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# Tank Characterization Report for Single-Shell Tank 241-SX-108

Robert F. Eggers
Westinghouse Hanford Company, Richland, WA 99352
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Abstract: This document summarizes the information on the historical uses, present status, and the sampling and analysis results of waste stored in Tank 241-SX-108. This report supports the requirements of Tri-Party Agreement Milestone M-44-09.



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# Tank Characterization Report for Single-Shell Tank 241-SX-108

R. F. Eggers
Westinghouse Hanford Company

J. D. Franklin
B. J. Morris
T. T. Tran
Los Alamos Technical Associates

Date Published
July 1996

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Westinghouse Hanford Company P.O Box 1970 Richland, Washington

Management and Operations Contractor for the
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## EXECUTIVE SUMMARY

This tank characterization report summarizes information on the historical uses, current status, and sampling and analysis results of waste stored in single-shell underground tank 241-SX-108. This report supports the requirements of the *Hanford Federal Facility Agreement and Consent Order* Milestone M-44-09 (Ecology et al. 1996).

This report is based on auger samples taken from two risers. The auger devices used to take the samples penetrated about the top 48 cm (19 in.) of solid waste on the bottom of the tank. The results described below apply only to the top layer of solid waste sampled by augers. Rotary mode core samples of the waste are planned for fiscal year 1998 (Stanton 1996). Based on the analysis of these samples, the following was determined:

- No safety notification limits were exceeded for samples of solid waste
- The vapor above the solid waste did not exceed the notification limit for flammable gas
- The solid waste meets the criteria for reduction-oxidation (REDOX) process high-level waste, except for the 38 to 56 percent moisture content criterion; the waste has dried out since it was transferred into the tank, and contains only about 2 percent moisture.

Tank 241-SX-108 is one of 15 single-shell underground waste storage tanks located in the 200 West Area SX Tank Farm on the Hanford Site. It is the second tank in a three-tank

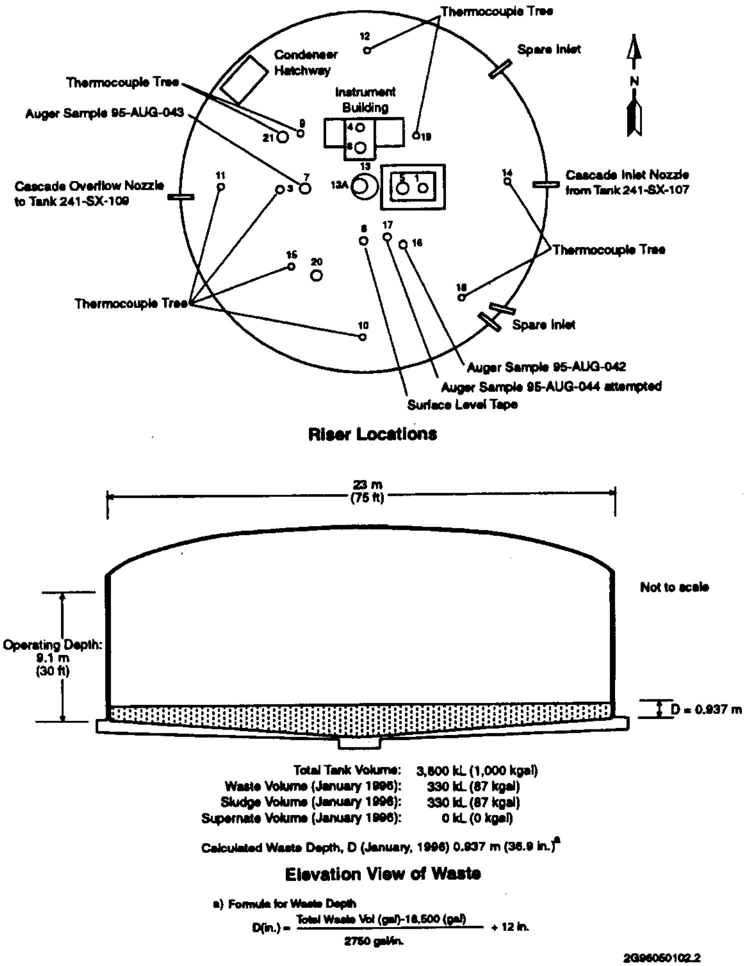
cascade series and was one of the first tanks designed for self-boiling waste. Although it is an actively ventilated, high-heat-load tank, it is not on a Watch List. The tank went into service in November 1955, receiving REDOX high-level waste. Because it was a self-boiling tank, tank 241-SX-108 was connected to an exhauster and waste contained in the tank was allowed to self concentrate. This occasionally increased the heat load on the ventilation system, and the condensate from the self-boiling process was directed back to the tank to maintain an even cooling rate. From 1959 to 1963, frequent transfers were made to tank 241-SX-108 from tanks 241-SX-105, 241-SX-106, and 241-SX-115. These transfers involved condensate from self-boiling actions, as well as REDOX high-level waste generated from 1952 to 1957 (R1) and REDOX high-level waste generated from 1958 to 1966 (R2). In 1967, tank 241-SX-108 was declared an assumed leaker and removed from service. Administrative interim stabilization was completed in August 1979 and intrusion prevention in December 1982.

A description and status of tank 241-SX-108 are given in Table ES-1 and Figure ES-1. The tank has an operating capacity of 3,800 kL (1,000 kgal) and presently contains an estimated 330 kL (87 kgal) of waste. Hanlon (1996) classifies all of the waste as sludge, but analysis of auger samples from the top 48 cm (19 in.) indicate that sodium nitrate is a major compound in the waste. It is therefore projected that the waste from the top 48 cm is a mixture of soluble and insoluble compounds. The likelihood that the waste is a mixture of soluble and insoluble compounds is important to the waste retrieval process. Also, according to Hanlon (1996), the waste contains an estimated 19 kL (5 kgal) of drainable interstitial liquid.

Table ES-1. Description and Status of Tank 241-SX-108.

| TANK DESCRIPTION | |
|---|---|
| Type | Single-shell |
| Constructed | 1953-1954 |
| In-service | November 1955 |
| Diameter | 23 m (75 ft) |
| Maximum operating depth | 9.1 m (30 ft) |
| Capacity | 3,800 kL (1,000 kgal) |
| Bottom Shape | Dish |
| Ventilation | Actively ventilated |
| **TANK STATUS** | |
| Waste classification | Noncomplexed |
| Total waste volume | 330 kL (87 kgal) |
| Sludge volume | 330 kL (87 kgal) |
| Drainable interstitial liquid | 19 kL (5 kgal) |
| Waste surf. level (1991 - 1993)<br>Waste surf. level (1st and 2nd QTR 1994)<br>Waste surf. level (July 1994)<br>Waste surf. level (April 1996) | 940 mm (37 in.)<br>Fluctuating<br>826 mm (32.5 in.)<br>826 mm (32.5 in.) |
| Highest Temp. - Tree 2, T/C #1 (11/5/95)<br>Highest Temp. - Tree 8, T/C #1 (11/5/95)<br>Overall Highest -Tree 8, T/C #1<br>(1/1989-12/1993) | 88 deg. C (191 deg. F)<br>91 deg. C (196 deg. F)<br><br>107 deg. C (224 deg. F) |
| Integrity | Assumed leaker 1967 |
| Watch List | None |
| **SAMPLING DATES** | |
| Auger samples | September 15 to 25, 1995 |
| **SERVICE STATUS** | |
| Removed from service | 1967 |
| Interim stabilized | August 1979 |
| Intrusion prevention | December 1982 |

Figure ES-1. Tank 241-SX-108 Riser Locations and Elevation View of Waste.



The exact reason(s) for changes in the measured value of the height of the waste, as shown in Table ES-1, are not known. Possible reasons include: 1) changing from the conductivity probe method of detecting the top of the waste to the "slack tape" method; 2) creating a hole in the waste surface by repeated deployment of the probe; 3) changes in the waste surface. Because of this uncertainty, waste surface levels and volumes are considered approximate.

Tank SX-108 contains two layers of REDOX high-level waste, which are of interest to the Historical DQO and the Pretreatment DQO. The waste in tank SX-108 generates a lot of heat and consequently has become dry and hard. Solidified REDOX waste poses a substantial technical challenge to waste retrieval, pretreatment, and final treatment activities.

A decision was made to sample tank 241-SX-108 by the auger method in 1995 rather than waiting to sample it by the rotary-mode method. The push-mode method could not be used because the waste is dry and hard. The rotary mode system can probably sample the waste successfully, but has not been available because it has been undergoing modification for use in flammable gas tanks.

The time required to modify the rotary mode system, and the relatively low priority of tank SX-108 for rotary mode sampling, has caused the date for rotary mode sampling to move out to 1998 (Stanton 1996). The auger method of sampling was considered capable of obtaining enough REDOX waste to provide the information needed.

The information learned from the 1995 auger sampling event will aid in preparing sampling plans for other tanks with the same type of waste and will contribute to the resolution of several outstanding technical questions regarding the composition and properties of REDOX waste.

Acquisition of three auger samples was attempted from risers 7, 16, and 17, but no sample material was obtained from riser 17. The samples from risers 7 and 16 were labeled auger samples 95-AUG-042 and 95-AUG-043. Both auger samples were analyzed at the 222-S Laboratory in accordance with the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995), the *Strategy for Sampling Hanford Site Tank Wastes for Development of Disposal Technology* (Kupfer et al. 1995), and the *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995). The requirements of the three data quality objectives (DQOs) were integrated by the *Tank 241-SX-108 Auger Sampling and Analysis Plan* (Eggers 1995a).

The safety screening DQO (Dukelow et al. 1995) requires analyses for fuel content using differential scanning calorimetry (DSC), percent water by thermogravimetric analysis (TGA), total alpha activity through alpha proportional counting, and bulk density. Before samples were removed from the tank, combustible gas meter readings were taken from within the tank headspace as required by the safety screening DQO.

As part of their new process development work to support disposal activities, the Pacific Northwest National Laboratory is performing sludge washing tests on tank SX-108 samples. Characterization results from these studies will be addressed in a future revised version of this tank characterization report. Analyses required by the historical DQO included bulk density, energetics, and moisture content, in addition to metal concentrations by inductively coupled plasma (ICP), anion concentrations by ion chromatography spectroscopy (IC), total organic carbon (TOC) by persulfate and coulometry, uranium by phosphorescence, and total beta analysis (Eggers 1995a). Bulk density measurements were not carried out, because the sample material was very dry and flighty and because some individual samples produced radiological dose rates exceeding 90 R/hr.

None of the notification limits established by the safety screening DQO were exceeded. None of the DSC scans exhibited exothermic reactions. Total alpha activity results for both augers were well below the safety screening notification limit of 41 $\mu$Ci/g. The highest result for the auger samples was 5.4 $\mu$Ci/g, indicating that the potential for a criticality is low. The highest 95 percent upper confidence limit for total alpha activity was 7.35 $\mu$Ci/g.

An Industrial Health and Safety vapor survey using a combustible gas meter, performed before the tank was sampled, found the flammable vapor concentration to be 0 percent of the lower flammability limit (LFL), satisfying the DQO requirement of less than 25 percent of the LFL. Because auger sampling the top 48 cm (19 in.) of waste does not provide a complete profile of the solid waste, safety screening for this tank will not be complete until at least two cores of the waste to the bottom of the tank have been obtained and analyzed

(Eggers 1996). According to Stanton (1996), tank SX-108 is scheduled to be rotary mode core sampled during 1998.

The requirements of the pretreatment DQO were met by providing samples of tank 241-SX-108 waste to the Pacific Northwest National Laboratory (PNNL) for analysis. Material from both auger samples was set aside for pretreatment studies as identified in the pretreatment DQO (Kupfer et al. 1995). One sample was provided from the lower half of sample 95-AUG-042 and one from the upper half of sample 95-AUG-043.

An historical evaluation was performed on both auger samples as prescribed in the historical DQO (Simpson and McCain 1995). The fingerprint analytes were sodium, aluminum, chromium, cesium-137, strontium-90, and water. Comparisons were made between the analytical results and the DQO-defined reference levels for these analytes. Except for percent water, results for all fingerprint analytes met the criteria for passing the fingerprint test. The measured value of moisture content is about 2 percent. To pass the fingerprint test, the measured value of analyte concentration in the waste must be at least 10 percent of the reference value specified in the historical DQO. Once the fingerprint test has been passed, further analyses (secondary analyses) must be performed. One of these analyses is TOC (total organic carbon). The established notification limit for TOC is 30,000 $\mu$g C/g. Results ranged from 90.7 to 1,680 $\mu$g C/g (average of sample and duplicate values) with a mean of 900 $\mu$g C/g.

Because only the top 48 cm (19 in.) of waste were sampled, a tank heat load based on the 1995 analytical data could not be calculated. An estimate of 7.48 kW (25,500 Btu/hr) was available from the historical tank content estimate (HTCE) (Brevick et al. 1994a). The value estimated from the headspace temperature is 16.4 kW (56,000 Btu/hr) (Kummerer 1994). Surveillance data show tank temperatures ranging from about 47 °C (117 °F) to 107 °C (224 °F), during the period January 1989 to the present.

The waste surface level has remained about the same (826 mm [32.5 in.]) from July 1994 to the present. The most recent manual tape reading was 826 mm (32.5 in.) on April 2, 1996.

Table ES-2 provides concentrations for the most prevalent analytes and analytes of concern based on the 1995 analytical results.

Table ES-2. Major Analytes and Analytes of Concern in Waste.

| Metals | Mean Value µg/g | Relative Standard Deviation (%) |
|---|---|---|
| Aluminum | 38,100 | 37.4 |
| Calcium | 1,750 | 50.2 |
| Chromium | 9,070 | 13.7 |
| Iron | 17,900 | 42.13 |
| Manganese | 5,990 | 49.3 |
| Nickel | 1,190 | 46.4 |
| Silicon | 1,090 | 49.1 |
| Sodium | 1.85E+05 | 17.2 |
| Sulfur | 1,960 | 40.5 |
| Uranium | 7,540 | 56.5 |
| **Anions** | **µg/g** | **%** |
| Chloride | 2,160 | 23.9 |
| Nitrate | 3.72E+05 | 553.4 |
| Nitrite | 15,700 | 30.0 |
| Oxalate | 3,130 | 42.0 |
| Sulfate | 6,890 | 14.9 |
| **Radionuclides** | **µCi/g** | **%** |
| Total Alpha | 3.29 | 45.6 |
| Total Beta | 6,930 | 52.1 |
| $^{89/90}Sr$ | 3,070 | 52.3 |

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## CONTENTS (Continued)

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## LIST OF TABLES

## LIST OF TABLES (Continued)

## LIST OF TERMS

| | |
|---|---|
| ANOVA | analysis of variance |
| Btu/hr | British thermal unit per hour |
| Ci | curies |
| cm | centimeter |
| c/s | counts per second |
| DQO | data quality objective |
| DSC | differential scanning calorimetry |
| ft | feet |
| gal | gallons |
| g | grams |
| g/L | grams per liter |
| g/mL | grams per milliliter |
| GEA | gamma energy analysis |
| HDW | Hanford Defined Waste |
| HTCE | Historical Tank Content Estimate |
| in | inch |
| IC | ion chromatography |
| ICP | inductively coupled plasma spectroscopy |
| J/g | joules per gram |
| kg | kilograms |
| kgal | kilogallons |
| kL | kiloliters |
| kW | kilowatts |
| LFL | lower flammability limit |
| m | meter |
| M | moles per liter |
| mm | millimeter |
| mR/hr | milliroentgen per hour |
| ppm | parts per million |
| PNNL | Pacific Northwest National Laboratory |
| QC | quality control |
| R1 | REDOX high-level waste generated from 1952 to 1957 |
| R2 | REDOX high-level waste generated from 1958 to 1966 |
| REDOX | reduction-oxidation |
| R/hr | roentgens per hour |
| RSD | relative standard deviation |
| SAP | sampling and analysis plan |
| TLM | Tank Layer Model |
| TGA | thermogravimetric analysis |
| TOC | total organic carbon |
| W | watts |

**LIST OF TERMS (Continued)**

| | |
|---|---|
| WHC | Westinghouse Hanford Company |
| WSTRS | Waste Status and Transaction Record Summary |
| wt% | weight percent |
| °C | degrees Celsius |
| °F | degrees Fahrenheit |
| μg C/g | micrograms carbon per gram |
| μCi/g | microcuries per gram |
| μeq/g | microequivalents per gram |
| μg/g | micrograms per gram |

# 1.0 INTRODUCTION

This tank characterization report summarizes the information on the historical uses, current status, and sampling and analysis results of waste stored in single-shell tank 241-SX-108. The tank was sampled in 1995 to satisfy the requirements of: *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995), the *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995), and the *Strategy for Sampling Hanford Site Tank Wastes for Development of Disposal Technology* (Kupfer et al. 1995). This report supports the requirements of the *Hanford Federal Facility Agreement and Consent Order* Milestone M-44-09 (Ecology et al. 1996).

Tank 241-SX-108 was removed from service in 1967 and interim stabilized in 1979. Consequently, the composition of the waste should not change appreciably until pretreatment and retrieval activities commence. The waste analyte concentration measurements reported in this document reflect the current composition of the waste based on available data. Tank 241-SX-108 is not on any Watch Lists.

