mean, and the result multiplied by 100.
[2]Outliers removed (Welsh 1995).

Table 5-3. Tank 241-SY-101 Comparison of Gross Beta Activities With the Total of the Individual Activities.

Analyte	Half-Life (years)	Crust (μCi/g)	Convective Layer (μCi/g)	Non-convective Layer (μCi/g)
^{90}Sr[1]	28.6	36.9	11.0	48.0
^{137}Cs[2]	30.17	568	556	461
Sum of Beta Emitters (a)	---	605	567	509
Gross Beta (b)	---	608	538	554
[3]Relative Percent Difference (RPD)	---	0.49%	5.25%	8.47%

Notes:
μCi/g = microcurie per gram.
RPD = relative percent difference.
[1]Analytical values multiplied by 1.42.
[2]Analytical values multiplied by 1.51.
[3]Relative Percent Difference = the absolute difference of a and b, divided by their mean, and the result multiplied by 100.

Table 5-4. Cation Mass and Charge Data.

Analyte	Concentration (μg/g)	Assumed Species	Concentration of Assumed Species (μg/g)	RSD (%)	Charge (μmol/g)
Chromium	3,650	$Cr(OH)_3$	7,230	13.5	0
Potassium	3,370	K^+	3,370	4.0	86
Sodium	205,000	Na^+	205,000	4.2	8,910
Totals			216,000	4.0	9,000

Notes:
μg/g = microgram per gram.
μmol/g = micromole per gram.
RSD = relative standard deviation.

Table 5-5. Anion Mass and Charge Data.

Analyte	Concentration (μg/g)	RSD (%)	Charge (μmol/g)
Aluminate (AlO_2^-)[a]	70,800	3.2	1,200
Acetate (TOC)[b]	37,600 (15,300)	1.7	637
Carbonate (TIC)[b]	37,300 (7,460)	14.2	1,240
Chloride	8,330	4.8	235
Hydroxide	22,100	9.8	1,300
Nitrate	126,000	9.9	2,030
Nitrite	110,000	6.4	2,390
Phosphate	6,600	7.2	208
Sulfate	3,930	5.2	82
Totals	423,000	3.7	9,320

Notes:
μg/g = microgram per gram.
RSD = relative standard deviation.
μmol/g = micromole per gram.
TOC = total organic carbon.
TIC = total inorganic carbon.
[a]Derived stoichiometrically from the aluminum concentration of 32,400 μg/g.
[b]The values in parentheses are from the TOC and TIC analytical results, and were used to derive the acetate and carbonate values on the left.

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

$$\begin{aligned}\text{Mass balance} &= \%\ \text{Water} + 0.0001 \times \{\text{Total Analyte Concentration}\} \\ &= \%\ \text{Water} + 0.0001 \times \{Cr(OH)_3 + K^+ + Na^+ + AlO_2^- + C_2H_3O_2^- \\ &\quad + CO_3^{-2} + Cl^- + OH^- + NO_3^- + NO_2^- + PO_4^{-3} + SO_4^{-2}\}\end{aligned}$$

The total analyte concentrations calculated from the above equation was 639,000 $\mu g/g$. The mean weight percent water obtained from TGA is 35.0 percent. The mass balance resulting from adding the percent water to the total analyte concentration is 98.9 percent (Table 5-6).

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

$$\text{Total cations (microequivalents)} = Na^+/23.0 + K^+/39.1 = 9{,}000 \text{ microequivalents}$$

$$\begin{aligned}&\text{Total anions (microequivalents)} \\ &= AlO_2^-/59 + C_2H_3O_2^-/59.0 + CO_3^{-2}/60.0 + Cl^-/35.5 + OH^-/17.0 + NO_3^-/62.0 + \\ &\quad NO_2^-/46.0 + PO_4^{-3}/95.0 + SO_4^{-2}/96.1 = 9{,}320 \text{ microequivalents}\end{aligned}$$

The charge balance obtained by dividing the sum of the positive charge by the sum of the negative charge was 0.966.

In summary, these calculations yield reasonable mass and charge balance values. For charge balance, the value was close to 1.00 and for mass balance the value was nearly 100 percent. These values strongly indicate that the analytical results are fairly self-consistent and therefore reliable.

Table 5-6. Mass Balance Totals.

	RSD (%)	Concentrations ($\mu g/g$)
Total from Table 5-4	4.0	216,000
Total from Table 5-5	3.7	423,000
Water (from Window E data)	1.2	350,000
Grand Total	1.9	989,000

Notes:
RSD = relative standard deviation.
$\mu g/g$ = microgram per gram.

5.2 COMPARISON OF HISTORICAL AND ANALYTICAL RESULTS

Table 5-7 compares two analytical estimates of the contents of Tank 241-SY-101 for the non-convective layer. The first estimate is historical (column 2) and is based on a 1986 dip sampling event in which samples were removed from three different waste levels (see Appendix C) (Mauss 1986). For the 1986 data, only one sample result per analyte was obtained for each waste layer. Column three gives the analytical results from the two 1991 sampling time frames (Windows C and E) for the non-convective layer.

Agreement between the 1986 and 1991 data is fair. The only change in tank contents between the 1986 and 1991 samplings was very minor additions of water, not enough to noticeably affect these comparisons.

Table 5-7. Comparison of 1986 and 1991 Data for the Non-convective Layer of Tank 241-SY-101. (2 sheets)

Analyte	Non-convective Layer	
	1986 Analytical Result (μg/g)	1991 Analytical Result (μg/g)
Al	35,800	35,500
Ca	169	375
Cr	20.3	6,590
Ni	227	240
K	3,010	2,950
Na	220,000	215,000
Cl^-	7,100	7,680
OH^-	23,400	23,600
NO_3^-	113,000	111,000
NO_2^-	80,600	95,700
PO_4^{3-}	7,300	8,440
SO_4^{2-}	<7,400	6,570
TIC	6,400	9,870
TOC	15,000	19,700
Percent Water	47.1	31.7

Table 5-7. Comparison of 1986 and 1991 Data for the Non-convective Layer of Tank 241-SY-101. (2 sheets)

Analyte	Non-convective Layer	
	1986 Analytical Result (μg/g)	1991 Analytical Result (μg/g)
Radionuclides	μCi/g	μCi/g
^{241}Am	<0.0088	0.174
^{137}Cs	394	305
$^{239/240}Pu$	0.0112	0.0125
^{90}Sr	7.99	33.8
^{99}Tc	0.124	0.295
Total β	734	554
Total U	<0.0119	56.4

Notes:
μg/g = microgram per gram.
μCi/g = microcurie per gram.
TIC = total inorganic carbon.
TOC = total organic carbon.

5.3 TANK WASTE PROFILE AND STATISTICAL TREATMENT OF DATA

The analytical results for Tank 241-SY-101 revealed a heterogeneous waste disposition with three discrete layers: the crust, convective, and non-convective layers prior to pump operation. There were notable variations in analyte concentrations between the three layers, but the concentrations were fairly consistent for most analytes within the layers.

As mentioned in Chapter 3.0, core sampling was conducted on two separate occasions, referred to as Windows C and E. The segments within each core were homogenized, and each core composite was formed by combining samples from the homogenized segments. Five core composite samples were made for each core. The core composite samples were then also homogenized. Two subsamples were taken from each composite sample and two analytical measurements, the sample and the duplicate, were obtained from each subsample. It is assumed that all subsamples and analytical measurements were analyzed independently of one another. Personnel from WHC computed all statistics in Section 5.3.

The first two composite samples represent the convective layer of the waste. The analytical results for the convective layer consisted of two components: the "liquid" phase, which represents the composition of the liquid phase after centrifuging the samples, and the "solid" phase, which represents the composition of the centrifuged solids. For each analyte, the two components were combined into a single "bulk" result using the weighting factors of approximately 80 percent for the liquid sample and 20 percent for the solid sample (Welsh 1995). The next two composites representing the analytical results for the non-convective layer were obtained from the "bulk" sample results. The last composite consisted of the the solid phase from segment 2.

The crossed effects statistical model describes the structure of the data when both Windows C and E data are used. In this mathematical model, each observation contains many different types of variability (measurement, mixing, sampling, and spatial) that are to be estimated. The variabilities associated with this model include estimates of the core variance (Window or spatial), the compositing variance, the interaction variance, and the analytical measurement variance. The core variance measures variability between the two sampling time frames and the compositing variance measures variability between composite replicates. The interaction variance measures the variance due to the possible influence of the core term on the analytical result of the composite term (or vice versa), and the analytical measurement variability measures the difference between results from the sample and duplicate analyses.

An analysis of variance (ANOVA) statistical test based on the crossed effects model was calculated for the core composite data. The ANOVA output was used to determine the degree of variability due to the four sources of variation mentioned above. The RSD estimates for each component of variability are listed in Table 5-8. The RSD is defined as the standard deviation divided by the mean times 100 and is a unitless measure of variability that allows the comparison of variation across constituents whose magnitudes may vary widely.

Table 5-8. RSDs Associated With Each Variance Component.

Analyte	Convective Layer				Non-convective Layer			
	RSD(S)	RSD(C)	RSD(SC)	RSD(A)	RSD(S)	RSD(C)	RSD(SC)	RSD(A)
Al	6	0	5	6	6	1	2	3
Ca	66	11	0	35	33	0	30	25
Cr	90	13	0	15	0	9	6	3
Fe	62	7	0	23	21	7	0	49
K	0	6	5	11	6	2	1	3
Na	9	0	6	5	0	6	4	4
Ni	16	0	7	24	0	7	2	3
Zn	60	80	11	32	18	52	40	22
Cl^-	21	3	19	55	8	0	9	10
NO_3^-	24	0	0	7	8	0	0	4
NO_2^-	15	0	4	4	0	4	2	5
OH^-	10	7	30	7	0	6	6	7
PO_4^{-3}	20	7	1	23	0	0	0	23
SO_4^{-2}	13	14	0	6	0	0	0	26
TIC	50	4	11	21	0	10	0	15
TOC	NA	5	NA	4	NA	1	NA	3
H_2O	NA	2	NA	2	NA	1	NA	0
Total α	14	16	15	9	61	0	108	115
Total β	9	15	4	5	0	0	7	11
Total U	69	0	23	19	115	0	3	9
^{241}Am	96	0	1	15	0	0	9	5
^{137}Cs	12	11	1	6	0	4	16	6
$^{239/240}Pu$	92	1	0	29	18	0	9	10
^{90}Sr	69	6	3	10	2	9	2	4
^{99}Tc	NA	24	NA	6	NA	0	NA	3

Notes:
RSD (S) = core variability.
RSD (C) = compositing variability.
RSD (SC) = interaction variability.
RSD (A) = analytical variability.
TIC = total inorganic carbon.
TOC = total organic carbon.
NA = Not applicable for these analytes.

5.4 COMPARISON OF ANALYTICAL AND TRANSFER HISTORY INFORMATION

As discussed in Section 2.3.2, historical tank content estimates are not yet available. However, a comparison can be made between the analytical results and the analytes expected to be in the tank based on the waste types received by the tank. This information can be found in Hanford Defined Wastes (Agnew 1995).

A substantial amount of uncontaminated liquid was recovered from the Window C convective layer, and a minor amount from Window E. High concentrations of aluminum, sodium, nitrate, and nitrite were found as expected. More hydroxide was found than would be expected from complexant concentrate and double-shell slurry liquid; conversely, more organic carbon was anticipated than was found. Finally, the amount of water found in the convective layer was less than what was expected.

The non-convective layer estimates were also compared with the historical waste stream information from Agnew (1995). Aluminum, sodium, nitrate, and nitrite were found in the sludge in the large quantities expected. However, high concentrations of hydroxide and carbonate were not found as expected. In addition, more water was expected to be present in the sludge than was found.

5.5 EVALUATION OF PROGRAM REQUIREMENTS

Data quality objectives 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 at the Hanford Site (Babad et al. 1994). These DQOs identify the data requirements needed by the various TWRS program elements. However, the sampling of Tank 241-SY-101 occurred in 1991, before the existence of DQOs. Therefore, the following comparisons are for informational purposes only.

Tank 241-SY-101 is included on the Flammable Gas Watch List. The Flammable Gas Tank Safety Program has created a DQO to address the Flammable Gas Tank Safety Issue, *Flammable Gas Tank Safety Program: Data Requirements for Core Sample Analysis Developed Through the Data Quality Objectives Process* (LeClair 1995). This document records the data requirements list for the analysis of core samples from tanks on the Flammable Gas Watch List. Since no decision rules or criteria are enumerated for particular analyte concentrations, no comparisons with analytical results were possible. The Flammable Gas DQO does not define any decision rules because a good set of criteria is not yet known. What is known is that the major factors influencing gas production are the concentrations of certain species, temperature, density, and radiation dose. Gas retention in the waste has been mitigated by operation of the mixer pump, preventing the episodic gas releases in which the lower flammability limit was exceeded. Consequently, it is unlikely that the tank headspace currently contains concentrations of gases above their lower flammability limit (LeClair 1995). Several of the analyses now mandated in the DQO were not performed in the 1991 analysis. Those analyses not executed include solubility determinations in 2.5 M NaOH and water and the determination of the presence of Ba, B, Bi, Si, Zr, ^{3}H, ^{238}Pu, ^{60}Co, and ^{154}Eu.

A second issue involving some of the tanks on the Flammable Gas Watch List is the potential of a "crust burn." A crust burn, or the secondary ignition of organic-nitrate/nitrite mixtures in the crust layer, can be initiated by two events: (1) the burning of flammable gases and (2) mechanical in-tank energy (e.g., friction during core sampling) (Johnson 1994). The investigation of a secondary crust burn for Tank 241-SY-101 is discussed in Fox et al. (1992) and was the primary basis for establishing the criteria and requirements of the Crust Burn DQO. Results of this study indicate that a self-propagating reaction in the crust would not occur from a hydrogen burn. A very small quantity at the crust surface and at surface projections could react, but in a benign manner (Fox et al. 1992).

The *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994) uses notification limits for concentrations of analytes of concern to determine whether a tank is safe. The primary analytical requirements identified are energetics, total alpha activity, moisture content, and flammable gas concentration. The safety screening DQO was not in existence when the sampling occurred, so no notification thresholds were applied to the data assessment after the initial analysis. If the analytical results are now compared to the decision limits, it is found that the total fuel content threshold of 481 joules per gram (J/g), as measured by DSC, is exceeded in many of the segments. Approximately half of the segments from the Window C sampling time frame contain exotherms exceeding the decision criteria, while 18 out of 21 segments from the Window E sample exceed the 481 J/g limit. These dry weight values are converted from the wet weight results listed in Table 4-9. The conversion is done according to the following equation:

$$Exotherm\ (dry\ wt) = \frac{[exotherm\ (wet\ wt)\ x\ 100]}{(100\ -\ \%\ water)}$$

For example, the 320 J/g wet weight exotherm from segment 9 of Window E would convert into a dry weight exotherm of 498 J/g, using the segment 9 percent water result (from thermogravimetric analysis) of 35.7 percent.

The analytical results for total alpha and percent moisture were within the safety screening DQO limits. The flammable gas concentration was not analyzed in the Window A, C, and E time frames.

Another factor in assessing the safety of the tank is the heat generation and temperature of the waste. Heat is generated in the tanks primarily from radioactive decay. Section 2.5.2 discussed temperature information for Tank 241-SY-101. The amount of heat resulting from radioactivity in the tank was calculated in Table 5-9. The estimated total curies for each analyte is listed in column 2 (from Table 4-3) and the number of watts is listed in column 3. The reported heat load for the tank is 11,800 watts (40,300 British thermal unit per hour [Btu/hr]), with an uncertainty estimate of 7 percent (assuming no uncertainty with the tank volume estimate). Taking the uncertainty into consideration, the heat load estimate is still below the upper safety limit of 50,000 Btu/hr specified for this tank (Harris 1994). The temperature of the tank from March to November of 1994 ranged between 21.4 °C and 48.7 °C (70.5-120 °F). Since an upper temperature limit is exhibited, it may be concluded that any heat generated from radioactive sources throughout the year is dissipated.

Table 5-9. Tank 241-SY-101 Projected Heat Load.

Radionuclide	Ci	RSD (mean)	Watts
^{241}Am	635	11.8	20.8
^{137}Cs	2.31E+06	7.4	10,900
$^{239/240}Pu$	46.6	14.6	1.42
^{90}Sr	1.31E+05	11.5	878
^{99}Tc	1,460	6.2	0.731
Watts		**7.0**	**11,800**

Notes:
Ci = curie.
RSD = relative standard deviation.

6.0 CONCLUSIONS

The contents of Tank 241-SY-101 were sampled in 1990 and 1991 to address flammable gas safety concerns. Although the decision criteria listed in *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994) were not in force at the time of these sampling events, a comparison of the analytical results to the safety thresholds indicates that a majority of the segments contained exothermic reactions exceeding the 481 J/g limit. The percent water and total alpha concentrations were below the limits. In addition, the estimated tank heat load of 40,300 Btu/hr was below the critical level of 50,000 Btu/hr established for Tank 241-SY-101 (Harris 1994).

