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Single-Shell Tank System Description

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Abstract: The purpose of this document is to describe the SST system for use in performing an engineering and compliance assessment in support of M-23 milestones (Ecology, et al. 2000). This system description provides estimated locations and volumes of waste within the SST system, including storage tanks, transfer systems, evaporators and miscellaneous support facilities.
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LIST OF TERMS

BBI	best basis inventory
CoC	constituent of concern
DOE	U.S. Department of Energy
DST	double-shell tank
Ecology	State of Washington Department of Ecology
EIS	Environmental Impact Statement
ENRAF	Enraf-Nonius 854 Advanced Technology Gauge
EPA	U.S. Environmental Protection Agency
FIC	Food Instrument Corporation
FY	fiscal year
HEPA	high-efficiency particulate air (filter)
HFFACO	*Hanford Federal Facility Agreement and Consent Order*
ILL	Interstitial Liquid level
IMUST	inactive miscellaneous underground storage unit
LOW	liquid observation well
LD	leak detection
MT	manual tape
PUREX	Plutonium-Uranium Extraction (Plant)
RCRA	*Resource Conservation and Recovery Act*
SACS	Surveillance Analysis Computer System
SAR	safety analysis report
SST	single-shell tank
TSD	treatment, storage, and/or disposal
URF	unit risk factor
WIDS	Waste Information Data System

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1.0 INTRODUCTION

The Hanford Site single-shell tank (SST) system consists of 149 underground SSTs and processing equipment designed and constructed between 1940 and 1964 to transport and store radioactive hazardous/dangerous wastes generated from irradiated nuclear fuel processing. The tanks, designed to store waste, vary in size from between 190,000 to 3,800,000 L (50,000 gal to 1,000,000 gal) and contain a variety of solid and liquid waste. The system also includes miscellaneous underground storage tanks (IMUST). In addition to the tanks, there is a large amount of ancillary equipment associated with the system and although not designed to store wastes, the ancillary equipment is contaminated through contact with the waste. Waste was routed to the tanks through a network of underground piping, with interconnections provided in concrete pits that allowed changes to the routing through instrumentation. Processing vaults used during waste handling operations, evaporators used to reduce the waste stored in the system, and other miscellaneous structures used for a variety of waste handling operations are also included in the system. The SST system was taken out of service in 1980 and no additional waste has been added to the tanks. The SSTs and ancillary equipment were designed and constructed before promulgation of *Resource Conservation and Recovery Act* (RCRA) in 1986.

The purpose of this document is to describe the SST system for use in performing an engineering and compliance assessment in support of M-23 milestones (Ecology et al. 2000). In 2001, the *Hanford Federal Facility Agreement and Consent Order* (HFFACO) (Ecology et al. 1989) was amended to establish milestones for assessing SST integrity and associated leak detection and monitoring requirements (M-23-01-01). This amendment resulted from the State of Washington Department of Ecology's inspection of interim status compliance of the SST system. Several deficiencies were noted in the inspection, and specific actions were included in the HFFACO to address the compliance of the SST system with the RCRA Interim Status regulations. This system description provides estimated locations and volumes of waste within the SST system. *Status of Facilities and Waste Transfer Lines Within Single-Shell Tank Farms* (RPP-10466) identifies some SST system components (diversion boxes, valve pits, SST pits, and transfer lines) as in-use facilities; these components will be used through September 2004 to perform interim stabilization activities on the SST tanks. This system description presents the currently known status of the in-use SST components as well as the inactive or not-in-use components. The SST system is composed of the following:

- Storage Tanks;
- Transfer Systems (diversion boxes, valve pits, flush pits, vaults, miscellaneous tanks, and transfer piping);
- Evaporators; and
- Miscellaneous Support Facilities (condenser shielding buildings, a ventilation building, an ion exchange column, an in-tank solidification system, and a cesium load-out facility).

The SST system does not include the process facilities or the cribs, but does include the first diversion box after a process facility and the last diversion box before a crib. Utility and services (e.g., raw water, sanitary water, sanitary sewer, electrical conduits, and ventilation systems) are part of the SST system but are presumed clean and are not included in the scope of this effort. A comprehensive evaluation of the location, size, and status of water lines has been conducted to assess the potential for water line leaks to mobilize contamination in the vadose zone (RPP-5002).

This document provides a summary of (1) waste volume estimates developed by component bin or group, (2) a description of the binning process used to assess the SST components, (3) a description of the components and their current status, (4) the methodology used for compiling waste estimates, and (5) the monitoring systems currently employed throughout the SST system. Appendix A provides further details of the methodology for estimating waste volumes. Appendix B presents the database reports used to support the analysis. Appendix C provides a description of the database used to collect and control the data on the SST system components. The procedures used to estimate the transfer piping lengths are described in Appendix D. Appendix E provides a listing of sources for each bin.

The inventory described in this assessment for ancillary system components is based on limited field data and represents a reasonable estimate for generally expected waste volumes in the various components (pits, piping, etc). Little or no information is available for some of the components. When little or no information was found, assumptions were made.

2.0 SUMMARY OF ESTIMATED WASTE VOLUMES

After a review of the SST system, as described in the following sections, estimates and known volumes of waste were tabulated to provide an overview of the system. Table 2-1 lists the known and/or estimated volumes of waste contained within the system components. Some components have an unknown waste volume and are not listed in this table. As indicated, liquid wastes are only expected to be in the storage components, which are the tanks (SSTs, IMUSTs, vault tanks, and evaporator vessels), with the exception that some of the vault cell sumps contain liquid. Note that the sum of the solid and liquid volumes may not equal the total waste volume because only total waste volumes or only either liquid or solid waste volumes were available for some components. The methodology used to estimate waste volumes is described in Section 5.0. Table 2-1 addresses only those components that have a known or estimated waste volume and does not include volumes for those storage components with unknown waste volume.

Table 2-1. Known and/or Estimated Waste Volume Summary by Component Type.

Component Type	Liquid		Solid		Total	
	Vol (gal)	Total (%)	Vol (gal)	Total (%)	Vol (gal)	Total (%)
SSTs	5,350,000*	98.51	31,483,000**	99.59	32,385,000	99.35
IMUSTs	11,000	0.20	63,000	0.20	73,000	0.22
Vault Tanks Cells	 45,000 16,000	 0.83 0.29	 50,000 15,000	 0.16 0.05	 98,000 30,000	 0.30 0.09
Evaporator Tanks & Vessels	9,000	0.17	0.0	0	9,000	0.03
Pits	0.0	0	450	0	450	0
Transfer Piping	0.0	0	1,200	0	1,200	0
Miscellaneous Fac. Ventilation Struct. Cesium Removal In-Tank Solid. Syst.	0.0	0	0.0	0	0	0
Total	5,431,000	100	31,612,000	100	32,596,000	100

Notes:

* Liquid volumes are derived from HNF-EP-0182, Rev. 167, and include supernatant plus drainable liquids in SSTs that have been interim stabilized and SSTs that are currently being interim stabilized.

**Solid volumes are also derived from HNF-EP-0182, Rev. 167 and include sludge and saltcake.

All volumes are rounded to the nearest 1,000 gal.

To assess the sensitivity of the unknown waste volumes to the distribution of waste in the storage components, it was assumed that those storage components with unknown waste volumes were filled to capacity. For this bounding condition, unknown waste volumes have been assigned as liquids in the various components and are listed in Table 2-2. Comparing Table 2-2 to Table 2-1 indicates that the potential volume that could be in those storage components with unknown waste volumes has a relatively large impact on the component group (i.e., IMUSTs change from 0.2 percent of the liquid volume to 1.06 percent of the total liquid volume in the system), but a relatively small effect on the distribution of waste within the system. The whole volume within the SSTs dominates the overall waste volume in the system.

Table 2-2. Upper Bound of Waste Volume Summary by Component Type.

Component Type	Liquid		Solid		Total	
	Vol (gal)	Total (%)	Vol (gal)	Total (%)	Vol (gal)	Total (%)
SSTs	5,350,000	97.61	31,483,000	99.59	32,385,000	99.21
IMUSTs (including unknown waste volume)	58,000*	1.06	63,000	0.20	121,000	0.37
Vault						
Tanks	48,000**	0.87	50,000	0.16	98,000	0.30
Cells	16,000	0.29	15,000	0.05	30,000	0.09
Evaporator Tanks and Vessels (including unknown waste volume)	9,000***	0.16	0.0	0	9,000	0.03
Pits	0.0	0	450	0	450	0
Transfer Piping	0.0	0	1,200	0	1,200	0
Miscellaneous Fac. Ventilation Struct. Cesium Removal In-Tank Solid Syst.	0.0	0	0.0	0	0	0
Total	5,481,000	100	31,612,000	100	32,644,000	100

Notes:

All volumes rounded to nearest 1,000 gallons.

* IMUST quantity denotes full capacity (47,200 gal) of seven tanks containing unknown waste volumes.

** Additional 3,000 gal of liquid is derived from assuming the waste in 244-CR-001 and 244-CR-002 is all liquid.

*** Upper bound of waste for the evaporators resides mostly in 242-S (9,000 gal). There are roughly 40 gal in 242-T.

Following interim stabilization, it is expected that the liquid waste volumes in the storage vessels will be significantly reduced. Nineteen SSTs remain to be interim stabilized, and two vault tanks will have liquids removed. The impacts of these stabilization efforts will reduce the volumes across the SST system to the approximate values listed in Table 2-3.

Table 2-3. Known/Estimated Waste Volume Summary (Post Interim Stabilization) by Component Type

Component Type	Liquid		Solid		Total	
	Vol (gal)	Total (%)	Vol (gal)	Total (%)	Vol (gal)	Total (%)
SSTs*	2,510,000	96.72	31,483,000	99.59	31,700,000	99.33
IMUSTs**	58,000	2.24	63,000	0.20	121,000	0.38
Vault						
Tanks	7,000	0.27	50,000	0.16	57,000	0.18
Cells	11,000	0.42	15,000	0.05	26,000	0.08
Evaporator Tanks & Vessels**	9,000	0.35	0.0	0	9,000	0.03
Pits	0.0	0	450	0	450	0
Transfer Piping	0.0	0	1,200	0	1,200	0
Miscellaneous Fac. Ventilation Struct. Cesium Removal In-Tank Solid. Syst.	0.0	0	0.0	0	0	0
Total	2,595,000	100	31,612,000	100	32,000,000	100

Notes:

* Liquid volume is for drainable liquid in SSTs that have been interim stabilized and projected non-pumpable liquid volume in SSTs undergoing interim stabilization.

** Denotes upper bounds from Table 2-2.

Using the current status of the system, as delineated in Table 2-1 or 2-2, indicates the waste volume within the SST system is predominantly in the SSTs. Table 2-4 compares the SSTs to the cumulative waste volume of all other components. This utilizes known waste volumes (post interim stabilization) only and does not include assumed volumes for tanks with unknown contents.

Table 2-4. Estimated Waste Inventory Summary Comparison of Single-Shell Tanks and Ancillary Equipment (Post Interim Stabilization).

Component Type	Liquid		Solid		Total	
	Vol (gal)	Total (%)	Vol (gal)	Total (%)	Vol (gal)	Total (%)
SSTs	2,510,000	96.72	31,483,000	99.59	31,700,000	99.33
Ancillary Equipment	85,000	3.28	129,000	0.41	214,000	0.67
Totals	2,595,000	100	31,612,000	100	31,914,000	100

Note: Volume totals rounded to significant digits for purposes of illustration. The number of significant digits shown does not indicate a degree of certainty.

Ancillary equipment includes all system components evaluated that are not SSTs.

Table 2-5 summarizes the waste volumes between the storage components (SSTs, IMUSTs, vault tanks, and the evaporator vessels) and the non-storage components using the data presented in Table 2-3. As depicted in Table 2-5, after interim stabilization only 8.1 percent of all the SST system waste will be in liquid form. The remaining 92 percent is in sludge or saltcake form.

Table 2-5. Estimated Waste Inventory Summary by Design Function (Post Interim Stabilization).

Component Type	Liquid		Solid		Total	
	Vol (gal)	Total (%)	Vol (gal)	Total (%)	Vol (gal)	Total (%)
Storage Components (Tanks and Vessels)	2,584,000	99.58	31,596,000	99.95	31,887,000	99.92
Non-Storage Components	11,000	0.42	16,000	0.05	27,000	0.08
Total	2,595,000	100	31,612,000	100	31,914,000	100

Note: Volume totals rounded to significant digits for purposes of illustration. The number of significant digits shown does not indicate a degree of certainty.

3.0 SYSTEM DESCRIPTION DATABASE

The SST system description provides data and information on the SST system components to support an engineering and compliance assessment necessary for continued safe storage of tank farm waste. The system description includes an estimate of the location, quantity, and composition of the waste material remaining within the system.

A database was created to manage the SST system description data. The database is composed of collected, calculated, estimated, and extrapolated data. The SST system is primarily described by tabulated data extracted from the database files. Brief descriptions are provided to clarify and define table contents and to define assumptions and approaches to data collection and extrapolation. An overview description of the database is provided in Appendix C with summary reports provided in Appendix B.

The SST system description uses publicly available Hanford Site information to identify the physical description; operating history; current operating status; and estimated location, quantities, and compositions of residual waste material held in the SST system components. Where field data are not provided (e.g., for pits, and piping) engineering estimates are used to provide inventory volumes. The equipment designed for process waste handling (e.g., tanks, piping, tank vaults, process cells, sumps) is included in this system description for the evaporator facilities, process vaults, and miscellaneous support facilities.

Many sources of information were reviewed in the effort to collect accurate system description information, and many discrepancies between documents were observed. Extensive efforts to validate the data by resolving data conflicts were beyond the scope of this activity. The identified primary sources of information used as the basis of conflict resolution are as follows:

- Latest engineering documents (e.g., drawings, studies) for the component being evaluated,
- Associated safety documentation (e.g., facility safety analysis reports, hazard analysis reports),
- Radiological surveys,
- Videotaped inspections of piping interiors, and
- Engineering drawings used with information provided by the routing board (Drawings H-14-104175 and H-14-104176).

The gaps in data, especially prevalent in the piping system, were accounted for using engineering estimation methods. Because the total waste volume in the piping system is a small percentage of the total waste contained within the SST system, further data collection was not deemed beneficial.

Although the inventory of a component or facility is often listed as unknown, many of the source documents provide an engineering analysis on the waste material inventory within the component or facility. This study found that in the few cases where additional data (e.g., radiological surveys) were available, the additional data appeared to corroborate the engineering analyses. Therefore, this report uses the engineering analysis information provided in the source documents for components that were inactive and isolated at the time the source documents were prepared.

The waste inventories within seven IMUSTS are not known and there is insufficient information to provide an engineering estimate of their contents. Assumptions attempting to bound the contents of these items have been made for comparison purposes only as discussed in Section 2.0.

4.0 DESCRIPTION OF THE SINGLE-SHELL TANK SYSTEM

The following sections provide an overview of the SST system and describe the system components and status.

4.1 OVERVIEW

The Hanford Site (Figure 4-1) is an approximately 1,517 km^2 (586 mi^2) U.S. Department of Energy (DOE) installation occupying a semiarid region near the Columbia River in south-central Washington State. In 1943 the U.S. Army Corps of Engineers selected the area to produce nuclear materials, primarily plutonium, in support of the World War II effort. Since that time, the area has been dedicated to the production of nuclear materials for national defense and electricity, diverse research, and waste management activities. Hanford Site facilities, first built and run by the U.S. Army Corps of Engineers (Manhattan Project), have been operated by the Atomic Energy Commission (1947 to 1974) and its successors, the Energy Research and Development Administration (1974 to 1977) and DOE (1977 to present).

Irradiated fuel discharged from eight onsite weapons-production reactors and one dual-purpose reactor was processed to recover uranium and plutonium. The processing resulted in the accumulation of a wide variety of radioactive and chemical waste. Since the 1940s, most of the Hanford Site nuclear defense waste, in terms of radioactivity, has been stored in underground storage tanks in the 200 Areas.

All tanks and ancillary equipment and facilities associated with the SSTs are located in the 200 East and 200 West Areas. The 200 Areas are located 35 km (22 mi) from the nearest residential community of Richland, Washington, and at least 8 km (5 mi) from the Columbia River.

This system description is applicable only to SST system components that were used to treat, store, or transfer waste as identified in Table 4-1. The groupings identified in Table 4-1 are consistent with the SST integrity evaluations and the development of leak detection and monitoring functions and requirements under the M-23 series milestones. The components are identified by function. The 100- and 200- series SSTs, IMUSTs, vault tanks, and evaporator vessels and tanks provide waste storage. The other SST components serve non-storage functions and provide a means to convey or transfer waste, contain leaks or spills. For example, pipes contain the waste during transfers and pits contain waste spilled or leaked from piping connectors.

A complete list of the SST system components considered in this system description, including the storage tanks and ancillary systems, is provided in Appendix B, Table B-7.

The SST system includes the following:

- 12 individual SST farms constructed between 1943 and 1964 that contain 133 large volume 100-series tanks (1.9 to 3.8 million L [500,000 to 1 million gal]),
- 16 smaller volume 200-series tanks (210,000 L [55,000 gal]), and
- Ancillary equipment associated with the tank farms.

The ancillary equipment includes 24 IMUSTs; 6 vaults; 2 evaporators; and numerous at-tank pits, between-tank pits, and pipelines that compose the waste transfer system. Also considered are the ventilation building (241-A-431), the two condenser shielding buildings (241-SX-401 and 241-SX-402), the ion exchange column (241-AX-IX), and the in-tank solidification system (241-BY-ITS1).

Figure 4-1. Hanford Site Map.