## 1.1 PURPOSE

This report summarizes information concerning the use and contents of tank 241-SX-108. When possible, this information will be used to assess issues associated with safety, operations, environmental, and process activities. This report also serves as a reference point for more detailed information about tank 241-SX-108.

## 1.2 SCOPE

Auger samples were taken in September of 1995. Prior to retrieving these samples, tank headspace vapors were measured using a combustible gas meter to determine the lower flammability limit of the vapors. Auger samples 95-AUG-042 and 95-AUG-043 were analyzed to comply with the requirements of the safety screening, pretreatment, and historical DQOs. Because sampling the top of the waste does not provide a complete profile of all of the solid waste in the tank, the safety screening analyses for this tank will not be complete until cores to the bottom of the tank from at least two risers have been obtained and analyzed. However, subsampling and analyses performed on the auger samples did meet the requirements of the pretreatment and historical DQOs.

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# 2.0 HISTORICAL TANK INFORMATION

This section describes tank 241-SX-108 based on current and historical information. The first part details the current condition of the tank. The next part discusses the tank's background, transfer history, and the process sources that contributed to the tank waste, including an estimate of the current contents based on the process history. Conditions that may be related to tank safety, such as potentially hazardous tank contents or off-normal operating temperatures, are included. The final part summarizes available surveillance data for the tank. Solid and liquid level data are used to determine tank integrity (leaks) and to provide clues to internal activity in the solid layers of the tank. Temperature data are provided to evaluate the heat-generating characteristics of the waste.

## 2.1 TANK STATUS

As of January 31, 1996, tank 241-SX-108 contained an estimated 330 kL (87 kgal) of noncomplexed waste (Hanlon 1996). Liquid volume was determined using a photographic evaluation method, and solids volume was determined using a manual tape surface level gauge. The last solids volume estimate reported in Hanlon (1996) was performed in December 1993. The volume of the various waste phases found in the tank are shown in Table 2-1.

Table 2-1. Estimated Tank Contents.[1]

| Waste Form | Estimated Volume[2] | |
|---|---|---|
| | kL | kgal |
| Total waste | 330 | 87 |
| Supernatant liquid | 0 | 0 |
| Drainable interstitial liquid | 19 | 5 |
| Drainable liquid remaining | 19 | 5 |
| Pumpable liquid remaining | 0 | 0 |
| Sludge | 330 | 87 |
| Saltcake | 0 | 0 |

Notes:

[1]Hanlon (1996)

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

In 1962, tank 241-SX-108 was suspected of being a leaker and in 1967 was declared an assumed leaker (with a leak volume between 9 kL (2.4 kgal) and 132 kL (35 kgal)) and removed from service. Administrative interim stabilization was completed in August 1979 and intrusion prevention in December 1982.

This tank is a high-heat-load tank, although not on a Watch List, and is actively ventilated. All monitoring systems were in compliance with documented standards as of January 31, 1996 (Hanlon 1996).

## 2.2 TANK DESIGN AND BACKGROUND

The 241-SX Tank Farm was built between 1953 and 1954, and consists of fifteen type IV, 3,800-kL (1,000-kgal) single-shell tanks. Nine of these tanks were the first tanks designed for self-boiling waste, and the original construction included underground duct headers connected to a common condenser-ventilation system. These tanks were designed for a maximum temperature of 121 °C (250 °F), pH values from eight to ten, and a boiling period of one to five years. Tank 241-SX-108 has four air lift circulators to help prevent sludge settling and to control waste temperatures. This tank is equipped to cascade to tank 241-SX-109 and is second in the three-tank step series cascade that includes tank 241-SX-107. Tank 241-SX-108 has 22 risers ranging in size from 64 mm (2.5 in.) to 460 mm (18 in.) in diameter that provide surface level access to the underground tank. Tank 241-SX-108 has three 305-mm (12-in.)-diameter risers (numbers 7, 16, and 17) available for use. If used as sampling ports, the risers would give access to a moderate area near the middle of the tank.

Tank 241-SX-108 entered service in November of 1955. The single-shell tank is constructed of 610-mm (2-ft)-thick concrete on the lower portion of the tank walls and 380-mm (1.25-ft)-thick reinforced concrete on the upper part of the walls. The liner on the bottom and sides is 9.5-mm (0.375-in.) mild carbon steel. The dome of the tank is 380-mm (1.25-ft)-thick concrete. This tank has a 305-mm (12-in.) dish bottom, no knuckle, a 9.53-m (31.25-ft) liner height, and a 9.1-m (30-ft) operating depth. The tank is set on a reinforced concrete foundation. Various coatings and sealants were used to seal the inside and outside of the liner, dome, risers, and manholes to prevent leaks and intrusions. The steel liner and risers were given one coat of red lead paint. The exposed interior concrete surfaces were given three coats of magnesium zincfluorosilicate. The tank was covered with approximately 2.2 m (7.25 ft) of overburden.

The tank surface level is monitored quarterly with a manual tape through riser number 2. A list of tank 241-SX-108 risers, showing the size and general use, is provided in Table 2-2. A plan view that depicts the riser configuration and relative locations is shown as Figure 2-1. A tank cross-section showing the approximate waste level along with a schematic of the tank equipment is found in Figure 2-2. This constitutes all installed equipment for tank 241-SX-108.

Table 2-2. Tank 241-SX-108 Risers.[1,2] (2 sheets)

| Riser Number | Diameter (inches) | Description and Comments |
|---|---|---|
| R1 | 4 | Pit drain |
| R2 | 4 | Liquid level reel in housing |
| R3 | 4 | Thermocouple tree - unused |
| R4 | 4 | Covered with concrete |
| R5 | 12 | Pump |
| R6 | 12 | Weather covered |
| R7 | 12 | Flange, spare, benchmark |
| R8 | 12 | Air circulator lines |
| R9 | 2.5 | Thermocouple tree, to CASS |
| R10 | 2.5 | Thermocouple tree, to CASS, weather covered |
| R11 | 2.5 | Thermocouple tree, to CASS, weather covered |
| R12 | 2.5 | Thermocouple tree, to CASS, weather covered |
| R13 | 42 | Caisson |
| R13A | 18 | Air inlet filter |
| R14 | 2.5 | Thermocouple tree, to CASS, weather covered |
| R15 | 2.5 | Thermocouple tree, to CASS, weather covered |
| R16 | 12 | Flange with bale |
| R17 | 12 | Observation port, benchmark |
| R18 | 2.5 | Thermocouple tree, to CASS, weather covered |
| R19 | 2.5 | Thermocouple tree, to CASS, weather covered |
| R20 | 18 | Exhauster port |
| R21 | 12 | Thermocouple tree - unused |
| **Nozzle Number** | **Diameter (inches)** | **Description and Comments** |
| N1 | 5 | Spare nozzle |
| N2 | 4 | Cascade inlet nozzle |
| N3 | 4 | Cascade outlet nozzle |
| N4 | 3.5 | Spare nozzle |
| N5 | 4 | Sludge level measurement |

Notes:

CASS = Computer automated surveillance system

[1]Alstad (1993)

[2]Hanford Site Drawings:

H-2-33907, Rev. 1 (Isochem Incorporated 1968)
H-2-34064, Rev. 2 (Isochem Incorporated 1970)
H-2-73211, Rev. 2 (Vitro 1985)
H-2-36568, Rev. 0 (Atlantic Richfield Hanford Company 1972)

Figure 2-1. Riser Configuration for Tank 241-SX-108.

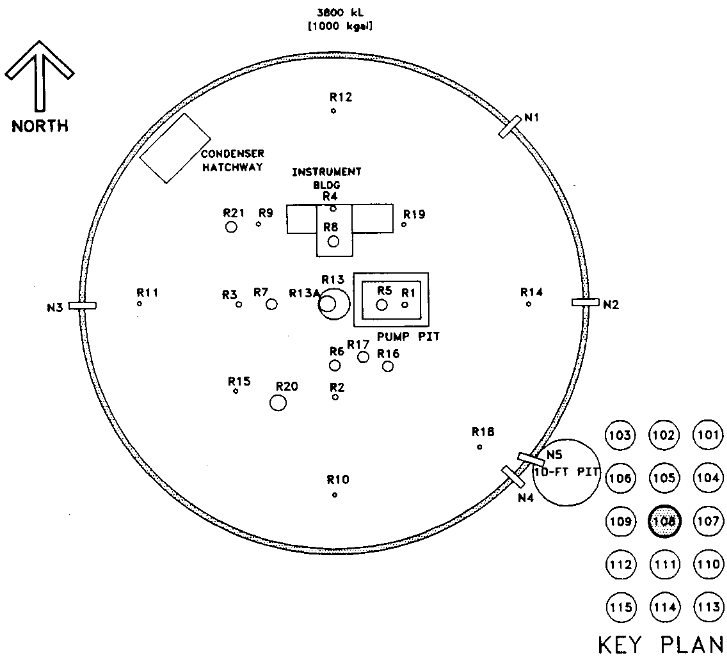
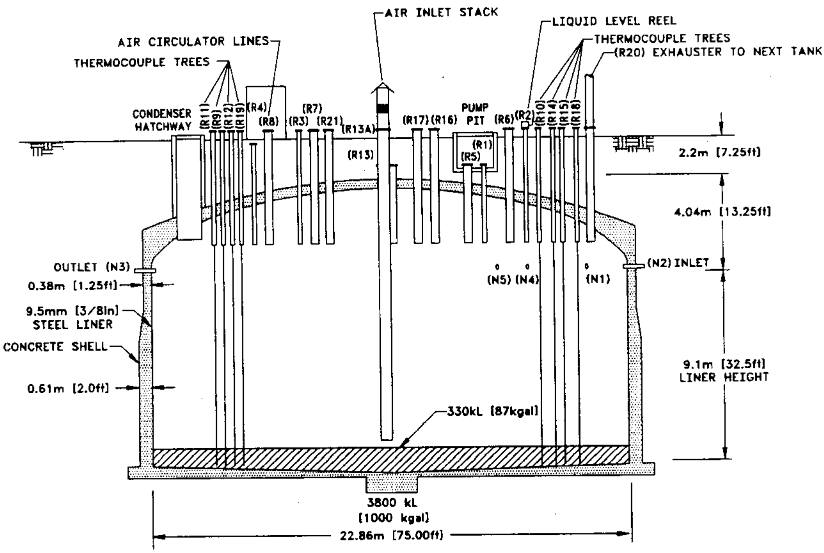


Figure 2-2. Tank 241-SX-108 Configuration.




## 2.3 PROCESS KNOWLEDGE

These sections present the transfer history of tank 241-SX-108 and describe the process wastes that made up these transfers. This is followed by an estimate of current tank contents based on transfer history.

### 2.3.1 Waste Transfer History

Reduction-oxidation (REDOX) high-level waste produced in the S Plant REDOX process from 1952 to 1957 is referred to as R1 waste. REDOX high-level waste produced from 1958 to 1966 is referred to as R2 waste. REDOX Plant R1 and R2 wastes were transferred to tank 241-SX-108 from 1955 to 1964.

The tanks in the 241-SX tank farm were self-boiling tanks, and tank 241-SX-108 was connected to an exhauster. As a result, waste contained within tank 241-SX-108 became self concentrated. The condensate from the self-boiling process was directed back to the tank to maintain an even cooling rate on those occasions when the heat load on the ventilation system increased.

Frequent transfers from tanks 241-SX-105, 241-SX-106, and 241-SX-115 in the 241-SX Tank Farm were made to tank 241-SX-108 from 1959 to 1963. These transfers involved condensate from self-boiling actions, as well as R1 and R2 waste.

Approximately 329 kL (87 kgal) of waste remained in tank 241-SX-108 after the final waste removal in 1974.

Table 2-3. Summary of Tank 241-SX-108 Waste Transfer History.[1]

| Transfer Source | Waste Type Received | Time Period | Estimated Waste Volume[2] | |
|---|---|---|---|---|
| | | | kiloliters | kilogallons |
| S Plant (REDOX) | REDOX high-level waste (R1 and R2) | 1955 - 1964 | 10,369 | 2,739 |
| SX-106 | Condensate waste | 1959 - 1963 | 2,162 | 571 |
| SX-105 | REDOX high-level waste (R1) | 1962 - 1963 | 1,495 | 395 |
| SX-115 | REDOX high-level waste (R1 and R2) | 1963 | 64 | 17 |

Notes:

[1]Agnew et al. (1995b)

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

### 2.3.2 Historical Estimation of Tank Contents

An estimate of the current contents of Tank 241-SX-108 based on historical transfer data is available from the *Historical Tank Content Estimate (HTCE) for the Southwest Quadrant of the Hanford 200 West Area* (Brevick et al. 1994b). The historical data used for the estimate are found in the *Waste Status and Transaction Record Summary for the Southwest Quadrant* (WSTRS) (Agnew et al. 1995b), the *Hanford Defined Waste: Chemical and Radionuclide Compositions* (HDW) (Agnew 1995), and the *Tank Layer Model for Northeast, Southwest, and Northwest Quadrants* (TLM) (Agnew et al. 1995a). The WSTRS is a compilation of available waste transfer and volume status data. The HDW provides the assumed typical compositions for Hanford waste types. In most cases, the available data is incomplete reducing the reliability of the transfer data and the modeling results derived from it. The TLM takes the WSTRS data, models the waste deposition processes, and, using additional data from the HDW (which may introduce more error), generates an estimate of the tank contents. Thus, these model predictions can only be considered an estimate that requires further evaluation using analytical data.

The HTCE (Brevick et al. 1994a) states that tank 241-SX-108 contains, from the bottom to the top, 102 kL (27 kgal) of type R1 waste (REDOX high-level waste generated between 1952 and 1957) and 333 kL (88 kgal) of type R2 waste (REDOX high-level waste generated between 1958 and 1966). This statement conflicts with the current status given in the *Waste Tank Summary Report for Month Ending January 31, 1996* (Hanlon 1996). It is noted in the source document (WSTRS) that there was a change in the tank level status in 1993 from 435 kL (115 kgal) to 330 kL (87 kgal). The conflict will be resolved as more information becomes available.

The waste is stratified, and the largest layer is the bottom layer, consisting of R1 waste. The top layer consists of R2 waste. The R1 sludge layer should contain large quantities of aluminum, iron, chromium, sodium, and nitrites. This waste type will also contain notable quantities of uranium, plutonium, strontium, and cesium. The strontium and cesium quantities are enough to give this waste a large activity. As expected, the R2 waste composition is very similar to the R1 waste composition. The two waste types can be distinguished by observing that particular R2 sludge constituent concentrations will be larger than the same constituents found in the R1 sludge. The constituents are defined as chromium, nitrate, uranium, plutonium, cesium, and strontium. The activity of the R2 layer will be much higher than the R1 layer. The waste constituents in the HTCE for tank 241-SX-108 and their concentrations are presented in Table 2-5.

Figure 2-3. Tank Layer Model for Tank 241-SX-108.

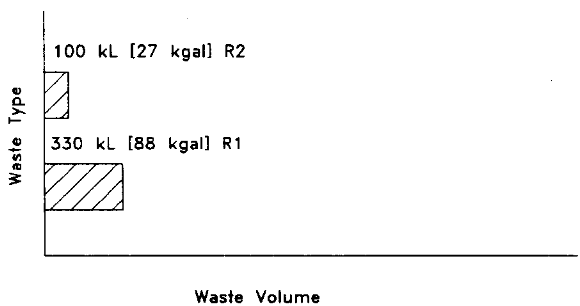


Table 2-5. Tank 241-SX-108 Inventory Estimate
Based on Historical Tank Content Estimate.[1,2,3] (2 sheets)

| Solids Composite Inventory Estimate | | | |
|---|---|---|---|
| **Physical Properties** | | | |
| Total solid waste | 6.76E+05 kg (115 kgal) | | |
| Heat load | 7.48 kW (25,500 Btu/hr) | | |
| Bulk density | 1.55 (g/mL) | | |
| Void fraction | 0.782 | | |
| Water wt% | 61.5 | | |
| Total organic carbon wt% carbon (wet) | 0 | | |
| **Chemical Constituents** | **mole/L** | **ppm** | **kg** |
| $Na^+$ | 2.84 | 42,000 | 28,400 |
| $Al^{3+}$ | 4.49 | 77,900 | 52,700 |
| $Fe^{3+}$ (total Fe) | 0.914 | 32,800 | 22,200 |
| $Cr^{3+}$ | 1.20 | 40,300 | 27,300 |
| $Bi^{3+}$ | 0 | 0 | 0 |
| $La^{3+}$ | 0 | 0 | 0 |
| $Ce^{3+}$ | 0 | 0 | 0 |
| Zr (as $ZrO(OH)_2$) | 0 | 0 | 0 |
| $Pb^{2+}$ | 0 | 0 | 0 |
| $Ni^{2+}$ | 0.0432 | 1,630 | 1,100 |
| $Sr^{2+}$ | 0 | 0 | 0 |
| $Mn^{4+}$ | 0 | 0 | 0 |
| $Ca^{2+}$ | 0.0960 | 2,480 | 1,680 |
| $K^+$ | 0 | 0 | 0 |
| $OH^-$ | 20.5 | 2.25E+05 | 1.52E+05 |
| $NO_3^-$ | 2.01 | 80,300 | 54,300 |
| $NO_2^-$ | 0 | 0 | 0 |
| $CO_3^{2-}$ | 0.0960 | 3,710 | 2,510 |
| $PO_4^{3-}$ | 0 | 0 | 0 |
| $SO_4^{2-}$ | 0.0167 | 1,040 | 700 |
| Si (as $SiO_3^{2-}$) | 0.243 | 4,400 | 2,970 |
| $F^-$ | 0 | 0 | 0 |

Table 2-5. Tank 241-SX-108 Inventory Estimate Based on Historical Tank Content Estimate.[1,2,3] (2 sheets)

| | | | |
|---|---|---|---|
| $Cl^-$ | 0.0420 | 958 | 648 |
| **Chemical Constituents (cont'd)** | **mole/L** | **ppm** | **kg** |
| Citrate | 0 | 0 | 0 |
| $EDTA^{4-}$ | 0 | 0 | 0 |
| $HEDTA^{3-}$ | 0 | 0 | 0 |
| $NTA^{3-}$ | 0 | 0 | 0 |
| glycolate$^-$ | 0 | 0 | 0 |
| acetate$^-$ | 0 | 0 | 0 |
| oxalate$^{2-}$ | 0 | 0 | 0 |
| DBP | 0 | 0 | 0 |
| NPH | 0 | 0 | 0 |
| $CCl_4$ | 0 | 0 | 0 |
| hexone | 0 | 0 | 0 |
| $Fe(CN)_6^{4-}$ | 0 | 0 | 0 |
| **Radiological Constituents** | **Ci/L** | **$\mu$Ci/g** | **Ci** |
| Pu | | 0.0130 | 0.146 (kg) |
| U | 0.0621(M) | 9,510 ($\mu$g/g) | 6,430 (kg) |
| Cs | 0.0959 | 61.7 | 41,700 |
| Sr | 2.48 | 1,600 | 1.08E+06 |

Notes:

[1]Agnew (1995b)

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

[3]Small differences appear to exist among the inventory above and the inventories calculated from the two sets of concentrations. These differences are being evaluated.