Tank 241-SY-101 currently does not exhibit the historical phenomenon of a large buildup of gas within the slurry (and consequent slurry growth), followed by a gas release event (GRE). This situation has been relieved through the installation of a mixer pump. This pump allows small amounts of gas to be slowly released and prevents the episodic release of large volumes of gas.

The 1991 samplings were performed before the installation of the mixer pump. Prior to the mixer pump operation, three distinct layers existed in Tank 241-SY-101. It is unlikely that these layers remain today. Therefore, the data from 1990 and 1991 may not represent the current distribution of waste in the tank. It is also important to note that all three of the samplings occurred immediately after a GRE. When a gas release occurs, a sudden outburst of waste from the bottom of the tank accompanies the discharging gas, causing some mixing of the convective and non-convective layers. The extent of the mixing of the layers after a GRE is indeterminable. However, it is possible that, because of the mixing caused by a gas release, the data from the three samplings may resemble the current makeup of the waste to some extent. Regardless of the former or present distribution of the waste, the tank contents remain unchanged, and the analytical results from the 1990 and 1991 sampling events remain valid.

Tank 241-SY-101 currently consists mostly of double-shell slurry and saltcake. The analytes in the largest concentrations were sodium, nitrate, and nitrite, along with lesser quantities of aluminum, hydroxide, total organic carbon, and many smaller constituents. The major radionuclide was ^{137}Cs, and water comprised 35 percent of the waste.

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APPENDIX A

DOUBLE-SHELL TANK 241-SY-101

ANALYTICAL RESULTS

WINDOWS C AND E

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APPENDIX A

A.1 INTRODUCTION

Appendix A presents the chemical and radiological characteristics of Tank 241-SY-101 in a tabular form, in terms of the specific concentrations of metals, ions, radionuclides, physical properties, organic complexants, and volatile and semivolatile compounds.

The data table for each analyte lists the laboratory sample identification, a description of where the sample was obtained, and an evaluated data result. The projected tank inventory is listed in section 5.2. These data are listed in standard notation for values greater than 0.001 and less than 100,000. Values outside these limits are listed in scientific notation.

A.2 TABLE DESCRIPTION

The tables in Appendix A are divided into groups dependent on the characteristics of the analytes.

Analyte Characteristic	Table Number
Metal	Table A-1
Ion (anion or cation)	Table A-2
Radionuclide	Table A-3
Physical Property	Table A-4
Total Carbon	Table A-5
Organic Complexants	Table A-6
Volatile Organic	Table A-7
Semivolatile Organic	Table A-8

Standard abbreviations are used to describe analytical methods and procedures. Analytical and procedure numbers are found in Appendix E.

Metals	ICP - Inductively Coupled Plasma Spectrometry (generic for all metals unless otherwise indicated)
	AAS - Hydride Atomic Absorption
	CVAA - Cold Vapor Atomic Absorption

Ions	IC - Ion Chromatography
	Specphoto. - Spectrophotography
	Titra. - Titration
	mDist. - Microdistillation
	KJN - Kjeldahl Nitrification
Radionuclides	GEA - Gamma Energy Analysis
	AEA - Alpha Energy Analysis
	APC - Alpha Proportional Counting
	BPC - Beta Proportional Counting
	LSC - Liquid Scintillation Counting
	LF - Laser Fluorimetry
	MS - Mass Spectrometry
Physical Properties	TGA - Thermogravimetric Analysis
	DSC - Differential Scanning Calorimetry
	KF - Karl Fischer Titration
	Grav. - Gravimetry
Carbon and Organic Complexants	GC/MS - Gas Chromatography/Mass Spec.

Abbreviations are also used to describe the sample types.

Auger Sample	AS
Bulk Composite	BC
Dilute Liquid Composite	DLC
Dilute Liquid Segment	DLS
Dilute Solid Segment	DSS
Centrifuged Liquid Segment	FLS
Centrifuged Solid Composite	FSC
Centrifuged at Room Temperature	FRT
Centrifuged Segment	FS
Homogenized at Room Temperature	HRT
Liquid Composite	LC
Liquid Segment	LS
Solid Composite	SC
Solid Segment	SS
Sludge Weight	SW

A.3 COLUMN HEADINGS

The "Analyte" column contains, in addition to the name of the analyte or physical characteristic, information about the method of measurement, and where applicable, information about the method of digestion.

Digestion methods will be denoted for the analytes that were digested by more than one method. Digestion methods used are abbreviated: a - acid digestion; w - water leach; and f- potassium hydroxide fusion, followed by acid digestion. Analytes may also be measured directly on an undigested sample and these are abbreviated: d - direct.

The analyte and method are presented as follows: "method.analyte," or (where applicable) "method.digestion.analyte." For example, the specific concentration of Lead (Pb) was determined by the inductively coupled plasma method which was preceded by acid digestion, and is listed as "ICP.a.Pb."

Column two describes the core and segment that each sample was derived from. The letters indicate the sample type followed by a colon. The numbers that follow the colon indicate the composite or segment from which the sample was obtained. Occasionally these numbers are followed by a lower case t or b. In these cases, the sample was divided between a top and bottom portion of the segment.

The "Sample Number" column lists the laboratory sample from which the analyte was measured; this identification number is different from the number assigned to the samples at the tank farm. Sampling rationale, locations, and descriptions of the sampling time frames are contained in Section 3.0.

"Result" is the specific concentration of the analyte determined at different sampling points. No quality control data such as matrix spikes, serial dilutions, or duplicate analyses are listed. This information may be obtained from the Window C data package (Herting et al. 1992a) and the Window E data package (Herting et al. 1992b).

The number listed is an average between the primary sample and its duplicate sample. Where more than one duplicate was performed the primary sample was averaged with all the duplicates.

Numbers that are preceded by a less than symbol (<) indicate the analyte was noted, but was below the analytical instrument's calibrated detection limit for the sample.

Table A-1A. Tank 241-SY-101 Analytical Data: ALUMINUM (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Al	SC:1	1099	27,700	ICP.a.Al	SC:1	N270/N271	30,000
	SC:2	1101/1106	26,800		SC:2	N274/N275	23,500
	SC:3	1087	35,800				
	SC:4	1069/1149/1167	37,000				
	SC:5	1121	38,600				
ICP.f.Al	SC:1	1095/1097/1170	24,400	ICP.f.Al	SC:1	N200/N245	32,400
	SC:2	1103/1104/1183/ 1186	27,300		SC:2	N248/N249	26,100
	SC:3	1085	35,600				
	SC:4	1070-2	35,500				
				ICP.a.Al	BC:3	N286/N287	33,900
					BC:4	N317/N318	34,000
				ICP.f.Al	BC:3	N290/N291	36,400
			µg/g		BC:4	N321/N322	34,800
ICP.a.Al	LC:1	1092/TR75L2	30,700	ICP.a.Al	DLC:1	N278/N279	31,100
	LC:2	1109/1107	27,500		DLC:2	N282/N283	34,000
	LC:3	1118/965	33,500		DLC:3	N367/N368	35,600
	LC:4	1153	29,500		DLC:4	N379/N380	35,000

Table A-1A. Tank 241-SY-101 Analytical Data: ALUMINUM (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Al	LS:4	576/577	27,200	ICP.a.Al	DLS:19	N137/N138	31,500
	LS:5	627/625	33,700		DLS:22R	N174/N175	30,300
	LS:6	537/477	34,700				
	LS:7	656/635	37,700				
	LS:8	677/680	23,100				
	LS:9	694/685	32,500				
	LS:10	711/710	35,800				
	LS:11	840/842	37,900				
	LS:13	591/464	37,300				
	LS:14 top	760	30,500				
ICP.a.Al	SS:4	569/621	28,100	ICP.a.Al	SS:19	N141/N142	35,000
	SS:5	643/640	35,600		SS:22A	N170/N171	33,300
	SS:6	459	30,300				
	SS:7	638/639	39,100				
	SS:8	674/675	22,500				
	SS:9	688/692	33,100				
	SS:10	887	35,500				
	SS:11	848/851	40,100				

Table A-1A. Tank 241-SY-101 Analytical Data: ALUMINUM (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Al	SS:13	599/600	30,200				
	SS:14 t	479	33,900				
	SS:14 b	833	37,000				
	SS:15	671	29,100				
	SS:16	669/662	35,100				
	SS:17	704	33,100				
	SS:18	784	36,500				
	SS:19	790	35,000				
	SS:20	781	37,400				
	SS:21	765	36,400				
	SS:22	756	38,100				
	SS:20 A	846	37,500				
	SS:21 A	860	36,700				
	SS:22 A	853	37,900				

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Table A-1A. Tank 241-SY-101 Analytical Data: ALUMINUM (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Al	FS:4	629/628	24,000				
	FS:7	657/658	22,800				
	FS:8	678	25,100				
	FS:11	843	23,000				
	FS:13	592/593	20,000				
	FS:14 t	476	21,300				
ICP.a.Al	SW:13A	493	3,730				
			µg/g				
ICP.a.Al	AS:22A t	435	40,400				
	AS:22A b	427	43,100				
	AS:13A	457/461	33,900				
	AS:11A	561	29,300				
	AS:16A	963	38,000				
	SW:13A	473	18,000				
	SW:11A	1058	46,300				
ICP.a.Al	HRT:6	471	34,000				
	FRT:6	467	25,000				

Table A-1B. Tank 241-SY-101 Analytical Data: ARSENIC

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
				AAS.a.As	SC:1	N270/N271	23.2
					SC:2	N274/N275	35.8
				AAS.f.As	SC:1	N200/N245	158
					SC:2	N248/N249	287
				AAS.a.As	BC:1	N286/N287	24.5
					BC:2	N317/N318	16.6
				AAS.f.As	BC:1	N290/N291	354
					BC:2	N321/N322	107
				AAS.a.As	DLC:1	N278/N279	6.13
					DLC:2	N282/N283	8.12
					DLC:3	N367/N368	9.83
					DLC:4	N379/N380	7.92
				Segment Sample			
						Vial Number	µg/g
				AAS.a.As	DLS:19	N137/N138	12.8
					DLS:22R	N174/N175	25.1
				AAS.a.As	SS:19	N141/N142	39.7
					SS:22A	N170/N171	39.7

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Table A-1C. Tank 241-SY-101 Analytical Data: CALCIUM (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Ca	SC:1	1099	498	ICP.a.Ca	SC:1	N270/N271	331
	SC:2	1101/1106	670		SC:2	N274/N275	690
	SC:3	1087	623				
	SC:4	1069/1149/1167	441				
	SC:5	1121	535				
ICP.f.Ca	SC:1	1095/1097/1170	1,550	ICP.f.Ca	SC:1	N200/N245	822
	SC:2	1103/1104/ 1183/1186	1,560		SC:2	N248/N249	1,170
	SC:3	1085	702				
	SC:4	1070-2	5,330				
				ICP.a.Ca	BC:3	N286/N287	269
					BC:4	N317/N318	269
				ICP.f.Ca	BC:3	N290/N291	1,080
			µg/g		BC:4	N321/N322	971
ICP.a.Ca	LC:1	1092/TR75L2	460	ICP.a.Ca	DLC:1	N278/N279	108
	LC:2	1109/1107	578		DLC:2	N282/N283	57.5
	LC:3	1118/965	500		DLC:3	N367/N368	264
	LC:4	1153	1,190		DLC:4	N379/N380	70.9

Table A-1C. Tank 241-SY-101 Analytical Data: CALCIUM (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Ca	LS:4	576/577	133	ICP.a.Ca	DLS:19	N137/N138	281
	LS:5	627/625	43.0		DLS:22R	N174/N175	358
	LS:6	537/477	53.0				
	LS:7	656/635	49.0				
	LS:8	677/680	34.0				
	LS:9	694/685	166				
	LS:10	711/710	59.0				
	LS:11	840/842	62.0				
	LS:13	591/464	44.0				
	LS:14 t	760	77.0				
ICP.a.Ca	SS:4	569/621	196	ICP.a.Ca	SS:19	N141/N142	624
	SS:5	643/640	205		SS:22A	N170/N171	439
	SS:6	459	223				
	SS:7	638/639	360				
	SS:8	674/675	189				
	SS:9	688/692	215				
	SS:10	887	223				
	SS:11	848/851	264				

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Table A-1C. Tank 241-SY-101 Analytical Data: CALCIUM (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Ca	SS:13	599/600	233				
	SS:14 t	479	603				
	SS:14b	833	627				
	SS:15	671	255				
	SS:16	669/662	231				
	SS:17	704	236				
	SS:18	784	313				
	SS:19	790	303				
	SS:20	781	420				
	SS:21	765	361				
	SS:22	756	552				
	SS:20A	846	528				
	SS:21A	860	563				
	SS:21A	853	503				

Table A-1C. Tank 241-SY-101 Analytical Data: CALCIUM (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Ca	FS:4	628/629	98.5				
	FS:7	657/658	164				
	FS:8	678	684				
	FS:11	843	167				
	FS:13	592/593	180				
	FS:14 t	476	1,010				
ICP.a.Ca	SW:13A	493	55.0				
			µg/g				
ICP.a.Ca	AS:22A t	435	182				
	AS:22A b	427	212				
	AS:13A	457/461	422				
	AS:11A	561	354				
	AS:16A	963	187				
	SW:13A	473	1,110				
	SW:11A	1058	578				
ICP.a.Ca	HRT:6	471	92.0				
	FRT:6	467	145				

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Table A-1D. Tank 241-SY-101 Analytical Data: CHROMIUM (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Cr	SC:1	1099	2,210	ICP.a.Cr	SC:1	N270/N271	7,020
	SC:2	1101/1106	2,740		SC:2	N274/N275	8,580
	SC:3	1087	5,750				
	SC:4	1069/1149/1167	5,050				
	SC:5	1121	7,600				
ICP.f.Cr	SC:1	1095/1097/1170	1,870	ICP.f.Cr	SC:1	N200/N245	7,210
	SC:2	1103/1104/ 1183/1186	1,970		SC:2	N248/N249	7,680
	SC:3	1085	5,870				
	SC:4	1070-2	6,930				
				ICP.a.Cr	BC:3	N286/N287	6,450
					BC:4	N317/N318	6,890
				ICP.f.Cr	BC:3	N290/N291	6,770
			µg/g		BC:4	N321/N322	7,0780
ICP.a.Cr	LC:1	1092/TR75L2	55	ICP.a.Cr	DLC:1	N278/N279	81.3
	LC:2	1109/1107	50		DLC:2	N282/N283	84.7
	LC:3	1118/965	100		DLC:3	N267/N268	122
	LC:4	1153	220		DLC:4	N279/N380	149

Table A-1D. Tank 241-SY-101 Analytical Data: CHROMIUM (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Cr	LS:4	576/577	64.0	ICP.a.Cr	DLS:19	N137/N138	99.5
	LS:5	627/625	120		DLS:22R	N174/N175	85.3
	LS:6	537/477	49.0				
	LS:7	656/635	59.0				
	LS:8	677/680	57.0				
	LS:9	694/685	63.0				
	LS:10	711/710	53.0				
	LS:11	840/842	66.0				
	LS:13	591/464	61.0				
	LS:14 T	760	69.0				
ICP.a.Cr	SS:4	569/621	2,910	ICP.a.Cr	SS:19	N141/N142	11,700
	SS:5	643/640	3,030		SS:22A	N170/N171	10,700
	SS:6	459	2,890				
	SS:7	638/639	3,520				
	SS:8	674/675	3,250				
	SS:9	688/692	4,660				
	SS:10	887	4,340				
	SS:11	848/851	4,170				

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Table A-1D. Tank 241-SY-101 Analytical Data: CHROMIUM (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Cr	SS:13	599/600	4,050				
	SS:14 t	479	5,320				
	SS:14 b	833	5,470				
	SS:15	671	5,650				
	SS:16	669/662	7,160				
	SS:17	704	7,210				
	SS:18	784	7,040				
	SS:19	790	7,610				
	SS:20	781	7,360				
	SS:21	765	7,290				
	SS:22	756	7,900				
	SS:20 A	846	6,490				
	SS:21 A	860	6,490				
	SS:22 A	853	7,060				

Table A-1D. Tank 241-SY-101 Analytical Data: CHROMIUM (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Cr	FS:4	629/628	7,120				
	FS:7	657/658	7,650				
	FS:8	678	67,700				
	FS:11	843	7,090				
	FS:13	592/593	9,290				
	FS:14 t	476	32,300				
ICP.a.Cr	SW:13A	493	9.00				
			µg/g				
ICP.a.Cr	AS.22A t	435	4,670				
	AS:22A b	427	4,030				
	AS:13A	457/461	5,810				
	AS:11A	561	5,100				
	AS:16A	963	3,500				
	SW:13A	473	63,400				
	SW:11A	1058	3,590				
ICP.a.Cr	HRT:6	471	954				
	FRT:6	467	1,770				

