HISTORICAL TANK CONTENT ESTIMATE FOR THE SOUTHEAST QUADRANT OF THE HANFORD 200 AREAS

WORK ORDER E11728

Prepared for

Westinghouse Hanford Company

June 1995

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Prepared by

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7. Abstract

Historical Tank Content Estimate of the Southeast Quadrant provides historical evaluations on a tank by tank basis of the radioactive mixed wastes stored in the underground double-shell tanks of the Hanford 200 East and West Areas. This report summarizes historical information such as waste history, temperature profiles, psychrometric data, tank integrity, inventory estimates and tank level history on a tank by tank basis. Tank Farm aerial photos and in-tank photos of each tank are provided. A brief description of instrumentation methods used for waste tank surveillance are included. Components of the data management effort, such as Waste Status and Transaction Record Summary, Tank Layering Model, Supernatant Mixing Model, Defined Waste Types, and Inventory Estimates which generate these tank content estimates, are also given in this report.

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FOR THE SOUTHEAST QUADRANT
OF THE HANFORD 200 AREAS**

WORK ORDER E11728

Prepared for

Westinghouse Hanford Company

June 1995

Prepared by

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Richland, Washington**

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for

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1 Introduction

1.1 Purpose

This document provides historical evaluations of the radioactive and mixed waste stored in the Hanford Site underground double-shell tanks (DSTs). A Historical Tank Content Estimate has been developed by reviewing the process histories, waste transfer data, and available physical and chemical characterization data from various Department of Energy (DOE) and Department of Defense (DOD) contractors.

The historical data will supplement information that is currently being gathered from core sampling the wastes in the tanks. Review of a tank history accompanied by current characterization data will create an inventory estimate that is more complete and reliable than core sampling alone. A historical review of the tanks may reveal anomalies or unusual contents that are critical to characterization and post characterization activities.

Complete and accurate tank waste characterizations are critical first steps for the DOE and Westinghouse Hanford Company safety programs, waste pretreatment, and waste retrieval activities.

1.2 Scope

The scope of this document is limited to the DSTs in the Hanford 200 Area. The SY Tank Farm was added to the southeast quadrant because of its similarities with the other tanks and it is the only DST farm in the 200-West Area. The northeast and southeast quadrants represent an approximate geographical division of the 200-East Area tank farms. The division was made as follows:

- NE Quadrant: A, AX, B, BX, BY, C
- SE Quadrant: AN, AP, AW, AY, AZ, SY

The maps on the following pages detail the 200-East and 200-West Areas.

1.3 Approach

This report is a compilation of work performed by ICF Kaiser Hanford Company, Los Alamos National Laboratory, and Westinghouse Hanford Company.

ICF Kaiser Hanford Company reviewed the history of the tanks in each of the four quadrants and incorporated the inventory estimates and models of tank layers being developed by Los Alamos National Laboratory into the report. Historical waste transfer and level data, tank physical information, temperature data, and sampling data have been compiled for this report and supporting documents for the Southeast Quadrant Historical Tank Content Estimate (Brevick, 1995).

200 East Area

200 West Area

Legend	
Tanks	○
Boundaries	—
Railroad	—
Single Shell Tank - SST	
Double Shell Tank - DST	

1.3.1 Surveillance Techniques for the Hanford Radioactive and Mixed Waste Storage Tanks

Surveillance information is used to determine the condition of the tanks and the characteristics of the waste. Tank integrity (i.e., sound, assumed leaker, assumed re-leaker) is investigated by monitoring waste levels and the leak detection pits. Waste temperatures can be used to correlate the inventories of heat-generating radionuclides such as cesium 137 (^{137}Cs) and strontium 91 (^{91}Sr). The instrumentation and methods used for tank surveillance are described in the following sections.

■ In-Tank Surface Levels

Four liquid level devices are used to monitor and control liquid levels in the primary tank of a double-shell tank: a level indicating transmitter or Food Instrument Corporation gauge, a level indicator assembly or manual tape, a high level detector, and the ENRAF 854 Liquid Level Indicator/Transmitter. A level indicator assembly or manual tape is used to measure liquid levels in the annulus.

The Food Instrument Corporation gauge is used as the primary liquid level monitoring device with the manual tape as a backup in the primary tank. The high level detector is used to detect intrusions within the primary tank. The Food Instrument Corporation gauge consists of an electrode and steel tape that detects liquid on contact. The measurements are scanned hourly on the computer automated surveillance system (CASS).

The manual tape flake boxes are used as access for measuring liquid levels manually if the automatic system fails or does not exist in the primary tank. A hand crank on the flake box is used to lower the tape probe until liquid is contacted and a liquid level measurement can be obtained. The flake boxes located over the annulus are used to lower manual tapes into the annulus to monitor leaks from the primary tank.

The ENRAF 854 Liquid Level Indicator/Transmitter has been installed on several tanks and will eventually replace the old level measurement devices. Level detection in the ENRAF is based on the principle of buoyancy of a non-floating polyethylene displacer. The weight of the displacer is entered into the memory of the gauge. A second weight of about 10-15 grams less than the actual weight of the displacer is entered into a different location in the memory. The displacer will move up or down until it weighs the same as the second (lighter) weight. The displacer remains in contact with the waste and sustains the programmed second weight. The measurements are entered into the Tank Monitoring and Control System (TMACS).

Sludge levels are determined with a sludge measurement device which consists simply of a "doughnut" shaped weight attached to a steel tape. The sludge measurement device is lowered into the tank until it stops. Several risers are used to determine the contours of the sludge below the liquid waste.

■ Interstitial Liquid Level (Liquid Observation Wells)

Food Industry Corporation gauges and manual tapes are limited to surface level measurement. Therefore, wells to observe liquid have been installed in Tanks 241-SY-102 and 241-AW-103 to monitor the interstitial liquid levels. The interstitial liquid is the liquid trapped within and underneath the solid waste. Gamma, neutron, and acoustic probes may be lowered into the liquid observation wells to determine the interstitial liquid levels within the tank. The two observation wells are used strictly for special surveillance and are not monitored on a regular basis.

■ Temperatures

The temperatures of the double-shell tanks are monitored with thermocouples. A typical double-shell tank contains approximately 100 thermocouples at a variety of locations including the structural concrete of the tank foundation, walls, and dome; the tank knuckle region; the insulating concrete in the base; the primary steel liner; and the tank waste and vapor space. The aging waste tanks (AY and AZ Tank farms) have thermocouples in their air lift circulators. Thermocouples in the waste are typically attached to a thermocouple tree anchored to a tank riser. Several tree designs exist, but a tree generally consists of thermocouples and leads housed in a pipe that provides a means of fixing the probes at different heights in the waste. A typical double-shell tank contains one tree, and a typical tree contains 18 thermocouples. In recent years, multi-functional instrument trees (MIT) have been installed into a few of the watch list tanks (Tanks 241-SY-101, 241-SY-103, and 241-AW-101). These trees measure other properties, such as gas pressure and hydrogen concentration in the vapor space, in addition to the temperature. An MIT contains 22 thermocouples. Details on the status of the thermocouples as of April 1993 can be found in the Thermocouple Status, Single Shell and Double Shell Waste Tanks (Tran 1993).

The temperatures are recorded either manually on data sheets using a portable potentiometer or by one of several computer-automated systems. These systems include the computer automated surveillance system (CASS), the tank monitor and control system (TMACS), and the data acquisition and control system (DACS). These systems record other data besides temperatures. The surveillance analysis computer system (SACS) is the primary database for storing tank temperature data. The CASS and TMACS record temperatures on some single-shell tanks and double-shell tanks. The DACS only records temperatures in Tank 241-SY-101. In the past, the CASS has recorded temperatures of all double-shell tanks, but it presently records temperatures only for the AP Tank farm. The CASS stores temperature data on magnetic tape, but the data will be transferred to the SACS in the future. The TMACS presently records temperatures for the AN and SY Tank farms, but it is planned to be operating for all tank farms by September 1996. The TMACS transfers its daily temperature readings to the SACS. Operators manually record temperatures on data sheets for the AP, AW, AY, and AZ Tank Farms. For the AP and AW Tank Farms, these temperatures from data sheets are manually entered and stored in the SACS. The SACS does not presently store temperature data for AY and AZ farms.

■ Annulus

The double-shell tanks are designed so that if a leak develops in the primary tank shell, the leak can be detected in the annulus, the space between the steel liners. The annulus monitoring equipment is used to detect the presence of liquids, level of radiation, increase in temperature, and differential pressure. Drain channels are installed in the basal concrete to collect any leakage and direct it to the annulus. Photographs were taken inside the annulus for inspection purposes during tank construction.

■ Leak Detection Pits

Leak detection pits are located next to the tank. Three measurement devices are used in the leak detection pits: a liquid level detector, a thermocouple, and a radiation monitor. The liquid level detector used in the leak detection pits is a specific gravity dip tube. Since the dip tubes need to be checked for accuracy periodically, a 6-inch water level is maintained in the bottom of the 24-inch leak detection pit to provide continuous checking capabilities. A thermocouple is placed at the bottom of the pit to detect an increase in temperature from any leak of heat generating radionuclides. A drywell next to the leak detection pit, contains a radiation monitoring device to determine background radiation levels and detect leaks.

■ Ventilation

The ventilation for the primary tank and the annulus is filtered through high-efficiency particulate air (HEPA) filters and monitored continuously for malfunctions. All the double-shell tanks are actively ventilated to prevent radioactive releases to the environment. Because the ventilation creates negative pressure in the primary tank, the negative pressure is monitored in the primary tank to prevent buckling of the tank bottom. The annulus vacuum or negative pressure is also monitored for changes that indicate a tank leak or system problems.

Since differential pressure is related to air flow in the tank, differential pressure readings are taken at the exhaust fans, filters, and deentrainers. The vapor space and atmospheric pressures are monitored and compared. High differential pressures are caused by filter plugging or wet filters, while low differential pressure can be caused by filter seal problems or tank pressurization. Continuous monitoring exists for radiation levels in the ventilation room and at various locations along the ventilation system.

■ Evaporation Rate (Psychrometrics)

Psychrometric data are collected on all the double-shell tanks and high-heat load single-shell tanks. The data are obtained from air moving through the inside of each tank and the annulus. The schedule for obtaining psychrometric data is determined by WHC Process Engineering. Presently, data are recorded about once a month.

The main reason for recording psychrometric data for the tank is an attempt to determine the rate of evaporation in the tanks. The evaporation rates can be used to account for loss of liquid from the tanks. The

psychrometric data collected in the annulus are used to quantify the moisture content of the air in the annulus. The psychrometric data can also be used to estimate the instantaneous rate of heat transfer into the ventilation systems of the tank and the annulus.

In order to calculate the evaporation rates and heat exchange in the tank, five pieces of information are required. The first two pieces are the wet-bulb and dry-bulb temperatures of air entering the tank. The next two pieces are the wet-bulb and dry-bulb temperatures of air leaving the tank. The final piece is the volumetric flow rate of air moving through the tank.

Dry-bulb temperatures are obtained using a standard thermometer. Wet-bulb temperatures are measured with a thermometer whose bulb is covered by a cotton wick saturated with water. When the wet wick is placed in the air stream, some of the water in the wick is evaporated. As a result, the temperature of the water decreases. After awhile, the heat loss from the water by evaporation equals the heat gain from the air, and the water temperature stabilizes. This stabilized temperature is the wet-bulb temperature.

Once the wet-bulb and dry-bulb temperatures are known, one can determine the properties (enthalpy, relative humidity, specific volume, and humidity ratio) of air at the tank entrance and exit. By comparing the properties of air at these points, one can determine the amount of water added and heat transferred to or from the air stream.

The raw data have always been measured and recorded in the field. However, methods of calculating the evaporation rate and heat transfer rate have differed. Before 1989, evaporation rates and heat transfer rates were calculated using a program on a Hewlett Packard Calculator. From 1989 until the present, the raw data were entered into a computer spreadsheet (Microsoft Excel) and the evaporation rate and heat transfer rate were automatically calculated. The program was modified to represent more accurately the calculations made by the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. The main difference is that the density of water is now fit to a curve as a function of temperature to match the latest standards. These calculations have been documented and checked (Wood, 1993).

■ In-Tank Photography

In-tank photography is another method to determine the volume of waste. Photographs are used to resolve anomalous measurements inside the tanks and to assist in determining tank integrity. Photographs can also be used to determine sludge and liquid levels, provide a degree of corroboration with other waste management processes, and be a source of information about foreign objects contained in the tanks. The photographs can be compared to see if wastes in tanks with similar histories have similar characteristics. Currently, photographs are not used to determine waste levels in double-shell tanks because none are leaking. Photographs were taken in each annulus during construction for inspection purposes.

1.3.2 Approach and Development of Supporting Information Contained in the Historical Tank Content Estimate and Supporting Documents

Extensive historical information was gathered for each tank. The data are summarized in the Historical Tank Content Estimate Report (HTCE) including the tank level history, in-tank photos, the Tank Layer Model, the Supernatant Mixing Model, and the inventory estimate. For a more comprehensive data set on each tank, refer to the Supporting Documents for the Historical Tank Content Estimate Reports for each respective tank farm in the southeastern quadrant (Brevick, 1995).

■ Tank Level Histories

The tank level histories are graphical representations of waste levels over the lifetime of a tank. They include information such as waste types, in-tank photograph dates, transfer data, and physical data. Information was gathered from various documents and the resulting comments were added directly to each drawing.

The liquid and solids levels are shown on the tank level history graphs as volumes and tank elevations. The following conversion was used to relate the elevation to the respective volume for all tanks in the double-shell tank farms:

FORMULA

$$\frac{\text{Total Gallons}}{2750 \frac{\text{Gallons}}{\text{Inch}}} = \text{Total Inches} \quad (1)$$

■ Temperature Plots

The source of the historical temperatures presented here are the computer automated surveillance system, surveillance analysis computer system, and data sheets from manual recordings. The raw data from these three sources span from July 1981 to March 1995. The computer automated surveillance system stored daily temperature readings for all DST farms on magnetic tapes. The computer automated surveillance system stores temperatures for most thermocouples in the tank (foundation, walls, primary liner, etc.); however, only in-tank thermocouple data are presented in this report. The surveillance analysis computer system database provided weekly temperature readings for all farms but the AY and AZ Tank Farms. The surveillance analysis computer system stores temperature readings for a subset of the in-tank thermocouples in each double-shell tank. Data sheets provided daily temperature readings for the AZ Tank Farm during a brief period of time in late 1989 and early 1990. More data sheets may exist, but they have not been located.

The raw data from the computer automated surveillance system, surveillance analysis computer system, and data sheets were imported into the computer spreadsheet software (Microsoft Excel). Within the Excel program, time history plots of each thermocouple revealed suspect data points that were subsequently removed from the data set. Statistical and linear regression analyses based on this reduced data set of non-suspect temperatures are presented in the individual tank sections. Suspect data points satisfied one of the following criteria: 1) a large scatter in temperatures from one day to the next over a continuous period of time; 2) an individual temperature reading not following the trend of the other temperatures recorded in the same period of time; 3) disagreement between data recorded at the same time from the computer automated surveillance system and surveillance analysis computer system; or 4) the disagreement between an individual thermocouple reading with the reading of thermocouples located above and below it on the tree. The non-suspect data set spanned from July 1983 to December 1993. Tabular listings and plots of the in-tank temperature data are available in the Supporting Documents for the Southeast Quadrant Historical Tank Content Estimate (Brevick, 1995).

■ Surface Level Plots

The surface level data from 1991 to 1994 were obtained from the Westinghouse Hanford Company ORACLE database through the surveillance analysis computer system. The information was parsed in a spreadsheet (Excel) and graphed to show waste level versus time. Current surface level information is available in the supporting documents (Brevick, 1995).

■ Tank Profiles and Other Drawings

The drawings in this report were compiled from several sources including as-built drawings and the Double-Shell Waste Storage Tanks Riser Study (Anderson, 1992). The risers and penetrations through the tank dome serve several purposes including points of access for monitoring equipment and sampling the waste.

■ Photographs

The latest tank interior and tank farm aerial photographs were obtained from Pacific Northwest Laboratory. The tank farm aerial photographs were labeled to indicate the relative position of each tank in the farm. Larger equipment was labeled in the photographs. Photographs of tank interiors have been arranged to show the contents of each tank. The auxiliary equipment within each photographic collage was identified, if possible, and labeled appropriately.

■ Historical Sample Analysis Data

The sampling data were obtained from the WHC Tank Waste and Retrieval group. Tables of analytical data were made for samples taken prior to September 1989. The information was compiled in the Microsoft Excel computer program to present the data as similarly as possible. The tables include physical data and chemical and radiological analysis data by analyte (i.e., each item analyzed). Other data included with the sample references are summarized as text. Historical tank sample analysis data are available in the supporting documents (Brevick, 1995).

■ Psychrometric Plots

The psychrometric data were obtained from both the manual and electronic records of the WHC Tank Farm Surveillance group. In order to represent the data, all the data needed to be based on the same equations. Consequently, all the data were entered into computer spreadsheets (Excel), and the latest program (Wood, 1993) was used to calculate evaporation rates and heat transfer rates. These quantities have been plotted against time on separate graphs. Evaporation rate versus time is plotted in gallons per week. Evaporation in gallons per week is used to show the amount of water removed from the tank. Heat transfer rates were plotted in Btu/hr.

The heat generated in the tank waste is dispersed into the environment through the ventilation systems of the tank and annulus, through the tank walls into the soil, and through other types of heat loss. The major portion of the heat exchanged with the environment occurs through the ventilation systems. By plotting the rate of heat exchange between the waste and the ventilation systems, and reviewing the respective trends in conjunction with the flow rates and ambient temperatures, trends were postulated for the heat generation rate of the waste.

1.3.3 Approach and Development of the Process-Based Historical Tank Content Estimate

The estimates of tank contents using process-based historical data, presented in this report were developed by Los Alamos National Laboratory. The estimates are the primary sources of data to characterize tank contents until the tank waste characterization reports are completed. The characterization reports will incorporate the results of current core sampling and analyses with the tank content estimates based on historical data to present the most current evaluation of waste constituents.

Generating tank content estimates based on historical information involves managing and evaluating large quantities of data. The system of generating the estimates is composed of several parts which are described in the following sections.

■ Waste Status and Transaction Record Summary

The Waste Status and Transaction Record Summary (WSTRS) is a database containing all known waste transfer records. Historically, when waste was pumped from plant (process) to tank or tank to tank, a record was kept of the volume and type of waste that was pumped. The transaction summary is the recorded levels of the solids and supernatant.

The WSTRS is partitioned into four separate sections (i.e., quadrants). The database for the southeast quadrant is available in Document No. WHC-SD-WM-TI-689, Rev. 1 (Agnew, 1995).

■ Tank Layer Model

The Tank Layer Model is derived from the WSTRS database. The purpose of the Tank Layer Model is to predict the waste types and volumes of solids in each tank. The model is generated by reconciling the reported levels

of solids from each tank in the WSTRS with the volume percent of solids expected for the primary additions of waste (Agnew, 1995). The transaction summary database contains records of the types of waste that entered each tank and the corresponding increase in the solids volume from each waste entry. Not all transactions that occurred were recorded in the WSTRS. However, the primary waste additions and measurements of solids levels used in the Tank Layer Model are well represented. The results of the model are reported in this document. The model is presented graphically with the inventory estimate described below.

■ Defined Waste Types

Early in the development of the historical tank content estimates, a need to compile the chemical compositions of all known waste types into one reference document was recognized. The information was compiled by Los Alamos National Laboratories. The Hanford defined wastes document was developed independently of the WSTRS database and the Tank Layer Model. However, the Hanford defined waste list will be used with the model to obtain the tank waste inventory estimates described below.

The Hanford defined wastes document contains the compositions and physical properties for all known Hanford waste types that went into the double-shell and single-shell tanks. For more details on the methods used to develop these waste types, refer to Hanford Defined Wastes: Chemical and Radionuclide Compositions (Agnew, 1995).

■ Supernatant Mixing Model

Los Alamos National Laboratory developed the Supernatant Mixing Model that describes a "supernatant" portion of each tank as a combination of Hanford defined waste supernatants that have been concentrated by some factor. The following assumptions were used for this model:

- 1) Ideal mixing of the total volume of each tank throughout its history (i.e., no excluded volume for remaining solids layers).
- 2) Transactions were added to the WSTRS to resolve unknown transactions for each quarter according to a set of rules. Therefore, an updated WSTRS was used that will be published later as Rev. 2.
- 3) Not all of the saltwell liquid sources for 1978 through 1995 are known. All unknown saltwell liquid is now assigned to water for this estimate.

■ Inventory Estimates

The end result of combining the information from the Tank Layer Model, the Supernatant Mixing Model, and the Hanford defined wastes document is the tank inventory estimate. When the volumes and compositions of each waste type in a particular tank are known from the above sources of information, the total chemical inventory in the tank is calculated. The Tank Layer Model predicts unknown layers for some tanks. When possible, these unknown layers are assigned to a best estimate defined waste type for the composite inventory estimates. Layers that have not been assigned a best estimate waste type are not included in the composite tank estimates. Diatomaceous earth and cement are also not included in the composite

inventory estimates. The tank inventories use data through the December 1993 Tank Farm Surveillance and Waste Status Summary Reports (Hanlon, 1993). The results for individual tanks are presented in tabular form with tanks that have unassigned waste layers indicated.

The inventory estimates developed by Los Alamos National Laboratory are checked against existing data from current sample analyses, thermal and physical models, and historical records. The checking constitutes a large portion of the time required to develop the estimates. When estimates are checked against existing data, the models used may be reevaluated. Thus, the process of generating estimates will be iterated and the associated errors will be reduced over time as the historical knowledge of the tank waste operations increases.

1.3.4 Assumptions

The quality of the historical information available for the tanks often requires that assumptions and judgements be made on the applicability and validity of the data. Some assumptions were used to interpret the data.

■ Temperature Data

The temperature readings from the computer automated surveillance system, surveillance analysis computer system, and manually recorded data sheets are assumed to apply to the same set of thermocouples on the same thermocouple tree. Thermocouples are identified by tag name; for example, thermocouple 36 in Tank 241-AP-101 is named TE-101-AP-36. The Tran report (1993) identifies all the double-shell tank thermocouples using this naming convention. The computer automated surveillance system and data sheets use this naming convention to identify thermocouples; therefore, it was easy to match the data from these two sources for identical thermocouples. The surveillance analysis computer system database uses a different naming convention. The thermocouples are numbered sequentially from 1 to 18 on an 18-thermocouple tree, from number 1 at the bottom of the tree to number 18 at the top. The difference in naming conventions could introduce errors during data entry into the surveillance analysis computer system. It is assumed that no mistakes were made during temperature data entry into the surveillance analysis computer system and therefore the thermocouple number (1 to 18) corresponds to the correct thermocouple.

The data acquisition system that allows temperatures to be manually recorded on data sheets is assumed to be calibrated the same as the system used by the computer automated surveillance system.

■ Sampling Data

The data obtained from the historical analytical information are understood to vary widely in type, quality, and scope. The data range from the process control analysis obtained from a grab sample on a few selected analytes to a total characterization suite performed on a core sample. There are no specific criteria for quantitative data quality for the information incorporated into the historical tank content estimate. The information sources are assessed qualitatively during construction of the

historical tank content estimate. The available data will be assessed for suitability and consistency in the study and each data source is weighted appropriately for its contribution to the overall estimates.

When the sampling data were compiled, a sample was considered to be a solids sample if it contained greater than 30% solids. Sludge and slurry samples were included.

■ Psychrometric Plots

Psychrometric data are collected once a month, but at random times. The data from air entering the tank would not always be collected at the same time as the data from air exiting the tank. Therefore, the calculated evaporation rate and heat transfer rate may not be a true representation of the monthly, weekly, or daily average. The data represent only one point per month. By combining all these points, a trend is assumed to exist for each tank. The liquid waste temperature is assumed to be the same temperature as the outlet dry-bulb temperature.

■ Inventory Estimates

Formation of solids in the wastes vary by type and are determined individually by examination of the historical fill records. Further refinement and bounding of the solids formation are provided by conformation to physically attainable systems (e.g., waste volumes contained in the tanks do not exceed the tank capacity and negative void fractions are not possible). Waste stream compositions were based on process flowsheet information and previous analytical data.

The solids were assumed to be evenly distributed throughout the slurry during their transfer. In the Tank Layer Model, the distribution of solids is chronological and volumetric, but does not attempt to predict the solids stratigraphy (configuration of layers). Localized mounding and pocketing in various areas of the tank may have occurred due to phenomena around the inlets and outlets (e.g., cascades and transfers through floating suction pumps removing or depositing sludge). These phenomena would have affected only a small fraction of the tank area and do not impact the overall results of this study. However, spatial variability within the physical configuration and process history is acknowledged. No method currently exists that would adequately model this discrepancy. An effort is underway to develop this concept further and incorporate it into the tank characterization process, but it is incomplete at this time.

Solids from a specifically designated waste type are assumed to be homogeneous. Variation and layering of the sludge due to differences in component concentration between batches, precipitate particle size, and particle density were quite likely. The effect of these factors on the distribution of analytes within the solids is unknown. However, the effect probably was small and not detectable with the present sample collection and analysis process.

It was assumed that solids were not compacted and compaction was not accounted for in the study. Although compaction probably occurred in the history of the tanks because additional layers of solids formed atop each

other, the degree of compression is unknown and, therefore, was not incorporated.

Density and other physical characteristics of the solids were determined from individual waste type using available information or were based on approximate physical analogues.

The capacity of each tank was never exceeded during transfers. Tank capacity is dependent on fill status, fill order, tank location in a cascade, and tank type.

Tank transfers were normally free of particulates. Therefore, the majority of solids were confined to their initial receiver tanks and were not sent to cribs or transferred extensively between tanks. This assumption was based on the fact that the pumping equipment typically was not designed to transfer substantial quantities of solids (except when sluicing or specifically transferring solids). Monitors on the crib discharge lines should have indicated significant solids contamination, and the tank farm operating procedures would have prevented discharging solids to the ground.

1.4 Historical Information Quality

The quality of historical data compiled for this report varied greatly. Some data came from published documentation. Other data were retrieved electronically from various Westinghouse Hanford Company databases. The quality of data used in the estimates is described in the following section.

■ Level Histories

The level history narrative is designed to give a general description of the waste types contained in a specific tank from startup to the present. The history presents physical characteristics such as the latest maximum temperature of the waste. The current status is also presented. The history is not designed to be a detailed summary of every waste type and transaction for a tank. The waste types are general and are usually given only for large transactions (i.e., if a waste is not of sufficient volume to significantly impact the total volume of the tank, then it was not reported in the narrative). For a more complete record of transactions and types of wastes involved, refer to the Waste Status and Transaction Record Summary (Agnew, 1995).

The accuracy of the tank level histories relies on the completeness of the Westinghouse Hanford Company document "A History of the 200 Area Tank Farms" (Anderson, 1990); the monthly Westinghouse Hanford Company, Atlantic Richfield Hanford Company, and Rockwell Hanford Operations waste summary reports; and the Waste Status and Transaction Record Summary (Agnew, 1995).

Surface level readings may be affected by plummet error, flushing water accumulation, waste surface irregularities and gas generation. Crystalline wastes (i.e., saltcake) can build up on the end of the plummet

gradually and contact the waste which indicates a false surface level increase. Significant level discrepancies occur when the buildup breaks off or when the measuring instrument plummet is flushed to remove the saltcake buildups. Flushing the Food Industry Corporation gauge, manual tapes, or any other equipment may cause accumulated wash water to collect under the plummet which indicates a false increase in the overall volume of waste within the tank. Surface level readings are often difficult to obtain from tanks with a relatively dry saltcake surface. Some tanks have crystalline buildup on in-tank equipment (i.e., pumps, thermocouples, and other protruding equipment). As the supernatant is pumped from the tanks, the crystalline structure may remain attached to the equipment and be suspended above the liquid. Therefore, an accurate surface level measurement would be difficult if the breakup of the crystalline structure was inconsistent and a nonuniform waste surface was created. Steel tapes that are bent or warped from operation or those discarded on the waste surface are other sources of altered surface level readings.

■ Temperature Readings

The quality of raw data from the computer automated surveillance system, surveillance analysis computer system, and manually recorded data sheets has not been verified. Engineering judgement formed the basis of removing suspect data from this raw data set to produce a set of non-suspect data. The raw data sources should be reviewed before using the data for any design purposes or safety evaluations.

■ Surface Level Data

The surveillance analysis computer system data were obtained electronically from the Westinghouse Hanford Company surveillance group and were plotted. The data are actual surface levels recorded from the surveillance equipment. If the surveillance equipment in a particular tank riser was removed from service, the readings may show a level change when a new instrument and/or riser is used, especially if the waste surface shows severe heterogeneity.

Agreement between the plots and the data obtained from the surveillance group has been verified. However, errors in the data prior to the exchange of information could still exist. The surveillance analysis computer system data were understood to be unverified prior to the exchange. Therefore, the data should be reviewed before being used for any design purposes or safety evaluations.

■ Riser Configuration

The riser configuration was determined from the Double-Shell Waste Storage Tanks Riser Study (Anderson, 1992). Any changes made after the revision to the study would not be included.

■ Photographs

The photograph collages were made from the latest available in-tank photographs. In some tanks, photographs have not been taken since the early 1970s. Some tanks had fogging problems in the vapor space which prevented use of the latest photographs. Sometimes, a review of the older photographs was useful to determine the waste changes. Collages made from

older photographs may not be indicative of current tank contents, especially if the tank had been pumped since the last time a photograph was taken.

■ Psychrometric Data

The psychrometric data obtained from Westinghouse Hanford Company came from hard copies before 1989 and electronic copies after 1989. Agreement between the raw data obtained from Westinghouse Hanford Company and the psychrometric plots has been verified. However, errors in the data prior to the exchange of information may still exist.

The raw data could contain errors. The inlet (ambient) conditions could have been measured when the operators first entered the farm and not immediately before the outlet measurements of each tank were taken. The volumetric flow rate is measured using a pitot tube. As the flow rate decreases, the pitot tube measurements become less accurate. Minter (1994) demonstrated a high degree of uncertainty in determining changes in moisture content as air passed through a primary tank and annulus. Even though Minter (1994) discusses uncertainties with Tank 241-C-106 (a single-shell tank), some of the same principles and errors exist in the data obtained from the double-shell tanks. Dodd (1994) suggested that psychrometric data collection cease for tank annuli until more rigorous examination determined whether collecting the data was worthwhile.

Other considerations, besides the fact that the calculated data represent only one recorded data point per month, should be made before drawing any conclusions. The heat transfer rate only expresses heat transferred to or from the air stream; it does not include other methods of heat transfer such as conduction through the soil or radiant heat transfer. Floating objects or a surface crust could exist in the tank which would change the surface area available for evaporation and possibly change the temperature of the liquid.

■ Historical Sample Analysis Data

The historical sample results refer only to sample and analysis information obtained before August 1989. The historical sample and analysis results have not been validated by the characterization program. When validation occurs, they will be reissued in a later revision of the Historical Tank Content Estimate report and supporting documentation. The sample data often were retrieved from memoranda indicating the results of the sample analysis. The analytical methods, holding times, and quality control information are unavailable. The location at which the sample was taken was not provided which leads to integration of some uncertainty into the sampling results. The analytical scope performed in many cases was quite narrow which limited the available data set. However, the data set is the only available historical information on chemical characterization.

1.5 Background SE Quadrant

The double-shell tanks located on the Hanford Site near Richland, Washington were built between 1968 and 1986 to provide interim storage for high-level nuclear wastes. Processes such as plutonium separation from

spent nuclear fuel and uranium metal recovery generated the millions of gallons of mixed (radioactive and hazardous) waste stored within these tanks.

Several waste tanks are on watch lists which are defined in a succeeding section of this report.

The southeast quadrant is located in the 200-East exclusion area and consists of 28 tanks grouped into six tank farms: the AN Tank Farm (seven 1,140,000 gallon tanks), the AP Tank Farm (eight 1,140,000 gallon tanks), the AW Tank Farm (six 1,140,000 gallon tanks), the AY Tank Farm (two 980,000 gallon tanks), the AZ Tank Farm (two 980,000 gallon tanks), and the SY Tank Farm (three 1,140,000 gallon tanks). Double-shell tanks are constructed of a primary carbon steel cylinder and base inside a secondary carbon steel liner. The secondary liner is encased in a reinforced concrete shell and both liners are covered by a reinforced concrete dome. Depending on the farm, the top of the tanks are buried between six and eight feet underground.

The most common waste stored in the SE quadrant is dilute waste. However, many tanks in the quadrant currently store wastes from the Plutonium Finishing Plant and onsite separation processes. Much of the waste is awaiting concentration in the 242-A Evaporator.

1.5.1 Waste Generating Plants and Processes

Although not all of the processes listed below contributed waste directly to tanks in the SE quadrant, the waste they generated could have been transferred indirectly to the quadrant through tank-to-tank transfers. The plants and processes that generated waste now contained in the single-shell and double-shell tanks are presented in chronological order in this section. Typically, the name of the plant and the process are synonymous.

■ T Plant

T Plant was the first full-scale separations plant at Hanford. It was constructed in 1944 and was used as a separation facility for irradiated production reactor fuel until 1956. The bismuth phosphate separation process used at T Plant was identical to the one used at B Plant. The 224 Building, adjacent to T Plant, was part of the bismuth phosphate process. Since 1957, T Plant has been used as a facility for repair and decontamination of equipment. The facility was modified in 1978 for storage of pressurized water reactor (PWR) core II fuel assemblies. T Plant facilities have been used for repairing, testing, shipping, decontaminating, decommissioning, and burying contaminated tools and equipment from locations both onsite and offsite.

The following wastes were sent to interim storage: waste solution from equipment decontamination efforts at T Plant, decontamination waste (DW), metal waste (MW) from the bismuth phosphate process, first-cycle (1C) decontamination waste from the bismuth phosphate process, second-cycle (2C) decontamination waste from the bismuth phosphate process, and (224) waste.

■ B Plant

B Plant was constructed between August 1943 and February 1945 and was used for the bismuth phosphate process until 1952. As one of the first plants built along with T Plant, B Plant was designed to separate plutonium from uranium and the bulk of fission products in irradiated fuel through the bismuth phosphate separation process. The 224 Building, adjacent to B Plant, was part of the bismuth phosphate process. In 1968, B Plant became a waste fractionation plant and was retrofitted to remove ^{137}Cs and ^{90}Sr from PUREX acid waste, high-level supernatant liquids, and sludge from self-boiling liquid wastes.

The following B Plant waste streams were sent to interim storage: B Plant high-level waste (B), B Plant flush (BFSH), low-level waste from the waste fractionation plant (BL), complex concentrate (CC) or (CCPL), complexed waste (CPLX), fission products waste (FP), metal waste (MW), REDOX ion exchange waste processed at B Plant (RIX), ion exchange (IX), strontium sludge (SRS), cell 5 tank 6 waste (5-6), first-cycle waste (1C), second-cycle waste (2C), and (224) waste.

■ Bismuth Phosphate Process

B Plant and T Plant used the bismuth phosphate extraction process to remove plutonium from uranium fuel elements. The 224 Buildings were also part of the bismuth phosphate process. The extraction waste that resulted was a metal waste that still contained 90% of the fission products and 99% of the original uranium. The metal waste (MW) was sent to specific tank cascades in the 200-East and 200-West Areas. First-cycle decontamination waste (1C) containing approximately 10% of the fission products, second-cycle waste (2C), and (224) waste were also stored in other underground waste tanks in the 200 Area.

■ Plutonium Finishing Plant

The Plutonium Finishing Plant (PFP) or Z Plant, previously called Plutonium Recovery and Finishing Operations, began operating in late 1949 to process plutonium and prepare plutonium products. The PFP operations included plutonium handling, plutonium reclamation, plutonium conversion, and decontamination and decommissioning.

Wastes from the Plutonium Reclamation Facility and the remote mechanical C line (Z) were sent to tanks.

■ Uranium Oxide Plant

The 224-U Building was completed in 1944 as part of the U Plant complex. The building was converted to a UO_2 plant in 1951. The 224-UA Building was constructed in 1957 with six installed calciners. The UO_2 plant was capable of handling the uranyl nitrate hexahydrate (UNH) stream from REDOX, U Plant, and PUREX. The UO_2 plant shut down in 1972 and restarted in 1984 with the feed lines from REDOX and the U Plant canyon disconnected. Since 1984, there have been 17 campaigns at the plant that averaged eight days each. The plant can calcine UNH much faster than the PUREX plant can produce it. Final deactivation was ordered for the plants in 1992. In April 1993, the UO_2 plant resumed operations to convert 200,000 gallons of remaining UNH to uranium oxide powder. A final

deactivation plan for the facility was prepared in the summer of 1993 and will be carried out in the next few years.

■ REDOX

The Reduction and Oxidation extraction (REDOX) plant was built between May 1950 and August 1951 and operated until July 1967. Uranium and plutonium were extracted from solid uranium metal slugs that were irradiated in the Hanford reactors or piles. Uranium and plutonium were extracted with methyl isobutyl ketone (hexone) solvent in a continuous solvent extraction process. The REDOX process was the first at Hanford to recover both plutonium and uranium.

The following wastes were sent to interim storage: REDOX process waste resulting from the dissolution of aluminum and zircaloy fuel element cladding, REDOX coating waste (CWR), REDOX high-level waste (R), the supernatant liquid portion of waste generated by the REDOX process, and REDOX supernatant (RSN). RSN is found above the sludge in the underground storage tanks that received waste from REDOX.

■ U Plant

U Plant (221-U) was built as one of three original bismuth phosphate process facilities, although it was not used for that purpose. U Plant was modified extensively and used for the uranium recovery process. U Plant operated from 1952 to 1958. The main canyon at U Plant currently stores failed equipment.

Uranium in waste from the BiPO₄ process initially was stored in the SSTs. Later, it was mined by sluicing, dissolved in nitric acid, and processed through a solvent extraction process. The uranium extraction process yielded approximately 1.4 gallons of UR waste for every gallon of metal waste originally stored. The increase in waste volume made developing technology to reduce the volume of stored waste a priority. This need resulted in the development and implementation of the ferrocyanide scavenging process.

The waste sent to interim storage from U Plant was called tributyl phosphate (TBP) even though it contained very little TBP. Therefore, to eliminate confusion, the waste will be referred to as uranium recovery (UR) waste in this report.

■ Strontium Semi-Works

The Strontium or Hot Semi-Works processing facility (i.e., C Plant) was built in 1949 as a hot pilot plant for the REDOX process but was converted to a pilot plant for the PUREX process. In 1960, the plant was reactivated and used as a process demonstration for the conversion of B Plant to a waste fractionation facility. The plant was used to recover ⁹⁰Sr, promethium 147 (¹⁴⁷Pm), and ¹⁴⁴Cs from PUREX waste. The building and the building site have been decontaminated and decommissioned.

Waste from the Strontium Semi-Works sent to interim storage was known as hot semi-works (HS), strontium semi-works (SSW), and fission products waste (FP).

■ PUREX

The Plutonium Uranium Extraction (PUREX) plant (i.e., A Plant) was an advanced solvent extraction process that used tributyl phosphate in a paraffin hydrocarbon solvent to recover uranium and plutonium from nitric acid solutions of irradiated uranium. The PUREX plant was built between April 1953 and April 1955, and it operated until 1972 when it was closed for 11 years. Two thorium campaigns were conducted in the PUREX plant between 1966 and 1971. The irradiated waste was similar to the PUREX waste, but it contained thorium and uranium 233 rather than uranium and plutonium which was extracted from typical PUREX waste. It restarted in November 1983 and was shut down in 1988 after a safety violation. The PUREX plant was shut down several times between 1988 and 1990 for various reasons. In October 1990, the PUREX plant was put on standby and was eventually identified for closure in December 1992 by Secretary of Energy James Watkins.

The following PUREX waste streams were sent to interim storage: cladding waste (CW) or (CWP), organic solvent wash waste (OWW), neutralized PUREX plant acid waste (P), low-level waste from PUREX (PL), PUREX sludge supernatant liquid (PSS), organic wash waste using sodium carbonate (CARB), cesium feed (CF), and concentrated neutralized high-level waste (LWW).

1.5.2 Waste Management Operations

This section describes the different waste concentrating methods used in the 200 Area. Evaporating, concentrating, and scavenging are all methods used to reduce liquid volumes or precipitate solids out of supernatant solutions. The operations are presented in chronological order.

■ 242-T Evaporator

The 242-T Evaporator was built in the early 1950s to reclaim nonboiling waste storage capacity in existing tanks. The evaporator was shut down in the summer of 1955 and modified for tributyl phosphate scavenging, although scavenging was never performed in this evaporator. The 242-T Evaporator restarted in 1965 and operated until 1976. Tank 241-TX-118 was the feed tank for this evaporator.

The following wastes were sent to tanks from the 242-T Evaporator: slurry product from the evaporator bottoms (EB), evaporator feed (EF), and terminal liquor (TL).

■ 242-B Evaporator

The 242-B Evaporator was built south of the B Tank Farm and started operating in December 1951. It received feed waste until November 1954 and was shutdown in September 1955. The evaporator was never reactivated. Tanks 241-B-106 and -105 were used as the feed tank and bottoms tank respectively. The evaporator operated at atmospheric pressure.

■ Ferrocyanide Scavenging

Ferrocyanide scavenging was developed to reduce waste volumes. The ferrocyanide flowsheet was first tested in U Plant in October 1953, and in-

farm scavenging was completed in March 1956 and December 1957 for the 200-West and 200-East Areas, respectively. The ferrocyanide scavenging program was designed to remove fission products such as ^{137}Cs (half life = 28.6 yr) and ^{90}Sr (half life = 30.2 yr) from the uranium recovery and 1C wastes as a precipitate. After the ^{137}Cs and ^{90}Sr precipitates settled, the clarified supernatant was sampled and disposed of in cribs.

■ In-Tank Solidification

The primary function of the in-tank solidification systems was to concentrate the nonboiling waste directly inside of specially designed tanks. The in-tank solidification tanks produced a saltcake slurry. Each in-tank solidification system included a heat exchanger for water evaporation and a series of bottoms tanks. The first in-tank solidification unit (ITS #1) operated with an airlift circulator through Tank 241-BY-102, and the second in-tank solidification unit (ITS #2) operated with a similar circulator through Tank 241-BY-112. Tank 241-BY-112 also contained a 4,000 kW electric immersion heater. Tank 241-BY-101 contained an in-tank solidification prototype that was used for demonstration purposes only. In-tank solidification units 1 and 2 began operating in 1965 and 1968, respectively. In 1971, in-tank solidification unit 1 became the cooler for in-tank solidification unit 2. Both units were shut down in 1974.

■ REDOX Concentrator

The REDOX concentrator was used for volume reduction of dilute 200-West Area tank farm wastes by removing water. The concentrator received tank farm wastes from July 28, 1967 until June 30, 1972. Cell D in the REDOX process was the concentration and neutralization section of the plant.

■ 242-S Evaporator-Crystallizer

The 242-S Evaporator-Crystallizer began operating in November 1973 and was shut down in 1981. It was designed as a reduced pressure (i.e., partial vacuum) evaporator-crystallizer. Aqueous salt wastes were converted in the evaporator to salt crystals for storage in underground tanks in the 241-S and 241-SX Tank Farms.

The following waste types were sent to interim storage from the 242-S Evaporator: noncomplexed waste concentrated until the solution was nearly saturated with sodium aluminate known as double-shell slurry feed (DSSF), slurry product from the evaporator bottoms (EB), evaporator feed (EF), Hanford defense residual liquor (HDRL), partially neutralized feed waste (PNF), and terminal liquor (TL).

■ 242-A Evaporator-Crystallizer

Construction of the 242-A Evaporator-Crystallizer was completed in 1976. The evaporator began operation in March 1977 with a design life of 10 years. In 1987, design changes were developed to extend the operating life of the facility by 10 years. The evaporator was shut down in April 1989 because of regulatory issues. The evaporator was restarted in May 1994 after extensive modifications.

The following evaporated waste was sent to interim storage: evaporator bottoms from B Plant low-level waste feed (BLEB), noncomplexed waste concentrated in evaporators known as double-shell slurry feed (DSSF), evaporator feed (EF) or (EVAP), evaporator bottoms (EB), and terminal liquor (TL).

1.5.3 Miscellaneous Waste Sources and Equipment

Wastes from various other sources on the Hanford Site have been added to the tanks. Some wastes are from the 300 Area, 100 Area production reactors, various laboratories, and catch tanks. Unique contents added to single-shell tanks included laboratory wastes; diatomaceous earth; Portland cement; shroud tubes; ceramic balls; experimental fuel elements; and relatively small amounts of enriched uranium, plutonium, cobalt, and natural uranium.

The following wastes contributed to interim storage waste: diatomaceous earth (DE), Hanford defense residual liquor (HDRL), Hanford laboratory operations (HLO), filtered Hanford water (H₂O), phosphate decontamination waste from N Reactor (N), and noncomplexed waste (NCPL).

■ Critical Mass Lab

The critical mass lab was used to develop data on the factors necessary to make a criticality or self-sustained nuclear reaction occur. Because plutonium is the key radioactive element on the Hanford Site, the research was based on plutonium criticality safety in various fuel cycles. The facility was located next to the strontium semiworks and ran from the early 1950s to the early 1980s. The plutonium used in the lab was reprocessed in PUREX.

■ 244-AR, -BXR, and -CR Process Vaults

There are three process vaults in the NE quadrant: the 244-AR Vault, the 244-BXR Vault, and the 244-CR Vault. These vaults were composed of several process vessels or tanks used to prepare the waste for treatment or storage. Specific wastes from tanks can be pumped temporarily to the vaults and the wastes can be sent directly to desired tanks or processing facilities later.

The AR Vault was designed and constructed between 1964 and 1968 and is located next to the A and AX Tank Farms. The AR Vault has been on standby since 1978.

The 244-BXR vault is located south of the 241-BX Tank Farm and was constructed between 1950 and 1951. The BXR Vault began operating in 1952 and became inactive in 1956. The waste in the vault was difficult to handle, so the vault was jetted with high-pressure steam in 1976. The vault was interinly isolated after 1976 and interinly stabilized in March 1985. Tank BXR-004 was removed in 1963.

The CR Vault was constructed in 1952 and is located next to the C Tank Farm. Saltwell waste from the C Tank Farm is interinly stored in the CR Vault. The 244-BXR and -CR vaults were originally constructed to aid in

the recovery of uranium from bismuth phosphate metal waste. The CR Vault received waste from the Strontium Semiworks Plant en route to the 241-C Tank Farm.

■ 204-AR and 204-S Railroad Car Facilities

The 204-AR rail car unloading facility was built in 1981 and replaced the 204-S rail car unloading facility. The facilities were built for unloading tank cars containing radioactive liquid waste.

Liquids or slurries from the 1314-N Building in the 100 Area and the 340 Building in the 300 Area are unloaded at the 204-AR unloading facility.

1.5.4 Timeline

A timeline is presented on the following pages that represents the times and spans of different events that occurred during the lifetime of major Hanford plants and tank farms in the 200-East and 200-West Areas. The plants were the main contributors to the waste currently contained in the tanks. The following is a list of abbreviations used in the timeline and their corresponding meanings:

PUREX:	Plutonium uranium extraction process
UO ₃ :	Uranium trioxide
PPF:	Plutonium Finishing Plant
RG-RB:	Rubber glove - remote button line
RMA:	Remote mechanical "A" line
RSE:	Recuplex solvent extraction
RMC:	Remote mechanical "C" line
PRF:	Plutonium Reclamation Facility
PCB:	Polychlorinated biphenyls
WESF:	Waste Encapsulation and Storage Facility
ITS:	In-tank solidification (units #1 and #2)
PWR:	Pressurized water reactor
REDOX:	Reduction oxidation process

PROCESSES PRODUCING WASTE CONTAIN

ED IN 200 AREA TANK FARMS

NW/SW TA

TANK FARMS

LEGEND:

△ INTO SERVICE

▲ REMOVED FROM SERVICE

NE TANK

LEGEND:

△ INTO SERVICE

▲ REMOVED FROM SERVICE

FARMS

AN FARM
(7 DOUBLE-SHELL TANKS)

AP FARM
(8 DOUBLE-SHELL TANKS)

AW FARM
(6 DOUBLE-SHELL TANKS)

AY FARM
(2 DOUBLE-SHELL TANKS)

AZ FARM
(2 DOUBLE-SHELL TANKS)

SY FARM
(3 DOUBLE-SHELL TANKS)

SE TANK FARMS

LEGEND:

△ INTO SERVICE

1.6 Safety Issues

The safety issues that affect the tanks can be divided into two groups: watch list and non-watch list. The watch lists are a listing of all tanks that are believed to pose potential safety hazards to the environment and the public. Non-watch list issues are of concern because they may impact the environment.

1.6.1 Watch List Safety Issues

Safety issues for these tanks were identified as "issues/situations that contain most necessary conditions that could lead to worker (onsite) or offsite radiation exposure through an uncontrolled release of fission products" under Public Law 101-510, Section 3137, of the National Defense Authorization Act of Fiscal Year 1991 (i.e., the Wyden Amendment). As of November 1993, 45 SSTs and 6 DSTs are on a watch list. In the SE quadrant, 6 of the 28 DSTs are on a watch list. The four watch list designations described in this report are ferrocyanide, hydrogen or other flammable gas, organic salts, and high-heat load. The following sections provide a general description and criteria of the different watch lists. For a more complete explanation, refer to the Hanford Site Tank Farm Facilities Interim Safety Basis (WHC, 1993).

■ Ferrocyanide

A tank containing or believed to contain greater than 1,000 gram moles of ferrocyanide (dry basis) is on the ferrocyanide watch list. Tanks containing ferrocyanide are potentially explosive if ferrocyanide and nitrates combine.

■ Hydrogen or Other Flammable Gas

Tanks were placed on this watch list mostly because of the potential to contain flammable gases rather than the verified presence of hazardous concentrations. Tanks on the watch list for hydrogen or other flammable gases have been identified as an unreviewed safety question due to the concern that burning flammable gas could result in a radiological release.

■ Organic Salts

Tanks containing or believed to contain more than the equivalent of 10% by weight of sodium acetate or 3 wt% total organic carbon (TOC) on a dry basis received a watch list designation as in the Tank Farm Surveillance and Waste Status Summary Report (Hanlon, 1993). Tanks containing organic salts could release waste if an uncontrolled increase in temperature or pressure results from oxidation by nitrates and nitrites.

■ High-Heat Loads

Tanks with a heat load greater than 40,000 Btu/hr are designated as high-heat load tanks. Tank 241-C-106 is the only high-heat load tank on the high-heat load watch list.

Any tank not appearing on the high-heat load tank list or the high-heat load watch list, but with a heat load less than 40,000 Btu/hr, is considered, by default, a low-heat load tank.

The following table lists the tanks in the SE quadrant that appeared on a watch list as of November 1993. A current listing is published monthly in the Tank Farm Surveillance and Waste Status Summary Report (Hanlon, 1993).

SE Quadrant DST Watch List Tanks

DST Tank	Category	DST Tank	Category
241-AN-103	Hydrogen	241-AW-101	Ferrocyanide
241-AN-104	Hydrogen	241-SY-101	Hydrogen
241-AN-105	Hydrogen	241-SY-103	Hydrogen

1.6.2 Non-Watch List Safety Issues

Tank leaks are a safety hazard because of the potential to release chemicals and radioactive liquids to the ground. Corrosion is the main cause of tank leaks. Three other safety issues that do not require a watch list and continual monitoring under the Wyden Amendment include criticality, tank bumps, and toxic vapor releases.

■ Corrosion

Corrosion is believed to be caused by a localized or general reduction in the thickness of the carbon steel liner. Localized reduction in the liner thickness is caused by three types of corrosion: pitting corrosion, stress corrosion cracking, and crevice cracking. General reduction in liner thickness may be caused by uniform corrosion.

None of the double-shell tanks are assumed or confirmed leaking.

■ Criticality

Criticality is an inadvertent, self-sustained, nuclear chain reaction. Studies have concluded that a nuclear criticality accident in the tank farms is probably not an imminent risk. However, there is a lack of definitive knowledge on the inventory of fissile material and its distribution within the tanks. Therefore, criticality remains a safety issue. The key radionuclide on the Hanford Site that would be involved in a criticality accident is plutonium. To prevent a criticality, a maximum content of 125 kg of fissile material has been specified for the tanks. An unusual occurrence report involving nuclear criticality was filed in June 1991 for Tank 241-C-104. Later, an inventory of 56 kg was calculated which indicated a low probability for criticality. Criticality is considered an unreviewed safety question, but is not affected by the Wyden Amendment according to the Hanford Site Tank Farm Facilities Interim Safety Basis (WHC, 1993).

■ Tank Bumps

Tank bumps have been an issue at Hanford since 1953 with the last bump occurring in 1968. Tank bumps occur when heat from the hotter solid waste in the lower portion of the tank is suddenly transferred to a near boiling

supernatant. Mixing can be achieved by "roll over" or sudden restart of airlift circulators which results in rapid fluid vaporization and a sudden internal tank pressurization that causes a bump. The three documented bumps that have occurred were due to airlift circulator failure followed by rapid startup of the airlift circulators which causes rapid mixing. Two key factors have been identified to control bumping: liquid and solid temperatures must be maintained as far away from the local boiling point as possible, and airlift circulators and ventilation systems must be operated as designed. A tank bump is extremely unlikely if airlift circulators and vent flowrates are maintained at 500 to 1,000 ft³/min per tank and 50 ft³/min to the airlift circulators, according to the Hanford Site Tank Farm Facilities Interim Safety Basis (WHC, 1993).

■ Toxic Vapor Releases

Toxic vapor releases are a recently analyzed safety concern at Hanford. Odors have been released from the C Tank Farm in the NE quadrant and from Tank 241-SY-101 in the SE quadrant. If toxic vapors are determined to exist in a tank, three safety recommendations should be followed: determine a release rate, determine offsite and onsite exposure concentrations, and determine if the release is a spray effect. The entire issue of toxic gas releases at the tank farms has just begun to be understood, according to the Hanford Site Tank Farm Facilities Interim Safety Basis (WHC, 1993).

1.7 Occurrences

Over the years, unusual events that occurred at the Hanford Site have been documented by various reporting methods. Some of these reports include Unusual Occurrences Reports (U.O.), Off Normal Reports (O.N.), Event Fact Sheets (E.F.S.) and occurrence reports. According to these reports, four unusual events apply to the southeastern quadrant as a whole. Occurrence reports RL--WHC-Tank Farm-1993-0072, RL--WHC-Tank Farm-1992-0028, RL--WHC-Tank Farm-1991-1031, and RL--WHC-Tank Farm-1991-1026 were written due to loss of power in the area. For more information on occurrences, refer to the Supporting Document for the Southeast Quadrant HTCE (Brevick, 1995).

2 AN Tank Farm

2.0.1 AN Tank Farm History

The AN Tank Farm is located north of 4th Street and east of Buffalo Avenue in the 200-East Area. The AN Tank Farm contains seven, 100 series, 1,160,000 gallon, 75-foot diameter double-shell tanks. The AN Tank Farm is the latest tank design with a reinforced concrete shell and dome, and an insulating concrete base. A heat-treated, stress-relieved, primary steel liner and a nonstress-relieved, outer steel liner are inside the concrete shell. These tanks were made to hold concentrated supernatant. The maximum design temperature for liquid storage is 350°F. The tanks are at the same elevation and no cascade lines exist between the tanks.

A color aerial photograph taken in 1993 of the AN Tank Farm shows the orientation of the tanks, leak detection pits, annulus ventilation equipment, instrument house, and valve pits.

AN TANK FARM

2.0.1.1 AN Tank Farm Waste History

All tanks in the 241-AN Tank Farm began receiving non-complexed waste in September 1981. Tank 241-AN-101 received waste from PUREX, Tanks 241-AN-102 and -103 received waste from Tank 241-SY-102, Tank 241-AN-104 received waste from Tank 241-AW-102, Tanks 241-AN-105 and -106 received waste from site sources, and Tank 241-AN-107 received waste from Tank 241-AN-102. The sources of waste have varied since then. Tanks 241-AW-102 and 241-AN-104 supplied double-shell slurry waste to tank 241-AN-105 from December 1982 to the second quarter of 1985. Tanks 241-AN-101 and -103 received low-level waste from B Plant. Tanks 241-AN-102 and -104 received low-level waste from PUREX. Currently, all of the tanks, except 241-AN-101, are inactive.

2.0.1.2 AN Tank Farm Temperature History

The seven tanks within the AN Tank Farm contain at least one thermocouple tree with readings found for between 6 and 18 thermocouples per tree. Since 1991, Tanks 241-AN-103, 241-AN-104, and 241-AN-105 have been on the Hydrogen Watch List. These watch list tanks are monitored weekly, at a minimum, with the remaining tanks required to have temperature recorded semiannually. All of the tanks in the AN Tank Farm are monitored by the TMACS as of August 1994.

2.0.1.3 AN Tank Farm Occurrences

Six unusual events affected AN Tank Farm as a whole. Occurrence reports RL--WHC-Tank Farm-1993-0070, RL--WHC-Tank Farm-1993-0009, RL--WHC-Tank Farm-1991-1077, and RL--WHC-Tank Farm-1991-1058 were written due to tanks pressurizing from equipment failures. Occurrence reports RL--WHC-Tank Farm-1990-0102 and RL--WHC-Tank Farm-1991-1016 both concerned electrical problems. The problem described in RL--WHC-Tank Farm-1991-1016 caused a pressure inversion in every tank in the farm.

2.0.1.4 AN Tank Farm Ventilation

Each tank is designed to have 85.7 standard cubic feet per minute of air travel through it and 800 cubic feet per minute of air travel through the annulus. Air enters the tanks by infiltration because there is no supply fan. After exiting each tank's system, the air ducts are joined to allow the service of one fan to send air into the primary exhaust system. Before the tank air is released to the atmosphere, the air is heated, forced through a prefilter, and then sent through two high-efficiency particulate air (HEPA) filters. In the annulus system, air enters a 35% prefilter and a HEPA filter before it enters the annulus. Then the air enters an electric heater and two more HEPA filters before it is exhausted to the atmosphere. Both the tank and annulus systems have a primary and a backup system. For more information, refer to drawing H-2-71935, sheets 1 and 2.

The psychrometric data for tanks in the AN Tank Farm are recorded in two parts: the tank data and the annular data. For water and heat leaving

the tank, the numbers are positive. Psychrometric data have been recorded for 12 years from these tanks and annuli. For more information refer to the Supporting Document for the Southeast Quadrant HTCE for AN Tank Farm (Brevick, 1995).

