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ENGINEERING DATA TRANSMITTAL

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Name: B.C. Simpson

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7. Abstract

This document provides the essential characterization data for Double-Shell Tank AW-106

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Tank Characterization Report for Double-Shell Tank 241-AW-106

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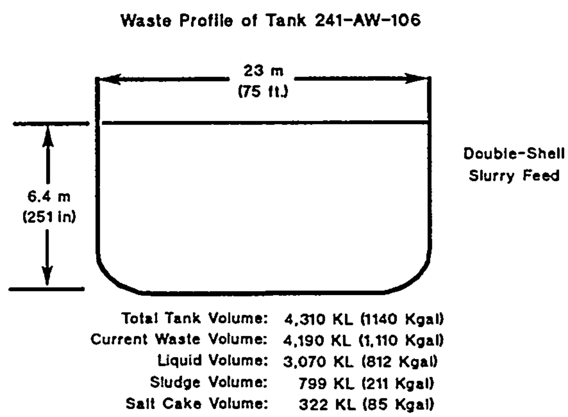
EXECUTIVE SUMMARY

Double-Shell Tank 241-AW-106 is an underground radioactive waste storage tank. Its supernatant volume was most recently sampled in December of 1993. The analytical data cited in this Tank Characterization Report were derived from this sampling event. Sampling and characterization of the waste in Tank 241-AW-106 contribute toward the fulfillment of Milestone M-44-05 of the *Hanford Federal Facility Agreement and Consent Order* (Ecology, EPA and DOE, 1993). Characterization will also provide support for Tank Farm Operations, safety programs, and design of retrieval, pretreatment, and disposal systems.

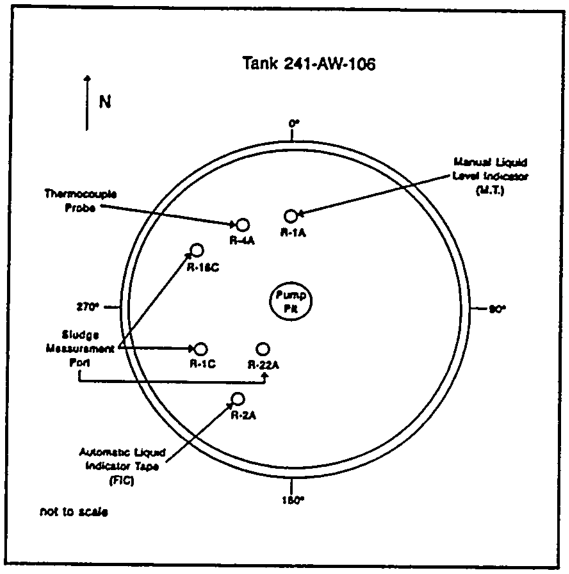


Tank 241-AW-106, located in the 200 East Area AW Tank Farm, was constructed and went into service in 1980. The tank is presently used as the double-shell slurry feed receiver tank from Evaporator 242-A, and is engaged in the current Evaporator 242-A Campaign 94-1. Most of the waste processed in the evaporator passes through Tank 241-AW-106 after evaporation. The waste is then either transferred to another double-shell tank for storage, or is rerouted to the evaporator through Tank 241-AW-102 for further volume reduction. The final disposal of the waste in Tank 241-AW-106 will be as high- and low-level glass fractions. The tank has an operational capacity of 4.31 million liters (1,140,000 gallons). The waste is heterogeneous and includes sludge, supernatant, and interstitial liquid. The most current and complete inventory reported a total of 4.19 million liters (1.11 million gallons) of waste, consisting of 3.07 million liters (812,000 gallons) of supernatant liquid, 799,000 liters (211,000 gallons) of sludge, and 322,000 liters (85,000 gallons) of salt cake (Hanlon, 1994). The tank is classified as a non-Watch List tank and is considered to be a sound or non-leaking tank. There are no Unreviewed Safety Questions associated with Tank 241-AW-106 at this time.

The volume of the waste in Tank 241-AW-106 is in a constant state of flux due to continuing waste management practices. As stated above, it is involved in the present evaporator campaign; it also is used in Tank Farms training programs, often receiving large amounts of flush water. Because of this continual change in volume and waste constituent concentrations, analytical data and inventory estimates may no longer be valid. However, based on the assumption that the solid level is static relative to the supernatant liquid, this Tank Characterization Report has instead attempted to give a historical background of the tank, to provide estimates of analyte concentrations and tank inventory that will be processed, to predict the amount and composition of the solid heel, and to catalogue any safety requirements which apply to the tank.

The latest sampling and characterization activity (O'Rourke, 1994) indicated that the most prevalent analytes were aluminum, fluoride, sodium, nitrate, nitrite, hydroxide, and sulfate. The major radionuclide constituent is ^{137}Cs. The calculated pH of 13.6 is above the *Resource Conservation and Recovery Act* established limit in corrosivity. Comparisons to established limits of concern for selected analytes can be made by referring to the *Tank Characterization Reference Guide* (De Lorenzo et al., 1994).

The estimated contents of the tank have been compared to the dangerous waste codes in the Washington Dangerous Waste Regulations (Ecology, 1991). The assessment was conducted by comparing tank contents against dangerous waste characteristics ("D" waste codes) and against state waste codes. It did not include checking tank constituents against "U", "P", "F", or "K" waste codes since application of these codes is dependent on the source of the waste and not on particular constituent concentrations. The results indicate that the waste in this tank is adequately described in the Dangerous Waste Permit Application for the Double-Shell Tank System; this permit is discussed in the *Tank Characterization Reference Guide* (De Lorenzo, et al., 1994).