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Table A-1E. Tank 241-SY-101 Analytical Data: IRON (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Fe	SC:1	1099	188	ICP.a.Fe	SC:1	N270/N271	462
	SC:2	1101/1106	243		SC:2	N274/N275	576
	SC:3	1087	479				
	SC:4	1069/1149/1167	633				
	SC:5	1121	1,160				
ICP.f.Fe	SC:1	1095/1097/1170	202	ICP.f.Fe	SC:1	N200/N245	471
	SC:2	1103/1104/ 1183/1186	319		SC:2	N248/N249	550
	SC:3	1185	602				
	SC:4	1070-2	558				
				ICP.a.Fe	BC:3	N286/N287	400
					BC:4	N317/N318	462
				ICP.f.Fe	BC:3	N290/N291	446
			µg/g		BC:4	N321/N322	474
ICP.a.Fe	LC:1	1092/TR75L2	---	ICP.a.Fe	DLC:1	N278/N279	26.3
	LC:2	1109/1107	30		DLC:2	N282/N283	23.6
	LC:3	1118/956	100		DLC:3	N367/N368	21.0
	LC:4	1153	---		DLC:4	N379/N380	15.6

Table A-1E. Tank 241-SY-101 Analytical Data: IRON (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Fe	LS:4	576/577	14.0	ICP.a.Fe	DLS:19	N127/N128	9.00
	LS:5	627/625	20.0		DLS:22R	N174/N175	18.8
	LS:7	656/635	13.0				
	LS:8	677/680	14.0				
	LS:9	694/685	30.0				
	LS:11	840/842	13.0				
	LS:13	591/464	14.0				
ICP.a.Fe	SS:4	569/621	227	ICP.a.Fe	SS:19	N141/N142	721
	SS:5	643/640	238		SS:22A	N170/N171	806
	SS:6	459	293				
	SS:7	638/639	280				
	SS:8	674/675	405				
	SS:9	688/692	335				
	SS:10	887	280				
	SS:11	848/851	251				

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Table A-1E. Tank 241-SY-101 Analytical Data: IRON (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Fe	SS:13	599/600	374				
	SS:14 t	479	424				
	SS:14 b	833	351				
	SS:15	671	513				
	SS:16	669/662	402				
	SS:17	704	427				
	SS:18	784	422				
	SS:19	790	456				
	SS:20	781	481				
	SS:21	765	472				
	SS:22	756	616				
	SS:20 A	846	900				
	SS:21 A	860	1,190				
	SS:22 A	853	702				

Table A-1E. Tank 241-SY-101 Analytical Data: IRON (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Fe	FS:4	629/628	418				
	FS:7	657/658	463				
	FS:8	678	4,160				
	FS:11	843	407				
	FS:13	592/593	568				
	FS:14 t	476	2,090				
ICP.a.Fe	SW:13A	493	< 4.00				
			µg/g				
ICP.a.Fe	AS:22A t	435	666				
	AS:22A b	427	331				
	AS:13A	457/461	426				
	AS:11A	561	1,410				
	AS:16A	963	249				
	SW:13A	473	5,080				
	SW:11A	1058	1,510				
ICP.a.Fe	HRT:6	471	146				
	FRT:6	467	148				

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Table A-1F. Tank 241-SY-101 Analytical Data: LEAD

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Pb	AS:22A t	435	146				

Table A-1G. Tank 241-SY-101 Analytical Data: MAGNESIUM

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	mg/L			Vial Number	µg/g
ICP.a.Mg	LS:6	477	11,400				

Table A-1H. Tank 241-SY-101 Analytical Data: MANGANESE

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Mn	SC:3	1085	109				
	SC:4	1070-2	132				

Table A-1I. Tank 241-SY-101 Analytical Data: MERCURY

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
CVAA.Hg	C:1	1074	< 0.105	CVAA.Hg	BC:1	N230/N231	1.19E-04
	C:2	1079	< 0.103		BC:2	N234/N235	1.21E-04
	C:3	1086	< 0.121		BC:3	N308/N309	1.78E-04
	C:4	1076	< 0.128		BC:4	N333/N334	2.27E-04
CVAA.Hg	BC:1	1123	< 0.114				

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Table A-1J. Tank 241-SY-101 Analytical Data: MOLYBDENUM

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Mo	LC:1	1092/TR75L2	105				
	LC:2	1109/1107	92.5				
	LC:3	1118/965	100				
	LC:4	1153	85				
			µg/g				
ICP.a.Mo	SC:3	1087	87.5				
	SC:4	1169/1149/1167	87.3				
ICP.f.Mo	SC:3	1085	88.5				
	SC:4	1070-2	85.0				
ICP.a.Mo	AS:22A t	435	129				

Table A-1K. Tank 241-SY-101 Analytical Data: NICKEL (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Ni	SC:1	1099	106	ICP.a.Ni	SC:1	N270/N271	231
	SC:2	1101/1106	225		SC:2	N274/N275	276
	SC:3	1087	227				
	SC:4	1069/1149/1167	259				
	SC:5	1121	269				
ICP.f.Ni	SC:1	1095/1097/1170	1,800	ICP.f.Ni	SC:1	N200/N245	271
	SC:2	1103/1104/ 1183/1186	1,610		SC:2	N248/N249	240
	SC:3	1085	551				
	SC:4	1070-2	558				
ICP.a.Ni	SW:11A	1058	278	ICP.a.Ni	BC:3	N286/N287	229
					BC:4	N317/N318	247
				ICP.f.Ni	BC:3	N290/N291	320
			µg/g		BC:4	N321/N322	18,800
ICP.a.Ni	LC:1	1092/TR75L2	45	ICP.a.Ni	DLC:1	N278/N279	27.6
	LC:2	1109/1107	30		DLC:2	N282/N283	30.2
	LC:3	1118/965	100		DLC:3	N367/N368	34.8
	LC:4	1153	60		DLC:4	N379/N380	40.2

Table A-1K. Tank 241-SY-101 Analytical Data: NICKEL (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
				ICP.a.Ni	DLS:19	N137/N138	31.0
					DLS:22R	N174/N175	44.8
				ICP.a.Ni	SS:19	N141/N142	396
					SS:22A	N170/N171	361

Table A-1L. Tank 241-SY-101 Analytical Data: POTASSIUM

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
				ICP.a.K	DLS:19	N137/N138	3,570
					DLS:22R	N174/N175	3,440
				ICP.a.K	SS:19	N141/N142	2,590
					SS:22A	N170/N171	3,320
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.K	SC:1	1099	2,670	ICP.a.K	SC:1	N270/N271	
	SC:2	1101/1106	5,080		SC:2	N274/N275	
	SC:3	1087	3,100				
	SC:4	1069/1149/1167	3,010				
	SC:5	1121	2,440				
ICP.a.K	SW:11A	1058	3,690	ICP.a.K	BC:3	N286/N287	37,000
					BC:4	N317/N318	2,750
			µg/g				
ICP.a.K	LC:1	1092/TR75L2	3,610	ICP.a.K	DLC:1	N278/N279	3,820
	LC:2	1109/1107	3,120				
	LC:3	1118/965	3,800				
	LC:4	1153	3,380				

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Table A-1M. Tank 241-SY-101 Analytical Data: SELENIUM

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Se	SC:1	1099	183	ICP.a.Se	SC:1	N270/N271	6.96E-04
	SC:2	1101/1106	493		SC:2	N274/N275	6.45E-04
	SC:3	1121	636	ICP.a.Se	BC:3	N286/N287	8.90E-04
					BC:4	N317/N318	9.64E-04

Table A-1N. Tank 241-SY-101 Analytical Data: SILICON

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Si	SW:11A	1058	287				

Table A-1O. Tank 241-SY-101 Analytical Data: SODIUM (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Na	SC:1	1099	2.18E+05	ICP.a.Na	SC:1	N270/N271	2.24E+05
	SC:2	1101/1106	2.29E+05		SC:2	N274/N275	2.33E+05
	SC:3	1087	2.04E+05				
	SC:4	1069/1149/1167	2.27E+05				
	SC:5	1121	2.01E+05				
ICP.f.Na	SC:1	1095/1097/1170	2.21E+05	ICP.f.Na	SC:1	N200/N245	2.20E+05
	SC:2	1103/1104/ 1183/1186	2.23E+05		SC:2	N248/N249	2.24E+05
	SC:3	1085	2.03E+05				
	SC:4	1070-2	2.10E+05				
				ICP.a.Na	BC:3	N286/N287	2.07E+05
					BC:4	N317/N318	2.17E+05
				ICP.f.Na	BC:3	N290/N291	2.20E+05
			µg/g		BC:4	N321/N322	2.15E+05
ICP.a.Na	LC:1	1092/TR75L2	1.93E+05	ICP.a.Na	DLC:1	N278/N279	1.80E+05
	LC:2	1109/1107	1.77E+05		DLC:2	N282/N283	1.95E+05
	LC:3	1118/965	2.11E+05		DLC:3	N367/N368	2.01E+05
	LC:4	1153	1.79E+05		DLC:4	N379/N380	2.08E+05

Table A-1O. Tank 241-SY-101 Analytical Data: SODIUM (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Na	LS:4	576/577	2.07E+05	ICP.a.Na	DLS:19	N137/N138	1.92E+05
	LS:5	627/625	2.00E+05		DLS:22R	N174/N175	1.82E+05
	LS:6	537/477	2.09E+05				
	LS:7	656/635	1.97E+05				
	LS:8	677/680	2.00E+05				
	LS:9	694/685	1.94E+05				
	LS:10	711/710	1.97E+05				
	LS:11	840/842	1.96E+05				
	LS:13	591/464	2.01E+05				
	LS:14 t	760	2.09E+05				
ICP.a.Na	SS:4	569/621	2.12E+05	ICP.a.Na	SS:19	N141/N142	2.46E+05
	SS:5	643/640	2.08E+05		NN:22A	N170/N171	1.84E+05
	SS:6	459	2.12E+05				
	SS:7	638/639	2.04E+05				
	SS:8	674/675	2.10E+05				
	SS:9	688/692	2.02E+05				
	SS:10	887	2.05E+05				
	SS:11	848/851	2.01E+05				

Table A-1O. Tank 241-SY-101 Analytical Data: SODIUM (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Na	SS:13	599/600	2.06E+05				
	SS:14 T	479	2.18E+05				
	SS:14 B	833	2.07E+05				
	SS:15	671	1.89E+05				
	SS:16	669/662	2.10E+05				
	SS:17	704	2.13E+05				
	SS:18	784	2.19E+05				
	SS:19	790	2.16E+05				
	SS:20	781	2.11E+05				
	SS:21	765	2.24E+05				
	SS:22	756	12.18E+05				
	SS:20A	846	2.02E+05				
	SS:21A	860	2.06E+05				
	SS:22A	853	2.09E+05				

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Table A-1O. Tank 241-SY-101 Analytical Data: SODIUM (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	mg/L			Vial Number	µg/g
ICP.a.Na	FS:4	629/628	1.29E+05				
	FS:7	657/658	1.48E+05				
	FS:8	678	1.43E+05				
	FS:11	843	1.11E+05				
	FS:13	592/593	1.25E+05				
	FS:14 t	476	96,500				
ICP/a.Na	SW:13A	493	21,500				
			µg/g				
ICP.a.Na	AS:22A t	435	2.41E+05				
	AS:22A b	427	2.46E+05				
	AS:13A	457/461	2.29E+05				
	AS:11A	561	1.95E+05				
	AS:16A	963	2.32E+05				
	SW:13A	473	19,800				
	SW:11A	1058	2.56E+05				
ICP.a.Na	HRT:6	471	1.80E+05				
	FRT:6	467	1.22E+05				

Table A-1P. Tank 241-SY-101 Analytical Data: SULFUR

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.S	LS:6	477	833				

Table A-1Q. Tank 241-SY-101 Analytical Data: ZINC (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	mg/L			Vial Number	µg/g
ICP.a.Zn	LS:6	477	305	ICP.a.Zn	DLS:19	N137/N138	12.8
					DLS:22R	N174/N175	25.1
				ICP.a.Zn	SS:19	N141/N142	39.7
					SS:22A	N170/N171	39.7
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.a.Zn	SC:1	1099	49.0	ICP.a.Zn	SC:1	N270/N271	23.2
	SC:2	1101/1106	143		SC:2	N274/N275	35.8
	SC:3	1087	57.5				
	SC:4	1069/1149/1167	43.8				
	SC:5	1121	47.0				

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Table A-1Q. Tank 241-SY-101 Analytical Data: ZINC (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
ICP.f.Zn	SC:1	1095/1097	473	ICP.f.Zn	SC:1	N200/N245	158
	SC:2	1103/1104	410		SC:2	N248/N249	287
	SC:3	1085	73.5				
	SC:4	1070-2	186				
				ICP.a.Zn	BC:3	N286/N287	32.3
					BC:4	N317/N318	16.1
				ICP.f.Zn	BC:3	N290/N291	354
			µg/g		BC:4	N321/N322	107
ICP.a.Zn	LC:1	1092/TR75L2	92.5	ICP.a.Zn	DLC:1	N278/N279	6.13
	LC:2	1109/1107	55				
	LC:3	1118/965	100				
	LC:4	1153	245				

Table A-2A. Tank 241-SY-101 Analytical Data: AMMONIA (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
$KJN.NH_3$	DLC:1	1094/1116	100	$KJN.NH_3$	DLC:1	N260/N261	210
	DLC:2	1111/1108	100		DLC:2	N266/N267	102
	DLC:3	1117/962	150		DLC:3	N359/N360	140
	DLC:4	1154	---				
			µg/g				
$KJN.NH_3$	SC:1	1093/1098	1,390	$KJN.NH_3$	SC:1	N239/N340	2,640
	SC:2	1110/1105	1,750		SC:2	N243/N244	90.0
	SC:3	1084/1088	3,090				
	SC:4	1072/1068-2	3,660				
	SC:5	1113/1124	< 890				
				$KJN.NH_3$	BC:3	N295/N296	2,440
					BC:4	N325/N326	1,980

Table A-2A. Tank 241-SY-101 Analytical Data: AMMONIA (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
KJN.NH_3	HRT:6	472	< 345				
NH_3	AS:22A t	439/431/1181	1,050				
	AS:22A b	430/442	< 328				
	AS:13A	454/456/691	< 406				
	AS:11A	539	533				
	AS:16A	957/959	370				

Table A-2B. Tank 241-SY-101 Analytical Data: CHLORIDE (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
IC.w.Cl^-	DLC:1	1094/1116/1187	7,750	IC.d.Cl^-	DLC:1	N260/N261	9,130
	DLC:2	1111/1108/ 1184/1185	6,200		DLC:2	N266/N267	9,010
	DLC:3	1117/962	9,230		DLC:3	N359/N360	9,820
	DLC:4	1154	7,000		DLC:4	N371/N372	8,570
			µg/g				
IC.w.Cl^-	SC:1	1093/1098/1189	7,350	IC.w.Cl^-	SC:1	N239/N240	6,920
	SC:2	1110/1105/ 1163/1164	6,780		SC:2	N243/N244	6,390
	SC:3	1084/1088	7,580				
	SC:4	1072/1068-2	9,250				
	SC:5	1113/1124/ 1147/1148	8,110				
				IC.w.Cl^-	BC:3	N295/N296	7,160
					BC:4	N325/N326	7,060

Table A-2B. Tank 241-SY-101 Analytical Data: CHLORIDE (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
IC.Cl^-	HRT:6	472	11,000	IC.w.Cl^-	DLS:19	N132/N133	9,170
IC.w.Cl^-	AS:22A t	439/431/1181	12,600		DLS:22R	N178/N179	10,900
	AS:22A b	430/442	21,300	IC.w.Cl^-	SS:19	N145/N146	6,540
	AS:13A	454/456/691	12,700		SS:22A	N182/N183	5,760
	AS:11A	539	6,580				
	AS:16A	957/959	9,210				
	SW:13A	461	9,620				
			mg/L				
IC.d.Cl^-	LS:6	537	8,680				
	SW:13A	493	984				

Table A-2C. Tank 241-SY-101 Analytical Data: CHROMIUM (VI)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
				SpcPto.d.Cr^{6+}	DLC:1	N278/N279	69.2
					DLC:2	N282/N283	17.8
				SpcPto.w.Cr^{6+}	DLC:3	N367/N368	153
					DLC:4	N379/N380	146
				SpcPto.w.Cr^{6+}	SC:1	N270/N271	6.84
					SC:2	N274/N275	9.71
				SpcPto.w.Cr^{6+}	BC:3	N286/N287	6.75
					BC:4	N318	6.63

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Table A-2D. Tank 241-SY-101 Analytical Data: CYANIDE

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
mDist.d.CN^-	SC:1	1074	152				
	SC:2	1079	117				
	SC:3	1086	389				
	SC:4	1076/1150	409				
	SC:5	1123	469				
			µg/g				
mDist.CN^-	LC:1	1092	870				
	LC:2	1118/965	102				
	LC:4	1153	396				