## 2.4 SURVEILLANCE DATA

Tank 241-SX-108 surveillance consists of surface level measurements (liquid and solid), temperature monitoring inside the tank (waste and headspace), and leak detection well (drywell) monitoring for radioactivity outside the tank. The data are significant because they provide the basis for determining tank integrity.

Liquid level measurement can provide an indicator of whether or not the tank has a significant leak. Solid surface level measurements provide an indication of surface level and changes in surface level, and can be used to detect changes in the consistency and density of solid layers of waste in the tank. If leakage to the soil occurs, radiation monitors in drywells located around the perimeter of the tank may show increased radioactivity due to leakage out to the soil. Inspecting and interpreting photographs of the tank's interior is another method of determining the presence of water in the waste, estimating waste height, helping to resolve some measurement anomalies, and determining tank integrity.

### 2.4.1 Surface Level Readings

Tank 241-SX-108's surface level is monitored quarterly with a manual tape through riser 2. From 1991 to the end of 1993, the surface level of the waste remained steady at 940 mm (37 in.). Fluctuations were observed in the surface level readings during the first and second quarters of 1994. The readings finally leveled out at 826 mm (32.5) in July 1994, and have remained consistent ever since. The most recent manual tape reading was 826 mm (32.5 in.) on April 2, 1996. A graphical representation of the quarterly surface level measurements can be found in Figure 2-4.

Tank 241-SX-108 does not have a liquid observation well.

### 2.4.2 Internal Tank Temperatures

Tank 241-SX-108 has eight thermocouple trees in risers 9 to 12, 14, 15, 18, and 19. Thermocouple trees 1, 3, 4, 5, and 7 have 4 thermocouples per tree. Thermocouple trees 2 and 8 have 6 thermocouples per tree. Riser 21 was used previously to record temperature data. Data are not available for thermocouple tree 6 in riser 15. Only thermocouple trees 2 and 8 have thermocouples with more than three recorded data points. The highest reading for tree 2 on November 5, 1995 was 88 °C (191 °F) recorded by thermocouple 1. The highest reading for tree 8 on November 5, 1995 was 91 °C (196 °F) recorded by thermocouple 1.

Thermocouples 1 and 3 on tree 2 have temperature readings recorded from January 1989 to December 1993. For thermocouple 1, the maximum temperature is 101 °C (213 °F), the minimum temperature is 84 °C (184 °F), and the average temperature is 91 °C (195 °F). For thermocouple 3, the maximum temperature is 86 °C (187 °F), the minimum temperature is 53 °C (128 °F), and the average temperature is 63 °C (145 °F). Thermocouples 2 and 4 on tree 2 have temperature readings recorded from January 1990 to December 1993. For thermocouple 2, the maximum temperature is 81 °C (178 °F), the minimum temperature is 70 °C (158 °F), and the average temperature is 77 °C (171 °F). For thermocouple 4, the maximum temperature is 61 °C (141 °F), the minimum temperature is 51 °C (124 °F), and the average temperature is 57 °C (135 °F). Thermocouples 5 and 7 on tree 2 have temperature readings recorded from January 1989 to July 1991. For thermocouple 5, the maximum temperature is 65 °C (149 °F), the minimum temperature is 56 °C (133 °F), and the average temperature is 61 °C (141 °F). For thermocouple 7, the maximum temperature is 65 °C (149 °F), the minimum temperature is 54 °C (129 °F), and the average temperature is 58 °C (137 °F).

Thermocouples on tree 8 have temperature readings recorded from January 1989 to December 1993. For thermocouple 1, the maximum temperature is 107 °C (224 °F), the minimum temperature is 87 °C (188 °F), and the average temperature is 92 °C (200 °F). This maximum temperature is the highest temperature recorded for any of the Hanford Site's single-shell tanks. For thermocouple 2, the maximum temperature is 78 °C (172 °F), the minimum temperature is 60 °C (140 °F), and the average temperature is 74 °C (166 °F). For thermocouple 3, the maximum temperature is 86 °C (186 °F), the minimum temperature is 47 °C (117 °F), and the average temperature is 61 °C (141 °F). For thermocouple 4, the maximum temperature is 62 °C (143 °F), the minimum temperature is 50 °C (122 °F), and the average temperature is 58 °C (137 °F). For thermocouple 5, the maximum temperature is 66 °C (150 °F), the minimum temperature is 53 °C (127 °F), and the average temperature is 58 °C (137 °F). For thermocouple 7, the maximum temperature is 66 °C (151 °F), the minimum temperature is 53 °C (127 °F), and the average temperature is 59 °C (139 °F).

Examining temperature readings taken on January 20, 1989 reveals a relatively consistent temperature difference between thermocouple 1 and 7 for all of the thermocouple trees. The lowest temperature difference was for tree 4 which had a 25 °C (45 °F) delta between thermocouples 1 and 7. Thermocouple tree 3 had the highest temperature difference between Thermocouples 1 and 7 at 45 °C (81 °F). The temperature difference between the trees might be attributed to proximity to the walls of the tank or the airlift circulators.

The data for tree 2 shows a slight downward trend in temperature between 1989 and 1993. A similar trend is shown on the graphs for tree 8 except for thermocouple 3, which has wide variations in temperature between January 1990 and March 1992. Tank 241-SX-108 is a high-heat-load tank with a requirement that temperatures are read monthly (although temperatures are often recorded at a more frequent interval). A graph of the weekly high temperature is shown in Figure 2-5.

Plots of the thermocouple readings for tank 241-SX-108 can be found in the *Supporting Document for the Northeast Quadrant Historical Tank Content Estimate Report for SX Tank Farm* (Brevick et al. 1994b).

### 2.4.3 Drywells

Tank 241-SX-108 has six drywells. Drywells 41-08-02 (active prior to 1990, current readings > 200 counts/second (c/s) ), 41-08-04 (active prior to 1990, current readings < 200 c/s), 41-08-07 (active prior to 1990, current readings > 200 c/s), and 41-08-11 (active prior to 1990, current readings > 200 c/s) have or had readings greater than the 50 c/s background radiation. Plotted readings for drywells 41-08-02, 41-08-04, 41-08-07, and 41-08-11 taken from April 1990 to January 1994 are available in the *Supporting Document for the Historical Tank Content Estimate for SX Tank Farm* (Brevick et al. 1994b).

Figure 2-4. Tank 241-SX-108 Level History.

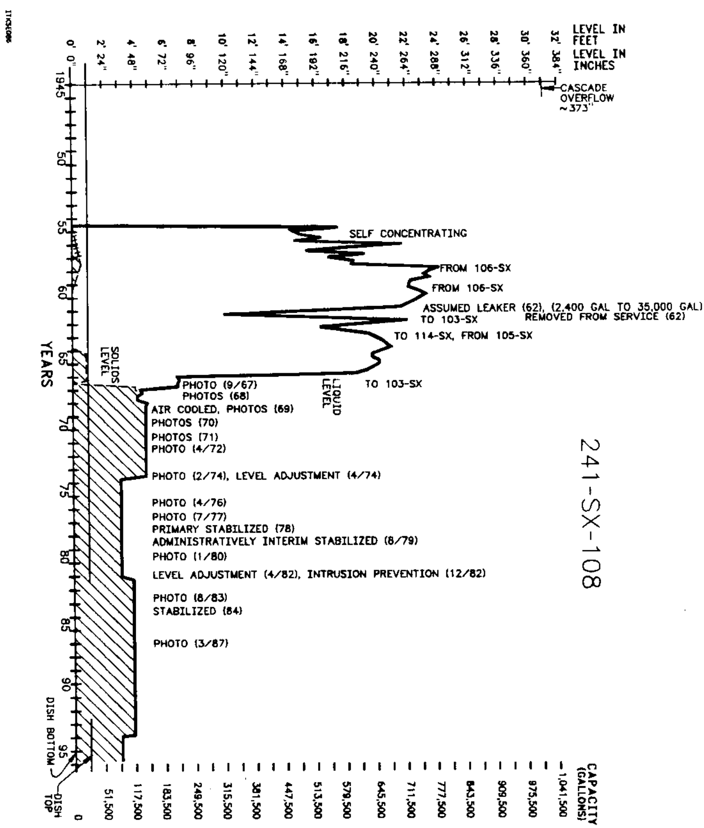
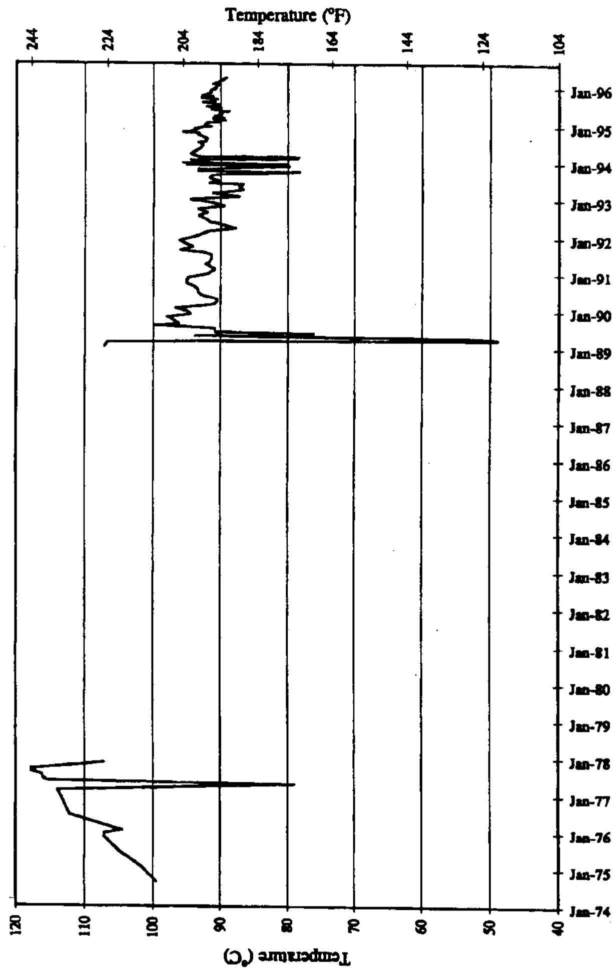


Figure 2-5. Tank 241-SX-108 Weekly High Temperature Plot.



### 2.4.4 Tank 241-SX-108 Photograph

The tank waste appears to be completely dry in the photographic montage. A small amount of brown residue is present on the surface of a light gray solid waste. Because of the low depth of the waste material, the airlift circulators are protruding from the surface of the material. Records indicate that there is a bulge in the bottom of this tank (Atlantic Richfield Company 1967). Thermocouple trees are situated around the perimeter of the tank. Equipment present in the tank includes a turbine pump, a manual tape, risers, and some nozzles. A discarded level measurement tape is on the surface near the center of the tank.

# 3.0 TANK SAMPLING OVERVIEW

This section describes the September 1995 sampling and analysis event for tank 241-SX-108. Auger samples were taken to satisfy the requirements of the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995), the *Strategy for Sampling Hanford Site Tank Wastes for Development of Disposal Technology* (Kupfer et al. 1995), and the *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995). The sampling and analyses were performed in accordance with the *Tank 241-SX-108 Auger Sampling and Analysis Plan* (Eggers 1995a). Further discussions of the sampling and analysis procedures can be found in the *Tank Characterization Reference Guide* (DeLorenzo et al. 1994).

## 3.1 DESCRIPTION OF SAMPLING EVENT

Attempts were made to obtain three auger samples of the top 48 cm (19 in.) of the waste in tank 241-SX-108 from risers 7, 16, and 17. However, no samples were retrieved from riser 17. Two auger samples, 95-AUG-042 and 95-AUG-043, were removed from tank 241-SX-108 through risers 16 and 7 on September 15 and 19, 1995, and were received at the 222-S Laboratory on September 18 and 20, 1995, respectively.

The safety screening DQO requires a vertical profile of the waste from a minimum of two risers separated radially to the maximum extent possible. Because sampling the top of the solid waste with augers does not provide a complete profile of all of the solid waste, the safety screening for this tank will not be completed until cores to the bottom of the tank in at least two risers have been obtained and analyzed.

Primary safety screening analyses are: total alpha activity to determine criticality, DSC to ascertain the fuel energy value, TGA to obtain the total moisture content, bulk density, and tank headspace vapor flammability.

## 3.2 SAMPLE HANDLING

The material recovered from risers 16 and 7 was described as very dry and powdery (Eggers 1995b). Operators working with samples described the material as "dry and flighty" (Eggers 1996). Consistent with this, the auger samples contained no drainable liquid. Also, high dose rates were measured. For these reasons, the analytical laboratory was concerned that problems might occur during the sampling and analysis processes.

Recovered amounts of sample and sample descriptions are summarized in Table 3-1. Each auger sample was divided into lower-half and upper-half samples that were further divided into subsamples for different analytical or archiving requirements as shown in Table 3-2.

Table 3-1. Tank 241-SX-108 Sample Recovery and Description.[1]

| Segment Portion | Drill String Dose Rate (mR/hr) | Recovered Amount (grams) | Sample Description |
|---|---|---|---|
| Auger number 95-AUG-042, Riser 16 | | | |
| Upper half | 250 | 30.8 | Very dry, gray, powdery. No drainable liquid. |
| Lower half | | 50.5 | Some large chunks. No drainable liquid. |
| Auger number 95-AUG-043, Riser 7 | | | |
| Upper half | 1,200 | 135.0 | Dry, gray-black, powdery, with large chunks. No drainable liquid. |
| Lower half | | 9.1 | Fine gray powder. No drainable liquid. |
| Sample number 95-AUG-044, Riser 17 | | | |
| N/A | 1.5 | 0 | N/A |

Note:
[1]Eggers (1996)

Table 3-2. Tank 241-SX-108 Subsampling Scheme.[1]

| Segment Portion | Mass (grams) | Sample Use |
|---|---|---|
| Auger number 95-AUG-042, Riser 16 | | |
| Upper half | 10.3 | Safety screening and historical analyses |
| | 20.5 | Archive sample |
| Lower half | 9.8 | Safety screening and historical analyses |
| | 16.5 | Archive sample |
| | 24.2 | Pretreatment DQO sample sent to PNNL |
| Auger number 95-AUG-043, Riser 7 | | |
| Upper half | 9.5 | Safety screening and historical analyses |
| | 60.6 | Archive sample |
| | 30.0 | Pretreatment DQO sample sent to PNNL |
| Lower half | 4.6 | Safety screening and historical analyses |
| | 2.7 | Archive sample |

Note:
[1]Eggers (1996)

## 3.3 SAMPLE ANALYSIS

The analyses performed on the auger samples were limited to those required by the safety screening and historical DQOs. Additional samples were set aside and shipped to PNNL in accordance with the pretreatment DQO. The required analyses for the safety screening DQO were exotherm energy by DSC, moisture content by TGA, and fissile content by total alpha activity analyses. The historical DQO required anion concentrations by IC, metal concentrations by ICP, bulk density, specific gravity, TOC by persulfate and coulometry, uranium by phosphorescence, and total beta analysis. Weight percent water for auger 95-AUG-042 was remeasured by gravimetry to verify the TGA results. Auger 95-AUG-043 exhibited dose rates that would have caused exposure to laboratory personnel in excess of what was considered reasonable under the circumstances, and therefore was not subjected to gravimetric analysis.