Tank 241-AW-106	
Tank Description	
Type:	Double-Shell
Constructed:	1980
In-Service:	1980
Diameter:	23 m (75 feet)
Usable Depth:	10.7 m (35 feet)
Operating Capacity:	4,320,000 L (1,140,000 gallons)
Bottom Shape:	Flat
Hanford Coordinates:	40,490° North 47,645° West
Ventilation:	Operating Exhauster
Tank Status: as of March 1994	
Contents:	Dilute Non-Complexed
Total Waste:	4,190,000 L (1,110,000 gallons)
Supernate Volume:	3,070,000 L (812,000 gallons)
Drainable Interstitial Liquid:	159,000 L (42,000 gallons)
Sludge:	799,000 L (211,000 gallons)
Saltcake:	322,000 L (85,000 gallons)
Manual Tape Surface Level:	6.38 m (251 inches) (06/13/94)
Temperature:	41.7°C (107°F) (06/13/94)
FIC Surface Level:	6.39 m (251.6 inches) (06/13/94)
Integrity Category:	Sound

Double-Shell Tank 241-AW-106 Concentrations and Inventories for Critical List Analytes (based on historical data from 1993 supernate sampling & March 1994 Volume Update)		
Liquid Volume	3,070,000 L (812,000 gallons)	
Chemical Constituents	**Average Liquid Concentration**	**Liquid Bulk Inventory**
Metals	**(wt%)**	**(kg)**
Al (Aluminum)	0.11	3,320
Na (Sodium)	2.71	83,200
Anions	**(wt%)**	**(kg)**
F^- (Fluoride)	0.48	14,700
OH^- (Hydroxide)	0.64	19,500
NO_3^- (Nitrate)	2.46	75,500
NO_2^- (Nitrite)	0.61	18,600
SO_4^{2-} (Sulfate)	0.27	8,350
Radionuclide	**(μCi/mL)**	**(Ci)**
^{137}Cs	50.7	156,000

The inventory estimates presented here are for information purposes only. They were calculated based on the assumptions that the historical analyte concentrations and waste volumes remained constant. Tank 241-AW-106 is currently in-service and is involved in the various ongoing waste management operations at the Hanford Site. Real-time tank inventories can be obtained from Tank Farm Operations. The Tank Characterization Reports for tanks still receiving waste will be revised as new information becomes available, on a quarterly basis, if necessary. However, due to the inherent delay in the revision and issuance of the document, the most current and authoritative data will be with Tank Farm Operations personnel.

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LIST OF TERMS

CASS	Computer Automated Surveillance System
CP	concentrated phosphate
DN	dilute non-complexed
DOE	U.S. Department of Energy
DQO	data quality objectives
EPA	United States Environmental Protection Agency
FIC	Food Instrument Corporation
TIC	total inorganic carbon
TOC	total organic carbon
TRU	transuranic
TWRS	Tank Waste Remediation System
WHC	Westinghouse Hanford Company

1.0 INTRODUCTION

This Tank Characterization Report presents an overview of the transfer history of Tank 241-AW-106 and contains observations regarding waste characteristics which resulted from the 242-A Evaporator Campaign 94-1.

1.1 PURPOSE

The purpose of this report is to describe and characterize the waste in Double-Shell Tank 241-AW-106 (hereafter, Tank 241-AW-106) based on information given from various sources. Specific objectives reached by the sampling and characterization of the waste in Tank 241-AW-106 are to:

- Contribute toward the fulfillment of the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) Milestone M-44-05 concerning the characterization of Hanford Site high-level radioactive waste tanks (Ecology, EPA, and DOE, 1993).

- Provide tank waste characterization information to the Tank Waste Remediation System (TWRS) Program Elements in accordance with the *TWRS Tank Waste Analysis Plan* (Bell, 1994).

1.2 SCOPE

This report deviates from the standard format for Tank Characterization Reports. A broad description of the tank, its historical background, and estimates of the volume and composition of the solid heel based on data from O'Rourke (1994) are presented. Specific safety issues and program element needs are also discussed.

1.3 ASSUMPTIONS

Tank 241-AW-106 is presently used as a receiver tank for the 242-A Evaporator; consequently, its level and waste composition are constantly changing. Definitive characterization is thus complicated. For this reason, the sections of the Tank Characterization Report that describe the sampling event, the sample handling and analysis, and the statistical analysis are being omitted. Information concerning sampling events, sample handling, and analytical procedures can be obtained in the *Tank Characterization Reference Guide* (De Lorenzo et al., 1994) sections 5.0 and 6.0.

2.0 HISTORICAL TANK INFORMATION

The purpose of this section is to describe Tank 241-AW-106 based on historical tank information. This section is divided into five parts. A brief description and historical background of the tank comprise the first part, followed by the recent tank status, a summary of the process sources that contributed to the tank waste, and a historical estimation of the tank contents. The final part details the surveillance data taken on the tank.

2.1 TANK HISTORY

Tank 241-AW-106 is a tank-in-tank design consisting of a heat-treated primary steel liner, inside a second steel liner. The tank has a design capacity for storing 4.39 million liters (1.16 million gallons) of waste; however, safety considerations restrict the maximum operating capacity to 4.32 million liters (1.14 million gallons). Instruments access Tank 241-AW-106 through risers and monitor the pressure, temperature, liquid level, sludge level, and other bulk tank characteristics (Bell, 1994). Active ventilation is used to keep the tank contents cool and filters are employed to minimize the potential for release of airborne contaminants to the environment (Husa et al., 1993). A detailed diagram of a double-shell tank is presented in Figure 2-1 (Hanlon, 1994).

Tank 241-AW-106 was constructed and went into service in 1980. It is one of six tanks that comprise the AW Tank Farm located in the south part of the 200 East Area. Figure 2-2 details the Hanford Site's 200 East Area and the location of the 241-AW Tank Farm. Tank 241-AW-106 is located in the southeast corner of the tank farm.

Tank 241-AW-106 is designated a slurry receiver and used primarily to store waste processed in the 242-A Evaporator. Other waste sources have included tanks 241-AW-103, 241-AW-102, and 241-AY-102; B Plant cesium processing; and flush water from various sources (waste transfers are detailed in Section 2.3).

2.2 TANK STATUS

Prior to the most recent 242-A Evaporator campaign, Campaign 94-1, Tank 241-AW-106 contained supernatant liquid, sludge, salt cake, and interstitial liquid. The last complete volume update reported 3.07 million liters (812,000 gallons) of supernatant liquid, 799,000 liters (211,000 gallons) of sludge, and 322,000 liters (85,000 gallons) of salt cake, making up a total of 4.19 million liters (1.11 million gallons) of waste (Hanlon, 1994). More recent figures breaking down the waste inventory of this tank following Campaign 94-1 were not available.

Tank 241-AW-106 remains in service. The "in service" designation allows the tank to continue receiving waste to support production and/or waste processing. The tank is classified as a structurally sound, non-Watch list tank. There are no Unreviewed Safety Questions associated with Tank 241-AW-106 at this time.