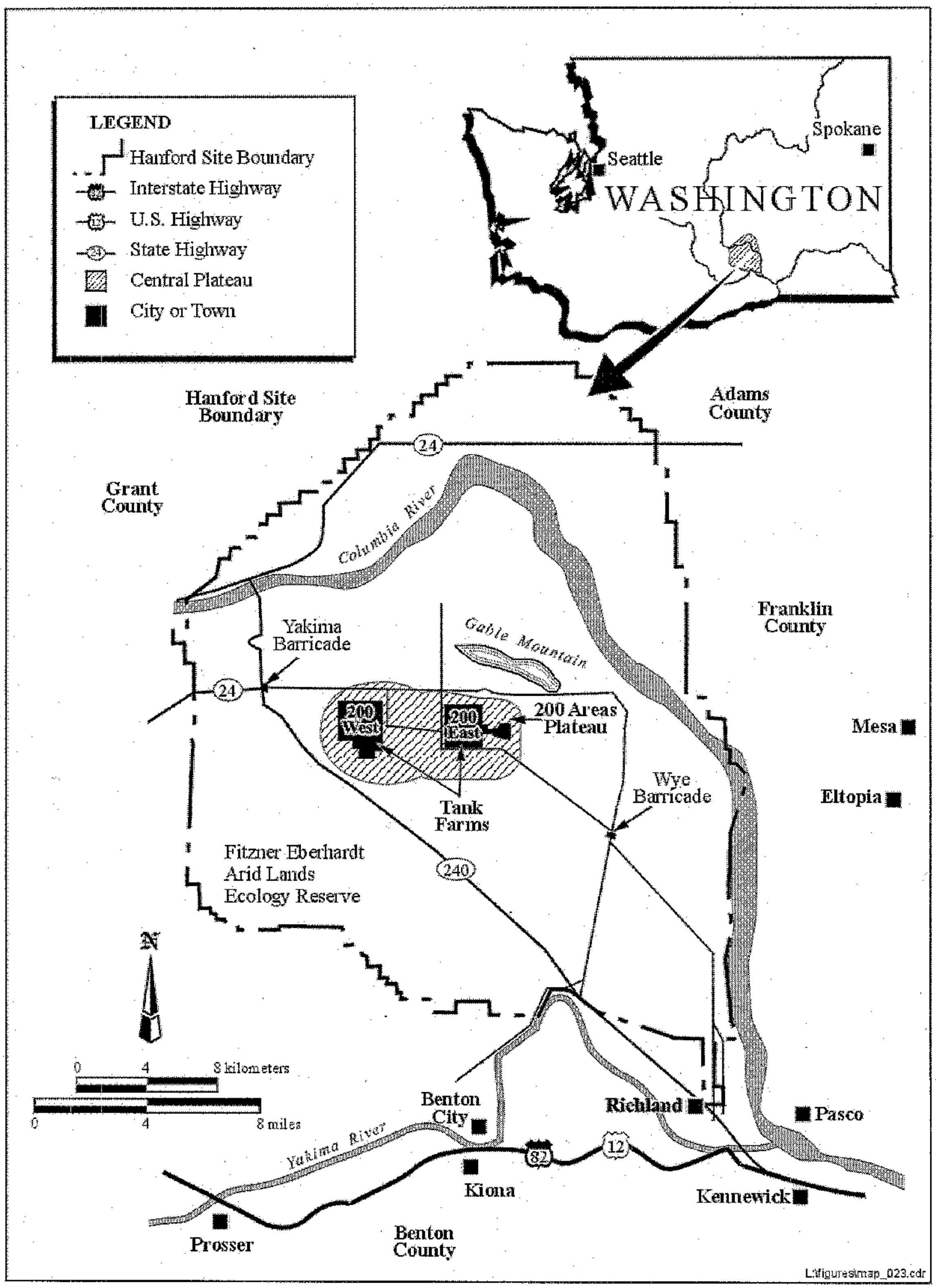


Table 4-1. Single-Shell Tank Component Groupings.

Major Grouping	Group Elements	Designed for Storage, Primary Conveyance, Secondary Containment of Waste, or Other	Applicable to this Report
Single-shell tanks	100-series tanks 200-series tanks	Storage Storage	Yes Yes
Miscellaneous tank systems in-tank equipment	In-tank equipment Instrumentation Ventilation systems Ventilation piping	Other Other Other Other	No No No No
Miscellaneous underground storage tanks	Inactive miscellaneous underground storage tanks	Storage	Yes
At-tank pits	Heel pits Pump pits Saltwell caisson Saltwell pits Sluice pits	Secondary Containment Secondary Containment Secondary Containment Secondary Containment Secondary Containment	Yes Yes Yes Yes Yes
Between-tank pits	Diversion boxes Flush pits Valve pits	Secondary Containment Other Secondary Containment	Yes Yes Yes
Transfer piping	Inactive Piping	Primary Conveyance	Yes
Miscellaneous structures	Cesium loadout facility Condenser shielding buildings Control buildings Evaporators (tanks) In-tank solidification sytem Ion exchange column Surveillance facilities Vaults (tanks) Ventilation structures	Primary Conveyance Other Other Storage Other Other Other Storage Other	Yes Yes No Yes Yes Yes No Yes Yes
Utilities	Electrical Compressed air Raw water systems Sanitary sewer Sanitary water Steam	Other Other Other Other Other Other	No No No No No No

The SSTs, IMUSTs, vault tanks, and evaporator vessels and tanks serve to provide storage of the waste. The other SST components provide conveyance or secondary containment.

Most of the waste in the SSTs is in the form of sludge, salt cake, and pumpable and nonpumpable liquids. Sludge consists of the solids (i.e., hydrous metal oxides) precipitated from the neutralization of acid waste before transfer to the SSTs. Salt cake is made up of the various salts formed from the evaporation of water from the waste. Pumpable liquid exists as supernatant and interstitial liquid in the tanks. Non-pumpable liquid is that liquid that cannot be pumped from the tank using saltwell pumping systems.

The SST waste is composed primarily of sodium hydroxide; sodium salts of nitrate, nitrite, carbonate, aluminate, and phosphate; and minor constituents of hydrous oxides of aluminum, iron, and manganese. The radioactive components are fission product radionuclides such as strontium-90, cesium-137, and iodine-129 and actinide elements such as uranium, neptunium, plutonium, thorium, and americium.

The SSTs primarily contain inorganic waste, although relatively small amounts of solvents were added during fuel reprocessing. Water-soluble complexing agents and carboxylic acids were added in the B-Plant waste fractionation process.

The majority of the waste stored in SSTs was generated by the following chemical processing operations:

- Bismuth phosphate ($BiPO_4$),
- Reduction-oxidation,
- Plutonium-uranium extraction,
- Tributyl phosphate, and
- B-Plant waste fractionation.

Nonradioactive chemicals have been added to the tanks to enhance storage capabilities while varying amounts of waste and heat-producing radionuclides have been removed. Additionally, natural processes have caused settling, stratification, and segregation of waste components. Waste was also cascaded (allowed to gravity-flow from one tank to another) through a series of interconnected tanks. Cooling of the waste and precipitation of radionuclides and solids occurred in each tank of the cascade.

4.2 DESCRIPTION OF SYSTEM COMPONENTS AND STATUS

The following sections provide descriptions and status of the SST components: SSTs, at-tank pits, between-tank pits, piping, IMUSTs, vaults, and miscellaneous structures.

4.2.1 Single-Shell Tanks

The function of an SST is to store mixed waste. The SSTs, constructed between 1943 and 1964 in groups of 4 to 18 tanks called farms, are located in the 200 East and 200 West Areas. SSTs were designed to contain waste within a reinforced-concrete shell with an internal liner (structurally independent from the reinforced concrete tank) of mild carbon steel covering the bottom and side walls. Earth cover over each tank provides shielding. Heat generated by radioactive decay is dissipated through the tank wall to the surrounding soil.

The capacity of each 100-series SST varies from 210,000 L to 3.8 million L (55,000 to 1 million gal). One hundred thirty-three of the SSTs are 23 m (75 ft) in diameter and 9 to 13 m (30 to 44 ft) high (at their highest points), with nominal capacities of 1.9 million to 3.8 million L (500,000 to 1 million gal). Sixteen of the tanks are smaller units of a similar design, 6.1 m (20 ft) in diameter and 7.77 m (25.5 ft) high with capacities of 210,000 L (55,000 gal). The smaller tanks are numbered in the 200-series. Cross-sectional views of various Hanford Site SSTs are presented in Figure 4-2. A diagram of a typical SST is provided in Figure 4-3.

Sixty-seven of the SSTs are assumed to have leaked in the past. Of the 149 SSTs, 129 have had sufficient liquids removed to be classified as interim stabilized (including all but 2 of the 67 assumed leakers). Per the consent decree (CT-99-5076-EPS), interim stabilization refers to the removal and transfer of pumpable liquids (i.e., the supernatant plus the amount of interstitial liquid capable of being pumped) from SSTs to DSTs. A tank is considered interim stabilized if it contains less than 190,000 L (50,000 gal) of drainable interstitial liquids and less than 19,000 L (5,000 gal) of supernatant (HNF-EP-0182). Interim stabilization is achieved by any of the following methods:

- Jet pumping interstitial liquids until a flow rate of 0.1895 L (0.05 gal) per minute is experienced
- Pumping the supernatant to the mandated level, or
- Declaring a tank administratively stabilized if the stabilization criteria are met.

All of the tanks have been either partially isolated (41 tanks) or modified to prevent intrusion (108 tanks) (HNF-EP-0182). Partially isolated means physical efforts required for interim isolation are complete except for isolation of risers and piping that is required for jet pumping or for other methods of interim stabilization. Intrusion prevention reflects the completion of a physical effort to minimize the intrusion of liquids into the SSTs.

Table 4-2 lists for each tank the waste volumes and status of measures to prevent waste migration to the environment.

Figure 4-2. Cross-Sectional Views of Hanford Site Single-Shell Tanks.

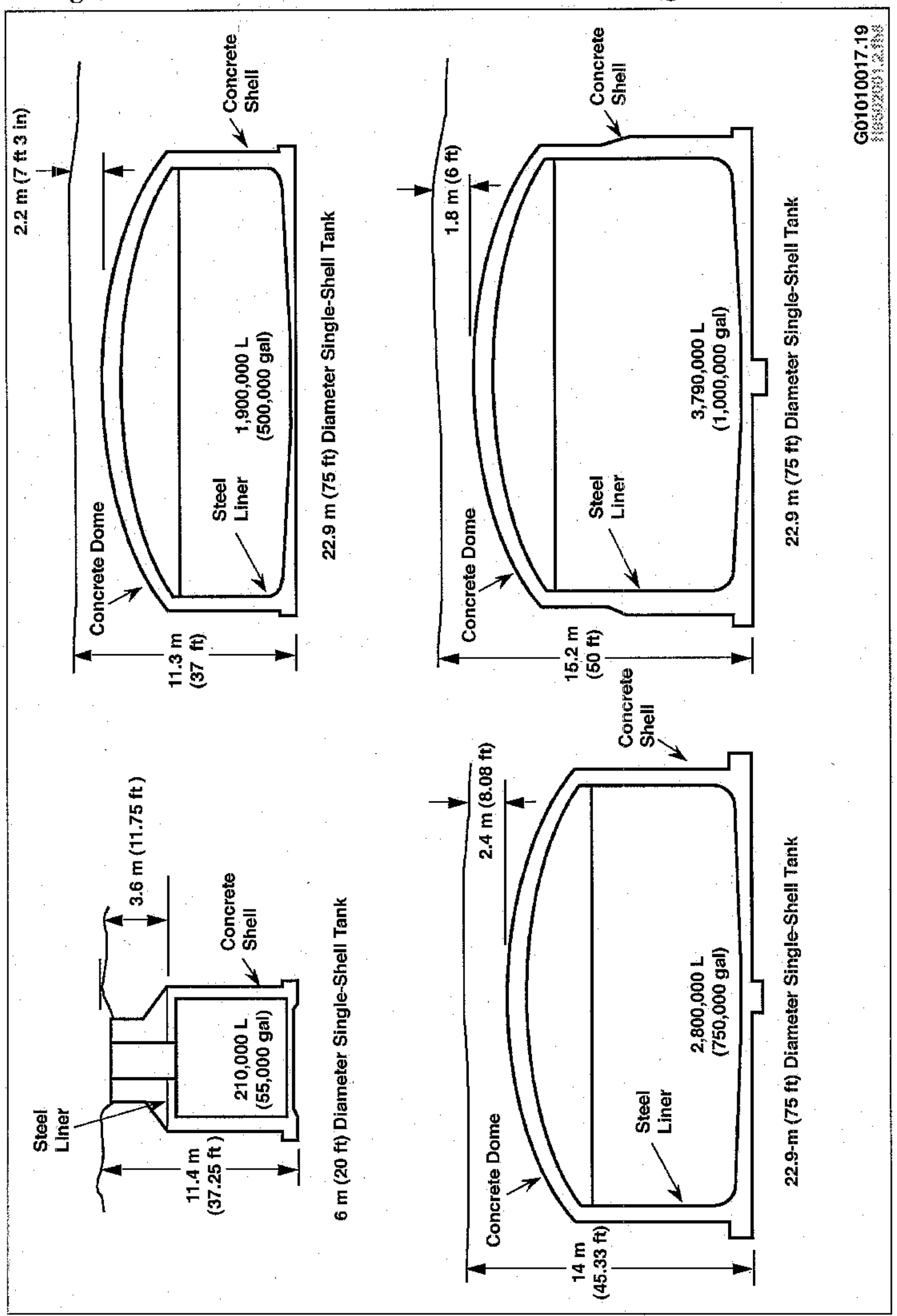


Figure 4-3. Typical Single-Shell Tank.

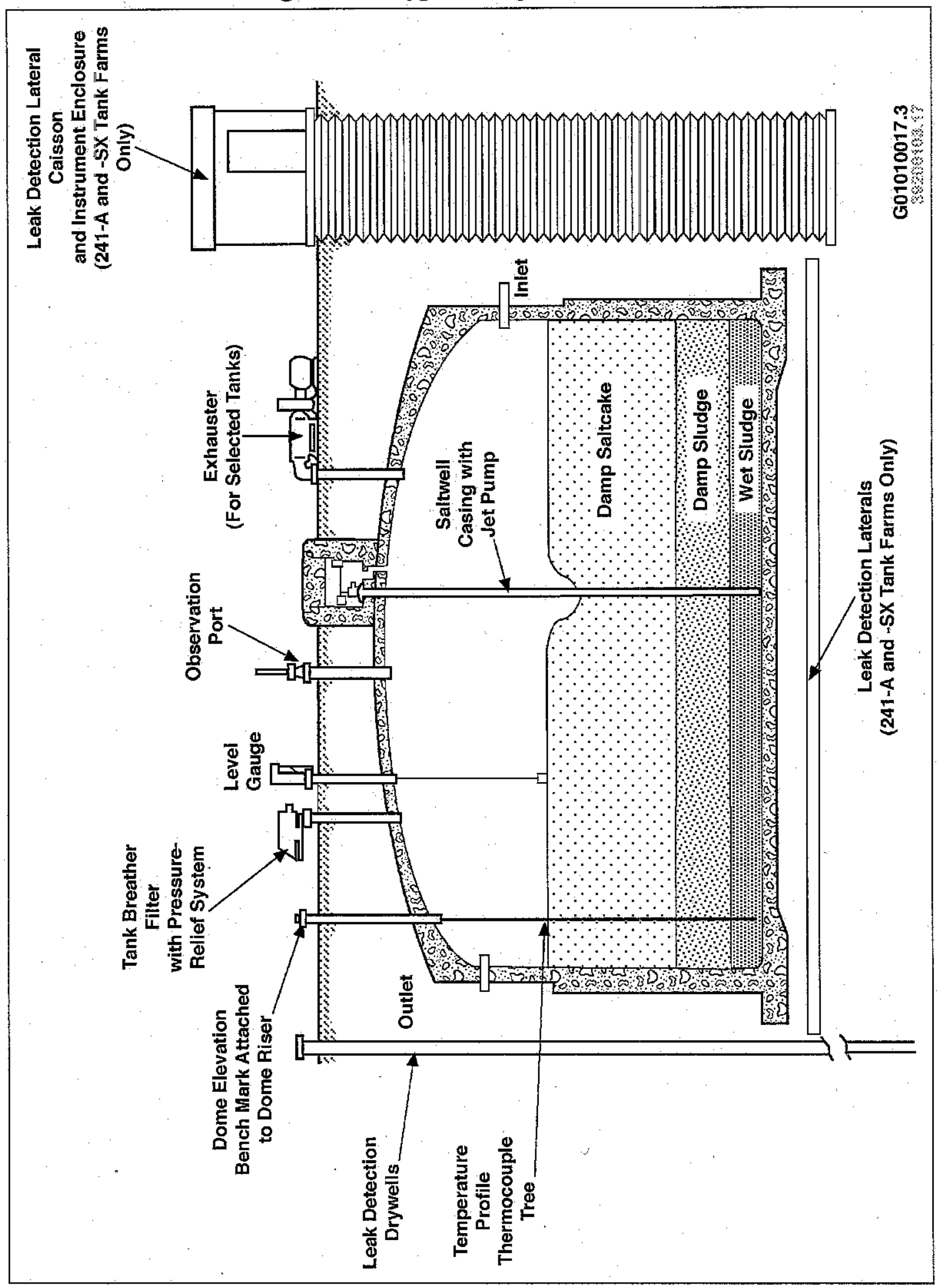


Table 4-2. Waste Volumes and Status of Measures to Prevent Waste Migration to the Environment (7 sheets)