The analytical results from the September auger sampling and analysis effort are reported in *Final Report for Tank 241-SX-108, Auger Samples 95-AUG-042, 95-AUG-043, and 95-AUG-044* (Eggers 1996), and are discussed in Sections 4.0 and 5.0 of this report.

Calibration standards and duplicate measurements were used to check and control all measurements. In addition, for selected measurements, matrix spikes were used to check unspiked sample measurement results. The analytical procedures that used spikes included total alpha, metals measured by ICP, total beta, uranium by phosphorescence, TOC and ions by IC. An assessment of the QC procedures and data is presented in Section 5.1.2 of this report.

A blank segment was analyzed using the following methods: total alpha, gamma energy analysis, strontium 89/90 high level, ICP, TOC by persulfate/coulometry, IC, total beta and uranium by phosphorescence. All reported analyses were performed in accordance with approved laboratory procedures. A list of the sample numbers and applicable analyses is presented in Table 3-3. Table 3-4 shows the analytical procedure by title and number.

Table 3-3. Summary of Samples and Analyses.[1] (2 sheets)

| Auger Number | Riser | Segment Portion | Sample Number | Analyses |
|---|---|---|---|---|
| 95-AUG-042 | 16 | Upper half | S95T002480 | TGA, DSC, gravimetry, TOC, |
| | | | S95T002481 | Total alpha, GEA, high-level $^{90}Sr$ |
| | | | S95T002482 | ICP/acid digest |
| | | | S95T002504 | Archive |
| | | | S95T003881 | IC |
| | | | S95T003882 | ICP/water wash |
| | | | S95T003885 | Total beta, uranium |
| | | Lower half | S95T002489 | TGA, DSC, gravimetry, TOC |
| | | | S95T002500 | Total alpha, GEA, high-Level $^{90}Sr$ |
| | | | S95T002501 | ICP/acid digest |
| | | | S95T002502 | Pretreatment sample |
| | | | S95T002503 | Archive |
| | | | S95T003886 | IC |
| | | | S95T003887 | ICP/water wash |
| | | | S95T003890 | Total beta, uranium |

Table 3-3. Summary of Samples and Analyses.[1] (2 sheets)

| Auger Number | Riser | Segment Portion | Sample Number | Analyses |
|---|---|---|---|---|
| 95-AUG-043 | 7 | Upper half | S95T002567 | TGA, DSC, |
| | | | S95T002572 | Total alpha, GEA, high-level $^{90}Sr$ |
| | | | S95T002573 | ICP/acid digest |
| | | | S95T002574 | Pretreatment sample |
| | | | S95T002575 | Archive |
| | | | S95T003891 | IC |
| | | | S95T003892 | ICP/water wash |
| | | | S95T003895 | Total beta, uranium |
| | | Lower half | S95T002577 | TGA, DSC |
| | | | S95T002578 | Total alpha, GEA, high-level $^{90}Sr$ |
| | | | S95T002579 | ICP/acid digest |
| | | | S95T002580 | Archive |
| | | | S95T000660 | TOC |

Note:

[1]Eggers (1996)

Table 3-4. Analytical Procedures.[1]

| Analysis | Instrument | Preparation Procedure | Procedure Number |
|---|---|---|---|
| Energetics by DSC | Mettler™<br>Perkin-Elmer™ | N/A | LA-514-113, Rev. C-0<br>LA-514-114, Rev. C-0 |
| Percent water by TGA | Mettler™<br>Perkin-Elmer™ | N/A | LA-560-112, Rev. B-0<br>LA-514-114, Rev. C-0 |
| Total alpha activity | Alpha proportional counter | LA-549-141, Rev.D-0 | LA-508-101, Rev. D-2 |
| Total beta activity | Beta proportional counter | LA-549-141, Rev. D-0 | LA-508-101, Rev. D-2 |
| $^{90}$Sr activity | High-level $^{90}$Sr counting | LA-549-141, Rev. D-0 | LA-220-101, Rev. D-1 |
| Metals/acid digest | Inductively coupled plasma spectrometer | LA-505-159, Rev. C-0 | LA-505-161 Rev. B-0 |
| Anions | Ion chromatography | LA-504-101, Rev. E-0 | LA-533-105, Rev. D-1 |
| Total uranium | | LA-549-141, Rev. D-0 | LA-925-009, Rev. A-1 |
| TOC | Persulfate oxidation/ coulometry | N/A | LA-342-100, Rev. C-0 |
| Percent water by gravimetric analysis | Furnace drying and sample weighing | N/A | LA-564-101, Rev. F-1 |
| Metals/water wash | Inductively coupled plasma spectrometer | LA-504-101, Rev. E-0 | LA-505-161, Rev. B-0 |
| Gamma energy analysis | High-purity germanium detector | LA-549-141, Rev. D-0 | LA-548-121, Rev. D-1 |

Notes:

N/A = not applicable
Rev. = revision
Mettler™ is a registered trademark of Mettler Electronics, Anaheim, California.
Perkin-Elmer™ is a registered trademark of Perkins Research and Manufacturing Company, Inc., Canoga Park, California.

[1]Eggers (1996)

# 4.0 ANALYTICAL RESULTS

## 4.1 OVERVIEW

This section presents a summary of the analytical results associated with the September 1995 sampling of tank 241-SX-108. The sampling and analysis were performed as directed in the *Tank 241-SX-108 Auger Sampling and Analysis Plan* (SAP) (Eggers 1995a). This plan integrated all documents related to sampling and analytical requirements, including applicable DQOs. The sampling and analytical requirements for augers 95-AUG-042 and 95-AUG-043 were taken from the safety screening DQO (Dukelow et al. 1995), the pretreatment DQO (Kupfer et al. 1995) and the historical model DQO (Simpson and McCain 1995). Analysis of the two augers was performed at the Westinghouse Hanford Company 222-S Laboratory.

The location of analytical results is given in Table 4-1. Comprehensive analytical data are found in Appendix A. Except for physical data, only analyte overall means are reported in Section 4.

Table 4-1. Analytical Data Presentation Tables.

| Analysis | Tabulated Location |
|---|---|
| Chemical data summary | Table 4-2 |
| Thermogravimetric analysis results | Table 4-3 |
| Differential scanning calorimetry | Table 4-4 |
| 1995 comprehensive analytical data | Appendix A |

Overall means were calculated for all analytes with the exception of DSC. The overall mean for a given analyte was determined by first averaging each of the sample and duplicate pairs to obtain a sample mean. The one exception is the mean for TOC, which is a weighted mean of one auger portion from an auger sample and the mean of two auger portions from the other auger sample. The sample means were then averaged to obtain a subsegment mean, the subsegment means were then averaged to obtain an auger mean, and the two auger means were averaged to obtain the overall mean. The sample, auger, and overall means were each reported as above the detection limit value if 50 percent or more of the contributing values were above the detection limit. If greater than 50 percent of the values contributing to a particular mean were less than the detection limit (denoted with a "less than" [<] symbol), the mean was reported as below the detection limit. The relative standard deviation (RSD) of the mean is a measure of variation and is defined as the standard deviation of the mean divided by the mean, expressed as a percentage.

Quality control tests for the 1995 sampling event included laboratory standard and spike recoveries, tests for blank contamination, and precision checks using the relative percent differences (RPDs) between sample and duplicate analyses.

## 4.2 DATA PRESENTATION

This section summarizes the analytical results from the 1995 sampling of tank 241-SX-108. The following subsections provide information about the chemical and physical nature of the tank waste, and the flammability of the tank headspace vapor. Data from the analysis of augers 95-AUG-042 and 95-AUG-043 were reported in *Final Report for Tank 241-SX-108, Auger Samples 95-AUG-042, 95-AUG-043, and 95-AUG-044* (Eggers 1996).

### 4.2.1 Data Summary

Table 4-2 summarizes the analytical data associated with the 1995 auger sampling event. The means and RSDs were calculated as explained above. The concentrations of the metals by ICP are those from the acid digestion preparation method. Inventory estimates were not calculated because the auger samples did not provide a vertical profile of the tank waste. Core sampling is required to sample to the bottom of the tank.

Table 4-2. Chemical Data Summary for Tank 241-SX-108.[1] (3 sheets)

| Analyte | Mean Concentration | RSD (Mean) |
|---|---|---|
| METALS | μg/g | % |
| Aluminum | 38,100 | 37.4 |
| Antimony | < 112 | N/A |
| Arsenic | < 28.0 | N/A |
| Barium | 139 | 45.7 |
| Beryllium | < 2.80 | N/A |
| Bismuth | 66.4 | 18.3 |
| Boron | 30.3 | 27.2 |
| Cadmium | 17.3 | 55.4 |
| Calcium | 1,750 | 50.2 |
| Cerium | 198 | 47.6 |
| Chromium | 9,070 | 13.7 |
| Cobalt | 18.7 | 17.6 |
| Copper | 46.8 | 43.2 |
| Iron | 17,900 | 42.1 |
| Lanthanum | 121 | 49.2 |
| Lead | 234 | 49.6 |

Table 4-2. Chemical Data Summary for Tank 241-SX-108.[1] (3 sheets)

| Analyte | Mean Concentration | RSD (Mean) |
|---|---|---|
| METALS (Continued) | µg/g | % |
| Lithium | 31.8 | 46.4 |
| Magnesium | 269 | 47.0 |
| Manganese | 5,990 | 49.3 |
| Molybdenum | 34.0 | 19.0 |
| Neodymium | 352 | 48.9 |
| Nickel | 1,190 | 46.4 |
| Phosphorous | 134 | 18.1 |
| Potassium | 632 | 47.8 |
| Samarium | 102 | 24.2 |
| Selenium | < 56.6 | N/A |
| Silicon | 1,090 | 49.1 |
| Silver | 7.52 | 14.0 |
| Sodium | 1.85E+05 | 17.2 |
| Strontium | 563 | 47.9 |
| Sulfur | 1,960 | 40.5 |
| Thallium | < 112 | N/A |
| Titanium | 43.7 | 43.3 |
| Uranium | 7,540 | 56.5 |
| Vanadium | 34.0 | 19.0 |
| Zinc | 75.2 | 44.9 |
| Zirconium | 433 | 47.1 |
| ANIONS | µg/g | % |
| Bromide | < 1,510 | N/A |
| Chloride | 2,160 | 23.9 |
| Fluoride | 433 | 58.8 |
| Nitrate | 3.72E+05 | 53.4 |
| Nitrite | 15,700 | 30.0 |
| Oxalate | 3,130 | 42.0 |
| Phosphate | < 1,440 | N/A |
| Sulfate | 6,890 | 34.0 |

Table 4-2. Chemical Data Summary for Tank 241-SX-108.[1] (3 sheets)

| Analyte | Mean Concentration | RSD (Mean) |
|---|---|---|
| **CARBON** | $\mu$g C/g | % |
| Total organic carbon | 900 | 86.8 |
| **RADIONUCLIDES** | $\mu$Ci/g | % |
| $^{144}$Ce/Pr | < 18.6 | N/A |
| $^{60}$Co | < 0.920 | N/A |
| $^{134}$Cs | < 1.15 | N/A |
| $^{137}$Cs | 195 | 11.2 |
| $^{154}$Eu | < 43.6 | N/A |
| $^{155}$Eu | < 5.17 | N/A |
| $^{94}$Nb | < 0.915 | N/A |
| $^{226}$Ra | < 30.6 | N/A |
| $^{106}$Ru/Rh | < 24.1 | N/A |
| $^{89/90}$Sr | 3,070 | 52.3 |
| Total beta | 6,930 | 52.1 |
| Total alpha | 3.29 | 45.6 |
| **PHYSICAL PROPERTIES** | % | % |
| Weight percent water (TGA) | 2.03 | 55.1 |
| Weight percent water (Grav.) | 0.475 | 5.3 |

Note:

[1]Eggers (1996)

### 4.2.2 Physical Data Summary

Thermal analyses were performed on tank 241-SX-108 auger samples to satisfy the requirements of the safety screening DQO (Dukelow et al. 1995) and the historical DQO (Simpson and McCain 1995). Thermal analyses included differential scanning calorimetry (DSC), thermogravimetric analysis (TGA) and gravimetry. In addition, density measurements were to be performed on the auger samples; however, because of high sample dose rates and the very dry, flighty nature of the samples, bulk density and specific gravity measurements were not performed.

**4.2.2.1 Thermogravimetric Analysis and Gravimetry.** In a TGA, the mass of a sample is measured while its temperature is increased at a constant rate. A gas such as nitrogen or air is passed over the sample during the heating to remove any released gases. Any decrease in the weight of a sample represents a loss of gaseous matter from the sample either through evaporation or through a reaction that forms gas phase products. Gravimetry does not use a nitrogen purge and the sample weights are measured once before and once after the procedure.

Table 4-3 shows the TGA percent water data for tank 241-SX-108. The laboratory did not encounter any problems that required samples to be reanalyzed. The mean weight percent water result for the tank was 2.03 percent, with an RSD of 55.1. The TGA data are also reported in Appendix A.

Table 4-3. Thermogravimetric Analysis Results for Tank 241-SX-108.[1]

| Sample Location | | Sample Number[2] | Temp. Range[3] | Result | Duplicate | Auger Mean | Overall Auger Mean |
|---|---|---|---|---|---|---|---|
| Auger Number | Auger Portion | | °C | % $H_2O$ | % $H_2O$ | % $H_2O$ | % $H_2O$ |
| 95-AUG-042 | Upper ½ | 2480[4] | 35-490 (35-490) | 2.86 | 3.48 | 3.15 | 2.03 |
| | Lower ½ | 2489[4] | 35-490 (35-490) | 2.70 | 3.56 | | |
| 95-AUG-043 | Upper ½ | 2567[5] | 25-225 (25-112) | 0.591 | 1.621 | 0.911 | |
| | Lower ½ | 2577[5] | 30-250 (30-250) | 0.535 | 0.897 | | |

Notes:

[1]Eggers (1996)
[2]All sample numbers begin with 'S95T00'.
[3]Range in parenthesis is for the duplicate.
[4]Percent water by thermogravimetric analysis using a Perkin-Elmer™ instrument.
[5]Percent water by thermogravimetric analysis using a Mettler™ instrument.

Weight percent water was measured by gravimetry as required by the SAP whenever TGA results are less than 25 weight percent. Auger sample 95-AUG-042 exhibited mean gravimetry results of 0.500 and 0.450 weight percent water of the upper half and lower half auger portions, respectively. Gravimetry was not performed on auger sample 95-AUG-043 because of radiation exposure concerns.

**4.2.2.2 Differential Scanning Calorimetry.** In DSC analysis, heat absorbed or emitted by a substance is measured while the substance is exposed to a linear increase in temperature. While the substance is being heated, a gas such as nitrogen is passed over the waste material to remove any gases being released. The onset temperature for an endothermic event (characterized by or causing the absorption of heat) or an exothermic event (characterized by or causing the release of heat) is determined graphically.

The DSC analyses were performed by the 222-S Laboratory under a nitrogen atmosphere using procedures LA-514-113, Rev. C-0 (Mettler™) or LA-514-114, Rev. C-0 (Perkin-Elmer™). No exothermic reactions were observed.

The DSC results are presented in Table 4-4. The temperature range and magnitude of the enthalpy change are provided for each endothermic transition. The transition represents the endothermic reaction associated with the evaporation of free and interstitial water. Because there were no exothermic reactions, the calculation of a 95 percent confidence limit high value, as required by the safety screening DQO (Dukelow et al. 1995), was not necessary.

Table 4-4. Differential Scanning Calorimetry Results for Tank 241-SX-108.[1]

| Sample Location | | Sample Number | Run | Sample Weight (mg) | Transition | |
|---|---|---|---|---|---|---|
| Auger Number | Subsegment | | | | Peak Temp. (°C) | ΔH (J/g) |
| 95-AUG-042 | Upper ½ | S95T002480[2] | 1 | 11.620 | 298.818 | 96.614 |
| | | | 2 | 15.040 | 303.070 | 106.263 |
| | Lower ½ | S95T002489[2] | 1 | 9.080 | 295.496 | 91.757 |
| | | | 2 | 14.950 | 299.289 | 75.172 |
| 95-AUG-043 | Upper ½ | S95T002567[3] | 1 | 27.633 | 295.7 | 117.1 |
| | | | 2 | 20.233 | 298.7 | 65.4 |
| | Lower ½ | S95T002577[3] | 1 | 17.371 | 296.9 | 71.9 |
| | | | 2 | 21.846 | 296.5 | 72.8 |

Notes:

ΔH = change in enthalpy.

[1]Eggers (1996)
[2]Analysis performed on Perkin-Elmer™ equipment.
[3]Analysis performed on Mettler™ equipment.

**4.2.2.3 Density.** Due to high sample dose rates, density measurements could not be carried out in laboratory hoods. An alternate procedure of measuring sample bulk density in the hot cell was considered. However, this procedure calls for centrifugation of the sample material, which in this case was a dry-flighty powder. Because of the dryness and flightiness of the sample material, it was estimated that the measurement results would not be sufficiently accurate to be useful.