Figure 2-1. Double-Shell Tank Configuration.

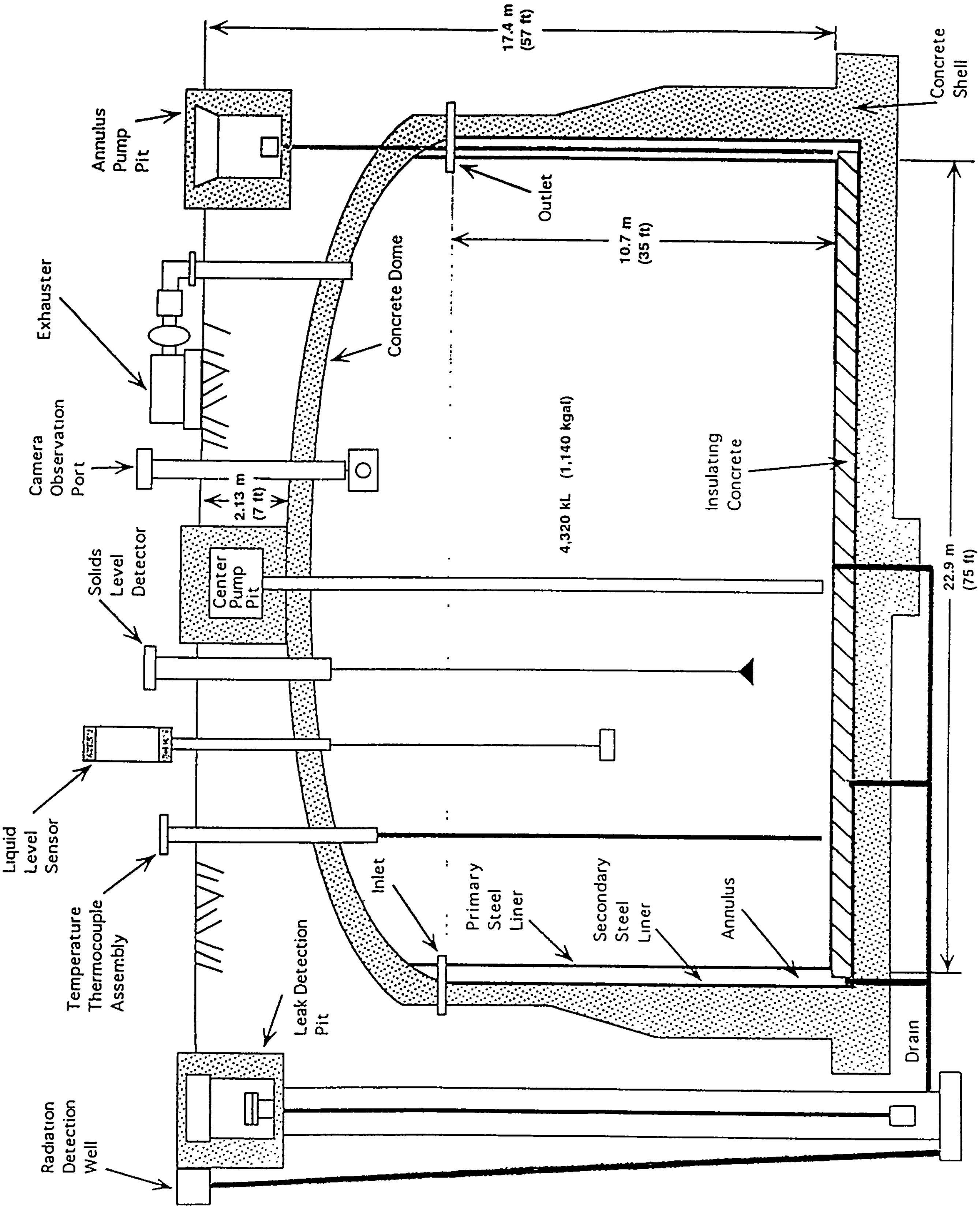
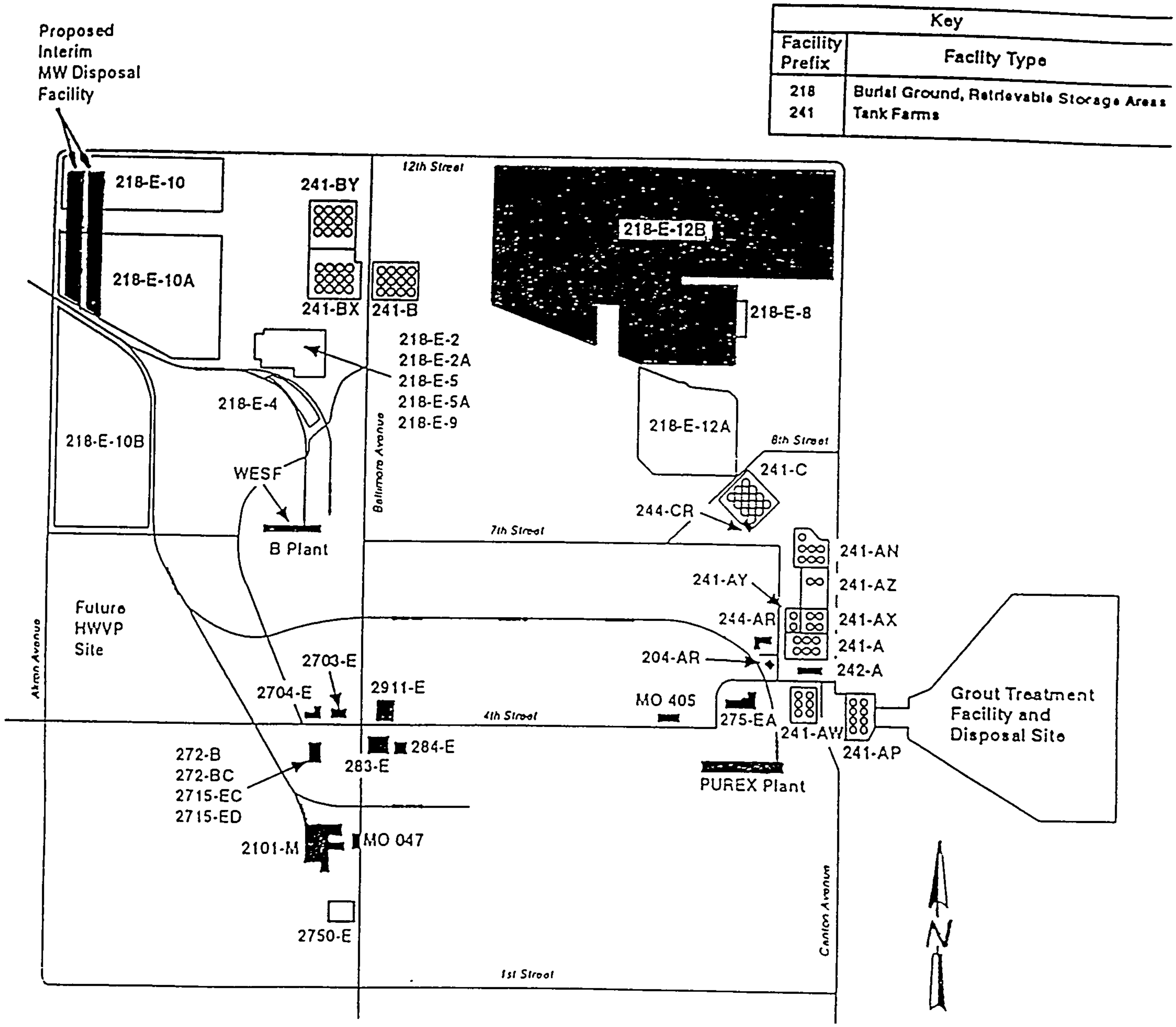