2.0.2 Current Status of AN Tank Farm

Tanks 241-AN-103, -104, and -105 were officially added to the Hydrogen Watch List in January 1991. The three tanks have been identified as unreviewed safety questions due to the concern that burning flammable gas could result in a radiological release. All tanks are actively ventilated and categorized as sound. The waste volume currently totals 6,564,000 gallons. The estimated volumes (Agnew, January 1994) depicted in each tank cross-section total 6,024,000 gallons of waste. At the time of the estimate, there were 6,022,000 gallons of supernatant with 1,439,000 gallons of concentrated supernatant solids and 2,000 gallons of low-level waste from B Plant.

2.1 Tank 241-AN-101

2.1.1 241-AN-101 Tank History

2.1.1.1 Waste History of Tank 241-AN-101

Tank 241-AN-101 began service by receiving non-complexed waste from PUREX in September 1981. Non-complexed waste was received and transferred through this tank until September 1990 when it began receiving dilute non-complexed waste. During this time, the tank also received low-level waste from B Plant, decontamination waste from N Reactor, and dilute non-complexed waste from the 200-East Area SSTs. As of March 1994, the tank was receiving only dilute non-complexed waste. Currently, the tank is an active dilute receiver tank which receives non-complexed saltwell waste.

2.1.1.2 Temperature History of Tank 241-AN-101

Temperature data for Tank 241-AN-101 are recorded by 18 thermocouples at known elevations on one tree inside the tank located in riser 4A. Non-suspect temperature data for all 18 thermocouples taken between July 1983 and May 1986 were available from the computer automated surveillance system. Non-suspect temperature data recorded between January 1990 and September 1993 for six of the thermocouples were available from the surveillance analysis computer system. Within the time spans of each system, there were no significant breaks in the sequence of temperature data. The average temperature during these periods was 66.4°F with a minimum of 51°F, a maximum of 82°F, and a standard deviation of 6.2°F. Linear regressions were performed on each thermocouple that had recorded temperature data beginning in January 1990. The slopes from these regressions were averaged with a resulting average slope of 0.00438. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

2.1.1.3 Occurrences of Tank 241-AN-101

Two unusual events occurred at Tank 241-AN-101. Off-Normal Report 86-6 was issued in January 1986 due to an equipment problem. During a transfer of waste solution from Tank 241-AY-102 to Tank 241-AW-102, a valve leaked, sending solution into Tank 241-AN-101. Occurrence Report RL--WHC-Tank Farm-1993-0027 was issued in March 1993 because the waste level indicators failed.

2.1.1.4 Psychrometrics of Tank 241-AN-101

The apparent trend of the evaporation rate from the tank has decreased from 96.4 gallons per week in January 1983 to 59.6 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank and annular ventilation has apparently decreased. A review of the psychrometric data in Tank 241-AN-101 would suggest an overall decrease in the rate of heat generation by the waste.

2.1.2 Current Status of Tank 241-AN-101

Tank 241-AN-101 entered into service in September 1981 and currently stores 859,000 gallons of waste. The following plan view and tank cross section depict the approximate waste volume of 700,000 gallons and riser configurations as of January 1994. At the time of the estimate, all 700,000 gallons were supernatant. The waste level in the tank is measured with the FIC gauge and the manual tape and has increased from about 128 inches in January 1991 to 312 inches in January 1995. The increase was mostly the addition of dilute and non-complexed waste received from the 200-East Area single-shell tanks between June 1991 and February 1992. The tank is active and receives non-complexed saltwell waste. The tank is actively ventilated and categorized as sound. Tank 241-AN-101 has 61 risers. One 12-inch riser (no.7B) is available for use.

2.1.2.1 Inventory Estimate of Tank 241-AN-101

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew, 1995) and Supernatant Mixing Model (Agnew, 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AN-101 are also presented.

2.1.2.2 In-Tank Photograph of Tank 241-AN-101

No in-tank photographs are available.

2.1.3 Synopsis of Tank 241-AN-101 (To be completed.)

ANDERSON 1990
WASTE TYPES

NCPLX:

PRIMARY
ADDITIONS

PL2:

SWLIQ:

BL:

N:

LEVEL IN
FEET
LEVEL IN
INCHES

36' 432"
34' 408"
32' 384"
30' 360"
28' 336"
26' 312"
24' 288"
22' 264"
20' 240"
18' 216"
16' 192"
14' 168"
12' 144"
10' 120"
8' 96"
6' 72"
4' 48"
2' 24"
0' 0"

LIQUID
LEVEL

FROM PUREX
TO AW-102

TO AW-102

TO AY-102

TO AZ-102 & AY-102

TO AW-102

TO AW-102

FROM AW-102

TO AW-102

YEARS

DN:

UNK:

NOTES:

CONSTRUCT 1980-1981
 NOMINAL CAPACITY: 1,000,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

1,188,000

1,122,000

1,056,000

990,000

924,000

858,000

792,000

726,000

660,000

594,000

528,000

462,000

396,000

330,000

264,000

198,000

132,000

66,000

0

NCPLX: NON-COMPLEXED WASTE
 PL2: PUREX LOW-LEVEL WASTE
 SWLIQ: SALTWELL LIQUOR
 BL: B PLANT LOW-LEVEL WASTE
 N: N REACTOR WASTE
 UNK: UNKNOWN
 DN: DILUTE NON-COMPLEXED WASTE

LEGEND

□—□—□ LIQUID OBSERVATION
 WELL (LOW)
 — LIQUID LEVEL
 // SOLIDS LEVEL
 // // // SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

**AN TANK FARM
PLOT PLAN**

SUPERNATANT 700KGAL

See glossary for abbreviations and definitions.

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AN-101 DOUBLE-SHELL TANK
 LEVEL HISTORY 1982 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: N/A

SIZE	BLOG NO.	DWG NO.	DATE
B	241	ES-TKS-E150	6/94
SCALE	NONE	JOB NO.	SHEET 1 OF 1

Double-Shell Tank 241-AN-101			
Total Inventory Estimate*			
Physical Properties			
Total Waste	2.69E+06 kg	(700 kgal)	
Heat Load	0.102 kW	(349 BTU/hr)	
Bulk Density†	1.01 (g/cc)		
Water wt%†	97.6		
TOC % C (wet)†	0.032		
Chemical Constituents			
	moles/L	ppm	kg
Na ⁺	0.302	6.86E+03	1.84E+04
Al ³⁺	3.29E-02	877	2.35E+03
Fe ³⁺ (total Fe)	2.97E-04	16.4	44.0
Cr ³⁺	1.06E-03	54.2	143
BP ³⁺	2.32E-05	4.79	12.9
La ³⁺	1.02E-07	1.39E-02	3.74E-02
Hg ²⁺	4.41E-07	8.72E-02	0.234
Zr (as Zr(OH) ₄)	1.02E-04	9.19	24.7
Pb ²⁺	3.39E-06	0.692	1.86
Ni ²⁺	2.12E-04	12.3	33.1
Sr ²⁺	1.07E-07	9.28E-03	2.49E-02
Mn ²⁺	4.14E-04	22.4	60.3
Ca ²⁺	2.04E-03	82.3	221
K ⁺	7.31E-03	282	757
OH ⁻	0.150	2.52E+03	6.77E+03
NO ₃ ⁻	0.131	8.04E+03	2.16E+04
NO ₂ ⁻	3.96E-02	1.80E+03	4.83E+03
CO ₃ ²⁻	1.93E-02	1.14E+03	3.07E+03
PO ₄ ³⁻	5.91E-03	554	1.49E+03
SO ₄ ²⁻	7.08E-03	621	1.80E+03
Si (as SiO ₂)	1.47E-03	40.8	110
P	8.57E-03	161	431
Cl	5.17E-03	181	486
C ₂ H ₃ O ₂ ⁻	9.41E-04	176	471
EDTA ⁴⁻	3.27E-04	93.0	250
HEDTA ³⁻	5.34E-04	144	388
glycolate ⁻	6.17E-03	452	1.23E+03
acetate ⁻	3.85E-04	22.4	60.2
oxalate ²⁻	3.83E-07	3.33E-02	8.94E-02
DBP	4.72E-04	74.9	201
butanol	4.72E-04	34.5	92.6
NH ₃	2.38E-02	396	1.07E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pa		2.22E-03 (μCi/g)	9.91E-02 (kg)
U	2.88E-04 (M)	67.6 (μg/g)	182 (kg)
Cs	7.16E-03 (CM/L)	7.06 (μCi/g)	1.90E+04 (Ch)
Sr	7.43E-04 (CM/L)	0.734 (μCi/g)	1.97E+03 (Ch)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AN-101			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	2.69E+06 kg	(700 kgal)	
Heat Load	0.102 kW	(349 BTU/hr)	
Bulk Density*	1.01 (g/cc)		
Water wt%†	97.6		
TOC wt% C (wet)	0.032		
Chemical Constituents			
Na ⁺	0.302	6.86E+03	1.84E+04
Al ³⁺	3.29E-02	877	2.35E+03
Fe ²⁺ (total Fe)	2.97E-04	16.4	44.0
Cr ³⁺	1.06E-03	54.2	145
Bi ³⁺	2.32E-05	4.79	12.9
La ³⁺	1.02E-07	1.39E-02	3.74E-02
Hg ²⁺	4.41E-07	8.72E-02	0.234
Zr (as ZrO(OH) ₂)	1.02E-04	9.19	24.7
Pb ²⁺	3.39E-06	0.692	1.86
Ni ²⁺	2.12E-04	12.3	33.1
Sr ²⁺	1.07E-07	9.28E-03	2.49E-02
Mn ²⁺	4.14E-04	22.4	60.3
Ca ²⁺	2.08E-03	82.3	221
K ⁺	7.31E-03	282	757
OH ⁻	0.150	2.52E+03	6.77E+03
NO ₃ ⁻	0.131	8.04E+03	2.16E+04
NO ₂ ⁻	3.96E-02	1.80E+03	4.83E+03
CO ₃ ²⁻	1.93E-02	1.14E+03	3.07E+03
PO ₄ ³⁻	5.91E-03	554	1.49E+03
SO ₄ ²⁻	7.08E-03	671	1.80E+03
Si (as SiO ₃ ²⁻)	1.47E-03	40.8	110
F ⁻	8.57E-03	161	431
Cl ⁻	5.17E-03	181	486
C ₂ H ₃ O ₂ ⁻	9.41E-04	176	471
EDTA ⁴⁻	3.27E-04	93.0	250
HEDTA ³⁻	5.34E-04	144	388
glycolate ⁻	6.17E-03	457	1.23E+03
acetate ⁻	3.85E-04	22.4	60.2
oxalate ²⁻	3.83E-07	3.33E-02	8.94E-02
DBP	4.72E-04	74.9	201
butanol	4.72E-04	34.5	92.6
NH ₃	2.38E-02	398	1.07E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	2.25 (μCi/L)		9.91E-02 (kg)
U	2.88E-04 (M)	67.6 (μg/g)	182 (kg)
Cs	7.16E-03 (Ci/L)	7.06 (μCi/g)	1.90E+04 (Ci)
Sr	7.43E-04 (Ci/L)	0.734 (μCi/g)	1.97E+03 (Ci)

*Density is calculated based on Na, OH⁻, and AlO₂⁻.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AN-101			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	0 kg	(0 kgal)	
Heat Load	0 kW	(0 BTU/hr)	
Bulk Density	0 (g/cc)		
Water wt%	0		
TOC wt% C (wet)	0		
Chemical Constituents			
Na ⁺	0	0	0
Al ³⁺	0	0	0
Fe ²⁺ (total Fe)	0	0	0
Cr ³⁺	0	0	0
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0	0	0
Sr ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	0	0	0
K ⁺	0	0	0
OH ⁻	0	0	0
NO ₃ ⁻	0	0	0
NO ₂ ⁻	0	0	0
CO ₃ ²⁻	0	0	0
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₃ ²⁻)	0	0	0
F ⁻	0	0	0
Cl ⁻	0	0	0
C ₂ H ₃ O ₂ ⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	0	0	0
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0	0
U	0	0	0
Cs	0	0	0
Sr	0	0	0

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

2.2 Tank 241-AN-102

2.2.1 241-AN-102 Tank History

2.2.1.1 Waste History of Tank 241-AN-102

Tank 241-AN-102 began service by receiving non-complexed waste from Tank 241-SY-102 in September 1981. The tank received non-complexed waste until December 1982. The tank received complexant concentrate waste from January 1983 until October 1983. From November 1983 until June 1984, the tank again received non-complexed waste. During the first quarter of 1984, the tank received low-level waste from PUREX. The tank received complexant concentrate waste from Tank 241-AW-101 from July 1984 until the fourth quarter of 1992 and has not received any waste since 1992. The tank is currently inactive and is considered a concentrated waste holding tank.

2.2.1.2 Temperature History of Tank 241-AN-102

Temperature data for Tank 241-AN-102 are recorded by 18 thermocouples at known elevations on one thermocouple tree inside the tank, located in riser 4A. Non-suspect temperature data taken between July 1983 and November 1990 for all 18 thermocouples were available from the computer automated surveillance system. However, the quality of the data varied between thermocouples. Therefore, temperature data for an individual thermocouple may not have encompassed this entire length of time. Non-suspect temperature data taken between January 1990 and September 1993 for six thermocouples were available from the surveillance analysis computer system. Within the time span for the computer automated surveillance system, there were several small breaks in the sequence of the temperature data. Within the time span of the surveillance analysis computer system, there were no significant breaks in the sequence of temperature data. The average temperature during these periods was 90.7°F with a minimum of 65°F, a maximum of 104°F, and a standard deviation of 9.0°F. Linear regressions were performed on each thermocouple that recorded temperature data starting from January 1990. The slopes from these regressions were averaged with a resulting average slope of 0.00849. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

2.2.1.3 Occurrences of Tank 241-AN-102

One unusual event concerned Tank 241-AN-102. TFS & O-EFS-89-046 was issued in July 1989. Samples taken indicated that the tank had a deficient amount of caustic. A second set of samples verified the problem.

2.2.1.4 Psychrometrics of Tank 241-AN-102

The apparent trend of the evaporation rate from the tank has increased from 97 gallons per week in August 1982 to 178.1 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank and annular ventilation has apparently increased. A review of the psychrometric data in Tank 241-AN-102 would suggest an overall increase in the rate of heat generation by the waste.

2.2.2 Current Status of Tank 241-AN-102

Tank 241-AN-102 entered service in September 1981 and currently stores 1,082,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 1,095,000 gallons and riser configurations for January 1994. At the time of the estimate, there were 1,095,000 gallons of supernatant with 89,000 gallons of concentrated supernatant solids. The waste level in the tank is measured with the FIC gauge and has remained at about 400 inches over the last three years. The one increase was the addition of dilute and non-complexed waste from PUREX miscellaneous streams. This tank is inactive at the present time. The tank is actively ventilated and categorized as sound. Tank 241-AN-102 has 61 risers. One 4-inch riser (no.21A) and one 12-inch riser (no.7A) are available for use.

2.2.2.1 Inventory Estimate of Tank 241-AN-102

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew, 1995) and Supernatant Mixing Model (Agnew, 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AN-102 are also presented. Concentrated supernatant solids are considered as an integral part of the liquid for the purpose of estimating inventories, but are graphed as solids on the level histories. The actual substance, which was derived from double-shell slurry, appears as a solid if undisturbed, but the particles are resuspended in solution if heated or disturbed.

2.2.2.2 In-Tank Photograph of Tank 241-AN-102

No in-tank photographs are available.

2.2.3 Synopsis of Tank 241-AN-102

(To be completed.)

ANDERSON 1990
WASTE TYPES

NCPLX:

CC:

NCPLX:

CC:

PRIMARY
ADDITIONS

PL2:

LEVEL IN
FEET
LEVEL IN
INCHES

36' 432"
34' 408"
32' 384"
30' 360"
28' 336"
26' 312"
24' 288"
22' 264"
20' 240"
18' 216"
16' 192"
14' 168"
12' 144"
10' 120"
8' 96"
6' 72"
4' 48"
2' 24"
0' 0"

FROM SY-102
TO AW-102

FROM AW-102
TO AN-107

FROM SY-102, AY-102, & AW-105
FROM AN-101

TO AW-102
FROM AW-101

LIGU
LEVE

YEARS

NOTES:

CONSTRUCT 1980-1981
 NOMINAL CAPACITY: 1,000,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

UNK:

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

— 1,188,000

— 1,122,000

— 1,056,000

— 990,000

— 924,000

— 858,000

— 792,000

— 726,000

— 660,000

— 594,000

— 528,000

— 462,000

— 396,000

— 330,000

— 264,000

— 198,000

— 132,000

— 66,000

0

NCPLX: NON-COMPLEXED WASTE
 CC: COMPLEXANT CONCENTRATE WASTE
 PL2: PUREX LOW-LEVEL WASTE
 UNK: UNKNOWN

LEGEND LIQUID OBSERVATION
WELL (LOW)

LIQUID LEVEL

SOLIDS LEVEL

SOLIDS LEVEL BEST
ENGINEERING JUDGEMENTAN TANK FARM
PLOT PLAN

SUPERNATANT 1006 KGAL
 CS SOLIDS 89 KGAL
 See glossary for abbreviations and definitions

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AN-102 DOUBLE-SHELL TANK
 LEVEL HISTORY 1982 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: N/A

SIZE	BLDG NO.	DWG NO.	DATE
B	241	ES-TKS-E151	6/95
SCALE	ACC NO.	SHEET	OF
NONE		1	1

Double-Shell Tank 241-AN-102			
Total Inventory Estimate*			
Physical Properties			
Total Waste	5.26E+06 kg (1.10E+03 kgal)		
Heat Load	4.17 kW (1.42E+04 BTU/hr)		
Bulk Density†	1.27 (g/cc)		
Water wt%	62.8		
TOC wt% C (wet)	0.736		
Chemical Constituents			
	mg/L	ppm	kg
Na ⁺	5.90	1.07E+05	5.62E+05
Al ³⁺	0.728	1.55E+04	8.14E+04
Fe ³⁺ (total Fe)	3.41E-03	150	788
Cr ³⁺	2.10E-02	861	4.53E+03
Bi ³⁺	7.32E-04	120	634
La ³⁺	4.43E-06	0.485	2.55
Hg ²⁺	5.05E-06	0.797	4.20
Zr (as ZrO(OH).1)	4.69E-04	31.7	177
Pb ²⁺	6.48E-05	10.6	55.7
Ni ²⁺	2.97E-03	137	722
Sr ²⁺	4.68E-06	0.323	1.70
Mn ²⁺	7.18E-03	311	1.64E+03
Ca ²⁺	2.38E-02	752	3.96E+03
K ⁺	2.06E-02	633	3.34E+03
OH ⁻	3.24	4.34E+04	2.28E+05
NO ₃ ⁻	2.07	1.01E+05	5.33E+05
NO ₂ ⁻	1.24	4.48E+04	2.36E+05
CO ₃ ²⁻	0.302	1.43E+04	7.51E+04
PO ₄ ³⁻	0.108	8.08E+03	4.25E+04
SO ₄ ²⁻	0.162	1.23E+04	6.47E+04
Si (as SiO ₂) [†]	3.03E-02	670	3.52E+03
F ⁻	5.06E-02	757	3.99E+03
Cl ⁻	9.98E-02	2.78E+03	1.47E+04
C ₂ H ₃ O ₂ ⁻	2.35E-02	3.49E+03	1.84E+04
EDTA ⁴⁻	1.12E-02	2.53E+03	1.33E+04
HEDTA ³⁻	1.82E-02	3.93E+03	2.07E+04
glycolate ⁻	8.96E-02	5.29E+03	2.78E+04
acetate ⁻	1.33E-02	617	3.25E+03
oxalate ²⁻	1.67E-05	1.16	6.10
DBP	1.25E-02	1.58E+03	8.33E+03
hydroxyl	1.25E-02	728	3.83E+03
NH ₃	3.30E-02	442	2.33E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiochemical Constituents			
Pu		2.12E-02 (μCi/g)	1.86 (kg)
U	4.02E-03 (M)	753 (μg/g)	3.96E+03 (kg)
Ce	0.201 (Ci/L)	158 (μCi/g)	8.33E+03 (Ci)
Sr	9.49E-03 (Ci/L)	7.47 (μCi/g)	3.93E+04 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AN-102			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	5.26E+06 kg (1.10E+03 kgal)		
Heat Load	4.17 kW (1.42E+04 BTU/hr)		
Bulk Density*	1.27 (g/cc)		
Water wt%	62.8		
TOC wt% C (wet)	0.736		
Chemical Constituents			
	mg/L	g/g	kg
Na ⁺	5.90	1.07E+05	5.62E+05
Al ³⁺	0.728	1.55E+04	8.14E+04
Fe ³⁺ (total Fe)	3.41E-03	150	788
Cr ³⁺	2.10E-02	861	4.53E+03
Bi ³⁺	7.32E-04	120	634
La ³⁺	4.43E-06	0.485	2.55
Hg ²⁺	5.05E-06	0.797	4.20
Zr (as Zr(OH) ₄)	4.69E-04	33.7	177
Pb ²⁺	6.48E-05	10.6	55.7
Ni ²⁺	2.97E-03	137	722
Sr ²⁺	4.68E-06	0.323	1.70
Mn ²⁺	7.18E-03	311	1.64E+03
Ca ²⁺	2.34E-02	752	3.96E+03
K ⁺	2.06E-02	635	3.34E+03
OH	3.24	4.34E+04	2.28E+05
NO ₃ ⁻	2.07	1.01E+05	5.35E+05
NO ₂ ⁻	1.24	4.48E+04	2.36E+05
CO ₃ ²⁻	0.302	1.43E+04	7.51E+04
PO ₄ ³⁻	0.108	8.08E+03	4.25E+04
SO ₄ ²⁻	0.162	1.23E+04	6.47E+04
Si (as SiO ₂)	3.03E-02	670	3.52E+03
F ⁻	5.06E-02	757	3.99E+03
Cl ⁻	9.98E-02	2.78E+03	1.47E+04
C ₆ H ₈ O ₇	2.35E-02	3.49E+03	1.84E+04
EDTA ⁴⁻	1.12E-02	2.53E+03	1.33E+04
HEDTA ³⁻	1.82E-02	3.93E+03	2.07E+04
glycolate ⁻	8.96E-02	5.29E+03	2.78E+04
acetate ⁻	1.33E-02	617	3.25E+03
oxalate ²⁻	1.67E-05	1.16	6.10
DBP	1.25E-02	1.58E+03	8.33E+03
butanol	1.25E-02	728	3.83E+03
NH ₃	3.30E-02	442	2.33E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	26.9 (μCi/L)		1.86 (kg)
U	4.02E-03 (M)	753 (μg/g)	3.96E+03 (kg)
Ce	0.201 (Cv/L)	158 (μCv/g)	8.33E+05 (Ci)
Sr	9.49E-03 (Cv/L)	7.47 (μCv/g)	3.93E+04 (Ci)

*Density is calculated based on Na, OH₂, and AlO₂.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AN-102			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	0 kg	(0 kgal)	
Heat Load	0 kW	(0 BTU/hr)	
Bulk Density	0 (g/cc)		
Water wt%	0		
TOC wt% C (wet)	0		
Chemical Constituents			
Na ⁺	0	0	0
Al ³⁺	0	0	0
Fe ³⁺ (total Fe)	0	0	0
Cr ³⁺	0	0	0
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as Zr(OH) ₄)	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0	0	0
Sr ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	0	0	0
K ⁺	0	0	0
OH	0	0	0
NO ₃ ⁻	0	0	0
NO ₂ ⁻	0	0	0
CO ₃ ²⁻	0	0	0
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₂)	0	0	0
F ⁻	0	0	0
Cl ⁻	0	0	0
C ₆ H ₈ O ₇	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	0	0	0
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0	0
U	0	0	0
Cs	0	0	0
Sr	0	0	0

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

2.3 Tank 241-AN-103

2.3.1 241-AN-103 Tank History

2.3.1.1 Waste History of Tank 241-AN-103

Tank 241-AN-103 began service by receiving non-complexed waste from Tank 241-SY-102 in September 1981. The tank received non-complexed waste until February 1984. During 1983, the tank received low-level waste from B Plant and dilute non-complexed waste from the 200-East Area SSTs. The tank received double-shell slurry feed waste from March 1984 until April 1986. Since May 1986, the tank has contained double-shell slurry waste. The solid level readings in 1987 and 1988 seem to be in error. The reported solids level is higher than what can be accounted for by the reported total volume of waste. The solids level may have risen during this time, but not to the values reported which exceeded the capacity of the tank. This erroneous data was removed. The slight level changes are attributed to slurry growth as a result of gas generation. The tank has not received any waste, other than wash water, since the first quarter of 1986. The tank is currently inactive and is considered a concentrated waste holding tank.

2.3.1.2 Temperature History of Tank 241-AN-103

Temperature data for Tank 241-AN-103 are recorded by 18 thermocouples at known elevations on one tree inside the tank, located in riser 4A. Non-suspect temperature data recorded between July 1983 and June 1991 for all 18 thermocouples were available from the computer automated surveillance system. Non-suspect temperature data recorded between January 1990 and September 1993 for six thermocouples were available from the surveillance analysis computer system. Within the time span for the computer automated surveillance system, there were several small breaks in the sequence of temperature data. Within the time span for the surveillance analysis computer system, there were no significant breaks in the sequence of temperature data. The average temperature during these periods was 103.7°F with a minimum of 62°F, a maximum of 150°F, and a standard deviation of 12.5°. Linear regressions were performed on each thermocouple that had temperature data starting from January 1990. The slopes from these regressions were averaged with a resulting average slope of 0.00235. Refer to the supporting document for a more thorough review of the temperature data (Brevick 1995).

2.3.1.3 Occurrences of Tank 241-AN-103

Four unusual events occurred at Tank 241-AN-103. TFS & O-EFS-88-0145 was issued in September 1988 due to surface level measurements exceeding procedural criteria. The change was due to crystal growth and new surface level measuring equipment. TFS & O-EFS-89-027 was issued in March 1989. The tank pressurized to +0.3 inches water gauge when the primary exhaustor did not start and when the secondary system was shut down. Occurrence Report RL--WHC-Tank Farm-1991-1036 was issued in August 1991 due to personnel not recording tank level data. Occurrence Report RL--WHC-Tank

Farm-1991-1072 was issued in December 1991 due to the liquid level in the leak detector pit exceeding safety limits.

2.3.1.4 Psychrometrics of Tank 241-AN-103

The apparent trend of the evaporation rate from the tank has decreased from 89.1 gallons per week in February 1983 to 79.6 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank and annular ventilation remained nearly constant. Any changes in the rate of heat exchange can be attributed to changes in the average ventilation rates. A review of the psychrometric data in Tank 241-AN-103 would suggest a constant rate of heat generation by the waste.

2.3.2 Current Status of Tank 241-AN-103

Tank 241-AN-103 entered service in September 1981 and currently stores 951,000 gallons of waste. The following plan view and tank cross section depict the approximate waste volume of 953,000 gallons and riser configurations as of January 1994. At the time of the estimate, there were 951,000 gallons of supernatant with 935,000 gallons of concentrated supernatant solids and 2,000 gallons of B Plant low-level waste (BL). The waste level in the tank is measured with the FIC gauge and has remained at about 345 inches over the last three years. This tank is on the Hydrogen Watch List and, therefore, is prohibited from receiving waste. The tank is actively ventilated and categorized as sound. Tank 241-AN-103 has 61 risers. Two 4-inch risers (no.10A and no.21A) and one 12-inch riser (no.7B) are available for use.

2.3.2.1 Inventory Estimate of Tank 241-AN-103

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew, 1995) and Supernatant Mixing Model (Agnew, 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AN-103 are also presented. Concentrated supernatant solids are considered as an integral part of the liquid for the purpose of estimating inventories, but are graphed as solids on the level histories. The actual substance, which was derived from double-shell slurry, appears as a solid if undisturbed, but the particles are resuspended in solution if heated or disturbed.

2.3.2.2 In-Tank Photograph of Tank 241-AN-103

The 1988 collage for Tank 241-AN-103 shows a waste surface which is typical for saltcake produced by the Hanford evaporators. The colors are off-white with areas of light yellow, and it is probably mostly composed of sodium nitrate. The tank walls and dome are rusted. Picture quality is good and therefore the in-tank equipment is clearly visible. This equipment has been identified and labeled for the reader. The tank contains 953,000 gallons of waste (Hanlon, 1994) which corresponds with a waste height of about 29 feet.

2.3.3 Synopsis of Tank 241-AN-103

(To be completed.)

ANDERSON 1990
WASTE TYPES

NCPLX:

DSSF:

DSS:

PRIMARY
ADDITIONS

SWLIO:
BL:

NOTES:

CONSTRUCT 1980-1981
 NOMINAL CAPACITY: 1,000,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE,
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

GAS:

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

— 1,188,000

— 1,122,000

— 1,056,000

— 990,000

— 924,000

— 858,000

— 792,000

— 726,000

— 660,000

— 594,000

— 528,000

— 462,000

— 396,000

— 330,000

— 264,000

— 198,000

— 132,000

— 66,000

— 0

NCPLX: NON-COMPLEXED WASTE

DSSF: DOUBLE-SHELL SLURRY FEED WASTE

DSS: DOUBLE-SHELL SLURRY

SWLIQ: SALTWELL LIQUOR

BL: B PLANT LOW-LEVEL WASTE

GAS: LEVEL FLUXUATION DUE TO GAS BUILD-UP

LEGEND LIQUID OBSERVATION
WELL (LOW)

LIQUID LEVEL

SOLIDS LEVEL

SOLIDS LEVEL BEST
ENGINEERING JUDGEMENTSOLIDS
LEVEL

SUPERNATANT 16 KGAL
 CS SOLIDS 935 KGAL
 BL 2 KGAL

See glossary for abbreviations and definitions

**AN TANK FARM
PLOT PLAN**

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AN-103 DOUBLE-SHELL TANK
 LEVEL HISTORY 1982 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: HYDROGEN

SIZE	BLDG NO.	DWG NO.	DATE
B	241	ES-TKS-E152	6/95
SCALE	NONE	JOB NO.	SHEET 1 OF 1

Double-Shell Tank 241-AN-103			
Total Inventory Estimate*			
Physical Properties			
Total Waste	5.66E+05 kg	(953 kgal)	
Heat Load	7.67 kW	(2.62E+04 BTU/hr)	
Bulk Density†	1.57 (g/cc)		
Water wt%	32.9		
TDC wt% C (wt%)	1.46		
Chemical Constituents			
	mole/l	ppm	kg
Na ⁺	13.0	1.90E+05	1.08E+06
Al ³⁺	1.54	2.65E+04	1.50E+05
Fe ²⁺ (total Fe)	1.34E-02	477	2.70E+03
Cr ³⁺	4.43E-02	1.47E+03	8.31E+03
Bi ³⁺	1.44E-03	192	1.09E+03
La ³⁺	8.72E-06	0.772	4.37
Hg ²⁺	1.39E-05	2.04	11.5
Zr (as ZrO(OH) ₂)	2.95E-03	171	970
Pb ²⁺	1.34E-04	17.6	99.8
NP ⁺	7.74E-03	290	1.64E+03
Se ²⁺	9.21E-06	0.515	2.91
Mn ²⁺	1.51E-02	528	2.98E+03
Ca ²⁺	6.60E-02	1.69E+03	9.55E+03
K ⁺	0.191	4.75E+03	2.69E+04
OH ⁻	6.94	7.52E+04	4.26E+05
NO ₂ ⁻	5.02	1.96E+05	1.12E+06
NO ₃ ⁻	2.38	6.97E+04	3.94E+05
CO ₃ ²⁻	0.701	2.68E+04	1.52E+05
PO ₄ ³⁻	0.237	1.44E+04	8.12E+04
SO ₄ ²⁻	0.335	2.05E+04	1.16E+05
Si (as SiO ₂)	6.40E-02	1.15E+03	6.49E+03
F ⁻	0.261	3.16E+03	1.79E+04
Cl ⁻	0.222	5.02E+03	2.84E+04
C ₂ H ₃ O ₂ ⁻	4.55E-02	5.49E+03	3.11E+04
EDTA ⁴⁻	2.00E-02	3.67E+03	2.08E+04
HEDTA ³⁻	3.26E-02	5.69E+03	3.22E+04
glycolate ⁻	0.215	1.03E+04	5.83E+04
acetate ⁻	2.38E-02	895	5.06E+03
oxalate ²⁻	3.29E-05	1.25	10.4
DBP	2.36E-02	2.43E+03	1.37E+04
humic ⁻	2.36E-02	1.12E+03	6.32E+03
NH ₄ ⁺	0.591	6.40E+03	3.62E+04
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		5.13E-02 (μCi/g)	4.84 (kg)
U	1.32E-02 (M)	2.00E+03 (μg/g)	1.13E+04 (kg)
Cs	0.383 (CIVL)	244 (μCi/g)	1.38E+06 (Ci)
Sr	4.93E-02 (CIVL)	31.4 (μCi/g)	1.78E+05 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TDC wt% C.

Double-Shell Tank 241-AN-103			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	5.64E+06 kg	(951 kgal)	
Heat Load	7.06 kW	(2.41E+04 BTU/hr)	
Bulk Density*	1.57 (g/cc)		
Water wt%	32.9		
TOC wt% C (wet)	1.46		
Chemical Constituents			
	moles	g/m	kg
Na ⁺	13.0	1.91E+03	1.08E+06
Al ³⁺	1.34	2.65E+04	1.49E+05
Fe ³⁺ (total Fe)	9.40E-03	333	1.89E+03
Cr ³⁺	4.44E-02	1.47E+03	8.31E+03
Bi ³⁺	1.44E-03	192	1.09E+03
La ³⁺	5.74E-06	0.774	4.37
Hg ²⁺	1.60E-05	2.04	11.5
Zr (as ZrO(OH) ₂)	2.95E-03	172	970
Pb ²⁺	1.34E-04	17.7	99.8
Ni ²⁺	7.07E-03	265	1.49E+03
Sr ²⁺	9.23E-06	0.516	2.91
Mn ²⁺	1.51E-02	529	2.98E+03
Ca ²⁺	6.58E-02	1.68E+03	9.49E+03
K ⁺	0.191	4.76E+03	2.69E+04
OH ⁻	6.91	7.50E+04	4.23E+05
NO ₃ ⁻	5.02	1.99E+05	1.12E+06
NO ₂ ⁻	2.38	6.98E+04	3.94E+05
CO ₃ ²⁻	0.702	2.69E+04	1.52E+05
PO ₄ ³⁻	0.238	1.44E+04	8.12E+04
SO ₄ ²⁻	0.335	7.05E+04	1.16E+05
Si (as SiO ₂)	6.27E-02	1.12E+03	6.34E+03
F ⁻	0.261	3.16E+03	1.79E+04
Cl ⁻	0.223	5.03E+03	2.84E+04
C ₆ H ₅ O ₇ ³⁻	4.56E-02	5.50E+03	3.10E+04
EDTA ⁴⁻	2.00E-02	3.68E+03	2.08E+04
HEDTA ³⁻	3.26E-02	5.71E+03	3.22E+04
glycolate ⁻	0.215	1.03E+04	5.82E+04
acetate ⁻	2.38E-02	898	5.06E+03
oxalate ²⁻	3.30E-05	1.85	10.4
DBP	2.37E-02	2.43E+03	1.37E+04
butanol	2.37E-02	1.13E+03	6.32E+03
NH ₃	0.592	6.42E+03	3.62E+04
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	77.7 (μCi/L)		4.66 (kg)
U	1.04E-02 (M)	1.58E+03 (μg/g)	8.93E+03 (kg)
Cs	0.384 (Ci/L)	245 (μCi/g)	1.38E+06 (Ci)
Sr	2.42E-02 (Ci/L)	15.5 (μCi/g)	8.73E+04 (Ci)

*Density is calculated based on Na, OH⁻, and AlO₂⁻.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AN-103			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	1.48E+04 kg	(2 kgal)	
Heat Load	0.610 kW	(2.08E+03 BTU/hr)	
Bulk Density	1.95 (g/cc)		
Water wt%	50.0		
TOC wt% C (wet)	0.251		
Chemical Constituents			
	moles	g/m	kg
Na ⁺	4.22	4.97E+04	735
Al ³⁺	2.00	2.77E+04	409
Fe ³⁺ (total Fe)	1.92	5.49E+04	813
Cr ³⁺	1.67E-07	4.44E-03	6.57E-05
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0.330	9.91E+03	147
Sr ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	0.188	3.85E+03	56.9
K ⁺	0	0	0
OH ⁻	20.9	1.82E+05	2.69E+03
NO ₃ ⁻	1.42	4.51E+04	667
NO ₂ ⁻	1.96E-02	461	6.82
CO ₃ ²⁻	0.398	1.22E+04	181
PO ₄ ³⁻	8.35E-03	406	6.00
SO ₄ ²⁻	9.18E-02	4.51E+03	66.8
Si (as SiO ₂)	0.675	9.70E+03	144
F ⁻	0	0	0
Cl ⁻	5.37E-02	975	14.4
C ₆ H ₅ O ₇ ³⁻	1.25E-02	1.21E+03	17.9
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0.167	6.41E+03	94.8
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	3.70E-06	3.22E-02	4.76E-04
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0.740 (μCi/g)	0.183 (kg)
U	1.32 (M)	1.61E+05 (μg/g)	2.39E+03 (kg)
Cs	0	0	0
Sr	12.0 (Ci/L)	6.13E+03 (μCi/g)	9.06E+04 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

241-AN-103

Photo date: 10-29-67

2.4 Tank 241-AN-104

2.4.1 241-AN-104 Tank History

2.4.1.1 Waste History of Tank 241-AN-104

Tank 241-AN-104 began service by receiving non-complexed waste in September 1981. The majority of the waste was sent from Tank 241-AW-102 during the fourth quarter of 1982. The tank continued to receive non-complexed waste until November 1982. The tank has contained double-shell slurry feed waste from December 1982 until the present. During the fourth quarter of 1983, the tank also received low-level waste from PUREX. The tank has not received waste since the second quarter of 1985. The slight level changes are attributed to slurry growth as a result of gas generation. The tank is currently inactive and is considered a concentrated waste holding tank.

2.4.1.2 Temperature History of Tank 241-AN-104

Temperature data for Tank 241-AN-107 are recorded by 18 thermocouples at known elevations on one tree inside the tank, located in riser 4A. Non-suspect temperature data recorded between July 1983 and June 1991 for all 18 thermocouples were available from the computer automated surveillance system. Non-suspect temperature data taken between January 1990 and September 1993 for 12 thermocouples were available from the surveillance analysis computer system. However, not all of the twelve thermocouples have data that encompass the entire length of time. Within the time spans for both systems, there were several small breaks in the sequence of temperature data. The average temperature during these periods was 91.8°F with a minimum of 72°F, a maximum of 107°F, and a standard deviation of 6.2°F. Linear regressions were performed on each thermocouple that had temperature data starting from January 1990. The slopes from these regressions were averaged with a resulting average slope of 0.00483. Refer to the supporting document for a more thorough review of the temperature data (Brevick 1995).

2.4.1.3 Occurrences of Tank 241-AN-104

No unusual events are associated exclusively with Tank 241-AN-104.

2.4.1.4 Psychrometrics of Tank 241-AN-104

The apparent trend of the evaporation rate from the tank has decreased from 111.4 gallons per week in December 1982 to 46.5 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank and annular ventilation has apparently decreased. A review of the psychrometric data in Tank 241-AN-104 would suggest an overall decrease in the rate of heat generation by the waste.

2.4.2 Current Status of Tank 241-AN-104

Tank 241-AN-104 entered service in September 1981 and currently stores 1,061,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 1,058,000 gallons and riser configurations in January 1994. At the time of the estimate, there were 1,058,000 gallons of supernatant with 264,000 gallons of concentrated supernatant solids. The waste level in the tank is measured with the PIC gauge and has remained at about 385 inches over the last three years. This tank is on the Hydrogen Watch List and, therefore, is prohibited from receiving waste. The tank is actively ventilated and categorized as sound. Tank 241-AN-104 has 61 risers. Two 4-inch risers (no.10A and no.21A) are available for use.

2.4.2.1 Inventory Estimate of Tank 241-AN-104

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew, 1995) and Supernatant Mixing Model (Agnew, 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AN-104 are also presented. Concentrated supernatant solids are considered as an integral part of the liquid for the purpose of estimating inventories, but are graphed as solids on the level histories. The actual substance, which was derived from double-shell slurry, appears as a solid if undisturbed, but the particles are resuspended in solution if heated or disturbed.

2.4.2.2 In-Tank Photograph of Tank 241-AN-104

The 1988 collage for this tank provides a clear picture of the tank interior. Waste surface color cannot be determined with certainty because the photographs were developed in such a way that some show the tank surface as light brown, some as grey, and some as off-white. Many tanks contain material with the off-white or light yellow color seen in some of these photographs and that appears to be the most likely color of this waste. The tank walls appear to be rusted heavily in some locations. Equipment is clearly visible. This tank contains 7 level probes, a saltwell screen, and a temperature probe which have been identified in the picture. This tank, which contains 1,057,000 gallons of waste (Hanlon, 1994), is almost filled to capacity. The waste height is about 32 feet.

2.4.3 Synopsis of Tank 241-AN-104

(To be completed.)

NOTES:

CONSTRUCT 1980-1981
NOMINAL CAPACITY: 1,000,000 GAL
FLAT BOTTOM TANK, NO KNUCKLE,
75 FOOT DIAMETER DOUBLE-SHELL TANK
SURFACE LEVEL READING: PHOTO
(LIQUIDS & SOLIDS), FIC (SOLIDS)

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

1,188,000

1,122,000

1,056,000

990,000

924,000

858,000

792,000

726,000

660,000

594,000

528,000

462,000

396,000

330,000

264,000

198,000

132,000

66,000

0

NCPLX: NON-COMPLEXED WASTE
DSSF: DOUBLE-SHELL SLURRY FEED WASTE
PL2: PUREX LOW-LEVEL WASTE
GAS: LEVEL FLUXUATION DUE TO GAS BUILD-UP

LEGEND

LIQUID OBSERVATION
WELL (LOW)
LIQUID LEVEL
SOLIDS LEVEL
SOLIDS LEVEL BEST
ENGINEERING JUDGEMENT

AN TANK FARM PLOT PLAN

SOLIDS
LEVEL

SUPERNATANT 794 KGAL
CS SOLIDS 264 KGAL
See glossary for abbreviations and definitions

U.S. DEPARTMENT OF ENERGY
RICHLAND FIELD OFFICE
ICF KAISER HANFORD

241-AN-104 DOUBLE-SHELL TANK
LEVEL HISTORY 1982 TO 1994
SOUND/ACTIVE TANK
WATCH LIST: HYDROGEN

SIZE	BLOC NO.	UWG NO.	DATE
B	241	ES-TKS-E153	6/95
SCALE	NONE	JOB NO.	SHEET 1 OF 1

Double-Shell Tank 241-AN-104			
Total Inventory Estimate*			
Physical Properties			
Total Waste	5.43E+06 kg (1.06E+03 kgal)		
Heat Load	5.16 kW (1.76E+04 BTU/hr)		
Bulk Density†	1.36 (g/cc)		
Water wt%†	53.9		
TOC wt% C	0.919		
Chemical Constituents			
Na ⁺	7.78	1.32E+05	7.16E+05
Al ³⁺	0.966	1.92E+04	1.04E+05
Fe ³⁺ (total Fe)	4.47E-03	184	999
Cr ³⁺	2.67E-02	1.02E+03	5.55E+03
Bi ³⁺	9.92E-04	153	830
La ³⁺	6.10E-06	0.625	3.39
Hg ²⁺	8.34E-06	1.23	6.70
Zr (as Zr(OH) ₄)	1.18E-03	79.3	431
Pb ²⁺	7.20E-05	11.0	59.7
Ni ²⁺	3.58E-03	155	841
Sr ²⁺	6.45E-06	0.417	2.26
Mn ²⁺	8.04E-03	326	1.77E+03
Ca ²⁺	3.13E-02	924	5.02E+03
K ⁺	6.51E-02	1.88E+03	1.02E+04
OH ⁻	4.30	5.39E+04	2.93E+05
NO ₃ ⁻	2.76	1.26E+05	6.84E+05
NO ₂ ⁻	1.67	5.67E+04	3.08E+05
CO ₃ ²⁻	0.374	1.65E+04	8.99E+04
PO ₄ ³⁻	0.136	9.51E+03	5.17E+04
SO ₄ ²⁻	0.212	1.50E+04	8.16E+04
Si (as SiO ₂)	3.80E-02	787	4.28E+03
F ⁻	0.111	1.55E+03	8.42E+03
Cl ⁻	0.133	3.46E+03	1.88E+04
C ₂ H ₃ O ₂ ⁻	2.93E-02	4.08E+03	2.22E+04
EDTA ⁴⁻	1.43E-02	3.04E+03	1.65E+04
HEDTA ³⁻	2.36E-02	4.77E+03	2.59E+04
glycolate ⁻	0.114	6.33E+03	3.44E+04
acetate ⁻	1.60E-02	698	3.79E+03
oxalate ²⁻	2.30E-05	1.49	8.12
DBP	1.50E-02	1.78E+03	9.69E+03
butanol	1.50E-02	821	4.46E+03
NH ₃	0.183	2.30E+03	1.25E+04
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		2.89E-02 (μCi/g)	2.61 (kg)
U	5.53E-02 (M)	971 (μg/g)	5.28E+03 (kg)
Cs	0.258 (Ci/L)	191 (μCi/g)	1.03E+06 (Ci)
Sr	1.15E-02 (Ci/L)	8.50 (μCi/g)	4.62E+04 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AN-104			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	5.43E+06 kg	(1.06E+03 keal)	
Heat Load	5.16 kW	(1.76E+04 BTU/hr)	
Bulk Density*		1.36 (g/cc)	
Water wt%†		53.9	
TOC wt% C (wet)		0.919	
Chemical Constituents	mole/L	ppm	kg
Na ⁺	7.78	1.32E+05	7.16E+05
Al ³⁺	0.966	1.92E+04	1.04E+05
Fe ³⁺ (total Fe)	4.47E-03	184	999
Cr ³⁺	2.67E-02	1.02E+03	5.55E+03
Bi ³⁺	9.92E-04	153	830
La ³⁺	6.10E-06	0.625	3.39
Hg ²⁺	8.34E-06	1.23	6.70
Zr (as ZrO(OH) ₂)	1.18E-03	79.3	431
Pb ²⁺	7.20E-05	11.0	59.7
NP ⁺	3.58E-03	155	841
Sr ²⁺	6.45E-06	0.417	2.26
Mn ²⁺	8.04E-03	326	1.77E+03
Ca ²⁺	3.13E-02	924	5.02E+03
K ⁺	6.51E-02	1.88E+03	1.02E+04
OH ⁻	4.30	5.39E+04	2.93E+05
NO ₂ ⁻	2.76	1.26E+05	6.84E+05
NO ₃ ⁻	1.67	3.67E+04	3.08E+05
CO ₃ ²⁻	0.374	1.65E+04	8.99E+04
PO ₄ ³⁻	0.136	9.51E+03	5.17E+04
SO ₄ ²⁻	0.212	1.50E+04	8.16E+04
Si (as SiO ₂ ²⁻)	3.60E-02	787	4.28E+03
F ⁻	0.111	1.55E+03	8.42E+03
Cl ⁻	0.133	3.46E+03	1.88E+04
C ₂ H ₃ O ₂ ²⁻	2.93E-02	4.08E+03	2.22E+04
EDTA ⁴⁻	1.43E-02	3.04E+03	1.65E+04
HEDTA ³⁻	2.36E-02	4.77E+03	2.59E+04
glycolate ⁻	0.114	6.33E+03	3.44E+04
acetate ⁻	1.60E-02	698	3.79E+03
oxalate ²⁻	2.30E-05	1.49	8.12
DBP	1.50E-02	1.78E+03	9.69E+03
butanol	1.50E-02	821	4.46E+03
NH ₃	0.183	2.30E+03	1.23E+04
Fe(CN) ₆ ⁴⁻	0	0	0
Radiochemical Constituents			
Pa	39.2 (μCi/L)		2.61 (kg)
U	5.53E-03 (M)	971 (μg/g)	5.28E+03 (kg)
Cs	0.258 (Ci/L)	191 (μCi/g)	1.03E+06 (Ci)
Sr	1.15E-02 (Ci/L)	8.50 (μCi/g)	4.62E+04 (Ci)

*Density is calculated based on Na, OH₂, and AlO₂⁻.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AN-104			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	0 kg	(0 keal)	
Heat Load	0 kW	(0 BTU/hr)	
Bulk Density		0 (g/cc)	
Water wt%		0	
TOC wt% C (wet)		0	
Chemical Constituents	mole/L	ppm	kg
Na ⁺	0	0	0
Al ³⁺	0	0	0
Fe ³⁺ (total Fe)	0	0	0
Cr ³⁺	0	0	0
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	0	0	0
NP ⁺	0	0	0
Sr ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	0	0	0
K ⁺	0	0	0
OH ⁻	0	0	0
NO ₂ ⁻	0	0	0
NO ₃ ⁻	0	0	0
CO ₃ ²⁻	0	0	0
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₂ ²⁻)	0	0	0
F ⁻	0	0	0
Cl ⁻	0	0	0
C ₂ H ₃ O ₂ ²⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	0	0	0
Fe(CN) ₆ ⁴⁻	0	0	0
Radiochemical Constituents			
Pr		0	0
U		0	0
Cs		0	0
Sr		0	0

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

Photo date: 8-19-88

WMC-SD-MM-ER350, Rev. 0.

2.5 Tank 241-AN-105

2.5.1 241-AN-105 Tank History

2.5.1.1 Waste History of Tank 241-AN-105

Tank 241-AN-105 began service by receiving non-complexed waste in September 1981. The tank continued to receive non-complexed waste until November 1982. The tank received double-shell slurry feed waste from Tanks 241-AW-102 and 241-AN-104 from December 1982 until the second quarter of 1985, when waste reception ceased. The slight level changes are attributed to slurry growth as a result of gas generation. The tank is currently inactive and is considered a concentrated waste holding tank.

2.5.1.2 Temperature History of Tank 241-AN-105

Temperature data for Tank 241-AN-105 are recorded by 18 thermocouples at known elevations on one tree inside the tank, located in riser 4A. Non-suspect temperature data recorded between July 1983 and June 1991 for all 18 thermocouples were available from the computer automated surveillance system. Non-suspect temperature data from between January 1990 and September 1993 for six thermocouples were available from the surveillance analysis computer system. Within the time span of the computer automated surveillance system there are several small breaks in the sequence of temperature data. Within the time span of the surveillance analysis computer system, there were no significant breaks in the sequence of temperature data. The average temperature during these periods was 96.0°F with a minimum of 67°F, a maximum of 129°F, and a standard deviation of 11.5°F. Linear regressions were performed on each thermocouple that recorded temperature data starting from January 1990. The slopes from these regressions were averaged with a resulting average slope of 0.00097. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

2.5.1.3 Occurrences of Tank 241-AN-105

No unusual events are associated exclusively with Tank 241-AN-105.

2.5.1.4 Psychrometrics of Tank 241-AN-105

The apparent trend of the evaporation rate from the tank has decreased from 92.9 gallons per week in February 1983 to 28.9 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank ventilation has decreased. The annular ventilation heat exchange rate shows an increasing trend. The majority of the changes in the rate of heat exchange can be attributed to changes in the average ventilation rates. A review of the psychrometric data in Tank 241-AN-105 would suggest a constant rate of heat generation by the waste.

2.5.2 Current Status of Tank 241-AN-105

Tank 241-AN-105 entered service in September 1981 and currently stores 1,131,000 gallons of waste. The following plan view and tank cross section depict the approximate waste volume of 1,131,000 gallons and riser configurations as of January 1994. At the time of the estimate, all 1,131,000 gallons were supernatant. The waste level in the tank is measured with the FIC and has remained at about 410 inches over the last three years. This tank is on the Hydrogen Watch List and, therefore, is prohibited from receiving waste. The tank is actively ventilated and categorized as sound. Tank 241-AN-105 has 61 risers. Two 4-inch risers (no.10A and no.21A) and one 12-inch riser (no.7B) are available for use.

2.5.2.1 Inventory Estimate of Tank 241-AN-105

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew 1995) and Supernatant Mixing Model (Agnew 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AN-105 are also presented.

2.5.2.2 In-Tank Photograph of Tank 241-AN-105

The 1988 collage for Tank 241-AN-105 shows a waste surface which is typical for saltcake produced by the Hanford evaporators. The colors are off-white with areas of light yellow and it is probably mostly composed of sodium nitrate. The tank walls and dome are rusted. The picture quality is good and equipment is easily seen. The equipment has been identified and labeled for the reader. This tank, which contains 1,131,000 gallons of waste (Hanlon 1994), is almost filled to capacity. The height of the waste is about 34 feet.

2.5.3 Synopsis Tank of Tank 241-AN-105

(To be completed.)

NOTES:

CONSTRUCT 1980-1981
 NOMINAL CAPACITY: 1,000,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

INVENTORY ESTIMATE DATE

CAPACITY
 (GALLONS)

1,188,000

1,122,000

1,056,000

990,000

924,000

858,000

792,000

726,000

660,000

594,000

528,000

462,000

396,000

330,000

264,000

198,000

132,000

66,000

0

NCPLX: NON-COMPLEXED WASTE
 DSSF: DOUBLE-SHELL SLURRY FEED WASTE
 UNK: UNKNOWN
 GAS: LEVEL FLUXUATION DUE TO GAS BUILD-UP

LEGEND

□-□-□ LIQUID OBSERVATION
 WELL (LOW)
 — LIQUID LEVEL
 // SOLIDS LEVEL
 +++ SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

**AN TANK FARM
 PLOT PLAN**

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AN-105 DOUBLE-SHELL TANK
 LEVEL HISTORY 1982 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: HYDROGEN

SIZE	PLG NO.	DWG NO.	DATE
B	241	ES-TKS-E154	6/95
SCALE	NONE	JOB NO.	SHEET 1 OF 1

Double-Shell Tank 241-AN-105			
Total Inventory Estimate*			
Physical Properties			
Total Waste	6.17E+06 kg (1.13E+03 kgal)		
Heat Load	6.58 kW (2.25E+04 BTU/hr)		
Bulk Density†	1.44 (g/cc)		
Water wt%†	46.6		
TOC wt% C	1.14		
Chemical Constituents			
Na ⁺	9.57	1.53E+05	9.42E+03
Al ³⁺	1.22	2.29E+04	1.41E+03
Fe ³⁺ (total Fe)	4.97E-03	193	1.19E+03
Cr ³⁺	3.09E-02	1.12E+03	6.88E+03
Bi ³⁺	1.27E-03	184	1.13E+03
La ³⁺	7.43E-06	0.716	4.42
Hg ²⁺	8.68E-06	1.21	7.46
Zr (as Zr(OH) ₄)	1.09E-03	69.2	427
Pb ²⁺	9.28E-05	13.3	82.3
Ni ²⁺	4.14E-03	169	1.04E+03
Si ²⁺	7.83E-06	0.477	2.93
Mn ²⁺	8.81E-03	336	2.07E+03
Ca ²⁺	3.48E-02	968	5.97E+03
K ⁺	5.34E-02	1.45E+03	8.94E+03
OH ⁻	5.42	6.39E+04	3.94E+03
NO ₃ ⁻	3.42	1.47E+05	9.08E+03
NO ₂ ⁻	2.05	6.54E+04	4.04E+03
CO ₃ ²⁻	0.450	1.87E+04	1.16E+03
PO ₄ ³⁻	0.147	9.69E+03	5.98E+04
SO ₄ ²⁻	0.265	1.76E+04	1.09E+03
Si (as SiO ₂)	4.67E-02	910	5.61E+03
P	0.112	1.47E+03	9.08E+03
Cl ⁻	0.166	4.08E+03	2.52E+04
C ₂ H ₃ O ₂ ⁻	3.68E-02	4.83E+03	2.98E+04
EDTA ⁴⁻	1.74E-02	3.47E+03	2.14E+04
HEDTA ³⁻	2.77E-02	5.27E+03	3.25E+04
glycolate ⁻	0.146	7.62E+03	4.70E+04
acetate ⁻	2.25E-02	922	5.69E+03
oxalate ²⁻	2.80E-05	1.71	10.6
DBP	1.91E-02	2.13E+03	1.32E+04
butanol	1.91E-02	982	6.06E+03
NH ₃	0.134	1.38E+03	9.78E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radionuclide Concentrations			
Pu		3.26E-02 (μCi/g)	3.35 (kg)
U	6.38E-03 (M)	1.05E+03 (μg/g)	6.50E+03 (kg)
Cr	0.309 (C/L)	214 (μCi/g)	1.32E+06 (Ci)
Sr	1.34E-02 (C/L)	9.26 (μCi/g)	5.72E+04 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

241-AN-105

4,396,400 Liters
(1,160,000 Gallons)

TANK RISER LOCATION

TANK CROSS-SECTION

Not to scale

TANK LAYER MODEL

Double-Shell Tank 241-AN-105			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	6.17E+06 Lg (1.13E+03 kgal)		
Heat Load	6.58 kW (2.25E+04 BTU/hr)		
Bulk Density*	1.44 (g/cc)		
Water wt%	46.6		
TOC wt% C (wet)	1.14		
Chemical Constituents	mole/L	gpm	kg
Na ⁺	9.57	1.53E+05	9.42E+05
Al ³⁺	1.22	2.29E+04	1.41E+05
Fe ²⁺ (total Fe)	4.97E-03	193	1.19E+03
Cr ³⁺	3.09E-02	1.12E+03	6.88E+03
BP ⁺	1.27E-03	184	1.13E+03
La ³⁺	7.43E-06	0.716	4.42
Hg ²⁺	8.68E-06	1.21	7.46
Zr (as ZrO(OH) ₂)	1.09E-03	69.2	427
Pb ²⁺	9.28E-05	13.3	82.3
Ni ²⁺	4.14E-03	169	1.04E+03
Sr ²⁺	7.85E-06	0.477	2.95
Mn ²⁺	8.81E-03	336	2.07E+03
Cs ⁺	3.48E-02	968	5.97E+03
K ⁺	5.34E-02	1.45E+03	8.94E+03
OH ⁻	5.42	6.39E+04	3.94E+05
NO ₃ ⁻	3.42	1.47E+05	9.08E+05
NO ₂ ⁻	2.05	6.54E+04	4.04E+05
CO ₃ ²⁻	0.430	1.87E+04	1.16E+05
PO ₄ ³⁻	0.147	9.69E+03	5.98E+04
SO ₄ ²⁻	0.265	1.76E+04	1.09E+05
Si (as SiO ₂)	4.67E-02	910	5.61E+03
F ⁻	0.112	1.47E+03	9.08E+03
Cl ⁻	0.166	4.08E+03	2.52E+04
C ₂ H ₃ O ₂ ⁻	3.68E-02	4.89E+03	2.98E+04
EDTA ⁴⁻	1.74E-02	3.47E+03	2.14E+04
HEDTA ³⁻	2.77E-02	5.27E+03	3.25E+04
glycolate ⁻	0.146	7.62E+03	4.70E+04
acetate ⁻	2.25E-02	922	5.69E+03
oxalate ²⁻	2.80E-05	1.71	10.6
DBP	1.91E-02	2.13E+03	1.32E+04
butanol	1.91E-02	982	6.06E+03
NH ₃	0.134	1.58E+03	9.78E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	46.9 (μCi/L)		3.33 (kg)
U	6.38E-03 (M)	1.05E+03 (μg/g)	6.50E+03 (kg)
Cs	0.309 (Ci/L)	214 (μCi/g)	1.32E+06 (Ci)
Sr	1.34E-02 (Ci/L)	9.26 (μCi/g)	5.72E+04 (Ci)

*Density is calculated based on Na, OH⁻, and AlO₂⁻.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AN-105			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	0 kg (0 kgal)		
Heat Load	0 kW (0 BTU/hr)		
Bulk Density	0 (g/cc)		
Water wt%	0		
TOC wt% C (wet)	0		
Chemical Constituents	mole/L	gpm	kg
Na ⁺	0	0	0
Al ³⁺	0	0	0
Fe ²⁺ (total Fe)	0	0	0
Cr ³⁺	0	0	0
BP ⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0	0	0
Sr ²⁺	0	0	0
Mn ²⁺	0	0	0
Cs ⁺	0	0	0
K ⁺	0	0	0
OH ⁻	0	0	0
NO ₃ ⁻	0	0	0
NO ₂ ⁻	0	0	0
CO ₃ ²⁻	0	0	0
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₂)	0	0	0
F ⁻	0	0	0
Cl ⁻	0	0	0
C ₂ H ₃ O ₂ ⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	0	0	0
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0	0
U		0	0
Cs		0	0
Sr		0	0

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

241-AN-105

Photo date: 1-26-88

2.6 Tank 241-AN-106

2.6.1 241-AN-106 Tank History

2.6.1.1 Waste History of Tank 241-AN-106

Tank 241-AN-106 began service by receiving non-complexed waste in September 1981. The tank continued to receive non-complexed waste until January 1983. From February 1983 until February 1984, the tank received concentrated customer waste. The tank contained Hanford facility waste from March 1984 until May 1990. From June 1990 until the present, the waste contained in the tank has been designated as phosphate waste. The tank has not received any waste, other than wash water, since the third quarter of 1984. The supernatant was pumped to Tank 241-AP-102 during the second and third quarters of 1992. The tank is currently inactive and is considered a concentrated waste holding tank.