Table A-2E. Tank 241-SY-101 Analytical Data: CYANIDE PLUS SULFUR

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
mDist.CN^-+S	LC:1	1092	94				
	LC:2	1110/965	97.5				
	LC:3	1096/1110	97				
	LC:4	1153	392				

Table A-2F. Tank 241-SY-101 Analytical Data: FLUORIDE (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
IC.w.F⁻	DLC:1	1094/1116/1187	7,750	IC.d.F⁻	DLC:1	N260/N261	129
	DLC:2	1111/1108/ 1184/1185	---		DLC:2	N266/N267	68.8
	DLC:3	1117/962	675		DLC:3	N359/N360	94.2
	DLC:4	1154	400		DLC:4	N371/N372	97.6
			µg/g				
IC.w.F⁻	SC:1	1093/1098/1189	342	IC.w.F⁻	SC:1	N239/N240	410
	SC:2	1110/1105/ 1163/1164	< 303		SC:2	N243/N244	403
	SC:3	1084/1088	< 1,000				
	SC:4	1072/1068-2	< 1,000				
	SC:5	1113/1124/ 1147/1148	1,860				
				IC.w.F⁻	BC:3	N295/N296	408
					BC:4	N325/N326	406

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Table A-2F. Tank 241-SY-101 Analytical Data: FLUORIDE (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
IC.F⁻	HRT:6	472	< 10,000	IC.w.F⁻	DLS:19	N132/N133	159
IC.w.F⁻	AS:22A t	439/431/1181	< 1,000		DLS:22R	N178/N179	187
	AS:22A b	430/442	< 3,870	IC.w.F⁻	SS:19	N145/N146	410
	AS:13A	454/456/691	< 4,310		SS:22A	N182/N183	233
	AS:11A	539	< 1,000				
	AS:16A	957/959	< 1,040				
	SW:13A	461	< 14.0				
			mg/L				
IC.d.F⁻	LS:6	537	< 10.0				
	SW:13A	493	< 212				

Table A-2G. Tank 241-SY-101 Analytical Data: HYDROXIDE

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
Titrat.OH⁻	DLC:1	1094/1116	28,200	Titrat.d.OH⁻	DLC:1	N260/N261	26,800
	DLC:2	1111/1108/ 1184/1185	1.01E+05		DLC:2	N266/N267	28,300
	DLC:3	1117/962	30,900		DLC:3	N359/N360	30,600
	DLC:4	1154	1.22E+05		DLC:4	N371/N372	26,100
			µg/g				
Titrat.OH⁻	SC:1	1093/1098/ 1189/1100	13,700	Titrat.w.OH⁻	SC:1	N239/N240	20,600
	SC:2	1110/1105/ 1163/1164	15,800		SC:2	N243/N244	22,900
	SC:3	1184/1088	25,200				
	SC:4	1072/1068-2	24,200				
	SC:5	1113/1124	16,900				
				Titrat.w.OH⁻	BC:1	N295/N296	25,000
					BC:2	N325/N326	20,900
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
Titrat.OH⁻	SW:13A	461	29,000				
	SS:6	460	13,300				
	FRT:6	470	23,500				

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Table A-2H. Tank 241-SY-101 Analytical Data: NITRATE (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
$IC.NO_3^-$	DLC:1	1094/1116/1187	1.57E+05	$IC.d.NO_3^-$	DLC:1	N260/N261	1.04E+05
	DLC:2	1111/1108/ 1184/1185	1.01E+05		DLC:2	N266/N267	1.03E+05
	DLC:3	1117/962	1.19E+05		DLC:3	N359/N360	1.18E+05
	DLC:4	1154	1.22E+05		DLC:4	N371/N372	1.48E+05
$IC.w.NO_3^-$	SC:1	1093/1098/1189	1.90E+05	$IC.w.NO_3^-$	SC:1	N239/N240	1.41E+05
	SC:2	1100/1105/ 1163/1164	2.12E+05		SC:2	N243/N244	1.64E+05
	SC:3	1084/1088	1.05E+05				
	SC:4	1072/1068	1.04E+05				
	SC:5	1113/1124/ 1147/1148	1.28E+05				
				$IC.w.NO_3^-$	BC:3	N295/N296	1.16E+05
					BC:4	N325/N326	1.18E+05

Table A-2H. Tank 241-SY-101 Analytical Data: NITRATE (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
IC.w.NO_3^-	DLS:4	573/572	1.33E+05	IC.w.NO_3^-	DLS:19	N132/N133	1.65E+05
	DLS:5	626	1.25E+05		DLS:22R	N178/N179	2.42E+05
	DLS:6	537	1.33E+05	IC.w.NO_3^-	SS:19	N145/N146	98,700
	DLS:7	655/636	1.04E+05		SS:22A	N182/N183	1.51E+05
	DLS:8	676/679	1.19E+05				
	DLS:9	693/683	1.12E+05				
	DLS:10	708/881	9.2E+04				
	DLS:11	836/841	8.7E+04				
	DLS:13	463/564	9.8E+04				
	DLS:14 t	753	1.15E+05				
			µg/g				
IC.w.NO_3^-	SS:4	620	90,600				
	SS:5	884	87,000				
	SS:6	460	1.88E+05				
	SS:7	652	82,400				
	SS:8	633	2.38E+05				
	SS:9	687	85,100				

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Table A-2H. Tank 241-SY-101 Analytical Data: NITRATE (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	mg/L			Vial Number	µg/g
IC.w.NO_3^-	SS:10	890	81,000				
	SS:11	845	81,400				
	SS:13	598	88,600				
	SS:14 t	785	96,600				
	SS:14 b	837/829	92,900				
	SS:15	673/594	1.12E+05				
	SS:16	668/663/646	1.09E+05				
	SS:17	706/707	1.08E+05				
	SS:18	784/771	95,100				
	SS:19	790/722	1.02E+05				
	SS:20	781/774	92,400				
	SS:21	765/787	1.00E+05				
	SS:22	756/768	1.06E+05				
	SS:20A	855/474	86,500				
	SS:21A	847/854	88,300				
	SS:22A	858/852	85,700				

Table A-2H. Tank 241-SY-101 Analytical Data: NITRATE (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
IC.w.NO_3^-	AS:22A t	439/431/1181	1.94E+05				
	AS:22A b	430/442	1.71E+05				
	AS:13A	454/456/691	1.41E+05				
	AS:11A	539	1.24E+05				
	AS:16A	957/959	1.57E+05				
	SW:13A	461	1.53E+05				
	SW:11A	1058	1.28E+05				
	SW:16A	1059	1.86E+05				
IC.NO_3^-	FRT:6	470	1.96E+05				
	HRT:6	472	89,600				
			mg/L				
IC.NO_3^-	FLS:1	540	98,600				
	FLS:2	543	1.09E+05				
IC.NO_3^-	FRT:6	477	1.39E+05				
	SW:13A	493	11,900				

Table A-2I. Tank 241-SY-101 Analytical Data: NITRITE (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
IC.NO_2^-	DLC:1	1094/1116	1.45E+05	IC.d.NO_2^-	DLC:1	N260/N261	1.03E+05
	DLC:2	1111/1108/ 1184/1185	89,000		DLC:2	N266/N267	1.15E+05
	DLC:3	1117/962	98,400		DLC:3	N359/N360	1.24E+05
	DLC:4	1154	86,700		DLC:4	N271/N372	1.11E+05
Spec.NO_2^-	DLC:1	1187	1.30E+05				
	DLC:2	1184/1185	51,600				
IC.w.NO_2^-	SC:1	1093/1098/ 1189	1.13E+05	IC.w.NO_2^-	SC:1	N239/N240	1.08E+05
	SC:2	1100/1105/ 1163/1164	1.35E+05		SC:2	N243/N244	1.09E+05
	SC:3	1084/1088	1.05E+05				
	SC:4	1072/1068	82,600				
	SC:5	1113/1124/ 1147/1148	85,900				
				IC.w.NO_2^-	BC:3	N295/N296	95,600
					BC:4	N325/N326	93,700

Table A-2I. Tank 241-SY-101 Analytical Data: NITRITE (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
IC.w.NO_2^-	DLS:4	573/572	1.43E+06	IC.w.NO_2^-	DLS:19	N132/N133	1.12E+05
	DLS:5	626/624	1.28E+06		DLS:22R	N178/N179	1.39E+05
	DLS:6	537	1.34E+06		SS:19	N145/N146	87,200
	DLS:7	655/636	1.08E+06		SS:22A	N182/N183	72,200
	DLS:8	676/679	1.25E+06				
	DLS:9	683	1.13E+06				
	DLS:10	708/881	1.08E+06				
	DLS:11	836/841	1.10E+06				
	DLS:13	463/564	1.14E+06				
	DLS:14 t	753	1.17E+06				
			µg/g				
IC.w.NO_2^-	SS:4	620	1.04E+05				
	SS:5	884	1.05E+05				
	SS:6	460	1.66E+05				
	SS:7	652	96,300				
	SS:8	633	92,300				
	SS:9	687	99,600				

Table A-2I. Tank 241-SY-101 Analytical Data: NITRITE (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
IC.w.NO_2^-	SS:10	890	82,200				
	SS:11	845	96,300				
	SS:13	598	1.06E+05				
	SS:14 t	785	93,800				
	SS:14 b	837/829	91,400				
	SS:415	673/594	83,500				
	SS:16	668/663/646	94,900				
	SS:17	706/707	93,900				
	SS:18	784/771	89,000				
	SS:19	790/722	1.04E+05				
	SS:20	781/774	90,400				
	SS:21	765/787	81,800				
	SS:22	756/768	87,700				
	SS:20A	855/474	88,500				
	SS:21A	847/854	1.01E+05				
	SS:22A	858/852	93,200				

Table A-2I. Tank 241-SY-101 Analytical Data: NITRITE (4 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
IC.w.NO_2^-	AS:22A t	439/431/1181	2.18E+05				
	AS:22A b	430/442	1.48E+05				
	AS:13A	454/456/691	1.04E+05				
	AS:11A	539	80,500				
	AS:16A	957/959	1.24E+05				
	SW:13A	461	1.17E+05				
	SW:11A	1058	1.52E+05				
	SW:16A	1059	1.18E+05				
IC.NO_2^-	FRT:6	470	1.85E+05				
	HRT:6	472	1.07E+05				
			mg/L				
IC.NO_2^-	FLS:1	540	98,900				
	FLS:2	543	90,100				
IC.NO_2^-	SW:13A	493	10,400				

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Table A-2J. Tank 241-SY-101 Analytical Data: PHOSPHATE (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
$IC.PO_4^{3-}$	DLC:1	1094/1116/1187	5,300	$IC.d.PO_4^{3-}$	DLC:1	N260/N261	3,470
	DLC:2	1111/1108/ 1184/1185	3,960		DLC:2	N266/N267	4,950
	DLC:3	1117/962	9,050		DLC:3	N359/N360	5,620
	DLC:4	1154	---		DLC:4	N371/N372	7,580
$IC.w.PO_4^{3-}$	SC:1	1093/1098/1189	4,960	$IC.w.PO_4^{3-}$	SC:1	N239/N240	5,910
	SC:2	1100/1105/ 1163/1164	4,350		SC:2	N243/N244	5,690
	SC:3	1084/1088	8,140				
	SC:4	1072/1068	8,960				
	SC:5	1113/1124/ 1147/1148	18,100				
				$IC.w.PO_4^{3-}$	BC:3	N295/N296	8,300
					BC:4	N325/N326	8,140

Table A-2J. Tank 241-SY-101 Analytical Data: PHOSPHATE (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	mg/L			Vial Number	µg/g
IC.w.PO_4^{3-}	DLS:6	537	< 100	IC.w.PO_4^{3-}	DLS:19	N132/N133	5,950
					DLS:22R	N178/N179	6,370
				IC.w.PO_4^{3-}	SS:19	N145/N146	7,140
					SS:22A	N182/N183	7,910
IC.d.PO_4^{3-}	SW:13A	493	< 100				
			µg/g				
IC.PO_4^{3-}	HRT:6	472	< 10,000				
IC.w.PO_4^{3-}	AS:22A t	439/431/1181	7,200				
	AS:22A b	430/442	4,900				
	AS:13A	454/456/691	9,920				
	AS:11A	539	12,800				
	AS:16A	957/959	8,330				
	SW:13A	461	< 14,400				

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Table A-2K. Tank 241-SY-101 Analytical Data: SULFATE (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
IC.SO_4^{2-}	DLC:1	1094/1116/1187	1,280	IC.d.SO_4^{2-}	DLC:1	N260/N261	930
	DLC:2	1111/1108/ 1184/1185	363		DLC:2	N266/N267	729
	DLC:3	1117/962	775		DLC:3	N359/N360	631
	DLC:4	1154	2,750		DLC:4	N371/N372	707
IC.w.SO_4^{2-}	SC:1	1093/1098/1189	3,780	IC.w.SO_4^{2-}	SC:1	N239/N240	5,300
	SC:2	1100/1105/ 1163/1164	2,390		SC:2	N243/N244	6,170
	SC:3	1084/1088	6,680				
	SC:4	1072/1068	7,060				
	SC:5	1113/1124/ 1147/1148	16,500				
				IC.w.SO_4^{2-}	BC:3	N295/N296	6,370
					BC:4	N325/N326	6,560

Table A-2K. Tank 241-SY-101 Analytical Data: SULFATE (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	mg/L			Vial Number	µg/g
IC.w.SO_4^{2-}	DLS:6	537	1,700	IC.w.SO_4^{2-}	DLS:19	N132/N133	871
					DLS:22R	N178/N179	1,020
				IC.w.SO_4^{2-}	SS:19	N145/N146	9,260
IC.d.SO_4^{2-}	SW:13A	493	497		SS:22A	N182/N183	8,630
			µg/g				
IC.w.SO_4^{2-}	HRT:6	472	11,800				
IC.w.SO_4^{2-}	AS:22A t	439/431/1181	12,300				
	AS:22A b	430/442	15,600				
	AS:13A	454/456/691	12,500				
	AS:11A	539	14,700				
	AS:16A	957/959	10,400				
	SW:13A	461	9,630				

Table A-3A. Tank 241-SY-101 Analytical Data: AMERICIUM-241

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µCi/g			Vial Number	µCi/g
APC.f.^{241}Am	LC:1	TR75L1/1115	5.5E-04	APC.d.^{241}Am	DLC:1	N252/N253	5.56E-04
	LC:2	1096/1110	5.5E-05		DLC:2	N256/N257	5.39E-04
	LC:3	953/964	0.002				
	LC:4	1151	0.002		DLC:3	N363/N364	5.10E-04
					DLC:4	N275/N276	8.26E-04
			µCi/g	APC.f.^{241}Am	SC:1	N200/N245	0.177
APC.f.^{241}Am	SC:1	1095/1097	0.0483		SC:2	N248/N249	0.186
	SC:2	1103/1104	0.0550				
	SC:3	953/964/1085	0.537	APC.f.^{241}Am	BC:3	N290/N291	0.174
	SC:4	1070-2	0.196		BC:4	N321/N322	0.160
	SC:5	1122/1179	0.199				
Segment Sample				Segment Sample			
APC.f.^{241}Am	AS:22A t	426	0.115				
	AS:22A b	428	0.102				
	AS:13A	452/461	0.212				
	AS:11A	562	0.137				
	AS:16A	956	0.120				
	SW:13A	473	1.85				

Table A-3B. Tank 241-SY-101 Analytical Data: CARBON-14

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µCi/L			Vial Number	µCi/g
				LSC.w.^{14}C	BC:1	N187/N188	5.34E-04
					BC:2	N192/N193	9.08E-04
					BC:3	N299/N300	0.00127
					BC:4	N342/N343	0.00160

Table A-3C. Tank 241-SY-101 Analytical Data: CESIUM-137 (7 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µCi/g			Vial Number	µCi/g
GEA.d.^{137}Cs	LC;1	1094	432	GEA.d.^{137}Cs	DLC:1	N260/N261	435
	LC:2	1111/1108	395		DLC:2	N266/N267	33.5
	LC:3	1117/962	488		DLC:3	N359/N360	461
	LC:4	1154	358		DLC:4	N371/N372	288
GEA.f.^{137}Cs	LC:1	TR78L1	2.20E+05	GEA.w.^{137}Cs		N406/N407	580
	LC:2	1096/1110	3.35E+05				
GEA.w.^{137}Cs	SC:1	1093/1098/1189	308	GEA.f.^{137}Cs	SC:1	N200/N245	334
	SC:2	1100/1105/1163/1164	298		SC:2	N248/N249	264
	SC:3	1084/1088	354	GEA.w.^{137}Cs	SC:1	N239/N240	222
	SC:4	1072/1068/1168/1169	287		SC:2	N243/N244	187
	SC:5	1113/1124	326				
GEA.w.^{137}Cs	SC:1	1095/1097/1170	276	GEA.f.^{137}Cs	BC:3	N290/N291	348
	SC:2	1103/1104/1183/1186	329		BC:4	N321/N322	314
	SC:3	1085	371	GEA.w.^{137}Cs	BC:3	N295/N296	311
	SC:4	1070-2	383		BC:4	N325/N326	324
	SC:5	1122/1179	301				