Figure 2-2. Location of the 241-AW Tank Farm.



Tank 241-AW-106 is equipped with both a manual tape and an automated liquid indicator device for surface level readings; both are operable. The waste occupied approximately 6.38 m (251 inches) of the tank on June 13, 1994 (Rios, 1994). All tank monitoring instruments are in compliance with documentation (Hanlon, 1994). The temperature within the tank, as measured on 06/13/1994, was 41.7°C (107°F).

2.3 PROCESS KNOWLEDGE

Figure 2-3 depicts the fill history of Tank 241-AW-106 from February 1981 to May 1994. A detailed description of the transfers responsible for these fluctuations follows. These data are also summarized in Tables 2-1 and 2-2. All information comes from *Waste Volume Projection Historical Database* (Koreski, 1994) unless noted otherwise.

The Koreski data begin with 2.03 million liters (536,000 gallons) of concentrated phosphate (CP) waste within Tank 241-AW-106 as of February 1, 1981. During the following year the tank received two transfers of dilute non-complexed (DN) waste from B Plant cesium processing, 64,300 liters (17,000 gallons) in June and 60,600 liters (16,000 gallons) in October as well as three additions of flush water totalling 136,000 liters (36,000 gallons). These five transactions representing a total addition of 261,000 liters (69,000 gallons) to Tank 241-AW-106 brought the total waste volume to 2.29 million liters (605,000 gallons) at the end of October 1982.

Beginning January 1983 and continuing through the end of 1989, a series of transfers involving mostly additions of waste to Tank 241-AW-106 from the 242-A Evaporator and removals of waste from Tank 241-AW-106 to Tank 241-AW-102, the feed tank for the 242-A Evaporator, was performed. Other possibilities of waste gains during this time period include additions of flush water, waste from Tanks 241-AW-103 and 241-AY-102, and back-transfers from Tank 241-AW-102. Other waste losses are due to transfers to Tanks 241-AP-105 and 241-AP-106 as well as to unknown sources. For example, in January 1983, 2.13 million liters (564,000 gallons) of waste were transferred from Tank 241-AW-106 to Tank 241-AW-102. Later, in March 1983, Tank 241-AW-106 received 30,300 liters (8,000 gallons) of flush water and 3.48 million liters (919,000 gallons) of DN waste from Tank 241-AW-103, bringing its total volume to 3.66 million liters (968,000 gallons). This last transfer in 1983 consisted of double-shell slurry feed decanted from Tanks 241-AX-101 and 241-A-101 (Knight, 1985). Most of this waste was in turn sent to Tank 241-AW-102 in two transfers, 2.01 million liters (531,000 gallons) in March 1984 and 1.42 million liters (374,000 gallons) in November 1984, leaving 238,000 liters (63,000 gallons) of waste in the tank.

Fill activities were minimal from 1990 through 1993 and included flush water additions and unknown gains and losses. The most likely reasons for the unknown gains and losses were evaporation, possible measurement inconsistencies since 2.54 cm (one inch) is equivalent to about 10,400 liters (2,750 gallons) of waste, and the propagation of errors due to the active transfer history of Tank 241-AW-106. In addition, during this time frame, the Koreski database was corrected to show a total of 799,000 liters (211,000 gallons) of sludge having settled in Tank 241-AW-106.

Figure 2-3. Tank 241-AW-106 Fill History.