2.6.1.2 Temperature History of Tank 241-AN-106

Temperature data for Tank 241-AN-106 are recorded by 18 thermocouples at known elevations on one thermocouple tree inside the tank, located in riser 4A. Non-suspect temperature data taken between July 1983 and June 1991 for all 18 thermocouples were available from the computer automated surveillance system. However, not all of the 18 thermocouples have data that encompass the entire length of time. Non-suspect temperature data from between January 1990 and September 1993 for 12 thermocouples were available from the surveillance analysis computer system. Not all of the 12 thermocouples have data that encompass the entire length of time. Within the time spans for both systems, there were several small breaks in the sequence of temperature data. The average temperature during these periods was 72.4°F with a minimum of 60°F, a maximum of 113°F, and a standard deviation of 5.5°F. Linear regressions were performed on each thermocouple that had temperature data starting from January 1990. The slopes from these regressions were averaged with a resulting average slope of 0.00041. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

2.6.1.3 Occurrences of Tank 241-AN-106

No unusual events are associated exclusively with Tank 241-AN-106.

2.6.1.4 Psychrometrics of Tank 241-AN-106

The apparent trend of the evaporation rate from the tank has decreased from 110.7 gallons per week in February 1983 to 103.8 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank ventilation has remained nearly constant. The rates of heat exchange in the annular ventilation show a decreasing trend. The majority of the changes in the rates of heat exchange can be attributed to changes in the average ventilation rates. A review of the psychrometric data in Tank 241-AN-106 would suggest a decrease in the rate of heat generation by the waste.

2.6.2 Current Status of Tank 241-AN-106

Tank 241-AN-106 entered service in September 1981 and currently stores 420,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 21,000 gallons and riser configurations in January 1994. At the time of the estimate, there were 21,000 gallons of supernatant with 17,000 gallons of concentrated supernatant solids. The waste level in the tank is measured with the FIC and has decreased from about 370 inches in January 1991 to 10 inches in January 1994, and then increased to 153 inches in September 1994. The decrease was mostly from waste sent to Tank 241-AP-102 between November 1992 and December 1992. The increase was due to a transfer from Tank 241-AW-106 in September 1994. This tank is inactive at the present time. The tank is actively ventilated and categorized as sound. Tank 241-AN-106 has 61 risers. Two 4-inch risers (no.10A and no.21A) and one 12-inch riser (no.7A) are available for use.

2.6.2.1 Inventory Estimate of Tank 241-AN-106

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew 1995) and Supernatant Mixing Model (Agnew 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AN-106 are also presented. Concentrated supernatant solids are considered as an integral part of the liquid for the purpose of estimating inventories, but are graphed as solids on the level histories. The actual substance, which was derived from double-shell slurry, appears as a solid if undisturbed, but the particles are resuspended in solution if heated or disturbed.

2.6.2.2 In-Tank Photograph of Tank 241-AN-106

No in-tank photographs are available.

2.6.3 Synopsis of Tank 241-AN-106

(To be completed.)

CP:

NOTES:

CONSTRUCT 1980-1981
 NOMINAL CAPACITY: 1,000,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE,
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

1,188,000

1,122,000

1,056,000

990,000

924,000

858,000

792,000

726,000

660,000

594,000

528,000

462,000

396,000

330,000

264,000

198,000

132,000

66,000

0

CCW: CONCENTRATED CUSTOMER WASTE
 CHFV: CONCENTRATED HANFORD FACILITY WASTE
 UNK: UNKNOWN
 CP: CONCENTRATED PHOSPHATE WASTE
 NCPLX: NON-COMPLEXED WASTE

LEGEND

□ □ □ LIQUID OBSERVATION
 WELL (LOW)
 — LIQUID LEVEL
 // // // SOLIDS LEVEL
 // // // SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

AN TANK FARM
PLOT PLAN

SUPERNATANT 4 KGAL
 CS SOLIDS 17 KGAL
 See glossary for abbreviations and definitions

SOLIDS
LEVEL

B9 90 91 92 93 94

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AN-106 DOUBLE-SHELL TANK
 LEVEL HISTORY 1982 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: N/A

SIZE	BLDG NO.	DWG. NO.	DATE
B	241	ES-TKS-E155	6/95
SCALE	NONE	JOB NO.	SHEET 1 OF 1

Double-Shell Tank 241-AN-106			
Total Inventory Estimate*			
Physical Properties			
Total Waste	1.17E+03 kg	(21 kgal)	
Heat Load	0.135 kW	(460 BTU/hr)	
Bulk Density†		1.47 (g/cc)	
Water wwt%		44.2	
TOC wwt% C		1.17	
Chemical Constituents			
Na ⁺	10.3	1.60E+03	1.88E+04
Al ³⁺	1.31	2.39E+04	2.80E+03
Fe ³⁺ (total Fe)	5.28E-03	200	23.4
Cr ³⁺	3.71E-02	1.31E+03	153
B ³⁺	1.41E-03	200	23.4
La ³⁺	1.02E-05	0.938	0.112
Hg ²⁺	8.54E-06	1.16	0.136
Zr (as ZrO(OH) ₂)	8.43E-04	52.3	6.13
Pb ²⁺	7.88E-05	11.1	1.30
Ni ²⁺	4.61E-03	184	21.5
Sr ²⁺	1.07E-03	0.639	7.48E-02
Mn ²⁺	7.25E-03	270	31.7
Ca ²⁺	3.70E-02	1.01E+03	118
K ⁺	2.82E-02	747	87.5
OH ⁻	5.81	6.70E+04	7.85E+03
NO ₃ ⁻	3.53	1.49E+05	1.74E+04
NO ₂ ⁻	2.40	7.48E+04	8.76E+03
CO ₃ ²⁻	0.412	1.68E+04	1.97E+03
PO ₄ ³⁻	0.196	1.26E+04	1.48E+03
SO ₄ ²⁻	0.279	1.82E+04	2.13E+03
Si (as SiO ₂)	4.50E-02	857	100
F ⁻	9.27E-02	1.19E+03	140
Cl ⁻	0.179	4.30E+03	504
C ₂ H ₃ O ₂ ⁻	3.73E-02	4.81E+03	563
EDTA ⁴⁻	2.05E-02	4.00E+03	468
HEDTA ³⁻	3.36E-02	6.25E+03	732
acetate ⁻	0.123	6.36E+03	745
acetate ⁻	2.35E-02	942	110
oxalate ²⁻	3.84E-05	2.29	0.268
DBP	1.94E-02	2.12E+03	248
nitrate ⁻	1.94E-02	974	114
NH ₃	5.10E-02	583	68.9
Fe(CN) ₆ ⁴⁻	0	0	0
Radioisotopic Constituents			
Pu		3.03E-02 (μCi/g)	5.92E-02 (kg)
U	5.81E-03 (M)	938 (μCi/g)	110 (kg)
Cs	0.347 (Ci/g)	236 (μCi/g)	2.76E+04 (Ci)
Sr	1.01E-02 (Ci/L)	6.88 (μCi/g)	805 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

[†]Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AN-106			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	1.17E+05 kg	(21 kgal)	
Heat Load	0.135 kW	(460 BTU/hr)	
Bulk Density*	1.47 (g/cc)		
Water wt%	44.2		
TOC wt% C (wet)	1.17		
Chemical Constituents			
	mole/L	atoms	kg
Na ⁺	10.3	1.60E+05	1.88E+04
Al ³⁺	1.31	2.39E+04	2.80E+03
Fe ³⁺ (total Fe)	5.28E-03	200	23.4
Cr ³⁺	3.71E-02	1.31E+03	153
B ³⁺	1.41E-03	200	23.4
La ³⁺	1.02E-05	0.938	0.112
Hg ²⁺	8.54E-06	1.16	0.136
Zr (as ZrO(OH))	8.45E-04	52.3	6.13
Pb ²⁺	7.88E-05	11.1	1.30
Ni ²⁺	4.61E-03	184	21.5
Sr ²⁺	1.07E-05	0.639	7.48E-02
Mn ²⁺	7.25E-03	270	31.7
Ca ²⁺	3.70E-02	1.01E+03	118
K ⁺	2.82E-02	747	87.5
OH ⁻	5.31	6.70E+04	7.85E+03
NO ₃ ⁻	3.53	1.49E+05	1.74E+04
NO ₂ ⁻	2.40	7.48E+04	8.76E+03
CO ₃ ²⁻	0.412	1.68E+04	1.97E+03
PO ₄ ³⁻	0.196	1.26E+04	1.48E+03
SO ₄ ²⁻	0.279	1.82E+04	2.13E+03
Si (as SiO ₂ ²⁻)	4.50E-02	857	100
F ⁻	9.27E-02	1.19E+03	140
Cl ⁻	0.179	4.30E+03	504
C ₂ H ₃ O ₂ ⁻	3.73E-02	4.81E+03	563
EDTA ⁴⁻	2.03E-02	4.00E+03	468
HEDTA ³⁻	3.36E-02	6.23E+03	732
glycolate ⁻	0.125	6.36E+03	745
acetate ⁻	2.33E-02	942	110
oxalate ²⁻	3.84E-05	2.29	0.268
DBP	1.94E-02	2.12E+03	248
butanol	1.94E-02	974	114
NH ₃	5.10E-02	588	68.9
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	44.7 (μCi/L)		5.92E-02 (kg)
U	5.81E-03 (M)	938 (μg/g)	110 (kg)
Cr	0.347 (Ci/L)	236 (μCi/g)	2.76E+04 (Ci)
Sr	1.01E-02 (Ci/L)	6.88 (μCi/g)	805 (Ci)

*Density is calculated based on Na, OH⁻, and AlO₂⁻.

*Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AN-106			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	0 kg	(0 kgal)	
Heat Load	0 kW	(0 BTU/hr)	
Bulk Density	0 (g/cc)		
Water wt%	0		
TOC wt% C (wet)	0		
Chemical Constituents			
	mole/L	atoms	kg
Na ⁺	0	0	0
Al ³⁺	0	0	0
Fe ³⁺ (total Fe)	0	0	0
Cr ³⁺	0	0	0
B ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH))	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0	0	0
Sr ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	0	0	0
K ⁺	0	0	0
OH ⁻	0	0	0
NO ₃ ⁻	0	0	0
NO ₂ ⁻	0	0	0
CO ₃ ²⁻	0	0	0
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₂ ²⁻)	0	0	0
F ⁻	0	0	0
Cl ⁻	0	0	0
C ₂ H ₃ O ₂ ⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	0	0	0
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0	0
U		0	0
Cr		0	0
Sr		0	0

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

2.7 Tank 241-AN-107

2.7.1 241-AN-107 Tank History

2.7.1.1 Waste History of Tank 241-AN-107

Tank 241-AN-107 began service by receiving non-complexed waste in September 1981 from Tank 241-AN-102. The tank continued to receive non-complexed waste until June 1983. From July 1983 until the present, the tank has contained complexant concentrate waste, most of which was received from Tank 241-AZ-102 during the fourth quarter of 1983. The tank has not received any waste since the third quarter of 1986. The tank is currently inactive and is considered a concentrated waste holding tank.

2.7.1.2 Temperature History of Tank 241-AN-107

Temperature data for Tank 241-AN-107 are recorded by 18 thermocouples at known elevations on one tree inside the tank, located in riser 4A. Non-suspect temperature data taken between July 1983 and June 1991 for all 18 thermocouples were available from the computer automated surveillance system. Non-suspect temperature data recorded between January 1990 and September 1993 for 12 thermocouples were available from the surveillance analysis computer system. However, not all of the 12 thermocouples have data that encompass the entire length of time. Within the time spans for both systems, there were several small breaks in the sequence of temperature data. The average temperature during these periods was 91.8°F with a minimum of 72°F, a maximum of 107°F, and a standard deviation of 6.2°F. Linear regressions were performed on each thermocouple that had temperature data starting from January 1990. The slopes from these regressions were averaged with a resulting average slope of 0.00483. Refer to the supporting document for a more thorough review of the temperature data (Brevick 1995).

2.7.1.3 Occurrences of Tank 241-AN-107

Two unusual events occurred at Tank 241-AN-107. TFS & O-EFS-89-046 was issued in July 1989 because samples indicated that the tank was deficient in caustic. A second set of samples verified the deficiency. Occurrence Report RL--WHC-Tank Farm-1992-0090 was issued in December 1992 due to alarms for high levels of radon within the tank annulus.

2.7.1.4 Psychrometrics of Tank 241-AN-107

The apparent trend of the evaporation rate from the tank has increased from 132.8 gallons per week in February 1983 to 164.1 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank and annular ventilation has apparently increased. A review of the psychrometric data in Tank 241-AN-107 would suggest an overall increase in the rate of heat generation by the waste.

2.7.2 Current Status of Tank 241-AN-107

Tank 241-AN-107 entered service in September 1981 and currently stores 1,060,000 gallons of waste. The following plan view and tank cross section depict the approximate waste volume of 1,066,000 gallons and riser configurations as of January 1994. At the time of the estimate, there were 1,066,000 gallons of supernatant with 134,000 gallons of concentrated supernatant solids. The waste level in the tank is measured with the PIC gauge and the manual tape and has remained at about 385 inches over the last three years. This tank is inactive at the present time. The tank is actively ventilated and categorized as sound. Tank 241-AN-107 has 61 risers. Two 4-inch risers (no.10A and no.21A) and one 12-inch riser (no.7B) are available for use.

2.7.2.1 Inventory Estimate of Tank 241-AN-107

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew 1995) and Supernatant Mixing Model (Agnew 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AN-107 are also presented. Concentrated supernatant solids are considered as an integral part of the liquid for the purpose of estimating inventories, but are graphed as solids on the level histories. The actual substance, which was derived from double-shell slurry, appears as a solid if undisturbed, but the particles are resuspended in solution if heated or disturbed.

2.7.2.2 In-Tank Photograph of Tank 241-AN-107

The 1988 collage for Tank 241-AN-107 shows a waste surface which is too dark and too hazy to determine the waste color or characteristics with much certainty. A dark brown liquid appears to be on the surface, but this could be due to the lighting or the underlying solid material. Tank walls and equipment show up with excellent clarity in the picture. The walls appear to be in good condition and the equipment has all been identified and labeled. This tank, which contains 1,062,000 gallons of waste (Hanlon 1994), is almost filled to capacity. The height of the waste is about 32 feet.

2.7.3 Synopsis of Tank 241-AN-107

{To be completed.}

ANDERSON 1990
WASTE TYPES

NCPLX:

CC:

PRIMARY
ADDITIONS

UNK:

LEVEL IN
FEET
LEVEL IN
INCHES

36' 432"
34' 408"
32' 384"
30' 360"
28' 336"
26' 312"
24' 288"
22' 264"
20' 240"
18' 216"
16' 192"
14' 168"
12' 144"
10' 120"
8' 96"
6' 72"
4' 48"
2' 24"
0' 0"

FROM AZ-102

FROM AN-102

LIQUID
LEVEL

PHOTO (10/80)

YEARS

NOTES:

CONSTRUCT 1980-1981
NOMINAL CAPACITY: 1,000,000 GAL
FLAT BOTTOM TANK, NO KNUCKLE,
75 FOOT DIAMETER DOUBLE-SHELL TANK
SURFACE LEVEL READING: PHOTO
(LIQUIDS & SOLIDS), FIC (SOLIDS)

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

1,188,000

1,122,000

1,056,000

990,000

924,000

858,000

792,000

726,000

660,000

594,000

528,000

462,000

396,000

330,000

264,000

198,000

132,000

66,000

0

NCPLX: NON-COMPLEXED WASTE
CC: COMPLEXANT CONCENTRATE WASTE
UNK: UNKNOWN

LEGEND

LIQUID OBSERVATION
WELL (LOW)
LIQUID LEVEL
SOLIDS LEVEL
SOLIDS LEVEL BEST
ENGINEERING JUDGEMENT

AN TANK FARM PLOT PLAN

SUPERNATANT 932 KGAL
CS SOLIDS 134 KGAL
See glossary for abbreviations and definitions

SOLIDS
LEVEL

U.S. DEPARTMENT OF ENERGY
RICHLAND FIELD OFFICE
ICF KAISER HANFORD

241-AN-107 DOUBLE-SHELL TANK
LEVEL HISTORY 1982 TO 1994
SOUND/ACTIVE TANK
WATCH LIST: N/A

SIZE	BLDG NO.	DWG NO.	DATE
B	241	ES-TKS-E156	6/95
SCALE	NONE	JOB NO.	SHEET 1 OF 1

Double-Shell Tank 241-AN-107			
Total Inventory Estimate*			
Physical Properties			
Total Waste	5.76E+06 kg (1.07E+03 kgal)		
Heat Load	7.08 kW (2.42E+04 BTU/hr)		
Bulk Density†	1.43 (g/cc)		
Water wt%†	47.8		
TOC wt% C	1.46		
Chemical Constituents			
Na ⁺	9.27	1.49E+05	8.60E+05
Al ³⁺	1.20	2.26E+04	1.30E+05
Fe ³⁺ (total Fe)	3.95E-03	134	889
Cr ³⁺	2.91E-02	1.06E+03	6.12E+03
BH ⁺	1.27E-03	186	1.07E+03
La ³⁺	7.96E-06	0.775	4.46
Hf ³⁺	8.00E-06	1.12	6.48
Zr (as Zr(OH) ₄)	7.14E-04	45.6	263
Pb ²⁺	1.07E-04	15.3	89.3
Ni ²⁺	3.33E-03	137	788
Sr ²⁺	8.42E-06	0.516	2.98
Mn ²⁺	7.09E-03	273	1.57E+03
Ca ²⁺	2.76E-02	775	4.47E+03
K ⁺	2.84E-02	779	4.49E+03
OH ⁻	5.32	6.34E+04	3.65E+05
NO ₃ ⁻	3.06	1.33E+05	7.67E+05
NO ₂ ⁻	2.17	7.00E+04	4.03E+05
CO ₃ ²⁻	0.386	1.62E+04	9.35E+04
PO ₄ ³⁻	0.125	8.31E+03	4.79E+04
SO ₄ ²⁻	0.272	1.83E+04	1.06E+05
Si (as SiO ₂)	4.79E-02	942	5.43E+03
F ⁻	8.54E-02	1.14E+03	6.55E+03
Cl ⁻	0.160	3.96E+03	2.28E+04
C ₂ H ₃ O ₂ ⁻	4.60E-02	5.29E+03	3.05E+04
EDTA ⁴⁻	2.74E-02	5.53E+03	3.19E+04
HEXTA ⁶⁻	4.48E-02	8.61E+03	4.96E+04
glycolic ⁻	0.130	6.82E+03	3.93E+04
acetic ⁻	3.20E-02	1.32E+03	7.61E+03
oxalate ²⁻	3.01E-05	1.85	10.7
DBP	2.25E-02	2.53E+03	1.46E+04
hydroxyl	2.25E-02	1.17E+03	6.77E+03
NH ₃	4.16E-02	496	2.86E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiochemical Constituents			
Pu		3.13E-02 (μCi/g)	3.01 (kg)
U	5.86E-03 (M)	976 (μCi/g)	5.63E+03 (kg)
Cs	0.359 (Ci/L)	251 (μCi/g)	1.45E+06 (Ci)
Sr	1.10E-02 (Ci/L)	7.70 (μCi/g)	4.44E+04 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AN-107			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	5.76E+06 kg (1.07E+03 kgal)		
Heat Load	7.08 kW (2.42E+04 BTU/hr)		
Bulk Density*	1.43 (g/cc)		
Water wt%	47.8		
TOC wt% C (wt)	1.46		
Chemical Constituents			
	mg/L	mmol	kg
Na ⁺	9.27	1.49E+05	8.60E+05
Al ³⁺	1.20	2.26E+04	1.30E+05
Fe ²⁺ (total Fe)	3.95E-03	154	889
Cr ³⁺	2.91E-02	1.06E+03	6.12E+03
Bi ³⁺	1.27E-03	186	1.07E+03
La ³⁺	7.96E-06	0.775	4.46
Hg ²⁺	8.00E-06	1.12	6.48
Zr (as Zr(OH) ₄)	7.14E-04	45.6	263
Pb ²⁺	1.07E-04	15.5	89.3
Ni ²⁺	3.33E-03	137	788
Sr ²⁺	8.42E-06	0.516	2.98
Mn ²⁺	7.09E-03	273	1.57E+03
Ca ²⁺	2.76E-02	775	4.47E+03
K ⁺	2.84E-02	779	4.49E+03
OH ⁻	5.32	6.34E+04	3.65E+05
NO ₃ ⁻	3.06	1.33E+05	7.67E+05
NO ₂ ⁻	2.17	7.00E+04	4.03E+05
CO ₃ ²⁻	0.186	1.62E+04	9.35E+04
PO ₄ ³⁻	0.125	8.31E+03	4.79E+04
SO ₄ ²⁻	0.172	1.83E+04	1.06E+05
Si (as SiO ₃ ²⁻)	4.79E-02	942	5.43E+03
F ⁻	8.14E-02	1.14E+03	6.55E+03
Cl ⁻	0.160	3.96E+03	2.28E+04
C ₆ H ₅ O ₇ ³⁻	4.00E-02	5.29E+03	3.05E+04
EDTA ⁴⁻	2.74E-02	5.53E+03	3.19E+04
HEDTA ³⁻	4.48E-02	8.61E+03	4.96E+04
glycolate ⁻	0.130	6.82E+03	3.93E+04
acetate ⁻	3.20E-02	1.32E+03	7.61E+03
oxalate ²⁻	3.91E-05	1.85	10.7
DBP	2.25E-02	2.53E+03	1.46E+04
butanol	2.25E-02	1.17E+03	6.72E+03
NH ₃	4.16E-02	496	2.86E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	44.7 (μCi/L)		3.01 (kg)
U	5.86E-03 (M)	976 (mg/g)	5.63E+03 (kg)
Cs	0.359 (Ci/L)	251 (μCi/g)	1.45E+06 (Ci)
Sr	1.10E-02 (Ci/L)	7.70 (μCi/g)	4.44E+04 (Ci)

*Density is calculated based on Na, OH₂, and AlO₂.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AN-107			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	0 kg (0 kgal)		
Heat Load	0 kW (0 BTU/hr)		
Bulk Density	0 (g/cc)		
Water wt%	0		
TOC wt% C (wt)	0		
Chemical Constituents			
	mg/L	mmol	kg
Na ⁺	0	0	0
Al ³⁺	0	0	0
Fe ²⁺ (total Fe)	0	0	0
Cr ³⁺	0	0	0
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as Zr(OH) ₄)	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0	0	0
Sr ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	0	0	0
K ⁺	0	0	0
OH ⁻	0	0	0
NO ₃ ⁻	0	0	0
NO ₂ ⁻	0	0	0
CO ₃ ²⁻	0	0	0
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₃ ²⁻)	0	0	0
F ⁻	0	0	0
Cl ⁻	0	0	0
C ₆ H ₅ O ₇ ³⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	0	0	0
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0	0
U		0	0
Cs		0	0
Sr		0	0

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

241-AN-107

Photo date: 9-1-88

WMC-SD-WM-ER350, Rev. 0.

3 AP Tank Farm

3.0.1 AP Tank Farm History

The AP Tank Farm is located south of 4th Street and east of Canton Avenue in the 200-East Area. The AP Tank Farm contains eight, 100 series, 1,160,000-gallon, 75-foot diameter double-shell tanks. The AP Tank Farm is the most recent tank design, with a reinforced concrete shell and dome and an insulating concrete base. A heat-treated, stress-relieved, primary steel liner and a non-stress-relieved, outer steel liner are inside the concrete shell. These tanks were made to hold concentrated supernatant. The maximum design temperature for liquid storage is 300°F. The tanks are all at the same elevation and no cascade lines exist between the tanks.

A color aerial photograph taken in 1993 of the AP Tank Farm shows the orientation of the 100 series tanks, leak detection pits, annulus exhaust equipment, air intake stations, and a valve pit.

AP TANK FARM

3.0.1.1 AP Tank Farm Waste History

The AP Tank Farm began receiving waste in July 1986. The first wastes consisted of non-complexed waste, Hanford Site facilities waste, and double-shell slurry waste. Low-level waste from PUREX was sent to Tanks 241-AP-101, -102, -103, -107, and -108 from 1987 to 1992. Tank 241-AP-104 received N Reactor decontamination waste in 1987. Tanks 241-AN-102 and -104 were feed tanks for the grout facility. Presently, only Tanks 241-AN-101, -107, and -108 are active, and they are dilute process feed tanks to the 242-A Evaporator.

3.0.1.2 AP Tank Farm Temperature History

The eight tanks within the AP Tank Farm contain one thermocouple tree each, with 18 thermocouples per tree at known elevations. All of the AP tanks have a requirement for temperatures to be recorded semiannually and all are connected to CASS.

3.0.1.3 AP Tank Farm Occurrences

Five unusual events concerned AP Tank Farm as a whole according to the reports. Occurrence reports RL--WHC-Tank Farm-1993-0049, RL--WHC-Tank Farm-1992-0055, RL--WHC-Tank Farm-1992-0019, and RL--WHC-Tank Farm-1991-0226 were written because equipment failures caused the tanks to reach atmospheric pressure. According to Off-Normal Report 86-55 issued in December 1986, tanks were pressurized from a power failure causing loss of ventilation. For more information, refer to the Supporting Document for the Southeast Quadrant HTCE for AP Tank Farm (Brevick, 1995).

3.0.1.4 AP Tank Farm Ventilation

Each tank is designed to have 146.25 SCFM of air travel through it and 1,075 SCFM of air travel through the annulus. Air enters the tanks by infiltration because there is no supply fan. After exiting each tank, the air ducts are joined to allow the service of one fan to send air into the primary exhaust system. Before the tank air is released to the atmosphere, the air is heated, routed through a prefilter, then sent through two HEPA filters. Each tank annulus receives supplied air. Each source of supplied air serves two tank annuli after entering through a heater, prefilter, and HEPA filter. After air leaves each annulus, it is sent through joined ducts to a heater and two HEPA filters before it is released to the atmosphere. Both the tank and annulus systems have a primary and a backup system. For more information, refer to drawing H-2-90514, sheets 1 and 2.

The psychrometric data are recorded in two parts, the tank data and the annulus data. For water and heat leaving the tank, the numbers are positive. For more information, refer to the Supporting Document for the Southeast Quadrant HTCE for AP Tank Farm (Brevick, 1995).

3.0.2 Current Status of AP Tank Farm

Tanks 241-AP-101, -107, and -108 are active with the 242-A Evaporator. All tanks are actively ventilated and categorized as sound. The total waste volume is 4,201,000 gallons. The estimated volumes depicted in each tank cross-section total 7,269,000 gallons of waste (Agnew, January 1994). At the time of the estimate, there were 7,269,000 gallons of supernatant.

3.1 Tank 241-AP-101

3.1.1 241-AP-101 Tank History

3.1.1.1 Waste History of Tank 241-AP-101

Tank 241-AP-101 began service by receiving non-complexed waste in July 1986. During 1987, 1988, and 1989, the tank received waste from PUREX. The tank received non-complexed waste until May 1990. From June 1990 until the present, the tank has contained dilute non-complexed waste. The tank has not received any waste since the fourth quarter of 1989. The tank is currently an active dilute receiver tank containing waste that is being concentrated by the 242-A Evaporator.

3.1.1.2 Temperature History of Tank 241-AP-101

Temperature data for Tank 241-AP-101 are recorded by 18 thermocouples at known elevations on one thermocouple tree inside the tank, located in riser 4. Non-suspect temperature data recorded between March 1986 and November 1993 for all 18 thermocouples were available from the computer automated surveillance system. Non-suspect temperature data taken between July 1989 and August 1993 for 12 of the thermocouples were available from the surveillance analysis computer system. However, not all of the 12 thermocouples have data that encompass the entire length of time. Within the time spans of each system, there were small breaks in the sequence of temperature data. The average temperature during these periods was 60°F with a minimum of 49°F, a maximum of 81°F, and a standard deviation of 4.3°F. Linear regressions were performed on each thermocouple that had temperature data between January 1990 and January 1994. The slopes from these regressions were averaged with a resulting average slope of -0.0028. Refer to the supporting document for a more thorough review of the temperature data (Brevick 1995).

3.1.1.3 Occurrences of Tank 241-AP-101

No unusual events are associated exclusively with Tank 241-AP-101.

3.1.1.4 Psychrometrics of Tank 241-AP-101

Psychrometric data have been recorded from this tank for 12 years and from the annulus for six years. The apparent trend of the evaporation rate

from the tank has decreased from 76.7 gallons per week in May 1988 to 48.3 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank and annular ventilation has apparently decreased. A review of the psychrometric data in Tank 241-AP-101 would suggest an overall decrease in the rate of heat generation by the waste.

3.1.2 Current Status of Tank 241-AP-101

Tank 241-AP-101 was placed into service in October 1986 and currently stores 1,060,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 1,060,000 gallons and configuration of risers in January 1994. At the time of the estimate, all 1,060,000 gallons were supernatant. The waste level in the tank is measured with the FIC gauge and the manual tape and has increased and decreased between 385 inches and 54 inches. The increases were additions of waste from Tank 241-AP-108 occurring in October 1994 and January 1995. The decreases came from transferring waste to Tank 241-AW-102 in October 1994. This tank is active and the waste is currently being concentrated by the 242-A Evaporator. The tank is actively ventilated and categorized as sound. Tank 241-AP-101 has 71 risers. Eight 4-inch risers (no.15, no.21, no.24, no.26, three no.27s, and no.28), three 12-inch risers (no.7 and two no.10s), and two 42-inch risers (two no.5s) are available for use.

3.1.2.1 Inventory Estimate of Tank 241-AP-101

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew 1995) and Supernatant Mixing Model (Agnew 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AP-101 are also presented.

3.1.2.2 In-Tank Photograph of Tank 241-AP-101

No in-tank photographs are available.

3.1.3 Synopsis of Tank 241-AP-101

(To be completed.)

NCPLX:

ANDERSON 1990
WASTE TYPES

CWPZR2:
UNK:

PRIMARY
ADDITIONS

LEVEL IN
FEET
LEVEL IN
INCHES

36' 432"
34' 408"
32' 384"
30' 360"
28' 336"
26' 312"
24' 288"
22' 264"
20' 240"
18' 216"
16' 192"
14' 168"
12' 144"
10' 120"
8' 96"
6' 72"
4' 48"
2' 24"
0' 0"

1977 78 79 80 81 82 83 84 85 86 87 88

YEARS

FROM PUREX (PASF)

DN:

USF:

NOTES:

CONSTRUCT 1980-1981
 NOMINAL CAPACITY: 1,000,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE,
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

1,188,000

1,122,000

1,056,000

990,000

924,000

858,000

792,000

726,000

660,000

594,000

528,000

462,000

396,000

330,000

264,000

198,000

132,000

66,000

0

NCPLX: NON-COMPLEXED WASTE
 DN: DILUTE NON-COMPLEXED WASTE
 CWPZR2: PUREX CLADDING WASTE (ZIRCALOY)
 UNK: UNKNOWN
 PASF: PUREX AMMONIA SCRUBBER FEED WASTE

LEGEND

□-□-□ LIQUID OBSERVATION
 WELL (LOW)
 — LIQUID LEVEL
 // // // SOLIDS LEVEL
 // // // SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

AP TANK FARM
PLOT PLAN

FROM AP-103

TO AP-103 & AW-102

LIQUID
LEVEL

SUPERNATANT 1060 KGAL

See glossary for abbreviations and definitions

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AP-101 DOUBLE-SHELL TANK
 LEVEL HISTORY 1986 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: N/A

SIZE B	BLDG NO. 241	DWG NO. ES-TKS-E157	DATE 6/95
SCALE NONE	JOB NO.	SHEET 1 OF 1	

Double-Shell Tank 241-AP-101			
Total Inventory Estimate*			
Physical Properties			
Total Waste	4.16E+06 kg (1.06E+03 kgal)		
Heat Load	0.425 kW (1.45E+03 BTU/hr)		
Bulk Density†	1.04 (g/cc)		
Water wt%	93.2		
TOC wt% C	0.065		
Chemical Constituents			
Na ⁺	0.845	1.87E+04	7.79E+04
Al ³⁺	8.79E-02	2.29E+03	9.51E+03
Fe ³⁺ (total Fe)	2.59E-03	139	579
Cr ³⁺	2.57E-03	129	532
Bi ³⁺	5.17E-05	10.4	43.4
La ³⁺	3.69E-07	4.82E-02	0.201
Hg ²⁺	1.11E-06	0.216	0.897
Zr (as ZrO(OH) ₂)	2.68E-04	23.6	98.1
Pb ²⁺	8.81E-06	1.76	7.34
Ni ²⁺	5.72E-04	32.4	135
Si ²⁺	3.80E-07	3.21E-02	0.134
Mn ²⁺	1.12E-03	59.5	247
Ca ²⁺	1.81E-02	699	2.91E+03
K ⁺	1.95E-02	734	3.06E+03
OH ⁻	0.414	6.78E+03	2.62E+04
NO ₃ ⁻	0.407	2.43E+04	1.01E+05
NO ₂ ⁻	9.06E-02	4.02E+03	1.67E+04
CO ₃ ²⁻	5.86E-02	3.39E+03	1.41E+04
PO ₄ ³⁻	1.57E-02	1.44E+03	5.97E+03
SO ₄ ²⁻	1.90E-02	1.76E+03	7.32E+03
Si (as SiO ₂)	4.23E-03	114	476
F ⁻	2.23E-02	409	1.70E+03
Cl ⁻	1.33E-02	454	1.89E+03
C ₂ H ₃ O ₂ ⁻	2.48E-03	453	1.88E+03
EDTA ⁴⁻	7.29E-04	202	843
HEDTA ³⁻	1.21E-03	319	1.33E+03
glycolate ⁻	1.94E-02	1.40E+03	5.82E+03
acetate ⁻	8.03E-04	45.7	190
oxalate ²⁻	1.36E-06	0.113	0.480
DBP	1.13E-03	176	731
butanol	1.13E-03	80.9	337
NH ₃	0.108	1.77E+03	7.37E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radioisotopic Constituents			
Pu		5.93E-03 (μCi/g)	0.411 (μg)
U	8.09E-04 (M)	186 (μCi/g)	772 (μg)
Cs	1.96E-02 (Ci/L)	15.9 (μCi/g)	7.85E+04 (Ci)
Sc	2.13E-03 (Ci/L)	2.06 (μCi/g)	8.56E+03 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AP-101			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	4.16E+06 kg	(1.06E+03 kgal)	
Heat Load	0.425 kW	(1.45E+03 BTU/hr)	
Bulk Density*	1.04 (g/cc)		
Water wt%	93.2		
TOC wt% C (wet)	0.086		
Chemical Constituents			
Na ⁺	0.845	1.87E+04	7.79E+04
Al ³⁺	8.79E-02	2.29E+03	9.51E+03
Fe ³⁺ (total Fe)	2.59E-03	139	579
Cr ³⁺	2.57E-03	129	537
Bi ³⁺	5.17E-05	10.4	43.4
La ³⁺	3.60E-07	4.82E-02	0.201
Hg ²⁺	1.11E-06	0.216	0.897
Zr (as ZrO(OH) ₂)	2.68E-04	23.6	98.1
Pb ²⁺	8.83E-06	1.76	7.34
Ni ²⁺	5.72E-04	32.4	135
Sr ²⁺	3.80E-07	3.21E-02	0.134
Mn ²⁺	1.12E-03	59.5	247
Ca ²⁺	1.81E-02	699	2.91E+03
K ⁺	1.95E-02	734	3.06E+03
OH ⁻	0.414	6.78E+03	2.82E+04
NO ₃ ⁻	0.407	2.43E+04	1.01E+05
NO ₂ ⁻	9.06E-02	4.02E+03	1.67E+04
CO ₃ ²⁻	5.86E-02	3.39E+03	1.41E+04
PO ₄ ³⁻	1.57E-02	1.44E+03	5.97E+03
SO ₄ ²⁻	1.90E-02	1.76E+03	7.32E+03
Si (as SiO ₃ ²⁻)	4.23E-03	114	476
F ⁻	2.23E-02	409	1.70E+03
Cl ⁻	1.33E-02	454	1.89E+03
C ₆ H ₅ O ₇ ³⁻	2.48E-03	453	1.88E+03
EDTA ⁴⁻	7.29E-04	202	843
HEDTA ³⁻	1.21E-03	319	1.33E+03
glycolate ⁻	1.94E-02	1.40E+03	5.82E+03
acetate ⁻	8.03E-04	45.7	190
oxalate ²⁻	1.36E-06	0.115	0.480
DBP	1.13E-03	176	731
butanol	1.13E-03	80.9	337
NH ₃	0.108	1.77E+03	7.37E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	5.15 (μCi/L)		0.411 (kg)
U	8.09E-04 (M)	186 (μg/g)	772 (kg)
Cs	1.96E-02 (Ci/L)	18.9 (μCi/g)	7.85E+04 (Ci)
Sr	2.13E-03 (Ci/L)	2.06 (μCi/g)	8.56E+03 (Ci)

*Density is calculated based on Na, OH⁻, and AlO₂⁻.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AP-101			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	0 kg	(0 kgal)	
Heat Load	0 kW	(0 BTU/hr)	
Bulk Density	0 (g/cc)		
Water wt%	0		
TOC wt% C (wet)	0		
Chemical Constituents			
Na ⁺	0	0	0
Al ³⁺	0	0	0
Fe ³⁺ (total Fe)	0	0	0
Cr ³⁺	0	0	0
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0	0	0
Sr ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	0	0	0
K ⁺	0	0	0
OH ⁻	0	0	0
NO ₃ ⁻	0	0	0
NO ₂ ⁻	0	0	0
CO ₃ ²⁻	0	0	0
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₃ ²⁻)	0	0	0
F ⁻	0	0	0
Cl ⁻	0	0	0
C ₆ H ₅ O ₇ ³⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	0	0	0
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0	0
U		0	0
Cs		0	0
Sr		0	0

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

3.2 Tank 241-AP-102

3.2.1 241-AP-102 Tank History

3.2.1.1 Waste History of Tank 241-AP-102

Tank 241-AP-102 began service by receiving Hanford facility waste in July 1986. The tank received Hanford facility waste until May 1990. During 1988 and 1989, waste was transferred from the tank to the grout vaults. The tank received waste from PUREX during the third and fourth quarters of 1989. The tank has contained dilute non-complexed waste since June 1990. The tank has not received any waste since the fourth quarter of 1992. The tank is currently an inactive, grout feed tank containing excess water from the grout facility.

3.2.1.2 Temperature History of Tank 241-AP-102

Temperature data for Tank 241-AP-102 are recorded by 18 thermocouples at known elevations on one thermocouple tree inside the tank, located in riser 4. Non-suspect temperature data recorded between March 1986 and November 1993 for 17 thermocouples were available from the computer automated surveillance system. Non-suspect temperature data from between July 1989 and August 1993 for 12 of the thermocouples were available from the surveillance analysis computer system. However, not all of the 12 thermocouples have data that encompass the entire length of time. Within the time spans of each system, there were small breaks in the sequence of temperature data. The average temperature during these periods was 66°F with a minimum of 50°F, a maximum of 86°F, and a standard deviation of 8.5°F. Linear regressions were performed on each thermocouple that had temperature data between January 1990 and January 1994. The slopes from these regressions were averaged with a resulting average slope of 0.017. Refer to the supporting document for a more thorough review of the temperature data (Brevick 1995).

3.2.1.3 Occurrences of Tank 241-AP-102

No unusual events concerned this tank since it went into service.

3.2.1.4 Psychrometrics of Tank 241-AP-102

Psychrometric data have been recorded from this tank and annulus for six years. The apparent trend of the evaporation rate from the tank has decreased from 63.4 gallons per week in May 1988 to 49.3 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank ventilation has decreased. The rates of heat exchange through the annular ventilation show an increasing trend. The majority of the changes in the rate of heat exchange can be attributed to changes in the average ventilation rates. A review of the psychrometric data in Tank 241-AP-102 would suggest an increase in rate of heat generation by the waste.

3.2.2 Current Status of Tank 241-AP-102

Tank 241-AP-102 was placed into service in October 1986 and currently stores 1,104,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 1,104,000 gallons and configuration of risers in January 1994. At the time of the estimate, all 1,104,000 gallons were supernatant. The waste level in the tank is measured with the FIC gauge and the manual tape and has increased from about 50 inches in January 1991 to 400 inches in January 1994. The increase was mostly waste received from Tank 241-AN-106 between November 1992 and January 1993. This tank is inactive at the present time. The tank is actively ventilated and categorized as sound. Tank 241-AP-102 has 71 risers. Six 4-inch risers (no.15, no.21, three no.27s, and no.28), two 12-inch risers (no.7 and no.10), and two 42-inch risers (two no.5s) are available for use.

3.2.2.1 Inventory Estimate of Tank 241-AP-102

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew 1995) and Supernatant Mixing Model (Agnew 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AP-102 are also presented.

3.2.2.2 In-Tank Photograph of Tank 241-AP-102

No in-tank photographs are available.

3.2.3 Synopsis of Tank 241-AP-102

(To be completed.)

HFW:

ANDERSON 1990
WASTE TYPES

PRIMARY
ADDITIONS

LEVEL IN
FEET
LEVEL IN
INCHES

36' 432"

34' 408"

32' 384"

30' 360"

28' 336"

26' 312"

24' 288"

22' 264"

20' 240"

18' 216"

16' 192"

14' 168"

12' 144"

10' 120"

8' 96"

6' 72"

4' 48"

2' 24"

0' 0"

1977

78

79

80

81

82

83

84

85

86

87

88

YEARS

LIQUID
LEVEL

FLUSH WATER ADDITIONS

TO AW-102

FROM AP-104

TO CRUIT MAINS

DN:

NOTES:

CONSTRUCT 1980-1981
NOMINAL CAPACITY: 1,000,000 GAL
FLAT BOTTOM TANK, NO KNUCKLE,
75 FOOT DIAMETER DOUBLE-SHELL TANK
SURFACE LEVEL READING: PHOTO
(LIQUIDS & SOLIDS), FIC (SOLIDS)

PASF:

UNK:

INVENTORY ESTIMATE DATE

FROM AN-106

CAPACITY
(GALLONS)

1,188,000

1,122,000

1,056,000

990,000

924,000

858,000

792,000

726,000

660,000

594,000

528,000

462,000

396,000

330,000

264,000

198,000

132,000

66,000

0

HFV: HANFORD FACILITY WASTE
DN: DILUTE NON-COMPLEXED WASTE
PASF: PUREX AMMONIA SCRUBBER FEED WASTE
UNK: UNKNOWN

LEGEND

LIQUID OBSERVATION
WELL (LOW)
LIQUID LEVEL
SOLIDS LEVEL
SOLIDS LEVEL BEST
ENGINEERING JUDGEMENT

AP TANK FARM
PLOT PLAN

U.S. DEPARTMENT OF ENERGY
RICHLAND FIELD OFFICE
ICF KAISER HANFORD

241-AP-102 DOUBLE-SHELL TANK
LEVEL HISTORY 1986 TO 1994
SOUND/ACTIVE TANK
WATCH LIST: N/A

SUPERNATANT 1104 KGAL

See glossary for abbreviations and definitions

SIZE	BLOB NO.	OWG NO.	DATE
B	241	ES-TKS-E158	6/95
SCALE	JOB NO.	SHEET	OF
NONE		1	1

Double-Shell Tank 241-AP-102			
Total Inventory Estimate*			
Physical Properties			
Total Waste	5.19E+06 kg (1.10E+03 kgal)		
Heat Load	1.60 kW (1.23E+04 BTU/hr)		
Bulk Density†	1.24 (g/cc)		
Water wt%†	66.1		
TOC wt% C	0.596		
Chemical Constituents			
Na ⁺	5.27	9.76E+04	5.07E+05
Al ³⁺	0.665	1.44E+04	7.50E+04
Fe ³⁺ (total Fe)	2.83E-03	127	659
Cr ³⁺	1.94E-02	811	4.21E+03
B ³⁺	7.18E-04	121	627
La ³⁺	4.91E-06	0.549	2.85
Hg ²⁺	4.34E-06	0.701	3.64
Zr (as Zr(OH) ₄)	4.30E-04	31.6	164
Pb ²⁺	4.00E-05	6.67	34.6
NP ³⁺	2.47E-03	117	605
Si ⁴⁺	5.19E-06	0.366	1.90
Mn ²⁺	3.69E-03	163	847
Ca ²⁺	1.98E-02	638	3.31E+03
K ⁺	1.43E-02	451	2.34E+03
OH ⁻	2.96	4.05E+04	2.10E+05
NO ₃ ⁻	1.81	9.02E+04	4.69E+05
NO ₂ ⁻	1.22	4.52E+04	2.35E+05
CO ₃ ²⁻	0.210	1.02E+04	5.28E+04
PO ₄ ³⁻	0.109	8.37E+03	4.34E+04
SO ₄ ²⁻	0.142	1.10E+04	5.72E+04
Si (as SiO ₂)	2.29E-02	517	2.69E+03
F ⁻	4.21E-02	721	3.74E+03
Cl ⁻	9.13E-02	2.60E+03	1.35E+04
C ₂ H ₃ O ₂ ⁻	1.91E-02	2.90E+03	1.51E+04
EDTA ⁴⁻	1.04E-02	2.42E+03	1.26E+04
HEDTA ³⁻	1.71E-02	3.78E+03	1.96E+04
glycolate ⁻	6.34E-02	3.84E+03	2.00E+04
acetate ⁻	1.19E-02	567	2.94E+03
oxalate ²⁻	1.85E-05	1.31	6.82
DBP	9.86E-03	1.28E+03	6.63E+03
butanol	9.86E-03	588	3.05E+03
NH ₃	2.61E-02	357	1.85E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiochemical Constituents			
Pu	1.83E-02 (μCi/g)	1.58 (kg)	
U	2.95E-03 (M)	565 (μg/g)	2.93E+03 (kg)
Cs	0.177 (Ci/L)	142 (μCi/g)	7.38E+05 (Ci)
Sr	5.16E-03 (Ci/L)	4.15 (μCi/g)	2.15E+04 (Ci)

* Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

† Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AP-102			
SMD Composite Inventory Estimate			
Physical Properties			
Total Supernatant	5.19E+06 kg	(1.10E+03 keal)	
Heat Load	3.60 kW	(1.23E+04 BTU/hr)	
Bulk Density*	1.24 (g/cc)		
Water wt%	66.1		
TOC wt% C (wet)	0.596		
Chemical Constituents			
Na ⁺	5.27	9.76E+04	5.07E+03
Al ³⁺	0.663	1.44E+04	7.50E+04
Fe ³⁺ (total Fe)	2.83E-03	127	659
Cr ³⁺	1.94E-02	811	4.21E+03
Bi ³⁺	7.18E-04	121	627
La ³⁺	4.91E-06	0.549	2.83
Hg ²⁺	4.34E-06	0.701	3.64
Zr (as ZrO(OH) ₂)	4.30E-04	31.6	164
Pb ²⁺	4.00E-05	6.67	34.6
Ni ²⁺	2.47E-03	117	605
Sr ²⁺	5.19E-06	0.366	1.90
Mn ²⁺	3.69E-03	163	847
Ca ²⁺	1.98E-02	638	3.31E+03
K ⁺	1.43E-02	451	2.34E+03
OH ⁻	2.96	4.05E+04	2.10E+05
NO ₃ ⁻	1.81	9.02E+04	4.69E+05
NO ₂ ⁻	1.22	4.52E+04	2.35E+05
CO ₃ ²⁻	0.210	1.02E+04	5.28E+04
PO ₄ ³⁻	0.109	8.37E+03	4.34E+04
SO ₄ ²⁻	0.142	1.10E+04	5.72E+04
Si (as SiO ₂)	2.29E-02	517	2.69E+03
F ⁻	4.71E-02	721	3.74E+03
Cl ⁻	9.13E-02	2.60E+03	1.35E+04
C ₂ H ₃ O ₂ ⁻	1.91E-02	2.90E+03	1.51E+04
EDTA ⁴⁻	1.04E-02	2.42E+03	1.26E+04
HEDTA ³⁻	1.71E-02	3.78E+03	1.96E+04
glycolate ⁻	6.36E-02	3.84E+03	2.00E+04
acetate ⁻	1.19E-02	567	2.94E+03
oxalate ²⁻	1.85E-05	1.31	6.82
DBP	9.86E-03	1.28E+03	6.63E+03
butanol	9.86E-03	588	3.05E+03
NH ₃	2.61E-02	357	1.85E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	22.7 (μCi/L)		1.58 (kg)
U	2.95E-03 (M)	565 (μg/g)	2.93E+03 (kg)
Cs	0.177 (Ci/L)	142 (μCi/g)	7.38E+03 (Ci)
Sr	5.16E-03 (Ci/L)	4.15 (μCi/g)	2.15E+04 (Ci)

*Density is calculated based on Na, OH, and AlO₂.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AP-102			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	0 kg	(0 keal)	
Heat Load	0 kW	(0 BTU/hr)	
Bulk Density	0 (g/cc)		
Water wt%	0		
TOC wt% C (wet)	0		
Chemical Constituents			
Na ⁺	0	0	0
Al ³⁺	0	0	0
Fe ³⁺ (total Fe)	0	0	0
Cr ³⁺	0	0	0
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0	0	0
Sr ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	0	0	0
K ⁺	0	0	0
OH ⁻	0	0	0
NO ₃ ⁻	0	0	0
NO ₂ ⁻	0	0	0
CO ₃ ²⁻	0	0	0
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₂)	0	0	0
F ⁻	0	0	0
Cl ⁻	0	0	0
C ₂ H ₃ O ₂ ⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	0	0	0
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0	0
U		0	0
Cs		0	0
Sr		0	0

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

3.3 Tank 241-AP-103

3.3.1 241-AP-103 Tank History

3.3.1.1 Waste History of Tank 241-AP-103

Tank 241-AP-103 began service by receiving non-complexed waste in July 1986. The tank received non-complexed waste until May 1990. The tank received waste from PUREX during the first, second, and third quarters of 1988. From June 1990 until the present, the tank has contained dilute non-complexed waste. The tank has not received waste since the second quarter of 1991. The tank is currently an inactive dilute receiver tank.

3.3.1.2 Temperature History of Tank 241-AP-103

Temperature data for Tank 241-AP-103 are recorded by 18 thermocouples at known elevations on one thermocouple tree inside the tank, located in riser 4. Non-suspect temperature data from between March 1986 and November 1993 for all 18 thermocouples were available from the computer automated surveillance system. Non-suspect temperature data taken between July 1989 and August 1993 for 12 of the thermocouples were available from the surveillance analysis computer system. However, not all of the 12 thermocouples have data that encompass the entire length of time. Within the time spans of each system, there were small breaks in the sequence of temperature data. The average temperature during these periods was 63°F with a minimum of 52°F, a maximum of 75°F, and a standard deviation of 4.6°F. Linear regressions were performed on each thermocouple that had temperature data between January 1990 and January 1994. The slopes from these regressions were averaged with a resulting average slope of -0.0045. Refer to the supporting document for a more thorough review of the temperature data (Brevick 1995).

3.3.1.3 Occurrences of Tank 241-AP-103

No unusual events exclusively concerned Tank 241-AP-103.

3.3.1.4 Psychrometrics of Tank 241-AP-103

Psychrometric data have been recorded for six years from this tank and annulus. The apparent trend of the evaporation rate from the tank has increased from 60.7 gallons per week in February 1988 to 79.9 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank ventilation has increased. The rates of heat exchange in the annular ventilation show a decreasing trend. The majority of the changes in the rates of heat exchange can be attributed to changes in the average ventilation rates. A review of the psychrometric data in Tank 241-AP-103 would suggest a decrease in the rate of heat generation by the waste.

3.3.2 Current Status of Tank 241-AP-103

Tank 241-AP-103 was placed in service in October 1986 and currently stores 27,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 1,131,000 gallons and configuration of risers in January 1994. At the time of the estimate, all 1,131,000 gallons were supernatant. The large decrease in volume was due to transferring waste to Tank 241-AW-102. This tank is active and the waste is currently being concentrated by the 242-A Evaporator. The tank is actively ventilated and categorized as sound. Tank 241-AP-103 has 71 risers. Seven 4-inch risers (no.15, no.21, no.24, three no.27s, and no.28), three 12-inch risers (no.7 and two no.10s), and two 42-inch risers (two no.5) are available for use.

3.3.2.1 Inventory Estimate of Tank 241-AP-103

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew 1995) and Supernatant Mixing Model (Agnew 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AP-103 are also presented.

3.3.2.2 In-Tank Photograph of Tank 241-AP-103

No in-tank photographs are available.

3.3.3 Synopsis of Tank 241-AP-103

(To be completed.)