Table A-3C. Tank 241-SY-101 Analytical Data: CESIUM-137 (7 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µCi/g			Vial Number	µCi/g
GEA.w.^{137}Cs	LS:4	573/572	464	GEA.w.^{137}Cs	DLS:19	N132/N133	299
	LS:5	626	516		DLS:22R	N178/N179	335
	LS:6	537	561				
	LS:7	636	562				
	LS:8	676/679	442				
	LS:9	693	519				
	LS:10	708/881	23,400				
	LS:11	836/841	511				
	LS:14 t	753	432				
GEA.a.^{137}Cs	LS:4	576/577	530				
	LS:5	627/625	302				
	LS:7	656/635	468				
	LS:8	677/680	397				
	LS:9	694/685	399				
	LS:10	711	1,760				
	LS:11	840	495				
	LS:13	591/464	390				
	LS:14 t	760	462				

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Table A-3C. Tank 241-SY-101 Analytical Data: CESIUM-137 (7 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µCi/g			Vial Number	µCi/g
GEA.w.^{137}Cs	SS:4	620	445	GEA.w.^{137}Cs	SS:19	N145/N146	313
	SS:5	884	443		SS:22R	N182/N183	265
	SS:6	460	321				
	SS:7	652	441				
	SS:8	633	295				
	SS:9	687	459				
	SS:10	890	406				
	SS:11	845	397				
	SS:13	598	412				
	SS:14 t	785	342				
	SS:14 b	837/829	329				
	SS:15	673/594	364				
	SS:16	668/663/646	359				
	SS:17	706/707	375				
	SS:18	784/771	386				
	SS:19	790/722	375				
	SS:20	781/774	384				
	SS:21	765/787	376				
	SS:22t	756/768	376				

Table A-3C. Tank 241-SY-101 Analytical Data: CESIUM-137 (7 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µCi/g			Vial Number	µCi/g
GEA.w.^{137}Cs	SS:20A	855/474	322				
	SS:21A	847/854	351				
	SS:22A	858/852	318				
GEA.a.^{137}Cs	SS:4	569/621	392	GEA.a.^{137}Cs	SS:19	N141/N142	292
	SS:5	643/640	422		SS:22R	N170/N171	284
	SS:6	459	345				
	SS:7	638/639	434				
	SS:8	674/675	278				
	SS:9	688/692	438				
	SS:10	887	441				
	SS:11	848/851	359				
	SS:13	599/600	423				
	SS:14 t	479	389				
	SS:14 b	833	402				
	SS:15	671	374				
	SS:16	669/662	401				
	SS:17	704	319				
	SS:18	784	366				
	SS:19	790	353				

Table A-3C. Tank 241-SY-101 Analytical Data: CESIUM-137 (7 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µCi/g			Vial Number	µCi/g
GEA.a.^{137}Cs	SS:20	781	387				
	SS:21	765	351				
	SS:22	756	310				
	SS:20A	846	387				
	SS:21A	860	375				
	SS:22A	853	406				
GEA.a.^{137}Cs	DSS:4	629/628	325				
	DSS:7	657/658	318				
	DSS:8	678	339				
	DSS:11	843	7.00				
	DSS:13	592/593	309				
	DSS:14 t	476	207				
GEA.d.^{137}Cs	Liner Liquid	1180	21,400				
GEA.d.^{137}Cs	AS:13A	493	41,700				
GEA.d.^{137}Cs	FLS:1	540	4.37E+05				
	FLS:2	643	4.28E+05				
	FLS:3	534	10,300				
GEA.d.^{137}Cs	FRT:6	477	6.67E+05				

Table A-3C. Tank 241-SY-101 Analytical Data: CESIUM-137 (7 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µCi/g			Vial Number	µCi/g
GEA.w.^{137}Cs	AS:22A t	439/431/1181	395				
	AS:22A b	430/442	340				
	AS:13A	454/456/691	471				
	AS:11A	539	320				
	AS:16A	957/959	358				
	SW:13A	461	365				
	SW:11A	1058	472				
	SW:16A	1059	670				
GEA.a.^{137}Cs	AS:22A t	435	470				
	AS:22A b	427	397				
	AS:13A	457	347				
	AS:16A	963	371				
	SW:13A	473	26.0				

Table A-3C. Tank 241-SY-101 Analytical Data: CESIUM-137 (7 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µCi/g			Vial Number	µCi/g
GEA.f.^{137}Cs	AS:22A t	426	435				
	AS:22A b	428	376				
	AS:13A	452	308				
	AS:11A	562	310				
	AS:16A	956	505				
	SW:13A	461	955				
GEA.^{137}Cs	HRT:6	472	498				
	FRT:6	467/470	319				

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Table A-3D. Tank 241-SY-101 Analytical Data: CURIUM-242

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µCi/L			Vial Number	µCi/g
				GEA.^{242}Cm	FSC:1	PNL:1	1.40E-04
					FSC:2	PNL:2	4.70E-05
					BC:3	PNL:3	4.50E-04
					BC:4	PNL:4	6.80E-04

Table A-3E. Tank 241-SY-101 Analytical Data: CURIUM-243/244

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µCi/L			Vial Number	µCi/g
				GEA.$^{243/244}$Cm	FSC:1	PNL:1	0.00400
					FSC:2	PNL:2	0.00300
					BC:3	PNL:3	0.00700
					BC:4	PNL:4	0.0130

Table A-3F. Tank 241-SY-101 Analytical Data: IODINE-129

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µCi/g			Vial Number	µCi/g
				GEA.d.^{129}I	DLC:1	N252/N253	5.52E-04
					DLC:2	N256/N257	2.40E-04
Segment Sample					DLC:3	N363/N364	2.39E-04
GEA.f.^{129}I	AS:22A t	426	< 0.0150		DLC:4	N375/N376	1.17E-04
	AS:22A b	428	< 1.60	GEA.f.^{129}I	SC:1	N200/N245	0.0217
	AS:13A	452/461	< 0.0508		SC:2	N248/N249	0.0164
	AS:11A	562	< 0.0150	GEA.f.^{129}I	BC:3	N290/N291	0.0179
	AS:16A	956	< 0.0450		BC:4	N321/N322	0.00763

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Table A-3G. Tank 241-SY-101 Analytical Data: NEPTUNIUM-237

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µCi/g			Vial Number	µCi/g
				AEA.d.^{237}Np	DLC:1	N252/N253	7.50E-05
					DLC:2	N256/N257	3.77E-05
					DLC:3	N363/N364	5.19E-05
					DLC:4	N375/N276	9.51E-05
				AEA.a.^{237}Np	SS:1	N270/N271	0.00562
					SS:2	N274/N275	0.0267
Segment Sample				AEA.f.^{237}Np	SS:1	N200/N245	0.0625
AEA.f.^{237}Np	AS:22A t	426	< 0.500		SS:2	N248/N249	0.0182
	AS:22A b	428	< 0.660	AEA.a.^{237}Np	BC:3	N286/N287	0.00840
	AS:13A	452/461	< 0.800		BC:4	N317/N318	0.00983
	AS:11A	562	< 0.500	AEA.f.^{237}Np	BC:3	N290/N291	0.0968
	AS:16A	956	< 0.550		BC:4	N321/N322	0.0731
AEA.a.^{237}Np	AS:22A t	435	< 0.100				
	AS:22A b	427	< 0.125	GEA.^{237}Np	FSC:1	PNL1	2.30E-05
	AS:13A	457/461	< 0.405		FSC:2	PNL2	2.90E-05
	AS:11A	561	< 1.10	GEA.^{237}Np	FSC:1	PNL1	< 3.60E-05
AEA.^{237}Np	HRT:6	471	< 0.100		FSC:2	PNL2	3.00E-05

Table A-3H. Tank 241-SY-101 Analytical Data: NICKEL-59

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µCi/L			Vial Number	µCi/g
				GEA.^{59}Ni	FSC:1	PNL:1	1.60E-04
					FSC:2	PNL:2	4.00E-05
					BC:3	PNL:3	7.00E-05
					BC:4	PNL:4	2.06E-04

Table A-3I. Tank 241-SY-101 Analytical Data: NICKEL-63

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µCi/L			Vial Number	µCi/g
				GEA.^{63}Ni	FSC:1	PNL:1	0.0260
					FSC:2	PNL:2	0.00600
					BC:3	PNL:3	0.0150
					BC:4	PNL:4	0.0480

Table A-3J. Tank 241-SY-101 Analytical Data: NIOBIUM-94

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µCi/L			Vial Number	µCi/g
				GEA.^{94}Nb	FSC:1	PNL:1	< 6.00E-05
					FSC:2	PNL:2	< 7.00E-05
					BC:3	PNL:3	< 1.00E-04
					BC:4	PNL:4	< 5.00E-05

Table A-3K. Tank 241-SY-101 Analytical Data: NIOBIUM-93m

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µCi/L			Vial Number	µCi/g
				GEA.^{93m}Nb	FSC:1	PNL:1	0.00200
					FSC:2	PNL:2	0.00300
					BC:3	PNL:3	0.00400
					BC:4	PNL:4	0.00900

Table A-3L. Tank 241-SY-101 Analytical Data: PLUTONIUM-239/240

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µCi/g			Vial Number	µCi/g
APC.f.$^{239/240}$Pu	LC:1	TR75L1/1115	7E-05	APC.d.$^{239/240}$Pu	DLC:1	N252/N253	5.52E-05
	LC:2	1096/1110	9.75E-05		DLC:2	N256/N257	6.97E-05
					DLC:3	N363/N364	6.26E-05
			µCi/g		DLC:4	N275/N276	1.89E-04
APC.f.$^{239/240}$Pu	SC:1	1095/1097	0.00325	APC.f.$^{239/240}$Pu	SS:1	N200/N245	0.0119
	SC:2	1103/1104	0.00400		SS:2	N248/N249	0.0128
	SC:3	1085	0.0130	APC.f.$^{239/240}$Pu	BC:3	N290/N291	0.0115
	SC:4	1070-2	0.0153		BC:4	N321/N322	0.0103
	SC:5	1122/1179	0.0168				
Segment Sample							
APC.f.$^{239/240}$Pu	AS:22A t	426	0.0120				
	AS:22A b	428	0.00950				
	AS:13A	452/461	0.0265				
	AS:11A	562	0.0115				
	AS:16A	956	0.00700				
APC.f.$^{239/240}$Pu	SW:13A	473	0.205				

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Table A-3M. Tank 241-SY-101 Analytical Data: SELENIUM-79

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µCi/L			Vial Number	µCi/g
				GEA.^{79}Se	FSC:1	PNL-1	2.40E-04
					FSC:2	PNL-2	2.50E-05
					BC:3	PNL-3	2.40E-04
					BC:4	PNL-4	1.90E-04

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Table A-3N. Tank 241-SY-101 Analytical Data: STRONTIUM-90

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µCi/g			Vial Number	µCi/g
BPC.f.^{90}Sr	LC:1	TR75L1/1115	3.3	BPC.d.^{90}Sr	DLC:1	N252/N253	2.80
	LC:2	1096/1110	2.65		DLC:2	N256/N257	2.87
	LC:3	953/964	2.76		DLC:3	N363/N364	2.36
	LC:4	1151	2.71		DLC:4	N275/N276	2.65
			µCi/g				
BPC.f.^{90}Sr	SC:1	1095/1097/1170	8.82	BPC.f.^{90}Sr	SS:1	N200/N245	32.0
	SC:2	1103/1104	10.4		SS:2	N248/N249	38.1
	SC:3	1085	31.8	BPC.f.^{90}Sr	BC:3	N290/N291	31.6
	SC:4	1070-2	37.1		BC:4	N321/N322	35.0
	SC:5	1122/1179	41.1				
Segment Sample							
BPC.f.^{90}Sr	AS:22A t	426	20.9				
	AS:22A b	428	22.9				
	AS:13A	452/461	52.8				
	AS:11A	562	27.0				
	AS:16A	956	21.9				

Table A-3O. Tank 241-SY-101 Analytical Data: TECHNETIUM-99

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µCi/L			Vial Number	µCi/g
				LSC.d.^{99}Tc	DLC:1	N252/N253	0.127
					DLC:2	N256/N257	0.621
					DLC:3	N364	0.118
					DLC:4	N376	0.0754
				LSC.a.^{99}Tc	SS:1	N200/N245	0.296
					SS:2	N248/N249	0.256
				LSC.a.^{99}Tc	BC:3	N290/N291	0.300
			µCi/g		BC:4	N321/N322	0.294
Segment Sample							
LSC.f.^{99}Tc	AS:22A t	426	0.400				
	AS:22A b	428	0.420				
	AS:13A	452/461	0.255				
	AS:11A	562	0.260				
	AS:16A	956	0.420				

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Table A-3P. Tank 241-SY-101 Analytical Data: TOTAL ALPHA

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µCi/g			Vial Number	µCi/g
APC.f.Tot α	LC:1	TR75L1/1115	0.0148	APC.d.Tot α	DLC:1	N252/N253	0.0482
	LC:2	1096/1110	0.0413		DLC:2	N256/N257	0.0191
	LC:3	953/964	0.238		DLC:3	N363/N364	0.0352
	LC:4	1151	0.130		DLC:4	N375/N376	0.187
			µCi/g	APC.f.Tot α	SC:1	N200/N245	0.141
APC.f.Tot α	SC:1	1095/1097	0.340		SC:2	N248/N249	0.226
	SC:2	1103/1104	0.395	APC.f.Tot α	BC:3	N290/N291	0.223
	SC:3	1085	0.309		BC:4	N321/N322	0.205
	SC:4	1070-2	2.39				
	SC:5	1122/1179	0.393				
Segment Sample							
APC.f.Tot α	AS:22A t	426	0.180				
	AS:22A b	428	2.05				
	AS:13A	452/461	0.408				
	AS:11A	562	< 245				
	AS:16A	956	0.0190				
APC.a.Tot α	SW:13A	473	5.25				

Table A-3Q. Tank 241-SY-101 Analytical Data: TOTAL BETA

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µCi/g			Vial Number	µCi/g
BPC.f.Tot β	LC:1	TR75L1/1115	432	BPC.d.Tot β	DLC:1	N252/N253	537
	LC:2	1096/1110	569		DLC:2	N256/N257	695
	LC:3	953/964	968		DLC:3	N363/N364	607
	LC:4	1151	538		DLC:4	N375/N376	649
			µCi/g	BPC.f.Tot β	SC:1	N200/N245	561
BPC.f.Tot β	SC:1	1095/1097	455		SC:2	N248/N249	441
	SC:2	1103/1104	468	BPC.f.Tot β	BC:3	N290/N291	556
	SC:3	1085	506		BC:4	N321/N322	521
	SC:4	1070-2	629				
	SC:5	1122/1179	536				
Segment Sample							
BPC.f.Tot β	AS:22A t	426	674				
	AS:22A b	428	530				
	AS:13A	452/461	1,140				
	AS:11A	562	566				
	AS:16A	956	688				
BPC.a.Tot β	SW:13A	473	762				

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Table A-3R. Tank 241-SY-101 Analytical Data: TOTAL URANIUM

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µCi/g			Vial Number	µCi/g
LF.f.Tot U	LC:1	TR75L1/1115	---	LF.d.Tot U	DLC:1	N252/N253	0.966
	LC:2	1096/1110	9.5E-05		DLC:2	N256/N257	1.13
	LC:3	953/964	1.0E-04		DLC:3	N363/N364	1.69
	LC:4	1151	---		DLC:4	N375/N376	1.27
			µCi/g	LF.f.Tot U	SC:1	N200/N245	107
LF.f.Tot U	SC:1	1095/1097	266		SC:2	N248/N249	136
	SC:2	1103/1104	31.0	LF.f.Tot U	BC:3	N290/N291	105
	SC:3	1085	10.0		BC:4	N321/N322	99.4
	SC:4	1070-2	337				
	SC:5	1122/1179	103				
Segment Sample							
LF.f.Tot U	AS:22A t	426	59.5				
	AS:22A b	428	86.0				
	AS:13A	452/461	123				
	AS:11A	562	75.5				
	AS:16A	956	72.0				
LF.a.Tot U	SW:13A	461	234				
LF.f.Tot U	SW:H2O Wash Solid	473	1,130				