Designation	Tank Integrity	Interim Stabilized	Isolated	Capacity (kgal)	Total Waste (kgal)	Supernatant Liquid (kgal)	Drainable Interstitial Liquid (kgal)	Drainable Liquid Remaining (kgal)	Pumpable Liquid Remaining (kgal)	Sludge Volume (kgal)	Saltcake Volume (kgal)
241-A-101	Sound	N	Partial	1,000	819	(a)	(a)	(a)	589	3	380
241-A-102	Sound	Y	Partial	1,000	38	2	9	11	2	0	36
241-A-103	Asmd Lkr	Y	Complete	1,000	370	4	87	91	84	2	364
241-A-104	Asmd Lkr	Y	Complete	1,000	28	0	0	4	0	28	0
241-A-105	Asmd Lkr	Y	Complete	1,000	37	0	0	0	0	37	0
241-A-106	Sound	Y	Complete	1,000	79	0	9	9	1	50	29
241-AX-101	Sound	N	Partial	1,000	662	(b)	(b)	(b)	444	3	295
241-AX-102	Asmd Lkr	Y	Complete	1,000	30	0	0	0	0	6	24
241-AX-103	Sound	Y	Complete	1,000	108	0	22	22	10	8	100
241-AX-104	Asmd Lkr	Y	Complete	1,000	7	0	0	0	0	7	0
241-B-101	Asmd Lkr	Y	Complete	530	109	0	20	20	16	28	81
241-B-102	Sound	Y	Complete	530	32	4	7	11	4	0	28
241-B-103	Asmd Lkr	Y	Complete	530	56	0	10	10	2	1	55
241-B-104	Sound	Y	Complete	530	374	0	45	45	41	309	65
241-B-105	Asmd Lkr	Y	Complete	530	290	0	20	20	16	28	262
241-B-106	Sound	Y	Complete	530	122	1	8	9	2	121	0
241-B-107	Asmd Lkr	Y	Complete	530	161	0	23	23	18	86	75
241-B-108	Sound	Y	Complete	530	92	0	19	19	15	27	65
241-B-109	Sound	Y	Complete	530	125	0	23	23	19	50	75
241-B-110	Asmd Lkr	Y	Complete	530	245	1	27	28	23	244	0
241-B-111	Asmd Lkr	Y	Complete	530	242	1	23	24	20	241	0
241-B-112	Asmd Lkr	Y	Complete	530	35	3	2	5	1	15	17
241-B-201	Asmd Lkr	Y	Complete	55	30	0	5	5	0	30	0
241-B-202	Sound	Y	Complete	55	29	0	4	4	0	29	0

Table 4-2. Waste Volumes and Status of Measures to Prevent Waste Migration to the Environment (7 sheets)

Designation	Tank Integrity	Interim Stabilized	Isolated	Capacity (kgal)	Total Waste (kgal)	Supernatant Liquid (kgal)	Drainable Interstitial Liquid (kgal)	Drainable Liquid Remaining (kgal)	Pumpable Liquid Remaining (kgal)	Sludge Volume (kgal)	Saltcake Volume (kgal)
241-B-203	Asmd Lkr	Y	Complete	55	52	1	5	6	1	51	0
241-B-204	Asmd Lkr	Y	Complete	55	51	1	5	6	1	50	0
241-BX-101	Asmd Lkr	Y	Complete	530	48	0	4	4	0	48	0
241-BX-102	Asmd Lkr	Y	Complete	530	112	0	0	0	0	112	0
241-BX-103	Sound	Y	Complete	530	73	11	4	15	11	62	0
241-BX-104	Sound	Y	Complete	530	100	3	4	7	3	97	0
241-BX-105	Sound	Y	Complete	530	72	5	4	9	5	67	0
241-BX-106	Sound	Y	Complete	530	38	0	4	4	0	38	0
241-BX-107	Sound	Y	Complete	530	347	0	37	37	33	347	0
241-BX-108	Asmd Lkr	Y	Complete	530	31	0	4	4	0	31	0
241-BX-109	Sound	Y	Complete	530	193	0	25	25	20	193	0
241-BX-110	Asmd Lkr	Y	Complete	530	205	1	35	36	31	65	139
241-BX-111	Asmd Lkr	Y	Complete	530	189	0	6	6	2	32	157
241-BX-112	Sound	Y	Complete	530	164	1	9	10	7	163	0
241-BY-101	Sound	Y	Complete	758	370	0	24	24	20	37	333
241-BY-102	Sound	Y	Partial	758	277	0	40	40	33	0	277
241-BY-103	Asmd Lkr	Y	Partial	758	416	0	58	58	53	9	407
241-BY-104	Sound	Y	Complete	758	358	0	51	51	46	45	313
241-BY-105	Asmd Lkr	N	Partial	758	489	(c)	(c)	(c)	110	48	441
241-BY-106	Asmd Lkr	N	Partial	758	538	(d)	(d)	(d)	183	84	460
241-BY-107	Asmd Lkr	Y	Complete	758	272	0	42	42	37	15	257
241-BY-108	Asmd Lkr	Y	Complete	758	222	0	33	33	26	40	182
241-BY-109	Sound	Y	Partial	758	277	0	37	37	32	24	253
241-BY-110	Sound	Y	Complete	758	366	0	20	20	15	43	323

Table 4-2. Waste Volumes and Status of Measures to Prevent Waste Migration to the Environment (7 sheets)

Designation	Tank Integrity	Interim Stabilized	Isolated	Capacity (kgal)	Total Waste (kgal)	Supernatant Liquid (kgal)	Drainable Interstitial Liquid (kgal)	Drainable Liquid Remaining (kgal)	Pumpable Liquid Remaining (kgal)	Sludge Volume (kgal)	Saltcake Volume (kgal)
241-BY-111	Sound	Y	Complete	758	302	0	14	14	6	0	302
241-BY-112	Sound	Y	Complete	758	286	0	24	24	12	0	284
241-C-101	Asmd Lkr	Y	Complete	530	88	0	4	4	0	88	0
241-C-102	Sound	Y	Complete	530	316	0	62	62	55	316	0
241-C-103	Sound	N	Partial	530	202	77	52	129	81	125	0
241-C-104	Sound	Y	Complete	530	259	0	29	29	25	259	0
241-C-105	Sound	Y	Partial	530	132	0	10	10	6	132	0
241-C-106	Sound		Partial	530	36	30	1	31	27	6	0
241-C-107	Sound	Y	Complete	530	248	0	30	30	25	248	0
241-C-108	Sound	Y	Complete	530	66	0	4	4	0	66	0
241-C-109	Sound	Y	Complete	530	63	0	4	4	0	63	0
241-C-110	Asmd Lkr	Y	Complete	530	178	1	37	38	30	177	0
241-C-111	Asmd Lkr	Y	Complete	530	57	0	4	4	0	57	0
241-C-112	Sound	Y	Complete	530	104	0	6	6	1	104	0
241-C-201	Asmd Lkr	Y	Complete	55	1	0	0	0	0	1	0
241-C-202	Asmd Lkr	Y	Complete	55	1	0	0	0	0	1	0
241-C-203	Asmd Lkr	Y	Complete	55	3	0	0	0	0	3	0
241-C-204	Asmd Lkr	Y	Complete	55	3	0	0	0	0	3	0
241-S-101	Sound	N	Partial	758	425	0	84	84	80	123	302
241-S-102	Sound	N	Partial	758	492	(e)	(e)	(e)	146	105	387
241-S-103	Sound	Y	Partial	758	237	1	45	46	39	9	227
241-S-104	Asmd Lkr	Y	Complete	758	288	1	49	49	45	132	156
241-S-105	Sound	Y	Complete	758	406	0	42	42	33	2	404
241-S-106	Sound	Y	Partial	758	455	0	26	26	18	0	455

Table 4-2. Waste Volumes and Status of Measures to Prevent Waste Migration to the Environment (7 sheets)

Designation	Tank Integrity	Interim Stabilized	Isolated	Capacity (kgal)	Total Waste (kgal)	Supernatant Liquid (kgal)	Drainable Interstitial Liquid (kgal)	Drainable Liquid Remaining (kgal)	Pumpable Liquid Remaining (kgal)	Sludge Volume (kgal)	Saltcake Volume (kgal)
241-S-107	Sound	N	Partial	758	396	14	47	61	57	336	26
241-S-108	Sound	Y	Partial	758	550	0	4	4	0	5	545
241-S-109	Sound	Y	Partial	758	533	0	16	16	12	13	520
241-S-110	Sound	Y	Partial	758	389	0	30	30	27	96	293
241-S-111	Sound	N	Partial	758	473	(f)	(f)	(f)	178	98	337
241-S-112	Sound	N	Partial	758	523	0	81	81	70	6	517
241-SX-101	Sound	N	Partial	1,000	416	(g)	(g)	(g)	99	0	416
241-SX-102	Sound	N	Partial	1,000	513	(h)	(h)	(h)	216	0	380
241-SX-103	Sound	N	Partial	1,000	507	(I)	(I)	(I)	132	109	398
241-SX-104	Asmd Lkr	Y	Partial	1,000	446	0	48	48	39	136	310
241-SX-105	Sound	N	Partial	1,000	484	(j)	(j)	(j)	141	65	419
241-SX-106	Sound	Y	Partial	1,000	397	0	37	37	31	0	397
241-SX-107	Asmd Lkr	Y	Complete	1,000	95	0	7	7	3	79	16
241-SX-108	Asmd Lkr	Y	Complete	1,000	73	0	0	0	0	73	0
241-SX-109	Asmd Lkr	Y	Complete	1,000	241	0	0	0	0	58	183
241-SX-110	Asmd Lkr	Y	Complete	1,000	56	0	0	0	0	29	27
241-SX-111	Asmd Lkr	Y	Complete	1,000	115	0	11	11	7	76	39
241-SX-112	Asmd Lkr	Y	Complete	1,000	75	0	6	6	2	56	19
241-SX-113	Asmd Lkr	Y	Complete	1,000	19	0	0	0	0	19	0
241-SX-114	Asmd Lkr	Y	Complete	1,000	157	0	30	30	26	42	115
241-SX-115	Asmd Lkr	Y	Complete	1,000	4	0	0	0	0	4	0
241-T-101	Asmd Lkr	Y	Partial	530	100	0	16	16	12	37	63
241-T-102	Sound	Y	Complete	530	32	13	3	16	13	19	0
241-T-103	Asmd Lkr	Y	Complete	530	27	4	3	7	4	23	0

Table 4-2. Waste Volumes and Status of Measures to Prevent Waste Migration to the Environment (7 sheets)

Designation	Tank Integrity	Interim Stabilized	Isolated	Capacity (kgal)	Total Waste (kgal)	Supernatant Liquid (kgal)	Drainable Interstitial Liquid (kgal)	Drainable Liquid Remaining (kgal)	Pumpable Liquid Remaining (kgal)	Sludge Volume (kgal)	Saltcake Volume (kgal)
241-T-104	Sound	Y	Partial	530	317	0	31	31	27	317	0
241-T-105	Sound	Y	Complete	530	98	0	5	5	0	98	0
241-T-106	Asmd Lkr	Y	Complete	530	22	2	0	0	0	22	0
241-T-107	Asmd Lkr	Y	Partial	530	173	0	34	34	28	173	0
241-T-108	Asmd Lkr	Y	Complete	530	16	0	4	4	0	5	11
241-T-109	Asmd Lkr	Y	Complete	530	62	0	11	11	4	0	62
241-T-110	Sound	Y	Partial	530	369	1	48	48	43	314	55
241-T-111	Asmd Lkr	Y	Partial	530	447	0	38	38	35	447	0
241-T-112	Sound	Y	Complete	530	67	7	4	11	7	60	0
241-T-201	Sound	Y	Complete	55	31	2	4	6	2	29	0
241-T-202	Sound	Y	Complete	55	21	0	3	3	0	21	0
241-T-203	Sound	Y	Complete	55	37	0	5	5	0	37	0
241-T-204	Sound	Y	Complete	55	37	0	5	5	0	37	0
241-TX-101	Sound	Y	Complete	758	91	7	7	7	3	74	17
241-TX-102	Sound	Y	Complete	758	217	0	27	27	16	2	215
241-TX-103	Sound	Y	Complete	758	145	0	18	18	11	0	145
241-TX-104	Sound	Y	Complete	758	69	3	9	12	7	34	32
241-TX-105	Asmd Lkr	Y	Complete	758	576	0	25	25	14	8	568
241-TX-106	Sound	Y	Complete	758	348	0	37	37	30	5	341
241-TX-107	Asmd Lkr	Y	Complete	758	30	0	7	7	0	0	30
241-TX-108	Sound	Y	Complete	758	129	0	8	8	1	6	123
241-TX-109	Sound	Y	Complete	758	363	0	6	6	2	363	0
241-TX-110	Asmd Lkr	Y	Complete	758	467	0	14	14	10	37	430
241-TX-111	Sound	Y	Complete	758	365	0	10	10	6	43	322

Table 4-2. Waste Volumes and Status of Measures to Prevent Waste Migration to the Environment (7 sheets)

Designation	Tank Integrity	Interim Stabilized	Isolated	Capacity (kgal)	Total Waste (kgal)	Supernatant Liquid (kgal)	Drainable Interstitial Liquid (kgal)	Drainable Liquid Remaining (kgal)	Pumpable Liquid Remaining (kgal)	Sludge Volume (kgal)	Saltcake Volume (kgal)
241-TX-112	Sound	Y	Complete	758	634	0	26	26	21	0	634
241-TX-113	Asmd Lkr	Y	Complete	758	639	0	18	18	14	93	546
241-TX-114	Asmd Lkr	Y	Complete	758	532	0	17	17	11	4	528
241-TX-115	Asmd Lkr	Y	Complete	758	554	0	25	25	15	8	546
241-TX-116	Asmd Lkr	Y	Complete	758	597	0	21	21	17	66	531
241-TX-117	Asmd Lkr	Y	Complete	758	481	0	10	10	5	29	452
241-TX-118	Sound	Y	Complete	758	256	0	31	31	27	0	256
241-TY-101	Asmd Lkr	Y	Complete	758	118	0	2	2	0	72	46
241-TY-102	Sound	Y	Complete	758	69	0	13	13	6	0	69
241-TY-103	Asmd Lkr	Y	Complete	758	155	0	23	23	19	103	52
241-TY-104	Asmd Lkr	Y	Complete	758	44	0	4	5	1	43	0
241-TY-105	Asmd Lkr	Y	Complete	758	231	0	12	12	10	231	0
241-TY-106	Asmd Lkr	Y	Complete	758	16	0	1	1	0	16	0
241-U-101	Asmd Lkr	Y	Complete	530	24	0	4	4	0	24	0
241-U-102	Sound	N	Partial	530	275	(k)	(k)	(k)	93	37	238
241-U-103	Sound	Y	Partial	530	418	1	33	34	28	13	405
241-U-104	Asmd Lkr	Y	Complete	530	122	0	0	0	0	122	0
241-U-105	Sound	Y	Partial	530	353	0	44	44	40	32	321
241-U-106	Sound	Y	Partial	530	171	2	36	38	31	0	170
241-U-107	Sound	N	Partial	530	400	(l)	(l)	(l)	115	13	373
241-U-108	Sound	N	Partial	530	468	(m)	(m)	(m)	124	29	415
241-U-109	Sound	N	Partial	530	400	(n)	(n)	(n)	119	27	373
241-U-110	Asmd Lkr	Y	Partial	530	176	0	16	16	1	176	0
241-U-111	Sound	N	Partial	530	340	0	78	78	74	26	314

Table 4-2. Waste Volumes and Status of Measures to Prevent Waste Migration to the Environment (7 sheets)

Designation	Tank Integrity	Interim Stabilized	Isolated	Capacity (kgal)	Total Waste (kgal)	Supernatant Liquid (kgal)	Drainable Interstitial Liquid (kgal)	Drainable Liquid Remaining (kgal)	Pumpable Liquid Remaining (kgal)	Sludge Volume (kgal)	Saltcake Volume (kgal)
241-U-112	Asmd Lkr	Y	Complete	530	45	0	4	4	0	45	0
241-U-201	Sound	Y	Complete	55	5	1	1	2	1	4	0
241-U-202	Sound	Y	Complete	55	4	1	0	1	1	3	0
241-U-203	Sound	Y	Complete	55	4	1	0	1	1	3	0
241-U-204	Sound	Y	Complete	55	4	1	0	1	1	3	0

Notes:

Adapted from HNF-EP-0182, Rev 167

Complete isolation refers to the completion of efforts required to minimize the addition of liquids into a tank, process vault, sump, catch tank, or diversion box.

Partial isolation refers to all measures for complete isolation except that the risers and piping required for stabilization have not been sealed.

Footnotes
(a) A-101 Initial estimated pumpable liquid volume: 588.5kgal. Final volumes will be determined at completion of Interim Stabilization.
(b) AX-101 Initial estimated pumpable liquid volume: 444.0kgal. Final volumes will be determined at completion of Interim Stabilization.
(c) BY-105 Initial estimated pumpable liquid volume: 109.9kgal. Final volumes will be determined at completion of Interim Stabilization.
(d) BY-106 Initial estimated pumpable liquid volume: 182.7kgal. Final volumes will be determined at completion of Interim Stabilization.
(e) S-102 Initial estimated pumpable liquid volume: 145.8kgal. Final volumes will be determined at completion of Interim Stabilization.
(f) S-111 Initial estimated pumpable liquid volume: 178.3kgal. Final volumes will be determined at completion of Interim Stabilization.
(g) SX-101 Initial estimated pumpable liquid volume: 99.0kgal. Final volumes will be determined at completion of Interim Stabilization.
(h) SX-102 Initial estimated pumpable liquid volume: 216.0kgal. Final volumes will be determined at completion of Interim Stabilization.
(i) SX-103 Initial estimated pumpable liquid volume: 132.0kgal. Final volumes will be determined at completion of Interim Stabilization.
(j) SX-105 Initial estimated pumpable liquid volume: 141.0kgal. Final volumes will be determined at completion of Interim Stabilization.
(k) U-102 Initial estimated pumpable liquid volume: 93.0kgal. Final volumes will be determined at completion of Interim Stabilization.
(l) U-107 Initial estimated pumpable liquid volume: 115.0kgal. Final volumes will be determined at completion of Interim Stabilization.
(m) U-108 Initial estimated pumpable liquid volume: 124.0kgal. Final volumes will be determined at completion of Interim Stabilization.
(n) U-109 Initial estimated pumpable liquid volume: 119.4kgal. Final volumes will be determined at completion of Interim Stabilization.