NCPLX:

ANDERSON 1990
WASTE TYPES

PRIMARY
ADDITIONS

PL2:

LEVEL IN
FEET
LEVEL IN
INCHES

36' 432"
34' 408"
32' 384"
30' 360"
28' 336"
26' 312"
24' 288"
22' 264"
20' 240"
18' 216"
16' 192"
14' 168"
12' 144"
10' 120"
8' 96"
6' 72"
4' 48"
2' 24"
0' 0"

1977 78 79 80 81 82 83 84 85 86 87 88

YEARS

LIQUID
LEVEL

FROM PUREX (PASF)
TO AMU 100

DN:

NOTES:

CONSTRUCT 1980-1981
 NOMINAL CAPACITY: 1,000,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE,
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

1,188,000

1,122,000

1,056,000

990,000

924,000

858,000

792,000

726,000

660,000

594,000

528,000

462,000

396,000

330,000

264,000

198,000

132,000

66,000

0

NCPLX: NON-COMPLEXED WASTE
 DN: DILUTE NON-COMPLEXED WASTE
 PL2: PUREX LOW-LEVEL WASTE

LEGEND LIQUID OBSERVATION
WELL (LOW)

LIQUID LEVEL

SOLIDS LEVEL

SOLIDS LEVEL BEST
ENGINEERING JUDGEMENTAP TANK FARM
PLOT PLAN

SUPERNATANT 1131 KGAL

See glossary for abbreviations and definitions

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AP-103 DOUBLE-SHELL TANK
 LEVEL HISTORY 1986 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: N/A

SIZE	BLDG NO.	CHG NO.	DATE
B	241	ES-TKS-E159	6/95
SCALE	NONE	JOB NO.	SHEET 1 OF 1

Double-Shell Tank 241-AP-103			
Total Inventory Estimate*			
Physical Properties			
Total Waste	4.71E+06 kg (1.13E+03 kgal)		
Heat Load	1.52 kW (5.19E+03 BTU/hr)		
Bulk Density†	1.10 (g/cc)		
Water wt%†	83.7		
TOC wt% C	0.243		
Chemical Constituents			
Na ⁺	2.19	4.58E+04	2.15E+05
Al ³⁺	0.267	6.54E+03	3.08E+04
Fe ³⁺ (total Fe)	2.16E-03	110	516
Cr ³⁺	4.88E-03	231	1.09E+03
Bi ³⁺	6.46E-05	12.3	57.8
La ³⁺	4.12E-07	5.20E-02	0.245
Hg ²⁺	1.33E-06	0.243	1.15
Zr (as Zr(OH) ₄)	3.18E-04	26.3	124
Pb ²⁺	1.09E-05	2.06	9.71
Ni ²⁺	1.56E-03	83.2	392
Sr ²⁺	4.35E-07	3.47E-02	0.163
Mn ²⁺	1.39E-03	69.3	326
Ca ²⁺	1.51E-02	551	2.59E+03
K ⁺	2.30E-02	819	3.85E+03
OH ⁻	1.21	1.87E+04	8.81E+04
NO ₂ ⁻	1.06	5.98E+04	2.81E+05
NO ₃ ⁻	0.129	5.41E+03	2.55E+04
CO ₃ ²⁻	0.150	8.21E+03	3.87E+04
PO ₄ ³⁻	2.21E-02	1.91E+03	8.99E+03
SO ₄ ²⁻	5.60E-02	4.89E+03	2.30E+04
Si (as SiO ₂) ²	1.48E-02	379	1.78E+03
P	2.68E-02	463	2.18E+03
Cl ⁻	4.07E-02	1.31E+03	6.17E+03
C ₂ H ₃ O ₂ ⁻	7.17E-03	1.23E+03	5.80E+03
EDTA ⁴⁻	9.12E-04	239	1.12E+03
HEDTA ³⁻	1.51E-03	376	1.77E+03
acetate ⁻	7.83E-02	5.34E+03	2.52E+04
oxalate ²⁻	1.01E-03	54.3	256
nitrate ³⁻	1.55E-06	0.124	0.585
DBP	1.41E-03	206	972
betanin	1.41E-03	95.0	447
NH ₄ ⁺	8.03E-02	1.24E+03	5.84E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiochemical Constituents			
Pu		1.46E-02 (μCi/g)	1.14 (kg)
U	2.11E-03 (M)	458 (μg/g)	2.13E+03 (kg)
Cs	6.92E-02 (Ci/L)	62.9 (μCi/g)	2.96E+03 (Ci)
Sr	4.59E-03 (Ci/L)	4.18 (μCi/g)	1.97E+04 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AP-103			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	4.71E+06 kg (1.13E+03 kgal)		
Heat Load	1.52 kW (5.19E+03 BTU/hr)		
Bulk Density*	1.10 (g/cc)		
Water wt%	83.7		
TOC wt% C (wet)	0.243		
Chemical Constituents			
Na ⁺	2.19	4.58E+04	2.15E+09
Al ³⁺	0.267	6.54E+03	3.08E+04
Fe ³⁺ (total Fe)	2.16E-03	110	516
Cr ³⁺	4.88E-03	231	1.09E+03
Bi ³⁺	6.46E-05	12.3	57.8
La ³⁺	4.12E-07	5.20E-02	0.245
Hg ²⁺	1.33E-06	0.243	1.15
Zr (as ZrO(OH) ₂)	9.18E-04	26.3	124
Pb ²⁺	1.09E-05	2.06	9.71
Ni ²⁺	1.56E-03	83.2	392
Si ⁴⁺	4.35E-07	3.47E-02	0.163
Mn ²⁺	1.39E-03	69.3	326
Ca ²⁺	1.51E-02	551	2.59E+03
K ⁺	2.30E-02	819	3.85E+03
OH ⁻	1.21	1.87E+04	8.81E+04
NO ₃ ⁻	1.06	5.93E+04	2.81E+05
NO ₂ ⁻	0.129	5.41E+03	2.55E+04
CO ₃ ²⁻	0.150	8.21E+03	3.87E+04
PO ₄ ³⁻	2.21E-02	1.91E+03	8.99E+03
SO ₄ ²⁻	5.60E-02	4.89E+03	2.30E+04
Si (as SiO ₂) [†]	1.48E-02	379	1.78E+03
F ⁻	2.68E-02	463	2.18E+03
Cl ⁻	4.07E-02	1.31E+03	6.17E+03
C ₂ H ₃ O ₂ ⁻	7.17E-03	1.23E+03	5.80E+03
EDTA ⁴⁻	9.12E-04	239	1.12E+03
HEPTA ³⁻	1.51E-03	376	1.77E+03
glycolate ⁻	7.83E-02	5.34E+03	2.52E+04
acetate ⁻	1.01E-03	54.3	256
oxalate ²⁻	1.55E-06	0.124	0.585
DBP	1.41E-03	206	972
butanol	1.41E-03	95.0	447
NH ₃	8.03E-02	1.24E+03	5.84E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	16.0 (μCi/L)		1.14 (kg)
U	2.11E-03 (M)	458 (μg/g)	2.15E+03 (kg)
Cs	6.92E-02 (Ci/L)	62.9 (μCi/g)	2.96E+05 (Ci)
Sr	4.59E-03 (Ci/L)	4.18 (μCi/g)	1.97E+04 (Ci)

Double-Shell Tank 241-AP-103			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	0 kg	(0 kgal)	
Heat Load	0 kW	(0 BTU/hr)	
Bulk Density	0 (g/cc)		
Water wt%	0		
TOC wt% C (wet)	0		
Chemical Constituents			
Na ⁺	0	0	0
Al ³⁺	0	0	0
Fe ³⁺ (total Fe)	0	0	0
Cr ³⁺	0	0	0
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0	0	0
Sr ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	0	0	0
K ⁺	0	0	0
OH ⁻	0	0	0
NO ₃ ⁻	0	0	0
NO ₂ ⁻	0	0	0
CO ₃ ²⁻	0	0	0
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₂) [†]	0	0	0
F ⁻	0	0	0
Cl ⁻	0	0	0
C ₂ H ₃ O ₂ ⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEPTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	0	0	0
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0	0
U	0	0	0
Cs	0	0	0
Sr	0	0	0

*Density is calculated based on Na, OH⁻, and AJO₂.

†Water wt% derived from the difference of density and total dissolved species.

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

3.4 Tank 241-AP-104

3.4.1 241-AP-104 Tank History

3.4.1.1 Waste History of Tank 241-AP-104

Tank 241-AP-104 began service by receiving Hanford facility waste in July 1986 and continued receiving this waste until May 1990. The tank received decontamination waste from N Reactor from the first quarter until the third quarter of 1987. From June 1990 until the present, the tank contained dilute non-complexed waste. The tank has not received waste since the third quarter of 1987. Currently, the tank is an inactive grout feed tank.

3.4.1.2 Temperature History of Tank 241-AP-104

Temperature data for Tank 241-AP-104 are recorded by 18 thermocouples at known elevations on one thermocouple tree inside the tank, located in riser 4. Non-suspect temperature data recorded between March 1986 and November 1993 for all 18 thermocouples were available from the computer automated surveillance system. Non-suspect temperature data taken between July 1989 and August 1993 for 12 of the thermocouples were available from the surveillance analysis computer system. However, not all of the 12 thermocouples have data that encompass the entire length of time. Within the time spans of each system, there were small breaks in the sequence of temperature data. The average temperature during these periods was 61°F with a minimum of 46°F, a maximum of 72°F, and a standard deviation of 6.0°F. Linear regressions were performed on each thermocouple that had temperature data between January 1990 and January 1994. The slopes from these regressions were averaged with a resulting average slope of -0.00049. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

3.4.1.3 Occurrences of Tank 241-AP-104

One unusual event occurred at Tank 241-AP-104. Occurrence Report RL--WHC-Tank Farm-1991-0085 was issued in January 1991 because a loose wire to the alarm panel that monitors Tank 241-AP-104 caused a loss of power.

3.4.1.4 Psychrometrics of Tank 241-AP-104

Psychrometric data have been recorded for seven years from this tank and annulus. The apparent trend of the evaporation rate from the tank has decreased from 71.1 gallons per week in April 1987 to 38.3 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank ventilation has decreased. The heat exchange rates in the annular ventilation show an increasing trend. The majority of the changes in the rate of heat exchange can be attributed to changes in the average ventilation rates. A review of the psychrometric data in Tank 241-AP-104 would suggest an increase in the rate of heat generation by the waste.

3.4.2 Current Status of Tank 241-AP-104

Tank 241-AP-104 was placed into service in October 1986 and currently stores 18,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 18,000 gallons and configuration of risers as of January 1994. All 18,000 gallons were supernatant at the time of the estimate. This tank is inactive at the present time. The tank is actively ventilated and categorized as sound. Tank 241-AP-104 has 71 risers. Six 4-inch risers (no.15, no.21, three no.27s, and no.28), two 12-inch risers (no.7 and no.10), and two 42-inch risers (two no.5s) are available for use.

3.4.2.1 Inventory Estimate of Tank 241-AP-104

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew 1995) and Supernatant Mixing Model (Agnew 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AP-104 are also presented.

3.4.2.2 In-Tank Photograph of Tank 241-AP-104

No in-tank photographs are available.

3.4.3 Synopsis of Tank 241-AP-104

(To be completed.)

DN:

NOTES:

CONSTRUCT 1980-1981
 NOMINAL CAPACITY: 1,000,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE,
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

UNK:

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

— 1,188,000

— 1,122,000

— 1,056,000

— 990,000

— 924,000

— 858,000

— 792,000

— 726,000

— 660,000

— 594,000

— 528,000

— 462,000

— 396,000

— 330,000

— 264,000

— 198,000

— 132,000

— 66,000

— 0

HFV: HANFORD FACILITY WASTE
 N: N REACTOR WASTE
 DN: DILUTE NON-COMPLEXED WASTE
 UNK: UNKNOWN

LEGEND

□ □ □ LIQUID OBSERVATION
 WELL (LOW)
 — LIQUID LEVEL
 // // // SOLIDS LEVEL
 // // // SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

**AP TANK FARM
PLOT PLAN**

SUPERNATANT 18 KGAL

See glossary for abbreviations and definitions

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AP-104 DOUBLE-SHELL TANK
 LEVEL HISTORY 1986 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: N/A

SIZE 8	BLDG NO. 241	DMC NO. ES-TKS-E160	DATE 6/95
SCALE NONE	JOB NO.	SHEET 1	OF 1

Double-Shell Tank 241-AP-104			
Total Inventory Estimate*			
Physical Properties			
Total Waste	6.91E+04 kg (18 kgal)		
Heat Load	0 kW (0 BTU/hr)		
Bulk Density†	1.01 (g/cc)		
Water wt%†	97.4		
TOC wt% C	0		
Chemical Constituents			
Chemical	mg/L	g/gm	kg
Na ⁺	0.403	9.13E+03	631
Al ³⁺	0	0	0
Fe ³⁺ (total Fe)	1.27E-03	69.8	4.82
Cr ³⁺	5.08E-03	260	18.0
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	1.14E-03	66.0	4.56
Sr ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	8.87E-03	350	24.2
K ⁺	0	0	0
OH ⁻	3.28E-02	549	38.0
NO ₃ ⁻	9.91E-02	6.06E+03	419
NO ₂ ⁻	8.89E-03	403	27.9
CO ₃ ²⁻	4.42E-03	261	18.1
PO ₄ ³⁻	9.51E-02	8.90E+03	615
SO ₄ ²⁻	2.54E-03	241	16.6
Si (as SiO ₂)	0	0	0
F ⁻	0	0	0
Cl ⁻	2.02E-03	70.4	4.87
C ₆ H ₅ O ₂ ⁺	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
barium	0	0	0
NH ₄ ⁺	0	0	0
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	0	0	0
U	0	0	0
Cs	0	0	0
Sr	0	0	0

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AP-104			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	6.91E+04 kg	(18 kgal)	
Heat Load	0 kW	(0 BTU/hr)	
Bulk Density*	1.01 (g/cc)		
Water wt%	97.4		
TOC wt% C (wet)	0		
Chemical Constituents			
Na ⁺	0.403	9.13E+03	631
Al ³⁺	0	0	0
Fe ³⁺ (total Fe)	1.27E-03	69.5	4.82
Cr ³⁺	5.08E-03	250	18.0
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH))	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	1.14E-03	66.0	4.56
Sr ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	8.87E-03	350	24.2
K ⁺	0	0	0
OH ⁻	3.28E-02	549	38.0
NO ₃ ⁻	9.91E-02	6.06E+03	415
NO ₂ ⁻	8.89E-03	403	27.9
CO ₃ ²⁻	4.42E-03	261	18.1
PO ₄ ³⁻	9.51E-02	8.90E+03	615
SO ₄ ²⁻	2.54E-03	241	16.6
Si (as SiO ₂)	0	0	0
F ⁻	0	0	0
Cl ⁻	2.02E-03	70.4	4.87
C ₆ H ₅ O ₇ ³⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	0	0	0
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	0	0	0
U	0	0	0
Cs	0	0	0
Sr	0	0	0

*Density is calculated based on Na, OH-, and AlO2-.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AP-104			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	0 kg	(0 kgal)	
Heat Load	0 kW	(0 BTU/hr)	
Bulk Density	0 (g/cc)		
Water wt%	0		
TOC wt% C (wet)	0		
Chemical Constituents			
Na ⁺	0	0	0
Al ³⁺	0	0	0
Fe ³⁺ (total Fe)	0	0	0
Cr ³⁺	0	0	0
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH))	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0	0	0
Sr ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	0	0	0
K ⁺	0	0	0
OH ⁻	0	0	0
NO ₃ ⁻	0	0	0
NO ₂ ⁻	0	0	0
CO ₃ ²⁻	0	0	0
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₂)	0	0	0
F ⁻	0	0	0
Cl ⁻	0	0	0
C ₆ H ₅ O ₇ ³⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	0	0	0
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	0	0	0
U	0	0	0
Cs	0	0	0
Sr	0	0	0

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

3.5 Tank 241-AP-105

3.5.1 241-AP-105 Tank History

3.5.1.1 Waste History of Tank 241-AP-105

Tank 241-AP-105 began service by receiving non-complexed waste in July 1986. The tank received non-complexed waste until June 1989. From July 1989 until the present, the tank has contained double-shell slurry feed waste. The tank has not received waste since the third quarter of 1989. The tank is currently an inactive concentrated waste holding tank.

3.5.1.2 Temperature History of Tank 241-AP-105

Temperature data for Tank 241-AP-105 are recorded by 18 thermocouples at known elevations on one thermocouple tree inside the tank, located in riser 4. Non-suspect temperature data from between March 1986 and December 1992 for all 18 thermocouples were available from the computer automated surveillance system. Non-suspect temperature data recorded between July 1989 and August 1993 for 12 of the thermocouples were available from the surveillance analysis computer system. However, not all of the 12 thermocouples have data that encompass the entire length of time. Within the time spans of each system, there were small breaks in the sequence of temperature data. The average temperature during these periods was 69°F with a minimum of 53°F, a maximum of 88°F, and a standard deviation of 6.2°F. Linear regressions were performed on each thermocouple that had temperature data between January 1990 and January 1994. The slopes from these regressions were averaged with a resulting average slope of 0.0016. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

3.5.1.3 Occurrences of Tank 241-AP-105

No unusual events exclusively concerned Tank 241-AP-105 since it went into service.

3.5.1.4 Psychrometrics of Tank 241-AP-105

Psychrometric data have been recorded for six years from this tank and annulus. The apparent trend of the evaporation rate from the tank has increased from 80 gallons per week in February 1988 to 95.5 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank and annular ventilation has apparently increased. A review of the psychrometric data in Tank 241-AP-105 would suggest an overall increase in the rate of heat generation by the waste.

3.5.2 Current Status of Tank 241-AP-105

Tank 241-AP-105 entered service in October 1986 and currently stores 821,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 821,000 gallons and configuration

of risers in January 1994. At the time of the estimate, all 821,000 gallons were supernatant. This tank is inactive at the present time. The tank is actively ventilated and categorized as sound. Tank 241-AP-105 has 71 risers. Six 4-inch risers (no.15, no.21, no.24, three no.27s, and no.28), three 12-inch risers (no.7 and two no.10s), and two 42-inch risers (two no.5s) are available for use.

3.5.2.1 Inventory Estimate of Tank 241-AP-105

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew 1995) and Supernatant Mixing Model (Agnew 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AP-105 are also presented.

3.5.2.2 In-Tank Photograph of Tank 241-AP-105

No in-tank photographs are available.

3.5.3 Synopsis of Tank 241-AP-105

(To be completed.)

DSSF:

NOTES:

CONSTRUCT 1980-1981
 NOMINAL CAPACITY 1,000,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE,
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

NCPLX NON-COMPLEXED WASTE
 DSSF DOUBLE-SHELL SLURRY FEED WASTE

LEGEND

□ □ □ LIQUID OBSERVATION
 WELL (LOW)
 — LIQUID LEVEL
 // // // SOLIDS LEVEL
 // // // SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

AP TANK FARM
PLOT PLAN LIQUID
LEVEL

SUPERNATANT 821 KGAL

See glossary for abbreviations and definitions

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AP-105 DOUBLE-SHELL TANK
 LEVEL HISTORY 1986 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: N/A

SIZE	BLDG NO	DWG NO	DATE
B	241	ES-TKS-E161	6/95
SCALE	NONE	JOB NO	SHEET 1 OF 1

Double-Shell Tank 241-AP-105			
Total Inventory Estimate*			
Physical Properties			
Total Waste	4.14E+06 kg	(821 kgal)	
Heat Load	2.76 kW (9.43E+03 BTU/hr)		
Bulk Density†	1.33 (g/cc)		
Water wt%†	54.2		
TOC wt% C	0.801		
Chemical Constituents			
	mg/L	ppm	kg
Na ⁺	7.44	1.28E+05	5.32E+03
Al ³⁺	0.805	1.63E+04	6.75E+04
Fe ³⁺ (total Fe)	9.24E-03	387	1.60E+03
Cr ³⁺	2.48E-02	969	4.01E+03
Bi ³⁺	4.57E-04	71.7	297
La ³⁺	2.98E-06	0.311	1.29
Hg ²⁺	1.07E-05	1.62	6.70
Zr (as ZrO(OH) ₂)	2.64E-03	181	748
Pb ²⁺	9.02E-05	14.0	58.1
Ni ²⁺	5.43E-03	248	1.03E+03
Sr ²⁺	3.15E-06	0.207	0.859
Mn ²⁺	1.16E-02	478	1.98E+03
Ca ²⁺	6.47E-02	1.94E+03	8.05E+03
K ⁺	0.194	5.69E+03	2.35E+04
OH ⁻	3.67	4.68E+04	1.94E+05
NO ₃ ⁻	3.31	1.54E+05	6.37E+05
NO ₂ ⁻	0.804	2.78E+04	1.15E+05
CO ₃ ²⁻	0.590	2.39E+04	9.88E+04
PO ₄ ³⁻	0.159	1.13E+04	4.68E+04
SO ₄ ²⁻	0.175	1.26E+04	5.22E+04
Si (as SiO ₂)	3.92E-02	825	3.42E+03
F ⁻	0.218	3.12E+03	1.29E+04
Cl ⁻	0.122	3.25E+03	1.34E+04
C ₂ H ₃ O ₂ ⁻	2.28E-02	3.24E+03	1.34E+04
EDTA ⁴⁻	6.45E-03	1.39E+03	5.77E+03
HEDTA ³⁻	1.07E-02	2.20E+03	9.09E+03
glycolate ⁻	0.183	1.03E+04	4.26E+04
acetate ⁻	7.12E-03	315	1.31E+03
oxalate ²⁻	1.13E-05	0.744	3.08
DBP	1.09E-02	1.32E+03	5.45E+03
formol	1.09E-02	606	2.51E+03
NH ₃	0.663	8.48E+03	3.51E+04
Fe(CN) ₆ ⁴⁻	0	0	0
Radiochemical Constituents			
Pu		4.36E-02 (μCi/g)	3.01 (kg)
U	7.75E-03 (M)	1.36E+03 (μCi/g)	5.73E+03 (kg)
Ca	0.159 (CM)	119 (μCi/g)	4.94E+03 (Ci)
Sr	2.15E-02 (CIVL)	16.1 (μCi/g)	6.67E+04 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AP-105			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	4.14E+06 kg	(821 kgal)	
Heat Load	2.76 kW	(9.43E+03 BTU/hr)	
Bulk Density*	1.33 (g/cc)		
Water wt%	54.2		
TOC wt% C (wet)	0.801		
Chemical Constituents			
Na ⁺	7.44	1.28E+05	5.32E+05
Al ³⁺	0.805	1.63E+04	6.75E+04
Fe ³⁺ (total Fe)	9.24E-03	387	1.60E+03
Cr ³⁺	2.48E-02	969	4.01E+03
B ³⁺	4.57E-04	71.7	297
La ³⁺	2.98E-06	0.311	1.29
Hg ²⁺	1.07E-05	1.62	6.70
Zr (as ZrO(OH) ₂)	2.64E-03	181	748
Pb ²⁺	9.02E-05	14.0	58.1
Ni ²⁺	5.63E-03	248	1.03E+03
Si ²⁺	3.15E-06	0.207	0.839
Mn ²⁺	1.16E-02	478	1.98E+03
Ca ²⁺	6.47E-02	1.94E+03	8.05E+03
K ⁺	0.194	5.69E+03	2.35E+04
OH ⁻	3.67	4.68E+04	1.94E+05
NO ₂ ⁻	3.31	1.54E+05	6.37E+05
NO ₃ ⁻	0.804	2.78E+04	1.15E+05
CO ₃ ²⁻	0.530	2.39E+04	9.88E+04
PO ₄ ³⁻	0.159	1.13E+04	4.68E+04
SO ₄ ²⁻	0.175	1.26E+04	5.22E+04
Si (as SiO ₂ ²⁻)	3.92E-02	825	3.42E+03
F ⁻	0.218	3.12E+03	1.29E+04
Cl ⁻	0.122	3.25E+03	1.34E+04
C ₂ H ₃ O ₂ ²⁻	2.28E-02	3.24E+03	1.34E+04
EDTA ⁴⁻	6.45E-03	1.39E+03	5.77E+03
HEDTA ³⁻	1.07E-02	2.20E+03	9.09E+03
glycolate ⁻	0.183	1.03E+04	4.26E+04
acetate ⁻	7.12E-03	315	1.31E+03
oxalate ²⁻	1.13E-03	0.744	3.08
DBP	1.09E-02	1.32E+03	5.45E+03
butanol	1.09E-02	606	2.51E+03
NH ₃	0.665	8.48E+03	3.51E+04
Fe(CN) ₆ ⁴⁻	0	0	0
Radiochemical Constituents			
Pu	58.1 (μCi/L)		3.01 (kg)
U	7.75E-03 (M)	1.38E+03 (μg/g)	5.73E+03 (kg)
Cs	0.159 (Ci/L)	119 (μCi/g)	4.94E+05 (Ci)
Sr	2.15E-02 (Ci/L)	16.1 (μCi/g)	6.67E+04 (Ci)

*Density is calculated based on Na, OH⁻, and AlO₂⁻.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AP-105			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	0 kg	(0 kgal)	
Heat Load	0 kW	(0 BTU/hr)	
Bulk Density	0 (g/cc)		
Water wt%	0		
TOC wt% C (wet)	0		
Chemical Constituents			
Na ⁺	0	0	0
Al ³⁺	0	0	0
Fe ³⁺ (total Fe)	0	0	0
Cr ³⁺	0	0	0
B ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0	0	0
Si ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	0	0	0
K ⁺	0	0	0
OH ⁻	0	0	0
NO ₂ ⁻	0	0	0
NO ₃ ⁻	0	0	0
CO ₃ ²⁻	0	0	0
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₂ ²⁻)	0	0	0
F ⁻	0	0	0
Cl ⁻	0	0	0
C ₂ H ₃ O ₂ ²⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	0	0	0
Fe(CN) ₆ ⁴⁻	0	0	0
Radiochemical Constituents			
Pu		0	0
U		0	0
Cs		0	0
Sr		0	0

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

3.6 Tank 241-AP-106

3.6.1 241-AP-106 Tank History

3.6.1.1 Waste History of Tank 241-AP-106

Tank 241-AP-106 began service by receiving Hanford facility waste in July 1986. The tank continued to receive Hanford facility waste until September 1986. From October 1986 until May 1990, the tank received non-complexed waste. From June 1990 until the present, the tank has contained dilute non-complexed waste. The tank has not received waste since the fourth quarter of 1989. The tank is currently an inactive dilute receiver tank.

3.6.1.2 Temperature History of Tank 241-AP-106

Temperature data for Tank 241-AP-106 are recorded by 18 thermocouples at known elevations on one thermocouple tree inside the tank, located in riser 4. Non-suspect temperature data recorded between March 1986 and December 1992 for all 18 thermocouples were available from the computer automated surveillance system. Non-suspect temperature data recorded between July 1989 and August 1993 for 12 of the thermocouples were available from the surveillance analysis computer system. However, not all of the 12 thermocouples have data that encompass the entire length of time. Within the time spans of each system, there were small breaks in the sequence of temperature data. The average temperature during these periods was 66°F with a minimum of 54°F, a maximum of 107°F, and a standard deviation of 7.2°F. Linear regressions were performed on each thermocouple that had temperature data between January 1990 and January 1994. The slopes from these regressions were averaged with a resulting average slope of -0.0020. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

3.6.1.3 Occurrences of Tank 241-AP-106

No unusual events exclusively concerned this tank since it went into service.

3.6.1.4 Psychrometrics of Tank 241-AP-106

Psychrometric data have been recorded for six years from this tank and annulus. The apparent trend of the evaporation rate from the tank has decreased from 94.7 gallons per week in May 1988, to 57 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank ventilation has decreased. The rates of heat exchange through the annular ventilation show an increasing trend. The majority of the changes in the rate of heat exchange can be attributed to changes in the average ventilation rates. A review of the psychrometric data in Tank 241-AP-106 would suggest an increase in the rate of heat generation by the waste.

3.6.2 Current Status of Tank 241-AP-106

Tank 241-AP-106 was placed in service in October 1986 and currently stores 1,128,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 1,128,000 gallons and configuration of risers as of January 1994. At the time of the estimate, all 1,128,000 gallons were supernatant. This tank is inactive at the present time. The tank is actively ventilated and categorized as sound. Tank 241-AP-106 has 71 risers. Eight 4-inch risers (no.15, no.21, no.24, no.26, three no.27s, and no.28), three 12-inch risers (no.7 and two no.10s), and two 42-inch risers (two no.5s) are available for use.

3.6.2.1 Inventory Estimate of Tank 241-AP-106

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew 1995) and Supernatant Mixing Model (Agnew 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AP-106 are also presented.

3.6.2.2 In-Tank Photograph of Tank 241-AP-106

No in-tank photographs are available.

3.6.3 Synopsis of Tank 241-AP-106

(To be completed.)

ION:

NOTES:

CONSTRUCT 1980-1981
 NOMINAL CAPACITY: 1,000,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE,
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

1,188,000

1,122,000

1,056,000

990,000

924,000

858,000

792,000

726,000

660,000

594,000

528,000

462,000

396,000

330,000

264,000

198,000

132,000

66,000

0

HFV: HANFORD FACILITY WASTE
 NCPLX: NON-COMPLEX WASTE
 DN: DILUTE NON-COMPLEXED WASTE

LEGEND

□-□-□ LIQUID OBSERVATION
 WELL (LOW)
 — LIQUID LEVEL
 // // // SOLIDS LEVEL
 + + + + + SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

AP TANK FARM
PLOT PLAN

SUPERNATANT 112B KGAL

See glossary for abbreviations and definitions

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AP-106 DOUBLE-SHELL TANK
 LEVEL HISTORY 1986 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: N/A

SIZE B	DWG NO. 241	DWG NO. ES-TKS-E162	DATE 6/95
SCALE NONE	JOB NO.	SHEET 1 OF 1

Double-Shell Tank 241-AP-106			
Total Inventory Estimate*			
Physical Properties			
Total Waste	5.76E+06 kg (1.13E+03 keal)		
Heat Load	2.12 kW (7.23E+03 BTU/hr)		
Bulk Density†	1.21 (g/cc)		
Water wt%‡	68.5		
TOC wt% C	0.511		
Chemical Constituents			
Na ⁺	4.64	8.83E+04	4.56E+05
Al ³⁺	0.524	1.17E+04	6.04E+04
Fe ³⁺ (total Fe)	5.32E-03	246	1.27E+03
Co ²⁺	1.39E-02	598	3.08E+03
B ³⁺	2.61E-04	45.1	233
La ³⁺	1.73E-06	0.198	1.02
Hg ²⁺	5.76E-06	0.956	4.93
Zr (as ZrO(OH) ₂)	1.39E-03	105	543
Pb ²⁺	4.71E-05	8.07	41.6
Ni ²⁺	3.35E-03	163	840
Si ²⁺	1.82E-06	0.132	0.682
Mn ²⁺	6.01E-03	273	1.41E+03
Ca ²⁺	3.73E-02	1.24E+03	6.38E+03
K ⁺	0.103	3.29E+03	1.70E+04
OH ⁻	2.37	3.34E+04	1.72E+05
NO ₃ ⁻	2.10	1.07E+05	5.55E+05
NO ₂ ⁻	0.462	1.76E+04	9.07E+04
CO ₃ ²⁻	0.324	1.61E+04	8.31E+04
PO ₄ ³⁻	8.46E-02	6.65E+03	3.43E+04
SO ₄ ²⁻	0.112	8.94E+03	4.61E+04
Si (as SiO ₂)	2.63E-02	611	3.15E+03
F ⁻	0.116	1.82E+03	9.38E+03
Cl ⁻	7.85E-02	2.30E+03	1.19E+04
C ₂ H ₃ O ₂ ⁻	1.48E-02	2.31E+03	1.19E+04
EDTA ⁴⁻	3.68E-03	877	4.53E+03
HEPTA ³⁻	6.10E-03	1.38E+03	7.14E+03
glycolate ⁻	0.128	7.92E+03	4.09E+04
acetate ⁻	4.06E-03	198	1.02E+03
oxalate ²⁻	6.51E-06	0.474	2.45
DBP	5.90E-03	785	4.05E+03
butanol	5.90E-03	362	1.87E+03
NH ₃	0.349	4.91E+03	2.53E+04
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		2.99E-02 (μCi/g)	2.57 (kg)
U	4.73E-03 (M)	931 (μg/g)	4.80E+03 (kg)
Cs	8.83E-02 (Ci/L)	73.0 (μCi/g)	3.77E+03 (Ci)
Sr	1.22E-02 (Ci/L)	10.1 (μCi/g)	5.22E+04 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

† Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AP-106			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	5.16E+06 kg (1.13E+03 kgal)		
Heat Load	2.12 kW (7.23E+03 BTU/hr)		
Bulk Density*	1.21 (g/cc)		
Water wt%†	68.5		
TOC wt% C (wet)	0.511		
Chemical Constituents	mole/L	mgm	kg
Na ⁺	4.64	8.83E+04	4.56E+05
Al ³⁺	0.524	1.17E+04	6.04E+04
Fe ³⁺ (total Fe)	5.32E-03	246	1.27E+03
Cr ³⁺	1.39E-02	598	3.08E+03
B ³⁺	2.61E-04	45.1	233
La ³⁺	1.73E-06	0.198	1.02
Hg ²⁺	5.76E-06	0.956	4.93
Zr (as ZrO(OH) ₂)	1.39E-03	105	543
Pb ²⁺	4.71E-05	8.07	41.6
Ni ²⁺	3.35E-03	163	840
Sc ³⁺	1.82E-06	0.132	0.682
Mn ²⁺	6.01E-03	273	1.41E+03
Ca ²⁺	3.73E-02	1.24E+03	6.38E+03
K ⁺	0.102	3.29E+03	1.70E+04
OH ⁻	2.37	3.34E+04	1.72E+05
NO ₃ ⁻	2.10	1.07E+05	5.55E+05
NO ₂ ⁻	0.462	1.76E+04	9.07E+04
CO ₃ ²⁻	0.324	1.61E+04	8.31E+04
PO ₄ ³⁻	8.46E-02	6.65E+03	3.43E+04
SO ₄ ²⁻	0.112	8.94E+03	4.61E+04
Si (as SiO ₂)	2.63E-02	611	3.15E+03
F ⁻	0.116	1.82E+03	9.38E+03
Cl ⁻	7.85E-02	2.30E+03	1.19E+04
C ₆ H ₅ O ₇ ³⁻	1.48E-02	2.31E+03	1.19E+04
EDTA ⁴⁻	3.68E-03	877	4.53E+03
HEDTA ³⁻	6.10E-03	1.38E+03	7.14E+03
glycolate ⁻	0.128	7.92E+03	4.09E+04
acetate ⁻	4.06E-03	198	1.02E+03
oxalate ²⁻	6.51E-06	0.474	2.45
DBP	5.90E-03	785	4.05E+03
butanol	5.90E-03	362	1.87E+03
NH ₃	0.349	4.91E+03	2.53E+04
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	36.1 (μCi/L)		2.57 (kg)
U	4.73E-03 (M)	931 (μg/g)	4.80E+03 (kg)
Cs	8.83E-02 (Ci/L)	73.0 (μCi/g)	3.77E+03 (Ci)
Sr	1.22E-02 (Ci/L)	10.1 (μCi/g)	5.22E+04 (Ci)

*Density is calculated based on Na, OH⁻, and ASO₂.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AP-106			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	0 kg (0 kgal)		
Heat Load	0 kW (0 BTU/hr)		
Bulk Density	0 (g/cc)		
Water wt%	0		
TOC wt% C (wet)	0		
Chemical Constituents	mole/L	mgm	kg
Na ⁺	0	0	0
Al ³⁺	0	0	0
Fe ³⁺ (total Fe)	0	0	0
Cr ³⁺	0	0	0
B ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0	0	0
Sc ³⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	0	0	0
K ⁺	0	0	0
OH ⁻	0	0	0
NO ₃ ⁻	0	0	0
NO ₂ ⁻	0	0	0
CO ₃ ²⁻	0	0	0
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₂)	0	0	0
F ⁻	0	0	0
Cl ⁻	0	0	0
C ₆ H ₅ O ₇ ³⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	0	0	0
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0	0
U		0	0
Cs		0	0
Sr		0	0

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

3.7 Tank 241-AP-107

3.7.1 241-AP-107 Tank History

3.7.1.1 Waste History of Tank 241-AP-107

Tank 241-AP-107 began service by receiving double-shell slurry feed waste in July 1986. The tank received double-shell slurry feed waste until September 1986. From October 1986 until May 1990, the tank received non-complexed waste. The tank received waste from PUREX during the first quarter of 1990. The tank has contained dilute non-complexed waste from June 1990 until the present. The tank has not received waste since the first quarter of 1990. The tank is currently an active dilute receiver tank containing waste that is being concentrated by the 242-A Evaporator.

3.7.1.2 Temperature History of Tank 241-AP-107

Temperature data for Tank 241-AP-107 are recorded by 18 thermocouples at known elevations on one thermocouple tree inside the tank located in riser 4. Three of the 18 thermocouples gave data that consistently did not match the trend of the rest and, subsequently, were not considered in the statistical values. Non-suspect temperature data taken between March 1986 and December 1992 for all 18 thermocouples were available from the computer automated surveillance system. Non-suspect temperature data recorded between July 1989 and August 1993 for 12 of the thermocouples were available from the surveillance analysis computer system. However, not all of the 12 thermocouples have data that encompass the entire length of time. Within the time spans of each system, there were small breaks in the sequence of temperature data. The average temperature during these periods was 61°F with a minimum of 45°F, a maximum of 71°F, and a standard deviation of 4.8°F. Linear regressions were performed on each thermocouple that had temperature data between January 1990 and January 1994. The slopes from these regressions were averaged with a resulting average slope of -0.0056. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

3.7.1.3 Occurrences of Tank 241-AP-107

No unusual events concerned the tank since it went into service.

3.7.1.4 Psychrometrics of Tank 241-AP-107

Psychrometric data have been recorded from this tank for five years and from the annulus for six years. The apparent trend of the evaporation rate from the tank has increased from 122.3 gallons per week in December 1989 to 184.6 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank and annular ventilation has apparently increased. A review of the psychrometric data in Tank 241-AP-107 would suggest an overall increase in the rate of heat generation by the waste.

3.7.2 Current Status of Tank 241-AP-107

Tank 241-AP-107 was placed in service in October 1986 and currently stores 161,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 1,108,000 gallons and configuration of risers as of January 1994. At the time of the estimate, all 1,108,000 gallons were supernatant. The waste level in the tank is measured with the FIC gauge and the manual tape, and has decreased from 405 inches to 59 inches. The decrease was due to transferring waste to Tank 241-AW-102 on October 1994. This tank is active and the waste is currently being concentrated by the 242-A Evaporator. The tank is actively ventilated and categorized as sound. Tank 241-AP-107 has 71 risers. Seven 4-inch risers (no.15, no.21, no.24, three no.27s, and no.28), three 12-inch risers (no.7 and two no.10s), and two 42-inch risers (two no.5s) are available for use.

3.7.2.1 Inventory Estimate of Tank 241-AP-107

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew 1995) and Supernatant Mixing Model (Agnew 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AP-107 are also presented.

3.7.2.2 In-Tank Photograph of Tank 241-AP-107

No in-tank photographs are available.

3.7.3 Synopsis of Tank 241-AP-107

(To be completed.)

DSSF:
NCPLX:

ANDERSON 1990
WASTE TYPES

PRIMARY
ADDITIONS

LEVEL IN
FEET
LEVEL IN
INCHES

36' 432"
34' 408"
32' 384"
30' 360"
28' 336"
26' 312"
24' 288"
22' 264"
20' 240"
18' 216"
16' 192"
14' 168"
12' 144"
10' 120"
8' 96"
6' 72"
4' 48"
2' 24"
0' 0"

1977 78 79 80 81 82 83 84 85 86 87 88

YEARS

DN:

NOTES:

CONSTRUCT 1980-1981
 NOMINAL CAPACITY: 1,000,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE,
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

PASF:
 UNK:

INVENTORY ESTIMATE DATE

FROM PUREX (PASF)

CAPACITY
 (GALLONS)

1,188,000
 1,122,000
 1,056,000
 990,000
 924,000
 858,000
 792,000
 726,000
 660,000
 594,000
 528,000
 462,000
 396,000
 330,000
 264,000
 198,000
 132,000
 66,000
 0

LIQUID
 LEVEL

SUPERNATANT 1108 KGAL

See glossary for abbreviations and definitions

DSSF: DOUBLE-SHELL SLURRY FEED
 NCPLX: NON-COMPLEXED WASTE
 DN: DILUTE NON-COMPLEXED WASTE
 PASF: PUREX AMMONIA SCRUBBER FEED WASTE
 UNK: UNKNOWN

LEGEND

□—□—□ LIQUID OBSERVATION
 WELL (LOW)
 — LIQUID LEVEL
 // // // SOLIDS LEVEL
 + + + + + SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

**AP TANK FARM
 PLOT PLAN**

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AP-107 DOUBLE-SHELL TANK
 LEVEL HISTORY 1986 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: N/A

SIZE	BLOG NO.	DRG NO.	DATE
B	241	ES-TKS-E163	6/95
SCALE	JOB NO.	SHEET	OF
NONE		1	1

Double-Shell Tank 241-AP-107			
Total Inventory Estimate*			
Physical Properties			
Total Waste	4.20E+06 kg (1.11E+03 kgal)		
Heat Load	0 kW (0 BTU/hr)		
Bulk Density†	1.00 (g/cc)		
Water wt%†	99.3		
TOC wt% C	0		
Chemical Constituents			
	mg/kg†	g/kg†	kg
Na ⁺	5.73E-02	1.32E+03	5.53E+03
Al ³⁺	0	0	0
Fe ³⁺ (total Fe)	1.98E-03	110	463
Cr ³⁺	0	0	0
BP ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as Zr(OH) ₄)	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0	0	0
Se ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	1.38E-02	553	2.32E+03
K ⁺	0	0	0
OH ⁻	1.58E-02	268	1.13E+03
NO ₃ ⁻	6.52E-02	4.04E+03	1.70E+04
NO ₂ ⁻	0	0	0
CO ₃ ²⁻	4.93E-03	295	1.24E+03
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₂) [†]	0	0	0
F ⁻	0	0	0
Cl ⁻	0	0	0
C ₂ H ₃ O ₂ ⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
malonate ²⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	4.94E-02	839	3.52E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radioisotopic Constituents			
Pu		0	0
U	0	0	0
Cs	0	0	0
Sr	0	0	0

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AP-107			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	4.20E+06 kg (1.11E+03 kgal)		
Heat Load	0 kW (0 BTU/hr)		
Bulk Density*	1.00 (g/cc)		
Water wt%†	99.3		
TOC wt% C (wet)	0		
Chemical Constituents	mole/L	num	kg
Na ⁺	5.73E-02	1.32E+03	5.53E+03
Al ³⁺	0	0	0
Fe ²⁺ (total Fe)	1.98E-03	110	463
Cr ³⁺	0	0	0
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0	0	0
Sr ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	1.38E-02	553	2.32E+03
K ⁺	0	0	0
OH ⁻	1.58E-02	265	1.13E+03
NO ₃ ⁻	6.52E-02	4.04E+03	1.70E+04
NO ₂ ⁻	0	0	0
CO ₃ ²⁻	4.93E-03	295	1.24E+03
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₂)	0	0	0
F ⁻	0	0	0
Cl ⁻	0	0	0
C ₆ H ₅ O ₇ ³⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	4.94E-02	239	3.52E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radionuclides			
Pu	0		0
U	0		0
Cs	0		0
Sr	0		0

*Density is calculated based on Na, OH⁻, and AlO₂⁻.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AP-107			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	0 kg (0 kgal)		
Heat Load	0 kW (0 BTU/hr)		
Bulk Density	0 (g/cc)		
Water wt%	0		
TOC wt% C (wet)	0		
Chemical Constituents	mole/L	num	kg
Na ⁺	0	0	0
Al ³⁺	0	0	0
Fe ²⁺ (total Fe)	0	0	0
Cr ³⁺	0	0	0
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0	0	0
Sr ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	0	0	0
K ⁺	0	0	0
OH ⁻	0	0	0
NO ₃ ⁻	0	0	0
NO ₂ ⁻	0	0	0
CO ₃ ²⁻	0	0	0
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₂)	0	0	0
F ⁻	0	0	0
Cl ⁻	0	0	0
C ₆ H ₅ O ₇ ³⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	0	0	0
Fe(CN) ₆ ⁴⁻	0	0	0
Radionuclides			
Pu		0	0
U		0	0
Cs		0	0
Sr		0	0

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

3.8 Tank 241-AP-108

3.8.1 241-AP-108 Tank History

3.8.1.1 Waste History of Tank 241-AP-108

Tank 241-AP-108 began service by receiving double-shell slurry feed waste in July 1986, and continued to receive this waste until September 1986. From October 1986 until May 1990, the tank received non-complexed waste. From the first quarter of 1990 until the second quarter of 1992, the tank received waste from PUREX. The tank has contained dilute non-complexed waste from June 1990 until the present. The tank is currently an active dilute receiver tank with waste that is being concentrated by the 242-A Evaporator.

3.8.1.2 Temperature History of Tank 241-AP-108

Temperature data for Tank 241-AP-108 are recorded by 18 thermocouples at known elevations on one thermocouple tree inside the tank located in riser 4. Non-suspect temperature data recorded between March 1986 and December 1992 for all 18 thermocouples were available from the computer automated surveillance system. Non-suspect temperature data taken between July 1989 and August 1993 for 12 of the thermocouples were available from the surveillance analysis computer system. However, not all of the 12 thermocouples have data that encompass the entire length of time. Within the time spans of each system, there were small breaks in the sequence of temperature data. The average temperature during these periods was 63°F with a minimum of 50°F, a maximum of 74°F, and a standard deviation of 5.1°F. Linear regressions were performed on each thermocouple that had temperature data between January 1990 and January 1994. The slopes from these regressions were averaged with a resulting average slope of 0.0057. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

3.8.1.3 Occurrences of Tank 241-AP-108

No unusual events concerned the tank since it went into service.

3.8.1.4 Psychrometrics of Tank 241-AP-108

Psychrometric data have been recorded from this tank for five years and from the annulus for six years. The apparent trend of the evaporation rate from the tank has increased from 42.3 gallons per week in December 1989 to 125.9 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank and annular ventilation has apparently increased. A review of the psychrometric data in Tank 241-AP-108 would suggest an overall increase in the rate of heat generation by the waste.

3.8.2 Current Status of Tank 241-AP-108

Tank 241-AP-108 entered service in October 1986 and currently stores 793,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 899,000 gallons and configuration of risers as of January 1994. At the time of the estimate, all 899,000 gallons were supernatant. The waste level in the tank is measured with the FIC gauge and the manual tape and has increased from about 50 inches in January 1991 to 325 inches in January 1994, then decreased to 288 inches in January 1995. The increase was caused mostly by waste received from Tank 241-AY-102 in November 1991. The decrease was because waste was transferred to Tanks 241-AP-101 and 241-AW-102 in October 1994. This tank is active and the waste is currently being concentrated by the 242-A Evaporator. The tank is actively ventilated and categorized as sound. Tank 241-AP-108 has 71 risers. Eight 4-inch risers (no.15, no.21, no.24, no.26, three no.27s, and no.28), three 12-inch risers (no.7 and two no.10s), and two 42-inch risers (two no.5s) are available for use.

3.8.2.1 Inventory Estimate of Tank 241-AP-108

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew 1995) and Supernatant Mixing Model (Agnew 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AP-108 are also presented.

3.8.2.2 In-Tank Photograph of Tank 241-AP-108

No in-tank photographs are available.

3.8.3 Synopsis of Tank 241-AP-108

(To be completed.)

DSSF:
NCPLX:

ANDERSON 1990
WASTE TYPES

PRIMARY
ADDITIONS

LEVEL IN
FEET
LEVEL IN
INCHES

36' 432"

34' 408"

32' 384"

30' 360"

28' 336"

26' 312"

24' 288"

22' 264"

20' 240"

18' 216"

16' 192"

14' 168"

12' 144"

10' 120"

8' 96"

6' 72"

4' 48"

2' 24"

0' 0"

1977 78 79 80 81 82 83 84 85 86 87 88

YEARS

DN:

NOTES:

CONSTRUCT 1980-1981
NOMINAL CAPACITY: 1,000,000 GAL
FLAT BOTTOM TANK, NO KNUCKLE,
75 FOOT DIAMETER DOUBLE-SHELL TANK
SURFACE LEVEL READING: PHOTO
(LIQUIDS & SOLIDS), FIC (SOLIDS)

PASF:

PL2:

UNK:

SWLIQ:

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

1,188,000

1,122,000

1,056,000

990,000

924,000

858,000

792,000

726,000

660,000

594,000

528,000

462,000

396,000

330,000

264,000

198,000

132,000

66,000

0

DSSF: DOUBLE-SHELL SLURRY FEED WASTE
NCPLX: NON-COMPLEXED WASTE
DN: DILUTE NON-COMPLEXED WASTE
PASF: PUREX AMMONIA SCRUBBER FEED WASTE
PL2: PUREX LOW-LEVEL WASTE
UNK: UNKNOWN
SWLIQ: SALTWELL LIQUOR

LEGEND

□ □ □ LIQUID OBSERVATION
WELL (LOW)

— — — LIQUID LEVEL

////// SOLIDS LEVEL

||||| SOLIDS LEVEL BEST
ENGINEERING JUDGEMENT

AP TANK FARM PLOT PLAN

U.S. DEPARTMENT OF ENERGY
RICHLAND FIELD OFFICE
ICF KAISER HANFORD

241-AP-108 DOUBLE-SHELL TANK
LEVEL HISTORY 1986 TO 1994
SOUND/ACTIVE TANK
WATCH LIST: N/A

SUPERNATANT 899 KGAL

See glossary for abbreviations and definitions

SIZE	BLOC NO.	DRG NO.	DATE
B	241	ES-TKS-E164	6/95
SCALE	NONE	JOB NO.	SHEET 1 OF 1

Double-Shell Tank 241-AP-108			
Total Inventory Estimate*			
Physical Properties			
Total Waste	3.70E+06 kg	(899 kgal)	
Heat Load	1.05 kW	(3.60E+03 BTU/hr)	
Bulk Density†	1.09 (g/cc)		
Water wt%	85.6		
TOC wt% C	0.238		
Chemical Constituents (mg/L)			
Na ⁺	1.91	4.03E+04	1.49E+05
Al ³⁺	0.246	6.10E+03	2.26E+04
Fe ²⁺ (total Fe)	1.95E-03	99.9	370
Cr ³⁺	3.17E-03	151	560
Bi ³⁺	3.45E-05	6.62	24.5
La ³⁺	2.31E-07	2.95E-02	0.109
Hg ²⁺	7.56E-07	0.139	0.516
Zr (as ZrO(OH) ₂)	1.83E-04	15.3	56.7
Pb ²⁺	1.07E-05	2.05	7.57
Ni ²⁺	1.33E-03	71.8	266
Sr ²⁺	2.44E-07	1.97E-02	7.28E-02
Mn ²⁺	1.42E-03	71.6	265
Ca ²⁺	1.36E-02	502	1.86E+03
K ⁺	1.40E-02	501	1.86E+03
OH ⁻	1.10	1.72E+04	6.36E+04
NO ₃ ⁻	0.898	5.12E+04	1.89E+05
NO ₂ ⁻	7.72E-02	3.26E+03	1.21E+04
CO ₃ ²⁻	0.145	7.99E+03	2.96E+04
PO ₄ ³⁻	2.17E-02	1.89E+03	7.01E+03
SO ₄ ²⁻	5.34E-02	4.71E+03	1.74E+04
Si (as SiO ₂)	1.50E-02	358	1.44E+03
F ⁻	1.55E-02	271	1.00E+03
Cl ⁻	3.34E-02	1.09E+03	4.03E+03
C ₂ H ₃ O ₂ ⁻	6.91E-03	1.20E+03	4.44E+03
EDTA ⁴⁻	4.89E-04	129	479
HEDTA ³⁻	8.10E-04	204	755
glycolate ⁻	8.29E-02	5.71E+03	2.12E+04
acetate ⁻	5.39E-04	29.2	108
oxalate ²⁻	8.72E-07	7.06E-02	0.261
DBP	1.11E-03	164	607
butanol	1.11E-03	75.5	279
NH ₃	5.19E-02	811	3.00E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		1.42E-02 (μCi/g)	0.873 (kg)
U	2.03E-03 (M)	444 (μg/g)	1.64E+03 (kg)
Cs	5.93E-02 (CIV)	54.5 (μCi/g)	2.02E+05 (Ci)
Sr	4.72E-03 (CIV)	4.34 (μCi/g)	1.61E+04 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

† Volume average for density, mass average Water wt% and TOC wt% C.

241-AP-108

4,396,400 Liters
11,160,000 Gallons

DEFENDANT EXPOSURE Ref: W-2-95549 Rev. 4

TANK RISER LOCATION

Approximate Grade Elevation: 206.5m (678.01ft)

Ref: W-2-95544

TANK CROSS-SECTION

Not to scale

Waste Volume

TANK LAYER MODEL

Double-Shell Tank 241-AP-108			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	3.70E+06 kg	(899 kgal)	
Heat Load	1.05 kW	(3.60E+03 BTU/hr)	
Bulk Density*	1.09 (g/cc)		
Water wt%	85.6		
TOC wt% C (wet)	0.238		
Chemical Constituents			
	mmole/L	ppm	kg
Na ⁺	1.91	4.03E+04	1.49E+05
Al ³⁺	0.246	6.10E+03	2.26E+04
Fe ³⁺ (total Fe)	1.95E-03	99.9	370
Cr ³⁺	3.17E-03	151	560
Bi ³⁺	3.45E-05	6.62	24.5
La ³⁺	2.31E-07	2.95E-02	0.109
Hg ²⁺	7.56E-07	0.139	0.516
Zr (as ZrO(OH) ₂)	1.83E-04	15.3	56.7
Pb ²⁺	1.07E-05	2.05	7.57
Ni ²⁺	1.33E-03	71.8	266
Sr ²⁺	2.44E-07	1.97E-02	7.28E-02
Mn ²⁺	1.42E-03	71.6	265
Ca ²⁺	1.36E-02	502	1.86E+03
K ⁺	1.40E-02	501	1.85E+03
OH ⁻	1.10	1.72E+04	6.36E+04
NO ₃ ⁻	0.898	5.12E+04	1.89E+05
NO ₂ ⁻	7.72E-02	3.26E+03	1.21E+04
CO ₃ ²⁻	0.145	7.99E+03	2.96E+04
PO ₄ ³⁻	2.17E-02	1.89E+03	7.01E+03
SO ₄ ²⁻	5.34E-02	4.71E+03	1.74E+04
Si (as SiO ₂)	1.50E-02	388	1.44E+03
F ⁻	1.55E-02	271	1.00E+03
Cl ⁻	3.34E-02	1.09E+03	4.03E+03
C ₂ H ₃ O ₂ ⁻	6.91E-03	1.20E+03	4.44E+03
EDTA ⁴⁻	4.89E-04	129	479
HEDTA ³⁻	8.10E-04	204	755
glycolate ⁻	8.29E-02	5.71E+03	2.12E+04
acetate ⁻	5.39E-04	29.2	108
oxalate ²⁻	8.72E-07	7.06E-02	0.261
DBP	1.31E-03	164	607
butanol	1.11E-03	75.5	279
NH ₃	5.19E-02	811	3.00E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radionuclides			
Pu	15.4 (μCi/L)		0.873 (kg)
U	2.03E-03 (M)	444 (μg/g)	1.64E+03 (kg)
Cs	5.93E-02 (Ci/L)	54.5 (μCi/g)	2.02E+05 (Ci)
Sr	4.72E-03 (Ci/L)	4.34 (μCi/g)	1.61E+04 (Ci)

*Density is calculated based on Na, OH₂, and AlO₂⁻.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AP-108			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	0 kg	(0 kgal)	
Heat Load	0 kW	(0 BTU/hr)	
Bulk Density	0 (g/cc)		
Water wt%	0		
TOC wt% C (wet)	0		
Chemical Constituents			
	mmole/L	ppm	kg
Na ⁺	0	0	0
Al ³⁺	0	0	0
Fe ³⁺ (total Fe)	0	0	0
Cr ³⁺	0	0	0
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0	0	0
Sr ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	0	0	0
K ⁺	0	0	0
OH ⁻	0	0	0
NO ₃ ⁻	0	0	0
NO ₂ ⁻	0	0	0
CO ₃ ²⁻	0	0	0
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₂)	0	0	0
F ⁻	0	0	0
Cl ⁻	0	0	0
C ₂ H ₃ O ₂ ⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	0	0	0
Fe(CN) ₆ ⁴⁻	0	0	0
Radionuclides			
Pu		0	0
U		0	0
Cs		0	0
Sr		0	0

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

4 AW Tank Farm

4.0.1 AW Tank Farm History

The AW Tank Farm is located south of 4th Street and west of Canton Avenue in the 200-East Area. The AW Tank Farm contains six, 100 series, 1,160,000 gallon, 75-foot diameter double-shell tanks. The AW Tank Farm is the latest tank design with a reinforced concrete shell and dome, and an insulating concrete base. A heat-treated, stress-relieved, primary steel liner and a non-stress-relieved, outer steel liner are inside the concrete shell. These tanks were made to hold concentrated supernatant. The maximum design temperature for liquid storage is 350°F. The tanks are at the same elevation and no cascade lines exist between the tanks.

A color aerial photograph taken in 1993 of the AW Tank Farm shows the orientation of the 100 series tanks, leak detection pits, annulus ventilation equipment, instrument house, and valve pits.

AW TANK FARM

4.0.1.1 AW Tank Farm Waste History

Non-complexed waste was received by the AW Tank Farm in July 1980, and was distributed to all tanks except Tank 241-AW-106 which received complexant concentrate waste. Tanks 241-AW-101, -103, -105, and -106 received double-shell slurry waste from December 1981 to May 1990. Complexant concentrate waste was also sent to Tanks 241-AW-104 and -105, while Tank 241-AW-101 received complexed waste and dilute non-complexed waste from the 200-East Area single-shell tanks. Low-level PUREX waste has been added to Tanks 241-AW-101, -103, -104, and -105. Presently, Tanks 241-AW-102 and -106 are the feed and slurry receiver tanks, respectively, for 242-A Evaporator.

4.0.1.2 AW Tank Farm Temperature History

Each of the six tanks within the AW Tank Farm contains at least one thermocouple tree with readings indicating between 6 and 12 thermocouples per tree. Since 1993, Tank 241-AW-101 has been on the Hydrogen Watch List. This tank is monitored weekly, at a minimum, with requirements that the temperatures of the remaining tanks are recorded semiannually. Temperature data are stored in the computer automated surveillance system and the surveillance analysis computer system. These two databases hold all the temperature data used in developing the statistical results for each tank.

4.0.1.3 AW Tank Farm Occurrences

Six unusual events concerned AW Tank Farm as a whole. Occurrence report RL--WHC-Tank Farm-1990-0346 and Off-Normal Reports 86-33, 86-27, 86-25, and 86-17 were written because failing equipment caused tanks to pressurize. O.N. Report 86-27 was issued in June 1986 when the back up ventilation system failed during changing of the HEPA filters. O.N. Report 86-25 was issued in April 1986 when the exhaust ventilation system shut down for 21 minutes. O.N. Report 86-17 was issued in February 1986 when the exhaust ventilation system shut down again. O.N. Report 83-19 was written because tanks pressurized during a waste transfer. For more information, refer to the Supporting Document for the Southeast Quadrant HTCE for AW Tank Farm (Brevick, 1995).

4.0.1.4 AW Tank Farm Ventilation

Each tank is designed to have 167 SCFM of air travel through it and 800 CFM of air travel through the annulus. Air enters the tanks by infiltration because there is no supply fan. After exiting each tank system, the air ducts are joined to allow the service of one fan to send the air into the primary exhaust system. Before the tank air is released to the atmosphere, the air is heated, run through a prefilter, and then run through two HEPA filters. In the annular system, air enters a 35% prefilter and a HEPA filter before it enters the annulus. Then the air enters an electric heater and two more HEPA filters before it is exhausted to the atmosphere. Both the tank and annular systems have a primary and backup system. For more information, refer to drawings H-2-70336 and H-2-90905.

The psychrometric data are recorded in two parts, the tank data and the annulus data. For water and heat leaving the tank, the numbers are positive. For more information, refer to the Supporting Document for the Southeast Quadrant HTCE for AW Tank Farm (Brevick, 1995).

4.0.2 Current Status of AW Tank Farm

Tank 241-AW-101 was officially added to the Hydrogen Watch List in June 1993. The tank is identified as an unreviewed safety question due to the concern that burning flammable gas could result in a radiological release. All tanks are actively ventilated and categorized as sound. Currently, the total waste volume is 3,849,000 gallons. The estimated volumes (Agnew, January 1994) depicted in each tank cross-section total 6,000,000 gallons of waste. At the time of the estimate, there were 5,232,000 gallons of supernatant with 549,000 gallons of concentrated supernatant solids; 1,000 gallons of low-level waste from B Plant; 184,000 gallons of low-level waste from PUREX; and 583,000 gallons of coating waste from Z Plant and REDOX.

4.1 Tank 241-AW-101

4.1.1 241-AW-101 Tank History

4.1.1.1 Waste History of Tank 241-AW-101

Tank 241-AW-101 began service by receiving non-complexed waste in July 1980. The tank continued to receive non-complexed waste until November 1981, and again from December 1982 until March 1983. From December 1981 until November 1982, the tank received dilute double-shell slurry feed waste. The tank received complexant concentrate waste from April 1983 until June 1984. From July 1984 until April 1986, the tank again received non-complexed waste. The tank received waste from PUREX and dilute non-complexed waste from the 200-East Area SSTs from the third quarter of 1984 until the first quarter of 1986. The tank contained double-shell slurry feed waste from May 1986 until the present. The slight changes in level measurements are attributed to slurry growth as a result of gas generation. The tank has not received waste since the third quarter of 1986. The tank is currently an inactive concentrated waste holding tank.