Table A-4A. Tank 241-SY-101 Analytical Data: PERCENT WATER (Gravimetric) (3 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	%			Vial Number	%
				Grav. %H_2O	LC:1	N207/N208	41.2
					LC:2	N211/N212	41.2
					LC:3	N387/N388	38.5
					LC:4	N382/N383	37.5
					LC:5	N393/N394	47.3
Grav. %H_2O	SC:5	1137	32.3	Grav. %H_2O	SC:1	N215/N216	32.4
					SC:2	N217/N218	29.4
Grav. %H_2O	BC:5	1138	35.0	Grav. %H_2O	BC:3	N313/N314	31.5
					BC:4	N336/N337	31.9
Segment Sample				Segment Sample			
Grav. %H_2O	LS:4	F/B	34.3	Grav. %H_2O	LS:3	N32/N33	37.8
	LS:5	E/D	35.2		LS:8	N35/N36	32.8
	LS:7	C/642	40.3		LS:13	N38/N39	32.0
	LS:8	N/M	36.3		LS:15	N94/N95	33.6
	LS:9	K/L	37.1		LS:19	N91/N92	37.4
	LS:10	RR/OO	36.0		LS:22R	N148/N149	31.5
	LS:11	QQ/PP	36.5				
	LS:13	G/H	33.3				

Table A-4A. Tank 241-SY-101 Analytical Data: PERCENT WATER (Gravimetric) (3 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	%			Vial Number	%
Grav. $\%H_2O$	SS:5	A	33.9	Grav. $\%H_2O$	SS:3	N79/N80	36.2
	SS:8	J	21.2		SS:8	N81/N82	33.6
	SS:9	I	34.1		SS:13	N84/N85	35.7
	SS:13	590	31.6		SS:15	N101/N102	32.2
	SS:14	826	39.0		SS:19	N87/N88	27.7
	SS:15	Q	27.0		SS:22R	N157/N158	27.4
	SS:16	R/P	28.7				
	SS:17	P	31.8				
	SS:18	W/NN	33.6				
	SS:19	V	31.6				
	SS:20	U	35.0				
	SS:21	T/MM	31.9				
	SS:22	S/EE	32.4				
	SS:20A	AA	23.2				
	SS:21A	Z	18.1				
	SS:22A	X	19.9				

Table A-4A. Tank 241-SY-101 Analytical Data: PERCENT WATER (Gravimetric) (3 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	%			Vial Number	%
Grav. $\%H_2O$	SS:7	639	40.5				
Grav. $\%H_2O$	AS:22A t	429/437	20.2				
	AS:22A b	440/541	20.6				
	AS:13A	458	29.1				
	AS:11A	535	34.8				
	AS:16A	LL	23.1				
Grav. $\%H_2O$	FLS:1	540	60.0				
	FLS:2	543	57.8				

Table A-4B. Tank 241-SY-101 Analytical Data: PERCENT WATER (Karl Fischer Titration)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	%			Vial Number	%
KF.Titrat. $\%H_2O$	SS:6	542	39.1				
	SS:7	639	38.9				
	SS:8	674/675	31.3				
	SS:9	688/692	40.1				
	SS:18	828	27.3				
	SS:19	830	33.3				
	SS:20	820	44.7				
	SS:21	824	34.9				
	SS:22	822	35.4				
KF.Titrat. $\%H_2O$	AS:22A b	439a	31.1				

Table A-4C. Tank 241-SY-101 Analytical Data: PERCENT WATER (Thermogravimetric Analysis) (3 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	%			Vial Number	%
				TGA. %H_2O	LC;1	N255	42.0
					LC:2	N227	44.9
					LC:3	N391	31.2
					LC;4	N390	29.2
					LC:5	N396/N402/N403	48.2
TGA. %H_2O	SC:5	1114	31.9	TGA. %H_2O	SC:1	N220	27.1
					SC:2	N222	27.1
					SC:5	N398/N399	39.3
				TGA. %H_2O	BC:3	N311	30.9
					BC:4	N339	29.5
Segment Sample				Segment Sample			
TGA. %H_2O	SS:4	527	45.8	TGA. %H_2O	LS:15	N108	38.6
	SS:5	567	46.3		LS:19	N107	33.5
	SS:7	568	41.9		LS:22R	N154	78.4
	SS:8	660	38.6				
	SS:9	713	43.5				
	SS:10	709	43.4				

Table A-4C. Tank 241-SY-101 Analytical Data: PERCENT WATER (Thermogravimetric Analysis) (3 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	%			Vial Number	%
TGA. %H_2O	SS:11	885	40.5	TGA. %H_2O	SS:3	N61	40.3
	SS:13	565	26.8		SS:8	N62	38.2
	SS:14 t	755	36.1		SS:13	N63	38.6
	SS:14 b	832	36.7		SS:15	N112	32.0
	SS:15	597	38.5		SS:19	N104	28.2
	SS:16	669/664	35.8		SS:22R	N158	27.4
	SS:17	705	36.1				
	SS:18	827	34.4				
	SS:19	528/831	33.9				
	SS:20	834	34.4	TGA. %H_2O	BS:2	N3	33.4
	SS:21	823	30.7		BS:3	N7	39.0
	SS:22	825	31.2		BS:4	N18	34.1
	SS:20A	856	34.8		BS:5	N13	35.3
	SS:21A	844	31.8		BS:6	N9	37.0
	SS:22A	857	31.1		BS:7	N8	34.0
					BS:8	N4	36.8
					BS:9	N24	35.7
					BS:10	N16	36.7

Table A-4C. Tank 241-SY-101 Analytical Data: PERCENT WATER (Thermogravimetric Analysis) (3 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	%			Vial Number	%
TGA. %H_2O	AS:22A t	414	18.9	TGA. %H_2O	BS:11	N17	34.2
	AS:22A b	434	19.9		BS:12	N21	35.7
	AS:13A	455	31.7		BS:13	N20	32.2
	AS:11A	526	40.8		BS:14	N14	35.7
	AS:16A	955	23.4		BS:15	N10	32.9
TGA. %H_2O	SW:13A	466	31.7		BS:16	N12	34.5
	SW:22A	448	16.2		BS:17	N22	35.5
	SW:11A	1058	17.1		BS:18	N25	44.1
	SW:16A	1059	16.3		BS:19	N29	34.4
					BS:20	N30	33.5
					BS:21	N28	41.8
					BS:22	N26	30.8

Table A-4D. Tank 241-SY-101 Analytical Data: DENSITY and SPECIFIC GRAVITY (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number				Vial Number	g/mL
Specfic Gravity	DLC:1	1187	1.31	Density	DLC:1	N260/N261	1.31
	DLC:2	1108/1184/1185	1.16		DLC:2	N266/N267	1.33
	DLC:3	1117	1.14		DLC:3	N359/N360	1.5
	DLC:4	1153	1.07		DLC:4	N372	1.24
Specfic Gravity	SC:1	TR75L1	1.23		LC:5	N406/N407	1.43
	SC:2	1109	1.28				
Specfic Gravity	SC:1	TR75L2	1.22				
	SC:3	965	1.15				

Table A-4D. Tank 241-SY-101 Analytical Data: DENSITY and SPECIFIC GRAVITY (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number				Vial Number	g/mL
Specific Gravity	DLS:4	573/572	1.32	Density	DLS:3	N42/N43	1.34
	DLS:5	626/624	1.30		DLS:8	N44/N47	1.26
	DLS:6	537	1.30		DLS:13	N48/N49	1.30
	DLS:7	655/636	1.31		DLS:15	N123/N124	1.30
	DLS:8	676/679	1.26		DLS:19	N128/N129	1.27
	DLS:9	693/683	1.27		DLS:22R	N162/N163	1.19
	DLS:10	708/881	1.26				
	DLS:11	836/841	1.27				
	DLS:13	463/564	1.29				
	DLS:14 t	753	1.29				
Specific Gravity	SW:13A	493	1.06				
Specific Gravity	FLS:1	540	1.34				
	FLS:2	543	1.36				

Table A-4E. Tank 241-SY-101 Analytical Data: pH

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number				Vial Number	
H+.pH	C:3	958	13.7				
	C:4	1071-2	13.6				
Segment Sample							
H+.pH	AS:22A t	436	13.3				
	AS:22A b	441	12.9				
	SW:13A	892	8.00				
H+.pH	FLS:1	540	13.2				
	FLS:2	543	13.6				

Table A-5A. Tank 241-SY-101 Analytical Data: TOTAL ORGANIC CARBON (5 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
Coul.TOC	DLC:1	1094/1116	9,450	Coul.d.TOC	DLC:1	N260/N261	9,670
	DLC:2	1117/962	11,400		DLC:2	N266/N267	10,100
	DLC:4	1154	9,350		DLC:3	N359/N360	10,600
				Coul.w.TOC	SC:1	N239/N240	17,700
			µg/g		SC:2	N243/N244	17,200
Coul.w.TOC	SC:1	1098	17,000		SC:5	N411/N412	15,800
Coul.d.TOC	SC:5	1113/1124	19,600	Coul.w.TOC	BC:3	N295/N256	20,000
					BC:4	N325/N326	19,500
Segment Sample				Segment Sample			
			µg/g				
Coul.TOC	DLS:4	573/572	11,300	Coul.w.TOC	DLS:19	N132/N133	10,700
	DLS:5	626/624	12,200		DLS:2R	N178/N179	13,100
	DLS:6	537	11,400				
	DLS:7	655/636	9,400				
	DLS:8	676/679	10,900				
	DLS:9	693/683	12,000				

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Table A-5A. Tank 241-SY-101 Analytical Data: TOTAL ORGANIC CARBON (5 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
Coul.TOC	DLS:10	708/881	11,200	Coul.w.TOC	SS:19	N145/N146	24,000
	DLS:11	836/841	11,800		SS:22R	N182/N183	21,500
	DLS:13	463/564	11,400				
	DLS:14 t	753	8,200				
			µg/g				
Coul.TOC	SS:4	620	17,600				
	SS:5	884	15,900				
	SS:6	460	16,300				
	SS:7	652	18,800				
	SS:8	633	16,000				
	SS:9	687	19,300				
	SS:10	890	18,700				
	SS:11	845	19,400				
	SS:13	598	18,000				
	SS:14 t	785	19,000				
	SS:14 b	837/829	17,000				
	SS:915	673/594	19,300				

Table A-5A. Tank 241-SY-101 Analytical Data: TOTAL ORGANIC CARBON (5 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	
Coul.TOC	SS:16	668/663/646	19,200				
	SS:17	706/707	20,200				
	SS:18	784/771	20,700				
	SS:19	790/722	18,700				
	SS:20	781/774	20,200				
	SS:21	765/787	19,200				
	SS:22	756/768	19,100				
	SS:20A	855/474	18,500				
	SS:21A	847/854	19,300				
	SS:22A	858/852	18,700				
Coul.TOC	HRT:6	472	14,900				
	FRT:6	470	13,000				
			µg/mL				
Coul.TOC	SW:13A	493	1,480				
Coul.TOC	FLS:1	540	10,800				
	FLS:2	543	9,400				
Coul.TOC	FRT:6	477	15,300				

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Table A-5A. Tank 241-SY-101 Analytical Data: TOTAL ORGANIC CARBON (5 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
Coul.TOC	SS:4	PNL-619	11,700				
	SS:5	PNL-641	12,700				
	SS:7	PNL-634	15,200				
	SS:8	PNL-631	5,100				
	SS:10	PNL-888	15,100				
	SS:11	PNL-849	14,500				
	SS;13	PNL-601	12,400				
	SS:14 t	PNL-475	14,600				
Coul.d.TOC	SS:14 b	PNL-821	13,600				
	SS:15	PNL-672	15,800				
	SS:16	PNL-667/PNL-661	15,600				
	SS:17	PNL-650	12,500				
	SS:18	PNL-776	15,000				
	SS:19	PNL-789	15,300				
	SS;20	PNL-788	13,200				
	SS:21	PNL-766	14,600				
	SS:22	PNL-754	14,900				

Table A-5A. Tank 241-SY-101 Analytical Data: TOTAL ORGANIC CARBON (5 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
Coul.d.TOC	SS:20A	PNL-777	16,900				
	SS:21A	PNL-859	16,200				
	SS:22A	PNL-670	16,500				
Coul.d.TOC	AS:22A t	PNL-712	15,500				
	AS:22A b	PNL-443	14,500				
	AS:13A	PNL-451	15,500				
	AS:11A	PNL-538	9,500				
Coul.w.TOC	AS:22A t	439/431/1181	11,900				
	AS:22A b	430/442	18,700				
	AS:13A	454/456/691	19,200				
	AS:11A	539	16,000				
	AS:16A	957/959	15,600				
Coul.w.TOC	SW:13A	461	18,200				
	SW:11A	1058	18,400				
	SW:16A	1059	23,300				

Table A-5B. Tank 241-SY-101 Analytical Data: TOTAL INORGANIC CARBON (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
Coul.Titra.TIC	DLC:1	1094/1116/	3,700	Coul.Titra.d.TIC	DLC:1	N260/N261	1,120
	DLC:2	1111/1108/ 1184/1185	3,610		DLC:2	N266/N267	1,170
	DLC:3	1117/962	31,300		DLC:3	N359/N360	1,480
					DLC:4	N371/N372	1,640
			µg/g				
Coul.Titra.w.TIC	SC:1	1093/1098/1189	10,200	Coul.Titra.w.TIC	SC:1	N239/N340	11,000
	SC:2	1100/1105	11,800		SC:2	N243/N244	9,200
Coul.Titra.d.TIC	SC:3	1184/1188	9,850	Coul.Titra.w.TIC	BC:3	N295/N296	8,810
	SC:4	1072/1068/ 1168/1169	11,500		BC:4	N325/N326	10,800
	SC:5	1113/1124	13,800				

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Table A-5B. Tank 241-SY-101 Analytical Data: TOTAL INORGANIC CARBON (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Segment Sample				Segment Sample			
		Vial Number	µg/g			Vial Number	µg/g
Coul.Titra.w.TIC	AS:22A t	439/431/1181	20,000	Coul.Titra.w.TIC	DLS:19	N132/N133	1,480
	AS:22A b	430/442	11,900		DLS:22R	N178/N179	1,820
	AS:13A	454/456/691	10,000	Coul.Titra.w.TIC	SS:19	N145/N146	14,500
	AS:11A	539	15,800		SS:22R	N182/N183	13,800
	AS:16A	957/959	10,900				
Coul.Titra.w.TIC	SW:13A	461	8,300				
	SW:11A	1058	24,300				
	SW:16A	1059	22,600				
			µg/mL				
Coul.Titra.TIC	SW:13A	493	896				

Table A-6. Tank 241-SY-101 Analytical Data: ORGANIC COMPLEX (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
GC/MS.NIDA	BC:1	---	708	GC/MS.NIDA	BC:1	1197/1199	755
					BC:2	1215/1214	1,780
					BC:3	1196	226
					BC:4	1299/1306	195
GC/MS.NTA	BC:1	---	185	GC/MS.NTA	BC:1	1197/1199	196
					BC:2	1215/1214	204
					BC:3	1196	87
					BC:4	1299/1306	87.5
GC/MS.CA	BC:1	---	45	GC/MS.CA	BC:1	1197/1199	12.5
					BC:2	1215/1214	15
					BC:3	1196	30
					BC:4	1299/1306	62

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Table A-6. Tank 241-SY-101 Analytical Data: ORGANIC COMPLEX (2 sheets)

Window C				Window E			
Analyte	Sample Type	Sample Identification	Result	Analyte	Sample Type	Sample Identification	Result
Composite Sample				Composite Sample			
		Vial Number	µg/g			Vial Number	µg/g
GC/MS.ED3A	BC:1	---	115	GC/MS.EDTA	BC:1	1197/1199	122
					BC:2	1215/1214	30
					BC:3	1196	134
					BC:4	1299/1306	235
GC/MS.EDTA	BC:1	---	237	GC/MS.EDTA	BC:1	1197/1199	229
					BC:2	1215/1214	60.5
					BC:3	1196	480
					BC:4	1299/1306	241
GC/MS.HEDTA	BC:1	---	25	GC/MS.HEDTA	BC:1	1197/1199	15
					BC:2	1215/1214	10
					BC:3	1196	10
GC/MS.BA or SA	BC:1	---	80		BC:4	1299/1306	15

Notes:
NIDA = Nitrosoiminodiacetic acid.
NTA = Nitrilotriacetic acid.
CA = Citric acid.
ED3A = Ethylenediaminetriacetic acid.
EDTA = Ethylenediaminetetraacetic acid.
HEDTA = N-(2-hydroxyethyl-ethylnediaminetriacetic acid).
BA = Butanedioic acid.
SA = Succinic acid.