4.2.2 Inactive Miscellaneous Underground Storage Tanks

IMUSTs typically come in three basic designs: direct-buried concrete, concrete tanks with a steel liner, and direct-buried steel. There are 24 IMUSTs associated with the SST system. The capacity of the IMUSTs ranges from 2,000 to 136,000 L (500 to 36,000 gal). Many of the IMUSTs were used as catch tanks and contain sludge and process materials (RPP-9645). The following is a brief description of past uses of the IMUSTs in relation to the plutonium and uranium separations and waste management activities in the 200 East and West Areas (WHC-EP-0861):

- Settling solids before decanting and discharge of supernatant in cribs and reverse wells,
- Neutralizing acidic process wastes before crib disposal,
- Receiving and processing of SST waste for uranium recovery operations,
- Collecting waste that intruded into diversion boxes and transfer pipeline encasements and any leakage that occurred during waste transfer operations,
- Storing hexone from the reduction-oxidation process (S Plant),
- Receiving flush and decontamination solutions,
- Diverting flow streams, and
- Waste handling and process experimentation.

The current status of the IMUSTs relative to interim stabilization and interim isolation is listed in Table 4-3. Interim stabilized typically means that all liquids economically and technically practical to remove have been removed such that no more than 1,510 L (400 gal) or a 10-cm (4-in.) heel remains (either at tank bottom or sludge-to-supernatant interface). An interim isolated tank is defined as a having been interim stabilized and isolated from facilities by sealing all inlet and outlet connections to the tanks. However, if the tank liquid cannot be transported by tanker truck due to transport regulations, up to 5,000 gallons of liquid may remain in the IMUST and meet the interim stabilization definition provided in the *Tank Farm Facility Interim Stabilization Evaluation*, HNF-IP-0842, Volume IV, Section 4.1, Revision 3d.

As a result of the processes of isolation and interim stabilization, most monitoring systems have been removed. Two IMUSTs (240-S-302 and 241-TX-302B) are currently being monitored daily for liquids through the use of an ENRAF[1] gauge and a manual tape (RPP-9645).

The SST system component list identifies 29 IMUSTs; three of these tanks are RCRA past-practice units as described in Section 4.2.8.3. Two of the tanks are associated with the 231-W-151 vault and are addressed with the vault tanks in Section 4.2.3.

[1] ENRAF is a trademark of the ENRAF Corporation, Houston, Texas.

Table 4-3. Inactive Miscellaneous Underground Storage Tanks.

Tank Number	Use	Capacity (gal)	Solid Volume (gal)	Liquid Volume (gal)	Total Waste Volume (gal)	Liquid Depth (in.)	Status
241-AX-151-CT	Catch tank	11,000	Unknown	2,946	Unknown	Unknown	IS & ST
241-B-301B (aka 241-B-301)	Catch tank	36,000	21,660	590	22,250	3	IS & ST
241-B-302B	Catch tank	17,684	690	4,240	4,930	26	IS & ST
241-BX-302A	Catch tank	17,684	835	0	835	0	IS & ST
241-BX-302B	Catch tank	11,389	950	94	1,044	1	IS & ST
241-BX-302C	Catch tank	11,378	635	228	863	3	IS & ST
216-BY-201	Settling Tank	11,220	Unknown	Unknown	Unknown	Unknown	ST
241-BY-ITS2-Tank 2	Catch tank	2,742	Unknown	Unknown	Unknown	Unknown	ST
241-C-301 (aka 241-C-301C)	Catch tank	36,000	9,016	1,470	10,486	7.5	IS & ST
241-ER-311A	Catch tank	27,700	Unknown *	Unknown*	Unknown*	Unknown*	Empty, abandoned, in place 1954
240-S-302	Catch tank	17,684	2,276	0	2,276	Unknown	IS & ST Leaker
241-S-302B	Catch tank	14,314	0	0	0	0	IS & ST
241-SX-302 (aka 241-SX-304)	Catch tank	17,684	1,050	305	1,355	2.25	IS & ST
241-T-301B (aka 241-T-301)	Catch tank	36,000	21,658	588	22,246	3	IS & ST
242-T-135	Storage tank	830	Unknown	Unknown	Unknown	Unknown	Unknown
242-TA-R1	Receiver tank	4,200	Unknown	Unknown	Unknown	Unknown	Unknown
241-TX-302A	Catch tank	17,684	2,450	30	2,480	0.1	IS & ST
241-TX-302B	Catch Tank	17,684	Unknown	Unknown	1,320	Unknown	IS & ST
241-TX-302BR	Catch tank	12,000	1,090	50	1,140	Unknown	IS & ST
241-TX-302XB (aka 241-TX-302X)	Catch tank	14,314	108	245	353	3.5	IS & ST
241-TY-302A	Catch tank	17,684	450	0	450	0	IS & ST
241-TY-302B	Catch tank	14,314	0	0	0	0	IS & ST
200-W-7 (aka 243-S-TK-1; aka 246-L)	Catch tank	550	Unknown	Unknown	Unknown	Unknown	Unknown
241-Z-8	Settling tank	15,435	500	0	500	0	IS & ST

Notes: IS: Isolated

ST: Interim Stabilized

* Conflicting information exists for 241-ER-311A. Although it was abandoned in 1954, no definitive records state if any sludge or residual remains. Some sources claim the tank is empty.

4.2.3 Vaults

Vaults consist of shielded enclosures housing waste processing equipment. The vaults operated to collect, clarify, and allow physical and chemical modification of waste before transfer to other system components. Table 4-4 provides a summary of the tank capacities and waste volumes existing in the vault tanks.

Table 4-4. Vault Tank Data.

Vault/ Cell Number	Tank Capacity and Waste Volume (gal)				
	Tank Number	Capacity	Liquid	Solid/Sludge	Total
244-AR vault					
Cell 1	244-AR-001	43,000	1,200	100	1,300
Cell 2	244-AR-002	43,000	12,100	400	12,500
Cell 3	244-AR-003	4,700	1,950	50	2,000
Cell 3	244-AR-004	4,700	200	50	250
244-BXR vault					
Cell 1	244-BXR-001	50,000	0	7,215	7,215
Cell 2	244-BXR-002	15,000	380	1,805	2,185
Cell 3	244-BXR-003	15,000	356	1,449	1,805
Cell 4	244-BXR-011	50,000	98	7,020	7,118
244-CR vault					
Cell 1	244-CR-001	40,000	*	*	2,000
Cell 2	244-CR-002	15,000	*	*	1,500
Cell 3	244-CR-003	15,000	4,000	0	4,000
Cell 4	244-CR-011	40,000	21,000	14,683	35,683
244-TXR vault					
Cell 1	244- TXR -001	50,000	49	2,291	2,340
Cell 2	244- TXR -002	15,000	0	2,945	2,945
Cell 3	244- TXR -003	15,000	0	6,460	6,460
244-UR vault					
Cell 1	244-UR-001	50,000	390	1,872	2,262
Cell 2	244-UR-002	15,000	570	2,304	2,874
Cell 3	244-UR-003	15,000	0	1,568	1,568
Cell 4	244-UR-004	8,230	0	0	0
231-W-151					
Cell 1	231-W-151-001	4,000	1,430	0	1,430
Cell 1	231-W-151-002	950	950	10	960**
Known Waste Volume Total			44,700	50,200	98,400

Notes:

* Denotes unknown volumes

** HNF-1566 identifies a volume in excess of the capacity of the tank.

Sources: HNF-1566, RPP-5635, RPP-6029, WHC-SD-EN-ES-040, WIDS

A review of the Waste Information Data System (WIDS) indicates that some of the tanks in the vaults overflowed. Table 4-5 contains the number of cells by vault, the waste contents, and other details deemed pertinent to the vault analysis.

Table 4-5. Vault Cell Data.

Vault/ Cell Number	Cell Dimensions (ft)			Sump Waste Volume (gal)		
	Length	Width	Height	Liquid	Solid/ Sludge	Total
244-AR vault						
Cell 1	21	21	32.75	0	0	0
Cell 2	21	21	32.75	0	0	0
Cell 3	32	12	21	3,000	0	3,000
244-BXR vault						
Cell 1	26	22	29.5	12	0	12
Cell 2	20	16	19.5	250	33	283
Cell 3	20	16	19.5	616	7,690	8,306
Cell 4	26	22	29.5	0	4,200	4,200
244-CR vault						
Cell 1	26	22	29.5	1,000	0	1,000
Cell 2	20	16	19.5	1,000	0	1,000
Cell 3	20	16	19.5	400	0	400
Cell 4	26	22	29.5	1,000	0	1,000
244-TXR vault						
Cell 1	26	22	29.5	5	4	9
Cell 2	20	16	19.5	15	0	15
Cell 3	20	16	19.5	3	20	23
244-UR vault						
Cell 1	26	22	29.5	3,570	260	3,830
Cell 2	20	16	19.5	1,140*	30	1,170
Cell 3	20	16	19.5	3,700*	2,300	6,000
Cell 4	14	16	19.5	0	0	0
231-W-151 vault						
Cell 1	15	15	16.5	**	**	**
All Vault Total				15,700	14,500	30,300

Notes:

* WHC-SD-EN-ES-040 shows these two cells with an upper and lower estimate. The lower estimate is 0 for both cells. The upper estimate is listed in this table.

** Data are not available regarding the quantity of waste.

Sources: WIDS, RPP-6029, RPP-5635, WHC-SD-EN-ES-040

- **244-AR Vault** – The 244-AR vault is located north west of the A tank farm in the 200 East Area. The vault was designed to receive, treat and transfer Plutonium-Uranium Extraction (PUREX) Plant tank farm sludges to B-Plant for fission product removal; provide interim storage for the PUREX Plant acid waste feed to B-Plant; and receive and distribute the neutralized high-level waste from B-Plant. The 244-AR vault is planned to be interim stabilized by September 30, 2003.

The 244-AR vault and its contents are briefly described here; a detailed description including waste characteristics is provided in *244-AR Vault Interim Stabilization Project Plan* (RPP-5635). The facility contains approximately 72,100 L (19,050 gal) of radioactive waste; the majority of which is expected to be water from intrusion of precipitation and drainage from a failed sanitary water line. Of the total volume, 60,750 L (16,050 gal) is contained in the 4 waste process tanks and 11,300 L (3,000 gal) is in the concrete cells housing the tanks. Each cell contains a sump with an overflow connection to an adjacent cell. The facility and tank ventilation systems are not functional (RPP-9645).

The 244-AR vault has three process cells. Cell 1 has a 162,800 L (43,000 gal) flat bottom stainless steel tank (244-AR-001). It was the primary storage tank for neutralized current acid waste (high-level first-cycle solvent extraction waste from the PUREX Plant). This tank contains approximately 380 L (100 gal) of residual sludge from past transfers and contains approximately 4,500 L (1,200 gal) of liquid that is believed to be water from past transfer line flushes.

Cell 2 has a 162,800 L (43,000 gal) flat bottom stainless steel tank (244-AR-002). This tank contains approximately 1,520 L (400 gal) of residual sludge from 241-AX-104; 7,570 L (2,000 gal) of supernate; and 38,200 L (10,100 gal) of water transferred from tank 244-AR-004 and past transfer line flushes.

Cell 3 has two sloped-bottom stainless steel tanks (244-AR-003 and 244-AR-004). Tank 244-AR-003 contains approximately 190 L (50 gal) of residual sludge from past transfers and 7,380 L (1,950 gal) of water from the cell sump and past transfer line flushes. Tank 244-AR-004 contains approximately 190 L (50 gal) of residual sludge from tank 241-AX-104 and other transfers and 760 L (200 gal) of supernate heel. The cell 3 sump contains approximately 11,300 L (3,000 gal) of liquid that is believed to be drainage from a failed sanitary water line. None of the tanks in the 244-AR vault is monitored (RPP-9645).

- **244-BXR Vault** – The 244-BXR vault is a below-grade facility that contains four vertical tanks with dished bottoms and heads, each in its own cell and with its own 170 L (45 gal) sump. All of the sumps contain waste from what appears to be spillage from the vault tanks (WHC-SD-EN-ES-040).

  The BXR vault was operated from 1951 to 1957 and was utilized in the Uranium Recovery Program. The BXR vault was isolated in 1985. Isolation included cutting and capping pipes and ducts, sealing a conduit trench, and installing a weather cover over the vault at grade level.

  Tank 244-BXR-001 is constructed of carbon steel, the other three tanks are constructed of stainless steel. Tanks 244-BXR-001 and 244-BXR-011 have capacities of 189,300 L (50,000 gal); tanks 244-BXR-002 and 244-BXR-003 have capacities of 56,800 L (15,000 gal) (HNF-2503). This is an inactive facility and is not monitored (RPP-9645).

Tank 244-BXR-001 received metal waste slurry from the BX and BY farms. Tanks 244-BXR-002 and 244-BXR-003 were used as blend tanks, mixing slurry waste from 244-BXR-001 with nitric acid. Tank 244-BXR-011 received waste from Tanks 244-BXR-002 and –003 and was used as a pump tank. Tanks 244-BXR-001, -002, and -003 were sampled in 1984; tank 244-BXR-011 was sampled in 1978.

- **244-CR Vault –** The 244-CR vault, constructed in 1952, is an inactive facility that functioned as a lag storage and transfer station from various waste streams including liquid discharge from Hot Semiworks (200 E-41) and fission product 'crudes' being transported between the PUREX Plant and B-Plant. The facility also provided lag storage for PUREX acidified sludge in transit to the 244-AR vault and has been used for routing waste transfers from the C tank farm to the DSTs. The 244-CR Vault is planned to be interim stabilized by September 30, 2004 (Performance Incentive ORP-08).

The 244-CR vault and its contents are briefly described here; a detailed description including waste characteristics is provided in *244-CR Vault Interim Stabilization Project Plan* (RPP-6029). The facility contains approximately 176,300 L (46,600 gal) of radioactive waste. Of the total volume, 164,000L (43,200 gal) is contained in the four waste process tanks and 13,000 L (3,400 gal) is in the concrete cells housing the tanks. Each tank is in its own cell and each cell contains a sump with an overhead pump pit.

The 244-CR vault has four process cells. Cell 1 has a 151,450 L (40,000 gal) carbon steel tank (244-CR-001) that was a slurry accumulation tank. This tank contains approximately 7,600 L (2,000 gal) of waste from C farm tanks. The cell 1 sump is assumed to contain 3,800 L (1,000 gal) of liquid from precipitation runoff.

Cell 2 has a 56,800 L (15,000 gal) stainless steel tank (244-CR-002) that was used as an acid digestion tank. Nitric acid was mixed with sludge waste from tank 244-CR-001, resulting in a slurry known as PUREX acidified sludge. This tank contains approximately 5,700 L (1,500 gal) of this slurry. The cell 2 sump is assumed to contain 3,800 L (1,000 gal) of liquid from precipitation runoff.

Cell 3 has a 56,800 L (15,000 gal) stainless steel tank (244-CR-003) that was originally used for acid digestion in the uranium recovery process and later used as a saltwell receiver tank. Tank 244-CR-003 contains approximately 15,000 L (4,000 gal) waste including PUREX acid sludge and sludge from Hot Semiworks tank 241-CX-70, supernate from the C farm tanks. The cell 3 sump is assumed to contain 1,500 L (400 gal) of liquid from precipitation runoff.

Cell 4 has a 151,000 L (40,000 gal) stainless steel tank (244-CR-011). This tank contains approximately 80,000 L (21,000 gal) of supernate from the Hot Semiworks tank 241-CX-70 with the remaining inventory expected to be precipitation runoff pumped to the tanks from drainage sumps in the Hot Semiworks and 244-CR vault facilities. There are 55,600 L (14,700 gal) of solids also present in the tank. The cell 4 sump is assumed to contain 3,800 L (1,000 gal) of liquid from precipitation runoff.

All abovegrade portions of the facility including steam and air supply lines have been removed. Tank 244-CR-003 liquid level is currently monitored daily with a manual tape. None of the other tanks in the vault complex are monitored (RPP-9645).

- **244-TXR Vault –** The 244-TXR vault contains three vertical tanks with dished bottoms and heads, each in its own cell and with its own 170 L (45 gal) sump. The vault was in service from 1951 to 1956 receiving waste from tanks in T and TX farms. The vault was taken out of service in 1957, and it was isolated and interim stabilized in 1984. Tank 244-TXR-001 is constructed of carbon steel and has a capacity of 200,000 L (50,000 gal). Currently a total of 8,900 L (2,340 gal) of waste reside in the tank; 190 L (49 gal) of liquid and 8,700 L (2,300 gal) of solids. The other two tanks (244-TXR-002 and 244-TXR-003) are constructed of stainless steel and have capacities of 57,000 L (15,000 gal). Both of these tanks have no known liquid volume. 244-TXR-002 contains 11,000 L (2,900 gal) of solids, and 244-TXR-003 contains 25,000 L (6,500 gal) of solids. This is an inactive facility and is not monitored (RPP-9645).

  Tank 244-TXR-001 received metal waste slurry from the T and TX tank farms. Tanks 244-TXR-002 and 244-TXR-003 were used as blend tanks, mixing slurry waste from 244-TXR-001 with nitric acid. Tank 244-TXR-001, was sampled in 1984 and tank 244-TXR-002 was sampled in 1975. No sampling information is available for 244-TXR-003.