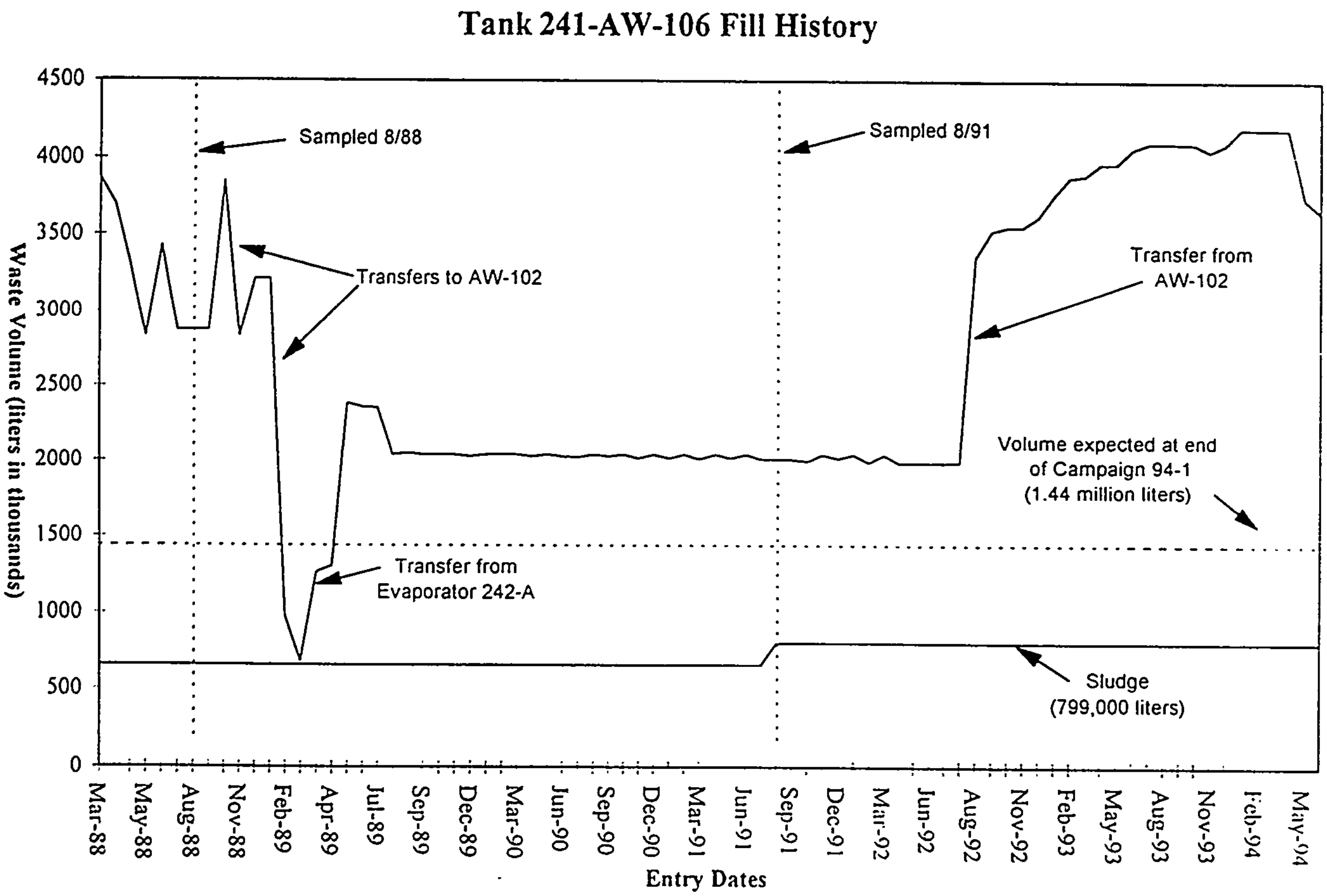


Table 2-1. Tank 241-AW-106 Waste Received 1982-1993.

Year	Waste Received from Evaporator		Other Gains	
	Number of Transactions	Volume, 1000 L (1000 gallons)	Number of Transactions	Volume, 1000 L (1000 gallons)
1982	0	0	5	+261 (+69)
1983	0	0	2	+3,510 (+927)
1984	1	+1,650 (+437)	0	0
1985	10	+20,400 (+5,383)	3	+6,180 (+1,633)
1986	10	+23,200 (+6,134)	2	+68 (+18)
1987	5	+13,900 (+3,661)	1	+11 (+3)
1988	11	+31,300 (+8,271)	3	+49 (+13)
1989	3	+6,070 (+282)	4	+1,140 (+302)
1990	0	0	2	+19 (+5)
1991	0	0	0	0
1992	0	0	5	+1,635 (+432)
1993	0	0	7	+526 (+139)
Total	40	+91,500 (+24,168)	34	+13,400 (+3,541)

Table 2-2. Tank 241-AW-106 Waste Removed 1982-1993.

Year	Transfer to Other Tanks		Other Losses	
	Number of Transactions	Volume, 1000 L (1000 gallons)	Number of Transactions	Volume, 1000 L (1000 gallons)
1982	0	0	0	0
1983	1	-2,130 (-564)	0	0
1984	2	-3,430 (-905)	0	0
1985	11	-27,300 (-7,210)	1	-11 (-3)
1986	11	-21,500 (-5,688)	1	-8 (-2)
1987	6	-13,300 (-3,508)	0	0
1988	14	-31,600 (-8,355)	0	0
1989	4	-3,330 (-882)	4	-61 (-16)
1990	0	0	3	-30 (-8)
1991	0	0	2	-19 (-5)
1992	0	0	2	-11 (-3)
1993	1	-49	1	-4 (-1)
Total	50	-103,000 (-27,125)	14	-144 (-38)

Overall, starting with a volume of 2.03 million liters (536,000 gallons) of waste in 1981, Tank 241-AW-106 received an additional total of 91.5 million liters (24.2 million gallons) from the 242-A Evaporator and 13.4 million liters (3.54 million gallons) from other sources and lost a total of 103 million liters (27.1 million gallons) due to transfers to other tanks and 144,000 liters (38,000 gallons) due to unknown sources during the period from 1982 through 1993. The final volume at the end of 1993 was 4.10 million liters (1.08 million gallons). Beginning in 1994, 102,000 liters (27,000 gallons) of flush water were added in January. An unknown loss of 3,790 liters (1,000 gallons) occurred in March, bringing the total waste volume of Tank 241-AW-106 to 4.19 million liters (1.11 million gallons) by the beginning of 242-A Evaporator Campaign 94-1. Prior to this campaign, most of the waste in Tank 241-AW-106, 1.99 million liters (527,000 gallons), consisted of feed from earlier evaporator campaigns, and about one-third, 1.37 million liters (361,000 gallons), was transferred from Tank 241-AW-102 in August 1992 (Koreski, 1994). Flush water made up the remainder of the waste.

During Campaign 94-1 (O'Rourke, 1994), approximately 10.9 million liters (2.89 million gallons) of dilute wastes from Tanks 241-AW-106, 241-AW-102, and 241-AP-103 were to be mixed and processed through the 242-A Evaporator with a projected overall waste volume reduction factor of 87%. Plans call for approximately 1.44 million liters (380,000 gallons) of dilute double-shell slurry feed to be returned to Tank 241-AW-106 at the completion of the campaign. If the sludge heel is assumed to remain relatively static at 799,000 liters (211,000 gallons), the ratio of sludge to supernate can be estimated to be 799,000 liters/640,000 liters (211,000 gallons/169,000 gallons), or 1.25:1 after the campaign. Throughput for this campaign was estimated to be 20.1 million liters (5.30 million gallons) and the processing time was anticipated to be 49 days with scheduled maintenance down time of 16 days. The evaporator campaign began April 15, 1994, with the transfer of 3.40 million liters (897,000 gallons) of waste from 241-AW-106 to the evaporator feed tank. By the end of April, 2.94 million liters (777,000 gallons) of processed waste were returned to Tank 241-AW-106 from the evaporator. In May, 2.94 million liters (777,000 gallons) of waste were again transferred to the feed tank with 2.85 million liters (753,000 gallons) returned from the evaporator. This brings the total waste volume of Tank 241-AW-106 to 3.65 million liters (964,000 gallons) as of May 27, 1994.