4.1.1.2 Temperature History of Tank 241-AW-101

Temperature data for Tank 241-AW-101 are recorded by 18 thermocouples at known elevations on one thermocouple tree inside the tank, located in riser 4A. Non-suspect temperature data taken between July 1983 and April 1992 for all 18 thermocouples were available from the computer automated surveillance system. However, not all of the 18 thermocouples have data that encompass the entire length of time. Non-suspect temperature data recorded between July 1989 and September 1993 for 12 of the thermocouples were available from the surveillance analysis computer system. Not all of the twelve thermocouples have data that encompass the entire length of time. Within the time spans for both systems, there were several small breaks in the sequence of temperature data. The average temperature during

these periods was 98°F with a minimum of 75°F, a maximum of 135°F, and a standard deviation of 9.0°F. Linear regressions were performed on each thermocouple that had temperature data between January 1990 and January 1994. The slopes from these regressions were averaged with a resulting average slope of -0.0029. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

4.1.1.3 Occurrences of Tank 241-AW-101

Nine unusual events occurred at Tank 241-AW-101. Occurrence report RL--WHC-Tank Farm-1993-0103 was written due to an equipment failure associated with waste level measurements. Occurrence report RL--WHC-Tank Farm-1992-0083 was written because the tank burped. O.N. Reports 86-2, 85-24, and 84-33 each describes the tank pressurizing during a waste transfer. O.N. Reports 85-48, 85-41, and 85-36 were written because of problems during a transfer of waste. O.N. Report 85-25 describes improper use of equipment causing the tank to pressurize.

4.1.1.4 Psychrometrics of Tank 241-AW-101

Psychrometric data have been recorded for 12 years from this tank and annulus. The apparent trend of the evaporation rate from the tank has decreased from 185 gallons per week in November 1981 to 42.4 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank ventilation has decreased. The rates of heat exchange through the annular ventilation show an increasing trend. The majority of the changes in the rate of heat exchange can be attributed to changes in the average ventilation rates. A review of the psychrometric data in Tank 241-AW-101 would suggest a decrease in the rate of heat generation by the waste.

4.1.2 Current Status of Tank 241-AW-101

Tank 241-AW-101 entered service in August 1980 and currently stores 1,123,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 1,138,000 gallons and configuration of risers in January 1994. At the time of the estimate, there were 1,077,000 gallons of supernatant with 23,000 gallons of concentrated supernatant solids and 61,000 gallons of PUREX low-level waste (PL2). The waste level in the tank is measured with the FIC gauge and the manual tape and has remained at about 410 inches over the last three years. This tank is on the Hydrogen Watch List and, therefore, is prohibited from receiving waste. The tank is actively ventilated and categorized as sound. Tank 241-AW-101 has 64 risers. One 4-inch riser (no.13A), three 12-inch risers (no.7B, no.24A, and no.24B), two 20-inch risers (no.25A and no.25B), one 36-inch riser (no.26A), and two 42-inch risers (no.5A and no.5B) are available for use.

4.1.2.1 Inventory Estimate of Tank 241-AW-101

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and

Transaction Record Summary (Agnew 1995) and Supernatant Mixing Model (Agnew 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AW-101 are also presented. Concentrated supernatant solids are considered as an integral part of the liquid for the purpose of estimating inventories, but are graphed as solids on the level histories. The actual substance, which was derived from double-shell slurry, appears as a solid if undisturbed, but the particles are resuspended in solution if heated or disturbed.

4.1.2.2 In-Tank Photograph of Tank 241-AW-101

As of April 1994, Tank 241-AW-101 contained 1,124,000 gallons of double-shell slurry feed (Hanlon 1994) which corresponds with a waste height of about 34 feet. This collage should represent accurately the contents of the tank which were the same in 1988 when the photographs were taken (Thurman 1988). The picture quality is good which allows items in the tank to be easily identified. Items identified have been labeled including a temperature probe, three level probes, a supernatant pump, a high level sensor, and many risers in the dome.

4.1.3 Synopsis of Tank 241-AW-101

(To be completed.)

NOTES:

CONSTRUCT 1978-1980
 NOMINAL CAPACITY: 1,160,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE,
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS). FIC (SOLIDS)

GAS:

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

— 1,188,000

— 1,122,000

— 1,056,000

— 990,000

— 924,000

— 858,000

— 792,000

— 726,000

— 660,000

— 594,000

— 528,000

— 462,000

— 396,000

— 330,000

— 264,000

— 198,000

— 132,000

— 66,000

— 0

LIQUID
LEVEL

NCPLX: NON-COMPLEXED WASTE
 DDSSF: DILUTE DOUBLE-SHELL SLURRY FEED
 CC: COMPLEXANT CONCENTRATE WASTE
 DSSF: DOUBLE-SHELL SLURRY FEED
 PL2: PUREX LOW-LEVEL WASTE
 N: N REACTOR WASTE
 SWLQ: SALTWELL LIQUOR
 UNK: UNKNOWN
 GAS: LEVEL FLUXUATION DUE TO GAS BUILD-UP

LEGEND

— — — — — LIQUID OBSERVATION
 WELL (LOW)
 — — — — — LIQUID LEVEL
 // // // // SOLIDS LEVEL
 // // // // SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

**AW TANK FARM
PLOT PLAN**

SUPERNATANT 1054 KGAL
 CS SOLIDS 23 KGAL
 PL2 61 KGAL

See glossary for abbreviations and definitions

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AW-101 DOUBLE-SHELL TANK
 LEVEL HISTORY 1986 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: HYDROGEN

SIZE	BLDG NO.	DWG NO.	DATE
B	241	ES-TKS-E165	6/95
SCALE	NONE	JOB NO.	SHEET 1 OF 1

Double-Shell Tank 241-AW-101			
Total Inventory Estimate*			
Physical Properties			
Total Waste	5.95E+06 kg	(1.14E+03 kgal)	
Heat Load	6.82 kW	(2.33E+04 BTU/hr)	
Bulk Density†	1.38 (g/cc)		
Water wt%†	51.1		
TOC wt% C	0.907		
Chemical Constituents			
	mg/L	g/g	kg
Na ⁺	8.26	1.38E+05	8.18E+05
Al ³⁺	0.946	1.83E+04	1.10E+05
Fe ³⁺ (total Fe)	0.108	4.39E+03	2.61E+04
Cr ³⁺	2.97E-02	1.12E+03	6.63E+03
B ³⁺	8.62E-04	131	776
La ³⁺	5.34E-06	0.538	3.20
Hg ²⁺	1.03E-05	1.49	8.88
Zr (as ZrO(OH) ₂)	1.97E-03	130	773
Pb ²⁺	9.26E-05	13.9	82.6
Ni ²⁺	1.09E-02	462	2.75E+03
Si ²⁺	5.65E-06	0.358	2.13
Mn ²⁺	1.08E-02	431	2.56E+03
Ca ²⁺	5.67E-02	1.65E+03	9.79E+03
K ⁺	0.131	3.71E+03	2.21E+04
OH ⁻	4.58	5.65E+04	3.36E+05
NO ₃ ⁻	3.26	1.47E+05	8.72E+05
NO ₂ ⁻	1.43	4.78E+04	2.84E+05
CO ₃ ²⁻	0.481	2.09E+04	1.24E+05
PO ₄ ³⁻	0.162	1.12E+04	6.63E+04
SO ₄ ²⁻	0.206	1.43E+04	8.52E+04
Si (as SiO ₂) ³	3.87E-02	789	4.69E+03
F ⁻	0.172	2.37E+03	1.41E+04
Cl ⁻	0.141	3.62E+03	2.15E+04
C ₂ H ₃ O ₂ ³	2.78E-02	3.81E+03	2.27E+04
EDTA ⁴⁻	1.21E-02	2.53E+03	1.51E+04
HRDTA ³	1.98E-02	3.94E+03	2.34E+04
phosphate ³	0.135	7.32E+03	4.35E+04
acetate ³	1.42E-02	608	3.62E+03
oxalate ³	2.02E-05	1.29	7.64
DBP	1.51E-02	1.78E+03	1.06E+04
butanol	1.51E-02	812	4.83E+03
NH ₃	0.406	5.00E+03	2.97E+04
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		4.30E-02 (μCi/g)	4.26 (kg)
U	6.72E-03 (M)	1.16E+03 (μCi/g)	6.89E+03 (kg)
Cs	0.240 (Ci/L)	174 (μCi/g)	1.03E+06 (Ci)
Sr	6.80E-02 (Ci/L)	49.2 (μCi/g)	2.93E+05 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, average Water wt% and TOC wt% C.

Double-Shell Tank 241-AW-101			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	5.68E+05 kg	(1.08E+03 kgal)	
Heat Load	5.30 kW	(1.81E+04 BTU/hr)	
Bulk Density*		1.39 (g/cc)	
Water wt%†		49.5	
TOC wt% C (wet)		0.936	
Chemical Constituents			
Na ⁺	8.70	1.44E+05	8.15E+05
Al ³⁺	1.00	1.94E+04	1.10E+05
Fe ³⁺ (total Fe)	6.83E-03	274	1.55E+03
Cr ³⁺	3.10E-02	1.16E+03	6.56E+03
Bi ³⁺	9.11E-04	137	776
La ³⁺	5.64E-06	0.563	3.20
Hg ²⁺	1.09E-05	1.56	8.88
Zr (as ZrO(OH) ₂)	2.04E-03	136	773
Pb ²⁺	9.56E-05	14.2	80.7
Ni ²⁺	5.14E-03	216	1.23E+03
Si ²⁺	5.97E-06	0.373	2.13
Mn ²⁺	1.11E-02	439	2.49E+03
Ca ²⁺	4.78E-02	1.38E+03	7.81E+03
K ⁺	0.138	3.88E+03	2.20E+04
OH ⁻	4.51	5.50E+04	3.12E+05
NO ₃ ⁻	3.44	1.53E+05	8.68E+05
NO ₂ ⁻	1.51	5.00E+04	2.84E+05
CO ₃ ²⁻	0.491	2.12E+04	1.20E+05
PO ₄ ³⁻	0.168	1.14E+04	6.49E+04
SO ₄ ²⁻	0.217	1.50E+04	8.51E+04
Si (as SiO ₂)	4.09E-02	826	4.69E+03
F ⁻	0.182	2.48E+03	1.41E+04
Cl ⁻	0.149	3.78E+03	2.15E+04
C ₆ H ₈ O ₇ ³⁻	2.94E-02	3.99E+03	2.27E+04
EDTA ⁴⁻	1.28E-02	2.65E+03	1.51E+04
HEDTA ³⁻	2.10E-02	4.13E+03	2.34E+04
glycolate ⁻	0.142	7.67E+03	4.35E+04
acetate ⁻	1.50E-02	637	3.62E+03
oxalate ²⁻	2.13E-05	1.35	7.64
DBP	1.58E-02	1.83E+03	1.04E+04
butanol	1.58E-02	841	4.78E+03
NH ₃	0.429	5.24E+03	2.97E+04
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	53.1 (μCi/L)		3.61 (kg)
U	7.08E-03 (M)	1.21E+03 (μg/g)	6.87E+03 (kg)
Cs	0.252 (Ci/L)	181 (μCi/g)	1.03E+06 (Ci)
Sr	1.76E-02 (Ci/L)	12.6 (μCi/g)	7.17E+04 (Ci)

*Density is calculated based on Na, OH⁻, and AlO₂⁻.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AW-101			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	2.68E+05 kg	(61 kgal)	
Heat Load	1.52 kW	(5.19E+03 BTU/hr)	
Bulk Density		1.16 (g/cc)	
Void Fraction		0.918	
Water wt%		79.1	
TOC wt% C (wet)		0.036	
Chemical Constituents			
Na ⁺	0.589	1.17E+04	3.12E+03
Al ³⁺	0	0	0
Fe ³⁺ (total Fe)	1.90	9.15E+04	2.45E+04
Cr ³⁺	7.35E-03	329	88.3
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	3.99E-05	7.13	1.91
Ni ²⁺	0.112	5.66E+03	1.52E+03
Si ²⁺	0	0	0
Mn ²⁺	5.51E-03	261	70.0
Ca ²⁺	0.215	7.41E+03	1.99E+03
K ⁺	5.51E-03	186	49.8
OH ⁻	5.94	8.69E+04	2.33E+04
NO ₃ ⁻	0.232	1.24E+04	3.32E+03
NO ₂ ⁻	1.29E-02	510	137
CO ₃ ²⁻	0.308	1.59E+04	4.27E+03
PO ₄ ³⁻	6.39E-02	5.23E+03	1.40E+03
SO ₄ ²⁻	3.72E-03	308	82.4
Si (as SiO ₂)	0	0	0
F ⁻	0	0	0
Cl ⁻	3.59E-03	116	29.4
C ₆ H ₈ O ₇ ³⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	2.89E-03	663	178
butanol	2.89E-03	185	49.5
NH ₃	4.86E-06	7.12E-02	1.91E-02
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0.147 (μCi/g)	0.656 (kg)
U	4.25E-04 (M)	87.1 (μg/g)	23.3 (kg)
Cs	2.76E-02 (Ci/L)	23.8 (μCi/g)	6.37E+03 (Ci)
Sr	0.957 (Ci/L)	825 (μCi/g)	2.21E+05 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

241-AW-101

Photo date: 3-17-88

4.2 Tank 241-AW-102

4.2.1 241-AW-102 Tank History

4.2.1.1 Waste History of Tank 241-AW-102

Tank 241-AW-102 began service by receiving non-complexed waste in July 1980. The tank received non-complexed waste until May 1983. The tank received evaporator feed waste from June 1983 until December 1984. During 1983 and 1984, the tank received dilute non-complexed waste from the 200-East Area SSTs. Between January 1985 and April 1986, the tank received Hanford facility waste. From May 1986 until May 1990, the tank received non-complexed waste from other DSTs. The tank has contained dilute non-complexed waste from June 1990 until the present. The slight level changes are attributed to slurry growth resulting from gas generation. The tank is currently an active, evaporator feed tank for the 242-A Evaporator.

4.2.1.2 Temperature History of Tank 241-AW-102

Temperature data for Tank 241-AW-102 are recorded by 18 thermocouples at known elevations on one thermocouple tree inside the tank, located in riser 4A. Non-suspect temperature data from between July 1983 and June 1991 for 18 thermocouples were available from the computer automated surveillance system. However, not all of the 18 thermocouples have data that encompass the entire length of time. Non-suspect temperature data taken between July 1989 and September 1993 for 12 of the thermocouples were available from the surveillance analysis computer system. Not all of the 12 thermocouples have data that encompass the entire length of time. Within the time spans for both systems, there were several small breaks in the sequence of temperature data. The average temperature during these periods was 79°F with a minimum of 53°F, a maximum of 130°F, and a standard deviation of 16°F. Linear regressions were performed on each thermocouple that had temperature data between January 1990 and January 1994. The slopes from these regressions were averaged with a resulting average slope of -0.0068. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

4.2.1.3 Occurrences of Tank 241-AW-102

Six unusual events occurred at tank 241-AW-102. Occurrence reports RL--WHC-Tank Farm-1992-0072, RL--WHC-Tank Farm-1992-0025, RL--WHC-Tank Farm-1991-1066, and RL--WHC-Tank Farm-1991-1050, and Off-Normal (O.N.) Report 82-01 concern unexpected waste transfers. O.N. Report 86-36 was written when a transfer of waste caused the tank to pressurize.

4.2.1.4 Psychrometrics of Tank 241-AW-102

Psychrometric data have been recorded for 12 years from this tank and annulus. The apparent trend of the evaporation rate from the tank has increased from 318.9 gallons per week in October 1981 to 364.4 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank and annular ventilation has

apparently decreased. A review of the psychrometric data in Tank 241-AW-102 would suggest an overall decrease in the rate of heat generation by the waste.

4.2.2 Current Status of Tank 241-AW-102

Tank 241-AW-102 entered service in August 1980 and currently stores 86,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 966,000 gallons and configuration of risers in January 1994. At the time of the estimate, there were 966,000 gallons of supernatant with 1,000 gallons of concentrated supernatant solids. The waste level in the tank is measured with the PIC gauge and the manual tape and has decreased and increased from about 370 inches in January 1991 to 31 inches in January 1995. The decrease was mostly waste sent to Tank 241-AW-106 in September 1992 and various 242-A Evaporator campaigns. The increase was from the 242-A Evaporator between August 1992 and January 1994. Other increases were from waste transferred from Tank 241-AP-103 in May 1994, and Tanks 241-AP-101, -107, and -108 in October 1994. This tank is an active feed tank to the 242-A Evaporator. The tank is actively ventilated and categorized as sound. Tank 241-AW-102 has 64 risers. One 20-inch riser (no.25A) and two 42-inch risers (no.5A and no.5B) are available for use.

4.2.2.1 Inventory Estimate of Tank 241-AW-102

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew 1995) and Supernatant Mixing Model (Agnew 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AW-102 are also presented. Concentrated supernatant solids are considered as an integral part of the liquid for the purpose of estimating inventories, but are graphed as solids on the level histories. The actual substance, which was derived from double-shell slurry, appears as a solid if undisturbed, but the particles are resuspended in solution if heated or disturbed.

4.2.2.2 In-Tank Photograph of Tank 241-AW-102

No in-tank photographs are available.

4.2.3 Synopsis of Tank 241-AW-102

(To be completed.)

DN:

UNK:

NOTES:

CONSTRUCT 1978-1980
 NOMINAL CAPACITY: 1,160,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE,
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

1,188,000
 1,122,000
 1,056,000
 990,000
 924,000
 858,000
 792,000
 726,000
 660,000
 594,000
 528,000
 462,000
 396,000
 330,000
 264,000
 198,000
 132,000
 66,000
 0

NCPLX: NON-COMPLEXED WASTE
 EVFD: EVAPORATOR FEED
 HFW: HANFORD FACILITY WASTE
 DN: DILUTE NON-COMPLEXED WASTE
 PL2: PUREX LOW-LEVEL WASTE
 BL: B PLANT LOW-LEVEL WASTE
 N: N REACTOR WASTE
 SWLQ: SALTWELL LIQUOR
 UNK: UNKNOWN

LEGEND

□-□-□ LIQUID OBSERVATION
 WELL (LOW)
 — LIQUID LEVEL
 // SOLIDS LEVEL
 |||| SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

**AW TANK FARM
PLOT PLAN**

SUPERNATANT 965 KGAL
 CS SOLIDS 1KGAL
 See necessary for abbreviations and definitions

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AW-102 DOUBLE-SHELL TANK
 LEVEL HISTORY 1986 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: N/A

SIZE B	BLDG NO. 241	TANK NO. ES-TKS-E166	DATE 6/95
SCALE NONE	JOB NO.	SHEET 1 OF 1	

Double-Shell Tank 241-AW-102			
Total Inventory Estimate*			
Physical Properties			
Total Waste	4.21E+06 kg (966 kgal)		
Heat Load	2.10 kW (7.19E+03 BTU/hr)		
Bulk Density†	1.13 (g/cc)		
Water wt%†	75.9		
TOC wt% C	0.360		
Chemical Constituents			
Conc	mg/L	ppm	kg
Na ⁺	3.40	6.78E+04	2.85E+05
Al ³⁺	0.368	8.62E+03	3.63E+04
Fe ³⁺ (total Fe)	4.19E-03	203	855
Cr ³⁺	1.13E-02	569	2.14E+03
B ³⁺	2.07E-04	37.5	158
Li ⁺	1.36E-06	0.164	0.691
Hg ²⁺	4.74E-06	0.825	3.47
Zn (as Zn(OH) ₂)	1.16E-03	91.6	385
Pb ²⁺	3.96E-05	7.12	30.0
Ni ²⁺	2.55E-03	130	547
Sr ²⁺	1.44E-06	0.109	0.460
Mn ²⁺	5.08E-03	242	1.02E+03
Ca ²⁺	2.93E-02	1.02E+03	4.30E+03
K ⁺	8.47E-02	2.88E+03	1.21E+04
OH ⁻	1.69	2.49E+04	1.05E+05
NO ₃ ⁻	1.51	8.11E+04	3.42E+05
NO ₂ ⁻	0.369	1.47E+04	6.20E+04
CO ₃ ²⁻	0.238	1.24E+04	5.21E+04
PO ₄ ³⁻	6.98E-02	5.75E+03	2.42E+04
SO ₄ ²⁻	8.01E-02	6.69E+03	2.82E+04
Si (as SiO ₂)	1.80E-02	438	1.85E+03
F ⁻	9.61E-02	1.59E+03	6.68E+03
Cl ⁻	5.63E-02	1.73E+03	7.30E+03
C ₂ H ₃ O ₂ ⁻	1.03E-02	1.69E+03	7.12E+03
EDTA ⁴⁻	2.92E-03	730	3.07E+03
HEDTA ³⁻	4.83E-03	1.15E+03	4.84E+03
glycolate ⁻	8.23E-02	5.36E+03	2.26E+04
acetate ⁻	3.22E-03	165	694
oxalate ²⁻	5.13E-06	0.392	1.63
DBP	4.84E-03	676	2.85E+03
benzene	4.84E-03	311	1.31E+03
NH ₃	0.292	4.30E+03	1.81E+04
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		2.31E-02 (μCi/g)	1.62 (kg)
U	3.48E-03 (M)	720 (μg/g)	3.03E+03 (kg)
Cs	0.109 (Ci/L)	94.8 (μCi/g)	3.99E+05 (Ci)
Sr	9.53E-03 (Ci/L)	8.28 (μCi/g)	3.48E+04 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AW-102			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	4.21E+06 kg	(966 kgal)	
Heat Load	2.10 kW (7.19E+03 BTU/hr)		
Bulk Density*	1.15 (g/cc)		
Water wt%	75.9		
TOC wt% C (wet)	0.360		
Chemical Constituents			
	mole/l	ppm	ppb
Na ⁺	3.40	6.78E+04	2.85E+05
Al ³⁺	0.368	8.62E+03	3.63E+04
Fe ³⁺ (total Fe)	4.19E-03	203	855
Cr ³⁺	1.13E-02	509	2.14E+03
B ³⁺	2.07E-04	37.5	158
La ³⁺	1.36E-06	0.164	0.691
Hg ²⁺	4.74E-06	0.825	3.47
Zr (as ZrO(OH) ₂)	1.16E-03	91.6	385
Pb ²⁺	3.96E-05	7.12	30.0
Ni ²⁺	2.55E-03	130	547
Sr ²⁺	1.44E-06	0.109	0.460
Mn ²⁺	5.08E-03	242	1.02E+03
Ca ²⁺	2.93E-02	1.02E+03	4.30E+03
K ⁺	8.47E-02	2.88E+03	1.21E+04
OH ⁻	1.59	2.49E+04	1.05E+05
NO ₃ ⁻	1.51	8.11E+04	3.42E+05
NO ₂ ⁻	0.369	1.47E+04	6.20E+04
CO ₃ ²⁻	0.238	1.24E+04	5.21E+04
PO ₄ ³⁻	6.98E-02	5.75E+03	2.42E+04
SO ₄ ²⁻	8.01E-02	6.69E+03	2.82E+04
Si (as SiO ₂)	1.80E-02	438	1.85E+03
F ⁻	9.61E-02	1.59E+03	6.68E+03
Cl ⁻	5.63E-02	1.73E+03	7.30E+03
C ₂ H ₃ O ₂ ⁻	1.03E-02	1.69E+03	7.12E+03
EDTA ⁴⁻	2.92E-03	730	3.07E+03
HEDTA ³⁻	4.83E-03	1.15E+03	4.84E+03
glycolate ⁻	8.23E-02	3.36E+03	2.26E+04
acetate ⁻	3.22E-03	165	694
oxalate ²⁻	5.13E-06	0.392	1.63
DBP	4.84E-03	676	2.85E+03
butanol	4.84E-03	311	1.31E+03
NH ₃	0.292	4.30E+03	1.81E+04
Fe(CN) ₆ ⁴⁻	0	0	0
Radiochemical Constituents			
Pu	26.6 (μCi/L)		1.62 (kg)
U	3.48E-03 (M)	720 (μg/g)	3.03E+03 (kg)
Cs	0.109 (Ci/L)	94.8 (μCi/g)	3.99E+05 (Ci)
Sr	9.53E-03 (Ci/L)	8.28 (μCi/g)	3.48E+04 (Ci)

*Density is calculated based on Na, OH, and AlO₂.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AW-102			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	0 kg	(0 kgal)	
Heat Load	0 kW (0 BTU/hr)		
Bulk Density	0 (g/cc)		
Water wt%	0		
TOC wt% C (wet)	0		
Chemical Constituents			
	mole/l	ppm	ppb
Na ⁺	0	0	0
Al ³⁺	0	0	0
Fe ³⁺ (total Fe)	0	0	0
Cr ³⁺	0	0	0
B ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0	0	0
Sr ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	0	0	0
K ⁺	0	0	0
OH ⁻	0	0	0
NO ₃ ⁻	0	0	0
NO ₂ ⁻	0	0	0
CO ₃ ²⁻	0	0	0
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₂)	0	0	0
F ⁻	0	0	0
Cl ⁻	0	0	0
C ₂ H ₃ O ₂ ⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	0	0	0
Fe(CN) ₆ ⁴⁻	0	0	0
Radiochemical Constituents			
Pu		0	0
U	0	0	0
Cs	0	0	0
Sr	0	0	0

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

4.3 Tank 241-AW-103

4.3.1 241-AW-103 Tank History

4.3.1.1 Waste History of Tank 241-AW-103

Tank 241-AW-103 began service by receiving non-complexed waste in July 1980. From the following month until November 1981, the tank received double-shell slurry feed waste. The tank received PUREX waste from the second quarter of 1983 until the fourth quarter of 1988. From December 1981 until March 1983, the tank received dilute double-shell slurry feed waste. During April and May 1983, the tank received double-shell slurry feed waste. The tank received non-complexed waste from June 1983 until May 1990. From June 1990 until the present, the tank has contained dilute non-complexed and PUREX neutralized cladding removal waste. The tank has not received waste since the third quarter of 1992. The tank is currently an inactive dilute receiver tank.

4.3.1.2 Temperature History of Tank 241-AW-103

Temperature data for Tank 241-AW-103 are recorded by 18 thermocouples at known elevations on one tree inside the tank, located in riser 4A. Non-suspect temperature data taken between July 1983 and June 1991 for all 18 thermocouples were available from the computer automated surveillance system. Non-suspect temperature data recorded between July 1990 and September 1993 from 12 of the thermocouples were available from the surveillance analysis computer system. However, not all of the 12 thermocouples have data that encompass the entire length of time. Within the time spans for both systems, there were several small breaks in the sequence of temperature data. The average temperature during these periods was 76°F with a minimum of 59°F, a maximum of 100°F, and a standard deviation of 8.8°F. Linear regressions were performed on each thermocouple that had temperature data between January 1990 and January 1994. The slopes from these regressions were averaged with a resulting average slope of -0.0058. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

4.3.1.3 Occurrences of Tank 241-AW-103

Seven unusual events occurred at tank 241-AW-103. TFS & O-EFS-88-0146 and Off-Normal Reports 85-47, 85-15, 85-13, and 85-09 were written when transfers of waste caused the tank to pressurize. TFS & O-EFS-88-007 concerns an unexpected waste transfer. Off-Normal Report 85-25 was written because improper use of equipment caused the tank to pressurize.

4.3.1.4 Psychrometrics of Tank 241-AW-103

Psychrometric data have been recorded for 13 years from this tank and annulus. The apparent trend of the evaporation rate from the tank has decreased from 171.9 gallons per week in November 1980 to 101.1 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank and annular ventilation has

apparently decreased. A review of the psychrometric data in Tank 241-AW-103 would suggest an overall decrease in the rate of heat generation by the waste.

4.3.2 Current Status of Tank 241-AW-103

Tank 241-AW-103 entered service in August 1980 and currently stores 515,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 647,000 gallons and configuration of risers as of January 1994. At the time of the estimate, there were 284,000 gallons of supernatant and 363,000 gallons of coating waste from 2 Plant and REDOX (CW/ZR2). The waste level in the tank is measured with the FIC gauge and the manual tape and has decreased from 235 inches to 187 inches in 1995. The decrease is due to a waste transfer to Tank 241-AP-107 in October 1994. This tank is inactive at the present. The tank is actively ventilated and categorized as sound. Tank 241-AW-103 has 59 risers. Two 4-inch risers (no.10A and no.15A), one 12-inch riser (no.7A), and two 42-inch risers (no.5A and no.5B) are available for use.

4.3.2.1 Inventory Estimate of Tank 241-AW-103

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew 1995) and Supernatant Mixing Model (Agnew 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AW-103 are also presented.

4.3.2.2 In-Tank Photograph of Tank 241-AW-103

No in-tank photographs are available.

4.3.3 Synopsis Tank of 241-AW-103

(To be completed.)

ANDERSON 1990
WASTE TYPES

NCPLX:
DSSF:

DDSSF:

DSSF:
NCPLX:

PRIMARY
ADDITIONS

CWPZR2:

UN

LEVEL IN
FEET
LEVEL IN
INCHES

36' 432"
34' 408"
32' 384"
30' 360"
28' 336"
26' 312"
24' 288"
22' 264"
20' 240"
18' 216"
16' 192"
14' 168"
12' 144"
10' 120"
8' 96"
6' 72"
4' 48"
2' 24"
0' 0"

LIQUID
LEVEL

1977 78 79 80 81 82 83 84 85 86 87 88

YEARS

DN/PD:

PL2:

NOTES:

CONSTRUCT 1978-1980
 NOMINAL CAPACITY: 1,160,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE,
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

— 1,188,000

— 1,122,000

— 1,056,000

— 990,000

— 924,000

— 858,000

— 792,000

— 726,000

— 660,000

— 594,000

— 528,000

— 462,000

— 396,000

— 330,000

— 264,000

— 198,000

— 132,000

— 66,000

— 0

NCPLX. NON-COMPLEXED WASTE
 DSSF. DOUBLE-SHELL SLURRY FEED WASTE
 DSSF. DILUTE DOUBLE-SHELL SLURRY FEED
 CWPZR2: PUREX CLADDING WASTE (ZIRCALOY)
 DN/PD: DILUTE NON-COMPLEXED WASTE / PUREX
 NEUTRALIZED CLADDING REMOVAL WASTE
 UNK: UNKNOWN
 PL2: PUREX LOW-LEVEL WASTE

LEGEND

— — — LIQUID OBSERVATION
 WELL (LOW)
 — LIQUID LEVEL
 // // // SOLIDS LEVEL
 + + + + + SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

AW TANK FARM
PLOT PLAN SOLIDS
LEVEL

SUPERNATANT 284 KGAL
 CW/ZR2 363 KGAL
 See glossary for abbreviations and definitions

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AW-103 DOUBLE-SHELL TANK
 LEVEL HISTORY 1986 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: N/A

SIZE	BLDG NO	OWG NO	DATE
B	241	ES-TKS-E167	6/95
SCALE	NONE	JOB NO.	SHEET 1 OF 1

Double-Shell Tank 241-AW-103			
Total Inventory Estimate*			
Physical Properties			
Total Waste	2.84E+06 kg	(647 kgal)	
Heat Load	9.91E-02 kW	(338 BTU/hr)	
Bulk Density†	1.16 (g/cc)		
Water wt%†	80.1		
TOC wt% C	0.009		
Chemical Constituents			
Na ⁺	3.28	6.49E+04	1.85E+05
Al ³⁺	9.12E-03	212	603
Fe ³⁺ (total Fe)	0.205	9.85E+03	2.80E+04
Cr ³⁺	3.48E-04	15.6	44.3
BP ³⁺	8.56E-06	1.54	4.38
La ³⁺	3.87E-08	4.64E-03	1.32E-02
Hf ³⁺	1.07E-03	185	527
Zr (as ZrO(OH) ₂)	0.521	4.09E+04	1.16E+05
Pb ²⁺	1.33E-06	0.238	0.675
Ni ²⁺	6.15E-05	3.11	8.83
Sr ²⁺	4.09E-08	3.09E-03	8.78E-03
Mn ²⁺	1.61E-04	7.61	21.6
Ca ²⁺	3.30E-02	1.14E+03	3.23E+03
K ⁺	0.157	5.27E+03	1.50E+04
OH ⁻	2.80	4.10E+04	1.17E+05
NO ₃ ⁻	0.304	1.62E+04	4.61E+04
NO ₂ ⁻	1.99E-02	791	2.25E+03
CO ₃ ²⁻	3.79E-02	1.96E+03	5.57E+03
PO ₄ ³⁻	2.19E-03	179	510
SO ₄ ²⁻	2.03E-03	168	477
Si (as SiO ₂)	3.68E-04	8.92	25.3
F ⁻	3.02	4.95E+04	1.41E+05
Cl ⁻	4.57E-03	140	397
C ₂ H ₃ O ₂ ⁻	2.68E-04	43.7	124
EDTA ⁴⁻	1.18E-04	29.2	83.1
HEDTA ³⁻	1.91E-04	45.1	128
glycolate ⁻	1.31E-03	84.4	240
acetate ⁻	1.44E-04	7.32	20.8
oxalate ²⁻	1.46E-07	1.11E-02	3.15E-02
DBP	1.78E-04	24.8	70.3
Inulinol	1.78E-04	11.4	32.4
NH ₃	0.547	8.02E+03	2.28E+04
Fe(CN) ₆ ⁴⁻	0	0	0
Radioisotopic Constituents			
Pu		0.454 (μCi/g)	21.5 (kg)
U	2.08E-03 (M)	427 (μCi/g)	1.21E+03 (kg)
Cs	4.96E-03 (Ci/L)	4.28 (μCi/g)	1.22E+04 (Ci)
Sr	2.56E-03 (Ci/L)	2.20 (μCi/g)	6.26E+03 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AW-103			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	1.09E+06 kg	(284 kgal)	
Heat Load	5.39E-02 kW	(184 BTU/hr)	
Bulk Density*	1.02 (g/cc)		
Water wt%	95.9		
TOC wt% C (wet)	0.021		
Chemical Constituents			
	mole/l	mm	kg
Na ⁺	0.431	9.74E+03	1.06E+04
Al ³⁺	2.08E-02	551	603
Fe ³⁺ (total Fe)	1.16E-03	63.5	69.4
Cr ³⁺	7.92E-04	40.5	44.3
B ³⁺	1.95E-05	4.01	4.38
La ³⁺	8.82E-08	1.21E-02	1.32E-02
Hg ²⁺	5.11E-06	1.01	1.10
Zr (as ZrO(OH) ₂)	1.51E-03	135	148
Pb ²⁺	3.03E-06	0.618	0.675
Ni ²⁺	1.40E-04	8.09	8.85
Sr ²⁺	9.32E-08	8.03E-03	8.78E-03
Mn ²⁺	3.66E-04	19.8	21.6
Ca ²⁺	8.09E-03	319	349
K ⁺	0.112	4.31E+03	4.72E+03
OH ⁻	0.143	2.43E+03	2.66E+03
NO ₃ ⁻	0.264	1.61E+04	1.75E+04
NO ₂ ⁻	3.64E-02	1.65E+03	1.80E+03
CO ₃ ²⁻	1.94E-02	1.14E+03	1.25E+03
PO ₄ ³⁻	4.99E-03	466	510
SO ₄ ²⁻	4.62E-03	436	477
Si (as SiO ₂)	8.39E-04	23.2	25.3
F ⁻	0.121	2.26E+03	2.47E+03
Cl ⁻	5.31E-03	185	202
C ₂ H ₃ O ₂ ⁻	6.11E-04	114	124
EDTA ⁴⁻	2.68E-04	76.0	83.1
HEDTA ³⁻	4.34E-04	117	128
glycolate ⁻	2.97E-03	219	240
acetate ⁻	3.28E-04	19.0	20.8
oxalate ²⁻	3.33E-07	2.88E-02	3.15E-02
DBP	4.06E-04	64.4	70.3
butanol	4.06E-04	29.6	32.4
NH ₃	0.391	6.54E+03	7.15E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	12.8 (μCi/L)		0.230 (kg)
U	1.57E-03 (M)	368 (μg/g)	402 (kg)
Cs	7.59E-03 (Ci/L)	7.46 (μCi/g)	8.15E+03 (Ci)
Sr	2.16E-03 (Ci/L)	2.13 (μCi/g)	2.32E+03 (Ci)

*Density is calculated based on Na, OH⁻, and AlO₂⁻.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AW-103			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	1.75E+06 kg	(363 kgal)	
Heat Load	4.52E-02 kW	(155 BTU/hr)	
Bulk Density	1.27 (g/cc)		
Water wt%	67.8		
TOC wt% C (wet)	0		
Chemical Constituents			
	mole/l	mm	kg
Na ⁺	5.50	9.95E+04	1.74E+05
Al ³⁺	0	0	0
Fe ³⁺ (total Fe)	0.364	1.60E+04	2.79E+04
Cr ³⁺	0	0	0
B ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	1.91E-03	301	326
Zr (as ZrO(OH) ₂)	0.927	6.65E+04	1.16E+05
Pb ²⁺	0	0	0
Ni ²⁺	0	0	0
Sr ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	5.24E-02	1.65E+03	2.89E+03
K ⁺	0.197	5.88E+03	1.03E+04
OH ⁻	4.88	6.52E+04	1.14E+05
NO ₃ ⁻	0.335	1.63E+04	2.85E+04
NO ₂ ⁻	7.04E-03	255	445
CO ₃ ²⁻	5.24E-02	2.47E+03	4.32E+03
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₂)	0	0	0
F ⁻	2.29	7.90E+04	1.38E+05
Cl ⁻	4.00E-03	111	193
C ₂ H ₃ O ₂ ⁻	0	0	0
BDTA ⁴⁻	0	0	0
HBDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	0.669	8.94E+03	1.56E+04
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0.730 (μCi/g)	21.3 (kg)
U	2.48E-03 (M)	464 (μg/g)	811 (kg)
Cs	2.91E-03 (Ci/L)	2.29 (μCi/g)	4.00E+03 (Ci)
Sr	2.86E-03 (Ci/L)	2.25 (μCi/g)	3.94E+03 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

4.4 Tank 241-AW-104

4.4.1 241-AW-104 Tank History

4.4.1.1 Waste History of Tank 241-AW-104

Tank 241-AW-104 began service by receiving non-complexed waste in July 1980. The tank received non-complexed waste until July 1981, and again from October 1982 until May 1990. During August, September, and October 1981, the tank received complexant concentrate waste. From November 1981 to September 1982, the tank received complexed waste. The tank contained non-complexed waste from October 1982 until May 1990. The tank received waste from PUREX from the third quarter of 1986 until the second quarter of 1991. From June 1990 until the present, the tank has contained dilute non-complexed waste. The tank has not received waste since the third quarter of 1992. Currently, the tank is an inactive dilute receiver tank.

4.4.1.2 Temperature History of Tank 241-AW-104

Temperature data for Tank 241-AW-104 are recorded by 18 thermocouples at known elevations on one thermocouple tree inside the tank, located in riser 4A. Non-suspect temperature data taken between July 1983 and June 1991 for all 18 thermocouples were available from the computer automated surveillance system. Non-suspect temperature data recorded between July 1989 and September 1993 for 12 thermocouples were available from the surveillance analysis computer system. However, not all of the 12 thermocouples have data that encompass the entire length of time. Within the time spans for both systems, there were several small breaks in the sequence of temperature data. The average temperature during these periods was 90°F with a minimum of 62°F, a maximum of 133°F, and a standard deviation of 14°F. Linear regressions were performed on each thermocouple that had temperature data between January 1990 and January 1994. The slopes from these regressions were averaged resulting in a slope of -0.011. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

4.4.1.3 Occurrences of Tank 241-AW-104

Two unusual events occurred at this tank since it went into service. Off-Normal Report 83-14 was issued in December 1986 due to transferring solution from 242-A Evaporator to Tank 241-AW-102. The tank pressurized to +0.65 inches water gauge. Off Normal Report 86-55 was issued in December 1986 due to a test on the ventilation system at AW Tank Farm. The tank maintained a negative pressurize of -0.05 inches water gauge, but exceeded the limits specified for ventilation.

4.4.1.4 Psychrometrics of Tank 241-AW-104

Psychrometric data have been recorded for 12 years from this tank and annulus. The apparent trend of the evaporation rate from the tank has decreased from 175.4 gallons per week in October 1981 to 124.6 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank ventilation has decreased. The rates of heat exchange through annular ventilation show an increasing trend. The majority of the changes in the rate of heat exchange can be attributed to changes in the average ventilation rates. A review of the psychrometric data in Tank 241-AW-104 would suggest a decrease in the rate of heat generation by the waste.

4.4.2 Current Status of Tank 241-AW-104

Tank 241-AW-104 entered service in August 1980 and currently stores 1,123,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 1,123,000 gallons and configuration of risers as of January 1994. At the time of the estimate, there were 1,020,000 gallons of supernatant with 187,000 gallons of concentrated supernatant solids; 98,000 gallons of PUREX low-level waste (PL2); and 5,000 gallons of coating waste from Z Plant and REDOX (CW/ZR2). The waste level in the tank is measured with the FIC gauge and the manual tape and has increased from about 360 inches in January 1991 to 410 inches in January 1994. The increase was mostly dilute and non-complexed waste from PUREX miscellaneous streams between January 1991 and March 1991. The tank is inactive at this time. The tank is actively ventilated and categorized as sound. Tank 241-AW-104 has 59 risers. Two 4-inch risers (no.15A and no.19C), one 12-inch riser (no.7B), and two 42-inch risers (no.5A and no.5B) are available for use.

4.4.2.1 Inventory Estimate of Tank 241-AW-104

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew, 1995) and Supernatant Mixing Model (Agnew, 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AW-104 are also presented. Concentrated supernatant solids are considered as an integral part of the liquid for the purpose of estimating inventories, but are graphed as solids on the level histories. The actual substance, which was derived from double-shell slurry, appears as a solid if undisturbed, but the particles are resuspended in solution if heated or disturbed.

4.4.2.2 In-Tank Photograph for Tank 241-AW-104

As of April 1994, Tank 241-AW-104 contained 1,122,000 gallons of dilute non-complexed waste (Hanlon 1994) from PUREX which corresponds with a waste height of about 34 feet. The collage for this tank was produced from 1983 photographs and shows liquid at a much lower level. In this picture, the liquid appears to be black with some very fine particles suspended on the surface and distributed in random patterns. The tank

walls are only slightly rusted. The location of equipment in the tank should be unchanged from 1983. Equipment which are identified include a saltwell screen, an FIC level probe, a temperature probe, and a high-level sensor.

4.4.3 Synopsis of Tank 241-AW-104

(To be completed.)

DN:

NOTES:

CONSTRUCT 1978-1980
 NOMINAL CAPACITY: 1,160,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE,
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

1,188,000

1,122,000

1,056,000

990,000

924,000

858,000

792,000

726,000

660,000

594,000

528,000

462,000

396,000

330,000

264,000

198,000

132,000

66,000

0

NCPLX: NON-COMPLEXED WASTE
 CC: COMPLEXANT CONCENTRATE WASTE
 CPLX: COMPLEXED WASTE
 DN: DILUTE NON-COMPLEXED WASTE
 CWPZR2: PUREX CLADDING WASTE (ZIRCALOY)
 PL2: PUREX LOW-LEVEL WASTE
 UNK: UNKNOWN

LEGEND

□ □ □ LIQUID OBSERVATION
 WELL (LOW)
 — LIQUID LEVEL
 // // // SOLIDS LEVEL
 // // // SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

AW TANK FARM
PLOT PLAN SOLIDS
LEVEL

SUPERNATANT 833 KGAL
 CS SOLIDS 187 KGAL
 PL2 98 KGAL
 CWR/ZR2 5 KGAL

See glossary for abbreviations and definitions

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AW-104 DOUBLE-SHELL TANK
 LEVEL HISTORY 1986 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: N/A

SIZE	BUDG NO.	DWG NO.	DATE
B	241	ES-TKS-E168	6/95
SCALE	NONE	JOB NO.	SHEET 1 OF 1

Double-Shell Tank 241-AW-104			
Total Inventory Estimate*			
Physical Properties			
Total Waste	4.40E+06 kg (1.12E+03 kgal)		
Heat Load	3.11 kW (1.06E+04 BTU/hr)		
Bulk Density†	1.04 (g/cc)		
Water wt%	94.1		
TOC wt% C	0.041		
Chemical Constituents			
Na ⁺	0.618	1.37E+04	6.04E+04
Al ³⁺	1.87E-03	48.6	214
Fe ³⁺ (total Fe)	0.169	9.13E+03	4.02E+04
Cr ³⁺	7.24E-03	366	1.61E+03
Bi ³⁺	1.84E-06	0.371	1.63
La ³⁺	8.45E-09	1.13E-03	4.99E-03
Hg ²⁺	8.50E-06	1.65	7.25
Zr (as ZrO(OH) ₂)	4.13E-03	364	1.60E+03
Pb ²⁺	3.94E-05	7.88	34.7
Ni ²⁺	1.12E-02	638	2.81E+03
Sr ²⁺	8.93E-09	7.55E-04	3.32E-03
Mn ²⁺	5.44E-03	288	1.27E+03
Ca ²⁺	3.05E-02	1.18E+03	5.20E+03
K ⁺	6.31E-03	238	1.05E+03
OH ⁻	0.561	9.22E+03	4.06E+04
NO ₃ ⁻	0.235	1.40E+04	6.18E+04
NO ₂ ⁻	1.58E-02	701	3.09E+03
CO ₃ ²⁻	0.123	7.15E+03	3.15E+04
PO ₄ ³⁻	6.31E-02	5.78E+03	2.55E+04
SO ₄ ²⁻	4.06E-03	377	1.66E+03
Si (as SiO ₂)	7.47E-05	2.03	8.92
F ⁻	2.37E-02	434	1.91E+03
Cl ⁻	3.81E-03	130	573
C ₂ H ₃ O ₂ ⁻	5.64E-05	10.3	45.3
EDTA ⁴⁻	2.69E-05	7.49	33.0
HEDTA ³⁻	4.48E-05	11.9	52.2
glycolate ⁻	2.35E-04	17.0	74.8
acetate ⁻	2.89E-05	1.65	7.25
oxalate ²⁻	3.19E-08	2.71E-03	1.19E-02
DBP	2.87E-03	472	2.08E+03
hydrol	2.87E-03	206	906
NH ₃	3.03E-03	49.8	219
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		1.91E-02 (μCi/g)	1.40 (kg)
U	4.39E-04 (M)	101 (μg/g)	444 (kg)
Cs	2.76E-02 (Ci/L)	26.7 (μCi/g)	1.17E+05 (Ci)
Sr	8.93E-02 (Ci/L)	85.2 (μCi/g)	3.80E+05 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AW-104			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	3.95E+06 kg (1.02E+03 kgal)		
Heat Load	0.667 kW (2.28E+03 BTU/hr)		
Bulk Density*	1.02 (g/cc)		
Water wt%	95.6		
TOC wt% C (wet)	0.042		
Chemical Constituents			
	mol/L	g/L	kg
Na ⁺	0.597	1.34E+04	5.30E+04
Al ³⁺	2.05E-03	54.2	214
Fe ³⁺ (total Fe)	1.82E-03	99.4	392
Co ²⁺	7.31E-03	372	1.47E+03
Bi ³⁺	2.02E-06	0.414	1.63
La ³⁺	9.30E-09	1.26E-03	4.99E-03
Hg ²⁺	1.31E-08	2.57E-03	1.02E-02
Zr (as ZrO(OH) ₂)	1.18E-06	0.105	0.415
Pb ²⁺	3.95E-05	8.01	31.6
Ni ²⁺	1.64E-03	93.9	371
Sr ²⁺	9.83E-09	8.42E-04	3.32E-03
Mn ²⁺	5.46E-03	293	1.16E+03
Ca ²⁺	1.27E-02	499	1.97E+03
K ⁺	5.48E-03	210	828
OH ⁻	2.39E-02	398	1.57E+03
NO ₃ ⁻	0.234	1.47E+04	5.61E+04
NO ₂ ⁻	1.61E-02	725	2.86E+03
CO ₃ ²⁻	0.106	6.22E+03	2.46E+04
PO ₄ ³⁻	6.33E-02	5.88E+03	2.32E+04
SO ₄ ²⁻	4.12E-03	387	1.53E+03
Si (as SiO ₂)	8.23E-05	2.26	8.92
F ⁻	1.27E-04	2.37	9.35
Cl ⁻	3.83E-03	133	523
C ₂ H ₃ O ₂ ⁻	6.21E-05	11.5	45.3
EDTA ⁴⁻	2.96E-05	8.35	33.0
HEDTA ³⁻	4.93E-05	13.2	52.2
glycolate ⁻	2.58E-04	18.9	74.8
acetate ⁻	3.18E-05	1.84	7.25
oxalate ²⁻	3.51E-08	3.02E-03	1.19E-02
DBP	2.89E-03	454	1.79E+03
butanol	2.89E-03	209	826
NH ₃	5.80E-05	0.965	3.81
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	0.844 (μCi/L)		5.43E-02 (kg)
U	4.30E-04 (M)	100 (μg/g)	395 (kg)
Cs	2.77E-02 (Ci/L)	27.1 (μCi/g)	1.07E+05 (Ci)
Sr	6.35E-03 (Ci/L)	6.21 (μCi/g)	2.45E+04 (Ci)

*Density is calculated based on Na, OH⁻, and AlO₂⁻.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AW-104			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	4.55E+05 kg (103 kgal)		
Heat Load	2.44 kW (8.33E+03 BTU/hr)		
Bulk Density	1.17 (g/cc)		
Water wt%	78.5		
TOC wt% C (wet)	0.034		
Chemical Constituents			
	mol/L	g/L	kg
Na ⁺	0.827	1.63E+04	7.41E+03
Al ³⁺	0	0	0
Fe ³⁺ (total Fe)	1.83	8.75E+04	3.98E+04
Co ²⁺	7.00E-03	312	142
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	9.26E-05	15.9	7.24
Zr (as ZrO(OH) ₂)	4.50E-02	3.32E+03	1.60E+03
Pb ²⁺	3.80E-05	6.75	3.07
Ni ²⁺	0.106	5.36E+03	2.44E+03
Sr ²⁺	0	0	0
Mn ²⁺	5.75E-03	247	112
Ca ²⁺	0.207	7.11E+03	3.23E+03
K ⁺	1.45E-02	487	221
OH ⁻	5.88	8.58E+04	3.90E+04
NO ₃ ⁻	0.237	1.26E+04	5.72E+03
NO ₂ ⁻	1.26E-02	496	226
CO ₃ ²⁻	0.296	1.52E+04	6.93E+03
PO ₄ ³⁻	6.08E-02	4.95E+03	2.25E+03
SO ₄ ²⁻	3.54E-03	291	132
Si (as SiO ₂)	0	0	0
F ⁻	0.257	4.18E+03	1.90E+03
Cl ⁻	3.61E-03	110	49.9
C ₂ H ₃ O ₂ ⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	2.75E-03	628	286
butanol	2.75E-03	175	79.6
NH ₃	3.25E-02	474	215
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0.178 (μCi/g)	1.35 (kg)
U	5.24E-04 (M)	107 (μg/g)	48.7 (kg)
Cs	2.64E-02 (Ci/L)	22.6 (μCi/g)	1.03E+04 (Ci)
Sr	0.911 (Ci/L)	781 (μCi/g)	3.55E+05 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

241-AW-104

Photo date 2 2 85

4.5 Tank 241-AW-105

4.5.1 241-AW-105 Tank History

4.5.1.1 Waste History of Tank 241-AW-105

Tank 241-AW-105 began service by receiving non-complexed waste in July 1980. The tank received complexant concentrate waste from August 1980 until May 1983. The tank received waste from PUREX from the second quarter of 1983 until the fourth quarter of 1988. From June 1983 until May 1990, the tank received non-complexed waste. During July 1986, the tank received double-shell slurry feed waste. From June 1990 until the present, the tank has contained dilute non-complexed waste and PUREX neutralized cladding removal waste. The tank is currently an active, dilute receiver tank receiving waste from PUREX.

4.5.1.2 Temperature History of Tank 241-AW-105

Temperature data for Tank 241-AW-105 are recorded by 18 thermocouples at known elevations on one thermocouple tree inside the tank, located in riser 4A. Non-suspect temperature data recorded between July 1983 and June 1991 for all 18 thermocouples were available from the computer automated surveillance system. Non-suspect temperature data taken between July 1989 and September 1993 for 12 thermocouples were available from the surveillance analysis computer system. However, not all of the 12 thermocouples have data that encompass the entire length of time. Within the time spans for both systems, there were several small breaks in the sequence of temperature data. The average temperature during these periods was 77°F with a minimum of 58°F, a maximum of 110°F, and a standard deviation of 11°F. Linear regressions were performed on each thermocouple that had temperature data between January 1990 and January 1994. The slopes from these regressions were averaged with a resulting average slope of -0.0058. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

4.5.1.3 Occurrences of Tank 241-AW-105

Three unusual events concerning Tank 241-AW-105 are described in TFS & O-EFS-88-0125, TFS & O-EFS-88-0123, and Off-Normal Report 86-21. Each report was written because transferring waste caused the tank to pressurize.

4.5.1.4 Psychrometrics of Tank 241-AW-105

Psychrometric data have been recorded for 13 years from this tank and annulus. The apparent trend of the evaporation rate from the tank has decreased from 198.3 gallons per week in September 1980 to -23.1 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank and annular ventilation has apparently decreased. A review of the psychrometric data in Tank 241-AW-105 would suggest an overall decrease in the rate of heat generation by the waste.

4.5.2 Current Status of Tank 241-AW-105

Tank 241-AW-105 entered service in August 1980 and currently stores 342,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 1,044,000 gallons and configuration of risers as of January 1994. At the time of the estimate, there were 804,000 gallons of supernatant with 43,000 gallons of concentrated supernatant solids; 215,000 gallons of coating waste from Z Plant and REDOX (CW/ZR2); and 25,000 gallons of PUREX low-level (PL2). The waste level in the tank is measured with the FIC gauge and the manual tape and has increased from about 330 inches in January 1991 to 380 inches in January 1994. The waste level decreased to 124 inches in January 1995. The increase was mostly the addition of dilute and non-complexed waste from PUREX miscellaneous streams between July 1992 and January 1994. The decrease was from a transfer to 241-AP-108 in December 1994. This tank is an active waste receiver of PUREX and is concentrated by the 242-A Evaporator. The tank is actively ventilated and categorized as sound. Tank 241-AW-105 has 59 risers. Two 4-inch risers (no.10A and no.15A) and two 42-inch risers (no.5A and no.5B) are available for use.

4.5.2.1 Inventory Estimate of Tank 241-AW-105

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew, 1995) and Supernatant Mixing Model (Agnew, 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AW-105 are also presented. Concentrated supernatant solids are considered as an integral part of the liquid for the purpose of estimating inventories, but are graphed as solids on the level histories. The actual substance, which was derived from double-shell slurry, appears as a solid if undisturbed, but the particles are resuspended in solution if heated or disturbed.

4.5.2.2 In-Tank Photograph of Tank 241-AW-105

No in-tank photographs are available.

4.5.3 Synopsis of Tank 241-AW-105

(To be completed.)