Table A-7A. Tank 241-SY-101 Analytical Data: VOLATILE ORGANIC

WINDOW C	
Non-detected Volatile Organic Constituents	
Chloromethane	1,2-Dichloropropane
Bromomethane	cis-1,3-Dichloropropene
Vinyl Chloride	Trichloroethene
Chloroethane	Dibromochloromethane
Methylene Chloride	1,1,2-Trichloroethane
Acetone	Benzene
Carbon Disulfide	trans-1,3-Dichloropropene
1,1-Dichloroethane	Bromoform
1,1-Dichloroethene (total)	4-Methyl-2-pentanone
Chloroform	Tetrachloroethane
1,2-Dichloroethane	1,1,2,2-Tetrachloroethane
2-Butanone	Toluene
1,1,1-Trichloroethane	Chlorobenzene
Carbon Tetrachloride	Ethylbenzene
Vinyl Acetate	Styrene
Bromodichloromethane	Xylene (total)

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Table A-7B. Tank 241-SY-101 Analytical Data: VOLATILE ORGANIC

WINDOW C			
Tentatively Identified Volatile Organic Constituents			
Analyte	Sample Type	Sample Identification	Result
		Vial Number	µg/L
GC/MS.Furan, tetrahydro-2-methyl	Composite	91-6264	25.0
GC/MS.Hexane	Composite	91-6425	5.00
GC/MS.1-Hexanol, 2-ethyl-	Composite	91-6264	150
			µg/kg
GC/MS.1-Hexanol, 2-ethyl-	Composite	91-6265/91-6266/91-6267/ 91-7174/91-7175/91-9319	162
GC/MS.Undecane	Composite	91-7319	24.0
GC/MS.Dodecane	Composite	91-7319	34.0
GC/MS.Tridecane	Composite	91-7319	29.0

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Table A-8. Tank 241-SY-101 Analytical Data: SEMI-VOLATILE ORGANIC (2 sheets)

WINDOW C	
Non-detected Semi-volatile Organic Constituents	
Phenol	1,2,4-Trichlorobenzene
bis(2-Chloroethyl)Ether	Naphthalene
2-Chlorophenol	4-Chloroaniline
1,3-Dichlorobenzene	Hexachlorobutadiene
1,4-Dichlorobenzene	4-Chloro-3-methylphenol
Benzyl alcohol	2-Methylnaphthalene
1,2-Dichlorobenzene	Hexachlorocyclopentadiene
2-Methylphenol	2,4,6-Trichlorophenol
bis(2-chloroisopropyl)ether	2,4,5-Trichlorophenol
4-Methylphenol	2-Chloronaphthalene
N-Nitroso-Di-n-propylamine	2-Nitroaniline
Hexachloroethane	Dimethylphthalate
Nitrobenzene	Acenaphthylene
Isophorone	2,6-Dinitrotoluene
2-Nitrophenol	3-Nitroaniline
2,4-Dimethylphenol	Acenaphthene
Benzoic acid	2,4-Dinitrophenol
bis(2-Chloroethoxy)methane	4-Nitrophenol
2,4-Dichlorophenol	Dibenzofuran
2,4-Dinitrotoluene	Pyrene
Diethylphthalate	Butylbenzylphthalate
4-Chlorophenyl-phenylether	3,3'-Dichlorobenzidine
Fluorene	Benzo(a)anthracene

Table A-8. Tank 241-SY-101 Analytical Data: SEMI-VOLATILE ORGANIC (2 sheets)

WINDOW C	
Non-detected Semi-volatile Organic Constituents	
4-Nitroaniline	Chrysene
4,6-Dinitro-2-methylphenol	bis(2-Ethylexyl)phthalate
N-Nitrosodiphenylamine (1)	Di-n-octylphthalate
4-Bromophenyl-phenylether	Benzo(b)fluoranthene
Hexachlorobenzene	Benzo(k)fluoranthene
Pentachlorophenol	Benzo(a)pyrene
Phenanthrene	Indeno(1, 2, 3-cd)pyrene
Anthracene	Dibenz(a,h)anthracene
Di-n-butylphthalate	Benzo(g,h,i)perylene
Fluoranthene	

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Table A-8B. Tank 241-SY-101 Analytical Data: SEMI-VOLATILE ORGANIC

Tentatively Identified Semivolatile Organic Constituents				
Analyte	Window	Sample Type	Sample Identification	Result
			Vial Number	µg/L
GC/MS.Benzene, 1,1,1'-sulfonylbis[4-	E	Soil	1295A/1295B/1296A	25,200
[1]GC/MS.Phosphine oxide, triphenyl	E	Soil	1295A/1295B/1296A/1296B/ 1203-2/1307-2	1.10E+05
	C	Soil	1060/1060D/1061/1061D/1062/ 1062D/1063/1063D	92,600
GC/MS.Phosphine oxide, dipheyl	E	Soil	1296A	16,000
GC/MS.Dodecane	E	Soil	195A/1295B/1296A/1296B/ 1203-2/1307-2	44,900
GC/MS.Tridecane	E	Soil	1295A/1295B/1296A/1296B/ 1203-2/1307-2	1.40E+05
GC/MS.Teratdecane	E	Soil	1295A/1295B/1296A/1296B/ 1203-2/1307-2	1.03E+05
GC/MS.Pentadecane	E	Soil	1295A/1295B	8,950
				µg/L
[1]GC/MS.Phosphine oxide, triphenyl	C	Soil	1061/1061D/1063/1063D	7,230
[1]GC/MS.Hexanedioic acid ester	C	Soil	1061/1061D	1,600
[2]GC/MS.2-Fluoro-4-Nitrophenol	C	Soil	1061/1061D	2,900

Notes:
[1]Assumed to be from lab renovation in 325 building.
[2]Assumed to be a nitration product of acid surrogate 2-fluorphenol.

A.4 REFERENCES

Herting, D.L., D.B. Bechtold, B.A. Crawford, T.L. Welsh, and L. Jensen, 1992a, *Laboratory Characterization of Samples Taken in May 1991 from Hanford Waste Tank 241-SY-101*, WHC-SD-WM-DTR-024, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Herting, D.L., D.B. Bechtold, B.E. Hey, B.D. Keele, L. Jensen, and T.L. Welsh, 1992b, *Laboratory Characterization of Sample Taken in December 1991 (Window E) from Hanford Waste Tank 241-SY-101*, WHC-SD-WM-DTR-026, Westinghouse Hanford Company, Richland, Washington.

APPENDIX B

DOUBLE-SHELL TANK 241-SY-101

ANALYTICAL RESULTS

1990 WINDOW A CRUST SAMPLES

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APPENDIX B

Appendix B tabulates the results from the November 1990 Window A crust sampling time frame. The data was obtained from *Analysis of November 1990 crust Samples from Tank 241-SY-101* (Herting and Bechtold 1992).

The samples were collected from material adhering to three level detectors that were removed from the tank: (1) a sludge weight (SW), (2) a manual tape plummet, and (3) a Food Instrument Company (FIC) plummet. The amount of solids recovered from the manual tape plummet and the FIC plummet was very small, so only partial characterization was possible for these samples. The sludge weight was divided before analysis into three subsamples (SW/wet, SW/Dry, and SW/Loose), differing in physical appearance and origin (Herting and Bechtold 1992).

Table B-1. Results of Chemical Analysis of Tank 241-SY-101 Crust Samples. (2 sheets)

Analyte	SW/Dry (μg/g)	SW/Wet (μg/g)	SW/Loose (μg/g)	Manual Tape Plummet (μg/g)	FIC Plummet (μg/g)
AlO_2^-	*87,000*	*85,000*	*93,000*	78,000	23,000
Ca	*400*	*300*	*500*	400	400
Cr	*7,000*	*9,000*	*0*	3,000	1,000
Fe	*6,000*	*1,000*	*3,000*	0	0
K	*3,000*	*3,000*	*4,000*	4,000	5,000
Na	*243,000*	*240,000*	*289,000*	272,000	246,000
Ni	*300*	*300*	*0*	400	0
Si	*500*	*300*	*200*	400	2,000
$C_2H_3O_2^-$	49,000	40,000	55,000	56,000	39,000
Cl^-	10,000	7,000	9,000	10,000	14,000
NO_2^-	117,000	88,000	111,000	93,000	169,000
NO_3^-	158,000	138,000	178,000	167,000	193,000
OH^-	14,000	19,000	1,000	5,000	2,000
PO_4^{3-}	13,000	9,000	9,000	<11,000	<51,000
SO_4^{2-}	7,000	8,000	44,000	143,000	405,000
TIC	64,000	39,000	87,000	105,000	110,000

Table B-1. Results of Chemical Analysis of Tank 241-SY-101 Crust Samples. (2 sheets)

Analyte	SW/Dry (μg/g)	SW/Wet (μg/g)	SW/Loose (μg/g)	Manual Tape Plummet (μg/g)	FIC Plummet (μg/g)
TOC	20,000	16,000	22,000	23,000	16,000

Note:
SW = Sludge weight (samples were removed from three detectors in the tank, called sludge weights).
μg/g = microgram/gram.
TIC = Total inorganic carbon.
TOC = Total organic carbon.
FIC = Food Instrument Corporation.
Results in italics were obtained from acid leaches; all other results were obtained from water leaches.

Table B-2. Results of Radiochemical Analysis of Tank 241-SY-101 Crust Samples.

Radio-nuclide	SW/Dry (μCi/g)	SW/Wet (μCi/g)	SW/Loose (μCi/g)	Manual Tape Plummet (μCi/g)	FIC Plummet (μCi/g)	Middle Slurry (μCi/g)
Fusion						
^{241}Am	0.010	<0.005	0.016	Insufficient Sample for fusion		<0.012
^{137}Cs	434	315	469			539
^{129}I	<0.01	<0.008	0.012			NR
^{237}Np	<0.56	<0.47	<0.62			NR
$^{239/240}$Pu	<0.0039	<0.0031	<0.0073			0.013
^{90}Sr	13	23	98			5.6
^{99}Tc	0.48	0.40	0.43			0.15
U (Total)	1.1E-04	1.1E-04	1.0E-04			<1E-05
Total Alpha	<0.08	<0.15	0.25			NR
Total Beta	560	427	661			930
Water Leach						
^{137}Cs	477	328	417	492	501	NR
^{60}Co	<0.22	<0.036	<0.053	0.098	<0.076	NR
Acid Leach						
^{237}Np	<0.07	<0.11	<0.10	NR	NR	NR

Note:
NR = Not reported.
μCi/g = microcurie/gram.
SW = Sludge weight (samples were taken from three detectors in the tank, called sludge weights).
All results are based on the weight of the sample as received.

REFERENCE

Herting, D.L. and D.B. Bechtold, 1992, *Analysis of November 1990 Crust Samples from Tank 241-SY-101*, WHC-SD-WM-DTR-022, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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APPENDIX C

DOUBLE-SHELL TANK 241-SY-101

HISTORICAL ANALYTICAL RESULTS

1986 BOTTLE-ON-A-STRING SAMPLE

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Three samples at different waste levels (top, middle, and bottom) were acquired in early 1986 using the bottle-on-a-string method. For further description of this sampling method refer to the *Tank Characterization Reference Guide* (De Lorenzo et al. 1994).

The results from the 1986 bottle-on-a-string sampling event are summarized in Table B-1. The data was derived from *101-SY Samples: Laboratory Analysis and Results* (Mauss 1986).

The top and middle samples were not used in any analytical comparisons due to the results being highly suspect. The top sample is not a crust sample and appears to have been diluted prior to sampling. The middle sample results were calulated with a density that is also highly suspect, therfore the conversion from molarity to micrograms per gram are also suspect.

The molarity data was converted to micrograms per gram by using the following formula.

$$\mu g/g = \frac{(\text{Molarity(moles/L) X Analyte atomic weight (g/mol) X 1.00E+06}\mu g/g\ \text{XL/1000mL})}{\text{density (g/mL)}}$$

Table C-1. Analytical Results of Tank 241-SY-101 1986 Bottle-on-a-String Sampling Event (2 sheets).

Analyte	Top Sample Bulk Composite	Middle Sample Bulk Composite	Bottom Sample Bulk Composite
METAL	µg/g	µg/g	µg/g
Aluminum (Al)	14,400	43,700	35,800
Boron (B)	27.1	67.8	48.2
Calcium (Ca)	94.6	160	169
Chromium (Cr)	73.9	37.3	20.3
Copper (Cu)	---	---	7.03
Iron (Fe)	---	---	---
Magnesium (Mg)	---	---	---
Nickel (Ni)	113	107	227
Phosphorus (P)	1,400	3,100	2,200
Potassium (K)	1,660	4,240	3,010
Silicon (Si)	---	---	---
Sodium (Na)	1.27E+05	2.55E+05	2.20E+05
ION	µg/g	µg/g	µg/g
Carbonate (CO_3^{2-})	20,300	18,100	32,000
Chloride (Cl^-)	4,000	9,300	7,100
Fluoride (F^-)	< 1,100	< 2,400	< 1,800
Hydroxide (OH^-)	15,000	35,100	23,400
Nitrate (NO_3^-)	68,100	1.49E+05	1.13E+05

Table C-1. Analytical Results of Tank 241-SY-101 1986 Bottle-on-a-String Sampling Event (2 sheets).

Analyte	Top Sample Bulk Composite	Middle Sample Bulk Composite	Bottom Sample Bulk Composite
ION (continued)	µg/g	µg/g	µg/g
Nitrite (NO_2^-)	46,400	1.09E+05	80,600
Phosphate (PO_4^{3-})	4,300	12,500	7,300
Sulfate (SO_4^{2-})	2,200	< 5,200	< 7,400
RADIONUCLIDE	µCi/g	µCi/g	µCi/g
Americium-241	< 0.012	< 0.012	< 0.0088
Cesium-137	217	539	394
Plutonium-239/240	0.0065	0.013	0.0112
Strontium-90	3.14	5.58	7.99
Technetium-99	0.0678	0.151	0.124
Total Beta	402	930	734
Total Uranium	< 9.00E-06	< 9.30E-06	< 0.0119
Mass Balance	93.2	103	104
Physical Properties			
Wt. % Water	61.3	33.1	47.1
SpG	1.33	1.29	1.69
CARBON	µg/g	µg/g	µg/g
Total Organic Carbon	8,420	14,300	15,000
Organic Complex	µg/g	µg/g	µg/g
EDTA	< 18,000	< 37,100	67,200
HEDTA	33,100	44,600	< 24,000

Notes:
µg/g = microgram per gram.
µCi/g = microcurie per gram.
EDTA: ethylenediaminetetraacetate.
HETDA: N-(2-hydroxyethyl)-ethylenediaminetriacetate.

REFERENCES

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

Mauss, B.M., 1986, "101-SY Samples: Laboratory Analysis and Results", Internal letter 65453-86-079 to L.M. Sasaki, May 30, Rockwell Hanford Operations, Richland, Washington.

APPENDIX D

DOUBLE-SHELL TANK 241-SY-101

CONVECTIVE AND NON-CONVECTIVE SEGMENT PHOTOGRAPHS

WINDOW C

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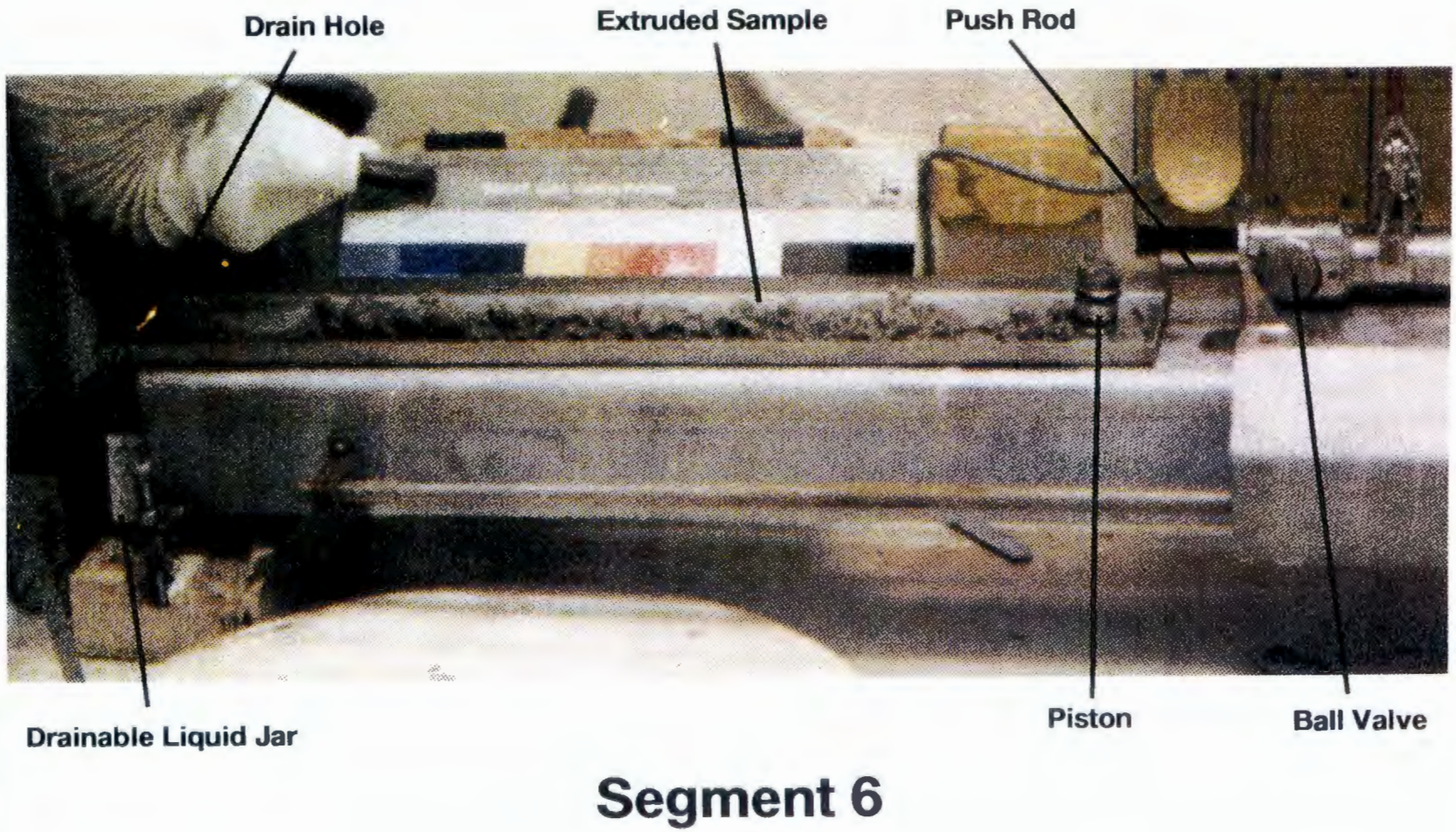

Figure D-1. Segment 6, Convective Layer, Window C Core Sample.