### 4.2.3 Vapor Data Summary

The safety screening DQO has established a notification limit of 25 percent of the lower flammability limit for headspace vapors. Prior to removing auger samples, tank vapors were measured for flammability using a combustible gas meter and an organic vapor meter. The concentration of flammable gas was 0 percent of the lower flammability limit. The concentration of ammonia and total organic vapor in the tank headspace were both 0 ppm.

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# 5.0 INTERPRETATION OF CHARACTERIZATION RESULTS

This section evaluates the overall quality and consistency of the available results for tank 241-SX-108 and assesses and compares these results against historical information and program requirements.

## 5.1 ASSESSMENT OF SAMPLING AND ANALYTICAL RESULTS

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

### 5.1.1 Field Observations

The safety screening DQO (Dukelow et al. 1995) requirement that at least two widely spaced risers be sampled was fulfilled. The requirement for obtaining a vertical profile of the waste was not fulfilled. Sample recoveries were generally fair for the two augers and no anomalies were noted.

### 5.1.2 Quality Control Assessment

The usual quality control (QC) assessment includes an evaluation of the appropriate standard recoveries, spike recoveries, duplicate analyses, and blanks that are performed in conjunction with the chemical analyses. All the pertinent QC tests were conducted on the 1995 auger samples, allowing a full assessment regarding the accuracy and precision of the data. The SAP (Eggers 1995a) established the specific criteria for the primary and secondary analytes required by the safety screening and historical DQOs, whereas the opportunistic analytes were governed by the laboratory criteria (DOE 1995). Quality control results outside the specified criteria for the primary and secondary analytes are identified by footnotes in the Appendix A tables.

The standard and spike recovery results provide an estimate of the accuracy of the analysis. If a standard or spike recovery is above or below the given criterion, then the analytical results may be biased high or low, respectively. The precision is estimated by the relative percent difference (RPD), which is defined as the absolute value of the difference between the primary and duplicate samples, divided by their mean, times one hundred. The only analyte with any standard recoveries outside the criterion was sodium, possibly due to the large dilutions required for samples with high analyte concentrations relative to the detection limit. Uranium, as analyzed by phosphorescence, was the only analyte to have a spike recovery outside the limits. However, this deviation was only a few percent, and the other three spikes conducted with uranium were within the limits. All primary and secondary analytes had at least one RPD outside their criterion, but this was likely due to sample heterogeneity. The principles of As Low As Reasonable Achievable, as applied to radiation dose rates, pointed toward not rerunning highly radioactive samples if the results of the initial result and duplicate measurements were fit for use. In the case of weight percent water as determined by TGA and gravimetry, high RPD values were not unreasonable considering the low average values of percent water and the small sample sizes used by the TGA method to determine percent water (10 to 20 mg). None of the samples exceeded the criterion for preparation blanks. Thus, contamination was not a problem for any of the analyses.

In summary, the majority of the QC results were within the boundaries specified in the SAP. Although a number of results were outside their target levels, they were not found to substantially impact either the validity or the use of the data. Because the opportunistic analytes were not specifically requested in the SAP, their QC results are not discussed in this report.

### 5.1.3 Data Consistency Checks

Comparing different analytical methods can help in assessing data consistency and quality. The subsections below provide information regarding the comparison of sulfur as analyzed by ICP with sulfate as analyzed by IC, the comparison of total beta with the sum of the beta emitters, and the calculation of a mass and charge balance.

**5.1.3.1 Comparison of Results from Different Analytical Methods.** The following data consistency check compares the results from two different analytical methods. A close correlation between the two methods strengthens the credibility of both results, whereas a poor correlation brings the reliability of the data into question. All analytical mean results were taken from Table 4-2.

The ICP sulfur value of 1,960 $\mu$g/g converts to 5,870 $\mu$g/g of sulfate. This compares well with the IC sulfate result of 6,890 $\mu$g/g. The RPD between these two sulfate results was 16 percent.

A comparison was made between the total beta activities with the sum of the individual beta emitters. The activities of the individual beta emitters were summed as follows:

$$\text{Sum of beta emitters} = (2 * {}^{90}\text{Sr}) + {}^{137}\text{Cs}.$$

Because $^{90}$Sr is in equilibrium with its daughter product $^{90}$Y, the radiochemically measured value for $^{90}$Sr must be multiplied by 2 in order to obtain comparable numbers with total beta. The comparison is shown in Table 5-1.

Table 5-1. Tank 241-SX-108 Comparison of Gross Beta Activities With the Total of the Individual Activities.

| Analyte | Overall Mean ($\mu$Ci/g) | Beta Activities ($\mu$Ci/g) |
|---|---|---|
| $^{90}Sr$ | 3,070 | 6,140 |
| $^{137}Cs$ | 195 | 195 |
| Sum of beta emitters | | 6,340 |
| Gross beta | | 6,930 |
| Relative percent difference | | 8.9 % |

**5.1.3.3 Mass and Charge Balance.** The objectives of the mass and charge balance are to determine if the measurement results are self consistent and if the total concentration of the analytes measured accounts for all significant analytes in the waste. Except for sodium and chromium, cations were assumed to be in a common oxide or hydroxide form that was insoluble. By comparing the concentration of aluminum in samples prepared by the water-wash method to the concentration in samples prepared by the acid digestion method, it was determined that at least 80 percent of the aluminum was insoluble.

Positive and negative charge values were computed and found to agree well with one another for a tank average mixture of analytes. However, the total concentration of the species considered amounted to only 76 to 78 percent of the waste, depending on the breakdown of species assumed.

Adding together all the ICP, IC and TGA results for sample 95-AUG-042 yielded a total of about 900,000 $\mu$g/g, or about 90 percent of the waste present. Adding the ICP, IC and TGA results for sample 95-AUG-043 yielded only about 450,000 $\mu$g/g, or only about 45 percent of the waste present.

The biggest difference between the 95-AUG-042 and 95-AUG-043 results was in measurements of nitrate concentration. Sample 95-AUG-042 had a measured nitrate concentration of 571,000 $\mu$g/g and sample 95-AUG-043 had a concentration of 173,000 $\mu$g/g. The analytical laboratory reviewed the data and found no apparent discrepancies in the procedures followed, but suggested that the 95-AUG-043 subsamples be remeasured based on the differences between the 95-AUG-042 and 95-AUG-043 results.

Further review of the measurement data, and of the conclusions reached about tank safety and waste composition, led to the decision to complete the current tank characterization report and delay remeasuring samples until after the end of fiscal year 1996. The reasons for this decision are listed below. (See the detailed information in Section 5.5 for the objectives of this auger sampling event.)

1. The top 48 cm (19 in.) of waste at the bottom of the tank has been found to be safe from self-propagating chemical or nuclear chain reactions. Remeasurement of the 95-AUG-043 subsamples by the IC method will not change these results.

2. When the tank headspace gas was sampled, it was found to be safe from self-propagating chemical reactions.

3. The composition of the top 48 cm (19 in.) of waste passes the historical DQO fingerprint test for REDOX high-level waste. Sample 95-AUG-042 and 95-AUG-043 data pass this test. Remeasurement of 95-AUG-043 subsamples is not likely to change this conclusion.

4. Tank 241-SX-108 will be completely resampled by the rotary mode method and analyzed in fiscal year 1998 (Stanton 1996)

## 5.2 COMPARISON OF HISTORICAL WITH ANALYTICAL RESULTS

Tank 241-SX-108 was last sampled in 1966. Because of changes in tank composition due to waste transfers between 1966 and 1967, no meaningful comparisons could be made.

## 5.3 TANK WASTE PROFILE

The visual descriptions of the samples from both augers were similar except that some large chunks of material were recovered from the lower half of one auger (95-AUG-042) and from the upper half of the other auger (95-AUG-043). The TLM (Figure 2-3) predicts two different waste types, indicating that some vertical heterogeneity is expected. Based on the length of the auger used, the depth of the waste, and the disposition of the two waste types (according to the TLM), the 1995 auger sampling event probably recovered roughly equal proportions of the two waste types, indicating that some vertical heterogeneity would be expected in the analytical results.

A standard statistical technique known as the analysis of variance (ANOVA) was conducted on the 1995 auger samples in order to determine whether there were horizontal or vertical variations in the analyte concentrations. The test for vertical variation compared the upper and lower half subsegments of each auger. The calculations were performed on all analytes, both DQO driven and opportunistic (except the ICP water digestions), that had half or more of their individual measurements above the detection limit. The ANOVA generates a p-value that is compared with a standard significance level ($\alpha = 0.05$). If a p-value is below 0.05, there is sufficient evidence to conclude that the sample means are significantly different from each other. However, if a p-value is above 0.05, there is not sufficient evidence to conclude that the samples are significantly different from each other.

The results of the ANOVA indicated that there were significant concentration differences between the two augers for 21 of the 45 analytes tested. Vertically, 31 of the 45 analytes showed concentration differences between the upper and lower half subsegments. This information, coupled with the visual description of the samples, indicates that the tank contents vary somewhat both horizontally and vertically.

## 5.4 COMPARISON OF TRANSFER HISTORY WITH ANALYTICAL RESULTS

The HTCE of the contents of tank 241-SX-108 is shown in Table 5-2 along with the analytical results from the 1995 auger sampling event. This comparison is presented for informational purposes only.

Table 5-2. Comparison of Historical Estimates with the 1995 Analytical Results for Tank 241-SX-108.[1,2] (2 Sheets)

| Analyte | HTCE Estimate | 1995 Analytical Result | Relative Percent Difference |
|---|---|---|---|
| METALS | μg/g | μg/g | % |
| Aluminum | 77,900 | 38,100 | 69 |
| Calcium | 2,480 | 1,750 | 35 |
| Chromium | 40,300 | 9,070 | 127 |
| Iron | 32,800 | 17,900 | 59 |
| Nickel | 1,630 | 1,190 | 31 |
| Silicon | 1,620 | 1,090 | 39 |
| Sodium | 42,000 | 1.85E+05 | 126 |
| ANIONS | μg/g | μg/g | % |
| Nitrate | 80,300 | 3.72E+05 | 129 |
| Sulfate | 1,040 | 6,890 | 148 |
| RADIONUCLIDES | | | % |
| $^{137}Cs$ | 61.7 μCi/g | 195 μCi/g | 104 |
| $^{89/90}Sr$ | 1,600 μCi/g | 3,070 μCi/g | 63 |
| Uranium | 9,510 μg/g | 7,540 μg/g | 23 |
| Total alpha | 0.0130 μCi/g[3] | 3.29 μCi/g | 198 |
| PHYSICAL PROPERTIES | | | % |
| Percent Water | 61.5 % | 2.03 % | 187 |

Notes:

[1]Brevick et al. (1994a) (as updated by Brevick 1995)

[2]Eggers (1996)

[3]Assuming plutonium is the sole contributor.

Comparing the HTCE with the analytical values produced varied results. A total of 14 analytes were compared. Four of the analytes exhibited RPDs less than 50 percent. Two analytes (total alpha, and weight percent water) exhibited RPDs greater than 150 percent. The RPDs for the remaining eight analytes were in between 50 and 150 percent.

## 5.5 EVALUATION OF PROGRAM REQUIREMENTS

The two tank 241-SX-108 auger samples analyzed at the 222-S Laboratory were acquired to meet the requirements of the safety screening DQO (Dukelow et al. 1995), the pretreatment DQO (Kupfer et al. 1995), and the historical DQO (Simpson and McCain 1995). This section discusses the requirements of the DQOs and compares the analytical data to the defined concentration limits.

### 5.5.1 Safety Evaluation

Data criteria identified in the safety screening DQO are used to assess the waste safety and to check for unidentified safety issues. The DQO requires a vertical profile of the tank waste from two widely spaced risers. Of the five primary analyses required by the DQO, three have decision criteria thresholds that, if exceeded, could warrant further investigation to ensure tank safety. These three analyses include DSC (to measure the fuel content), a determination of total alpha activity to evaluate the criticality potential, and a measurement of the flammability of the tank headspace vapors. Table 5-3 lists the safety issues, the analytes of concern along with their notification limits, and the corresponding analytical results. The safety screening DQO has established a notification limit of -480 J/g (dry weight basis) for exothermic reactions detected during the DSC analysis. No exothermic reactions were observed in any of the tank 241-SX-108 samples.

For criticality reasons, the safety screening DQO limit for total alpha activity is 1 g/L, or 41 $\mu$Ci/g as specified in the SAP. All results were well below the limit, with 5.70 $\mu$Ci/g being the largest single result. None of the 95 percent upper confidence level limits for these results exceeded 7.35 $\mu$Ci/g.

The DQO notification limit for flammable gas concentration is 25 percent of the LFL. Combustible gas meter readings taken at the time of sampling revealed the concentration of flammable gases to be 0 percent of the LFL.

In summary, the September auger core sampling event met all the requirements of the safety screening DQO with the exception of the requirement for a vertical profile of the waste.

Table 5-3. Safety Screening Data Quality Objective Decision Variables and Criteria.

| Issue | Primary Decision Variable | Decision Criteria Threshold | Mean Analytical Result |
|---|---|---|---|
| Ferrocyanide/organics | Total fuel content | -480 J/g | No exothermic reactions |
| Criticality | Total alpha | 41 $\mu$Ci/g | 3.29 $\mu$Ci/g |
| Flammable gas | Flammable gas | 25 percent of the LFL | 0 percent of LFL |

Another factor in assessing tank waste safety is heat generation and temperature of the waste. Heat is generated in the tanks from radioactive decay. Tank 241-SX-108 has been designated a high-heat tank (non-Watch List), but recent temperature measurements have been below defined limits (Hanlon 1996). An estimate of the heat load was not calculated from the 1995 radionuclide data because only a portion of the waste was sampled. The historical tank content estimate of the heat load was 7.48 kW (25,500 Btu/hr), while the heat load based on headspace temperature was 16.4 kW (55,900 Btu/hr) (Kummerer 1994). Because an upper temperature limit has been exhibited (Section 2.4.3), it may be concluded that any heat generated from radioactive sources throughout the year is dissipated.

### 5.5.2 Pretreatment Evaluation

As outlined in the SAP, samples of tank 241-SX-108 waste were provided to the Pacific Northwest National Laboratory for pretreatment development testing. Future developments of these tests may provide the basis for revisions of this tank characterization report.

### 5.5.3 Historical Evaluation

In addition to the safety screening DQO, the auger samples were analyzed according to the historical DQO (Simpson and McCain 1995). This DQO strives to quantify the errors associated with the tank waste composition predictions based on waste transaction history and waste type compositions. The DQO identifies key components or "fingerprint" analytes for certain waste types. Tank 241-SX-108 was selected as a tank for historical evaluation because it is expected to contain a thick REDOX waste layer. The first step is to compare the analytical results with DQO-defined concentration levels for the "fingerprint" analytes. This comparison determines whether the predicted waste type is in the tank at the predicted location within the waste matrix. If the analytical results are $\geq$ 10 percent of the DQO levels (ratio of 0.1), the waste type and layer identification are considered acceptable (Simpson and McCain 1995).

The lower limit of the fingerprint test window was set at one-tenth of the reference value for the following reasons:

1) The purpose of the fingerprint test is to provide a rough first screening of the waste that will lead to further testing of the waste if the fingerprint test is passed.

2) A single reference value cannot account for the range of conditions found in different tanks; therefore, the lower limit for the test must be set significantly below the reference value.

Table 5-4 compares the concentration levels for REDOX waste from the historical DQO and the 1995 analytical results. All analyses except percent water had analytical results at least 10 percent of the DQO-specified level.

The historical DQO requires that TOC and other analytes be analyzed when the measurement results for the fingerprint analytes pass the fingerprint tests. A notification limit of 30,000 $\mu$g C/g has been established for the measurement of TOC (Eggers 1995a). The TOC results were well below the notification limit, with an overall mean of 900 $\mu$g C/g.

Table 5-4. Comparison of Fingerprint Analytes with Analytical Results.

| Fingerprint Analyte | Analytical Result | Historical DQO Reference Value[1] | Ratio[2] |
|---|---|---|---|
| Aluminum | 38,100 $\mu$g/g | 56,400 $\mu$g/g | 0.68[2] |
| Chromium | 9,070 $\mu$g/g | 12,500 $\mu$g/g | 0.73[2] |
| Sodium | 1.85E+05 $\mu$g/g | 27,300 $\mu$g/g | 6.8[2] |
| $^{137}$Cs | 195 $\mu$Ci/g | 41 $\mu$Ci/g | 4.8[2] |
| $^{90}$Sr | 3,070 $\mu$Ci/g | 94 $\mu$Ci/g | 33[2] |
| Percent water | 2.03 % | 38-56 % | 0.053[3] |

Note:

[1]Simpson and McCain (1995)
[2]Ratio of analytical result to Historical DQO reference value
[3]Ratio of analytical value to lower Historical DQO reference value

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# 6.0 CONCLUSIONS AND RECOMMENDATIONS

The waste in tank 241-SX-108 was sampled in September 1995. Three DQOs governed the sampling and analysis of augers 95-AUG-042, 95-AUG-043, and 95-AUG-044: the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995), the *Strategy for Sampling Hanford Site Tank Wastes for Development of Disposal Technology* (Kupfer et al. 1995), and the *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995). In addition, an internal letter (Kristofzski 1995) directed the laboratories to perform all feasible analyses of the waste samples on an opportunistic basis, according to the work load in the laboratory. All samples were analyzed at the Westinghouse 222-S Laboratory.