- **244-UR Vault –** The 244-UR vault contains four vertical tanks with dished bottoms and heads, each in its own cell. The vault was in service from 1952 to 1957 and supported the Uranium Recovery Project. The vault underwent interim stabilization in 1985. Except for cell 4, each cell has a 170 L (45 gal) capacity sump. Tank 244-UR-001 is constructed of carbon steel and has a capacity of 200,000 L (50,000 gal). Tanks 244-UR-002 and 244-UR-003 are constructed of stainless steel and have capacities of 57,000 L (15,000 gal). 244-UR-004 is constructed of stainless steel and has a capacity of 31,200 L (8,230 gal).

  Tank 244-UR-001 received neutralized metal waste slurry (bismuth-phosphate process) from tanks U-101, 102, 103, and 107. It is known to contain 1,500 L (390 gal) of liquid and 7,080 L (1,870 gal) of sludge. Tanks 244-UR-002 and 244-UR-003 were used as blend tanks, mixing slurry waste from 244-UR-001 with nitric acid. Tank 244-UR-002 contains 2,200 L (570 gal) of liquid and 8,700 L (2,304 gal) of solid waste. Tank 244-UR-004 provided storage for 60% nitric acid. It does not contain any mixed waste.

- **231-W-151 Vault** – The 231-W-151 vault was used to receive waste from 75 floor drains in the 231-Z building. Two tanks are contained within this single-celled vault. Tank 231-W-151-001 has a capacity of 15,000 L (4,000 gal) and currently is known to have 5,400 L (1,430 gal) of liquid remaining in the tank. Tank 231-W-151-002 has a capacity of 3,600 L (950 gal) with roughly 1 percent of that volume attributable to solids and the remaining 99 percent associated with supernatant. No treatment activities are known to have occurred within the two tanks.

4.2.4 At-Tank Pits

Pumps, monitoring equipment, and transfer systems are typically contained in below-grade concrete enclosures with removable reinforced concrete cover blocks. The type and number of pits associated with SSTs depend on the type of waste stored and the function of the SST. Therefore, not all tanks have all of the types of pits listed here. The pits located above the 100-series and 200-series tanks are collectively referred to as at-tank pits and include pump pits, sluice pits, heel pits, distribution pits, and saltwell caissons. These pits typically have a floor drain that drains directly back to the SST it services. The at-tank pits serve to collect spills or leaks from the equipment within the pit and, though contaminated, by design and practice the at-tank pits do not provide a storage function.

The routing board drawings (H-14-104175, and H-14-104176) document the current system configuration and were the primary source of information for the status of pit isolation (isolated and weather sealed) and status of the pit drains (open or closed). An assumed flood depth of either (1) the depth of outgoing transfer lines or (2) half the depth of the pit where no outgoing transfer lines exist, was calculated to account for potential past spills and used to derive the extent of the contaminated surfaces within an at-tank pit. Table 4-6 summarizes the number of at-tank pits and the associated surface areas.

Table 4-6. At-Tank Pits Contaminated Surface Area Summary

Pit Type	Number of At-Tank Pits	Estimated Contaminated Surface Area (ft^2)
Pump pit	114	21,200
Sluice pit	74	14,500
Heel pit	25	2,100
Distribution pit	14	1,300
Saltwell caissons	18	700
Totals	245	39,800

4.2.5 Between-Tank Pits

The pits between the tanks and between the tank farms provide for flexible connection to the pipeline network that allows waste to be transferred between tanks in the SST system.
The between-tank pits include diversion boxes, valve pits, and flush pits. The valve pits and diversion boxes were designed to collect spills or leaks from the piping components within the boundaries of the pits (e.g., jumpers, valves). Also, piping encasements were designed to drain back into the valve pits and diversion boxes. The collected liquids drained from the pit into a connected catch tank. Spray nozzles in the pits provide a means to flush these components after transfer operations. Although the pits are contaminated with tank waste, by design and practice, the pits do not provide a storage function.

The primary sources of information and the assumed flood depth for contaminated surface area calculations are the same as described for the at-tank pits. By design, the flush pit should not have received waste, and is not included in the calculation for contaminated surface area of the pits. Table 4-7 summarizes the quantity and assumed contaminated surface area of the between-tank pits.

Table 4-7. Between-Tank Pits Contaminated Surface Area Summary

Pit Type	Number of Between-Tank Pits	Estimated Contaminated Surface Area (ft^2)
Diversion box	59	17,100
Valve pit	17	1,900
Flush pit	1	*
Totals	77	19,000

Note: * Flush pit did not contact mixed waste, therefore there is no contaminated surface area.

Diversion Boxes. Diversion boxes are below-grade, reinforced concrete structures that provide a flexible method of directing liquid waste from a process facility or tank to another process facility or tank. The top of the diversion box is a concrete cover block that usually extends above grade. The cover blocks vary in thickness from box to box. Some diversion boxes are lined with steel. Transfer lines terminate at a nozzle in the wall or floor of the diversion box. Transfer lines are connected in the diversion box by installing a jumper between the connecting nozzles. Diversion boxes contain drain lines connected to catch tanks that together serve to collect any waste leakage from the jumper connections. Diversion boxes also provide containment for leaks in encased waste transfer lines, which drain back to the diversion boxes through the encasement.

Valve Pits. Valve pits are a form of a diversion box and are located below ground. They are reinforced concrete structures that contain valve and jumper assemblies to route the liquid waste through the connected pipelines within a tank farm. Heavy, thick, grade-level blocks cover each of the valve pits. When several tanks are undergoing simultaneous pumping to a single receiver tank, the flow is routed to a valve pit. In the valve pit, the transfer lines of the sending tank are manifolded to the receiver tank line by means of a series of valves and jumper connections. Two- and three-way valves are built into each rigid jumper assembly to divert the flow in the required direction. Waste also can be routed through the valve pit with stainless steel flex jumpers. Each valve pit is equipped with leak detection that is interlocked to shut down pumps. Each valve pit also has a flush line connected to a flush pit or a drain line connected to an underground catch tank.

Flush Pits. The components for pipeline flushing and decontamination operations are located in flush pits. In-line back flow preventers protect the flush pit system from mixed waste back-flowing into the flushing system.

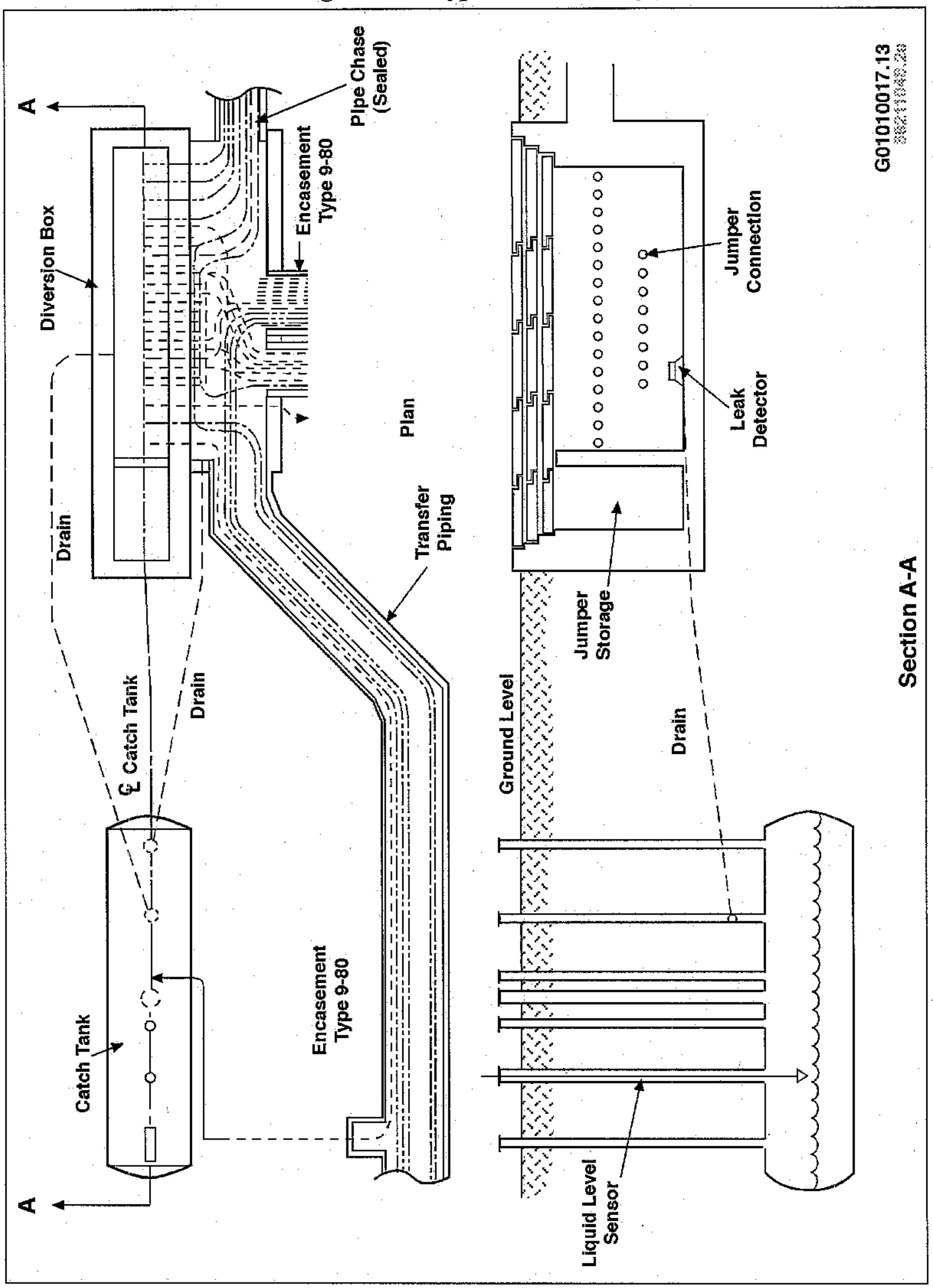
4.2.6 Piping

An extensive network of transfer lines connects the various components of the tank farms. The transfer lines were designed to convey wastes. A diagram of a typical transfer system is provided in Figure 4-4. The piping network conveyed a variety of process wastes, typically in a slurry form. Some lines were installed for specific purposes (e.g., drain lines, saltwell lines) while others were used for general transfers between facilities in the 200 Areas. Only five cases of plugged transfer lines are documented in the SST system. In most cases, flushing procedures were followed to prevent the build-up of residuals inside the piping.

The analysis performed for this SST system description identified pipes connected to SST components and allocated half the length to that particular component based on the routing boards (H-14-104175, H-14-104176). The transfer lines associated solely with the SST system have been estimated at approximately 154 km (96 mi) +/- 30%. This includes approximately 1,400 different lines ranging in size from 5.1 to 15.2 cm (2 to 6 in.) in diameter. The average diameter of the transfer lines has been modeled at 7.6 cm (3 in.). Appendix D details the methodology for the piping extrapolation for the SST system.

The construction specifications and hydraulic profiles for the piping system indicate the lines generally were sloped to allow self-drainage (Drawings H-2-44502 and H-2-44512). If a low point in a pipe exists, typically a low-point drain feeds from there into a tank. Most lines are out of service. The transfer pipelines were contaminated through use (direct contact with tank waste), but estimates indicate that they do not contain significant volumes of waste.

Figure 4-4. Typical Transfer System.



4.2.7 Evaporators

Evaporators were designed to reduce the volume of radioactive liquid waste by evaporation of water to produce a concentrated salt solution. Both SST system evaporators, the 242-S Evaporator and the 242-T Evaporator, have been in a shutdown/standby mode since the 1980s with no anticipated use for future missions.

- **242-S Evaporator** – The 242-S Evaporator is located in the 200 West Area and began operations in November 1973. It was shutdown November 1980. In 1981, the 242-S Evaporator was placed in shutdown/standby Condition II that included flushing and removal of radioactive liquids from the facility. The facility was upgraded to allow the contents of the evaporator vessel to be pumped to a DST in case of shutdown during operations. These upgrades were done in anticipation of additional requirements in 1984 for waste concentration capabilities. The 242-S Evaporator was placed in standby/shutdown Condition III in 1985.

  The following vessels were drained and flushed following the facility shutdown in 1981 (HNF-2503):

  - E-C-1, primary condenser
  - E-C-2, inter condenser
  - E-A-1, reboiler
  - E-C-3, after condenser
  - TK-C-103, flow measurement tank
  - DU-C-1, deentrainment unit.

  The status of the remaining vessels is as follows (HNF-2503):

  - **C-A-1, Vapor/Liquid Separator (134,790 L [35,600 gal])** – Contains a residual liquid of 7.6 to 10.2 cm (3 to 4 in.); the liquid is believed to be undrained liquid from the flushing operation.

  - **TK-C-100, Condensate Catch Tank (67,400 L [17,800 gal])** – Contains 30,290 L to 34,100 L (8,000 to 9,000 gal) of residual waste. The amount of sludge is unknown; last used in 1985 for the U1/U2 groundwater treatment campaign.

  - **IX-D-1, Ion Exchange Column** – The column originally contained zeolite; an organic resin was added to support the U1/U2 groundwater campaign after which the column was regenerated with sodium hydroxide and the column was filled with water.

  - **TK-E-101, Eluent Tank** – The tank is empty; previously contained sodium nitrate and later contained sodium hydroxide for ion exchange column regeneration.

- **TK-E-102, Anti-Foam Tank** – This tank was sampled in 1997; contains residual amount of sodium bicarbonate.
- **TK-E-104, Decontamination Tank** – This tank was sampled in 1997; contains a minimum heel of rusty water.
- **TK-302-C, Lag Storage Tank** – This tank has been emptied and cleaned for use as a raw water storage and chemical addition tank.
- **Pump Room Floor Sump** – This sump contains an undetermined amount of floor drainage from the hot side of the facility.

- **242-T Evaporator** – The 242-T Evaporator was originally constructed in the early 1950s as a prototype to reclaim storage capacity in existing underground waste storage tanks. Evaporator operations were discontinued at the facility in 1976 and the tanks were used to receive and neutralize salt acid waste from the Plutonium Finishing Plant (Z Plant). Operation of the process areas at the facility was no longer required after November 1980. In 1983, plans were initiated to place the process portions of the facility in shutdown/standby Condition V until decommissioning (up to 50 years). The 242-T Evaporator is planned for transfer to the Deactivation and Demolition contractor by September 30, 2005 (Performance Incentive ORP-08).

  In the early 1970s, the ground under the floor of the 242-T Evaporator was washed out and the resultant void was filled with grout. This event caused visible cracks in the building structure. Evaluations of floor and walls indicated that they did not provide adequate containment of liquid waste. Some patching and sealing of the cracks was conducted, but new cracks continue to form. Because of problems with the roof sagging and allowing water leakage into the process areas, the roof was repaired in 1981 and a foam weather cover was installed, which completely sealed the roof. The process areas, particularly the evaporator, are contaminated from previous process line failures and leakage. Dose rates preclude normal entry into the evaporator area (SD-HS-SAR-009).

  The process area roof cover blocks have been foamed over. The processing area consists of a feed cell, evaporator cell, and a condensate cell.

  The following vessels are located within the 242-T Evaporator (HNF-2503):

  - 242-T-101, evaporator vessel, 41,650 L (11,000 gal),
  - 242-T-102, feed tank (also known as TK-B1), 15,900 L (4,200 gal),
  - 242-T-103, preheater, 180 L (47 gal),
  - 242-T-104, preheater, 180 L (47 gal),
  - 242-T-105, cyclone separator, 570 L (150 gal),
  - 242-T-106, packed scrubber,
  - 242-T-107, condenser,
  - 242-T-108, condenser catch tank, 16,280 L (4,300 gal),
  - 242-T-109, condenser catch tank, 16,280 L (4,300 gal),
  - 242-T-110, cyclone catch tank, 360 L (95 gal),

- 242-T-112, anti-foam tank, and
- 242-T-123, compressor receiver tank.

According to HNF-2503, the radiological and chemical materials contained in the 242-T Evaporator are unknown and the shutdown report tasks of SD-HS-SAR-009, if completed, were not documented.

4.2.8 Miscellaneous Structures

The following sections briefly describe other SST system components not addressed in previous sections.

4.2.8.1 Ventilation Structures

4.2.8.1.1. 241-A-431 Ventilation Building. The fan house deentrainer facility (241-A-431) is also known as the ventilation house as well as the tank farm ventilation building. It was constructed in 1953 to provide offgas deentrainment for the 6 tanks in the A tank farm and to receive drainage from the 296-A-11 stack. The facility began operations in 1955 and was shut down in 1969 (RPP-6637). Residual contamination is expected on the equipment, walls, and floors. The ventilation building's exterior dimensions are 6.4 × 4.9 × 7.6 m (21 × 16 × 25 ft) high. The building is partitioned into two sections. The section that houses the ventilation equipment is 3.0 × 4.9 × 2.7 m (10 × 16 × 9 ft) high. This section houses the fan, a motor, and associated piping and instrumentation. The other section is 3.4 × 4.9 × 7.6 m (11 × 16 × 25 ft) high and contains a deentrainment tank, a 61 cm (24 in.) high-efficiency particulate air filter stack, and sampling equipment. The deentrainment tank is a 2 m (6.5 ft) diameter by 3 m (10 ft) overall height steel tank with dished heads. The deentrainment material is stoneware or porcelain rings to a depth of 1.5 m (5 ft) of the 1.8 m (6 ft) cylindrical section of the tank. Although the waste inventory in the tank is not known, due to low recorded radiation readings around the deentrainment tank, the waste inventory in the tank is expected to be limited to contamination of the tank and deentrainment materials (see Appendix A and Section 2.0 for the development of the engineering estimate for waste volume). This facility is inactive and partially isolated. (RPP-6637 and survey reports DST009487and ET160334).