ANDERSON 1990
WASTE TYPES

NCPLX:
CC:

NCPLX:

NCPLX:
DSSF:

PRIMARY
ADDITIONS

BL:
PL2:

CWPZR2:
SWLIQ:

LEVEL IN
FEET
LEVEL IN
INCHES

36' 432"
34' 408"
32' 384"
30' 360"
28' 336"
26' 312"
24' 288"
22' 264"
20' 240"
18' 216"
16' 192"
14' 168"
12' 144"
10' 120"
8' 96"
6' 72"
4' 48"
2' 24"
0' 0"

LIQUID
LEVEL

FROM AW-104

TO AW-101
FROM AW-103

TO AW-102

FROM PUREX
TO AW-102

1977 78 79 80 81 82 83 84 85 86 87 88

YEARS

DN/PD:

UNK:

NOTES:

CONSTRUCT 1978-1980
 NOMINAL CAPACITY: 1,160,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE,
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

1,188,000

1,122,000

1,056,000

990,000

924,000

858,000

792,000

726,000

660,000

594,000

528,000

462,000

396,000

330,000

264,000

198,000

132,000

66,000

0

NCPLX: NON-COMPLEXED WASTE
 CC: COMPLEXANT CONCENTRATE WASTE
 DSSF: DOUBLE-SHELL SLURRY FEED WASTE
 DN/PD: DILUTE NON-COMPLEXED WASTE / PUREX
 NEUTRALIZED CLADDING REMOVAL WASTE
 BL: B PLANT LOW-LEVEL WASTE
 PL2: PUREX LOW-LEVEL WASTE
 CWPZR2: PUREX CLADDING WASTE (ZIRCALOY)
 SWLIQ: SALTWELL LIQUOR
 UNK: UNKNOWN

LEGEND

□ □ □ LIQUID OBSERVATION
 WELL (LOW)
 — LIQUID LEVEL
 // // // SOLIDS LEVEL
 // // // SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

AW TANK FARM
PLOT PLAN SOLIDS
LEVEL

SUPERNATANT 761 KGAL
 CS SOLIDS 43 KGAL
 PL2 1 KGAL
 CW/ZR2 215 KGAL
 PL2 24 KGAL

See glossary for abbreviations and definitions

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AW-105 DOUBLE-SHELL TANK
 LEVEL HISTORY 1986 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: N/A

SIZE	BLDG NO.	DWG NO.	DATE
B	241	ES-TKS-E169	6/95
SCALE	NONE	JOB NO.	SHEET 1 OF 1

Double-Shell Tank 241-AW-105			
Total Inventory Estimate*			
Physical Properties			
Total Waste	4.65E+06 kg (1.04E+03 kgal)		
Heat Load	1.95 kW (6.68E+03 BTU/hr)		
Bulk Density†	1.18 (g/cc)		
Water wt%	74.0		
TOC wt% C	0.273		
Chemical Constituents			
Na ⁺	3.78	7.39E+04	3.44E+05
Al ³⁺	0.280	6.42E+03	2.98E+04
Fe ³⁺ (total Fe)	0.123	5.86E+03	2.72E+04
Cr ³⁺	9.11E-03	402	1.87E+03
Bi ³⁺	1.89E-04	33.6	156
La ³⁺	1.21E-06	0.143	0.663
Hg ²⁺	3.98E-04	67.8	315
Zr (as ZrO(OH) ₂)	0.192	1.49E+04	6.93E+04
Pb ²⁺	3.07E-03	5.40	25.1
Ni ²⁺	4.52E-03	726	1.05E+03
Sr ²⁺	1.28E-06	9.50E-02	0.442
Mn ²⁺	3.84E-03	179	833
Ca ²⁺	3.67E-02	1.25E+03	5.81E+03
K ⁺	0.131	4.36E+03	2.03E+04
OH ⁻	2.44	3.89E+04	1.64E+05
NO ₃ ⁻	1.24	7.37E+04	3.05E+05
NO ₂ ⁻	0.328	1.45E+04	5.97E+04
CO ₃ ²⁻	0.190	1.09E+04	4.50E+04
PO ₄ ³⁻	5.37E-02	4.87E+03	2.01E+04
SO ₄ ²⁻	6.05E-02	5.56E+03	2.25E+04
Si (as SiO ₂)	1.28E-02	343	1.42E+03
F ⁻	1.19	2.09E+04	8.96E+04
Cl ⁻	4.49E-02	1.52E+03	6.28E+03
C ₂ H ₃ O ₂ ⁻	7.96E-03	1.44E+03	5.94E+03
BDTA ⁻	2.67E-03	736	3.04E+03
HBDTA ⁻	4.39E-03	1.15E+03	4.76E+03
glycolate ⁻	5.30E-02	3.95E+03	1.63E+04
acetate ⁻	3.04E-03	172	709
oxalate ²⁻	4.56E-06	0.384	1.59
DBP	4.05E-03	630	2.60E+03
butanol	4.05E-03	287	1.19E+03
NH ₃	0.446	7.16E+03	2.99E+04
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0.185 (pCi/g)	14.3 (kg)
U	3.40E-03 (M)	687 (μg/g)	3.20E+03 (kg)
Cs	6.17E-02 (C/L)	52.4 (pCi/g)	2.44E+05 (Ci)
Sr	3.05E-02 (C/L)	26.0 (pCi/g)	1.21E+05 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AW-105			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	3.51E+06 kg	(804 kgal)	
Heat Load	1.31 kW	(4.46E+03 BTU/hr)	
Bulk Density*	1.15 (g/cc)		
Water wt%	75.5		
TOC wt% C (wet)	0.354		
Chemical Constituents			
Na ⁺	3.42	6.83E+04	2.39E+05
Al ³⁺	0.363	8.51E+03	2.98E+04
Fe ³⁺ (total Fe)	3.85E-03	186	654
Cr ³⁺	1.16E-02	323	1.84E+03
Bi ³⁺	2.46E-04	44.5	156
La ³⁺	1.57E-06	0.189	0.663
Hg ²⁺	6.50E-06	1.13	3.97
Zr (as ZrO(OH) ₂)	1.63E-03	129	454
Pb ²⁺	3.86E-05	6.94	24.3
Ni ²⁺	2.39E-03	122	428
Sr ²⁺	1.66E-06	0.126	0.442
Mn ²⁺	4.81E-03	230	805
Ca ²⁺	2.69E-02	937	3.29E+03
K ⁺	0.119	4.04E+03	1.42E+04
OH ⁻	1.67	2.78E+04	8.66E+04
NO ₃ ⁻	1.52	9.21E+04	2.87E+05
NO ₂ ⁻	0.424	1.91E+04	5.94E+04
CO ₃ ²⁻	0.223	1.31E+04	4.07E+04
PO ₄ ³⁻	6.77E-02	6.29E+03	1.96E+04
SO ₄ ²⁻	7.84E-02	7.36E+03	2.29E+04
Si (as SiO ₂) ³	1.66E-02	455	1.42E+03
F ⁻	0.135	2.31E+03	7.80E+03
Cl ⁻	5.71E-02	1.98E+03	6.16E+03
C ₂ H ₃ O ₂ ⁻	1.03E-02	1.91E+03	5.93E+03
EDTA ⁴⁻	3.47E-03	977	3.04E+03
HEDTA ³⁻	5.70E-03	1.53E+03	4.76E+03
glycolate ⁻	7.14E-02	5.24E+03	1.63E+04
acetate ⁻	3.95E-03	228	709
oxalate ²⁻	5.92E-06	0.510	1.59
DBP	5.17E-03	813	2.53E+03
butanol	5.17E-03	374	1.17E+03
NH ₃	0.400	6.65E+03	2.07E+04
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	29.0 (μCi/L)		1.47 (kg)
U	3.74E-03 (M)	772 (μg/g)	2.71E+03 (kg)
Cs	7.85E-02 (Ci/L)	65.1 (μCi/g)	2.39E+05 (Ci)
Sr	9.20E-03 (Ci/L)	7.98 (μCi/g)	2.80E+04 (Ci)

*Density is calculated based on Na, OH⁻, and AlO₂⁻.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AW-105			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	1.15E+06 kg	(240 kgal)	
Heat Load	0.649 kW	(2.22E+03 BTU/hr)	
Bulk Density	1.26 (g/cc)		
Water wt%	68.9		
TOC wt% C (wet)	0.004		
Chemical Constituents			
Na ⁺	4.99	9.11E+04	1.04E+05
Al ³⁺	0	0	0
Fe ³⁺ (total Fe)	0.524	2.32E+04	2.66E+04
Cr ³⁺	7.66E-04	31.6	36.2
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	1.71E-03	272	311
Zr (as ZrO(OH) ₂)	0.830	6.01E+04	6.88E+04
Pb ²⁺	4.16E-06	0.684	0.783
Ni ²⁺	1.17E-02	543	622
Sr ²⁺	0	0	0
Mn ²⁺	5.74E-04	25.0	28.7
Ca ²⁺	6.93E-02	2.20E+03	2.52E+03
K ⁺	0.172	5.33E+03	6.10E+03
OH ⁻	4.99	7.27E+04	7.70E+04
NO ₃ ⁻	0.324	1.72E+04	1.83E+04
NO ₂ ⁻	7.65E-03	302	320
CO ₃ ²⁻	7.91E-02	4.07E+03	4.31E+03
PO ₄ ³⁻	6.66E-03	542	574
SO ₄ ²⁻	3.87E-04	31.9	33.8
Si (as SiO ₂) ³	0	0	0
F ⁻	4.74	7.72E+04	8.18E+04
Cl ⁻	3.96E-03	120	127
C ₂ H ₃ O ₂ ⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	3.01E-04	68.8	72.9
butanol	3.01E-04	19.2	20.3
NH ₃	0.599	8.74E+03	9.26E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0.674 (μCi/g)	12.9 (kg)
U	2.27E-03 (M)	428 (μg/g)	490 (kg)
Cs	3.48E-03 (Ci/L)	4.35 (μCi/g)	4.98E+03 (Ci)
Sr	0.102 (Ci/L)	81.1 (μCi/g)	9.29E+04 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

4.6 Tank 241-AW-106

4.6.1 241-AW-106 Tank History

4.6.1.1 Waste History of Tank 241-AW-106

Tank 241-AW-106 began service by receiving complexant concentrate waste in July 1980. The tank received complexed waste during August and September 1980. From October 1980 to February 1983, the tank received concentrated customer waste. The tank received double-shell slurry feed waste from March 1983 until May 1990. During July 1986, the tank received non-complexed waste. Since June 1990, the tank has contained dilute non-complexed waste. Currently, the tank is an active slurry receiver tank for the 242-A Evaporator.

4.6.1.2 Temperature History of Tank 241-AW-106

Temperature data for Tank 241-AW-106 are recorded by 18 thermocouples at known elevations on one thermocouple tree inside the tank, located in riser 4A. Non-suspect temperature data taken between July 1983 and June 1991 for all 18 thermocouples were available from the computer automated surveillance system. However, not all of the 18 thermocouples have data that encompass the entire length of time. Non-suspect temperature data for 12 thermocouples recorded between July 1989 and September 1993 were available from the surveillance analysis computer system. Not all of the 12 thermocouples have data that encompass the entire length of time. Within the time spans for both systems, there were several small breaks in the sequence of temperature data. The average temperature during these periods was 89°F with a minimum of 66°F, a maximum of 123°F, and a standard deviation of 13°F. Linear regressions were performed on each thermocouple that had temperature data between January 1990 and January 1994. The slopes from these regressions were averaged with a resulting average slope of -0.0037. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

4.6.1.3 Occurrences of Tank 241-AW-106

Four unusual events occurred at Tank 241-AW-106. Occurrence report RL--WHC-Tank Farm-1993-0020 and Off-Normal Report 84-42 were written because waste was transferred unexpectedly. Off-Normal Reports 86-20 and 85-19 involved the tank becoming pressurized during a transfer of waste.

4.6.1.4 Psychrometrics of Tank 241-AW-106

Psychrometric data have been recorded for 13 years from this tank and annulus. The apparent trend of the evaporation rate from the tank has increased from 127.1 gallons per week in September 1980 to 264.8 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank and annular ventilation has apparently increased. A review of the psychrometric data would suggest an overall increase in the rate of heat generation by the waste.

4.6.2 Current Status of Tank 241-AW-106

Tank 241-AW-106 entered service in August 1980 and currently stores 660,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 1,082,000 gallons and configuration of risers as of January 1994. At the time of the estimate, there were 1,081,000 gallons of supernatant with 295,000 gallons of concentrated supernatant solids and 1,000 gallons of low-level waste from B Plant. The waste level in the tank is measured with the FIC gauge and the manual tape and has increased from about 190 inches in January 1991 to 240 inches in January 1994. The increase was mostly waste received from Tank 241-AW-102 in August 1992 and with some waste from the 242-A Evaporator between August 1992 and January 1994. This tank is an active receiver for the 242-A Evaporator. The tank is actively ventilated and categorized as sound. Tank 241-AW-106 has 59 risers. Two 4-inch risers (no.13A and no.19C) and two 42-inch risers (no.5A and no.5B) are available for use.

4.6.2.1 Inventory Estimate of Tank 241-AW-106

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew, 1995) and Supernatant Mixing Model (Agnew, 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AW-106 are also presented. Concentrated supernatant solids are considered as an integral part of the liquid for the purpose of estimating inventories, but are graphed as solids on the level histories. The actual substance, which was derived from double-shell slurry, appears as a solid if undisturbed, but the particles are resuspended in solution if heated or disturbed.

4.6.2.2 In-Tank Photograph of Tank 241-AW-106

As of April 1994, Tank 241-AW-106 contained 988,000 gallons of dilute non-complexed waste from PUREX (Hanlon, 1994). The collage for this tank was produced from 1983 photographs. Tank contents were lower then than now and probably different, so the collage will not be representative of current tank contents. The 1983 picture shows some green and white materials crystallizing on the surface of a dark liquid. The tank walls are rusted, but not badly. The location of equipment in the tank should be unchanged from 1983. Equipment which are identified include a supernatant pump, an FIC level probe, a temperature probe, and a high-level sensor. The height of the waste in the tank currently is about 30 feet.

4.6.3 Synopsis of Tank 241-AW-106

(To be completed.)

ANDERSON 1990
WASTE TYPES

CC:
CPLX:
CCW:

DSSF:

NCPLX:
CC:

PRIMARY
ADDITIONS

BL:

DN:

NOTES:

CONSTRUCT 1978-1980
 NOMINAL CAPACITY: 1,160,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE,
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

UNK:

SULIO:

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

CC: COMPLEXANT CONCENTRATE WASTE
 CPLX: COMPLEXED WASTE
 CCW: CONCENTRATED CUSTOMER WASTE
 DSSF: DOUBLE-SHELL SLURRY FEED
 NCPLX: NON-COMPLEXED WASTE
 DN: DILUTE NON-COMPLEXED WASTE
 BL: B PLANT LOW-LEVEL WASTE
 UNK: UNKNOWN
 SWLIO: SALTWELL LIQUOR

LEGEND

□ — □ LIQUID OBSERVATION
 WELL (LOW)
 — LIQUID LEVEL
 // SOLIDS LEVEL
 + + + + SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

**AW TANK FARM
PLOT PLAN** SOLIDS
LEVEL

SUPERNATANT 786 KGAL
 CS SOLIDS 295 KGAL
 BL 1 KGAL

See glossary for abbreviations and definitions

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AW-106 DOUBLE-SHELL TANK
 LEVEL HISTORY 1986 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: N/A

SIZE	BLDG NO.	DWG NO.	DATE
B	241	ES-TKS-E170	6/95
SCALE	NONE	JOB NO.	SHEET 1 OF 1

Double-Shell Tank 241-AW-106			
Total Inventory Estimate*			
Physical Properties			
Total Waste	4.93E+06 kg (1.08E+03 kgal)		
Heat Load	2.79 kW (9.54E+03 BTU/hr)		
Bulk Density†	1.20 (g/cc)		
Water wt%†	69.0		
TOC wt% C	0.488		
Chemical Constituents			
Na ⁺	4.34	8.67E+04	4.27E+05
Al ³⁺	0.495	1.11E+04	5.47E+04
Fe ³⁺ (total Fe)	7.37E-03	342	1.69E+03
Cr ³⁺	1.48E-02	640	3.16E+03
Bi ³⁺	2.72E-04	47.2	233
La ³⁺	1.80E-06	0.207	1.02
Hg ²⁺	6.37E-06	1.06	5.23
Zr (as ZrO(OH) ₂)	1.56E-03	118	584
Pb ²⁺	5.33E-05	9.18	45.3
Ni ²⁺	3.71E-03	181	891
Sr ²⁺	1.90E-06	0.138	0.681
Mn ²⁺	6.85E-03	313	1.54E+03
Ca ²⁺	3.94E-02	1.31E+03	6.46E+03
K ⁺	0.115	3.73E+03	1.84E+04
OH ⁻	2.27	3.36E+04	1.58E+05
NO ₃ ⁻	2.02	1.09E+05	5.13E+05
NO ₂ ⁻	0.481	1.92E+04	9.06E+04
CO ₃ ²⁻	0.322	1.68E+04	7.92E+04
PO ₄ ³⁻	9.41E-02	7.75E+03	3.66E+04
SO ₄ ²⁻	0.107	8.94E+03	4.22E+04
Si (as SiO ₂)	2.49E-02	614	2.86E+03
F ⁻	0.130	2.14E+03	1.01E+04
Cl ⁻	7.48E-02	2.30E+03	1.09E+04
C ₂ H ₃ O ₂ ⁻	1.40E-02	2.29E+03	1.08E+04
BDTA ⁺	3.83E-03	938	4.52E+03
HBDTA ⁺	6.35E-03	1.51E+03	7.12E+03
glycolate ⁻	0.114	7.41E+03	3.49E+04
acetate ⁻	4.23E-03	217	1.02E+03
oxalate ²⁻	6.78E-06	0.517	2.44
DBP	6.45E-03	901	4.26E+03
butanol	6.45E-03	415	1.96E+03
NH ₃	0.395	5.82E+03	2.73E+04
Fe(CN) ₆ ⁴⁻	0	0	0
Radiochemical Constituents			
Pa		3.06E-02 (μCi/g)	2.52 (kg)
U	5.93E-03 (M)	1.17E+03 (μCi/g)	5.79E+03 (kg)
Cs	0.111 (C/L)	92.3 (μCi/g)	4.53E+05 (Ci)
Sr	2.40E-02 (C/L)	19.9 (μCi/g)	9.82E+04 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AW-106			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	4.92E+06 kg	(1.03E+03 kgal)	
Heat Load	2.49 kW	(8.50E+03 BTU/hr)	
Bulk Density*	1.29 (g/cc)		
Water wt%	69.1		
TOC wt% C (wet)	0.489		
Chemical Constituents			
	mg/L	mmol	kg
Na ⁺	4.54	8.67E+04	4.27E+03
Al ³⁺	0.494	1.11E+04	5.45E+04
Fe ³⁺ (total Fe)	5.60E-03	260	1.28E+03
Co ²⁺	1.48E-02	641	3.16E+03
Br ⁻	2.72E-04	47.3	233
La ³⁺	1.80E-06	0.208	1.02
Hg ²⁺	6.38E-06	1.06	5.23
Zr (as ZrO(OH) ₂)	1.56E-03	119	584
Pb ²⁺	5.34E-05	9.20	45.3
Ni ²⁺	3.41E-03	166	818
Sr ²⁺	1.90E-06	0.138	0.681
Mn ²⁺	6.86E-03	313	1.54E+03
Ca ²⁺	3.92E-02	1.31E+03	6.43E+03
K ⁺	0.115	3.73E+03	1.84E+04
OH ⁻	2.25	3.33E+04	1.57E+05
NO ₃ ⁻	2.02	1.09E+05	5.13E+05
NO ₂ ⁻	0.481	1.92E+04	9.06E+04
CO ₃ ²⁻	0.322	1.68E+04	7.91E+04
PO ₄ ³⁻	9.41E-02	7.76E+03	3.66E+04
SO ₄ ²⁻	0.107	8.95E+03	4.22E+04
Si (as SiO ₂)	2.43E-02	592	2.79E+03
F ⁻	0.130	2.14E+03	1.01E+04
Cl ⁻	7.48E-02	2.30E+03	1.08E+04
C ₆ H ₅ O ₇ ³⁻	1.40E-02	2.79E+03	1.08E+04
EDTA ⁴⁻	3.84E-03	959	4.52E+03
HEDTA ³⁻	6.35E-03	1.51E+03	7.12E+03
glycolate ⁻	0.114	7.40E+03	3.49E+04
acetate ⁻	4.24E-03	217	1.02E+03
oxalate ²⁻	6.78E-06	0.518	2.44
DBP	6.46E-03	903	4.26E+03
butanol	6.46E-03	416	1.96E+03
NH ₃	0.395	5.83E+03	2.75E+04
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	35.6 (μCi/L)		2.43 (kg)
U	4.72E-03 (M)	933 (μg/g)	4.39E+03 (kg)
Cs	0.111 (Ci/L)	92.4 (μCi/g)	4.55E+05 (Ci)
Sr	1.29E-02 (Ci/L)	10.7 (μCi/g)	5.29E+04 (Ci)

*Density is calculated based on Na, OH⁻, and AlO₂⁻.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AW-106			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	7.40E+03 kg	(1 kgal)	
Heat Load	0.305 kW	(1.04E+03 BTU/hr)	
Bulk Density	1.95 (g/cc)		
Water wt%	50.0		
TOC wt% C (wet)	0.251		
Chemical Constituents			
	mg/L	mmol	kg
Na ⁺	4.22	4.97E+04	368
Al ³⁺	2.00	2.77E+04	205
Fe ³⁺ (total Fe)	1.92	5.49E+04	406
Co ²⁺	1.67E-07	4.44E-03	3.29E-05
Br ⁻	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0.330	9.91E+03	73.3
Sr ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	0.188	3.89E+03	28.5
K ⁺	0	0	0
OH ⁻	20.9	2.82E+05	1.35E+03
NO ₃ ⁻	1.43	6.99E+04	334
NO ₂ ⁻	1.96E-02	714	3.41
CO ₃ ²⁻	0.398	1.89E+04	90.3
PO ₄ ³⁻	8.35E-03	629	3.00
SO ₄ ²⁻	2.18E-02	7.00E+03	33.4
Si (as SiO ₂)	0.675	1.50E+04	71.8
F ⁻	0	0	0
Cl ⁻	5.37E-02	1.51E+03	7.21
C ₆ H ₅ O ₇ ³⁻	1.25E-02	1.88E+03	8.96
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0.167	9.93E+03	47.4
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	3.70E-06	4.99E-02	2.38E-04
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0.740 (μCi/g)	9.13E-02 (kg)
U	1.32 (M)	1.61E+05 (μg/g)	1.19E+03 (kg)
Cs	0	0	0
Sr	12.0 (Ci/L)	6.13E+03 (μCi/g)	4.53E+04 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

241-AW-106

Photo date 2-3-83

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5 AY Tank Farm

5.0.1 AY Tank Farm History

The AY Tank Farm is located east of Buffalo Avenue and west of Canton Avenue in the 200-East Area. The AY Tank Farm contains two, 100 series, 1,000,000 gallon, 75-foot diameter double-shell tanks. The AY Tank Farm is the latest tank design with a reinforced concrete shell and dome and an insulating concrete base. A heat-treated, stress-relieved, primary steel liner and a non-stress-relieved, outer steel liner are inside the concrete shell. These tanks were made to hold aging waste from PUREX and B Plant. The ventilation system is shared between the AY and AZ Tank Farms because they are both aging waste tank farms. Maximum design temperatures in the tanks are: 350°F for sludge, 220°F for vapor, and 260°F for liquid. The tanks are at the same elevation and no cascade lines exist between tanks.

A color aerial photograph taken in 1993 of the AY Tank Farm shows the orientation of the 100 series tanks, leak detection pits, annulus ventilation equipment, and instrument house. The AY change trailer is used for entry into the AX, A, and AZ Tank Farms.

AY TANK FARM

5.0.1.1 AY Tank Farm Waste History

The AY Tank Farm is classified as an aging waste tank farm. It received aging tank waste in 1976 through 1978. Tank 241-AY-101 also contains high-level B Plant waste, B Plant cesium feed waste, non-complexed, concentrated complexed and cesium and strontium recovery waste. Presently, the tank receives only condensate from other aging waste tanks. Tank 241-AZ-102 began receiving evaporator waste before receiving aging waste followed by double-shell tank slurry, low-level waste from B Plant, and non-complexed waste. Tank 241-AZ-102 now receives only condensate from other aging waste tanks.

5.0.1.2 AY Tank Farm Temperature History

The AY Tank Farm has thermocouples on the air circulators and at various depths in the tank. Both tanks are required to have temperature readings recorded semiannually and both are connected to the computer automated surveillance system. The computer automated surveillance system holds all the temperature data used to develop the statistical results for each tank.

5.0.1.3 AY Tank Farm Occurrences

Sixteen unusual events concerned AY Tank Farm as a whole. Occurrence reports RL--WHC-Tank Farm-1993-0088 and RL--WHC-Tank Farm-1993-0031 were written due to equipment failures. Occurrence reports RL--WHC-Tank Farm-1993-0083 and RL--WHC-Tank Farm-1992-0033 concern equipment that was out of compliance with procedures. Occurrence reports RL--WHC-Tank Farm-1993-0011, RL--WHC-Tank Farm-1991-1064, RL--WHC-Tank Farm-1991-1004, and RL--WHC-Tank Farm-1991-0043; Off-Normal Reports 86-53, 86-22, 86-13, 86-10, and 85-39; and Unusual Occurrence Report 84-81 concern failing equipment causing tanks to pressurize. Occurrence report RL--WHC-Tank Farm-1991-1074 and Unusual Occurrence Report 80-51 were written due to unexpected waste transfers. For more information, refer to the Supporting Document for the Southeast Quadrant HTCE for AY Tank Farm (Brevick, 1995).

5.0.1.4 AY Tank Farm Ventilation

Each tank is designed to have 2,000 CFM of air travel through the annulus. Air enters the tanks by infiltration because there is no supply fan. The tank air ducts are joined after leaving the tank and the exhaust air is sent to the 702-A primary ventilation system. In the annulus system, air enters radiant heaters, a prefilter, a HEPA filter, and a heater before it enters the annulus. Then the air enters an electric heater and two more HEPA filters before it is exhausted to the atmosphere. The tank has a backup system. For more information, refer to drawings H-2-64461, H-2-64462, H-2-92066, and H-2-35749.

The psychrometric data are recorded in two parts, the tank data and the annulus data. For water and heat leaving the tank, the numbers are positive. For more information, refer to the Supporting Document for the Southeast Quadrant HTCE for AY Tank Farm (Brevick, 1995).

5.0.2 Current Status of AY Tank Farm

Tanks 241-AY-101 and -102 are both inactive. All tanks are actively ventilated and categorized sound. Currently, the total waste volume is 1,668,000 gallons. The estimated volumes (Agnew, January 1994) depicted in each tank cross section total 1,835,000 gallons of waste. At the time of the estimate, there were 1,770,000 gallons of supernatant with 18,000 gallons of concentrated supernatant solids; 33,000 gallons of B Plant low-level waste (BL); 4,000 gallons of PUREX low-level waste; 8,000 gallons of waste sent to B Plant for strontium recovery (SRR); 7,000 gallons of waste sent to B Plant for cesium recovery (CSR); and 13,000 gallons of B Plant high-level waste (B).

5.1 Tank 241-AY-101

5.1.1 241-AY-101 Tank History

5.1.1.1 Waste History of Tank 241-AY-101

Tank 241-AY-101 began service by receiving B Plant high-level waste in the second quarter of 1971. The tank received high-level waste from B Plant until the second quarter of 1976. Aging waste was sent to the tank from the third quarter of 1976 until the fourth quarter of 1977. During the first quarter of 1978, the tank received active B Plant cesium feed waste. The tank received non-complexed waste from the second quarter of 1978 until the fourth quarter of 1979. From January 1980 until October 1981, the tank received complexant concentrate waste. The tank received complexed waste from November 1981 until May 1990. Cesium and strontium recovery waste were sent to the tank from the first quarter of 1983 until the third quarter of 1986. The tank has contained dilute complexed waste from June 1990 until the present. The tank is considered an aging waste tank, an inactive, dilute receiver tank that receives only condensate from other aging waste tanks.

5.1.1.2 Temperature History of Tank 241-AY-101

Temperature data for Tank 241-AY-101 are recorded by fifteen thermocouples affixed at known elevations to seven thermocouple trees inside the tank. The thermocouple trees are located in risers 13A, B, C, D and 16 A, B, C. There are between one and three thermocouples on each tree. Non-suspect temperature data recorded between July 1983 and February 1990 for all fifteen thermocouples were available from the computer automated surveillance system. However, not all of the fifteen thermocouples have data that encompass the entire length of time. Within the time span of the computer automated surveillance system, there were several small breaks in the sequence of the temperature data. The average temperature during this period was 94°F with a minimum of 50°F, a maximum of 247°F, and a standard deviation of 21°F. Linear regressions were performed on each thermocouple over the life of the tank. The slopes from these regressions were averaged with a resulting average slope of 0.0011. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

5.1.1.3 Occurrences of Tank 241-AY-101

Five unusual events occurred at Tank 241-AY-101. Occurrence report RL--WHC-Tank Farm-1993-0008 concerns failing equipment during a waste transfer. Occurrence report RL--WHC-Tank Farm-1991-0074 was written due to equipment failure. Off-Normal Reports 84-01 and 83-10 were written due to unexpected waste transfers. Unusual Occurrence Report 76-132 was written because radiation was detected in the annulus ventilation system.

5.1.1.4 Psychrometrics of Tank 241-AY-101

Psychrometric data have been recorded for 10 years from the tank annulus. Psychrometric data were not recorded for the tank. The rates of heat exchange through the annular ventilation show a decreasing trend from October 1980 to October 1991. The data would suggest a decrease in the rate of heat generation in Tank 241-AY-101, but no corroborating data from the tank ventilation exists.

5.1.2 Current Status of Tank 241-AY-101

Tank 241-AY-101 entered service in April 1971 and currently stores 864,000 gallons of waste. The following plan view and tank cross section depict the approximate waste volume of 891,000 gallons and configuration of risers as of January 1994. At the time of the estimate, there were 858,000 gallons of supernatant with 18,000 gallons of concentrated supernatant solids; 8,000 gallons of waste sent to B Plant for strontium recovery (SRR); 7,000 gallons of waste sent to B Plant for cesium recovery (CSR); 5,000 gallons of B Plant low-level waste (BL); and 13,000 gallons of B Plant high-level waste (B). The waste level in the tank is measured with the manual tape and has increased and decreased around 325 inches from January 1991 until January 1994. The increase was mostly from the addition of complexed saltwell liquid waste from the 200-East Area between December 1991 and February 1992. The cause of the decreases in tank level is unknown. This tank is inactive and only receives condensate from aging waste tanks. The tank is actively ventilated and categorized as sound. Tank 241-AY-101 has 117 risers. One 4-inch riser (no.5B), eight 6-inch risers (no.15A, no.15G, no.15I, no.15K, no.15M, no.15O, no.15Q, and no.15S), and one 42-inch riser (no.24A) are available for use.

5.1.2.1 Inventory Estimate of Tank 241-AY-101

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew, 1995) and Supernatant Mixing Model (Agnew, 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AY-101 are also presented. Concentrated supernatant solids are considered as an integral part of the liquid for the purpose of estimating inventories, but are graphed as solids on the level histories. The actual substance, which was derived from double-shell slurry, appears as a solid if undisturbed, but the particles are resuspended in solution if heated or disturbed.

5.1.2.2 In-Tank Photograph of Tank 241-AY-101

In April 1994, Tank 241-AY-101 contained 879,000 gallons of dilute complexed waste from PUREX (Hanlon, 1994) with a waste depth of about 27 feet. The most recent collage for this tank is 12 years old and was assembled from photographs taken in December 1982. At that time, the tank contained 180,000 gallons of complexed waste. The waste is the same type now as it was in 1982, so the waste may appear now as it does in this picture. The picture is hazy, but the waste is deep in the tank and appears to be a dark liquid. These photographs provide an accurate picture of the equipment in the tank. This is one of the four double-shell tanks containing aging waste and, therefore, it has more instruments compared to other waste storage tanks. Monitoring instruments which can be seen in this picture and have been identified include six temperature probes, four level probes, and five drywells. In addition, the tank contains air lift circulators, heating coils, drains, risers, and nozzles.

5.1.3 Synopsis of Tank 241-AY-101

(To be completed.)

ANDERSON 1990
WASTE TYPES

B:

AGING

CS/FD:
NCPLX:

CC:

CPLX:

PRIMARY
ADDITIONS

B:
P2:

SRR:

BL:

CSR:

PL2:

DC:

NOTES:

CONSTRUCT 1968-1970
 NOMINAL CAPACITY: 1,000,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE,
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

SWLIO:

UNK:

INVENTORY ESTIMATE DATE

B: 8-PLANT HIGH-LEVEL WASTE
 AGING: CONTAINS AGING WASTE
 CD\FD: 8 PLANT CESIUM FEED WASTE
 NCPLX: NON-COMPLEXED WASTE
 CC: COMPLEXANT CONCENTRATE WASTE
 CPLX: COMPLEXED WASTE
 DC: DILUTE COMPLEXED WASTE
 P2: PUREX HIGH-LEVEL WASTE
 BL: B PLANT LOW-LEVEL WASTE
 PL2: PUREX LOW-LEVEL WASTE
 SWLIO: SALTWELL LIQUOR
 UNK: UNKNOWN

LEGEND

□ □ □ LIQUID OBSERVATION
 WELL (LOW)
 — LIQUID LEVEL
 // // // SOLIDS LEVEL
 || || || SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

AY TANK FARM
 PLOT PLAN

SUPERNATANT 840 KGAL
 CS SOLIDS 18 KGAL
 SSR 8 KGAL
 CSR 7 KGAL
 B 13 KGAL

See glossary for abbreviations and definitions

SOLIDS
 LEVEL

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AY-101 DOUBLE-SHELL TANK
 LEVEL HISTORY 1971 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: N/A

SIZE B	BLOG NO. 241	DWG NO. ES-TKS-E171	DATE 6/95
SCALE NONE	JOB NO.	SHEET 1 OF 1	

Double-Shell Tank 241-AY-101			
Total Inventory Estimate*			
Physical Properties			
Total Waste	3.73E+06 kg	(891 kgal)	
Heat Load	15.7 kW	(5.36E+04 BTU/hr)	
Bulk Density†	1.11 (g/cc)		
Water wt%	82.8		
TOC wt% C	1.05		
Chemical Constituents			
Na ⁺	2.10	4.36E+04	1.63E+05
Al ³⁺	0.206	5.02E+03	1.87E+04
Fe ³⁺ (total Fe)	0.146	7.39E+03	2.75E+04
Cr ³⁺	8.04E-03	378	1.41E+03
B ³⁺	1.55E-04	29.2	109
La ³⁺	9.14E-07	0.115	0.428
Hg ²⁺	3.23E-06	0.586	2.19
Zr (as Zr(OH) ₄)	8.83E-05	7.29	27.2
Pb ²⁺	1.14E-05	2.14	7.99
Ni ²⁺	5.00E-03	266	991
Si ²⁺	9.66E-07	7.66E-02	0.285
Mn ²⁺	6.50E-03	323	1.20E+03
Ca ²⁺	2.68E-02	972	3.62E+03
K ⁺	7.48E-03	265	987
OH ⁻	1.48	2.28E+04	8.50E+04
NO ₃ ⁻	0.670	3.76E+04	1.40E+05
NO ₂ ⁻	0.297	1.24E+04	4.61E+04
CO ₃ ²⁻	0.135	7.35E+03	2.74E+04
PO ₄ ³⁻	1.57E-02	1.35E+03	5.03E+03
SO ₄ ²⁻	6.04E-02	5.25E+03	1.96E+04
Si (as SiO ₂)	3.33E-02	846	3.16E+03
F ⁻	9.76E-03	168	625
Cl ⁻	3.57E-02	1.14E+03	4.26E+03
C ₂ H ₃ O ₂ ⁻	1.27E-02	2.18E+03	8.12E+03
EDTA ⁴⁻	2.51E-02	6.53E+03	2.44E+04
HEDTA ³⁻	4.91E-02	1.22E+04	4.54E+04
citric acid ³⁻	6.15E-02	4.17E+03	1.56E+04
acetic acid ²⁻	3.23E-03	173	643
malic acid ²⁻	3.45E-06	0.275	1.02
DBP	4.52E-03	662	2.47E+03
butanol	4.48E-03	300	1.12E+03
NH ₃	6.30E-03	96.8	361
Fe(CN) ₆ ⁴⁻	0	0	0
Radioisotopic Constituents			
Pu		0.302 (μCi/g)	18.8 (kg)
U	1.27E-02 (M)	2.74E+03 (μg/g)	1.02E+04 (kg)
Cs	8.99E-02 (C/L)	81.3 (μCi/g)	3.03E+03 (Ci)
Sr	0.628 (C/L)	568 (μCi/g)	2.12E+06 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AY-101			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	3.54E+06 kg	(858 kgal)	
Heat Load	1.39 kW	(4.76E+03 BTU/hr)	
Bulk Density*	1.09 (g/cc)		
Water wt%	84.3		
TOC wt% C (wt)	1.04		
Chemical Constituents			
	moles/l.	ppm	kg
Na ⁺	2.09	4.41E+04	1.56E+05
Al ³⁺	0.173	4.34E+03	1.54E+04
Fe ²⁺ (total Fe)	1.40E-03	71.9	254
Cr ³⁺	8.23E-03	393	1.39E+03
BP ³⁺	1.60E-04	30.7	109
La ³⁺	9.49E-07	0.121	0.428
Hg ²⁺	3.31E-06	0.610	2.16
Zr (as ZrO(OH) ₂)	9.16E-03	7.67	27.1
Pb ²⁺	1.19E-03	2.26	7.98
NP ³⁺	9.74E-04	52.5	186
Si ²⁺	1.00E-06	8.07E-02	0.285
Mn ²⁺	3.77E-03	190	672
Ca ²⁺	9.81E-03	361	1.28E+03
K ⁺	7.69E-03	276	977
OH ⁻	0.877	1.37E+04	4.84E+04
NO ₂ ⁻	0.677	3.85E+04	1.36E+05
NO ₃ ⁻	0.306	1.29E+04	4.57E+04
CO ₃ ²⁻	0.119	6.55E+03	2.32E+04
PO ₄ ³⁻	1.62E-02	1.41E+03	5.00E+03
SO ₄ ²⁻	6.03E-02	5.32E+03	1.88E+04
Si (as SiO ₂) ³	2.16E-02	556	1.97E+03
F ⁻	1.01E-02	177	625
Cl ⁻	3.59E-02	1.17E+03	4.13E+03
C ₆ H ₈ O ₇ ³⁻	1.29E-02	2.24E+03	7.92E+03
BDTA ⁴⁻	2.47E-02	6.54E+03	2.31E+04
HEDTA ⁴⁻	4.84E-02	1.22E+04	4.31E+04
glycolate ⁻	6.03E-02	4.16E+03	1.47E+04
acetate ⁻	3.36E-03	182	643
oxalate ²⁻	3.58E-06	0.290	1.02
DBP	4.65E-03	688	2.43E+03
butanol	4.65E-03	317	1.12E+03
NH ₃	6.52E-03	102	360
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	9.37 (μCi/L)		0.507 (kg)
U	2.01E-03 (M)	440 (μg/g)	1.56E+03 (kg)
Cs	8.83E-02 (Ci/L)	81.1 (μCi/g)	2.87E+05 (Ci)
Sr	2.29E-03 (Ci/L)	2.11 (μCi/g)	7.45E+03 (Ci)

*Density is calculated based on Na, OH⁻, and AlO₂⁻.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AY-101			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	1.92E+05 kg	(33 kgal)	
Heat Load	14.3 kW	(4.88E+04 BTU/hr)	
Bulk Density	1.54 (g/cc)		
Water wt%	55.4		
TOC wt% C (wt)	1.18		
Chemical Constituents			
	moles/l.	ppm	kg
Na ⁺	2.29	3.42E+04	6.37E+03
Al ³⁺	0.997	1.75E+04	3.36E+03
Fe ²⁺ (total Fe)	3.91	1.42E+05	2.73E+04
Cr ³⁺	2.95E-03	99.7	19.1
BP ³⁺	1.10E-05	1.49	0.287
La ³⁺	0	0	0
Hg ²⁺	1.17E-06	0.152	2.92E-02
Zr (as ZrO(OH) ₂)	1.95E-06	0.116	2.22E-02
Pb ²⁺	4.00E-07	5.40E-02	1.04E-02
NP ³⁺	0.110	4.19E+03	805
Si ²⁺	0	0	0
Mn ²⁺	7.76E-02	2.77E+03	533
Ca ²⁺	0.469	1.22E+04	2.35E+03
K ⁺	2.00E-03	50.9	9.77
OH ⁻	17.2	1.90E+05	3.66E+04
NO ₂ ⁻	0.509	2.05E+04	3.94E+03
NO ₃ ⁻	7.80E-02	2.33E+03	448
CO ₃ ²⁻	0.568	2.22E+04	4.26E+03
PO ₄ ³⁻	2.10E-03	130	24.9
SO ₄ ²⁻	6.18E-02	3.86E+03	741
Si (as SiO ₂) ³	0.339	6.19E+03	1.19E+03
F ⁻	2.03E-04	2.40	0.481
Cl ⁻	3.00E-02	692	133
C ₆ H ₈ O ₇ ³⁻	8.81E-03	1.08E+03	208
BDTA ⁴⁻	3.36E-02	6.29E+03	1.21E+03
HEDTA ⁴⁻	6.72E-02	1.20E+04	2.30E+03
glycolate ⁻	9.27E-02	4.52E+03	869
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	1.09E-03	189	36.2
butanol	6.88E-06	0.332	6.37E-02
NH ₃	5.57E-04	6.16	1.18
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		5.71 (μCi/g)	18.3 (kg)
U	0.291 (M)	4.51E+04 (μg/g)	8.66E+03 (kg)
Cs	0.130 (Ci/L)	84.4 (μCi/g)	1.62E+04 (Ci)
Sr	16.9 (Ci/L)	1.10E+04 (μCi/g)	2.11E+05 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

241-AY-101

Photo date: 12-28-82

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WHC-SD-MM-ER350, Rev. 0.

5.2 Tank 241-AY-102

5.2.1 241-AY-102 Tank History

5.2.1.1 Waste History of Tank 241-AY-102

Tank 241-AY-102 began service by receiving water in the second quarter of 1971 and was labeled as a spare tank. The tank received evaporator waste from the third quarter of 1976 until the first quarter of 1977. From the second quarter of 1977 until the second quarter of 1978, the tank received aging waste. The tank received double-shell slurry feed waste from the third quarter of 1978 until the second quarter of 1980. From the first quarter of 1980 until the fourth quarter of 1992, the tank received waste from B Plant. The tank received non-complexed waste from August 1980 until May 1990. The tank has contained dilute non-complexed waste from June 1990 until present. The tank is considered an aging waste tank, an inactive, dilute receiver tank that receives only condensate from other aging waste tanks.

5.2.1.2 Temperature History of Tank 241-AY-102

Temperature data for Tank 241-AY-102 are recorded by 15 thermocouples affixed at known elevations to seven thermocouple trees inside the tank. The thermocouple trees are located in risers 13A, B, C, D and 16 A, B, C. Between one and three thermocouples are on each tree. Only 10 of the 15 thermocouples had temperature data. Non-suspect temperature data from the records taken between July 1983 and June 1988 for the 10 thermocouples were available from the computer automated surveillance system. However, not all of the 10 thermocouples have data that encompass the entire length of time. Within the time span of the computer automated surveillance system, there were several small breaks in the sequence of the temperature data. The average temperature during this period was 77°F with a minimum of 54°F, a maximum of 123°F, and a standard deviation of 10°F. Linear regressions were performed on each thermocouple over the life of the tank. The slopes from these regressions were averaged with a resulting average slope of 0.0028. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

5.2.1.3 Occurrences of Tank 241-AY-102

Twelve unusual events occurred at Tank 241-AY-102. Occurrence reports RL--WHC-Tank Farm-1993-0014 and RL--WHC-Tank Farm-1991-1068; Off-Normal Reports 85-22 and 82-12; and Unusual Occurrence Reports 81-52, 80-88, 80-8, 76-148, 76-138, and 75-127 were written due to unexpected waste transfers. U.O. Report 80-37 was written because failing equipment caused the tank to pressurize. U.O. Report 74-30 was written because a procedural requirement was not met.

5.2.1.4 Psychrometrics of Tank 241-AY-102

Psychrometric data have been recorded for ten years from the tank annulus. There are two psychrometric data points, recorded on the same

day, in the tank. Due to the small amount of data for the tank, no plots were made to display the data graphically. The trend in the rates of heat exchange through the annular ventilation increased from October 1980 to February 1991. This would suggest an increase in the rate of heat generation in Tank 241-AY-102, but no corroborating data from the tank ventilation exists.

5.2.2 Current Status of Tank 241-AY-102

Tank 241-AY-102 entered service in April 1971 and currently stores 804,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 944,000 gallons and configuration of risers as of January 1994. At the time of the estimate, there were 912,000 gallons of supernatant, 28,000 gallons of B Plant low-level waste (BL), and 4,000 gallons of PUREX low-level waste (PL2). The waste level in the tank is measured with the FIC gauge and the manual tape and has increased and decreased between January 1991 and January 1994. The increases were mostly from additions of dilute and non-complexed waste from B-Plant cell drainage and flush water from miscellaneous sources between January 1991 and January 1994. The decreases were mostly from waste sent to Tanks 241-AP-103 and -108. This tank is inactive and only receives condensate from aging waste tanks. The tank is actively ventilated and categorized as sound. Tank 241-AY-102 has 117 risers. One 4-inch riser (no.5A), nine 6-inch risers (no.15A, no.15E, no.15G, no.15I, no.15K, no.15M, no.15O, no.15Q, and no.15S), and one 42-inch riser (no.24A) are available for use.

5.2.2.1 Inventory Estimate of Tank 241-AY-102

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew, 1995) and Supernatant Mixing Model (Agnew, 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AY-102 are also presented.

5.2.2.2 In-Tank Photograph of Tank 241-AY-102

In April 1994, Tank 241-AY-102 contained 721,000 gallons of dilute non-complexed waste from PUREX (Hanlon, 1994) with a waste depth of about 22 feet. The most recent collage for this tank is 13 years old and was assembled from photographs taken in April 1981. At that time, the tank contained 282,000 gallons of non-complexed waste (Mudd, 1981). Not much can be determined from this picture as it is hazy and incomplete. Equipment which could be identified has been labeled.

5.2.3 Synopsis of Tank 241-AY-102

(To be completed.)

ANDERSON 1990
WASTE TYPES

WTR:

EVAP:

AGING:

DSSF:

NCPLX:

PRIMARY
ADDITIONS

BL:
PL2:

SWLIQ:

DN:

NOTES:

CONSTRUCT 1968-1970
 NOMINAL CAPACITY: 1,000,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE,
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

DW:
UNK:

INVENTORY ESTIMATE DATE

FROM SY-102 & 8 PLANT
TO AW-102, AW-106, & AP-106

FROM B PLANT & T PLANT
TO AP-103 & AP-108

WTR: WATER
 EVAP: EVAPORATOR FEED
 AGING: CONTAINS AGING WASTE
 DSSF: DOUBLE-SHELL SLURRY FEED
 NCPLX: NON-COMPLEXED WASTE
 DN: DILUTE NON-COMPLEXED WASTE
 BL: B PLANT LOW-LEVEL WASTE
 PL2: PUREX LOW-LEVEL WASTE
 DW: DECONTAMINATION WASTE
 UNK: UNKNOWN

CAPACITY
(GALLONS)

1,056,000
 990,000
 924,000
 858,000
 792,000
 726,000
 660,000
 594,000
 528,000
 462,000
 396,000
 330,000
 264,000
 198,000
 132,000
 66,000
 0

LEGEND

— □ — □ — □ — LIQUID OBSERVATION
 WELL (LOW)
 — LIQUID LEVEL
 // // // // SOLIDS LEVEL
 // // // // SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

AY TANK FARM
PLOT PLAN

SUPERNATANT 912 KGAL
 BL 26 KGAL
 PL2 4 KGAL
 BL 2 KGAL

See glossary for abbreviations and definitions

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AY-102 DOUBLE-SHELL TANK
 LEVEL HISTORY 1971 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: N/A

SIZE	B	BUDG. NO.	241	CHRG. NO.	ES-TKS-E172	DATE	6/95
SCALE	NONE	JOB NO.		SHEET	1	OF	1

Double-Shell Tank 241-AY-102			
Total Inventory Estimate*			
Physical Properties			
Total Waste	3.87E+06 kg	(944 kgal)	
Heat Load	9.15 kW	(3.13E+04 BTU/hr)	
Bulk Density†	1.08 (g/cc)		
Water wt%†	88.6		
TOC wt% C	0.158		
Chemical Constituents			
Na ⁺	1.27	2.70E+04	1.04E+05
Al ³⁺	0.215	5.37E+03	2.08E+04
Fe ²⁺ (total Fe)	6.60E-02	3.41E+03	1.32E+04
Cr ³⁺	1.47E-03	70.6	273
Bi ³⁺	1.67E-05	3.22	12.5
La ³⁺	7.98E-08	1.02E-02	3.96E-02
Hg ²⁺	3.67E-07	6.80E-02	0.263
Zr (as ZrO(OH) ₂)	8.86E-05	7.47	28.9
Pb ²⁺	3.06E-06	0.586	2.26
Ni ²⁺	1.10E-02	597	2.31E+03
Sr ²⁺	8.43E-08	6.83E-03	2.64E-02
Mn ²⁺	3.89E-04	19.8	76.4
Ca ²⁺	1.31E-02	483	1.88E+03
K ⁺	6.47E-03	234	903
OH ⁻	1.34	2.10E+04	8.12E+04
NO ₃ ⁻	0.387	3.36E+04	1.30E+05
NO ₂ ⁻	4.00E-02	1.70E+03	6.57E+03
CO ₃ ²⁻	9.57E-02	5.31E+03	2.05E+04
PO ₄ ³⁻	8.02E-03	704	2.72E+03
SO ₄ ²⁻	3.63E-02	3.22E+03	1.25E+04
Si (as SiO ₂)	2.97E-02	770	2.98E+03
F ⁻	7.52E-03	132	511
Cl ⁻	2.22E-02	728	2.82E+03
C ₂ H ₃ O ₂ ⁻	4.77E-03	834	3.22E+03
EDTA ⁴⁻	2.38E-04	63.3	245
HEDTA ³⁻	3.93E-04	99.6	385
glycolate ⁻	5.92E-02	4.10E+03	1.59E+04
acetate ⁻	2.64E-04	14.4	55.7
oxalate ²⁻	3.01E-02	2.45E+02	9.47E+02
DBP	3.81E-04	57.9	224
hydrazine	3.81E-04	26.1	101
NH ₃	2.23E-02	351	1.36E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		4.91E-02 (μCi/g)	3.17 (kg)
U	4.05E-02 (M)	8.91E+03 (μCi/g)	3.45E+04 (kg)
Ce	2.73E-02 (C/L)	25.2 (μCi/g)	9.74E+04 (Ci)
Sr	0.361 (C/L)	334 (μCi/g)	1.29E+06 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AY-102			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	3.64E+06 kg	(912 kgal)	
Heat Load	0.512 kW	(1.75E+03 BTU/hr)	
Bulk Density*	1.06 (g/cc)		
Water wt%	90.8		
TOC wt% C (wet)	0.154		
Chemical Constituents			
Na ⁺	1.18	2.58E+04	9.38E+04
Al ³⁺	0.161	4.13E+03	1.50E+04
Fe ²⁺ (total Fe)	9.79E-04	51.8	189
Cr ³⁺	1.49E-03	73.3	267
Bi ³⁺	1.73E-05	3.42	12.5
La ³⁺	8.26E-08	1.09E-02	3.96E-02
Hg ²⁺	3.80E-07	7.22E-02	0.263
Zr (as ZrO(OH) ₂)	9.17E-05	7.93	28.9
Pb ²⁺	2.99E-06	0.587	2.14
Ni ²⁺	7.76E-04	43.2	157
Sr ²⁺	8.73E-08	7.25E-03	2.64E-02
Mn ²⁺	3.79E-04	19.7	71.8
Ca ²⁺	6.86E-03	260	948
K ⁺	6.67E-03	247	900
OH ⁻	0.716	1.15E+04	4.20E+04
NO ₃ ⁻	0.563	3.31E+04	1.21E+05
NO ₂ ⁻	4.07E-02	1.78E+03	6.47E+03
CO ₃ ²⁻	8.55E-02	4.86E+03	1.77E+04
PO ₄ ³⁻	7.76E-03	699	2.54E+03
SO ₄ ²⁻	3.47E-02	3.16E+03	1.15E+04
Si (as SiO ₂)	1.00E-02	266	969
F ⁻	7.79E-03	140	511
Cl ⁻	2.14E-02	717	2.61E+03
C ₆ H ₅ O ₇ ³⁻	4.56E-03	816	2.97E+03
BDTA ⁺	2.46E-04	67.2	245
HBDA ⁺	4.07E-04	106	385
glycolate ⁻	5.61E-02	3.99E+03	1.45E+04
acetate ⁻	2.73E-04	15.3	55.7
oxalate ²⁻	3.12E-07	2.60E-02	9.47E-02
DBP	3.82E-04	38.2	212
butanol	3.82E-04	26.8	97.7
NH ₃	2.31E-02	373	1.36E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	9.85 (μCi/L)		0.567 (kg)
U	1.28E-03 (M)	289 (μg/g)	1.05E+03 (kg)
Cs	2.81E-02 (Ci/L)	26.6 (μCi/g)	9.70E+04 (Ci)
Sr	2.49E-03 (Ci/L)	2.36 (μCi/g)	8.59E+03 (Ci)

*Density is calculated based on Na, OH⁻, and AlO₂⁻.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AY-102			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	2.25E+05 kg	(32 kgal)	
Heat Load	8.64 kW	(2.95E+04 BTU/hr)	
Bulk Density	1.85 (g/cc)		
Water wt%	53.6		
TOC wt% C (wet)	0.224		
Chemical Constituents			
Na ⁺	3.77	4.67E+04	1.05E+04
Al ³⁺	1.75	2.55E+04	5.73E+03
Fe ²⁺ (total Fe)	1.92	5.78E+04	1.30E+04
Cr ³⁺	9.19E-04	25.8	5.79
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	4.99E-06	0.558	0.125
Ni ²⁺	0.303	9.58E+03	2.15E+03
Sr ²⁺	0	0	0
Mn ²⁺	6.89E-04	20.4	4.59
Ca ²⁺	0.191	4.13E+03	927
K ⁺	6.89E-04	14.5	3.26
OH ⁻	19.1	1.75E+05	3.92E+04
NO ₃ ⁻	1.77	4.25E+04	9.56E+03
NO ₂ ⁻	1.87E-02	463	104
CO ₃ ²⁻	0.387	1.25E+04	2.81E+03
PO ₄ ³⁻	1.53E-02	783	176
SO ₄ ²⁻	8.08E-02	4.18E+03	940
Si (as SiO ₂)	0.591	8.94E+03	2.01E+03
F ⁻	0	0	0
Cl ⁻	4.75E-02	907	204
C ₆ H ₅ O ₇ ³⁻	1.10E-02	1.12E+03	251
BDTA ⁺	0	0	0
HBDA ⁺	0	0	0
glycolate ⁻	0.146	5.91E+03	1.33E+03
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	3.62E-04	51.9	11.7
butanol	3.62E-04	14.5	3.25
NH ₃	3.84E-06	3.52E-02	7.91E-03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0.694 (μCi/g)	2.60 (kg)
U	1.26 (M)	1.49E+05 (μg/g)	3.34E+04 (kg)
Cs	3.45E-03 (Ci/L)	1.85 (μCi/g)	417 (Ci)
Sr	10.6 (Ci/L)	5.71E+03 (μCi/g)	1.28E+06 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

241-AY-102

Photo date: 4-28-81

North
Unknown

6 AZ Tank Farm

6.0.1 AZ Tank Farm History

The AZ Tank Farm is located east of Buffalo Avenue and west of Canton Avenue in the 200-East Area. The AZ Tank Farm contains two, 100 series, 1,000,000 gallon, 75-foot diameter double-shell tanks. The AZ Tank Farm is the latest tank design with a reinforced concrete shell and an insulating concrete base. A heat-treated, stress-relieved, primary steel liner and a non-stress-relieved, outer steel liner are inside the concrete shell. These tanks were made to hold aging waste from PUREX and B Plant. Maximum design temperatures in the tanks are: 350°F for sludge, 220°F for vapor, and 260°F for liquid. The tanks are at the same elevation and contain no cascade lines between tanks.

A color aerial photograph taken in 1993 of the AZ Tank Farm shows the orientation of the 100 series tanks, leak detection pits, annulus ventilation equipment, instrument house, and the 241-AZ-152 Diversion (Sluice Transfer) Box.

AZ TANK FARM

6.0.1.1 AZ Tank Farm Waste History

Both tanks in the AZ Tank Farm are aging waste tanks and presently only receive condensation from other aging waste tanks. Both tanks first received evaporator waste in 1976 and complexant concentrate waste in 1978. Both tanks also received residual liquor, PUREX low-level waste, and non-complexed waste while active. Tank 241-AZ-101 received double-shell tank slurry waste in 1978.

6.0.1.2 AZ Tank Farm Temperature History

The AZ Tank Farm has thermocouples on the air circulators and at various depths in the tank. Both tanks are required to have temperature readings recorded semiannually and both are connected to the computer automated surveillance system. The computer automated surveillance system holds all the temperature data used to develop the statistical results for each tank.

6.0.1.3 AZ Tank Farm Occurrences

Fifteen unusual events concerned AZ Tank Farm as a whole. Occurrence reports RL--WHC-Tank Farm-1993-0083 and RL--WHC-Tank Farm-1992-0012 concern equipment that was out of compliance with procedures. Occurrence report RL--WHC-Tank Farm-1993-0068 was written due to an unexpected waste transfer. Occurrence reports RL--WHC-Tank Farm-1993-0011, RL--WHC-Tank Farm-1991-1064, and RL--WHC-Tank Farm-1991-0043; Off-Normal Reports 86-53, 86-22, 86-13, 86-10, and 85-39; and Unusual Occurrence Report 84-81 were written because failing equipment caused the tanks to pressurize. Occurrence report RL--WHC-Tank Farm-1992-0016 concerns an electrical problem with the instrument panel. U.O. Report 77-102 was written because radioactive material was found in the air sample filters of each tank annulus. For more information, refer to the Supporting Document for the Southeast Quadrant HTCE for AZ Tank Farm (Brevick, 1995).

6.0.1.4 AZ Tank Farm Ventilation

Under the current system, each tank is designed to have 2,000 CFM of air travel through the annulus. Air enters the tanks by infiltration because there is no supply fan. The tank air ducts are joined after leaving the tanks and the air is sent to the 702-A primary ventilation system (the same system that AY Tank Farm uses). In the annulus system, air enters a heating coil, two prefilters, and a HEPA filter, before the duct is split so air can enter each tank's annulus. After traveling through each annulus, the air enters two heaters and two HEPA filters before the ducts are joined for the 7,040 CFM exhaust fan. The tank system shares the backup system with the AY Tank Farm. For more information, refer to drawings H-2-92964, sheets 1 and 2, and H-2-35749.

The psychrometric data are recorded in two parts, the tank data and the annulus data. For water and heat leaving the tank, the numbers are positive. Psychrometric data have been recorded for 14 years on the

annuli. Two psychrometric data points were recorded almost one year apart for each of the tanks. Due to the small amount of data from within the tanks, no plots were made to display the data graphically. For more information, refer to the Supporting Document for the Southeast Quadrant HTCE for AZ Tank Farm (Brevick, 1995).

6.0.2 Current Status of AZ Tank Farm

Tanks 241-AZ-101 and -102 in the AZ Tank Farm are both inactive. All tanks are actively ventilated and categorized as sound. The waste volume currently totals 1,911,000 gallons. The estimated volumes (Agnew, January 1994) depicted in each tank cross-section total 1,905,000 gallons of waste. At the time of the estimate, there were 1,833,000 gallons of supernatant with 2,000 gallons of concentrated supernatant solids; 40,000 gallons of PUREX high-level waste (P3); 1,000 gallons of B Plant low-level waste (BL); 4,000 gallons of PUREX low-level waste (PL2); 1,000 gallons of waste from Z Plant; and 26,000 gallons of unknown waste (UNK) which could be waste that was sent to B Plant for strontium recovery (SRR).

6.1 Tank 241-AZ-101

6.1.1 241-AZ-101 Tank History

6.1.1.1 Waste History of Tank 241-AZ-101

Tank 241-AZ-101 began service by receiving evaporator waste in the fourth quarter of 1976. The tank continued to receive evaporator waste until the fourth quarter of 1977. From the first quarter of 1978 until September 1980, the tank received complexed waste, double-shell slurry feed waste, non-complexed waste, water, evaporator waste, residual liquor, and complexant concentrate waste. The tank received non-complexed waste from October 1980 until January 1984. From the first quarter of 1981 until the first quarter of 1986, the tank received waste from PUREX. The tank has contained aging waste from February 1984 until the present. The tank is currently an inactive, concentrated waste holding tank that receives only condensate from other aging waste tanks.

6.1.1.2 Temperature History of Tank 241-AZ-101

Temperature data for Tank 241-AZ-101 are recorded by 15 thermocouples affixed at known elevations on seven thermocouple trees inside the tank. The thermocouple trees are located in risers 13A, B, C, D and 16 A, B, C. There are between one and three thermocouples on each tree. Non-suspect temperature data for all 15 thermocouples taken between July 1983 and March 1988 were available from the computer automated surveillance system. However, not all of the 15 thermocouples have data that encompass the entire length of time. Non-suspect temperature data for all 15 of the thermocouples were available from the data sheets recorded between November 1989 and April 1990. Within the time span of the computer automated surveillance system, there were several small breaks in the sequence of the temperature data. Within the time span of the manually recorded data, there were no significant breaks in the sequence of temperature data. The

average temperature during these periods was 148°F with a minimum of 63°F, a maximum of 263°F, and a standard deviation of 40°F. Linear regressions were performed on each thermocouple over the life of the tank. The slopes from these regressions were averaged with a resulting average slope of 0.014. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

6.1.1.3 Occurrences of Tank 241-AZ-101

Five unusual events occurred at tank 241-AZ-101. Occurrence report RL--WHC-Tank Farm-1992-0085 was written due to procedural requirements not being met. TFS & O-EFS-88-007 and Off-Normal Report 86-52 were written due to unexpected waste transfers. Off-Normal Report 86-16 concerns the tank pressurizing from an equipment failure. Unusual Occurrence Report 84-17 was written because of equipment failure.