2.4 HISTORICAL ESTIMATION OF THE CONTENTS OF TANK 241-AW-106

A preliminary estimation of the contents of Tank 241-AW-106 is complicated by the use of this waste tank as a slurry receiver for the 242-A Evaporator. The tank contents, particularly of the liquid waste, continually change with each Evaporator campaign. However, the analysis of liquid waste samples taken from Tank 241-AW-106 in late 1993 provides an estimation of the radionuclide, organic, and inorganic constituents of the liquid waste in the tank prior to the most recent Evaporator campaign, Campaign 94-1.

Table 2-3 presents analytical results of selected radionuclides, one organic analyte (a mean of ten samples), and the estimated concentrations of ten inorganic analytes obtained for Tank 241-AW-106, from the supernate sampling activity conducted in late 1993 (O'Rourke, 1994). The radionuclide results were obtained from composite samples. The concentrations of the inorganic constituents were derived by taking into account the original sample data and subsequent dilution with water and additions of waste from Tank 241-AW-102. Concentrations measured analytically are recorded as Tank Characterization Result.

These concentrations, obtained from supernate samples, were converted into Total Tank Inventory values using the liquid waste volume of 3,070,000 L. This conversion is valid only if the analytical concentrations remained constant. In addition, since the waste volume at the time of sampling was not available, the most current waste volume of 3,070,000 L was used.

Table 2-3. Tank Characterization Report Data for Double-Shell Tank 241-AW-106. (2 pages)

Analyte	Tank Characterization Result	Total Tank Inventory
Metals	**(μg/L)**	**(kg)**
Aluminum (Al)	1.08E+06	3,320
Sodium (Na)	2.71E+07	83,200
Ions	**(μg/L)**	**(kg)**
Ammonium (NH_4^+)	89.6 (ppm)	275
Fluoride (F^-)	4.78E+06	14,700
Hydroxide (OH^-)	6.34E+06	19,500
Nitrate (NO_3^-)	2.46E+07	75,500
Nitrite (NO_2^-)	6.07E+06	18,600
Phosphate (PO_4^{3-})	4.54E+05	1,390
Sulfate (SO_4^{2-})	2.72E+06	8,350
Other	**(μg/L)**	**(kg)**
TIC	3.08E+05	946
TOC	7.28E+05	2,230
Acetone	7800	24
Radionuclides	**(μCi/mL)**	**(Ci)**
^{3}H	0.0120	36.8
^{14}C	7.47E-05	0.2
^{60}Co	< 0.00637	< 19.6
^{79}Se	3.98E-05	0.1
^{90}Sr	0.0295	90.6
^{94}Nb	< 0.00766	< 23.5
^{99}Tc	0.0168	51.6
^{106}Ru	< 0.489	< 1,500
^{113}Sn	< 0.0502	< 154
^{129}I	< 4.24E-05	< 0.1
^{134}Cs	0.397	1,220
^{137}Cs	50.7	156,000
^{144}Ce	< 0.272	< 835
^{154}Eu	< 0.0161	< 49.4

Table 2-3. Tank Characterization Report Data for Double-Shell Tank 241-AW-106. (2 pages)

Analyte	Tank Characterization Result	Total Tank Inventory
Radionuclides (continued)	**(μCi/mL)**	**(Ci)**
^{155}Eu	< 0.0686	< 211
^{226}Ra	< 0.0776	< 238
$^{239/240}Pu$	9.89E-05	0.3
^{241}Am	2.15E-05	0.1
U_{Gross}	0.00947 (g/L)	29.1 (kg)

Among the cations for which data are available, aluminum is abundant and is almost completely water-insoluble. The majority of aluminum compounds present in the sludge are most likely $Al(OH)_3$. Other possible aluminum precipitates are aluminum silicate ($Al_2O_3.SiO_2$) and aluminum orthophosphate ($AlPO_4$). Sodium, on the other hand, is not expected to precipitate but rather to remain in the supernatant liquid. The anions listed in Table 2-3 are expected to be present in both the sludge and the supernatant liquid.

The inventory estimates presented in Table 2-3 are not necessarily representative of current tank conditions and are shown for information purposes only. Tank 241-AW-106 remains in active service and is involved in the various ongoing waste management operations at the Hanford Site. Real-time tank inventories can be obtained from Tank Farm Operations. The Tank Characterization Reports for tanks still receiving waste will be revised as new information becomes available, on a quarterly basis, if necessary. However, due to the inherent delay in the revision and issuance of the document, the most current and authoritative data will be with Tank Farm Operations personnel.

2.5 SURVEILLANCE DATA

2.5.1 Surface Level Readings

To determine the surface level of the waste, Tank 241-AW-106 is equipped with both an automatic gauge manufactured by the Food Instrument Corporation (FIC) and a manual tape. The manual tape readings are used when the FIC indicator is out of service. Both devices are currently operable. The most recent FIC liquid level measurement available was 6.39 m (251.6 inches) on June 13, 1994. The manual tape reading for the same date was about 6.38 m (251 inches) (Rios, 1994).

The FIC indicator uses a conductivity electrode which is lowered by machine until electrical contact is established with the waste surface; it can be monitored either automatically or manually (Husa et al., 1993). When monitored automatically, the FIC gauge is electrically connected to a computer for data transmission, analysis, and reporting via the Computer Automated Surveillance System (CASS). The manual tape also uses a conductivity probe but must be lowered by hand crank.