4.2.8.1.2. Condenser Shielding Buildings. There are currently two condenser shielding buildings in the SST system inventory: 241-SX-401 and 241-SX-402. The buildings were constructed in 1954 to cool some of the tanks in the SX tank farm by cooling the vapor. Both condenser shielding buildings were in operation until 1975. The facilities have been partially isolated at varying levels of implementation. Building 241-SX-402 was constructed to provide redundancy to building 241-SX-401. Both buildings comprise three components: the condenser shielding building proper, the attached control building, and a drywell. There are eight vessels in each facility including six condensers (each with an operating capacity of 1,100 L [280 gal]); one condensate return head tank (with an operating capacity of 910 L [240 gal]); and one condensate seal tank (with a capacity of 570 L [150 gal]). Waste was not stored in the buildings and no chemical processing occurred in these facilities. The contents of the various components within the facility are not well defined but are expected to consist of residual surface contamination on equipment with some residual condensate accumulation in system low points. Radiation levels are essentially background in 241-SX-402 indicating no significant radiological inventory (RPP-6637).

4.2.8.2. Ion Exchange Column. The ion exchange column (241-AX-IX) was constructed in 1967 as a prototypical cesium removal system. The facility consists of an ion exchange column in a shielded structure, a filter, valves, and piping as well as a radiation detector. The column was operated from 1973 until 1976 and functioned to treat condensate from the vapor of the aging waste tanks. It is not known if there is liquid in the ion exchanger or if the column was eluted at the time of its shutdown. Minimal radioactive materials are assumed in the column and are substantiated by the radiation readings taken over the top of the shield wall in late August 2000. These readings indicated essentially background levels of radiation (RPP-6637).

4.2.8.3. In-Tank Solidification System. The first In-Tank Solidification System (241-BY-ITS1) was constructed in the BY tank farm in the 1950s. ITS1 used 241-BY-102 as a "feed tank" and circulated hot air through the tank to evaporate the waste. 241-BY-ITS1 operated from 1965 through 1974 and consisted of the following components:

- De-entrainment vessel, 241-BY-ITS1-DM-102, a vertical tank 5.8 m (19 ft) tall by 3.3 m (11 ft) in diameter;
- Condenser, 241-BY-ITS1-EX-1, 4.3 m (14 ft) long by 0.7 m (2.25 ft) in diameter;
- Demister/Cyclone Separator, 241-ITS1-DM-1;
- High-efficiency particulate air (HEPA) filter and exhaust system;
- Feed Tank (Condensate Catch Tank), 241-ITS1-TK-2, vertical tank 1.5 m (5 ft) high by 1.7 m (5.5 ft) diameter, nominal capacity of 1,520 (400 gal);
- Cuno Filter, 241-ITS1-IX-2, 0.6 m (2.1 ft) diameter by 1.3 m (4.5 ft) tall;
- Ion Exchange Column, 241-ITS1-IX-1, 0.5 m (1.5 ft) by 2.7 m (9 ft) tall; and
- Solution Hold-up Tank, an oval tank with the major axis 1.1 m (3.5 ft) and the minor axis 0.5 m (1.75 ft) and 0.6 m (2 ft) high.

The tanks have been interim stabilized (i.e., the pumpable liquid has been removed) and the interconnecting piping has been removed, effectively isolating the facility. The dose rates around the catch tank, resin column, and cuno filter allow unrestricted access, although a high radiation area is posted around the deentrainer. Characterization of the waste has not been performed (RPP-6637).

Components Not Addressed. This system description provides information on those parts of the SST system as identified in the SST component list (RPP-10466) that provide storage of waste or may contain residual amounts of waste. Only SST farm equipment used in the storage, treatment, or transfer of the tank waste for the 100- and 200-series storage tanks are included in this report. Items on the RPP-10466 list that are marked as being a component of the DST system are not included in this system description of the SST system. For the purposes of this report, the SST system does not include the process facilities or the cribs, but does include the first diversion box after a process facility and the last diversion box before a crib. Utility and services (e.g., raw water, sanitary water, sanitary sewer, electrical conduits) are part of the SST system but are presumed clean and are not included in the scope of this effort. Components of the SST system that were not deemed to be applicable include the following:

- In-tank equipment, including pumps, air lift circulators, instrumentation;
- Surveillance facilities;
- Control buildings;
- Vertical storage units;
- Drywells;
- Groundwater wells;
- Utilities, including electrical, raw water, sanitary water, compressed air, steam; and
- Tank ventilation systems.

During the generation of this report, ongoing discussions have occurred regarding the components listed in RPP-10466, Rev. 2. The following identifies the components with issues remaining to be resolved. In some cases, items listed in RPP-10466, Rev. 2 have been excluded from analysis. In other cases, discussions since the receipt of the second revision have attempted to remove items contained on the list. The intricacies of the contentious components are listed below.

241-UX-702A Miscellaneous Tank – No information was found on this component. It is assumed to be a typographical error in RPP-10466 and as such is not included in this analysis.

241-A-302A Miscellaneous Tank - This tank is cited in RPP-10466; however, it is listed as a RCRA-Past Practice unit in WIDS. This tank is monitored continuously and had waste removed in 1992. Last reported waste volume was approximately 6,400 L (1,700 gal) in 1996. This IMUST is not included in this analysis.

241-A-302B Miscellaneous Tank - This tank is cited in RPP-10466; however, it is listed as a RCRA-Past Practice unit in WIDS. This tank is monitored and was isolated in 1985. It was interim stabilized in 1990. This tank currently contains 18,700 L (4,900 gal) of waste. This IMUST is not included in this analysis.

241-C-801 Cesium Loadout Facility – This facility was used to remove cesium from 241-C-103 (the assigned feed tank). Recent discussions have removed this component from the SST system and hence from this report. It is expected that revision three of RPP-10466 will delete this item from the SST system.

Other components like transfer lines and at-tank pits have not been reconciled due to their insignificance in volumetric calculations. Although some differences exist, the net effect of the reconciliation is not expected to change the findings presented in this document.

5.0 WASTE CHARACTERISTICS IN SINGLE-SHELL TANK COMPONENTS

In order to gauge the level of relative risk associated with each component, engineering estimates were required to quantify and classify the waste in the various elements. For those components that do not have currently published waste volumes (e.g., pipelines, pits, etc.), engineering estimates were contrived in order to provide a general understanding of the impact of these components with respect to the entire system. The primary objective was to perform the characterization with a bias that would yield conservative results.

The first step in determining the waste characteristics and volumes was to identify the most likely location of waste within a particular component. Locations were identified based on physical layouts of the components and also by applying chemical engineering principles for surface locations. Once identified, the waste was classified by one of four categories: stored waste, residual waste, fixed waste, or adsorbed waste. These waste accumulation mechanisms were assessed for each component in order to quantify remaining waste.

An analysis using the Best Basis Inventory (BBI) data was conducted to determine the concentrations of waste in the various components. The BBI is the Hanford Site's best understanding of the SSTs and represents the culmination of the waste processing over the past 40-plus years. The BBI provides estimated constituent concentrations and volumes for each of the 149 SSTs.

5.1 APPROACH FOR DETERMINING LOCATIONS

The approach to determining waste locations was to identify three types of general locations to which each of the SST components could be assigned. These were classified as engineered low-points, non-engineered low-points, and surfaces. This approach did not consider vapor locations because the amount of waste in gaseous form was considered not significant compared to the amount of waste in the condensed phases (i.e., solids, sludges, and liquids or supernatants). Stored waste, such as that in the SSTs and IMUSTs, were assigned to engineered low-points. Residual wastes, remaining in components after operations activities, were assigned to non-engineered low-points and surfaces. Adsorbed wastes, remaining after each operations activity or cycle, were assigned to surfaces.

5.2 APPROACH FOR DETERMINING WASTE VOLUMES

The approach to determine waste volumes used information/data where available as a primary source, and subsequently relied on engineering estimations as a secondary source. In the case of engineered low-points, waste information and data for these storage locations were used. For non-engineered low-points and surfaces, engineering estimates were used due to the limited availability of information and data. The estimates were made using chemical engineering principles as they apply to loosely held residual waste and adsorbed waste.

Residual and fixed waste estimates were based on available data, videos, and interviews with engineering and operations personnel. This information was used to obtain an estimation of the thickness of the waste and the area of the waste, which allowed for calculation of the volume of waste.

Adsorbed waste estimates were based on available data and chemical engineering principles. Volumes were estimated by using engineering principles and field experience to determine waste thicknesses and component surface areas exposed to waste to determine waste areas. Metal and concrete surfaces, as well as surfaces in the ventilation systems, were evaluated using three different engineering descriptions for adsorption.

Waste volume summaries at the system component level are provided in Tables 2-1 through 2-5.

5.3 APPROACH FOR DETERMINING RADIOISOTOPIC AND CHEMICAL CONSTITUENTS

The complexity of all the waste transfer and mixing activities conducted in the tank farms makes it difficult to estimate constituencies of waste in any single ancillary component in the tank farms. Sampling and analysis of the ancillary equipment were not available; therefore, engineering estimations were conducted for this assessment.

The estimations performed in this analysis were based on an averaging process to account for the variety of wastes to which a component may have been exposed during its operating life. In order to estimate the waste characteristics of the different SST components, a methodology was utilized to assign the components with an associated group of SSTs. Since the characteristics of the SSTs have been established through the BBI process, this association provided a means to quantify the inventory in those SST system components where characterization data are not available. The 12 SST farms have been segregated into seven different groups based on waste characteristics and operating histories. All ancillary equipment was then assigned to one of these seven groups for inventory estimating purposes. The assignment associated the equipment with the waste group to which it was exposed during its use. The number of groups is less than the number of tank farms because some of the tank farms have very similar waste.

The chemical characteristics of the seven groups are very similar based on concentrations of the following prime chemical constituents: sodium, iron, aluminum, bismuth, nitrate, nitrite, silicate, phosphate, sulfate, fluorine, and chlorine. The radiological characteristics of the seven groups are similar in the identity of the constituents but vary more with respect to their concentration or radioactivity levels.

Based on a review of the chemical characteristics of the seven waste groups, it is expected that they exhibit similar behaviors in terms of deposition, hold-up, and adsorption in the ancillary equipment. Although similar ancillary equipment components may be assigned to different waste groups, the processes through which the ancillary equipment was contaminated and waste volumes calculated would be the same across all seven waste groups. The following figures describe the manner in which waste inventories were derived for this system description. Appendices A and B contain the methods and results of the waste inventory estimates.

Figure 5-1 illustrates the overall logic used to determine the waste inventory for a given component. In all cases, the BBI was used as the foundation for the radiological/chemical analysis.

Figure 5-1. Logic Path for Waste Inventory Determination.

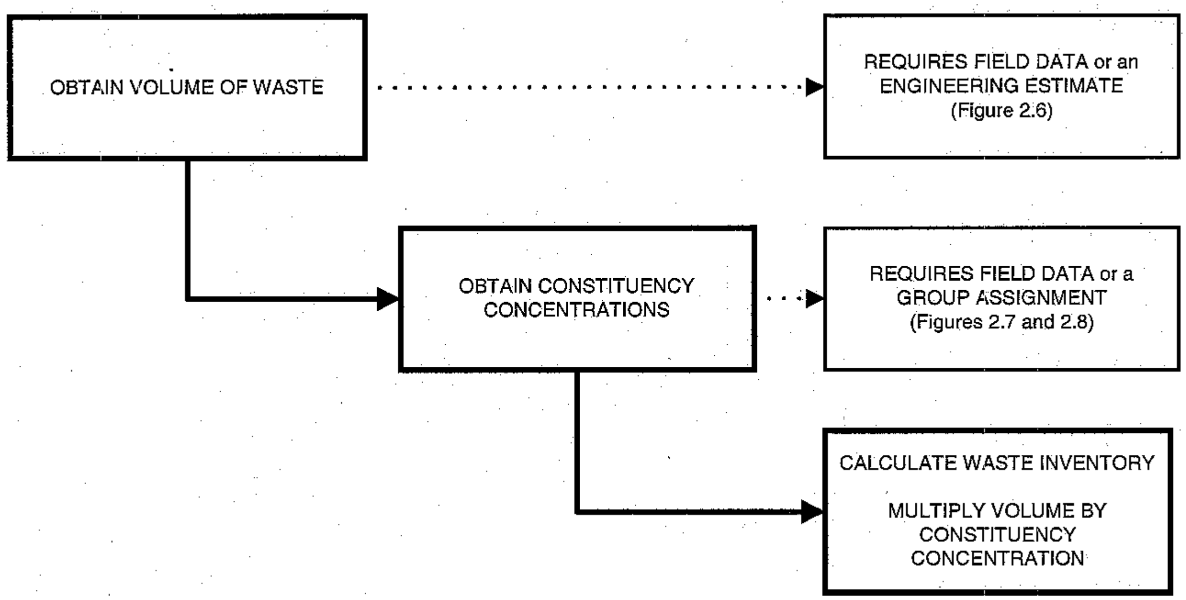


Figure 5-2 identifies the logic used to identify or estimate waste volumes within the components. Four alternatives are assumed: stored, residual, fixed, and adsorbed.

Figure 5-2. Logic Path for Waste Volume Determination

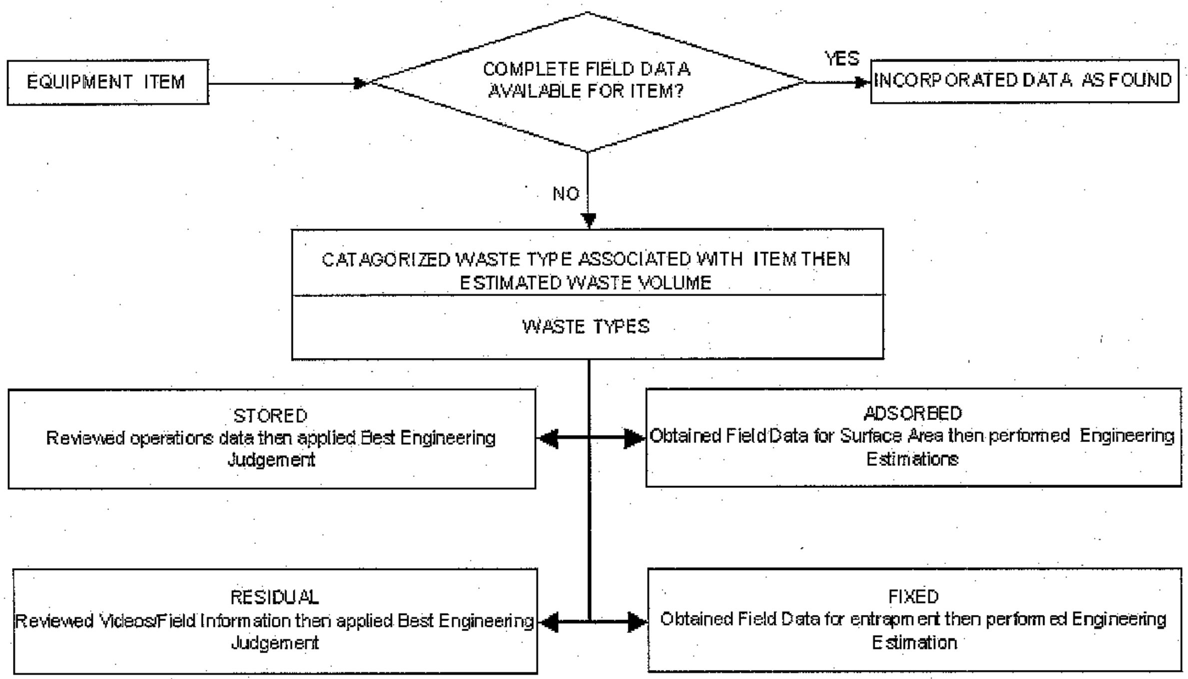


Figure 5-3 illustrates the logic used in grouping the tank farms into seven groups in order to determine contaminant concentrations in associated equipment. The twelve tank farms are binned according to the similarities in the waste characteristics.