Tank 241-SX-108 has been designated a high-heat tank (non-Watch List), but recent temperature measurements have been below defined limits (Hanlon 1996). The historical tank content estimate of heat load was 7.48 kW (25,500 Btu/hr), while the heat load based on headspace temperature was 16.4 kW (55,900 Btu/hr) (Kummerer 1994). Because the tank exhibits an upper temperature limit, it may be concluded that any heat generated from radioactive sources throughout the year is dissipated.

All analyses met the requirements of the safety screening DQO. No exothermic reactions were observed in the DSC analysis. The total alpha activity mean was 3.29 $\mu$Ci/g, well below the DQO notification limit of 41 $\mu$Ci/g. None of the samples or duplicate samples exhibited total alpha activity greater than the upper 95 percent confidence level of 7.35 $\mu$Ci/g. Finally, the concentration of flammable gas in the tank headspace was 0 percent of the lower flammability limit. It is recommended that the tank be core sampled to obtain a complete profile of the tank waste and complete the safety assessment.

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## 7.0 REFERENCES


Alstad, A. T., 1993, *Riser Configuration Document for Single-Shell Waste Tanks*, WHC-SD-RE-TI-053, Rev. 9, Westinghouse Hanford Company, Richland, Washington.

Agnew, S. F., 1995, *Hanford Defined Wastes: Chemical and Radionuclide Compositions*, LA-UR-94-2657, Rev. 2, Los Alamos National Laboratory, Los Alamos, New Mexico.

Agnew, S. F., P. Baca, R. Corbin, K. Jurgensen, and B. Young, 1995a, *Tank Layer Model (TLM)*, LA-UR-94-4269, Rev. 1, Los Alamos National Laboratory, Los Alamos, New Mexico.

Agnew, S. F., P. Baca, R. Corbin, T. Duran and K. Jurgensen, 1995b, *Waste Status and Transaction Record Summary for the Southwest Quadrant*, WHC-SD-WM-TI-614, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

Atlantic Richfield Company Hanford Operations, 1967, *Monthly Report, 200 Areas Operation*, ARH-60-DEL, Atlantic Richfield Hanford Company, Richland, Washington.

Atlantic Richfield Company Hanford Operations, 1972, *Tank 241-SX-108 Isolation*, Drawing H-2-36568, Rev. 0, Atlantic Richfield Hanford Company, Richland, Washington.

Brevick, C. H., L. Gaddis, W. Pickett, 1994a, *Historical Tank Content Estimate for the Southwest Quadrant of the Hanford 200 West Area*, WHC-SD-WM-ER-349, Rev. 0, ICF Kaiser Hanford Company, Richland, Washington.

Brevick, C. H., L. A. Gaddis, E. Johnson, 1994b, *Supporting Document for the Historical Tank Content Estimate for SX Tank Farm*, WHC-SD-WM-ER-324, Rev. 0, ICF Kaiser Hanford Company, Richland, Washington.

Brevick, C. H., 1995, *Partial Tank Characterization Report for Single-Shell Tank 241-SX-108 - E44219*, (letter to J. G. Kristofzski, Westinghouse Hanford Company, November 16), ICF Kaiser Hanford Company, Richland, Washington.

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

DOE, 1995, *Hanford Analytical Services Quality Assurance Plan*, DOE/RL-94-55, Rev. 2, U.S. Department of Energy, Richland, Washington.

Dukelow, G. T., J. W. Hunt, H. Babad, and J. E. Meacham, 1995, *Tank Safety Screening Data Quality Objective*, WHC-SD-WM-SP-004, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

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

Eggers, R. F., 1995a, *Tank 241-SX-108 Auger Sampling and Analysis Plan*, WHC-SD-WM-TSAP-007, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Eggers, R. F., 1995b, *45-Day Safety Screening Results for Tank 241-SX-108, Auger Samples 95-AUG-042, 95-AUG-043 and 95-AUG-044*, WHC-SD-WM-DP-151, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Eggers, R. F., 1996, *Final Report for Tank 241-SX-108, Auger Samples 95-AUG-042, 95-AUG-043, and 95-AUG-044*, WHC-SD-WM-DP-151, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Hanlon, B.M., 1996, *Waste Tank Summary Report for Month Ending February 29, 1996*, WHC-EP-0182-95, Westinghouse Hanford Company, Richland, Washington.

Isochem Incorporated, 1968, *108-SX Tank - Vertical Probe Holes & Cassion for Horizontal Hole for Sludge Level Detector - Assembly & Details*, Drawing No. H-2-33907, Rev. 1, Sheet 1, ICF Kaiser Hanford, Richland, Washington.

Isochem Incorporated, 1970, *Dome Equipment Arrangement Tank 108*, Drawing No. H-2-34064, Rev. 2, ICF Kaiser Hanford, Richland, Washington.

Kristofzski, J.G., 1995, "Directions for Opportunistic Analyses", (Letter 75310-95-103 to J.H. Baldwin, September 13), Westinghouse Hanford Company, Richland, Washington.

Kummerer, M., 1994, *Topical Report on Heat Removal Characteristics of Waste Storage Tanks*, WHC-SD-WM-SARR-010, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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

Simpson, B. C., D. J. McCain, 1995, *Historical Model Evaluation Data Requirements*, WHC-SD-WM-DQO-018, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Stanton, G. A. Jr., 1996, Baseline Sampling Schedule, Change 96-03, (internal memorandum 75610-96-08 to Distribution, May 31), Westinghouse Hanford Company, Richland, Washington.

Vitro Engineering Corporation, 1985, *Piping Waste Tank Isolation 241-SX-108*, Drawing No. H-2-73211, Rev. 2, ICF Kaiser Hanford, Richland, Washington.

# APPENDIX A

# ANALYTICAL RESULTS

# SINGLE-SHELL TANK 241-SX-108

## A.1 INTRODUCTION

Appendix A presents the chemical and radiological characteristics of tank 241-SX-108 in a tabular form, in terms of the specific concentrations of metals, ions, radionuclides, and total carbon. Also included are results for the weight percent water analyses by TGA and gravimetry.

The data table for each analyte lists segment number, sample number, auger portion, an original and duplicate result for each sample, a sample mean, an overall mean for the tank in which all augers and auger portions are weighted equally (with the exception of the mean for TOC), and a relative standard deviation. The 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.

The tables are numbered sequentially. The following list presents the table numbers of specific analyte groups.

| **Analyte Characteristic** | **Table Number** |
|---|---|
| Metals | Table A-1 through Table A-37 |
| Anions | Table A-38 through Table A-45 |
| Radionuclides | Table A-46 through Table A-57 |
| Total Carbon | Table A-58 |
| Weight Percent Water | Table A-59 |
| Uranium by Laser Phosphorescence | Table A-60 |

## A.2 ANALYTE TABLE DESCRIPTION

The "Segment Number" column lists the auger sample number for which the analyte was measured. Sampling rationale, locations, and descriptions of sampling events are discussed in Section 3.0.

Column two lists the LABCORE sample number.

Column three contains the name of the segment portion from which the sample was taken (upper ½ or lower ½).

The 'Result' and 'Duplicate' columns are self-explanatory. The 'Mean' column is the average of the result and duplicate values. All values, including those below the detection level (denoted by a 'less than' symbol, <), were averaged. If both sample values were non-detected, the mean is expressed as a non-detected value. If one or both values were above the detection limit, the mean is expressed as a detected value. Superscript letters on the

Mean values, for which the corresponding quality control violations are listed below, are quality control flags. Only those analytes specifically requested by the SAP were evaluated with respect to quality control. This is discussed in Sections 3.3 and 5.1.2.

"a" indicates a standard recovery below the QC limit.

"b" indicates a standard recovery above the QC limit.

"c" indicates a spike recovery below the QC limit.

"d" indicates a spike recovery above the QC limit.

"e" indicates that the RPD was outside the QC limits.

"f" indicates the presence of blank contamination.

The 'Overall Mean' column is a simple mean of both auger portion means, and both auger sample means. The one exception is the mean for TOC, which is a weighted mean of one auger portion from an auger sample and the mean of two auger portions from the other auger sample. Means were assigned a 'detect' or 'non-detect' status depending upon the relative number of non-detected values in the data set. Means for data sets having greater than 50 percent non-detected values were assigned a status of 'non-detect'.

Column 8, "Relative Standard Deviation" (RSD), is a measure of variance defined as the standard deviation divided by the mean. This number is expressed as a percentage.

Table A-1. Tank 241-SX-108 Analytical Results: Aluminum (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 18,300 | 30,500 | 24,400[e] | 38,100 | 37.4 |
| | S95T002501 | Lower ½ | 24,000 | 22,600 | 23,300 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 46,000 | 43,400 | 44,700 | | |
| | S95T002579 | Lower ½ | 57,400 | 62,400 | 59,900 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | 471 | 602.0 | 536.5[e] | 6,210 | 90.1 |
| | S95T003887 | Lower ½ | 738 | 645.0 | 691.5[e] | | |
| 95-AUG-043 | S95T003892 | Upper ½ | 10,800 | 10,500 | 10,600 | | |
| | S95T003897 | Lower ½ | 12,200 | 13,800 | 13,000[e] | | |

Table A-2. Tank 241-SX-108 Analytical Results: Antimony (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | < 202 | < 208.4 | < 205 | < 112 | N/A |
| | S95T002501 | Lower ½ | < 102 | < 104.7 | < 103 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | < 73.92 | < 74.12 | < 74.02 | | |
| | S95T002579 | Lower ½ | < 65.58 | < 64.46 | < 65.02 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 38.70 | < 44.7 | < 41.7 | < 32.4 | N/A |
| | S95T003887 | Lower ½ | < 45.00 | < 36.3 | < 40.7 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 21.90 | < 21.1 | < 21.5 | | |
| | S95T003897 | Lower ½ | < 26.00 | < 24.9 | < 25.5 | | |

Table A-3. Tank 241-SX-108 Analytical Results: Arsenic (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | μg/g | μg/g | μg/g | μg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | < 50.55 | < 52.10 | < 51.33 | < 28.0 | N/A |
| | S95T002501 | Lower ½ | < 25.49 | < 26.175 | < 25.83 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | < 18.48 | < 18.53 | < 18.51 | | |
| | S95T002579 | Lower ½ | < 16.39 | < 16.12 | < 16.26 | | |
| **Solids: $H_2O$ dig/acid** | | | μg/g | μg/g | μg/g | μg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 64.50 | < 74.6 | < 69.6 | < 54.1 | N/A |
| | S95T003887 | Lower ½ | < 74.90 | < 60.3 | < 67.6 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 36.50 | < 36.6 | < 36.6 | | |
| | S95T003897 | Lower ½ | < 43.40 | < 41.5 | < 42.5 | | |

Table A-4. Tank 241-SX-108 Analytical Results: Barium (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 87.00 | 82.80 | 84.90 | 139 | 45.7 |
| | S95T002501 | Lower ½ | 69.72 | 62.74 | 66.23 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 176 | 170.5 | 173.3 | | |
| | S95T002579 | Lower ½ | 239 | 226.3 | 232.8 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 32.20 | < 37.2 | < 34.7 | < 27.0 | N/A |
| | S95T003887 | Lower ½ | < 37.40 | < 30.1 | < 33.8 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 18.20 | < 18.3 | < 18.3 | | |
| | S95T003897 | Lower ½ | < 21.70 | < 20.8 | < 21.3 | | |

Table A-5. Tank 241-SX-108 Analytical Results: Beryllium (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | < 5.055 | < 5.210 | < 5.133 | < 2.80 | N/A |
| | S95T002501 | Lower ½ | < 2.549 | < 2.618 | < 2.584 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | < 1.848 | < 1.853 | < 1.851 | | |
| | S95T002579 | Lower ½ | < 1.639 | < 1.612 | < 1.626 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 3.220 | < 3.72 | < 3.47 | < 2.70 | N/A |
| | S95T003887 | Lower ½ | < 3.740 | < 3.01 | < 3.38 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 1.820 | < 1.83 | < 1.83 | | |
| | S95T003897 | Lower ½ | < 2.170 | < 2.08 | < 2.13 | | |

Table A-6. Tank 241-SX-108 Analytical Results: Bismuth (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | < 101 | < 104.2 | < 103 | 66.4 | 18.3 |
| | S95T002501 | Lower ½ | < 50.98 | < 52.35 | < 51.67 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 50.64 | 60.00 | 55.32 | | |
| | S95T002579 | Lower ½ | 61.30 | 50.37 | 55.84 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 64.50 | < 74.6 | < 69.6 | < 54.1 | N/A |
| | S95T003887 | Lower ½ | < 74.90 | < 60.3 | < 67.6 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 36.50 | < 36.6 | < 36.6 | | |
| | S95T003897 | Lower ½ | < 43.40 | < 41.5 | < 42.5 | | |

Table A-7. Tank 241-SX-108 Analytical Results: Boron (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | < 50.55 | < 52.10 | < 51.3 | 30.3 | 27.2 |
| | S95T002501 | Lower ½ | < 25.49 | < 26.175 | < 25.8 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 21.00 | 19.75 | 20.38 | | |
| | S95T002579 | Lower ½ | 23.77 | 23.86 | 23.81 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | 961 | 1,150 | 1,060 | 811 | 27.6 |
| | S95T003887 | Lower ½ | 1,140 | 879.0 | 1,010 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | 404 | 593.0 | 498.5 | | |
| | S95T003897 | Lower ½ | 696 | 653.0 | 674.5 | | |

Table A-8. Tank 241-SX-108 Analytical Results: Cadmium (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | **µg/g** | **µg/g** | **µg/g** | **µg/g** | **%** |
| 95-AUG-042 | S95T002482 | Upper ½ | < 10.11 | < 10.42 | < 10.27 | 17.3 | 55.4 |
| | S95T002501 | Lower ½ | < 5.098 | < 5.235 | < 5.167 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 30.04 | 29.22 | 29.63 | | |
| | S95T002579 | Lower ½ | 23.66 | 24.62 | 24.14 | | |
| **Solids: $H_2O$ dig/acid** | | | **µg/g** | **µg/g** | **µg/g** | **µg/g** | **%** |
| 95-AUG-042 | S95T003882 | Upper ½ | < 3.22 | < 3.72 | < 3.47 | < 2.93 | N/A |
| | S95T003887 | Lower ½ | < 3.74 | < 3.01 | < 3.38 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 1.82 | < 1.83 | < 1.83 | | |
| | S95T003897 | Lower ½ | < 2.17 | < 2.08 | < 3.04 | | |

Table A-9. Tank 241-SX-108 Analytical Results: Calcium (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 1,140 | 948.4 | 1,050 | 1,750 | 50.2 |
| | S95T002501 | Lower ½ | 733 | 653.2 | 693.1 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 2,880 | 2,820 | 2,850 | | |
| | S95T002579 | Lower ½ | 2,480 | 2,310 | 2,400 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | 250 | 765.0 | 507.5 | 179 | 76.0 |
| | S95T003887 | Lower ½ | 136 | 110.0 | 123.0 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | 43.50 | 44.00 | 43.75 | | |
| | S95T003897 | Lower ½ | < 43.40 | < 41.5 | < 42.5 | | |

Table A-10. Tank 241-SX-108 Analytical Results: Cerium (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 119 | 108.9 | 113.9 | 198 | 47.6 |
| | S95T002501 | Lower ½ | 98.55 | 87.56 | 93.05 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 244 | 234.8 | 239.3 | | |
| | S95T002579 | Lower ½ | 357 | 331.3 | 344.4 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 64.50 | < 74.6 | < 69.6 | < 54.1 | N/A |
| | S95T003887 | Lower ½ | < 74.90 | < 60.3 | < 67.6 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 36.50 | < 36.6 | < 36.6 | | |
| | S95T003897 | Lower ½ | < 43.40 | < 41.5 | < 42.5 | | |

Table A-11. Tank 241-SX-108 Analytical Results: Chromium (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 6,770 | 5,720 | 6,250[e] | 9,070 | 13.7 |
| | S95T002501 | Lower ½ | 10,100 | 9,030 | 9,580[e] | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 8,440 | 8,060 | 8,250 | | |
| | S95T002579 | Lower ½ | 12,500 | 11,800 | 12,200 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | 4,180 | 6,900 | 5,540[e] | 6,540 | 8.05 |
| | S95T003887 | Lower ½ | 7,240 | 5,740 | 6,490[e] | | |
| 95-AUG-043 | S95T003892 | Upper ½ | 6,930 | 6,990 | 6,960 | | |
| | S95T003897 | Lower ½ | 6,860 | 7,490 | 7,180 | | |

Table A-12. Tank 241-SX-108 Analytical Results: Cobalt (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | < 20.22 | < 20.84 | < 20.53 | 18.7 | 17.6 |
| | S95T002501 | Lower ½ | < 10.20 | < 10.47 | < 10.34 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 19.07 | 18.29 | 18.68 | | |
| | S95T002579 | Lower ½ | 26.18 | 24.55 | 25.37 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 12.90 | < 14.9 | < 13.9 | < 10.7 | N/A |
| | S95T003887 | Lower ½ | < 14.20 | < 12.2 | < 13.2 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 7.220 | < 7.32 | < 7.27 | | |
| | S95T003897 | Lower ½ | < 8.680 | < 8.30 | < 8.5 | | |