2.5.2 Internal Tank Temperatures

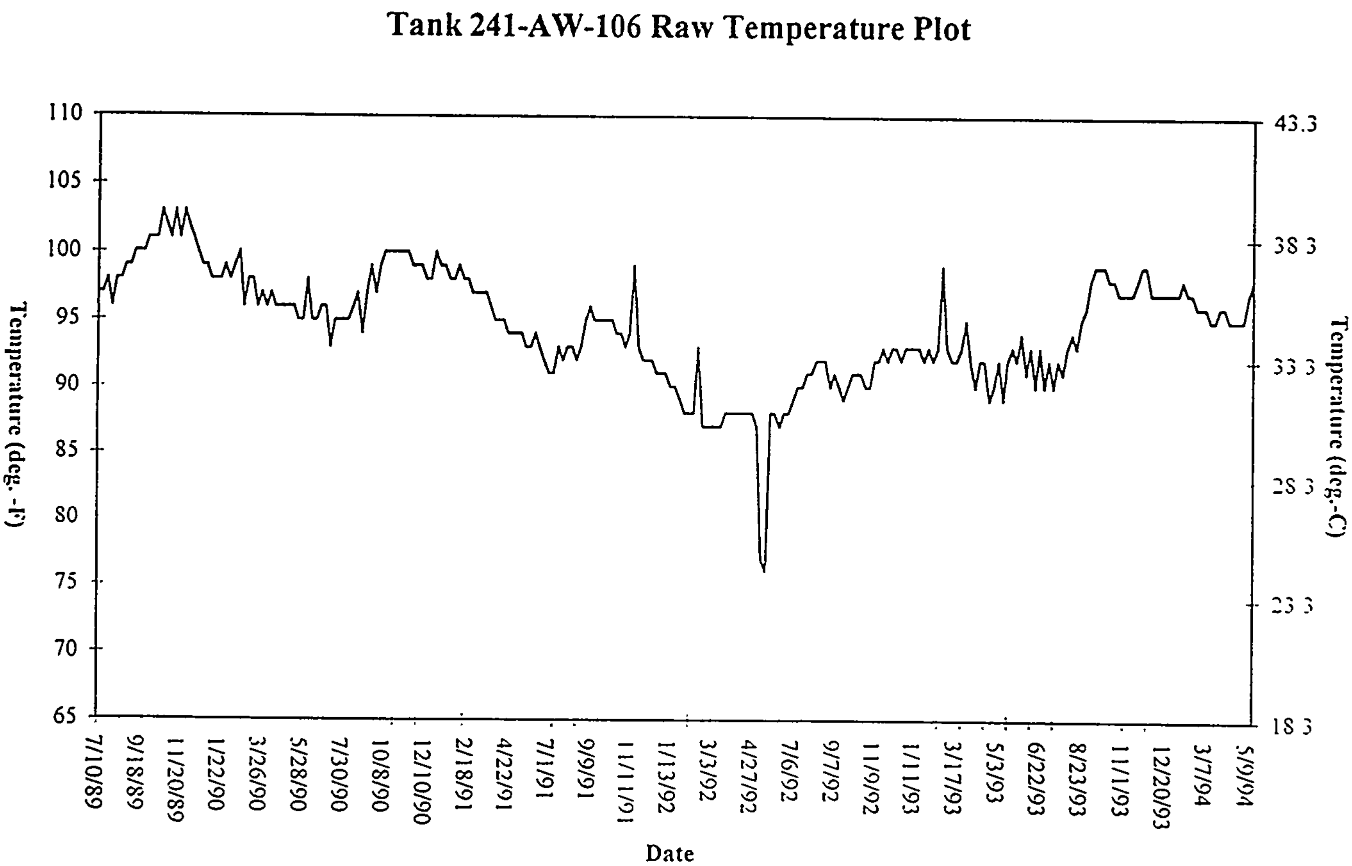
Each double-shelled tank is equipped with approximately 100 thermocouples. A probe with 18 thermocouples assembled in a pipe, called a thermocouple tree, is inserted into a waste tank and used to monitor the waste temperatures at various levels in the primary tank, usually every two feet. The temperature readings for Tank 241-AW-106 have been automatically recorded since the beginning of the third quarter 1989 by surveillance analysis computer systems. The maximum temperature readings from thermocouple tree one, which is located in the southwest quadrant of the primary tank at midway radial position (refer to the riser diagram in the Executive Summary for location, are plotted in Figure 2-4. This graph, along with all of the temperature data, have been taken from Rios (1994). The last available temperature reading for Tank 241-AW-106 was 38.9°C (102°F) as read from thermocouple #3 on June 13, 1994.

Temperature fluctuations seen in Figure 2-4 may be due to seasonal changes. This is expected since the soil between the surface level and approximately 3 m (10 ft) below surface level creates a zone that is thermally transient, thus displaying diurnal and seasonal variations in temperature (Freeze and Cherry, 1979). Usually the soil below this 3 m (10 ft) zone attenuates the effects of changing ambient air temperature. The bottom of the tank is 18 m (60 feet) below the surface level, but unlike a solid mass of soil the effects of changing air temperature are still felt because the tank is a more efficient heat conductor. The tank's metal and concrete container filled with liquid, surrounded by actively ventilated annular space and connected to the surface by risers and drywell openings, will transfer heat to and from the surface more readily. Furthermore, the active ventilation system forces heat transfer between the tank contents and the ambient air.

Temperature fluctuations in Tank 241-AW-106 between 39.4°C (103°F) and 24.4°C (76°F) may also be due to heat loss after evaporator processing and/or as a result of changing waste volume. Since the values plotted in Figure 2-4 are always the highest of all temperatures recorded on the thermocouple tree on a given day, they could represent the sludge temperature, the supernatant temperatures, or even the temperature of the air space of the waste.

Beginning in mid-1989, Tank 241-AW-106 was monitored on approximately a weekly basis. Three data points on the graph in Figure 2-4 are unexpectedly high [37°C (99°F) in about November 1991, 34°C (94°F) in about February 1992, and 37°C (99°F) in about March 1993)] given the readings that preceded and followed them. Two readings are unusually low [25°C (77°F) and 24°C (76°F) in about May 1992]. Since the unexpected readings occurred in times of minimal fill activity, possible explanations for these anomalies are possible thermocouple equipment malfunctions or the raw data may have been transmitted or recorded incorrectly.

Figure 2-4. Tank 241-AW-106 Thermocouple Tree Raw Temperature Plot (Rios, 1994).