Figure 5-3. Logic Path for Constituency Concentration (Radiological and Chemical)

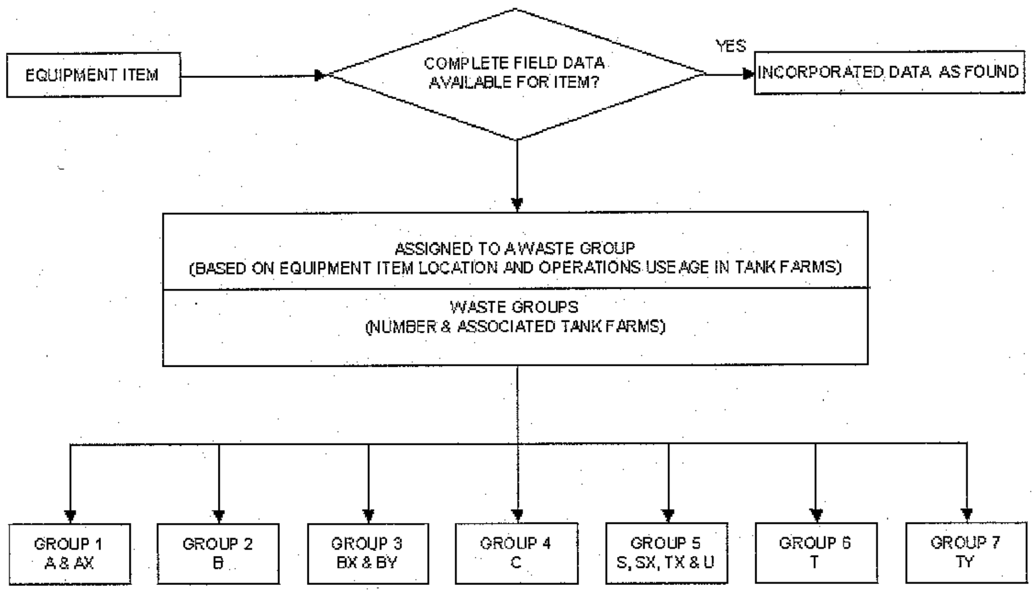
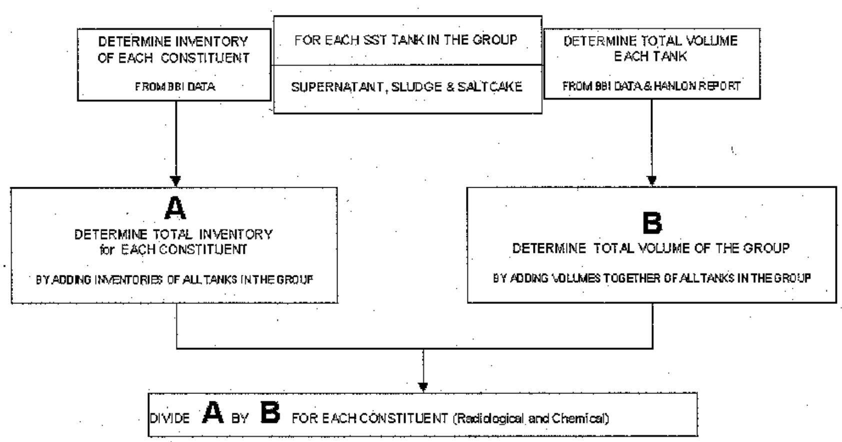


Figure 5-4 displays the approach used to calculate the normalized waste characteristics for the SST components that were assigned to each of the seven groups.

Figure 5-4. Logic Path for Determination of Waste Constituencies (Radiological and Chemical Constituency)



Using the methodology described, contaminant inventories were estimated for those components with no characterization data. A summary of the contaminant inventories at the system component level is presented in Table 5-1 for a subset of the key contaminants of concern. This subset of contaminants is a concern in the event a tank leaks because the contaminants are mobile, persistent in the environment and typically dominate the long-term impacts via the groundwater pathway (DOE/EIS-0189). These inventories provide a means for comparing levels of contaminants across the component groups. As shown in Table 5-1, the contaminant inventory in the SSTs is generally five or more orders of magnitude greater than the other component groups.

Table 5-1. SST System Component Inventory Summary.

Component	Constituent	Totals	Liquid
SSTs	Tc-99 (Ci)	1.67E+04	1.47E+03
	I-129 (Ci)	3.18E+01	2.84E+00
	C-14 (Ci)	2.70E+03	1.22E+02
	U-238 (Ci)	1.80E+02	3.10E-01
	NO2/NO3 (g)	4.98E+10	1.45E+09
IMUSTs	Tc-99 (Ci)	2.06E-01	6.29E-02
	I-129 (Ci)	3.42E-04	1.03E-04
	C-14 (Ci)	2.31E-02	6.37E-03
	U-238 (Ci)	1.33E-02	1.74E-03
	NO2/NO3 (g)	8.76E+05	1.56E+05
Vaults	Tc-99 (Ci)	6.52E-01	3.29E-01
	I-129 (Ci)	1.31E-03	6.32E-04
	C-14 (Ci)	8.25E-02	3.25E-02
	U-238 (Ci)	2.43E-02	1.22E-02
	NO2/NO3 (g)	1.37E+06	5.14E+05
Pits	Tc-99 (Ci)	1.31E-03	0
	I-129 (Ci)	2.46E-06	0
	C-14 (Ci)	1.94E-04	0
	U-238 (Ci)	2.39E-05	0
	NO2/NO3 (g)	3.42E+03	0
Evaporators	Tc-99 (Ci)	8.36E-04	*
	I-129 (Ci)	1.62E-04	*
	C-14 (Ci)	1.32E-02	*
	U-238 (Ci)	7.89E-04	*
	NO2/NO3 (g)	2.49E+05	*

Table 5-1. SST System Component Inventory Summary.

Component	Constituent	Totals	Liquid
Piping	Tc-99 (Ci)	8.54E-03	0
	I-129 (Ci)	1.58E-05	0
	C-14 (Ci)	1.20E-03	0
	U-238 (Ci)	1.62E-04	0
	NO2/NO3 (g)	2.15E+04	0

Notes: Contaminant inventories for the miscellaneous facilities are not presented. Waste volume estimates for the miscellaneous facilities are small in relation to the other component groups.

* Liquid inventories for the evaporators are not clearly defined and hence no values are presented here.

6.0 RELATIVE LONG-TERM HUMAN HEALTH RISK

In order to provide some perspective on the long-term human health risk potential associated with the waste in the different components and to provide a means to consider potential long-term human health risks in evaluating alternatives, a risk measure was calculated for each of the component groups. The risk measure was calculated using Unit Risk Factors (URFs) from the TWRS Environmental Impact Statement (EIS) (DOE/EIS-0189) for radionuclides and chemicals and the contaminant inventories (Appendix A). In the absence of conducting a fate and transport analysis, the product of the URF and the inventory yields a number that cannot be compared against risk standards. However, the risk measures can be used to make relative comparisons between component groups. To facilitate the comparisons, the risk measures calculated for each component group have been normalized to the component group with the smallest numerical risk measure. Therefore, the relative risk measures range from 1 (for the group with the smallest risk) to a multiple of the group with the smallest risk measure.

Figure 6-1 shows the results of these risk comparisons for each component group based on the current total waste inventory estimated for the components. The between tank pits have the smallest relative risk measure and the SSTs are approximately 40 million times greater.

Figure 6-1. Relative Radiological Risk – Normalized.

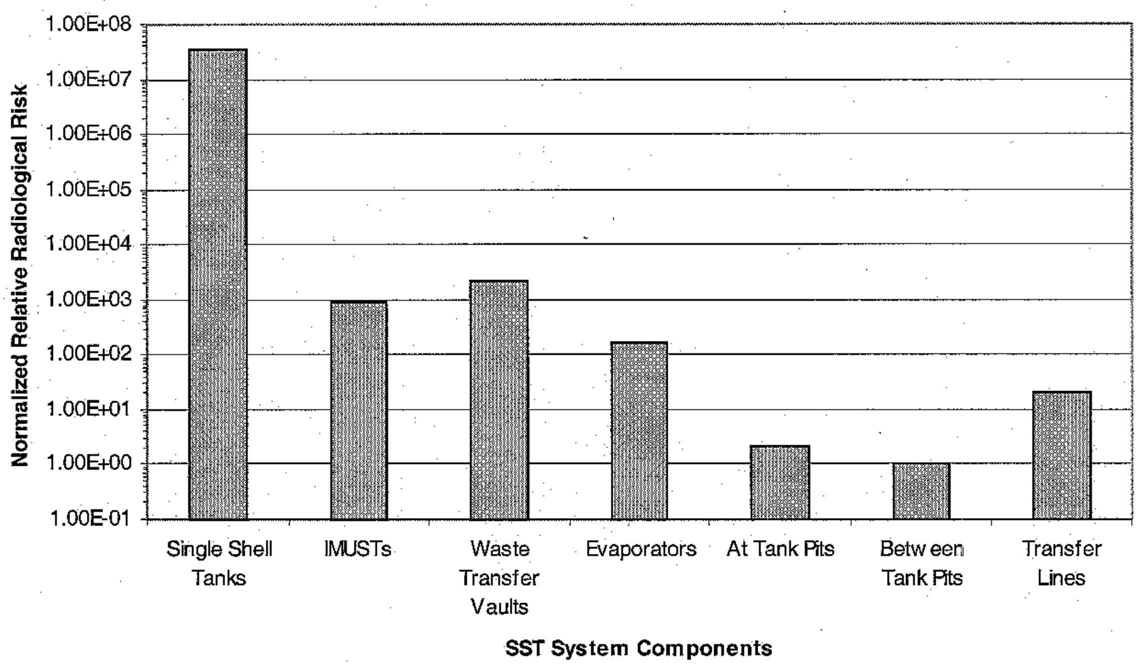
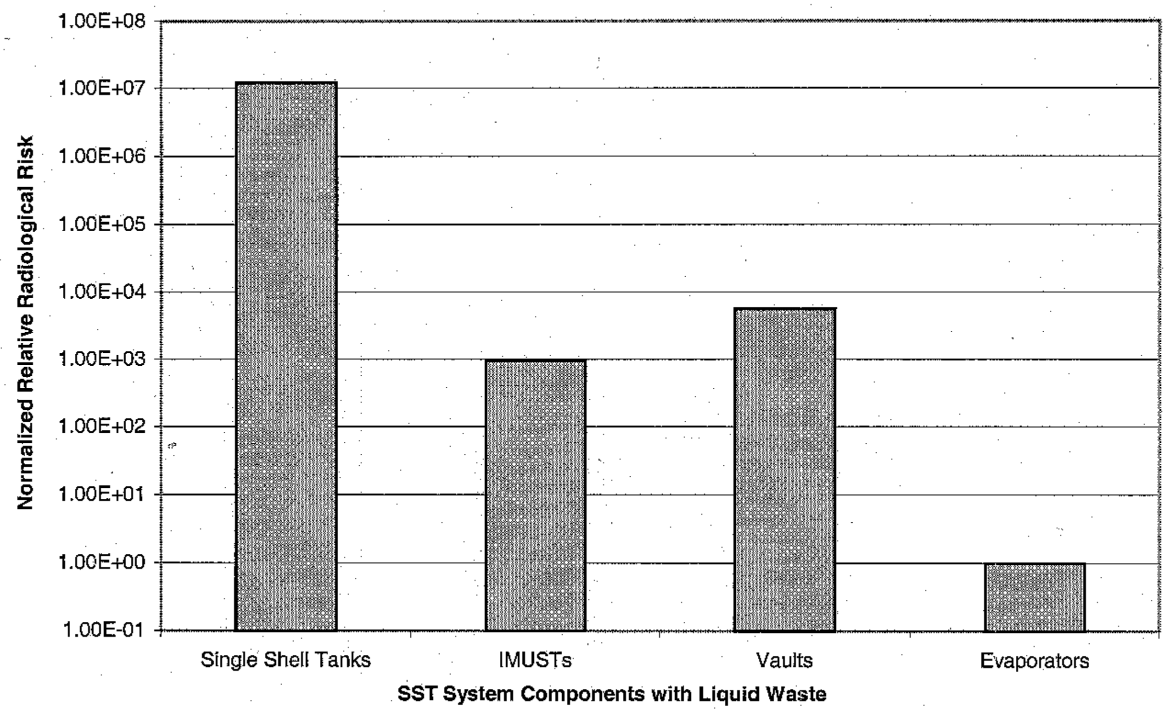


Figure 6-2 shows the results of these risk comparisons for the liquid waste in the component groups. Of particular concern during the continued storage phase of the SST system is the control of the liquid waste within the system. This plot was normalized to the evaporator relative risk measure. Therefore, the evaporator risk measure is 1 and the SSTs have approximately 10,000,000 times greater potential risk than the evaporators.

Figure 6-2. Risk Comparison for Liquid Waste in Component Groups.



7.0 MONITORING SYSTEMS AND PROCEDURES

The current SST surveillance and monitoring program is described in RPP-9645, *Single-Shell Tank System Surveillance and Monitoring Program.* The information in this section is taken from RPP-9645. The current program for SST leak detection was first implemented in June 1994, and the basic leak detection protocols have not changed since that time. The discussion below summarizes the leak detection protocols that have been applied in creating and maintaining this program.

The SST in-tank leak detection program is based on the premise that liquid or semi-liquid waste surfaces are expected to decrease in response to a leak, while dry or solid waste surfaces will not. Each of these waste surface conditions are discussed separately.

7.1 SINGLE-SHELL TANKS

Table 7-1 identifies and describes the presence or absence of in-tank monitoring instruments in SSTs. Table 7-1 lists, by tank, the leak detection method currently employed, (ENRAF, Food Instrument Corporation [FIC] Gauge, Manual Tape [MT], Interstitial Liquid Level [ILL], or None), the current surface level gauges or instruments, date of surface level gauge installation, the presence of a liquid observation well (LOW), the date of LOW installation, and any applicable comments. Note that the installation date is the date of first available data from that instrument in the Surveillance Analysis Computer System (SACS) database. The SACS database stores all readily available surveillance data back to approximately 1981, which represent the earliest availability of electronic data. Any equipment installed prior to SACS data is designated by a "less than" symbol followed by the date (e.g., <1981).

It is important to note that all available surface level and LOW instrumentation is listed in the table, whether it is used for leak detection purposes or not. For example, tank 241-AX-102 is the only SST that has two level gauges, an ENRAF and a MT. Both gauges are listed in Table 7-1, although the official leak detection method in column 2 is "None." Since the tank waste has a dry, solid surface, neither gauge can be used to provide leak detection, but the surface level instruments are used to verify that no intrusion has occurred.

Table 7-1. In-Tank Leak Detection Instrumentation Summary (6 Pages).

Tank	LD Method	Surface Level Gauge	Gauge Install Date	LOW Install	LOW Install Date	Comments
A-101	I	E	Sep-95	Yes	May-83	Dry surface, ENRAF used for intrusion only
A-102	N	FIC	Jan-02			Dry surface, FIC used for intrusion only
A-103	I	E	Jul-96	Yes	Apr-85	Dry surface, ENRAF used for intrusion only
A-104	N	E	Jun-96			Dry surface, ENRAF used for intrusion only
A-105	N	MT	< 1980			Dry surface, MT used for intrusion only
A-106	N	E	Jan-96			Dry surface, ENRAF used for intrusion only, New LOW scheduled as part of M-23-25
AX-101	I	E	Sep-95	Yes	Oct-84	Dry surface, ENRAF used for intrusion only
AX-102	N	E	Sep-98			Dry surface, ENRAF used for intrusion only
AX-102	N	MT	< 1981			Not used since ENRAF was installed, 9/98
AX-103	N	E	Sep-95			Dry surface, ENRAF used for intrusion only, New LOW scheduled as part of M-23-25
AX-104	N	E	Oct-96			Dry surface, ENRAF used for intrusion only
B-101	N	E	Aug-00			Dry surface, ENRAF used for intrusion only, New LOW scheduled as part of M-23-25
B-102	E	E	Mar-95			
B-103	N	E	Jul-00			Dry surface, ENRAF used for intrusion only
B-104	I	E	Aug-00	Yes	Apr-85	Dry surface, ENRAF used for intrusion only
B-105	I	E	Aug-00	Yes	Apr-85	Dry surface, ENRAF used for intrusion only
B-106	E	E	Jul-00			
B-107	N	E	Aug-00			Dry surface, ENRAF used for intrusion only, New LOW scheduled as part of M-23-25
B-108	N	E	Aug-00			Dry surface, ENRAF used for intrusion only, New LOW scheduled as part of M-23-25
B-109	N	E	Aug-00			Dry surface, ENRAF used for intrusion only, New LOW scheduled as part of M-23-25
B-110	I	E	Aug-00	Yes	Nov-94	Dry surface, ENRAF used for intrusion only, ENRAF currently out of service.
B-111	I	E	Aug-00	Yes	Nov-94	Dry surface, ENRAF used for intrusion only
B-112	E	E	Mar-95			
B-201	E	E	Jul-00			
B-202	E	E	Jul-00			
B-203	E	E	Jun-00			

Table 7-1. In-Tank Leak Detection Instrumentation Summary (6 Pages).

Tank	LD Method	Surface Level Gauge	Gauge Install Date	LOW Install	LOW Install Date	Comments
B-204	E	E	Jun-00			
BX-101	E	E	Dec-95			
BX-102	N	E	Jun-96			Dry surface, ENRAF used for intrusion only
BX-103	E	E	Dec-95			
BX-104	E	E	Dec-95			
BX-105	N	E	Mar-96			Dry surface, ENRAF used for intrusion only
BX-106	N	E	Jul-94			Dry surface, ENRAF used for intrusion only
BX-107	E	E	Dec-95			
BX-108	N	E	Jun-96			Dry surface, ENRAF used for intrusion only
BX-109	N	E	Aug-95			Dry surface, ENRAF used for intrusion only, New LOW scheduled as part of M-23-25
BX-110	N	E	Jun-96			Dry surface, ENRAF used for intrusion only, New LOW scheduled as part of M-23-25
BX-111	I	E	Jun-96	Yes	Apr-85	Dry surface, ENRAF used for intrusion only
BX-112	E	E	Dec-95			
BY-101	I	MT	< 1981	Yes	Aug-84	Dry surface, MT used for intrusion only
BY-102	I	E	May-00	Yes	Aug-84	Dry surface, ENRAF used for intrusion only
BY-103	I	E	Dec-96	Yes	Aug-84	Dry surface, ENRAF used for intrusion only
BY-104	I	MT	< 1981	Yes	Aug-84	Dry surface, MT used for intrusion only
BY-105	I	MT	< 1981	Yes	Apr-85	Dry surface, MT used for intrusion only
BY-106	I	MT	< 1981	Yes	Aug-84	Dry surface, MT used for intrusion only
BY-107	I	MT	< 1981	Yes	Sep-83	Dry surface, MT used for intrusion only
BY-108	N	MT	< 1981			Dry surface, MT used for intrusion only, New LOW scheduled as part of M-23-25
BY-109	I	FIC	< 1981	Yes	Aug-84	Dry surface, FIC used for intrusion only
BY-110	I	E	Jul-97	Yes	Aug-84	Dry surface, ENRAF used for intrusion only
BY-111	I	E	Apr-97	Yes	Sep-81	Dry surface, ENRAF used for intrusion only
BY-112	I	MT	< 1981	Yes	Aug-84	Dry surface, MT used for intrusion only
C-101	N	MT	< 1981			Dry surface, MT used for intrusion only
C-102	N	FIC	< 1983			Dry surface, FIC used for intrusion only, New LOW scheduled as part of M-23-25
C-103	E	E	Aug-94			Current liquid surface uses ENRAF. New LOW scheduled as part of M-23-25.