6.1.1.4 Psychrometrics of Tank 241-AZ-101

The trend in the rates of heat exchange through the annular ventilation shows an increase from October 1980 to November 1994. This would suggest an increase in the rate of heat generation in Tank 241-AZ-101, but no corroborating data from the tank ventilation exists.

6.1.2 Current Status of Tank 241-AZ-101

Tank 241-AZ-101 entered service in November 1976 and currently stores 965,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 931,000 gallons and configuration of risers as of January 1994. At the time of the estimate, there were 902,000 gallons of supernatant, 27,000 gallons of PUREX high-level waste (P3), 1,000 gallons of B Plant low-level waste (BL), and 1,000 gallons of PUREX low-level waste (PL2). The waste level in the tank is measured with the manual tape and has increased and decreased from January 1991 to January 1994. The increases and decreases were mostly flush water from miscellaneous sources between January 1991 and January 1994. The tank is actively ventilated and categorized as sound. Tank 241-AZ-101 has 117 risers. Three 4-inch risers (no.5B, no.11A, and no.30A), ten 6-inch riser (no.15A, no.15B, no.15C, no.15D, no.15E, no.15G, no.15H, no.15I, no.15J, and no.15K), and one 42-inch riser (no.7B) are available for use.

6.1.2.1 Inventory Estimate of Tank 241-AZ-101

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew 1995) and Supernatant Mixing Model (Agnew 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AZ-101 are also presented.

6.1.2.2 In-Tank Photograph of Tank 241-AZ-101

In April 1994, Tank 241-AZ-101 contained 949,000 gallons of high level or neutralized current acid waste from PUREX (Hanlon 1994) with a waste

depth of about 29 feet. The most recent collage for this tank is 11 years old and was assembled from photographs taken in August 1983. At that time, the tank contained 650,000 gallons of non-complexed waste (McCann 1983). Since the waste type and level have changed, the waste surface will not appear the same now as it did in 1983. These photographs do, however, provide an accurate picture of equipment inside the tank. This tank has more instruments and auxiliary equipment than other waste storage tanks because it is one of the four double-shell tanks containing aging waste. Monitoring instruments identified in this picture include three temperature probes, four level probes, and three drywells. The tank contains air lift circulators, heating coils, drains, risers, and ports.

6.1.3 Synopsis of Tank 241-AZ-101

(To be completed.)

NOTES:

CONSTRUCT 1971-1977
 NOMINAL CAPACITY: 1,000,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE,
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

Double-Shell Tank 241-AZ-101			
Total Inventory Estimate*			
Physical Properties			
Total Waste	4.03E+06 kg	(931 kgal)	
Heat Load	115 kW	(3.94E+05 BTU/hr)	
Bulk Density†	1.14 (g/cc)		
Water wt%†	80.3		
TOC wt% C	0.159		
Chemical Constituents			
Na ⁺	3.04	6.11E+04	2.46E+05
Al ³⁺	0.384	9.07E+03	3.65E+04
Fe ³⁺ (total Fe)	9.19E-02	4.49E+03	1.81E+04
Cu ²⁺	2.44E-03	111	448
B ³⁺	8.81E-05	16.1	64.9
La ³⁺	6.32E-07	7.68E-02	0.309
Hg ²⁺	5.41E-07	9.50E-02	0.383
Zr (as ZrO ₂ ·H ₂ O)	5.12E-05	4.08	16.4
Pb ²⁺	7.69E-06	1.39	5.61
Ni ²⁺	1.07E-03	54.9	221
Si ²⁺	6.68E-07	5.12E-02	0.206
Mn ²⁺	7.99E-04	38.4	153
Ca ²⁺	1.72E-02	602	2.43E+03
K ⁺	1.97E-03	67.4	271
OH ⁻	2.90	4.31E+04	1.74E+05
NO ₃ ⁻	0.563	3.05E+04	1.23E+05
NO ₂ ⁻	0.471	1.90E+04	7.64E+04
CO ₃ ²⁻	8.66E-02	4.55E+03	1.83E+04
PO ₄ ³⁻	1.36E-02	1.13E+03	4.54E+03
SO ₄ ²⁻	0.121	1.01E+04	4.09E+04
Si (as SiO ₂)	7.38E-02	1.81E+03	7.30E+03
F ⁻	2.46E-02	409	1.65E+03
Cl ⁻	5.34E-02	1.66E+03	6.67E+03
C ₂ H ₃ O ₂ ⁻	4.81E-03	796	3.21E+03
BDTA ⁺	1.43E-03	361	1.45E+03
HEDTA ⁺	2.37E-03	569	2.29E+03
glycolate ⁻	3.27E-02	2.61E+03	1.05E+04
acetate ⁻	1.58E-03	81.7	329
oxalate ²⁻	2.39E-06	0.184	0.740
DBP	1.46E-03	206	828
butanol	1.46E-03	94.5	381
NH ₃	1.51E-02	225	907
Pc(CN) ₄ ⁻	0	0	0
Radiological Constituents			
Pu		0.156 (μCi/g)	10.4 (kg)
U	2.80E-02 (M)	5.84E+03 (μg/g)	2.35E+04 (kg)
Cs	2.64 (Ci/L)	2.31E+03 (μCi/g)	9.30E+06 (Ci)
Sr	3.02 (Ci/L)	2.64E+03 (μCi/g)	1.07E+07 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

241-AZ-101

3,790,000 Liters
(1,000,000 Gallons)

Ref: H-2-47514

TANK RISER LOCATION

Approximate Grade Elevation 304.7m (997.9ft)

Ref: H-2-47517

TANK CROSS-SECTION

Waste Volume

TANK LAYER MODEL

Double-Shell Tank 241-AZ-101			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	3.84E+06 kg	(902 kgal)	
Heat Load	49.5 kW	(1.38E+05 BTU/hr)	
Bulk Density*	1.12 (g/cc)		
Water wt%	81.7		
TOC wt% C (wet)	0.167		
Chemical Constituents			
Na ⁺	2.97	6.08E+04	2.33E+05
Al ³⁺	0.368	8.84E+03	3.39E+04
Fe ²⁺ (total Fe)	1.94E-03	96.4	370
Co ²⁺	2.51E-03	116	446
B ³⁺	9.10E-05	16.9	64.9
La ³⁺	6.52E-07	8.06E-02	0.309
Hg ²⁺	5.59E-07	9.97E-02	0.383
Zr (as ZrO(OH) ₂)	5.28E-05	4.28	16.4
Pb ²⁺	7.89E-06	1.45	5.58
Ni ²⁺	6.14E-04	32.1	123
Sr ²⁺	6.89E-07	5.37E-02	0.206
Mn ²⁺	8.18E-04	40.0	154
Ca ²⁺	1.36E-02	484	1.86E+03
K ⁺	2.03E-03	70.5	271
OH ⁻	2.43	3.68E+04	1.41E+05
NO ₃ ⁻	0.576	3.18E+04	1.22E+05
NO ₂ ⁻	0.474	1.94E+04	7.45E+04
CO ₃ ²⁻	8.49E-02	4.53E+03	1.74E+04
PO ₄ ³⁻	1.39E-02	1.18E+03	4.51E+03
SO ₄ ²⁻	0.121	1.04E+04	3.97E+04
Si (as SiO ₂)	2.98E-02	744	2.86E+03
F ⁻	2.47E-02	417	1.60E+03
Cl ⁻	5.38E-02	1.70E+03	6.51E+03
C ₂ H ₃ O ₂ ⁻	4.96E-03	833	3.20E+03
EDTA ⁴⁻	1.48E-09	379	1.45E+03
HEDTA ³⁻	2.45E-03	597	2.29E+03
glycolate ⁻	4.08E-02	2.72E+03	1.05E+04
acetate ⁻	1.63E-03	85.7	329
oxalate ²⁻	2.46E-06	0.193	0.740
DBP	1.50E-03	215	825
butanol	1.50E-03	99.0	380
NH ₃	1.51E-02	228	828
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	37.1 (μCi/L)		2.11 (kg)
U	3.56E-03 (M)	753 (μg/L)	2.89E+03 (kg)
Cs	2.52 (Ci/L)	2.24E+03 (μCi/L)	8.61E+06 (Ci)
St	6.58E-03 (Ci/L)	5.85 (μCi/L)	2.25E+04 (Ci)

*Density is calculated based on Na, OH⁻, and AlO₂⁻.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AZ-101			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	1.89E+05 kg	(29 kgal)	
Heat Load	74.8 kW	(2.06E+05 BTU/hr)	
Bulk Density	1.72 (g/cc)		
Water wt%	52.1		
TOC wt% C (wet)	0.010		
Chemical Constituents			
Na ⁺	5.02	6.70E+04	1.27E+04
Al ³⁺	0.876	1.37E+04	2.59E+03
Fe ²⁺ (total Fe)	2.89	9.37E+04	1.77E+04
Co ²⁺	2.54E-04	7.66	1.45
B ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	1.38E-06	0.166	3.13E-02
Ni ²⁺	1.52E-02	520	98.2
Sr ²⁺	0	0	0
Mn ²⁺	1.90E-04	6.07	1.15
Ca ²⁺	0.129	3.00E+03	566
K ⁺	1.90E-04	4.32	0.816
OH ⁻	17.4	1.72E+05	3.24E+04
NO ₃ ⁻	0.139	5.00E+03	946
NO ₂ ⁻	0.377	1.01E+04	1.90E+03
CO ₃ ²⁻	0.139	4.85E+03	917
PO ₄ ³⁻	2.49E-03	137	26.0
SO ₄ ²⁻	0.105	5.86E+03	1.11E+03
Si (as SiO ₂)	1.44	2.35E+04	4.45E+03
F ⁻	2.26E-02	250	47.2
Cl ⁻	4.01E-02	826	156
C ₂ H ₃ O ₂ ⁻	4.32E-04	47.4	8.96
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	5.76E-03	251	47.4
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	9.98E-05	15.4	2.91
butanol	9.98E-05	4.30	0.812
NH ₃	1.50E-02	149	28.1
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		2.65 (μCi/g)	8.33 (kg)
U	0.790 (M)	1.09E+05 (μg/g)	2.06E+04 (kg)
Cs	6.33 (Ci/L)	3.68E+03 (μCi/g)	6.95E+05 (Ci)
St	96.8 (Ci/L)	5.63E+04 (μCi/g)	1.06E+07 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

241-AZ-101

Photo date 8-18-83

6.2 Tank 241-AZ-102

6.2.1 241-AZ-102 Tank History

6.2.1.1 Waste History of Tank 241-AZ-102

Tank 241-AZ-102 began service by receiving water in the second quarter of 1976 and was labeled as a spare. The tank received evaporator waste from the third quarter of 1976 until the second quarter of 1977. During the third and fourth quarters of 1977, the tank received residual liquor waste. The tank received complexant concentrate waste from the first quarter of 1978 until November 1983. During December 1983 and January 1984, the tank received complexed waste. From February 1984 until February 1986, the tank received non-complexed waste. The tank received waste from PUREX from the first quarter of 1986 until the first quarter of 1990. From April 1986 until the present, the tank has contained aging waste. The tank is currently an inactive, dilute receiver tank that receives only condensate from other aging waste tanks.

6.2.1.2 Temperature History of Tank 241-AZ-102

Temperature data for Tank 241-AZ-102 are recorded by 15 thermocouples affixed at known elevations on seven thermocouple trees inside the tank. The thermocouple trees are located in risers 13A, B, C, D and 16 A, B, C. Between one and three thermocouples are on each tree. Non-suspect temperature data taken between July 1983 and February 1990 for all 15 thermocouples were available from the computer automated surveillance system. However, not all of the 15 thermocouples have data that encompass the entire length of time. Non-suspect temperature data recorded between April 1990 and September 1990 for all 15 of the thermocouples were available from the data sheets. Within the time span of the computer automated surveillance system, there were several small breaks in the sequence of the temperature data. Within the time span of the manually recorded data, there were no significant breaks in the sequence of temperature data. The average temperature during these periods was 116°F with a minimum of 54°F, a maximum of 249°F, and a standard deviation of 48°F. Linear regressions were performed on each thermocouple over the life of the tank. The slopes from these regressions were averaged with a resulting average slope of 0.029. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

6.2.1.3 Occurrences of Tank 241-AZ-102

Four unusual events occurred at tank 241-AZ-102. TFS & O-EFS-89-063 concerns a bent riser. TFS & O-EFS-88-18 and Unusual Occurrence Report 76-143 were written due to equipment failures. Unusual Occurrence Report 84-21 was written due to an unexpected waste transfer.

6.2.1.4 Psychrometrics of Tank 241-AZ-102

The trend in the rates of heat exchange through the annular ventilation shows an increase from October 1980 to November 1994. This

would suggest an increase in the rate of heat generation in Tank 241-AZ-102, but no corroborating data from the tank ventilation exists.

6.2.2 Current Status of Tank 241-AZ-102

Tank 241-AZ-102 entered service in November 1976 and currently stores 946,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 974,000 gallons and configuration of risers as of January 1994. At the time of the estimate, there were 931,000 gallons of supernatant with 2,000 gallons of concentrated supernatant solids; 13,000 gallons of PUREX high-level waste (P3); 1,000 gallons of Z Plant waste (Z); 3,000 gallons of PUREX low-level waste (PL2); and 26,000 gallons of unknown waste (UNK) which could be waste that was sent to B Plant for strontium recovery (SRR). The waste level in the tank is measured with the manual tape and has increased and decreased from January 1991 to January 1994. The increases and decreases were mostly flush water from miscellaneous sources between January 1991 and January 1994. This tank is inactive and only receives condensate from aging waste tanks. The tank is actively ventilated and categorized as sound. Tank 241-AZ-102 has 117 risers. Two 4-inch risers (no.5B and no.11A), twelve 6-inch risers (no.15A, no.15B, no.15C, no.15D, no.15E, no.15F, no.15G, no.15H, no.15I, no.15J, no.15K, and no.15L), and one 42-inch riser (no.7B) are available for use.

6.2.2.1 Inventory Estimate of Tank 241-AZ-102

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew, 1995) and Supernatant Mixing Model (Agnew, 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-AZ-102 are also presented. Concentrated supernatant solids are considered as an integral part of the liquid for the purpose of estimating inventories, but are graphed as solids on the level histories. The actual substance, which was derived from double-shell slurry, appears as a solid if undisturbed, but the particles are resuspended in solution if heated or disturbed.

6.2.2.2 In-Tank Photograph of Tank 241-AZ-102

In April 1994, Tank 241-AZ-102 contained 961,000 gallons of high-level or neutralized current acid waste from PUREX (Hanlon, 1994) with a waste depth of about 29 feet. The most recent collage for this tank is 10 years old; it was assembled from photographs taken in October 1984. At that time, the tank contained 220,000 gallons of non-complexed waste (McCann, 1984). Since the waste type and level have changed, the waste surface will not appear the same now as it did in 1984. These photographs do, however, provide an accurate picture of the equipment in the tank. This tank has more instruments and auxiliary equipment than other waste storage tanks because it is one of the four double-shell tanks containing aging waste. Monitoring instruments identified in this picture include five temperature probes, four level probes, and five drywells. The tank contains air lift circulators, heating coils, and some drains and nozzles.

6.2.3 Synopsis of Tank 241-AZ-102

(To be completed.)

WTR:	RESID:	CC:
EVAP:		
ANDERSON 1990 WASTE TYPES		

CPLX:	AGING:
NCPLX:	

PL2:	SWLIO:	UNK:
	BL: P3:	

PRIMARY
ADDITIONS

NOTES:

CONSTRUCT 1971-1977
 NOMINAL CAPACITY: 1,000,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

INVENTORY ESTIMATE DATE

WTR: WATER
 EVAP: EVAPORATOR FEED
 RESID: RESIDUAL LIQUOR
 CC: CONCENTRATED CUSTOMER WASTE
 CPLX: COMPLEXED WASTE
 NCPLX: NON-COMPLEXED WASTE
 AGING: CONTAINS AGING WASTE
 PL2: PUREX LOW-LEVEL WASTE
 SWLIO: SALTWELL LIQUOR
 P3: PUREX HIGH-LEVEL WASTE
 UNK: UNKNOWN

LEGEND

— — — — — LIQUID OBSERVATION
 WELL (LOW)
 — — — — — LIQUID LEVEL
 // // // // SOLIDS LEVEL
 + + + + + SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

AZ TANK FARM
 PLOT PLAN

SOLIDS
 LEVEL

SUPERNATANT 929 KGAL
 CS SOLIDS 2 KGAL
 P3 13 KGAL
 Z 1 KGAL
 PL2 3 KGAL
 UNK (SRR) 26 KGAL

See glossary for abbreviations and definitions

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-AZ-102 DOUBLE-SHELL TANK
 LEVEL HISTORY 1976 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: N/A

SIZE	BLOC NO.	OWC NO.	DATE
B	241	ES-TKS-E174	6/95
SCALE	NONE	JOB NO.	SHEET 1 OF 1

Double-Shell Tank 241-AZ-102			
Total Inventory Estimate*			
Physical Properties			
Total Waste	3.88E+06 kg	(974 kgal)	
Heat Load	62.2 kW	(2.12E+05 BTU/hr)	
Bulk Density†	1.05 (g/cc)		
Water wt%	92.5		
TOC wt% C	0.164		
Chemical Constituents			
Na ⁺	1.11	2.42E+04	9.40E+04
Al ³⁺	0.127	3.26E+03	1.26E+04
Fe ³⁺ (total Fe)	6.86E-02	3.64E+03	1.41E+04
Co ²⁺	1.21E-04	5.97	23.2
B ³⁺	1.08E-06	0.215	0.836
La ³⁺	5.47E-09	7.23E-04	2.80E-03
Hg ²⁺	7.13E-09	1.36E-03	5.27E-03
Zr (as ZrO(OH) ₂)	6.89E-07	5.98E-02	0.232
Pb ²⁺	5.42E-07	0.107	0.414
Ni ²⁺	4.66E-04	26.0	101
Sr ²⁺	5.78E-09	4.82E-04	1.87E-03
Mn ²⁺	7.22E-05	3.77	14.6
Ca ²⁺	9.86E-03	376	1.46E+03
K ⁺	9.13E-05	3.39	13.2
OH ⁻	1.24	2.00E+04	7.75E+04
NO ₃ ⁻	6.01E-02	3.54E+03	1.37E+04
NO ₂ ⁻	0.170	7.45E+03	2.89E+04
CO ₃ ²⁻	1.75E-02	1000	3.88E+03
PO ₄ ³⁻	8.90E-04	80.4	312
SO ₄ ²⁻	4.80E-02	4.38E+03	1.70E+04
Si (as SiO ₂)	5.68E-02	1.52E+03	5.88E+03
F ⁻	1.01E-02	182	706
Cl ⁻	1.88E-02	632	2.45E+03
C ₂ H ₃ O ₂ ⁻	5.83E-05	10.5	40.8
BDTA ⁺	3.71E-03	1.01E+03	3.94E+03
HBDTA ⁺	7.41E-03	1.93E+03	7.48E+03
glycolate ⁻	7.84E-03	559	2.17E+03
succinate ⁻	1.90E-05	1.07	4.14
oxalate ²⁻	2.07E-08	1.73E-03	6.70E-03
DBP	5.20E-05	8.93	34.6
butanol	5.20E-05	3.66	14.2
NH ₃	6.71E-03	108	420
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0.154 (μCi/g)	9.93 (kg)
U	1.20E-02 (M)	466 (μg/g)	1.05E+04 (kg)
Cs	1.38 (Ci/L)	1.31E+03 (μCi/g)	5.07E+06 (Ci)
Sr	1.55 (Ci/L)	1.47E+03 (μCi/g)	5.70E+06 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-AZ-102			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	3.65E+06 kg	(931 kgal)	
Heat Load	22.2 kW (7.58E+04 BTU/hr)		
Bulk Density*	1.04 (g/cc)		
Water wt%	94.5		
TOC wt% C (wet)	0.002		
Chemical Constituents			
	moles	grams	kg
Na ⁺	0.944	2.09E+04	7.65E+04
Al ³⁺	0.109	2.83E+03	1.04E+04
Fe ³⁺ (total Fe)	6.96E-04	37.5	137
Cr ³⁺	9.69E-05	4.86	17.7
Bi ³⁺	1.13E-06	0.229	0.836
La ³⁺	5.73E-09	7.68E-04	2.80E-03
Hg ²⁺	7.46E-09	1.44E-03	5.27E-03
Zr (as ZrO(OH) ₂)	7.21E-07	6.35E-02	0.232
Pb ²⁺	4.39E-07	8.77E-02	0.320
Ni ²⁺	2.21E-05	1.25	4.57
Sr ²⁺	6.05E-09	5.12E-04	1.87E-03
Mn ²⁺	5.77E-06	3.06	11.2
Ca ²⁺	4.87E-03	188	687
K ⁺	7.78E-06	2.92	10.7
OH ⁻	0.917	1.51E+04	5.30E+04
NO ₃ ⁻	4.47E-02	2.67E+03	9.76E+03
NO ₂ ⁻	0.170	7.56E+03	2.76E+04
CO ₃ ²⁻	6.50E-03	376	1.37E+03
PO ₄ ³⁻	7.25E-04	66.5	243
SO ₄ ²⁻	4.60E-02	4.26E+03	1.56E+04
Si (as SiO ₂)	1.15E-02	312	1.14E+03
F ⁻	1.02E-02	187	684
Cl ⁻	1.74E-02	394	2.17E+03
C ₂ H ₃ O ₂ ⁻	6.12E-03	11.2	40.8
EDTA ⁴⁻	8.80E-06	2.45	8.93
HEDTA ³⁻	1.14E-05	3.01	11.0
glycolate ⁻	4.67E-04	33.8	124
acetate ⁻	1.99E-05	1.13	4.14
oxalate ²⁻	2.16E-08	1.84E-03	6.70E-03
DBP	4.43E-05	6.88	25.1
benzoic	4.43E-05	3.17	11.6
NH ₃	6.79E-03	111	406
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	15.8 (μCi/L)		0.929 (kg)
U	1.36E-03 (M)	312 (μg/g)	1.14E+03 (kg)
Cs	1.34 (Ci/L)	1.29E+03 (μCi/g)	4.73E+06 (Ci)
Sr	2.43E-03 (Ci/L)	2.34 (μCi/g)	8.56E+03 (Ci)

*Density is calculated based on Na, OH₂, and AlO₂.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-AZ-102			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	2.27E+03 kg	(43 kgal)	
Heat Load	40.0 kW (1.36E+05 BTU/hr)		
Bulk Density	1.39 (g/cc)		
Water wt%	60.3		
TOC wt% C (wet)	2.77		
Chemical Constituents			
	moles	grams	kg
Na ⁺	4.68	7.72E+04	1.75E+04
Al ³⁺	0.518	1.00E+04	2.28E+03
Fe ³⁺ (total Fe)	1.54	6.17E+04	1.40E+04
Cr ³⁺	6.40E-04	23.9	5.41
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	2.79E-06	0.414	9.39E-02
Ni ²⁺	1.01E-02	425	96.2
Sr ²⁺	0	0	0
Mn ²⁺	3.85E-04	15.2	3.44
Ca ²⁺	0.118	3.39E+03	769
K ⁺	3.85E-04	10.8	2.45
OH ⁻	8.15	9.95E+04	2.26E+04
NO ₃ ⁻	0.394	1.75E+04	3.97E+03
NO ₂ ⁻	0.171	5.64E+03	1.28E+03
CO ₃ ²⁻	0.256	1.10E+04	2.50E+03
PO ₄ ³⁻	4.46E-03	304	68.9
SO ₄ ²⁻	9.03E-02	6.23E+03	1.41E+03
Si (as SiO ₂)	1.04	2.09E+04	4.74E+03
F ⁻	7.35E-03	100	22.7
Cl ⁻	4.90E-02	1.25E+03	283
C ₂ H ₃ O ₂ ⁻	0	0	0
EDTA ⁴⁻	8.38E-02	1.73E+04	3.93E+03
HEDTA ³⁻	0.168	3.30E+04	7.47E+03
glycolate ⁻	0.168	9.02E+03	2.05E+03
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	2.19E-04	41.8	9.49
benzoic	2.19E-04	11.7	2.64
NH ₃	5.03E-03	61.4	13.9
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		2.38 (μCi/g)	9.00 (kg)
U	0.242 (M)	2.95E+03 (μg/g)	9.36E+03 (kg)
Cs	2.12 (Ci/L)	1.52E+03 (μCi/g)	3.45E+05 (Ci)
Sr	35.0 (Ci/L)	2.51E+04 (μCi/g)	5.69E+06 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

PHOTO AZ-102

241-AZ-102

Photo date: 10-24-84

MHC-SD-WM-ER350, Rev. 0.

7 SY Tank Farm

7.0.1 SY Tank Farm History

The SY Tank Farm is located east of Cooper Avenue and south of 16th Street in the 200-West Area. The SY Tank Farm contains three, 100 series, 1,160,000 gallon, 75-foot diameter double-shell tanks. The SY Tank Farm is the latest tank design with a reinforced concrete shell and dome, and a insulating concrete base. A heat-treated, stress-relieved, primary steel liner and a non-stress-relieved, outer steel liner are inside the concrete shell. These tanks were made for the storage of concentrated supernatant. Maximum design temperature for liquid is 250°F. The tanks are at the same elevation and no cascade lines exist between tanks.

A color aerial photograph, taken in 1993, of the SY Tank Farm shows the orientation of the 100 series tanks, ventilation equipment, and instrument house.

SY TANK FARM

AERIAL SY

7.0.1.1 SY Tank Farm Waste History

The SY Tank Farm began receiving waste in 1977, and only Tank 241-SY-102 remains active, receiving waste from PFP. Tank 241-SY-101 began receiving residual liquor from 242-S Evaporator in 1977. In 1978, Tank 241-SY-101 began receiving Hanford defense waste, double-shell tank slurry waste, complex concentrate waste, and partially neutralized feed waste. Tank 241-SY-102 also received partially neutralized feed waste and complex concentrate waste in 1978 along with non-complexed waste. Double-shell slurry waste was added in 1980 followed by dilute non-complexed waste from 200-East Area SSTs. The final tank in the SY Tank Farm (Tank 241-SY-103) began receiving residual liquor in 1977 and complexant concentrate in 1978. The final waste added to the SY Tank Farm was dilute non-complexed waste from 200-East Area SSTs.

7.0.1.2 SY Tank Farm Temperature History

Originally, the SY Tank Farm data were recorded from thermocouples on thermocouple trees. Currently, temperatures are recorded with thermocouples that are attached to thermocouple trees and multifunctional instrument trees (MITs). Tanks 241-SY-101 and 241-SY-103 are on the Hydrogen Watch List. Tank 241-SY-101 temperature data are currently obtained during each shift with an increased number of readings taken before and after gas is vented. Tank 241-SY-101 is monitored daily at a minimum, Tank 241-SY-103 is monitored weekly at a minimum, and Tank 241-SY-102 is required to have temperatures recorded semiannually. All of the SY Tanks are monitored by the tank monitor and control system and reported on the surveillance analysis computer system. Historical data from the thermocouples have been stored on the computer automated surveillance system or surveillance analysis computer system. These two databases hold all the temperature data used in developing the statistical results for each tank.

7.0.1.3 SY Tank Farm Occurrences

Eight unusual events affected SY Tank Farm as a whole. Occurrence reports RL--WHC-Tank Farm-1993-0100 and RL--WHC-Tank Farm-1992-0022 describe electrical equipment in the wrong configuration. Occurrence reports RL--WHC-Tank Farm-1993-0062 and WHC-90-0319-TFarm were written because failing equipment caused the tanks to pressurize. Occurrence reports RL--WHC-Tank Farm-1992-0051 and RL--WHC-Tank Farm-1991-1063 concern a loss of power causing the tanks to pressurize. Occurrence report RL--WHC-Tank Farm-1991-1001 was written due to an equipment failure. Occurrence report RL--WHC-Tank Farm-1990-0236 concerns equipment that was out of compliance with procedures. For more information, refer to the Supporting Document for the Southeast Quadrant HTCE for SY Tank Farm.

7.0.1.4 SY Tank Farm Ventilation

The ducts of all three tanks are joined so that the tank exhaust system and annulus exhaust system require one fan each. The tank system is designed to have a maximum flow from any one tank of 700 CFM. Air

enters the tanks by infiltration because there is no supply fan. The tank system has a portable exhaustor as a backup system. In the annulus system, 250 CFM of air enters a prefilter and a HEPA filter before entering the annulus. Then the air from all three annuli enters a steam coil heater, a prefilter, and two more HEPA filters before it is exhausted to the atmosphere. For more information, refer to drawing H-2-37744.

The psychrometric data is recorded in two parts, the tank data and the annulus data. For water and heat leaving the tank, the numbers are positive. For more information, refer to the Supporting Document for the Southeast Quadrant HTCE for SY Tank Farm (Brevick, 1995).

7.0.2 Current Status of SY Tank Farm

Tanks 241-SY-101 and -103 were officially added to the Hydrogen Watch List in January 1991. The two tanks have been identified as unreviewed safety questions due to concern that burning flammable gas could result in a radiological release. All tanks are actively ventilated and categorized as sound. Currently, the total waste volume is 2,608,000 gallons. The estimated volumes (Agnew, January 1994) depicted in each tank cross-section total 2,592,000 gallons of waste. At the time of the estimate, there were 2,521,000 gallons of supernatant with 1,667,000 gallons of concentrated supernatant solids, 5,000 gallons of decontamination waste (DW), 25,000 gallons of Z Plant waste (Z), and 41,000 gallons of salt slurry waste (S2 SLTSLRY) generated from the 242-S Evaporator-crystallizer from 1977 until 1980.

7.1 Tank 241-SY-101

7.1.1 241-SY-101 Tank History

7.1.1.1 Waste History of Tank 241-SY-101

Tank 241-SY-101 began service by receiving residual liquor from the 242-S Evaporator in the second quarter of 1977. The tank received residual liquor until the fourth quarter of 1977. During the first quarter of 1978, the tank received Hanford defense residual liquor. From the second quarter of 1978 until September 1980, the tank received double-shell slurry waste, complexant concentrate waste, and partially neutralized feed waste. The tank has contained complexant concentrate waste from October 1980 until the present. However, during March 1983 and May 1987, the tank waste was designated as double-shell slurry waste. The slight level changes are attributed to slurry growth as a result of gas generation. The tank has not received waste, other than waste water, since the fourth quarter of 1980. The tank is currently an inactive, concentrated waste holding tank.

7.1.1.2 Temperature History of Tank 241-SY-101

Temperature data from within Tank 241-SY-101 have been recorded by two methods. The first method used a thermocouple tree located in riser 4 which had 18 thermocouples affixed at known elevations. Non-suspect temperature data recorded from seven thermocouples on the thermocouple tree

between July 1983 and March 1988 are available on the computer automated surveillance system. Non-suspect temperature data recorded from all of the thermocouples on the tree between August 1990 and September 1992 are available on the surveillance analysis computer system. Within the time spans of each system, there were small breaks in the sequence of temperature data. The average temperature for the thermocouple tree data during these periods was 123.5°F with a minimum of 51°F, a maximum of 155°F, and a standard deviation of 16.5°F. Linear regressions were performed on each thermocouple on the thermocouple tree that had temperature data between January 1990 and January 1994. The slopes from these regressions were averaged with a resulting average slope of -0.015.

The thermocouple tree was listed as out of service and replaced by a multi-functional instrument tree (MIT). The MIT is located in riser 17B. There are 22 thermocouples on the MIT at known elevations in the tank. Non-suspect temperature data from all of the thermocouples on the MIT recorded between September 1992 and August 1993 are available on the surveillance analysis computer system. Within the time span of the surveillance analysis computer system, there were no significant breaks in the sequence of temperature data. The average temperature for the MIT data during this period was 115°F with a minimum of 82°F, a maximum of 129°F, and a standard deviation of 7.9°F. Linear regressions were performed on each thermocouple on the MIT that had temperature data between September 1992 and August 1993. The slopes from these regressions were averaged with a resulting average slope of -0.0066. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

7.1.1.3 Occurrences of Tank 241-SY-101

Thirty unusual events occurred at Tank 241-SY-101. Occurrence reports RL--WHC-Tank Farm-1993-0105, RL--WHC-Tank Farm-1993-0093, RL--WHC-Tank Farm-1993-0090, RL--WHC-Tank Farm-1993-0079, RL--WHC-Tank Farm-1993-0058, RL--WHC-Tank Farm-1993-0016, RL--WHC-Tank Farm-1992-0063, RL--WHC-Tank Farm-1992-0032, RL--WHC-Tank Farm-1991-1069, RL--WHC-Tank Farm-1991-1013, WHC-91-0141-TFarm, RL--WHC-Tank Farm-1990-0173, TFS & O-EFS-89-080, TFS & O-EFS-89-059, and TFS & O-EFS-88-007; Off-Normal Reports 86-18 and 83-19; and Unusual Occurrence Reports 78-16, 77-207, 77-175, and 77-92 account for each time the tank burped. Occurrence reports RL--WHC-Tank Farm-1993-0077, RL--WHC-Tank Farm-1993-0069, RL--WHC-Tank Farm-1993-0026, RL--WHC-Tank Farm-1992-0077, RL--WHC-Tank Farm-1991-1065, and RL--WHC-Tank Farm-1991-0200 concern equipment that was out of compliance with procedures. Occurrence reports RL--WHC-Tank Farm-1992-0076, RL--WHC-Tank Farm-1992-0003, and RL--WHC-Tank Farm-1991-0203 were written due to equipment failure.

7.1.1.4 Psychrometrics of Tank 241-SY-101

Psychrometric data have been recorded from this tank for 14 years and from the annulus for 17 years. The apparent trend of the evaporation rate from the tank has decreased from 143 gallons per week in May 1977 to 83.7 gallons per week in January 1995 (94.7 gallons per week in September 1991). Over that same period, the trend in the rates of heat exchange through the

primary tank and annular ventilation has apparently increased. A review of the psychrometric data in Tank 241-SY-101 would suggest an overall increase in the rate of heat generation by the waste.

7.1.2 Current Status of Tank 241-SY-101

Tank 241-SY-101 entered service in April 1977 and currently stores 1,097,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 1,102,000 gallons and configuration of risers as of January 1994. At the time of the estimate, there were 1,102,000 gallons of supernatant with 1,090,000 gallons of concentrated supernatant solids. The waste level in the tank is measured with the PIC gauge and the manual tape. The waste level increased and decreased between January 1991 and January 1994. The increases were from slurry growth as a result of gas generation and the decreases were caused by the venting of the gas between January 1991 and January 1994. This tank is on the Hydrogen Watch List and, therefore, is prohibited from receiving waste. The tank is actively ventilated and categorized as sound. Tank 241-SY-101 has 54 risers. Four 4-inch risers (no.11, no.14, no.16, and no.22) and two 12-inch risers (no.3 and no.7) are available for use.

7.1.2.1 Inventory Estimate of Tank 241-SY-101

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew, 1995) and Supernatant Mixing Model (Agnew, 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-SY-101 are also presented. Concentrated supernatant solids are considered as an integral part of the liquid for the purpose of estimating inventories, but are graphed as solids on the level histories. The actual substance, which was derived from double-shell slurry, appears as a solid if undisturbed, but the particles are resuspended in solution if heated or disturbed.

7.1.2.2 In-Tank Photograph of Tank 241-SY-101

In April, 1994, Tank 241-SY-101 contained 1,100,000 gallons of complexed concentrate (Hanlon, 1994) which is waste that has been processed through an evaporator. The 1989 collage for this tank shows an almost full tank of solid waste which was also complexed concentrate (Thurman, 1989) and is probably the same or similar to the current waste. The surface appears to have resulted from mixing several different materials together. Most of the waste appears to be grey, however, there is a large amount of off-white material. Tank walls are rusted. Equipment in the tank which has been identified includes two temperature probes, three level probes, a tank pressure port, and some risers. The waste height is about 33 feet.

7.1.3 Synopsis of Tank 241-SY-101

(To be completed.)

ANDERSON
1990
WASTE TYPES

RESID:
HDRL:

DSS: CC:
PNF:
CC:

DSS:
CC:

DSS:
CC:

GAS:

PRIMARY
ADDITIONS

LEVEL IN
FEET
LEVEL IN
INCHES

36' 432"

34' 408"

32' 384"

30' 360"

28' 336"

26' 312"

24' 288"

22' 264"

20' 240"

18' 216"

16' 192"

14' 168"

12' 144"

10' 120"

8' 96"

6' 72"

4' 48"

2' 24"

0' 0"

FORM 242-S EVAPORATOR

PHOTOS (1977)

FROM SX-106
PHOTO (12/78)

PHOTOS (1980)

FROM SY-102

PHOTOS (1981)

PHOTO (7/83)

PHOTOS (1984)

LIQUID
LEVEL

SOLIDS
LEVEL

1977

78

79

80

81

82

83

84

85

86

87

88

YEARS

NOTES:

CONSTRUCT 1974-1976
 NOMINAL CAPACITY 1,160,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE,
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

UNK:

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

RESID RESIDUAL LIQUOR
 HDRL HANFORD DEFENSE RESIDUAL LIQUOR
 OSS DOUBLE-SHELL SLURRY
 CC COMPLEXANT CONCENTRATE WASTE
 PNF PARTIAL NEUTRALIZED FEED
 GAS LEVEL FLUXUATION DUE TO GAS BUILD-UP
 UNK UNKNOWN

LEGEND

□-□-□ LIQUID OBSERVATION
 WELL (LOW)
 — LIQUID LEVEL
 // SOLIDS LEVEL
 +++ SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

SY TANK FARM
PLOT PLAN

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-SY-101 DOUBLE-SHELL TANK
 LEVEL HISTORY 1976 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: HYDROGEN

SIZE	BLDG NO	OWB NO	DATE
B	241	ES-TKS-E175	6/95
SCALE	NONE	JOB NO	SHEET 1 OF 1

Double-Shell Tank 241-SY-101			
Total Inventory Estimate*			
Physical Properties			
Total Waste	6.43E+06 kg (1.10E+03 kgal)		
Heat Load	8.36 kW (2.86E+04 BTU/hr)		
Bulk Density†	1.54 (g/cc)		
Water wt%†	40.5		
TOC wt% C	1.00		
Chemical Constituents			
Na ⁺	11.5	1.71E+05	1.10E+06
Al ³⁺	1.61	2.81E+04	1.81E+05
Fe ³⁺ (total Fe)	2.69E-03	97.4	626
Co ²⁺	3.67E-02	1.24E+03	7.95E+03
B ³⁺	2.05E-03	278	1.79E+03
La ³⁺	1.66E-05	1.49	9.59
Hf ⁴⁺	1.18E-05	1.53	9.84
Zr (as ZrO(OH) ₂)	1.28E-03	75.7	487
Pb ²⁺	2.77E-05	3.72	23.9
Ni ²⁺	2.40E-03	91.3	587
Sr ²⁺	1.75E-05	0.995	6.40
Mn ²⁺	9.31E-03	332	2.13E+03
Ca ²⁺	1.88E-02	489	3.15E+03
K ⁺	2.46E-02	623	4.01E+03
OH ⁻	6.93	7.65E+04	4.91E+05
NO ₃ ⁻	3.40	1.37E+05	8.78E+05
NO ₂ ⁻	3.42	1.02E+05	6.57E+05
CO ₃ ²⁻	0.430	1.68E+04	1.08E+05
PO ₄ ³⁻	0.162	9.99E+03	6.42E+04
SO ₄ ²⁻	0.325	2.03E+04	1.30E+05
Si (as SiO ₂)	4.25E-02	775	4.98E+03
F ⁻	0.119	1.47E+03	9.47E+03
Cl ⁻	0.199	4.58E+03	2.94E+04
C ₂ H ₃ O ₂ ⁻	3.48E-02	4.27E+03	2.74E+04
EDTA ⁴⁻	1.99E-02	3.72E+03	2.39E+04
HEDTA ³⁻	3.72E-02	6.62E+03	4.26E+04
glycolate ⁻	0.111	5.39E+03	3.47E+04
acetate ⁻	8.19E-03	314	2.02E+03
oxalate ²⁻	6.25E-05	3.57	22.9
DBP	1.49E-02	1.56E+03	1.00E+04
butanol	1.49E-02	717	4.61E+03
NH ₃	5.40E-02	596	3.83E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		2.43E-02 (μCi/g)	2.63 (kg)
U	6.01E-03 (M)	928 (μg/g)	5.97E+03 (kg)
Cs	0.415 (Ci/L)	269 (μCi/g)	1.73E+06 (Ci)
Sr	8.94E-03 (Ci/L)	5.80 (μCi/g)	3.73E+04 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-SY-101			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	6.43E+06 kg (1.10E+03 kgal)		
Heat Load	8.36 kW (2.86E+04 BTU/hr)		
Bulk Density*	1.54 (g/cc)		
Water wt%	40.5		
TOC wt% C (wet)	1.00		
Chemical Constituents			
Na ⁺	11.5	1.71E+05	1.10E+06
Al ³⁺	1.61	2.81E+04	1.81E+05
Fe ³⁺ (total Fe)	2.69E-03	97.4	626
Cr ³⁺	3.67E-02	1.24E+03	7.95E+03
Bi ³⁺	2.05E-03	278	1.79E+03
La ³⁺	1.66E-05	1.49	9.59
Hg ²⁺	1.18E-05	1.53	9.84
Zr (as ZrO(OH) ₂)	1.28E-03	75.7	487
Pb ²⁺	2.77E-05	3.72	23.9
Ni ²⁺	2.40E-03	91.3	587
Si ²⁺	1.74E-05	0.995	6.40
Mn ²⁺	9.31E-03	332	2.13E+03
Ca ²⁺	1.88E-02	489	3.15E+03
K ⁺	2.46E-02	623	4.01E+03
OH ⁻	6.93	7.65E+04	4.91E+05
NO ₃ ⁻	3.40	1.37E+05	8.78E+05
NO ₂ ⁻	3.42	1.02E+05	6.57E+05
CO ₃ ²⁻	0.430	1.68E+04	1.08E+05
PO ₄ ³⁻	0.162	9.99E+03	6.42E+04
SO ₄ ²⁻	0.325	2.03E+04	1.30E+05
Si (as SiO ₂)	4.25E-02	775	4.98E+03
F ⁻	0.119	1.47E+03	9.47E+03
Cl ⁻	0.199	4.58E+03	2.94E+04
C ₆ H ₅ O ₇ ³⁻	3.48E-02	4.27E+03	2.74E+04
EDTA ⁴⁻	1.99E-02	3.72E+03	2.39E+04
HEDTA ³⁻	3.72E-02	6.62E+03	4.26E+04
glycolate ⁻	0.111	5.39E+03	3.47E+04
acetate ⁻	8.19E-03	314	2.02E+03
oxalate ²⁻	6.25E-05	3.57	22.9
DBP	1.49E-02	1.56E+03	1.00E+04
butanol	1.49E-02	717	4.61E+03
NH ₃	5.40E-02	596	3.83E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	37.8 (μCi/L)		2.63 (kg)
U	6.01E-03 (M)	928 (μg/g)	5.97E+03 (kg)
Cs	0.415 (Ci/L)	269 (μCi/g)	1.73E+06 (Ci)
Sr	8.94E-03 (Ci/L)	5.80 (μCi/g)	3.73E+04 (Ci)

*Density is calculated based on Na, OH₂, and AlO₂.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-SY-101			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	0 kg (0 kgal)		
Heat Load	0 kW (0 BTU/hr)		
Bulk Density	0 (g/cc)		
Water wt%	0		
TOC wt% C (wet)	0		
Chemical Constituents			
Na ⁺	0	0	0
Al ³⁺	0	0	0
Fe ³⁺ (total Fe)	0	0	0
Cr ³⁺	0	0	0
Bi ³⁺	0	0	0
La ³⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0	0	0
Si ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	0	0	0
K ⁺	0	0	0
OH ⁻	0	0	0
NO ₃ ⁻	0	0	0
NO ₂ ⁻	0	0	0
CO ₃ ²⁻	0	0	0
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₂)	0	0	0
F ⁻	0	0	0
Cl ⁻	0	0	0
C ₆ H ₅ O ₇ ³⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	0	0	0
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0	0
U	0	0	0
Cs	0	0	0
Sr	0	0	0

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

241-SY-101

Photo date 4-12-89

7.2 Tank 241-SY-102

7.2.1 241-SY-102 Tank History

7.2.1.1 Waste History of Tank 241-SY-102

Tank 241-SY-102 began service by receiving evaporator feed waste in the second quarter of 1977. The tank continued receiving evaporator feed waste until the fourth quarter of 1977. From the first quarter of 1978 until September 1980, the tank received partially neutralized feed waste, non-complexed waste, and complexant concentrate waste. The tank received decontamination waste from the first quarter of 1980 until the first quarter of 1990. From October 1980 until October 1981, the tank received double-shell slurry feed waste. From the fourth quarter of 1981 until the second quarter of 1983, the tank received dilute non-complexed waste from the 200-East Area SSTs. The tank received non-complexed waste from November 1981 until May 1990. The tank has contained dilute non-complexed waste and PFP and TRU solids waste from June 1990 until the present. The tank is currently an active, dilute receiver tank that receives waste from PFP and non-complexed saltwell waste.

7.2.1.2 Temperature History of Tank 241-SY-102

Temperature data for Tank 241-SY-102 are recorded by 18 thermocouples at known elevations on one thermocouple tree inside the tank located in riser 4A. Only 13 of the 18 thermocouples have temperature data. Non-suspect temperature data taken between July 1983 and March 1988 for seven of the thermocouples were available from the computer automated surveillance system. Non-suspect temperature data recorded between January 1991 and December 1993 for seven of the thermocouples were available from the surveillance analysis computer system. Within the time spans of each system, there were small breaks in the sequence of temperature data. The average temperature during these periods was 76°F with a minimum of 52°F, a maximum of 155°F, and a standard deviation of 21°F. Linear regressions were performed on each thermocouple that had temperature data between January 1991 and January 1994. The slopes from these regressions were averaged with a resulting average slope of -0.0017. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

7.2.1.3 Occurrences of Tank 241-SY-102

Nine unusual events concerned Tank 241-SY-102. Occurrence reports RL--WHC-Tank Farm-1993-0028 and RL--WHC-Tank Farm-1992-0082 and Unusual Occurrence Report 77-52 were written due to equipment failures. Occurrence report RL--WHC-Tank Farm-1991-1011 was written because failing equipment pressurized the tank. Occurrence report RL--WHC-Tank Farm-1991-0192 and U.O. Report 77-64 were written due to unexpected waste transfers. U.O. Reports 80-66, 77-189, and 77-54 concerned radiation found on a sampling filter monitoring air in the annulus.

7.2.1.4 Psychrometrics of Tank 241-SY-102

Psychrometric data have been recorded for 17 years from this tank and annulus. The apparent trend of the evaporation rate from the tank has decreased from 492.9 gallons per week in May 1977 to 30.8 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank and annular ventilation has apparently decreased. A review of the psychrometric data in Tank 241-SY-102 would suggest an overall decrease in the rate of heat generation by the waste.

7.2.2 Current Status of Tank 241-SY-102

Tank 241-SY-102 entered service in April 1977 and currently stores 761,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 732,000 gallons and configuration of risers as of January 1994. At the time of the estimate, there were 661,000 gallons of supernatant, 5,000 gallons of decontamination waste (DW), 25,000 gallons of Z Plant waste (Z), and 41,000 gallons of salt slurry waste (S2SltStry) generated from the 242-S Evaporator-Crystallizer from 1977 until 1980. The waste level in the tank is measured with the FIC gauge and the manual tape and has increased from January 1991 to January 1994. The increases were mostly flush water from miscellaneous sources between January 1991 and January 1994. This tank is active and receives waste from PFP and non-complexed saltwell waste. The tank is actively ventilated and categorized as sound. Tank 241-SY-102 has 54 risers. One 42-inch riser (no.5B) and one 12-inch riser (no.13A) are available for use.

7.2.2.1 Inventory Estimate of Tank 241-SY-102

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew 1995) and Supernatant Mixing Model (Agnew 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-SY-102 are also presented.

7.2.2.2 In-Tank Photograph of Tank 241-SY-102

The 1981 collage for Tank 241-SY-102 shows a dark liquid waste surface with a swirl of white solids. The tank dome and walls appear slightly rusted. The photograph itself is adequate to see the instruments in the tank, but the flash of the camera caused a bright reflection off the nearby equipment. The equipment within the tank has been identified and labeled for the reader. The tank contains 725,000 gallons of waste (Hanlon, 1994) which corresponds to a waste height of about 20 feet.

7.2.3 Synopsis of Tank 241-SY-102

(To be completed.)

DN/PT

UNK:

NOTES:

CONSTRUCT 1974-1976
 NOMINAL CAPACITY: 1,160,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE,
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

— 1,188,000

— 1,122,000

— 1,056,000

— 990,000

— 924,000

— 858,000

— 792,000

— 726,000

— 660,000

— 594,000

— 528,000

— 462,000

— 396,000

— 330,000

— 264,000

— 198,000

— 132,000

— 66,000

— 0

EVAP: EVAPORATOR FEED
 PNF: PARTIAL NEUTRALIZED FEED
 CC: COMPLEXANT CONCENTRATE WASTE
 DSSF: DOUBLE-SHELL SLURRY FEED WASTE
 NCPLX: NON-COMPLEXED WASTE
 DN/PT: DILUTE NON-COMPLEXED WASTE / PFP
 AND TRU SOLIDS
 DW: DECONTAMINATION WASTE
 SWLQ: SALTWELL LIQUOR
 Z: Z PLANT WASTE
 UNK: UNKNOWN

LEGEND

— — — — — LIQUID OBSERVATION
 WELL (LOW)
 — — — — — LIQUID LEVEL
 // // // // SOLIDS LEVEL
 // // // // SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

**SY TANK FARM
PLOT PLAN**

SUPERNATANT 661 KGAL
 DW 5 KGAL
 Z 25 KGAL
 S2SLTSLRY 41 KGAL

See glossary for abbreviations and definitions

SOLIDS
LEVEL

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-SY-102 DOUBLE-SHELL TANK
 LEVEL HISTORY 1976 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: N/A

SIZE	BLOC NO.	DWG NO.	DATE
B	241	ES-TKS-E176	6/95
SCALE	NONE	JOB NO.	SHEET 1 OF 1

Double-Shell Tank 241-SY-102			
Total Inventory Estimate*			
Physical Properties			
Total Waste	3.04E+06 kg	(732 kgal)	
Heat Load	0.541 kW	(1.85E+03 BTU/hr)	
Bulk Density†	1.10 (g/cc)		
Water wt%	86.4		
TOC wt% C	0.123		
Chemical Constituents			
	wt%	ppm	kg
Na ⁺	1.69	3.53E+04	1.07E+05
Al ³⁺	0.550	1.35E+04	4.11E+04
Fe ³⁺ (total Fe)	8.63E-02	4.39E+03	1.33E+04
Cr ⁶⁺	1.35E-02	638	1.94E+03
Bi ³⁺	3.17E-04	60.5	184
La ³⁺	1.40E-06	0.178	0.540
Hg ²⁺	1.47E-06	0.269	0.817
Zr (as ZrO(OH) ₂)	2.38E-04	19.8	60.1
Pb ²⁺	4.56E-06	0.862	2.62
Ni ²⁺	7.30E-03	391	1.19E+03
Si ²⁺	2.92E-06	0.233	0.709
Mn ²⁺	9.20E-04	46.1	140
Ca ²⁺	1.96E-02	717	2.18E+03
K ⁺	4.07E-03	145	440
OH ⁻	2.22	3.44E+04	1.05E+05
NO ₃ ⁻	0.631	3.56E+04	1.08E+05
NO ₂ ⁻	0.463	1.94E+04	5.91E+04
CO ₃ ²⁻	8.09E-02	4.43E+03	1.35E+04
PO ₄ ³⁻	2.07E-02	1.79E+03	5.44E+03
SO ₄ ²⁻	3.66E-02	3.21E+03	9.75E+03
Si (as SiO ₂)	5.32E-03	136	414
F ⁻	1.02E-02	189	573
Cl ⁻	2.54E-02	822	2.50E+03
C ₆ H ₅ O ₂ ⁻	3.37E-03	581	1.77E+03
BDTA ⁻	1.92E-03	503	1.53E+03
HBDTA ⁻	3.47E-03	868	2.64E+03
glycolate ⁻	1.13E-02	774	2.35E+03
acetate ⁻	1.16E-03	62.2	189
oxalate ⁻	5.30E-06	0.425	1.29
DBP	1.55E-03	350	1.06E+03
butanol	1.55E-03	105	318
NH ₃	1.91E-02	295	895
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0.814 (μCi/g)	41.3 (kg)
U	5.78E-04 (M)	125 (μg/g)	381 (kg)
Cs	4.02E-02 (Ci/L)	36.6 (μCi/g)	1.11E+05 (Ci)
Sr	1.01E-03 (Ci/L)	0.919 (μCi/g)	2.79E+03 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

†Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-SY-102			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	2.58E+06 kg (661 kgal)		
Heat Load	6.01E+02 kW (205 BTU/hr)		
Bulk Density*	1.03 (g/cc)		
Water wt%	94.1		
TOC wt% C (wet)	0.018		
Chemical Constituents			
Na ⁺	0.744	1.66E+04	4.28E+04
Al ³⁺	5.17E-02	1.35E+03	3.49E+03
Fe ³⁺ (total Fe)	1.22E-03	66.0	170
Cr ⁶⁺	5.16E-03	260	671
BP ⁺	1.68E-05	3.41	8.80
Ia ⁺	7.35E-08	9.91E-03	2.59E-02
Hg ²⁺	1.91E-07	3.71E-02	9.57E-02
Zr (as ZrO(OH) ₂)	3.53E-05	3.12	8.06
Pb ²⁺	1.74E-06	0.350	0.902
Ni ²⁺	1.08E-02	61.5	159
Sr ²⁺	7.77E-08	6.61E-03	1.70E-02
Mn ²⁺	2.01E-04	10.7	27.6
Ca ²⁺	8.53E-03	332	855
K ⁺	2.32E-03	87.9	227
OH ⁻	0.277	4.57E+03	1.18E+04
NO ₃ ⁻	0.497	2.99E+04	7.70E+04
NO ₂ ⁻	4.00E-02	1.78E+03	4.60E+03
CO ₃ ²⁻	3.78E-02	2.20E+03	5.68E+03
PO ₄ ³⁻	3.06E-03	282	727
SO ₄ ²⁻	6.58E-03	613	1.58E+03
Si (as SiO ₂)	7.52E-04	20.5	52.9
F ⁻	3.11E-03	57.4	148
Cl ⁻	1.93E-02	663	1.71E+03
C ₆ H ₅ O ₇ ³⁻	5.45E-04	99.9	258
BDTA ⁺	2.38E-04	66.6	172
HBDTA ⁺	3.88E-04	103	266
glycolate ⁻	2.60E-03	189	487
acetate ⁻	2.82E-04	16.2	41.7
oxalate ²⁻	2.78E-07	2.37E-02	6.11E-02
DBP	2.92E-04	45.6	118
butanol	2.92E-04	21.0	54.2
NH ₃	7.13E-03	118	303
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	4.91 (μCi/L)		0.205 (kg)
U	1.26E-04 (M)	29.2 (μg/g)	75.3 (kg)
Cs	4.68E-03 (Ci/L)	4.54 (μCi/g)	1.17E+04 (Ci)
Sr	3.14E-04 (Ci/L)	0.305 (μCi/g)	786 (Ci)

*Density is calculated based on Na, OH⁻, and AlO₂⁻.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-SY-102			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	4.61E+05 kg (71 kgal)		
Heat Load	0.481 kW (1.64E+03 BTU/hr)		
Bulk Density	1.71 (g/cc)		
Water wt%	43.5		
TOC wt% C (wet)	0.713		
Chemical Constituents			
Na ⁺	10.4	1.40E+05	6.45E+04
Al ³⁺	5.18	8.16E+04	3.76E+04
Fe ³⁺ (total Fe)	0.878	2.86E+04	1.32E+04
Cr ⁶⁺	9.09E-02	2.76E+03	1.27E+03
BP ⁺	3.12E-03	380	175
Ia ⁺	1.34E-05	1.12	0.515
Hg ²⁺	1.34E-05	1.57	0.722
Zr (as ZrO(OH) ₂)	2.12E-03	113	52.0
Pb ²⁺	3.09E-05	3.73	1.72
Ni ²⁺	6.52E-02	2.23E+03	1.03E+03
Sr ²⁺	2.94E-05	1.50	0.692
Mn ²⁺	7.61E-03	244	112
Ca ²⁺	0.123	2.87E+03	1.32E+03
K ⁺	2.03E-02	464	214
OH ⁻	20.3	2.02E+05	9.29E+04
NO ₃ ⁻	1.88	6.79E+04	3.13E+04
NO ₂ ⁻	4.40	1.18E+05	5.45E+04
CO ₃ ²⁻	0.482	1.69E+04	7.77E+03
PO ₄ ³⁻	0.185	1.02E+04	4.71E+03
SO ₄ ²⁻	0.317	1.77E+04	8.17E+03
Si (as SiO ₂)	4.79E-02	784	361
F ⁻	8.37E-02	928	427
Cl ⁻	8.28E-02	1.71E+03	788
C ₆ H ₅ O ₇ ³⁻	2.97E-02	3.28E+03	1.51E+03
BDTA ⁺	1.75E-02	2.95E+03	1.36E+03
HEDTA ⁺	3.22E-02	5.15E+03	2.37E+03
glycolate ⁻	9.25E-02	4.05E+03	1.86E+03
acetate ⁻	9.29E-03	320	147
oxalate ²⁻	5.21E-05	2.67	1.23
DBP	1.32E-02	2.06E+03	947
butanol	1.32E-02	573	264
NH ₃	0.130	1.29E+03	595
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		5.35 (μCi/g)	41.1 (kg)
U	4.78E-03 (M)	664 (μg/g)	306 (kg)
Cs	0.371 (Ci/L)	216 (μCi/g)	9.97E+04 (Ci)
Sr	7.47E-03 (Ci/L)	4.36 (μCi/g)	2.01E+03 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

241-SY-102

Photo date 4-29-81

7.3 Tank 241-SY-103

7.3.1 241-SY-103 Tank History

7.3.1.1 Waste History of Tank 241-SY-103

Tank 241-SY-103 began service by receiving residual liquor in the second quarter of 1977. The tank received residual liquor until the fourth quarter of 1977. From the first quarter of 1978 until August 1980, the tank received complexant concentrate waste. The tank contained double-shell slurry waste from October 1980 until May 1990. During March 1983 and May 1987, the waste was designated complexant concentrate waste. The tank received dilute non-complexed waste from the 200-East Area single-shell tanks from the second quarter of 1988 until the second quarter of 1989. From June 1990 until the present, the tank has contained complexant concentrate waste. The slight level changes are attributed to slurry growth as a result of gas generation. The tank has not received waste since the second quarter of 1989. The tank is currently an inactive, concentrated waste holding tank.