Table A-13. Tank 241-SX-108 Analytical Results: Copper (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 32.68 | 30.82 | 31.75 | 46.8 | 43.2 |
| | S95T002501 | Lower ½ | 21.42 | 21.46 | 21.44 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 61.23 | 58.41 | 59.82 | | |
| | S95T002579 | Lower ½ | 75.81 | 72.41 | 74.11 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 6.450 | < 7.46 | < 6.96 | < 5.41 | N/A |
| | S95T003887 | Lower ½ | < 7.490 | < 6.03 | < 6.76 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 3.650 | < 3.66 | < 3.66 | | |
| | S95T003897 | Lower ½ | < 4.340 | < 4.15 | < 4.25 | | |

Table A-14. Tank 241-SX-108 Analytical Results: Iron (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 13,100 | 12,000 | 12,600 | 17,900 | 42.1 |
| | S95T002501 | Lower ½ | 8,130 | 8,220 | 8,170 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 24,100 | 25,700 | 24,900 | | |
| | S95T002579 | Lower ½ | 25,800 | 26,200 | 26,000 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 32.20 | < 37.2 | < 34.7 | < 27.0 | N/A |
| | S95T003887 | Lower ½ | < 37.40 | < 30.1 | < 33.8 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 18.20 | < 18.3 | < 18.3 | | |
| | S95T003897 | Lower ½ | < 21.70 | < 20.8 | < 21.3 | | |

Table A-15. Tank 241-SX-108 Analytical Results: Lanthanum (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | **μg/g** | **μg/g** | **μg/g** | **μg/g** | **%** |
| 95-AUG-042 | S95T002482 | Upper ½ | 71.32 | 67.10 | 69.21 | 121 | 49.2 |
| | S95T002501 | Lower ½ | 55.41 | 50.84 | 53.12 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 163 | 157.0 | 160.1 | | |
| | S95T002579 | Lower ½ | 205 | 194.4 | 199.7 | | |
| **Solids: $H_2O$ dig/acid** | | | **μg/g** | **μg/g** | **μg/g** | **μg/g** | **%** |
| 95-AUG-042 | S95T003882 | Upper ½ | < 32.20 | < 37.2 | < 34.7 | < 27.0 | N/A |
| | S95T003887 | Lower ½ | < 37.40 | < 30.1 | < 33.8 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 18.20 | < 18.3 | < 18.3 | | |
| | S95T003897 | Lower ½ | < 21.70 | < 20.8 | < 21.3 | | |

Table A-16. Tank 241-SX-108 Analytical Results: Lead (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 141 | 120.0 | 130.7 | 234 | 49.6 |
| | S95T002501 | Lower ½ | 108 | 103.3 | 105.7 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 351 | 335.7 | 343.3 | | |
| | S95T002579 | Lower ½ | 352 | 362.8 | 357.5 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 64.50 | < 74.6 | < 69.6 | < 54.1 | N/A |
| | S95T003887 | Lower ½ | < 74.90 | < 60.3 | < 67.6 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 36.50 | < 36.6 | < 36.6 | | |
| | S95T003897 | Lower ½ | < 43.40 | < 41.5 | < 42.5 | | |

Table A-17. Tank 241-SX-108 Analytical Results: Lithium (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 19.66 | 18.54 | 19.10 | 31.8 | 46.4 |
| | S95T002501 | Lower ½ | 15.77 | 14.29 | 15.03 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 37.95 | 36.69 | 37.32 | | |
| | S95T002579 | Lower ½ | 58.07 | 53.78 | 55.93 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 6.450 | < 7.46 | < 6.96 | < 5.41 | N/A |
| | S95T003887 | Lower ½ | < 7.490 | < 6.03 | < 6.76 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 3.650 | < 3.66 | < 3.66 | | |
| | S95T003897 | Lower ½ | < 4.340 | < 4.15 | < 4.25 | | |

Table A-18. Tank 241-SX-108 Analytical Results: Magnesium (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | $\mu$g/g | $\mu$g/g | $\mu$g/g | $\mu$g/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 174 | 158.7 | 166.2 | 269 | 47.0 |
| | S95T002501 | Lower ½ | 123 | 114.1 | 118.8 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 406 | 366.9 | 386.6 | | |
| | S95T002579 | Lower ½ | 454 | 354.1 | 403.8 | | |
| **Solids: $H_2O$ dig/acid** | | | $\mu$g/g | $\mu$g/g | $\mu$g/g | $\mu$g/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 64.50 | < 74.6 | < 69.6 | < 54.1 | N/A |
| | S95T003887 | Lower ½ | < 74.90 | < 60.3 | < 67.6 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 36.50 | < 36.6 | < 36.6 | | |
| | S95T003897 | Lower ½ | < 43.40 | < 41.5 | < 42.5 | | |

Table A-19. Tank 241-SX-108 Analytical Results: Manganese (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | **µg/g** | **µg/g** | **µg/g** | **µg/g** | **%** |
| 95-AUG-042 | S95T002482 | Upper ½ | 3,530 | 3,290 | 3,410 | 5,990 | 49.3 |
| | S95T002501 | Lower ½ | 2,780 | 2,530 | 2,650 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 7,310 | 7,050 | 7,180 | | |
| | S95T002579 | Lower ½ | 11,000 | 10,400 | 10,700 | | |
| **Solids: $H_2O$ dig/acid** | | | **µg/g** | **µg/g** | **µg/g** | **µg/g** | **%** |
| 95-AUG-042 | S95T003882 | Upper ½ | < 6.450 | < 7.46 | < 6.96 | < 5.41 | N/A |
| | S95T003887 | Lower ½ | < 7.490 | < 6.03 | < 6.76 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 3.650 | < 3.66 | < 3.66 | | |
| | S95T003897 | Lower ½ | < 4.340 | < 4.15 | < 4.25 | | |

Table A-20. Tank 241-SX-108 Analytical Results: Molybdenum (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | **µg/g** | **µg/g** | **µg/g** | **µg/g** | **%** |
| 95-AUG-042 | S95T002482 | Upper ½ | < 50.55 | < 52.10 | < 51.3 | 34 | 19.0 |
| | S95T002501 | Lower ½ | < 25.49 | < 26.175 | < 25.83 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 24.34 | 21.14 | 22.74 | | |
| | S95T002579 | Lower ½ | 40.61 | 31.42 | 36.01 | | |
| **Solids: $H_2O$ dig/acid** | | | **µg/g** | **µg/g** | **µg/g** | **µg/g** | **%** |
| 95-AUG-042 | S95T003882 | Upper ½ | < 32.20 | < 37.2 | < 34.7 | < 28.8 | N/A |
| | S95T003887 | Lower ½ | < 37.40 | < 30.1 | < 33.8 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | 23.60 | 24.40 | 24.00 | | |
| | S95T003897 | Lower ½ | < 21.70 | < 23.80 | < 22.8 | | |

Table A-21. Tank 241-SX-108 Analytical Results: Neodymium (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 209 | 200.1 | 204.5 | 352 | 48.9 |
| | S95T002501 | Lower ½ | 164 | 148.1 | 156.0 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 453 | 433.0 | 442.9 | | |
| | S95T002579 | Lower ½ | 631 | 581.6 | 606.5 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 64.50 | < 74.6 | < 69.6 | < 54.1 | N/A |
| | S95T003887 | Lower ½ | < 74.90 | < 60.3 | < 67.6 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 36.50 | < 36.6 | < 36.6 | | |
| | S95T003897 | Lower ½ | < 43.40 | < 41.5 | < 42.5 | | |

Table A-22. Tank 241-SX-108 Analytical Results: Nickel (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | μg/g | μg/g | μg/g | μg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 742 | 685.3 | 713.6 | 1,190 | 46.4 |
| | S95T002501 | Lower ½ | 594 | 528.5 | 561.1 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 1,480 | 1,430 | 1,460 | | |
| | S95T002579 | Lower ½ | 2,090 | 1,970 | 2,030 | | |
| **Solids: $H_2O$ dig/acid** | | | μg/g | μg/g | μg/g | μg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 12.90 | < 14.9 | < 13.9 | < 10.7 | N/A |
| | S95T003887 | Lower ½ | < 14.20 | < 12.2 | < 13.2 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 7.220 | < 7.32 | < 7.27 | | |
| | S95T003897 | Lower ½ | < 8.680 | < 8.30 | < 8.49 | | |

Table A-23. Tank 241-SX-108 Analytical Results: Phosphorus (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | **μg/g** | **μg/g** | **μg/g** | **μg/g** | **%** |
| 95-AUG-042 | S95T002482 | Upper ½ | < 202 | < 208.4 | < 205.2 | 134 | 18.1 |
| | S95T002501 | Lower ½ | < 102 | < 104.7 | < 103.4 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 119 | 119.5 | 119.0 | | |
| | S95T002579 | Lower ½ | 100 | 113.2 | 106.7 | | |
| **Solids: $H_2O$ dig/acid** | | | **μg/g** | **μg/g** | **μg/g** | **μg/g** | **%** |
| 95-AUG-042 | S95T003882 | Upper ½ | < 129 | < 149 | < 139 | < 107 | N/A |
| | S95T003887 | Lower ½ | < 142 | < 122 | < 132 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 72.20 | < 73.2 | < 72.7 | | |
| | S95T003897 | Lower ½ | < 86.80 | < 83.0 | < 84.9 | | |

Table A-24. Tank 241-SX-108 Analytical Results: Potassium (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 368 | 387.2 | 377.6 | 632 | 47.8 |
| | S95T002501 | Lower ½ | 343 | 224.2 | 283.7 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 811 | 819.7 | 815.5 | | |
| | S95T002579 | Lower ½ | 1,020 | 1,090 | 1,050 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | 480 | 485.0 | 482.5 | 658 | 26.0 |
| | S95T003887 | Lower ½ | 530 | 452.0 | 491.0 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | 851 | 824.0 | 837.5 | | |
| | S95T003897 | Lower ½ | 775 | 866 | 820.5 | | |

Table A-25. Tank 241-SX-108 Analytical Results: Samarium (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | < 101 | < 104.2 | < 103 | 102 | 24.2 |
| | S95T002501 | Lower ½ | < 50.98 | < 52.35 | < 51.67 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 108 | 108.0 | 108.2 | | |
| | S95T002579 | Lower ½ | 149 | 140.7 | 144.8 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 64.50 | < 74.6 | < 69.6 | < 54.1 | N/A |
| | S95T003887 | Lower ½ | < 74.90 | < 60.3 | < 67.6 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 36.50 | < 36.6 | < 36.6 | | |
| | S95T003897 | Lower ½ | < 43.40 | < 41.5 | < 42.5 | | |

Table A-26. Tank 241-SX-108 Analytical Results: Selenium (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | < 101 | < 104.2 | < 103 | < 56.6 | N/A |
| | S95T002501 | Lower ½ | < 50.98 | < 52.35 | < 51.67 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | < 36.96 | < 37.06 | < 37.01 | | |
| | S95T002579 | Lower ½ | 33.51 | 35.62 | 34.57 | | |
| **Solids: $H_2O$ dig/acid'** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 64.50 | < 74.6 | < 69.6 | < 54.1 | N/A |
| | S95T003887 | Lower ½ | < 74.90 | < 60.3 | < 67.6 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 36.50 | < 36.6 | < 36.6 | | |
| | S95T003897 | Lower ½ | < 43.40 | < 41.5 | < 42.5 | | |

Table A-27. Tank 241-SX-108 Analytical Results: Silicon (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 295 | 205.7 | 250.2 | 1,090 | 49.1 |
| | S95T002501 | Lower ½ | 873 | 847 | 860.2 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 1,970 | 1,700 | 1,840 | | |
| | S95T002579 | Lower ½ | 1,820 | 1,020 | 1,420 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | 2,000 | 1,710 | 1,860 | 1,020 | 72.8 |
| | S95T003887 | Lower ½ | 1,580 | 1,740 | 1,660 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | 185 | 329.0 | 257.0 | | |
| | S95T003897 | Lower ½ | 341 | 250.0 | 295.5 | | |

Table A-28. Tank 241-SX-108 Analytical Results: Silver (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | **µg/g** | **µg/g** | **µg/g** | **µg/g** | **%** |
| 95-AUG-042 | S95T002482 | Upper ½ | < 10.11 | < 10.42 | < 10.27 | 7.52 | 14.0 |
| | S95T002501 | Lower ½ | < 5.098 | < 5.235 | < 5.167 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 6.968 | 7.178 | 7.073 | | |
| | S95T002579 | Lower ½ | 9.832 | 5.300 | 7.566 | | |
| **Solids: $H_2O$ dig/acid** | | | **µg/g** | **µg/g** | **µg/g** | **µg/g** | **%** |
| 95-AUG-042 | S95T003882 | Upper ½ | 16.40 | 26.20 | 21.30 | 14.9 | 30.8 |
| | S95T003887 | Lower ½ | 17.90 | 17.50 | 17.70 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | 10.30 | 10.80 | 10.55 | | |
| | S95T003897 | Lower ½ | 10.00 | 10.20 | 10.10 | | |

Table A-29. Tank 241-SX-108 Analytical Results: Sodium (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 2.29E+05 | 2.29E+05 | 2.29E+05 | 1.85E+05 | 17.2 |
| | S95T002501 | Lower ½ | 2.06E+05 | 2.01E+05 | 2.03E+05 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 1.66E+05 | 1.53E+05 | 1.60E+05 | | |
| | S95T002579 | Lower ½ | 1.45E+05 | 1.47E+05 | 1.46E+05 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | 2.18E+05 | 3.55E+05 | 2.86E+05 | 1.95E+05 | 36.0 |
| | S95T003887 | Lower ½ | 2.45E+05 | 2.43E+05 | 2.44E+05 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | 1.17E+05 | 1.26E+05 | 1.22E+05 | | |
| | S95T003897 | Lower ½ | 1.23E+05 | 1.33E+05 | 1.28E+05 | | |

Table A-30. Tank 241-SX-108 Analytical Results: Strontium (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 345 | 323.1 | 333.9 | 563 | 47.9 |
| | S95T002501 | Lower ½ | 265 | 241.7 | 253.3 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 725 | 699.6 | 712.4 | | |
| | S95T002579 | Lower ½ | 987 | 921.7 | 954.1 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 6.450 | < 7.46 | < 6.96 | < 5.41 | N/A |
| | S95T003887 | Lower ½ | < 7.490 | < 6.03 | < 6.76 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 3.650 | < 3.66 | < 3.66 | | |
| | S95T003897 | Lower ½ | < 4.340 | < 4.15 | < 4.25 | | |

Table A-31. Tank 241-SX-108 Analytical Results: Sulfur (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 2,500 | 3,270 | 2,880 | 1,960 | 40.5 |
| | S95T002501 | Lower ½ | 3,050 | 2,220 | 2,640 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 1,450 | 1,530 | 1,490 | | |
| | S95T002579 | Lower ½ | 1,100 | 593.9 | 847.9 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | 2,290 | 3,100 | 2,700 | 1,560 | 51.0 |
| | S95T003887 | Lower ½ | 2,210 | 1,830 | 2,020 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | 695 | 678.0 | 686.5 | | |
| | S95T003897 | Lower ½ | 815 | 880.0 | 847.5 | | |

Table A-32. Tank 241-SX-108 Analytical Results: Thallium (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | < 202 | < 208.4 | < 205 | < 112 | N/A |
| | S95T002501 | Lower ½ | < 102 | < 104.7 | < 103 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | < 73.92 | < 74.12 | < 74.02 | | |
| | S95T002579 | Lower ½ | < 65.58 | < 64.46 | < 65.02 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 129 | < 149 | < 139 | < 107 | N/A |
| | S95T003887 | Lower ½ | < 142 | < 122 | < 132 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 72.20 | < 73.2 | < 72.7 | | |
| | S95T003897 | Lower ½ | < 86.80 | < 83.0 | < 84.9 | | |

Table A-33. Tank 241-SX-108 Analytical Results: Titanium (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | $\mu g/g$ | $\mu g/g$ | $\mu g/g$ | $\mu g/g$ | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 32.39 | 28.66 | 30.52 | 43.7 | 43.3 |
| | S95T002501 | Lower ½ | 20.31 | 17.81 | 19.06 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 70.43 | 63.15 | 66.79 | | |
| | S95T002579 | Lower ½ | 61.68 | 55.35 | 58.51 | | |
| **Solids: $H_2O$ dig/acid** | | | $\mu g/g$ | $\mu g/g$ | $\mu g/g$ | $\mu g/g$ | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 6.450 | < 7.46 | < 6.96 | < 5.41 | N/A |
| | S95T003887 | Lower ½ | < 7.490 | < 6.03 | < 6.76 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 3.650 | < 3.66 | < 3.66 | | |
| | S95T003897 | Lower ½ | < 4.340 | < 4.15 | < 4.25 | | |