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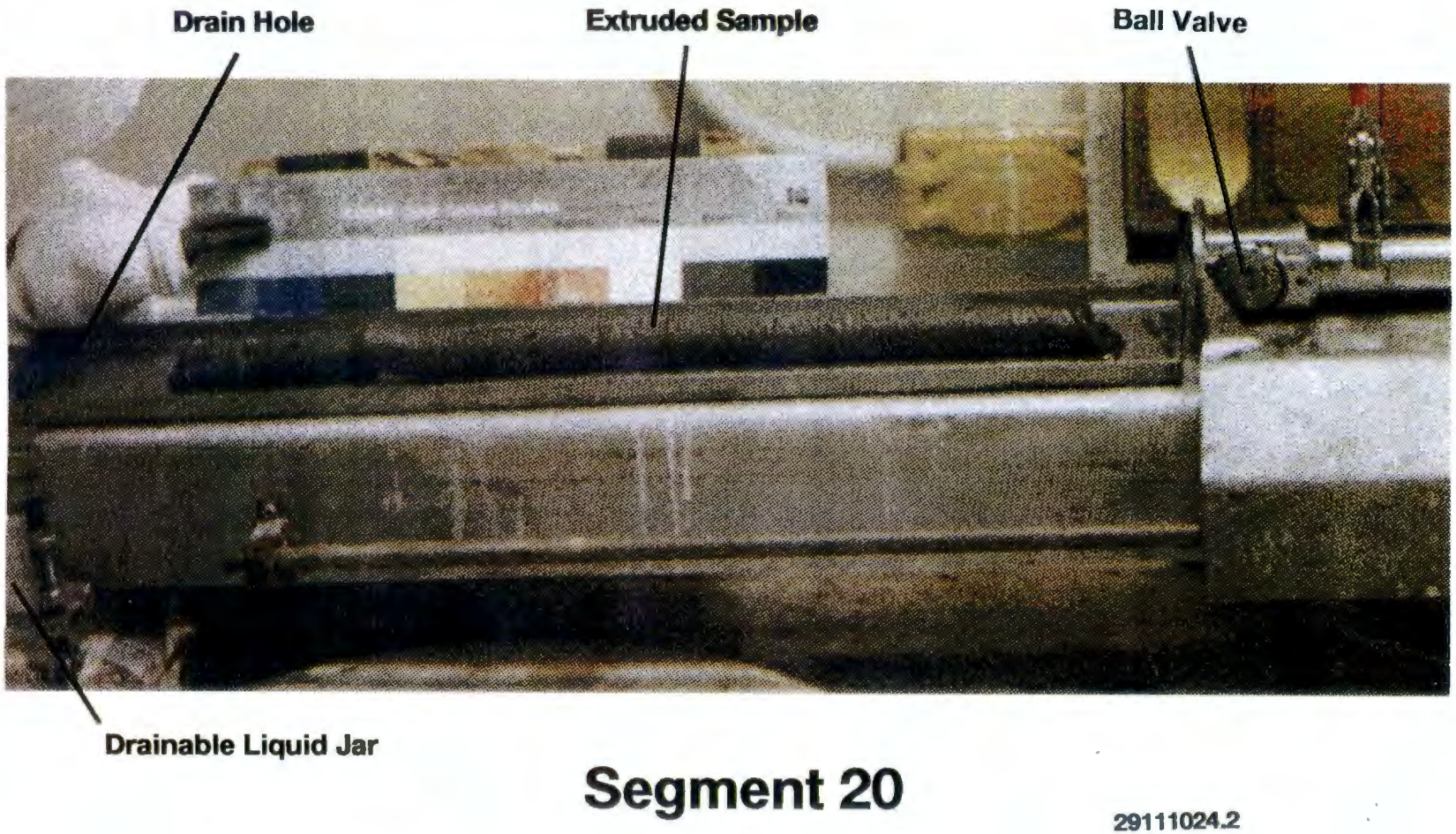

Figure D-2. Segment 20, Non-convective Layer, Window C Core Sample.

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APPENDIX E

DOUBLE-SHELL TANK 241-SY-101

ANALYTICAL METHODS AND PROCEDURES

WINDOWS C AND E

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Table E-1 delineates the methods and procedure numbers performed on Tank 241-SY-101 waste samples (Herting et al. 1992a; Herting et al. 1992b).

Table E-1. Analytical Methods and Procedures for Tank 241-SY-101 Windows C and E (2 sheets).

Analytical Component	Method	Procedure Number
Acid Digestion for Solids	ICP and AAS	LA-505-159
Total Alpha	APC	LA-548-11/LA-548-104
Ammonia	Kjeldahl	LA-634-102
Total Beta	BPC	LA-508-101
Carbonate	Coul. Titration	LA-622-102
Chromium (VI)	Spectrophoto.	PNL-ALO-227
Cyanide	mDist. Spec.	LA-695-102
Differential Scanning Calorimetry	DSC	TO42-A-01-712F
Fusion with Alkali Metal Hydroxide	---	LA-508-052
Gamma Energy Analysis	GEA	LA-548-121/LA-508-052
Hydride Atomic Absorption for As and Se	AAS	LA-355-131/LA-365-131
Hydroxide	Titration	LA-661-102
Inductively Coupled Plasma Spectrometry	ICP	LA-505-151
Iodine-129	GEA	LA-378-103/LA-508-052
Ion Chromatography	IC	LA-533-105
Mercury	CVAA	LA-325-102
Neptunium-237	AEA	LA-933-141
Nitrite	IC and Spec.	LA-533-105/LA-645-001
pH (Hydrogen Ion)	+H	LA-212-102/LA-212-103
Americium-341 and Plutonium-239/240	APC	LA-503-156/LA-542-101
SVOA	GC/MS	PNL-ALO-340/PNL-ALO-345
Strontium-90	BPC	LA-220-101
Technetium-99	LSC	LA-508-121
Thermogravimetric Analysis	TGA	TO45-A-01-712F
Total Organic Carbon (TOC)	Coul.	LA-344-101
TOC by Chemical Oxidation	Coul. Titrat.	(TOC-PNL)/7-40.47

Table E-1. Analytical Methods and Procedures for Tank 241-SY-101 Windows C and E (2 sheets).

Analytical Component	Method	Procedure Number
Uranium	LF	LA-928-106
VOA	GC/MS	PNL-ALO-330/PNL-ALO-335
Water Leach of Solids	---	LA-504-101
Water Analysis by Gravimetry (%H_2O)	Grav	LA-514-113/LA-564-101
% H_2O by Karl Fischer Titration	KF	LA-560-150

REFERENCES

Herting, D.L., D.B. Bechtold, B.A. Crawford, T.L. Welsh, and L. Jensen, 1992a, *Laboratory Characterization of Samples Taken in May 1991 from Hanford Waste Tank 241-SY-101*, WHC-SD-WM-DTR-022, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Herting, D.L., D.B. Bechtold, B.E. Hey, B.D. Keele, L. Jensen, and T.L. Welsh, 1992b, *Laboratory Characterization of Sample Taken in December 1991 (Window E) from Hanford Waste Tank 241-SY-101*, WHC-SD-WM-DTR-026, Westinghouse Hanford Company, Richland, Washington.

APPENDIX F

TYPICAL THERMODYNAMIC SCANS OF TANK 241-SY-101 SAMPLES

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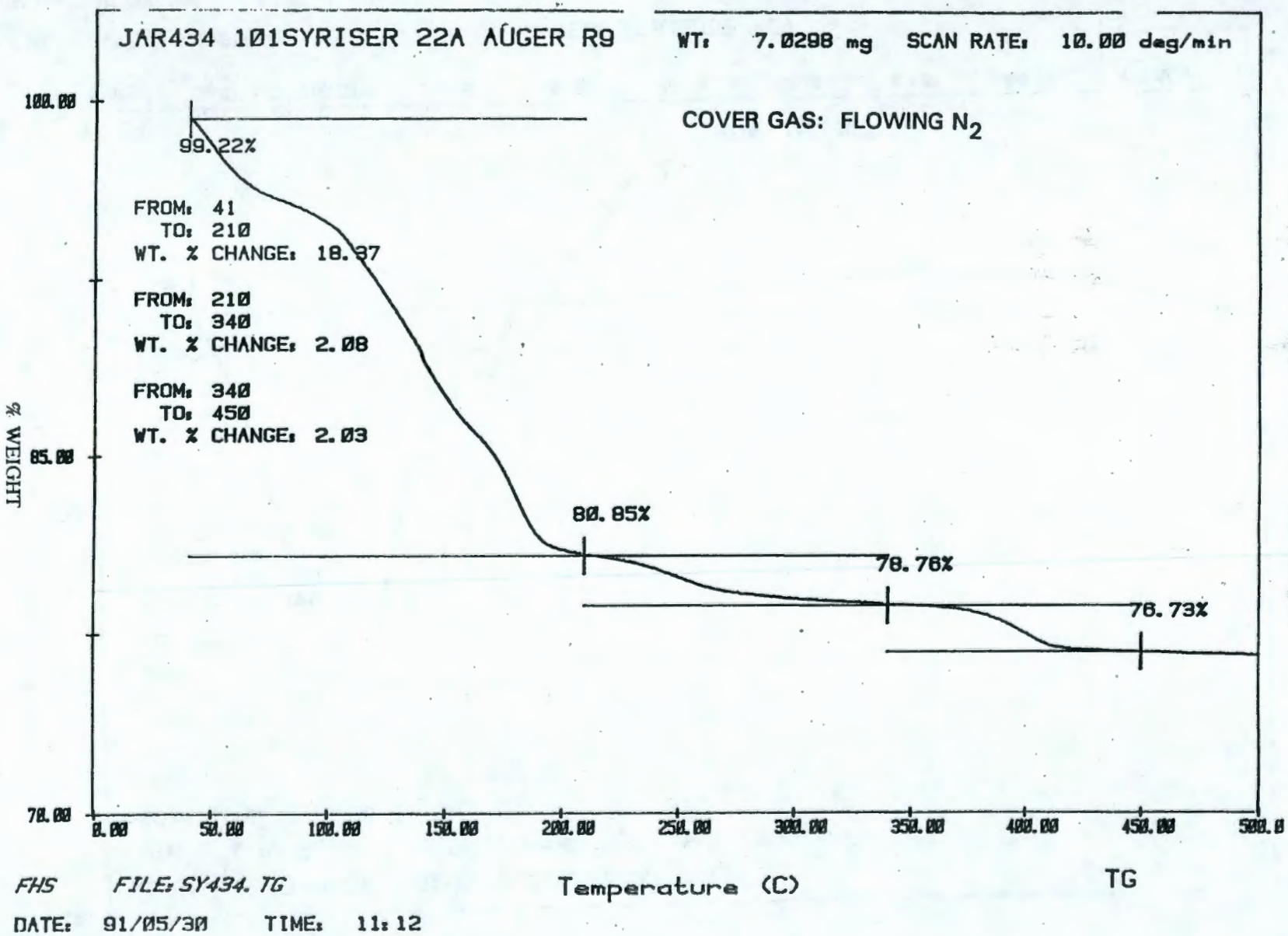

Figure F-1. Typical Thermogravimetric Analysis Scan for a Tank 241-SY-101 Waste Sample.

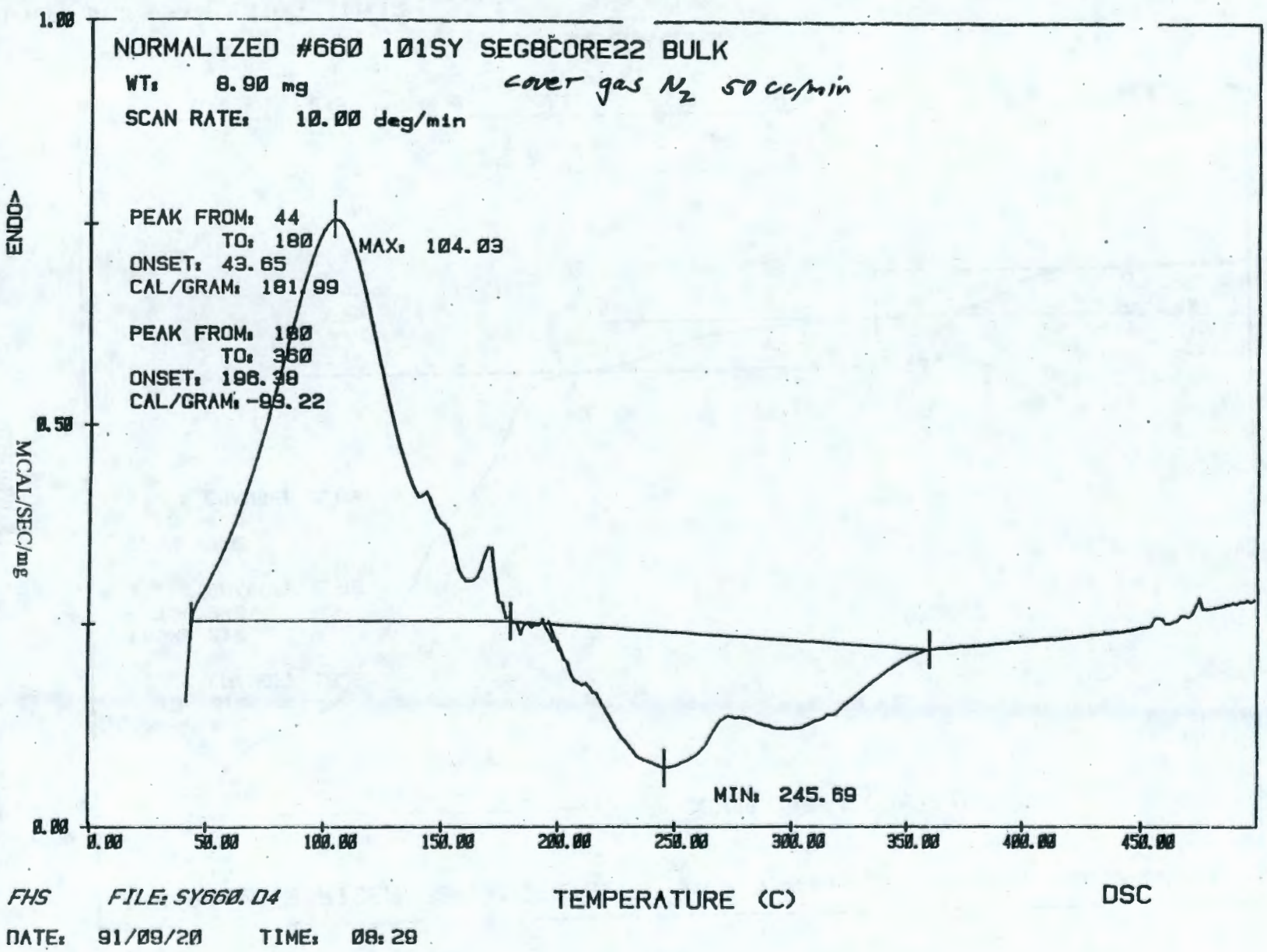

Figure F-2. Typical Differential Scanning Calorimetry Scan for a Tank 241-SY-101 Waste Sample.

REFERENCE

Herting, D.L., D.B. Bechtold, B.A. Crawford, T.L. Welsh and, L. Jensen, 1992b, *Laboratory Characterization of Samples Taken in May 1991 from Hanford Waste Tank 241-SY-101*, WHC-SD-WM-DTR-024, Westinghouse Hanford Company, Richland, Washington.

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