3.0 PROGRAM ELEMENT SPECIFIC ANALYSES

The sampling and analysis of Hanford Site waste tanks are driven by the need to satisfy the characterization requirements of the various Tank Waste Remediation System (TWRS) program elements. These characterization needs are implemented and documented through the Data Quality Objective (DQO) process, and expressed in a series of program specific DQO documents. The data needs are summarized in the *TWRS Tank Waste Analysis Plan* (Bell, 1994).

This Tank Characterization Report is a major step in the characterization of Tank 241-AW-106. According to the process and issue based data requirements, the inventory estimates and waste properties contained in this report can be applied to the data requirements of the various program elements. Contained in Table 3-1 is a summary of which program data needs are fulfilled through this characterization of the waste in Tank 241-AW-106, based on a review of the stated sampling and analysis requirements. In the future, the applicability of Tank Characterization Report results to each TWRS program element will be documented in tank specific Tank Characterization Plans, prior to the tank sampling.

Table 3-1. Applicability of Characterization Information to the Data Needs of the TWRS Program Elements.

Data Quality Objective	Applicability to Characterization of Tank 241-AW-106
Tank Safety Screening	applies[1]
Ferrocyanide Safety Issue	does not apply
Flammable Gas Tanks Crust Burn Issue	does not apply
Generic Tank Vapor Issue Resolution	not addressed
Flammable Gas Tank	not completed
Waste Compatibility	applies
Organic Fuel Rich Tank	does not apply
Rotary Core Vapor Sampling	does not apply
Evaporator Operations	not completed
Process Control	not completed
Waste Tank Retrieval	not completed
Waste Tank Pretreatment	not completed
High-Level Waste Immobilization	not completed
Low-Level Waste Immobilization	not completed
Solid, Low-Level Waste Disposal	not completed
RCRA Part B Permit Application	not completed

Table 3-1. Applicability of Characterization Information to the Data Needs of the TWRS Program Elements.

Data Quality Objective	Applicability to Characterization of Tank 241-AW-106
Tank C-106 High-Heat Safety Issue	does not apply
Organic Layer Sampling of Tank C-103	does not apply
Tank C-103 Vapor and Gas Sampling	does not apply

1 The sampling requirement for the Safety Screening Data Quality Objective (Babad, 1994) calls for both vertical waste samples and a vapor space sample. The sampling and analysis of Tank 241-AW-106 support full characterization of the waste in the tank; vapor space sampling or characterization was not conducted as part of this activity.

applies - The data needs expressed in this Data Quality Objectives document are fulfilled through this characterization report.

does not apply - The data needs expressed in this Data Quality Objectives document do not apply to the waste in Tank 241-AW-106.

not addressed - The data needs expressed in this Data Quality Objectives document were not addressed by this characterization report.

not complete - At the date of preparation of this report, this Data Quality Objectives document has not yet been completed.

There are two DQOs that apply to Tank 241-AW-106. The DQO for Tank Safety Screening has been developed for rapid classification of the 177 single-shell tanks and double-shell tanks containing high-level radioactive waste. Specific sampling and analytical requirements for this safety screening are contained in the *Tank Safety Screening Data Quality Objective* (Babad, 1994). The objective of the safety screening is to support tank safety issue resolution and to classify the waste tanks into specific safety categories for issues concerning ferrocyanide content, flammable gases, organic safety concerns, and criticality. Concerns related to high-heat and vapor content are not subject to this screening activity. Key parameters to be measured during screening are: energetics, % water, total alpha concentration, and lower flammability limit of the gases in the dome space.

As the receiver tank for the 242-A Evaporator, the role of Tank 241-AW-106 is to receive concentrated waste from the evaporator and then transfer the waste to other double-shell tanks for long-term storage. Since the evaporator will be operated so that the slurry product will meet the boundary condition limits specified for the double-shell tanks, it can be concluded with confidence that the waste in the tank will fall within set safety limits. Due to the decrease in water volume associated with the evaporator process, there is a tendency for precipitates to form in the slurry received by Tank 241-AW-106. Activity such as this has resulted in a layer of solids on the bottom of the tank. There is, however, a potential for these same precipitates to redissolve as water content increases from present or future evaporator campaigns.

Data Quality Objectives for the Waste Compatibility Program have been created to identify safety and operations decision elements relevant to waste transfers both within and external to the Hanford Site Double-Shell Tank system. These DQOs describe quantitative decision limits. The primary decision for waste compatibility is whether or not to allow a waste transfer. Four safety-related decision elements have been identified: criticality, flammable gas accumulation, energetics, and corrosivity. Operations-related elements include separation of transuranic (TRU) waste from non-TRU waste, limits on heat generation, and segregation of complexant waste (high organic content). When a quantified decision limit has been exceeded, the waste requires further attention before the transfer can proceed. These DQOs are outlined in the *Data Quality Objectives for the Waste Compatibility Program* (Carothers, 1994). As mentioned above, these decision criteria are considered in operation of the 242-A Evaporator. Thus, it is reasonable to conclude that the waste entering Tank 241-AW-106 will meet these criteria.

4.0 RECOMMENDATIONS

4.1 SAFETY ISSUES

According to the *Process Control Plan for 242-A Evaporator Campaign 94-1* (O'Rourke, 1993), the predicted inventory of fissionable radionuclides, organic or exothermic waste constituents, and flammable gas producing compounds indicates that no credible potential exists for loss of tank integrity or release of radioactivity due to tank farm processes. Tank 241-AW-106 is considered sound and non-leaking (Hanlon 1994), and examination of the waste volume history supports this conclusion (Koreski, 1994). Thermocouple data indicate that no self heating occurs in the waste, and that all variations in waste temperature are due to seasonal fluctuations, heat loss due to evaporator processing, and/or variable waste volume.

4.2 FURTHER CHARACTERIZATION NEEDS

Since Tank 241-AW-106 is the receiver tank for the 242-A Evaporator, its contents continually change during evaporator campaigns; one such campaign was in progress at the time this document was written. A complete characterization of the waste would require a sampling event to be conducted under static conditions with respect to tank farm operations. It may be useful to determine the composition of the precipitated solids and organic complexants in the waste upon the completion of the evaporator campaign. Thus, sludge and supernatant samplings are recommended for Tank 241-AW-106 at the completion of Evaporator Campaign 94-1.

5.0 REFERENCES

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