Table A-34. Tank 241-SX-108 Analytical Results: Uranium (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 3,180 | 2,950 | 3,070 | 5,150 | 47.8 |
| | S95T002501 | Lower ½ | 2,440 | 2,200 | 2,320 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 6,240 | 6,010 | 6,120 | | |
| | S95T002579 | Lower ½ | 9,480 | 8,730 | 9,100 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 322 | < 372 | < 347 | < 270 | N/A |
| | S95T003887 | Lower ½ | < 374 | < 301 | < 338 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 182 | < 183 | < 183 | | |
| | S95T003897 | Lower ½ | < 217 | < 208 | < 213 | | |

Table A-35. Tank 241-SX-108 Analytical Results: Uranium (Phosphorescence).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: fusion** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003885 | Upper ½ | 3,580 | 3,180 | 3,380 | 7,540 | 56.5 |
| | S95T003890 | Lower ½ | 3,570 | 2,810 | 3,190 | | |
| 95-AUG-043 | S95T003895 | Upper ½ | 12,000 | 11,500 | 11,800 | | |
| | S95T003900 | Lower ½ | 11,000 | 12,700 | 11,800 | | |

Table A-36. Tank 241-SX-108 Analytical Results: Vanadium (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | < 50.55 | < 52.10 | < 51.33 | 34 | 19.0 |
| | S95T002501 | Lower ½ | < 25.49 | < 26.175 | < 25.83 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 22.79 | 22.36 | 22.58 | | |
| | S95T002579 | Lower ½ | 36.24 | 36.37 | 36.31 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 32.20 | < 37.20 | < 34.7 | < 27.0 | N/A |
| | S95T003887 | Lower ½ | < 37.40 | < 30.1 | < 33.8 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 18.20 | < 18.3 | < 18.3 | | |
| | S95T003897 | Lower ½ | < 21.70 | < 20.8 | < 21.3 | | |

Table A-37. Tank 241-SX-108 Analytical Results: Zinc (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 48.45 | 46.37 | 47.41 | 75.2 | 44.9 |
| | S95T002501 | Lower ½ | 36.14 | 34.87 | 35.50 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 107 | 106.7 | 106.8 | | |
| | S95T002579 | Lower ½ | 112 | 110.6 | 111.2 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | 14.70 | 34.80 | 24.75 | 11.9 | 50.8 |
| | S95T003887 | Lower ½ | 11.50 | 11.00 | 11.25 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | 5.960 | 5.460 | 5.710 | | |
| | S95T003897 | Lower ½ | 5.410 | 6.650 | 6.030 | | |

Table A-38. Tank 241-SX-108 Analytical Results: Zirconium (ICP).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| **Solids: acid digest** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002482 | Upper ½ | 267 | 251.2 | 259.1 | 433 | 47.1 |
| | S95T002501 | Lower ½ | 208 | 188.8 | 198.6 | | |
| 95-AUG-043 | S95T002573 | Upper ½ | 538 | 518.9 | 528.6 | | |
| | S95T002579 | Lower ½ | 773 | 714.9 | 744.0 | | |
| **Solids: $H_2O$ dig/acid** | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003882 | Upper ½ | < 6.450 | < 7.46 | < 6.96 | < 5.41 | N/A |
| | S95T003887 | Lower ½ | < 7.490 | < 6.03 | < 6.76 | | |
| 95-AUG-043 | S95T003892 | Upper ½ | < 3.650 | < 3.66 | < 3.66 | | |
| | S95T003897 | Lower ½ | < 4.340 | < 4.15 | < 4.25 | | |

Table A-39. Tank 241-SX-108 Analytical Results: Bromide (IC).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids: $H_2O$ digest | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003881 | Upper ½ | < 1,620 | < 1,870 | < 1,750 | < 1,510 | N/A |
| | S95T003886 | Lower ½ | < 1,880 | < 1,520 | < 1,700 | | |
| 95-AUG-043 | S95T003891 | Upper ½ | < 1,200 | < 1,210 | < 1,200 | | |
| | S95T003896 | Lower ½ | < 1,430 | < 1,370 | < 1,400 | | |

Table A-40. Tank 241-SX-108 Analytical Results: Chloride (IC).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids: $H_2O$ digest | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003881 | Upper ½ | 1,320 | 1,850 | 1,580 | 2,160 | 23.9 |
| | S95T003886 | Lower ½ | 1,840 | 1,570 | 1,700 | | |
| 95-AUG-043 | S95T003891 | Upper ½ | 2,620 | 2,640 | 2,630 | | |
| | S95T003896 | Lower ½ | 2,740 | 2,720 | 2,730 | | |

Table A-41. Tank 241-SX-108 Analytical Results: Fluoride (IC).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids: $H_2O$ digest | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003881 | Upper ½ | < 168 | < 193 | < 181 | 433 | 58.8 |
| | S95T003886 | Lower ½ | < 194 | < 157 | < 176 | | |
| 95-AUG-043 | S95T003891 | Upper ½ | 713 | 767 | 739.9 | | |
| | S95T003896 | Lower ½ | 642 | 625.0 | 633.8 | | |

Table A-42. Tank 241-SX-108 Analytical Results: Nitrate (IC).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids: $H_2O$ digest | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003881 | Upper ½ | 4.52E+05 | 7.520E+05 | 6.020E+05 | 3.72E+05 | 53.4 |
| | S95T003886 | Lower ½ | 5.15E+05 | 5.650E+05 | 5.400E+05 | | |
| 95-AUG-043 | S95T003891 | Upper ½ | 1.36E+05 | 1.750E+05 | 1.550E+05 | | |
| | S95T003896 | Lower ½ | 1.88E+05 | 1.940E+05 | 1.910E+05 | | |

Table A-43. Tank 241-SX-108 Analytical Results: Nitrite (IC).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids: $H_2O$ digest | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003881 | Upper ½ | 14,500 | 21,900 | 18,200 | 15,700 | 30.0 |
| | S95T003886 | Lower ½ | 23,600 | 21,400 | 22,500 | | |
| 95-AUG-043 | S95T003891 | Upper ½ | 13,000 | 13,600 | 13,300 | | |
| | S95T003896 | Lower ½ | 8,790 | 8,490 | 8,640 | | |

Table A-44. Tank 241-SX-108 Analytical Results: Oxalate (IC).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids: $H_2O$ digest | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T003881 | Upper ½ | < 1,350 | < 1,560 | < 1,460 | 3,130 | 42.0 |
| | S95T003886 | Lower ½ | 4,930 | < 1,260 | 3,095 | | |
| 95-AUG-043 | S95T003891 | Upper ½ | < 1,000 | 1,210 | 1,110 | | |
| | S95T003896 | Lower ½ | 6,510 | 7,180 | 6,850 | | |

Table A-45. Tank 241-SX-108 Analytical Results: Phosphate (IC).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids: $H_2O$ digest | | | μg/g | μg/g | μg/g | μg/g | % |
| 95-AUG-042 | S95T003881 | Upper ½ | < 1,540 | < 1,780 | < 1,660 | < 1,440 | N/A |
| | S95T003886 | Lower ½ | < 1,790 | < 1,440 | < 1,620 | | |
| 95-AUG-043 | S95T003891 | Upper ½ | < 1,140 | < 1,150 | < 1,150 | | |
| | S95T003896 | Lower ½ | < 1,360 | < 1,300 | < 1,330 | | |

Table A-46. Tank 241-SX-108 Analytical Results: Sulfate (IC).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids: $H_2O$ digest | | | μg/g | μg/g | μg/g | μg/g | % |
| 95-AUG-042 | S95T003881 | Upper ½ | 8,960 | 11,700 | 10,300 | 6,890 | 34.0 |
| | S95T003886 | Lower ½ | 9,100 | 7,190 | 8,150 | | |
| 95-AUG-043 | S95T003891 | Upper ½ | 4,130 | 4,180 | 4,160 | | |
| | S95T003896 | Lower ½ | 4,970 | 4,910 | 4,940 | | |

Table A-47. Tank 241-SX-108 Analytical Results: Total Alpha.

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids:KOH fusion | | | µCi/g | µCi/g | µCi/g | µCi/g | % |
| 95-AUG-042 | S95T002481 | Upper ½ | 1.960 | 1.950 | 1.955 | 3.29 | 45.6 |
| | S95T002500 | Lower ½ | 1.740 | 1.520 | 1.630[c] | | |
| 95-AUG-043 | S95T002572 | Upper ½ | 4.070 | 4.320 | 4.195 | | |
| | S95T002578 | Lower ½ | 5.080 | 5.700 | 5.390[c] | | |

Table A-48. Tank 241-SX-108 Analytical Results: Total Beta.

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids: fusion | | | µCi/g | µCi/g | µCi/g | µCi/g | % |
| 95-AUG-042 | S95T003885 | Upper ½ | 3,590 | 3,260 | 3,420 | 6,930 | 52.1 |
| | S95T003890 | Lower ½ | 3,400 | 3,020 | 3,210[c] | | |
| 95-AUG-043 | S95T003895 | Upper ½ | 10,500 | 10,900 | 10,700 | | |
| | S95T003900 | Lower ½ | 10,400 | 10,300 | 10,400 | | |

Table A-49. Tank 241-SX-108 Analytical Results: Cerium/Praseodymium-144 (GEA).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids:KOH fusion | | | µCi/g | µCi/g | µCi/g | µCi/g | % |
| 95-AUG-042 | S95T002481 | Upper ½ | < 5.443 | < 5.03 | < 5.24 | < 18.6 | N/A |
| | S95T002500 | Lower ½ | < 5.583 | < 6.07 | < 5.83 | | |
| 95-AUG-043 | S95T002572 | Upper ½ | < 31.00 | < 29.5 | < 30.3 | | |
| | S95T002578 | Lower ½ | < 33.14 | < 32.6 | < 32.9 | | |

Table A-50. Tank 241-SX-108 Analytical Results: Cobalt-60 (GEA).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids:KOH fusion | | | µCi/g | µCi/g | µCi/g | µCi/g | % |
| 95-AUG-042 | S95T002481 | Upper ½ | < .211 | < .146 | < .179 | < 0.920 | N/A |
| | S95T002500 | Lower ½ | < .194 | < .185 | < .190 | | |
| 95-AUG-043 | S95T002572 | Upper ½ | < 1.477 | < 1.87 | < 1.67 | | |
| | S95T002578 | Lower ½ | < 1.747 | < 1.53 | < 1.64 | | |

Table A-51. Tank 241-SX-108 Analytical Results: Cesium-134 (GEA).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids:KOH fusion | | | μCi/g | μCi/g | μCi/g | μCi/g | % |
| 95-AUG-042 | S95T002481 | Upper ½ | < .317 | < .308 | < .313 | < 1.15 | N/A |
| | S95T002500 | Lower ½ | < .347 | < .367 | < .357 | | |
| 95-AUG-043 | S95T002572 | Upper ½ | < 1.891 | < 2.00 | < 1.95 | | |
| | S95T002578 | Lower ½ | < 2.086 | < 1.87 | < 1.98 | | |

Table A-52. Tank 241-SX-108 Analytical Results: Cesium-137 (GEA).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids:KOH fusion | | | μCi/g | μCi/g | μCi/g | μCi/g | % |
| 95-AUG-042 | S95T002481 | Upper ½ | 152 | 139.0 | 145.8 | 195 | 11.2 |
| | S95T002500 | Lower ½ | 212 | 261.0 | 236.3[e] | | |
| 95-AUG-043 | S95T002572 | Upper ½ | 173 | 170.0 | 171.7 | | |
| | S95T002578 | Lower ½ | 221 | 231.0 | 226.2 | | |

Table A-53. Tank 241-SX-108 Analytical Results: Europium-154 (GEA).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids:KOH fusion | | | µCi/g | µCi/g | µCi/g | µCi/g | % |
| 95-AUG-042 | S95T002481 | Upper ½ | < 81.4 | < 78.9 | < 80.2 | < 43.6 | N/A |
| | S95T002500 | Lower ½ | < 86.0 | < 84.5 | < 85.3 | | |
| 95-AUG-043 | S95T002572 | Upper ½ | < 4.283 | < .585 | < 2.43 | | |
| | S95T002578 | Lower ½ | < 6.456 | < 6.35 | < 6.40 | | |

Table A-54. Tank 241-SX-108 Analytical Results: Europium-155 (GEA).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids:KOH fusion | | | µCi/g | µCi/g | µCi/g | µCi/g | % |
| 95-AUG-042 | S95T002481 | Upper ½ | < 1.463 | < 1.36 | < 1.41 | < 5.17 | N/A |
| | S95T002500 | Lower ½ | < 1.412 | < 1.54 | < 1.48 | | |
| 95-AUG-043 | S95T002572 | Upper ½ | < 8.173 | < 8.80 | < 8.49 | | |
| | S95T002578 | Lower ½ | < 9.293 | < 9.26 | < 9.28 | | |

Table A-55. Tank 241-SX-108 Analytical Results: Niobium-94 (GEA).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids:KOH fusion | | | µCi/g | µCi/g | µCi/g | µCi/g | % |
| 95-AUG-042 | S95T002481 | Upper ½ | < 0.206 | < 0.174 | <0 .190 | < 0.915 | N/A |
| | S95T002500 | Lower ½ | <0 .212 | < 0.183 | < 0.120 | | |
| 95-AUG-043 | S95T002572 | Upper ½ | < 1.733 | < 1.85 | < 1.79 | | |
| | S95T002578 | Lower ½ | < 1.817 | < 1.31 | < 1.56 | | |

Table A-56. Tank 241-SX-108 Analytical Results: Radium-226 (GEA).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids:KOH fusion | | | µCi/g | µCi/g | µCi/g | µCi/g | % |
| 95-AUG-042 | S95T002481 | Upper ½ | < 9.613 | < 8.97 | < 9.29 | < 30.6 | N/A |
| | S95T002500 | Lower ½ | < 9.937 | < 11.1 | < 10.5 | | |
| 95-AUG-043 | S95T002572 | Upper ½ | < 48.93 | < 46.2 | < 47.6 | | |
| | S95T002578 | Lower ½ | < 56.09 | < 54.0 | < 55.0 | | |

Table A-57. Tank 241-SX-108 Analytical Results: Ruthenium/Rhodium-106 (GEA).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids:KOH fusion | | | µCi/g | µCi/g | µCi/g | µCi/g | % |
| 95-AUG-042 | S95T002481 | Upper ½ | < 6.553 | < 6.07 | < 6.31 | < 24.1 | N/A |
| | S95T002500 | Lower ½ | < 7.034 | < 7.94 | < 7.49 | | |
| 95-AUG-043 | S95T002572 | Upper ½ | < 39.89 | < 39.9 | < 39.9 | | |
| | S95T002578 | Lower ½ | < 46.49 | < 39.2 | < 42.8 | | |

Table A-58. Tank 241-SX-108 Analytical Results: Strontium-89-90 (GEA).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids:KOH fusion | | | µCi/g | µCi/g | µCi/g | µCi/g | % |
| 95-AUG-042 | S95T002481 | Upper ½ | 1,630 | 1,440 | 1,540 | 3,070 | 52.3 |
| | S95T002500 | Lower ½ | 1,350 | 1,430 | 1,390 | | |
| 95-AUG-043 | S95T002572 | Upper ½ | 4,130 | 4,510 | 4,320 | | |
| | S95T002578 | Lower ½ | 4,910 | 5,110 | 5,010 | | |

Table A-59. Tank 241-SX-108 Analytical Results: TOC (Persulfate/Coulometry).

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Solids: | | | µg/g | µg/g | µg/g | µg/g | % |
| 95-AUG-042 | S95T002480 | Upper ½ | 142 | 154.0 | 148.0 | 900 | 86.8 |
| | S95T002589 | Lower ½ | 55.40 | 126.0 | 90.70 | | |
| 95-AUG-043 | S95T000660 | Lower ½ | 1,830 | 1,520 | 1,680 | | |

Table A-60. Tank 241-SX-108 Analytical Results: Weight Percent Water.

| Segment Number | Sample Number | Sub-Sample | Result | Dup. | Mean | Overall Mean | RSD (Mean) |
|---|---|---|---|---|---|---|---|
| Thermogravimetric Analysis | | | wt% | wt% | wt% | wt% | % |
| 95-AUG-042 | S95T002480 | Upper ½ | 2.86 | 3.48 | 3.17[e] | 2.03 | 55.1 |
| | S95T002489 | Lower ½ | 2.70 | 3.56 | 3.13[e] | | |
| 95-AUG-043 | S95T002567 | Upper ½ | 0.591 | 1.621 | 1.106[e] | | |
| | S95T002577 | Lower ½ | 0.535 | 0.897 | 0.716[e] | | |
| Gravimetric Analysis | | | wt% | wt% | wt% | wt% | % |
| 95-AUG-042 | S95T002480 | Upper ½ | 0.500 | 0.5000 | 0.5000 | 0.475 | 5.3 |
| | S95T002489 | Lower ½ | 0.500 | 0.4000 | 0.4500[e] | | |

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| P. Szerszen | | X | | | |
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| S. F. Agnew (4) | | X | | | |
| <u>Los Alamos Technical Associates</u> | | | | | |
| T. T. Tran | B1-44 | X | | | |
| <u>Ogden Environmental</u><br>101 East Wellsian Way<br>Richland, WA 99352 | | | | | |
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| M. McAfee | | X | | | |
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