7.3.1.2 Temperature History of Tank 241-SY-103

Temperature data for Tank 241-SY-103 are recorded by 18 thermocouples at known elevations on one thermocouple tree inside the tank, located in riser 4A. Only 13 of the 18 thermocouples had temperature data. Non-suspect temperature data taken between July 1983 and March 1988 for seven of the thermocouples were available from the computer automated surveillance system. However, not all of the seven thermocouples have data that encompass the entire length of time. Non-suspect temperature data recorded between January 1991 and September 1993 for seven of the thermocouples were available from the surveillance analysis computer system. However, not all of these thermocouples have data that encompass the entire length of time. Within the time spans of each system, there were small breaks in the sequence of temperature data. The average temperature during these periods was 109°F with a minimum of 67°F, a maximum of 135°F, and a standard deviation of 15°F. Linear regressions were performed on each thermocouple that had temperature data between January 1991 and January 1994. The slopes from these regressions were averaged with a resulting slope of -0.0090. Refer to the supporting document for a more thorough review of the temperature data (Brevick, 1995).

7.3.1.3 Occurrences of Tank 241-SY-103

Three unusual events occurred at Tank 241-SY-103. Occurrence report RL--WHC-Tank Farm-1993-0101 was issued in November 1993 because a frozen valve on the exhaust header partially blocked air flow. Off-Normal Report 86-18 was written because Tank 241-SY-101 burped causing Tank 241-SY-103 to pressurize. Unusual Occurrence Report 79-17 was issued in February 1979 because the liquid waste level decreased below established criteria. The decrease in liquid level was due to an unexpected waste transfer.

7.3.1.4 Psychrometrics of Tank 241-SY-103

Psychrometric data have been recorded for 17 years from this tank and annulus. The apparent trend of the evaporation rate from the tank has increased from 112.8 gallons per week in May 1977 to 116.7 gallons per week in January 1995. Over that same period, the trend in the rates of heat exchange through the primary tank ventilation has decreased. The rates of heat exchange through the annular ventilation show an increasing trend. The majority of the changes in the rate of heat exchange can be attributed to changes in the average ventilation rates. A review of the psychrometric data in Tank 241-SY-103 would suggest an increase in the rate of heat generation by the waste.

7.3.2 Current Status of Tank 241-SY-103

Tank 241-SY-103 entered service in April 1977 and currently stores 750,000 gallons of waste. The following plan view and tank cross-section depict the approximate waste volume of 758,000 gallons and configuration of risers in January 1994. At the time of the estimate, there were 758,000 gallons of supernatant with 577,000 gallons of concentrated supernatant solids. The waste level in the tank is measured with the FIC gauge and the manual tape and has slightly increased and decreased from January 1991 to January 1994. The increases were slurry growth as a result of gas generation and the decreases were the venting of the gas between January 1991 and January 1994. This tank is on the Hydrogen Watch List and, therefore, is prohibited from receiving waste. The tank is actively ventilated and categorized as sound. Tank 241-SY-103 has 54 risers as of January 1994. Four 4-inch risers (no.11, no.14, no.16, and no.22) and two 12-inch risers (no.3 and no.7) are available for use.

7.3.2.1 Inventory Estimate of Tank 241-SY-103

The tank layer model (a volume based approximation) that follows was derived from the Los Alamos National Laboratory Waste Status and Transaction Record Summary (Agnew, 1995) and Supernatant Mixing Model (Agnew, 1995). The estimated inventories of total waste, solids, and supernatant in Tank 241-SY-103 are also presented. Concentrated supernatant solids are considered as an integral part of the liquid for the purpose of estimating inventories, but are graphed as solids on the level histories. The actual substance, which was derived from double-shell slurry, appears as a solid if undisturbed, but the particles are resuspended in solution if heated or disturbed.

7.3.2.2 In-Tank Photograph of Tank 241-SY-103

In April 1994, Tank 241-SY-103 contained 744,000 gallons of complexed concentrate (Hanlon, 1994) which is waste that has been processed through an evaporator. The most recent collage for this tank was assembled in 1985 and at that time the tank contained 577,000 gallons of double shell slurry. It appears the waste at that time was a black liquid. The tank walls appear to be in very good condition. The location of equipment in the tank should be the same now as it was in 1985. Some level probes and a

temperature probe are visible. The waste height is about 23 feet.

7.3.3 Synopsis of Tank 241-SY-103
(To be completed.)

ANDERSON
1990
WASTE TYPES

RESID:
CCPLX:

CC:

DSS:

CC:
DSS:

CC:
DSS:

UNK:

GAS:

SY

PRIMARY
ADDITIONS

LEVEL IN
FEET
LEVEL IN
INCHES

36' 432"
34' 408"
32' 384"
30' 360"
28' 336"
26' 312"
24' 288"
22' 264"
20' 240"
18' 216"
16' 192"
14' 168"
12' 144"
10' 120"
8' 96"
6' 72"
4' 48"
2' 24"
0' 0"

LIQUID
LEVEL

PHOTO (6/79)

TO S-107

PHOTOS (1980)

FROM S-103 & SY-102

PHOTO (7/83)

PHOTO (10/85)

FLUCL WATER ADDITIONS

YEARS

CC:

NOTES:

CONSTRUCT 1974-1976
 NOMINAL CAPACITY: 1,160,000 GAL
 FLAT BOTTOM TANK, NO KNUCKLE
 75 FOOT DIAMETER DOUBLE-SHELL TANK
 SURFACE LEVEL READING: PHOTO
 (LIQUIDS & SOLIDS), FIC (SOLIDS)

Q:

INVENTORY ESTIMATE DATE

CAPACITY
(GALLONS)

1,188,000

1,122,000

1,056,000

990,000

924,000

858,000

792,000

726,000

660,000

594,000

528,000

462,000

396,000

330,000

264,000

198,000

132,000

66,000

0

RESID: RESIDUAL LIQUOR
 CCPLX: CONCENTRATED COMPLEX WASTE
 CC: COMPLEXANT CONCENTRATE WASTE
 OSS: DOUBLE-SHELL SLURRY
 UNK: UNKNOWN
 GAS: LEVEL FLUXUATION DUE TO GAS BUILD-UP
 SWLIO: SALTWELL LIQUOR

LEGEND

LIQUID OBSERVATION
 WELL (LOW)
 LIQUID LEVEL
 SOLIDS LEVEL
 SOLIDS LEVEL BEST
 ENGINEERING JUDGEMENT

SOLIDS
LEVEL

SUPERNATANT 181 KGAL
 CS SOLIDS 577 KGAL
 See glossary for abbreviations and definitions

SY TANK FARM
PLOT PLAN

U.S. DEPARTMENT OF ENERGY
 RICHLAND FIELD OFFICE
 ICF KAISER HANFORD

241-SY-103 DOUBLE-SHELL TANK
 LEVEL HISTORY 1976 TO 1994
 SOUND/ACTIVE TANK
 WATCH LIST: HYDROGEN

SIZE	BLDG NO.	DWG NO.	DATE
B	241	ES-TKS-E177	6/95
SCALE	JOB NO.	SHEET	OF
NONE		1	1

Double-Shell Tank 241-SY-103			
Total Inventory Estimate*			
Physical Properties			
Total Waste	4.21E+06 kg	(758 kgal)	
Heat Load	536 kW	(1.83E+04 BTU/hr)	
Bulk Density		1.47 (g/cc)	
Water wgt%		45.7	
TOC wgt% C		1.08	
Chemical Constituents			
Na ⁺	9.94	1.56E+05	6.56E+05
Al ³⁺	1.40	2.56E+04	1.08E+05
Fe ³⁺ (total Fe)	2.74E-03	104	440
Co ²⁺	3.21E-02	1.14E+03	4.79E+03
B ³⁺	1.61E-03	229	964
La ³⁺	1.48E-03	1.40	5.91
Hg ²⁺	9.81E-06	1.34	5.63
Zr (as ZrO(OH) ₂)	9.84E-04	61.1	258
Pb ²⁺	4.85E-05	6.64	28.1
Ni ²⁺	2.39E-03	95.4	402
Sr ²⁺	1.57E-05	0.936	3.94
Mn ²⁺	8.08E-03	302	1.27E+03
Ca ²⁺	1.92E-02	524	2.21E+03
K ⁺	2.40E-02	639	2.69E+03
OH ⁻	6.06	7.01E+04	2.95E+05
NO ₃ ⁻	3.00	1.27E+05	5.34E+05
NO ₂ ⁻	2.84	8.90E+04	3.75E+05
CO ₃ ²⁻	0.369	1.51E+04	6.36E+04
PO ₄ ³⁻	0.134	8.66E+03	3.65E+04
SO ₄ ²⁻	0.281	1.84E+04	7.75E+04
Si (as SiO ₂)	4.06E-02	777	3.27E+03
F ⁻	9.67E-02	1.25E+03	5.27E+03
Cl ⁻	0.170	4.11E+03	1.73E+04
C ₂ H ₃ O ₂ ⁻	3.45E-02	4.45E+03	1.87E+04
EDTA ⁴⁻	2.15E-02	4.22E+03	1.78E+04
HEDTA ³⁻	3.84E-02	7.17E+03	3.02E+04
glycolate ⁻	0.104	5.31E+03	2.24E+04
acetate ⁻	1.48E-02	595	2.51E+03
oxalate ²⁻	5.60E-03	3.36	14.1
DBP	1.64E-02	1.80E+03	7.57E+03
betanof	1.64E-02	827	3.48E+03
NH ₃	4.69E-02	343	2.29E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		2.52E-02 (μCi/g)	1.77 (kg)
U	5.20E-03 (M)	843 (μCi/g)	3.55E+05 (kg)
Cs	0.386 (Ci/L)	263 (μCi/g)	1.11E+06 (Ci)
Sr	8.76E-03 (Ci/L)	5.97 (μCi/g)	2.51E+04 (Ci)

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

[†]Volume average for density, mass average Water wt% and TOC wt% C.

Double-Shell Tank 241-SY-103			
SMM Composite Inventory Estimate			
Physical Properties			
Total Supernatant	4.21E+06 kg	(758 kgal)	
Heat Load	5.36 kW	(1.83E+04 BTU/hr)	
Bulk Density*	1.47 (g/cc)		
Water wt%	45.7		
TOC wt% C (wet)	1.08		
Chemical Constituents			
Na ⁺	9.94	1.56E+03	6.56E+03
Al ³⁺	1.40	2.56E+04	1.08E+05
Fe ²⁺ (total Fe)	2.74E-03	104	440
Cr ³⁺	3.21E-02	1.14E+03	4.79E+03
BP ²⁺	1.61E-03	229	964
Ig ¹⁺	1.48E-05	1.40	5.91
Hg ²⁺	9.81E-06	1.34	5.65
Zr (as ZrO(OH) ₂)	9.84E-04	61.1	258
Pb ²⁺	4.85E-05	6.84	28.8
Ni ²⁺	2.39E-03	95.4	402
Se ²⁺	1.57E-05	0.936	3.94
Mn ²⁺	8.08E-03	302	1.27E+03
Ca ²⁺	1.92E-02	524	2.21E+03
K ⁺	2.40E-02	639	2.69E+03
OH ⁻	6.06	7.01E+04	2.95E+05
NO ₂ ⁻	3.00	1.27E+05	5.34E+05
NO ₃ ⁻	2.84	8.90E+04	3.75E+05
CO ₃ ²⁻	0.369	1.51E+04	6.36E+04
PO ₄ ³⁻	0.134	8.66E+03	3.65E+04
SO ₄ ²⁻	0.281	1.84E+04	7.76E+04
Si (as SiO ₂)	4.06E-02	777	3.27E+03
F ⁻	9.67E-02	1.25E+03	5.27E+03
Cl ⁻	0.170	4.11E+03	1.73E+04
C ₂ H ₃ O ₂ ⁻	3.45E-02	4.45E+03	1.87E+04
EDTA ⁴⁻	2.15E-02	4.22E+03	1.78E+04
HEDTA ³⁻	3.84E-02	7.17E+03	3.02E+04
glycolate ⁻	0.104	5.31E+03	2.24E+04
acetate ⁻	1.48E-02	595	2.51E+03
oxalate ²⁻	5.60E-05	3.36	14.1
DBP	1.64E-02	1.80E+03	7.57E+03
butanol	1.64E-02	827	3.48E+03
NH ₃	4.69E-02	543	2.29E+03
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu	36.9 (μCi/L)		1.77 (kg)
U	5.20E-03 (M)	843 (μg/g)	3.55E+03 (kg)
Cs	0.386 (Ci/L)	263 (μCi/g)	1.11E+06 (Ci)
Sr	8.76E-03 (Ci/L)	5.97 (μCi/g)	2.51E+04 (Ci)

*Density is calculated based on Na, OH⁻, and AlO₂⁻.

†Water wt% derived from the difference of density and total dissolved species.

Double-Shell Tank 241-SY-103			
TLM Solids Composite Inventory Estimate*			
Physical Properties			
Total Solid Waste	0 kg	(0 kgal)	
Heat Load	0 kW	(0 BTU/hr)	
Bulk Density	0 (g/cc)		
Water wt%	0		
TOC wt% C (wet)	0		
Chemical Constituents			
Na ⁺	0	0	0
Al ³⁺	0	0	0
Fe ²⁺ (total Fe)	0	0	0
Cr ³⁺	0	0	0
BP ²⁺	0	0	0
Ig ¹⁺	0	0	0
Hg ²⁺	0	0	0
Zr (as ZrO(OH) ₂)	0	0	0
Pb ²⁺	0	0	0
Ni ²⁺	0	0	0
Se ²⁺	0	0	0
Mn ²⁺	0	0	0
Ca ²⁺	0	0	0
K ⁺	0	0	0
OH ⁻	0	0	0
NO ₂ ⁻	0	0	0
NO ₃ ⁻	0	0	0
CO ₃ ²⁻	0	0	0
PO ₄ ³⁻	0	0	0
SO ₄ ²⁻	0	0	0
Si (as SiO ₂)	0	0	0
F ⁻	0	0	0
Cl ⁻	0	0	0
C ₂ H ₃ O ₂ ⁻	0	0	0
EDTA ⁴⁻	0	0	0
HEDTA ³⁻	0	0	0
glycolate ⁻	0	0	0
acetate ⁻	0	0	0
oxalate ²⁻	0	0	0
DBP	0	0	0
butanol	0	0	0
NH ₃	0	0	0
Fe(CN) ₆ ⁴⁻	0	0	0
Radiological Constituents			
Pu		0	0
U	0	0	0
Cs	0	0	0
Sr	0	0	0

*Unknowns in tank solids inventory are assigned by Tank Layer Model (TLM).

241-SY-103

Photo date 10-1-85

8 Glossary

0.17	Transaction flag key - monthly volumes derived from semiannual reports.
0.33	Transaction flag key - monthly volumes derived from quarterly reports.
1	Monthly report
1AYIN	See Waste Abbreviations.
1AZIN	See Waste Abbreviations.
1C	See Waste Abbreviations.
1CEB	See Waste Abbreviations.
1CS	See Waste Abbreviations.
1st Generation Tank	The original tank design found in Tank Farms B, C, T, U (excluding the 200 series tanks), and EX. These tanks have an operating capacity of 530,000 gallons, a 75-foot diameter, a 12-inch dish bottom, and a 4-foot knuckle. Also, see Type II tanks.
222-B	See Facilities.
222-C	See Facilities.
222-T	See Facilities.
222-U	See Facilities.
224	See Waste Abbreviations.
224-F	See Waste Abbreviations.
231Z	See Waste Abbreviations.
242-A	See Facilities.
242-B	See Facilities.
242-S	See Facilities.
242-T	See Facilities.
2AYIN	See Waste Abbreviations.

2AZIN	See Waste Abbreviations.
2C	See Waste Abbreviations.
2nd Generation Tank	Same as original tank design (1st generation or Type II) except the operating capacity was increased to 758,000 gallons. Also, see Type III tanks.
2SYIN	See Waste Abbreviations.
3	Quarterly report
3AWIN	See Waste Abbreviations.
3rd Generation Tank	The first generation of the Type IV tanks, contained only in the SX Tank Farm. These tanks have a 1,000,000 gallon operating capacity, a 75-foot diameter, a 14.875-inch dish bottom, and no knuckle. Also, see Type IV tanks.
4th Generation Tank	The second generation of the Type IV tanks, found only in the A Tank Farm. These tanks are the same as the 3rd generation except they have a flat bottom. Also, see Type IV tanks.
5	See Waste Abbreviations.
5-6#	Cells 5 and 6 from B Plant
5AWIN	See Waste Abbreviations.
5th Generation Tank	The third generation of the Type IV tanks, found only in the AX Tank Farm. These tanks are the same as the 4th generation with the addition of grid drain slots beneath the steel liner bottom.
6	Semiannual report
6AWIN	See Waste Abbreviations.
A Plant (PUREX)	See Facilities.
A1 SLTCK	See LANL Defined Waste List.
A2 SLTSLRY	See LANL Defined Waste List.
Active Tank	A tank that contains more than 33,000 gallons of waste and/or is still involved in waste management operations.
Active Drywell	Drywell in which radiation readings of greater

than 50 counts/second are detected. To be considered active, the readings must be consistent as to depth and radiation level for repeated readings.

ADD	Add primary waste from process.
ADJ	Adjustment to waste amount - see CORR.
AGE, AGING	Waste abbreviation
Aging Waste	High-level, first-cycle solvent extraction waste from the PUREX Plant (NCAW)
Airlift Circulator	Airlift circulators are installed in tanks used to age wastes. The circulators promote mixing of the supernatant and prevent agglomeration of radionuclides. By maintaining motion within the body of liquid, the circulators minimize overheating and, consequently, minimize bumping.
Annulus	A vessel space in the form of a ring; the space between concentric circular walls.
AR Vault	A structure containing tanks and chemical processing equipment that is used for waste processing or storage operations.
AR	See LANL Defined Waste List.
Assumed Leaker	A waste storage tank for which surveillance data in the past has indicated a loss of liquid attributed to a breach of integrity.
Assumed Re-leaker	A designation that exists after a tank has been declared an "assumed leaker" and then the surveillance data indicate a new loss of liquid attributed to a breach of integrity.
Assumed Leaking Tank	In 1984, the criteria designations of "suspect leaker", "questionable integrity", "confirmed leaker", "declared leaker", "borderline", and "dormant" were merged into one category now reported as "assumed leaker".
B SLTCK	See LANL Defined Waste List.
B	See Waste Abbreviations.
B Plant (222-B)	See Facilities.
B860N	See Waste Abbreviations.

Background Radiation	Radioactivity from naturally occurring sources; primarily radiation from cosmogenic and naturally occurring radionuclides.
Baseline	A reference; for example, a specified liquid level or radiation level against which new information is compared.
BFSH	See Waste Abbreviations.
BL	See Waste Abbreviations.
BLEB	See Waste Abbreviations.
BLIX	See Waste Abbreviations.
BLIXB	See Waste Abbreviations.
BNW	Battelle Northwest Laboratory
BNW	See Waste Abbreviations.
BPDCC	See Waste Abbreviations.
BPDCS	See Waste Abbreviations.
BPDCV	See Waste Abbreviations.
BPFPS	See Waste Abbreviations.
BPLCS	See Waste Abbreviations.
BPLDC	See Waste Abbreviations.
BPLDN	See Waste Abbreviations.
Bumping, Tank Bump	A tank bump occurs when solids overheat in the lower portion of the tank. The hot solids rapidly transfer heat to the liquid, some of which quickly vaporizes. The sudden pressurization caused by vapor generation is called a "bump".
BVCLN	See Waste Abbreviations.
BY SLTCK	See LANL Defined Waste List.
C Plant (222-C)	See Facilities.
C PLANT	See SSW.
Caisson	An underground structure used to store high-level waste; typical designs include corrugated metal or

concrete cylinders, 55-gallon drums welded end-to-end, and vertical steel pipes below grade.

Calcine	To heat a substance to a high temperature, but below its melting point, causing loss of volatile constituents such as moisture; refers also to the material produced by this process.
CARB	See Waste Abbreviations.
CAS	Cascade - see SET and END. This process filled three tanks with one pump using overflow siphoning. Normal use was with a sequence of tanks such as 101, 102, 103, or 110, 111, 112.
Cascade	Eleven of the single-shell tank farms (all except the AX Tank Farm) were equipped with overflow lines between tanks. The tanks were connected in series and were placed at different elevations creating a downhill gradient for liquids to flow from one tank to another.
CASS	Acronym for Computer Automated Surveillance System.
Catch Tanks	Small capacity single-shell tanks associated with diversion boxes and diverter stations. The tanks are designed to receive any transfer line clean out, spills or leakage from the boxes, or leakage from the adjacent pipe encasement.
CAW	Current acid waste; this is PUREX acid high-level waste.
CC	See Waste Abbreviations.
CCGL	See Waste Abbreviations.
CCGR	See Waste Abbreviations.
CCPL	See Waste Abbreviations.
CCPLX	See Waste Abbreviations.
CCW	Concentrated customer waste
CDF	Composition data file or transaction flag key - unit volume assumed to make stream active.
CE	See Waste Abbreviations.
CELL 23	Waste from cell 23 at B Plant. Cell 23 contained

an evaporator.

CEM	See Waste Abbreviations.
CF	See Waste Abbreviations.
CON	See Waste Abbreviations.
COND	Condensate - see EVAP, EB.
Condensate	Liquid formed from cooling vapors
Conductivity Probe	A device that completes an electrical circuit when contacted by a conductive material.
Confirmed or Declared Leaker	The designation of any underground waste storage tank where the data are considered sufficient to support a conclusion with 95 percent confidence that the tank has leaked.
COOL	Change in waste volume due to cooling. See CORR.
CORR	Correction to waste amount - see ADJ, LEAK, COOL.
CP	See Waste Abbreviations.
CPLX	See Waste Abbreviations.
CR Vault	Facility located adjacent to C Farm, used for scavenging campaign following uranium recovery. Ferrocyanide was added to tank supernatants in the CR Vault and the slurry was returned to C Farm.
Crib	A linear excavation approximately 15 feet in depth with a perforated pipe along the bottom. The ditch was backfilled with broken rock, gravel, or other loose material and then covered by soil and a membrane with very low permeability. The pipe distributed intermediate level liquid wastes along the crib.
Crust	A hard surface layer that has formed on top of the liquid in many waste tanks that contain concentrated solutions.
CSFD	See Waste Abbreviations.
CSR	See Waste Abbreviations.
CSS	See Waste Abbreviations.
CST	See Waste Abbreviations.

CSWLE	See Waste Abbreviations.
CSNLW	See Waste Abbreviations.
CTW	Caustic waste for makeup
CW	See Waste Abbreviations.
CW/ZR2	See Waste Abbreviations.
CWP	See Waste Abbreviations.
CWP/ZR	See Waste Abbreviations.
CWP2	See LANL Defined Waste List.
CWR	See Waste Abbreviations.
CX70	See Waste Abbreviations.
D	Transaction Flag Key - amount by difference
DBP	Dibutyl phosphate
DC	See Waste Abbreviations.
DCS	Acronym for dilute caustic solutions
DE	Acronym for diatomaceous earth that was added to Tanks 241-BX-102, -SX-113, -TX-106, and -U-104 from 1970 to 1972.
DE	See LANL Defined Waste List.
Deliquescent	Capable of absorbing moisture from the air and dissolving to become a liquid.
Desiccant	A drying agent such as diatomaceous earth.
Diatomaceous Earth	Diatomite is a light friable siliceous material derived from diatom (algae) remains. It is added to selected underground waste storage tanks to absorb and, thereby, immobilize residual liquids (i.e. help stabilize the tank).
DIL	Dilution
DILFD	Dilute feed
Ditch	A linearly oriented excavation often used for the temporary diversion or disposal of process waste streams.

Diversion Box	A below grade, concrete enclosure containing the remotely maintained jumpers and spare nozzles for the routing of waste solution to storage tank farms.
DN/PT	See Waste Abbreviations.
DN/PD	See Waste Abbreviations.
DN	See Waste Abbreviations.
Double-Shell Tank	The newer underground waste storage tanks consisting of a concrete shell and two concentric carbon steel liners with an annulus between the liners.
Double-Shell Slurry	Waste that exceeds the sodium aluminate saturation boundary in the evaporator without exceeding receiver tank composition limits. For reporting purposes, DSS is considered a solid.
Double-Shell Slurry Feed (DSSF)	Waste concentrated just before reaching the sodium aluminate saturation boundary in the evaporator without exceeding receiver tank composition limits. This form is not as concentrated as DSS.
Drywell	A steel casing, generally 6 inches in diameter, drilled into the ground to various depths and used to insert monitoring instruments for measuring the presence of radioactivity or moisture content.
Drywell (in-tank)	A sealed casing within a tank that is attached to a riser. It is used to insert experimental equipment, such as neutron or acoustical probes, to determine the level of drainable interstitial liquor.
DSS	See Waste Abbreviations.
DSSF	See Waste Abbreviations.
DUMM	See Waste Abbreviations.
DUMMY	See Waste Abbreviations.
DW	See Waste Abbreviations.
DWBIX	See Waste Abbreviations.
E	Transaction flag key - waste transferred through evaporator.

EB	See Waste Abbreviations.
EDTA	Ethylenediaminetetra-acetic acid
EF	See Waste Abbreviations.
EFD	See Waste Abbreviations.
END	Disconnect cascaded tanks, see CAS, Set.
Environs	Surrounding area, vicinity
EV	Evaporation
EVAP	See Waste Abbreviations.
EVAPF	See Waste Abbreviations.
Evaporator Feed	Any waste liquid that can be concentrated to form saltcake; e.g., aged waste, low heat waste, dilute interstitial liquor, and other radioactive waste solutions.
Evaporator-Crystallizer	242-A and 242-S waste concentration facilities that operate at a reduced pressure (vacuum) and are capable of producing a slurry containing about 30 volume percent solids at a specific gravity of greater than 1.6.
EVS	Partial neutralization in the 242-S Evaporator.
EVT	HEDTA destruction in the 242-B or 242-T Evaporators.
FD	See Waste Abbreviations.
FECN	Ferrocyanide wastes created during a scavenging campaign in 1953-57. See SCAV, POO, TOO.
Ferrocyanide	An ion composed of iron and cyanide with the chemical formula of $\text{Fe}(\text{CN})_6^{4-}$.
FIC gauge	A Food Instrument Corporation automatic liquid level gauge based on a conductivity probe. At Hanford, they are electrically connected to a computer for data transmission, analysis, and reporting. Local readings may also be obtained from a dial.
First- and Second-Cycle Decontamination Wastes	Waste containing 10% of the original fission product activity and 2% of the products. By-product cake solution was mixed with product

waste and neutralized with 50% caustic. The waste contained a mixture of suspended solids, iron, hydroxides, carbonate and phosphate, scavenger metals, chromium, sodium, and silicofluoride.

FLSH	See Waste Abbreviations.
FP	Fission Product Waste. Waste produced at B Plant and Hot Semiworks in campaigns for Cs and Sr recovery during the 1960s. Cs was removed from PUREX supernatant and Sr was removed from PUREX sludge; both were removed from acidic waste.
FP	See Waste Abbreviations.
GA	Gain to tank
Gamma Ray	Electromagnetic radiation emitted by the nuclei of some radioactive substances during decay, similar in nature to X-rays.
GAS	Slurry growth as a result of gas generation.
GM Instrument	Instrument for detecting low-level beta and gamma radiation using a Geiger-Mueller tube.
GROUP	A group of tanks where ITS was used to evaporate the supernatant phases. See ITS.
Gunite	A building material, consisting of a mixture of cement, sand, and water, that is sprayed onto a mold.
H ₂ O	Water
HDRL	See Waste Abbreviations.
HEAT	A tank correction, see CORR, COOL.
HEDTA	N-hydroxyethylenediaminetri-acetic acid
Heel	The amount remaining in a vessel or container after most of the contents have been removed.
Hexone	Methyl isobutyl ketone, an organic solvent used in the REDOX solvent extraction process. Also known as Isobutyl methyl ketone, Methyl isobutyl ketone, 4-Methyl 2-pentanone, MIBK.
High-Level Waste	Waste from the fuel reprocessing operations in separations plants.

Historical Information	All information obtained from published and unpublished sources. Unpublished sources include photographs and electronically retrieved data (i.e. liquid observation well data, temperatures, sampling results, and surface level data).
HLO	See Waste Abbreviations.
HLO	Hanford Laboratory Operations
HLW	See Waste Abbreviations.
HOT-SEMI	See HS, SSW.
HS	See Waste Abbreviations.
HS	Hot Semi-Works (C Plant) - A pilot facility that served a variety of operations.
HWVP	Dilute, non-complexed waste from the vitrification plant.
I&S	Tank isolated and stabilized.
Inactive Tank	A tank that has been removed from liquid-processing service, has been pumped to contain less than 33,000 gallons of waste, and is not yet or in the process of stabilization and interim isolation. This includes all tanks not in active or active-restricted categories. Also included are inactive spare tanks that would be used if an active tank failed.
INST	Change in tank level due to change in instrumentation.
Interim Isolation	An administrative designation reflecting the completion of the physical effort required to minimize the addition of liquids into an inactive storage tank, process vault, sump, catch tank, or diversion box. See Intrusion Prevention.
Interim Stabilization	A tank which contains less than 50,000 gallons of drainable interstitial liquid and has less than 5,000 gallons of supernatant. If the tank was jet pumped to achieve interim stabilization, then the jet pump flow must have been at or below 0.05 gallons per minute before interim stabilization is completed.
Interstitial Liquor	The liquid that fills the interstices (void space) within the solid material in a waste tank.

Interstitial	The volume within a solid matrix made up of the crevices, cracks, and other void space.
Intrusion Mode FIC Setting	The FIC probe is positioned a short distance above the waste surface. If the surface level of the waste in the tank increases, thereby touching the probe tip, a positive indication is received.
Intrusion Prevention	An administrative designation reflecting the completion of the physical effort required to minimize the addition of liquids into an inactive storage tank, process vault, catch tank, sump, or diversion box.
ISO	Tank is interimly isolated.
ITS	The In-Tank Solidification Program was used to reduce waste volume directly by evaporating the wastes from inside certain tanks in the BX and BY Farms. The process used both hot air (ITS-1) and an electric heater (ITS-2).
IWW	See Waste Abbreviations.
IX	See Waste Abbreviations.
Jet Pump	A modified, commercially available, low capacity jet pump used as a saltwell pump.
Knuckle	Point where the side wall and the bottom curved surface of a tank meet.
L222S	See Waste Abbreviations.
L3A4A	See Waste Abbreviations.
LaF	See Waste Abbreviations.
Lateral	Horizontal drywell under all tanks in A Farm and certain tanks in SX Farm.
Leak Detection Pit	Collection point for any leakage from tanks in AX Farm. The pits are equipped with radiation and liquid detection instruments.
LEAK	Tank leak volume, see CORR.
LETF	Liquid effluent treatment facility from N Reactor.
Level Adjustment	Any update in the waste inventory (or tank level) in a tank. The adjustments usually result from surveillance observations or historical

investigations.

Level History	A diagram that shows the history of the waste level and waste level changes in a tank. The diagram also includes other related data.
Liquid Observation Well (LOW)	Liquid observation wells are used to monitor the interstitial liquid level (ILL) in single-shell waste storage tanks. Three probes are used to monitor changes in the ILL: acoustic, gamma, and neutron. Each method can indicate intrusions or leaks by increases or decreases in the ILL.
Liquid Level Best Engineering Judgement Line	During the initial filling of certain single-shell tanks, only the liquid level was reported. To adjust for the big increase in level height, which occurred when solids were added to the record, a sloped line was used to reflect solids volume between the initial fill and the time the solids data were recorded.
LO	Loss from tank.
LUNC	See Waste Abbreviations.
LW	See Waste Abbreviations.
Metal Waste (MW)	Waste from extraction containing all the uranium, approximately 90% of the original fission product activity, and approximately 1% of the product. This waste was brought to the neutral point with 50% caustic and then treated with an excess of sodium carbonate. This procedure yielded almost completely soluble waste at a minimum total volume. The exact composition of the carbonate compounds was not known, but was assumed to be a uranium phosphate carbonate mixture.
Molarity	Number of gram molecular weights (moles) per liter of solution.
Mole	The amount of a substance with weight equal to the molecular weight in grams.
MW	See Waste Abbreviations.
MWF	See Waste Abbreviations.
N	See Waste Abbreviations.
NCAW	See Waste Abbreviations.

NCPL	See Waste Abbreviations.
NCPLEX	See Waste Abbreviations.
NCPLX	See Waste Abbreviations.
NCRW	See Waste Abbreviations.
Neutralized PUREX Acid Waste	In 1956, the original plant neutralized all of the high-level waste and sent it to the A Tank Farm. As recovery of fission products began, a portion of the waste was treated to recover strontium and then neutralized. As of 1967, all of the high-level waste left PUREX as an acid solution for treatment at B Plant.
Neutron Probe	Probe equipped with a neutron source and detector. They are used in dry well monitoring to determine the moisture content of the soil as one way to detect leaks in underground waste storage tanks or pipelines.
NFAW	See Waste Abbreviations.
NHAW	See Waste Abbreviations.
NIT	HNO ₃ /KMNO ₄ solution added during evaporator operation.
Noise At The Bottom Of Well - Drywell Probe	Erroneous reading caused by probe coming into contact with foreign objects at the bottom of a well.
Non-Complexed (NCPLX)	General waste term applied to all Hanford Site liquors not identified as complexed (containing organics).
NPH	Normal paraffin hydrocarbon
NRAW	See Waste Abbreviations.
NRP82	See Waste Abbreviations.
NRPO4	See Waste Abbreviations.
NRSO4	See Waste Abbreviations.
NTA	Nitrilotriacetic acid
Nuclear reactor	A device for creating a controlled nuclear chain reaction using atomic fuel, as for the production of energy.

Open Hole Saltwell	A well in which a pump is inserted in solid waste. This type of well is frequently used to remove the liquid from tanks containing less than two feet of sludge.
Organic Wash Waste(OWW)	The solvent used in PUREX was treated before reuse by washing with potassium permanganate and sodium carbonate, followed by dilute nitric acid and then a sodium carbonate wash.
Out-of-Service-Tank	A tank that does not meet the definition of an in-service tank. Before September 1988, these tanks were defined as inactive. (Note: All single-shell tanks are out of service.)
OWW	See Waste Abbreviations.
P	See Waste Abbreviations.
P1:	See LANL Defined Waste List.
P2:	See LANL Defined Waste List.
PADFG	See Waste Abbreviations.
PADWG	See Waste Abbreviations.
Partial Interim Isolation	The administrative designation for completion of the physical effort required for Interim Isolation, except for isolating the risers and piping that will be required for jet pumping or for other methods of stabilization.
PAS	See Waste Abbreviations.
PASF	See Waste Abbreviations.
PAW	See Waste Abbreviations.
PD	See Waste Abbreviations.
PDBNG	See Waste Abbreviations.
PDBSU	See Waste Abbreviations.
PDBTG	See Waste Abbreviations.
PDCSS	See Waste Abbreviations.
PDL87	See Waste Abbreviations.
PDL89	See Waste Abbreviation.

PDNSG	See Waste Abbreviations.
PDS87	See Waste Abbreviations.
PDS89	See Waste Abbreviations.
PDSLQ	See Waste Abbreviations.
PDSUP	See Waste Abbreviations.
PFeCN	See Waste Abbreviations.
PFeCN1:	See LANL Defined Waste List.
PFeCN2:	See LANL Defined Waste List.
PFMMS	See Waste Abbreviations.
PFP (Z Plant)	See facilities.
PFP	Plutonium Finishing Plant waste (see Z, 224, PRF).
PFPGR	See Waste Abbreviations.
PFPNT	See Waste Abbreviations.
PFPPT	See Waste Abbreviations.
PFPSL	See Waste Abbreviations.
pH	A measure of the hydrogen ion concentration in solution.
Pile	An early term used to describe a nuclear reactor.
PL	See Waste Abbreviations.
PML89	See Waste Abbreviations.
PMS89	See Waste Abbreviations.
PN	See Waste Abbreviations.
PNF	See Waste Abbreviations.
POO-P##	In-Plant scavenging with FeCN - see SCAV, TOO-T##.
Portland Cement	A hydraulic cement made by finely pulverizing a mixture of clay and limestone or similar materials.
PRF	Plutonium Reclamation Facility - Type of waste

generated in Z Plant for "finishing wastes". Solvent based extraction process using CCl_4 /TBP.

Primary Addition	An addition of waste from a specific plant or process vault. These additions come from the "Waste Status and Transaction Record Summary", WHC-SD-WM-TI-614 & -615, Rev. 0, DRAFT.
Primary Stabilization	The condition of an inactive waste storage tank after all liquid above the solids, other than isolated surface pockets, has been removed. Isolated surface pockets of liquid are those not pumpable by conventional techniques.
Probe	A device used to obtain information about the environment. In this report, an instrument package designed to be inserted in drywells, risers, or ports to measure waste characteristics.
PSL	See Waste Abbreviations.
PSS	See Waste Abbreviations.
PSSF	See Waste Abbreviations.
Psychrometry	Determination of humidity or dew point from wet and dry bulb temperatures with the difference in the two used as a measure of moisture in the atmosphere.
PT	See Waste Abbreviations.
PUREX	See Facilities.
PX86S	See Waste Abbreviations.
PXBAW	See Waste Abbreviations.
PXBSG	See Waste Abbreviations.
PXFTE	See Waste Abbreviations.
PXLOW	See Waste Abbreviations.
PXMET	See Waste Abbreviations.
PXMSC	See Waste Abbreviations.
PXNAW	See Waste Abbreviations.
Questionable Integrity	Any tank that has a small decrease in liquid level or a radiation increase in an associated dry well,

for which the remaining data for the tank are insufficient to support a conclusion with 95% confidence that the tank is sound.

R	See Waste Abbreviations.
R SLTCK:	See LANL Defined Waste List.
R1:	See LANL Defined Waste List.
R2:	See LANL Defined Waste List.
Radiation Zone	An area containing radioactive materials in quantities significant enough to require controlling entry of personnel into the area.
Radiation	Particles and electromagnetic energy emitted by nuclear transformations that are capable of producing ions when interacting with matter.
Readily Available Risers	Risers located above grade which do not have apparatus attached to or contained in them.
REC	Receive waste from another tank - see XFER.
REDOX	See Facilities.
Removed From Service (Tanks)	Any tank that is a confirmed leaker or is not intended for reuse.
Rerun Drywell Data	Surveillance data which supersedes "suspect data".
RESO	See Waste Abbreviations.
RIX	See Waste Abbreviations.
RMC	Remote Mechanical C-Line - Process used in Z Plant.
RSN	See Waste Abbreviations.
RSS	See Waste Abbreviations.
RTX	See Waste Abbreviations.
S	Transaction Flag Key - Partial neutralization (PNF).
S Plant (REDOX)	See Facilities.
S1 SLTCK:	See LANL Defined Waste List.

S2 SLTSLRY:	See LANL Defined Waste List.
Saltcake.	Crystallized nitrate and other salts deposited in waste tanks, usually after measures are taken to remove moisture.
Saltwell	A hole drilled or sluiced into a saltcake and lined with a cylindrical screen to permit drainage and jet pumping of interstitial liquors.
SCAV	Scavenging campaign with FECN on TBP, 1952-57. See TOO-T##, POO-P##.
Scavenged	Waste which has been treated with ferrocyanide to remove cesium from the supernatant by precipitating it into the sludge.
Scintillation Monitor	A radiation detection instrument based on the principle that light pulses are produced in some materials when they are exposed to radiation.
Self Concentrating	Liquid, high-level radioactive waste whose decaying radionuclides sufficiently heat the solution to boil off the water, thus concentrating the waste.
Self-Evaporation	A waste material in which moisture is being lost as the liquid changes to a vapor and diffuses into the atmosphere.
SET	Connect cascaded tanks together - see CAS and END.
SIX	See Waste Abbreviations.
SL	See Waste Abbreviations.
SL3SY	See Waste Abbreviations.
Sludge	Primarily insoluble metal hydroxides and oxides precipitated from neutralized waste.
Slugs	An early term for uranium fuel elements which had been machined or extruded into short cylinders which were then clad or encased in corrosion-resistant metals.
Sluicing, or sluiced	To wash with water. At Hanford, this has meant to dissolve or suspend in solution using a high pressure water stream.
Slurry	Insoluble material suspended in water or aqueous solution.

Sound Tank	The classification of a waste storage tank for which surveillance data indicates there has been no loss of liquid attributed to a breach of integrity.
SPRG	Sparge-transfer of water or volume
SRR	See Waste Abbreviations.
SRS	See Waste Abbreviations.
SRS	See Waste Abbreviations.
SSW	See Waste Abbreviations.
STAB	Tank stabilized by removal of liquid. Both floating suction and saltwell jet pumps are used to remove liquid.
Stabilization	The removal or immobilization, as completely as possible, of the liquid contained in a radioactive waste storage tank by saltwell pumping, open hole saltwell pumping, adding diatomaceous earth, etc.
Static Tank	A tank with no significant change in liquid level or involvement in transfer operations during a stated period of time.
Strontium Semi-Works	Called C Plant or Hot Semi-Works, was a pilot plant for both REDOX and PUREX, then reconfigured for strontium recovery.
SU	See Waste Abbreviations.
Supernatant	In waste storage tanks, the liquid quantity defined by the difference between the measured liquid level and the measured average solids level in a tank.
Surveillance	Regular or systematic watch kept over someone or something.
Suspect Data	Surveillance data which does not fall within the expected range and is superseded by "reruns".
SV	Transaction Flag Key - amount by difference in solids.
SW RCR	Saltwell receiver
SWLIQ	See Waste Abbreviations.

SWLQW	See Waste Abbreviation.
T Plant (222-T)	See Facilities.
T1 SLTCK:	See LANL Defined Waste List.
T2 SLTCK:	See LANL Defined Waste List.
Tank Farm	An area containing a number of aboveground or underground storage tanks for storing chemicals, petroleum products, or waste.
TBP	Tributyl phosphate, a solvent used in the PUREX solvent extraction process.
TBP	See Waste Abbreviations.
TCO	See Waste Abbreviations.
Terminal Liquor	The liquid product from the evaporation-crystallization process which, upon further concentration, forms a solid that is unacceptable for storage in single-shell tanks. Terminal liquor is characterized by a caustic concentration of approximately 5.5 M (the caustic molarity will be lower if the aluminum salt saturation is reached first).
TFeCN	See Waste Abbreviations.
TH	See Waste Abbreviations.
Thermocouple	A probe for measuring temperature, consisting of two dissimilar metal wires joined at one end (hot junction) with the free ends joined to a measuring instrument. Changes in electrical potential due to temperature changes at the hot end are measured and calibrated to read out as temperature.
Thermocouple Tree	A group of thermocouples assembled in a pipe and inserted into a waste tank for measuring temperatures at regular vertical intervals.
Thermowell	A well in a waste tank which contains thermocouples.
THL	See Waste Abbreviations.
Thorium	A chemical element which is a fertile material. Fertile means that when it is subjected to radiation in a nuclear reactor, it will be converted, in this case, to ²³³ U, a potential fuel.

TK	Tank. However, TK-17-2 was an early name for B Plant.
TL	See Waste Abbreviations.
TOO-T##	In-tank scavenging with FECN; see SCAV, P##.
TPLAL	See Waste Abbreviations.
TPLAN	See Waste Abbreviations.
TPLAS	See Waste Abbreviations.
TR	Transfer from tank
Trench	A deep furrow in the ground. At Hanford, they are used for the disposal of solid waste.
trFlag	Transaction Flag Keys - used by Wtrac - see CDF, D, E, S, SV, 1, 3, 6, 0.17, 0.33.
Tributyl Phosphate(TBP)	A chemical compound, an organic solvent, used in the PUREX solvent extraction process.
Type I Tank	These are the 200 series tanks found in B, C, T, and U Tank Farms. They have an operating capacity of 55,000 gallons, a 20-foot diameter, a six-inch deep dish bottom, and a three-foot knuckle. Generation is not associated with Type I tanks.
Type II Tank	These are the original (1st generation) tank designs, which are found in B, C, T, U (excluding the 200 series tanks), and BX Tank Farms. Also, see 1st Generation Tank.
Type III Tank	These are the 2nd Generation tank designs, which are found in BY, S, TX, and TY Tank Farms. Also, see 2nd Generation Tank.
Type IV Tank	These are 3rd, 4th, and 5th generation tank designs found in SX, A, and AX Tank Farms, respectively. Also, see 3rd Generation Tank, 4th Generation Tank, and 5th Generation Tank.
Type V Tank	These are the first double shell tank designs, which are found in AY, AZ, and SY Tank Farms.
U Plant (222-U)	See Facilities.
U1U2	See Waste Abbreviations.
UNKN	Unknown waste origin sink

UNKNOWN:	See LANL Defined Waste List.
UR	Uranium recovery operation in 222-U, 1952 - 57. Created TBP (primary waste) and FECN (scavenging wastes). See TFeCN, PFeCN, POO, TOO, FeCN.
UR:	See LANL Defined Waste List.
Watch List Tank	An underground storage tank requiring special safety precautions because the tank could potentially release high-level radioactive waste if there are uncontrolled increases in temperature or pressure. Special restrictions have been placed on these tanks by "Safety Measures for Waste Tanks at Hanford Nuclear Reservation", Section 3137 of the National Defense Authorization Act for Fiscal Year 1991, November 5, 1990, Public Law 101-501 (also known as the Wyden Amendment).
WATER	Flush water from various sources
WTR	Water
WVP	Waste volume projections
XFER	Transfer of waste out of tank
Z	See Waste Abbreviations.
Z Plant	See Facilities.
Z PLANT	Plutonium Finishing Plant (PFP)
ZAW	See Waste Abbreviations.
ZHIGH	See Waste Abbreviations.
ZLAB	See Waste Abbreviations.
ZLOW	See Waste Abbreviations.
ZPRFL	See Waste Abbreviations.
ZPRFS	See Waste Abbreviations.
ZRM	See Waste Abbreviations.
ZRMCL	See Waste Abbreviations.
ZRMCS	See Waste Abbreviations.
Tab	

8.1 Waste Abbreviations

1AYIN	Concentrated complexed waste from 101AY inventory
1AZIN	Pre 2-81 101AZ inventory
1C	First cycle waste
1CEB	1st cycle evaporator bottoms
1CS	1st cycle scavenging waste
224	224-U waste
224-F	224-U waste. LaF Pu finishing plant
231Z	Dilute, phosphate waste from 231Z laboratories
2AYIN	Pre 2-81 102AY inventory
2AZIN	Pre 2-81 concentrated complexed waste from 102AZ inventory
2C	Second cycle waste
2SYIN	Pre 2-81 102SY inventory
3AWIN	Pre 2-81 103AW inventory
5-6	B Plant tank 5,6 waste
5AWIN	Pre 2-81 105AW inventory
6AWIN	Concentrated phosphate waste in 106AW inventory
AGE, AGING	Aging waste
B	B Plant high-level waste
B860N	Dilute, non-complexed waste from B Plant cell drainage
BFSH	B Plant flush waste water
BL	B Plant low-level waste
BLEB	B Plant low-level evaporator bottoms
BLIX	B Plant low level ion exchange?
BLIXB	B Plant low level ion exchange bottoms?

BNW	Battelle Northwest Laboratory waste
BPDCC	Dilute, complexed waste from B Plant cesium processing
BPDCS	Dilute, complexed waste from B Plant strontium processing
BPDCV	Dilute, complexed waste from B Plant vessel clean-out
BFFPS	B Plant TRU solids from retrieved PFP solids
BPLCS	Dilute, non-complexed waste from B Plant strontium processing
BPLDC	Dilute, complexed waste from B Plant cesium processing
BPLDN	Dilute, non-complexed waste from B Plant cesium processing
BVCLN	Dilute, non-complexed waste from B Plant vessel clean-out
CARB	PUREX organic wash waste
CC	Complexant concentrate waste
CCGL	B Plant high TRU solids from retrieved complexed concentrate
CCGR	Dilute, non-complexed waste from retrieved complexed concentrate
CCPL	Complexant concentrate
CCPLX	Complexant concentrate - see CPLX
CE	Evaporator concentrate
CEM	Concrete - see CON
CF	Cesium feed
CON	Concrete - see CEM
CP	Concentrated phosphate waste from N Reactor decontamination
CPLX	Complexed waste

CSFD	Cesium feed
CSR	Waste sent to B Plant for cesium recovery
CSS	Concentrated supernatant solids
CST	Caustic solution
CSWLE	Complexed saltwell liquid east area
CSWLW	Complexed saltwell liquid west area
CW	Coating waste
CW/ZR2	Coating waste (REDOX), Zirconium cladding
CWP/ZR	Coating waste (PUREX), Zirconium cladding
CWP	Coating waste (PUREX)
CWR	Coating waste (REDOX)
CX70	Dilute, complexed mixture hot-semiworks TRU solids
DC	Dilute complexed waste
DE	Diatomaceous earth
DN/PD	DN with P TRU solids
DN	Dilute non-complexed waste
DN/PT	DN with PFP TRU solids
DSS	Double-shell slurry
DSSF	Double-shell slurry feed
DUMM, DUMMY	Dummy waste
DW	Decontamination waste
DWBIX	Decontamination waste and B Plant ion exchange
EB	Evaporator bottoms
EF	Evaporator feed
EFD	Evaporator feed dilute
EVAP	Evaporator feed (post 1976)

EVAPF	Dilute, non-complexed waste from evaporator pad flush
FD	Feed dilute
FLSH	Flush water
FP	Fission product waste
HDRL	Hanford defense residual liquor
HLO	Hanford laboratory operations waste
HLW	High-level waste - generic for all Hanford tank wastes
HS	Hot Semi-Works waste
IWW	PUREX #1 acid concentrator waste
IX	Ion exchange waste
L222S	222-S laboratory, dilute non-complexed waste
L3A4A	Dilute non-complexed laboratory wastes from 300 & 400 Areas
LaF	Lanthanum fluoride waste generated in PFP
LUNC	Dilute, non-complexed waste from UNC fuels fabrication
LW	Laboratory waste
MW	Metal waste
MWF	Metal waste feed
N	N-Reactor waste
NCAW	Neutralized current acid waste, primary HLW stream from PUREX process
NCPL, NCPLX, NCPLX	Non-complexed waste
NCRW	Neutralized cladding removal waste - same as CWP
NFAW	Aging waste from PUREX/PFM high level waste
NHAW	Aging waste from PUREX/PFM processing of NPR fuel
NRAW	Aging waste from PUREX/PFM residue acid waste

NRP82	Dilute, non-complexed waste from FY82 100-N Area waste transfer
NRPO4	Dilute, phosphate waste from 100-N Area
NRS04	Dilute, non-complexed waste from 100-N Area
OWW	Organic wash waste
P	PUREX waste
PADFG	PUREX ammonia destruction waste, from fuels grade fuel
PADWG	PUREX ammonia destruction waste, from weapons grade fuel
PAS	PUREX acidified sludge
PASF	PUREX ammonia scrubber feed
PAW	PUREX acidified waste
PD	PUREX decladding waste
PDENG	Decladding sludge (non-TRU) from B Plant processing
PDBSU	Dilute, non-complexed waste from B Plant decladding waste
PDBTG	B Plant aging waste solids from PUREX decladding waste
PDCSS	Dilute non-complexed PUREX decladding waste, FY1986 only
PDL87	PUREX decladding supernatant, 1987
PDL89	PUREX decladding supernatant, non-TRU, spent metathesis removed
PDNSG	Non-TRU decladding sludge from PUREX
PDS87	PUREX decladding sludge
PDS89	PUREX decladding sludge after FY89
PDSLQ	PUREX decladding sludge
PDSUP	Dilute, non-complexed waste, PUREX decladding waste

PFeCN	Ferrocyanide sludge produced by in-plant scavenging of waste from uranium recovery
PFMMS	Dilute, non-complexed waste from shear/leach processing of NPR fuel
PFPGR	Dilute, non-complexed waste from retrieved PFP solids
PFPNT	Non-TRU sludge from the PFP (Z Plant)
PFPPPT	Dilute, non-complexed waste from the PFP (with TRUEX)
PFPSL	TRU sludge from the PFP (Z Plant)
PL	PUREX low-level waste
PML89	PUREX spent metathesis liquid after FY89
PMS89	PUREX spent metathesis solids after FY89
PN	PUREX neutralized cladding waste
PNF	Partially neutralized waste
PSL	PUREX sludge sluiced during recovery of strontium
PSS	PUREX sludge supernatant
PSSF	PUREX sludge supernatant feed
PT	TRU solids from 200 West
PX86S	Dilute, non-complexed waste from PUREX miscellaneous streams (NPR fuel) FY86
PXBAW	B Plant aging waste supernatant from retrieved aging waste
PXBSG	B Plant aging waste solids from retrieved aging waste
PXFTF	Dilute, non-complexed waste from PUREX miscellaneous streams (FFTF)
PXLOW	PUREX low level waste
PXMET	PUREX dilute, non-complexed decladding: spent metathesis

PXMSC	Dilute, non-complexed waste from PUREX miscellaneous streams (NPR fuel)
PXNAW	Aging waste from PUREX high level waste
R	REDOX waste
RESO	Residual evaporator liquor
RIX	REDOX ion exchange waste
RSN	REDOX supernatant
RSS	REDOX sludge supernatant
RTX	REDOX ion exchange
SIX	PUREX ion exchange waste
SL	Sludge
SL3SY	Double shell slurry from end of FY80, 103SY inventory
SRR	Waste sent to B Plant for strontium recovery
SRS	Strontium sludge
SRS	Strontium recovery supernatant
SSW	Strontium Semi-Works waste
SU	Supernatant
SWLIQ	Dilute, non-complexed waste from 200-East Area single shell tanks
SWLQW	Dilute, non-complexed waste from 200-West Area single shell tanks
TBP	Tri-butyl phosphate
TCO	Dilute non-complexed waste from terminal cleanout
TFeCN	Ferrocyanide sludge produced by in-tank or in-farm scavenging
TH	Thoria HLW or cladding waste
THL	Thoria low-level waste
TL	Terminal liquor

TPLAL, TPLAN	Dilute, non-complexed waste from T Plant
TPLAS	Sludge from T Plant operations
U1U2	Dilute, non-complexed waste from U1/U2 ground water pumping
Z	Z Plant waste
ZAW	PUREX waste stream from zirconium clad fuel
ZHIGH	Dilute, non-complexed waste from the PFP (without TRUEX)
ZLAB	Dilute, non-complexed waste from the PFP laboratories
ZLOW	Dilute, non-complexed waste from Pre-FY85 Z Plant operations
ZPRFL	Dilute, non-complexed waste from PRF processing
ZPRFS	PFP TRU solids from PRF processing
ZRMCL	Dilute, non-complexed waste from PFP RMC processing
ZRMCS	PFP TRU solids from PFP RMC processing

8.2 LANL Defined Wastes

1C1	First cycle decontamination waste from the BiPO ₄ process, 1944 to 1951.
1C2	First cycle decontamination waste from the BiPO ₄ process, 1952 to 1956.
1CFeCN	??First cycle ferrocyanide scavenging waste??
2C1	Second cycle decontamination waste from the BiPO ₄ process, 1944 to 1951.
2C2	Second cycle decontamination waste from the BiPO ₄ process, 1952 to 1956.
A1 SLTCK	Saltcake waste generated from the 242-A Evaporator-crystallizer from 1977 until 1980.
A2 SLTSLRY	Salt slurry waste generated from the 242-A Evaporator-crystallizer from 1981 until 1994.
AR	"Washed" PUREX sludge from the AR vault
B SLTCK	Saltcake waste generated from the 242-B Evaporator from 1951 until 1955.
BY SLTCK	Saltcake waste generated from in-tank solidification units 1 and 2 between 1965 and 1974.
CWP2	Cladding waste - PUREX 2???
CWR1	REDOX cladding waste from 1952 to 1960
CWR2	REDOX cladding waste from 1961 to 1967
DE	Diatomaceous earth
MW1	Metal waste from BiPO ₄ , 1944 to 1951
MW2	Metal waste from BiPO ₄ , 1952 to 1956
P1	PUREX high-level waste generated between 1955 and 1962.
P2	PUREX high-level waste generated between 1963 and 1967.
PFeCN1	Ferrocyanide sludge generated from in-plant scavenging of waste from uranium recovery.

PFeCN2	Same as PFeCN1, except 0.0025 M ferrocyanide used.
R SLTCK	Saltcake waste from the REDOX concentrator.
R1	REDOX waste generated between 1952 and 1957.
R2	REDOX waste generated between 1958 and 1966.
S1 SLTCK	Saltcake waste generated from the 242-S Evaporator/crystallizer from 1973 until 1976.
S2 SLTSLRY	Salt slurry waste generated from the 242-S Evaporator-crystallizer from 1977 until 1980.
T1 SLTCK	Saltcake waste generated from the 242-T Evaporator from 1951 until 1955.
T2 SLTCK	Saltcake waste generated from the 242-T Evaporator from 1965 until 1955.
UNKNOWN	Unknown waste type
UR	Uranium recovery waste (also known as tributyl phosphate (TBP) waste).

8.3 Facilities

A Plant (PUREX)	The facility at Hanford which contains the latest solvent extraction process for recovery of both plutonium and uranium.
B Plant (222-B)	One of the three original bismuth-phosphate processing facilities, later converted to a waste fractionation plant.
C Plant (222-C)	Initially a pilot plant for REDOX, later a pilot plant for PUREX and B Plant waste partitioning.
S Plant (REDOX)	The facility at Hanford which contains the original extraction process for recovery of both plutonium and uranium.
T Plant (222-T)	One of the three original bismuth-phosphate processing facilities, later converted to a decontamination facility.
U Plant (222-U)	One of the three original bismuth-phosphate processing facilities, Later converted to a uranium recovery plant.
PFP (Z Plant)	Plutonium Finishing Plant where the final operations occur for production of plutonium products.
242-A	A forced circulation vacuum evaporation system.
242-B	An evaporator that operates at atmospheric pressure. Also referred to as an open air type evaporator.
242-S	A forced circulation vacuum evaporation system.
242-T	An evaporator that operates at atmospheric pressure. Also referred to as an open air type evaporator.

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