Table 7-1. In-Tank Leak Detection Instrumentation Summary (6 Pages).

Tank	LD Method	Surface Level Gauge	Gauge Install Date	LOW Install	LOW Install Date	Comments
C-104	N	E	Apr-99			Dry surface, ENRAF used for intrusion only
C-105	N	E	Jul-96			Dry surface, ENRAF used for intrusion only, New LOW scheduled as part of M-23-25
C-106	N	E	Sep-94			Dry surface, ENRAF used for intrusion only
C-107	E	E	Apr-95			
C-108	N	MT	< 1981			Dry surface, MT used for intrusion only
C-109	N	MT	< 1981			Dry surface, MT used for intrusion only
C-110	MT	MT	< 1981			
C-111	N	MT	< 1981			Dry surface, MT used for intrusion only
C-112	N	E	Mar-96			Dry surface, ENRAF used for intrusion only, New LOW scheduled as part of M-23-25
C-201	N	MT	< 1981			Dry surface, MT used for intrusion only
C-202	N	MT	< 1981			Dry surface, MT used for intrusion only
C-203	N	MT	< 1981			Dry surface, MT used for intrusion only
C-204	N	MT	< 1981			Dry surface, MT used for intrusion only
S-101	E	E	Feb-95	Yes	Aug-84	
S-102	I	E	May-95	Yes	Aug-84	Dry surface, ENRAF used for intrusion only
S-103	E	E	May-94	Yes	Aug-84	
S-104	I	E	Jun-99	Yes	Oct-94	Dry surface, ENRAF used for intrusion only
S-105	I	E	Jul-95	Yes	Aug-84	Dry surface, ENRAF used for intrusion only
S-106	I	E	Jun-94	Yes	Nov-81	Dry surface, ENRAF used for intrusion only
S-107	E	E	Jun-94			Current liquid surface uses ENRAF. New LOW scheduled as part of M-23-25.
S-108	I	E	Jul-95	Yes	Aug-83	Dry surface, ENRAF used for intrusion only
S-109	I	E	Aug-95	Yes	Sep-81	Dry surface, ENRAF used for intrusion only
S-110	I	E	Aug-95	Yes	Apr-85	Dry surface, ENRAF used for intrusion only
S-111	E	E	Aug-94	Yes	Apr-85	
S-112	I	E	May-95	Yes	Sep-81	Dry surface, ENRAF used for intrusion only
SX-101	I	E	May-95	Yes	Aug-84	Dry surface, ENRAF used for intrusion only
SX-102	I	E	May-95	Yes	Aug-84	Dry surface, ENRAF used for intrusion only
SX-103	I	E	May-95	Yes	Aug-84	Dry surface, ENRAF used for intrusion only
SX-104	I	E	May-95	Yes	May-82	Dry surface, ENRAF used for intrusion only
SX-105	I	E	May-95	Yes	Aug-84	Dry surface, ENRAF used for intrusion only

Table 7-1. In-Tank Leak Detection Instrumentation Summary (6 Pages).

Tank	LD Method	Surface Level Gauge	Gauge Install Date	LOW Install	LOW Install Date	Comments
SX-106	I	E	Aug-94	Yes	Aug-84	Dry surface, ENRAF used for intrusion only
SX-107	N	E	Sep-99			Dry surface, ENRAF used for intrusion only
SX-108	N	E	Sep-99			Dry surface, ENRAF used for intrusion only
SX-109	N	E	Sep-98			Dry surface, ENRAF used for intrusion only
SX-110	N	E	Sep-99			Dry surface, ENRAF used for intrusion only
SX-111	N	E	Sep-99			Dry surface, ENRAF used for intrusion only, New LOW scheduled as part of M-23-25
SX-112	N	E	Sep-99			Dry surface, ENRAF used for intrusion only, New LOW scheduled as part of M-23-25
SX-113	N	E	Sep-99			Dry surface, ENRAF used for intrusion only
SX-114	N	E	Sep-99			Dry surface, ENRAF used for intrusion only
SX-115	N	E	Nov-99			Dry surface, ENRAF used for intrusion only
T-101	N	E	Jun-95			Dry surface, ENRAF used for intrusion only, New LOW scheduled as part of M-23-25
T-102	E	E	Jun-94			
T-103	N	E	Jul-95			Dry surface, ENRAF used for intrusion only
T-104	I	E	Jan-96	Yes	Apr-85	Dry surface, ENRAF used for intrusion only
T-105	N	E	Aug-95			Dry surface, ENRAF used for intrusion only
T-106	N	E	Aug-95			Dry surface, ENRAF used for intrusion only
T-107	E	E	Jun-94			
T-108	E	E	Oct-95			
T-109	N	E	Sep-94			Dry surface, ENRAF used for intrusion only, New LOW scheduled as part of M-23-25
T-110	I	E	Jun-95	Yes	Apr-85	Dry surface, ENRAF used for intrusion only
T-111	I	E	Jul-95	Yes	Apr-85	Dry surface, ENRAF used for intrusion only
T-112	E	E	Sep-95			
T-201	MT	MT	< 1981			
T-202	MT	MT	< 1981			
T-203	N	MT	< 1981			Dry surface, MT used for intrusion only
T-204	MT	MT	< 1981			
TX-101	E	E	Oct-95			
TX-102	I	E	Apr-96	Yes	Apr-85	Dry surface, ENRAF used for intrusion only
TX-103	N	E	Jan-96			Dry surface, ENRAF used for intrusion only, New

Table 7-1. In-Tank Leak Detection Instrumentation Summary (6 Pages).

Tank	LD Method	Surface Level Gauge	Gauge Install Date	LOW Install	LOW Install Date	Comments
						LOW scheduled as part of M-23-25
TX-104	N	E	Apr-96			Dry surface, ENRAF used for intrusion only, New LOW scheduled as part of M-23-25
TX-105	N	E	Jun-96	Yes	May-82	Dry surface, ENRAF used for intrusion only. Last LOW data, 8/87, LOW damaged, unusable. New LOW scheduled as part of M-23-25
TX-106	I	E	Jun-96	Yes	Apr-85	Dry surface, ENRAF used for intrusion only
TX-107	N	E	May-96			Dry surface, ENRAF used for intrusion only
TX-108	N	E	May-96	Yes	Apr-85	Dry surface, ENRAF used for intrusion only. Last LOW data, 7/94, ILL too low to monitor
TX-109	I	E	Jan-96	Yes	Jun-82	Dry surface, ENRAF used for intrusion only
TX-110	I	E	Jun-96	Yes	May-82	Dry surface, ENRAF used for intrusion only
TX-111	I	E	Jul-96	Yes	Apr-85	Dry surface, ENRAF used for intrusion only
TX-112	I	E	Jul-96	Yes	Sep-81	Dry surface, ENRAF used for intrusion only
TX-113	I	E	Jun-96	Yes	Apr-85	Dry surface, ENRAF used for intrusion only
TX-114	I	E	Jun-96	Yes	Jun-82	Dry surface, ENRAF used for intrusion only
TX-115	I	E	Apr-96	Yes	Jun-82	Dry surface, ENRAF used for intrusion only
TX-116	N	E	Jun-96			Dry surface, ENRAF used for intrusion only, New LOW scheduled as part of M-23-25
TX-117	I	E	Jun-96	Yes	Apr-85	Dry surface, ENRAF used for intrusion only
TX-118	I	E	Feb-96	Yes	Sep-81	Dry surface, ENRAF used for intrusion only
TY-101	N	E	Jul-95			Dry surface, ENRAF used for intrusion only
TY-102	E	E	Sep-95			
TY-103	I	E	Oct-95	Yes	Jul-82	Dry surface, ENRAF used for intrusion only
TY-104	E	E	Jul-95			
TY-105	N	E	Dec-95			Dry surface, ENRAF used for intrusion only, New LOW scheduled as part of M-23-25
TY-106	N	E	Dec-95			Dry surface, ENRAF used for intrusion only
U-101	MT	MT	<1981			
U-102	I	E	Jan-96	Yes	Apr-85	Dry surface, ENRAF used for intrusion only
U-103	I	E	Jul-94	Yes	Apr-85	Dry surface, ENRAF used for intrusion only
U-104	N	MT	<1981			Dry surface, MT used for intrusion only
U-105	I	E	Jul-94	Yes	Apr-85	Dry surface, ENRAF used for intrusion only
U-106	I	E	Aug-94	Yes	Apr-85	Dry surface, ENRAF used for intrusion only

Table 7-1. In-Tank Leak Detection Instrumentation Summary (6 Pages).

Tank	LD Method	Surface Level Gauge	Gauge Install Date	LOW Install	LOW Install Date	Comments
U-107	E	E	Jul-94	Yes	Apr-85	
U-108	I	E	May-95	Yes	Apr-85	Dry surface, ENRAF used for intrusion only
U-109	I	E	Jul-94	Yes	Apr-85	Dry surface, ENRAF used for intrusion only
U-110	N	E	Jan-96			Dry surface, ENRAF used for intrusion only, New LOW scheduled as part of M-23-25
U-111	I	E	Jan-96	Yes	Apr-85	Dry surface, ENRAF used for intrusion only
U-112	N	MT	<1981			Dry surface, MT used for intrusion only
U-201	MT	MT	<1981			
U-202	MT	MT	<1981			
U-203	N	E	Oct-98			Dry surface, ENRAF used for intrusion only
U-204	E	E	Jun-98			

Notes:

Leak Detection (LD) Method
- E = ENRAF Gauge
- I = Interstitial Liquid Level (ILL)
- MT = Manual Tape
- N = None

Surface Level Gauge
- E = ENRAF Gauge
- FIC = Food Instrument Corporation Gauge (FIC)
- MT = Manual Tape.

7.2 ANCILLARY EQUIPMENT

This section addresses the current leak detection monitoring components of the SST system that support the storage function, other than the SSTs themselves. The SSTs were addressed in the previous section. Two miscellaneous tanks and one vault tank are currently monitored (RPP-9645).

240-S-302. The primary purpose of this 67,000-L (17,700-gal.) tank was to receive leakage, spillage, line flushes, and drainage associated with waste transfers through diversion box 241-S-151. It was suspected of leaking as early as 1977, and was officially declared a leaker in 1987. It has since been isolated from all liquid sources and is presently monitored daily with an ENRAF gauge.

241-TX-302B. 241-TX-302B holds approximately 67,000 L (17,700 gal). Its primary purpose was to receive drainage from diversion box 241-TX-155. The tank is inactive, stabilized, and isolated from all liquid sources. It is equipped with a manual tape, and levels are recorded daily.

244-CR-003. 244-CR-003 holds approximately 15,000 L (4,000 gal). The liquid level in this tank is monitored daily using a manual tape.

7.3 METHODS OR PROCESSES UTILIZED FOR THE EVALUATION OF THE STATUS OF SST SYSTEM MONITORING COMPONENTS

This section describes the methods or processes utilized for the evaluation of the status of SST system monitoring components. The processes used to determine whether a leak detection system or component has failed are described by system.

ENRAF Level Gauges. ENRAF level gauges are delivered with factory-installed diagnostic software built into each system. If an internal error is detected by the gauge, a fail code is output to the liquid-crystal display (LCD) screen in place of the usual waste level. If no fail codes are displayed, then the gauge has passed all internal diagnostics. Many of the ENRAF gauges are connected to the Tank Monitoring and Control System (TMACS), where tank levels are remotely monitored on a continuous basis electronically. When the gauge issues a fail code, the TMACS screen display will change from green to white, immediately indicating a non-functional gauge. Any loss of communications between the gauge and the central facility will show the same white response.

In addition to the automated diagnostics, all surface level and interstitial liquid level (ILL) data are reviewed by surveillance personnel at least once per week. All unexpected level or trend changes are investigated, and the investigation may include having the gauge field-checked by an instrument technician. Most equipment failures will show up as data deviations, (drift, spikes, flyers, or no response), and are easily identified during weekly data trend reviews. Every SST ENRAF gauge is scheduled to be calibrated twice per year. The calibrations are performed to an approved maintenance procedure, (5-LCD-300, ENRAF Series 854 Displacer Weight Check and Calibration Check), which is based on vendor recommendations.

Manual Tapes. A manual tape is a very simple instrument. Using the tank drawings, a tape is cut to the exact length from the bottom of the tank to the measure point at the tape housing, and is installed "backwards" with the maximum value at the tip of the plummet and zero at the connection point. This means that if the distance from the manual tape housing to the bottom of the tank were exactly 50 feet and the tank was empty, rolling out 50 feet of tape until the plummet just touched the bottom of the tank would yield a reading of "zero." The waste level would be recorded as "zero," which would be correct for an empty tank. The tape and plummet are part of a single electrical circuit, and as long as the plummet is hanging in air and not contacting anything conductive, there is no current flow. When the plummet contacts a conductive waste surface, completing the circuit, a meter indicates that current flow has been established. The depth marked on the tape is then recorded as the waste level.

Manual tapes are calibrated when they are initially installed by calculating and cutting the tape to a precise length. Once installed, that length cannot be adjusted, and no re-calibration is performed unless the tape is replaced. As the waste surface dries out, which often occurs after interim stabilization, many tanks are left with high resistance waste surfaces. At some point, the waste becomes dry enough that electrical flow is not supported, and a signal is no longer obtained. As the waste dries out, the accuracy of the device degrades, until ultimately no signal is possible. The drying out of the waste surface is typically observed as increasing levels of data scatter during routine data reviews.

Food Instrument Corporation (FIC) Gauges. Only three FICs are in service at this time, one each in tanks 241-A-102, 241-BY-109 and 241-C-102. A FIC is functionally equivalent to the manual tape, except that the tape and plummet are raised and lowered by a motor rather than manually, and there is an odometer readout instead of reading the tape directly. As with the manual tape, an electrically conductive waste surface is required to complete the circuit and obtain a valid reading. As with manual tapes, if the surface is very dry, a high degree of data scatter is usually observed. The FIC is mechanically more complex than the manual tape and is subject to mechanical failure. There is an established calibration procedure, which is normally performed annually, and which correlates the odometer readout to the actual tape length.

LOW Surveillance Van and Probes. There are two primary systems on a LOW surveillance van: the depth control system and the count rate system. The final product of a LOW survey is a plot of depth versus counts. The surveillance van's depth system must be calibrated each day before the van can be used. The daily depth calibration consists of measuring the depth of a 100-foot well in the garage at the 272-WA facility.

The neutron or gamma probes to be used are also calibrated each day before going to the field. There are neutron and gamma calibration fixtures in the garage, which generate known count rates, and the count rate obtained from the probe must match the standard within the allowable tolerance before it can be used. The count rate system accuracy is less critical than the depth system, since the ILL is determined from the depth of a sudden change in count rates, rather than any absolute count rate value.

In addition to the daily checks just described, there are comprehensive monthly, quarterly, and annual preventive maintenance procedures for both the vans and the probes. The final and most important quality control measure is a review of all scan data before the data are accepted and saved to the database. All new scans are compared to a "reference scan," which allows the reviewer to immediately identify any spikes, drifting, dead zones, or other anomalous probe behavior. If a tank's scan does not overlay the reference scan closely, a probe or van problem may be indicated. The majority of electronic problems is identified in this manner. If the scan data are considered "suspect" for any reason, a rerun is requested.

7.4 LEAK DETECTION SURVEILLANCE AND MONITORING TRENDING

This section describes the leak detection surveillance and monitoring trending.
All data that are used for leak detection purposes have established baselines and allowable increase and decrease limits. A baseline can consist of either a fixed value that does not change over time, or a sloping baseline. A sloping baseline has a built-in rate of change, expressed in inches per year and is applied when a tank has an obvious long-term increasing or decreasing linear trend. Long-term decreases are usually caused by evaporation, and are common in

actively ventilated tanks. Increases are usually caused by gas retention leading to waste swelling, condensation, or long-term chemical interactions within the waste. Additionally, many tanks exhibit increasing or decreasing trends for extended time periods following interim stabilization. A sloping baseline is determined by a best-fit least squares linear regression of the raw data. Most, although not all, surface level baselines are fixed values, while ILL baselines are always determined using the linear regression with a resulting slope. The method of establishing baselines and approving changes to an existing baseline are procedurally controlled.

Two key factors determine the allowable limits for surface level changes: the liquid fraction, which dictates the expected smoothness and repeatability of the waste surface, and the resolution of the measuring instrument being used. As the variability of the waste surface changes from a pure liquid surface to a partial liquid surface, then to a slurry, the allowable tolerance for a given level device increases. This is because the expected data scatter increases, making it more difficult to tell a legitimate decreasing trend (potential leak) from normal day-to-day scatter. Likewise, as the available instrument changes from a high-resolution device (ENRAF) to a lower resolution device (FIC or manual tape), the allowable tolerance also increases. The result is a system where the device with the highest resolution on the most repeatable waste surface has the tightest tolerance, and the tolerance gets larger as either surface conditions or instrumentation changes.

Some tanks exhibit a significant seasonal variation in surface level. These surface levels typically increase and decrease with seasonal temperature. If the allowable tolerance is excessively tight, it can be exceeded as a result of these normal seasonal variations. For the tightest tolerance, the allowable change is doubled if the tank exhibits a strong seasonal variation.

As described in RPP-9645, all SST LOW scans have established baselines that are based on a best-fit linear regression of the computed ILL values. This process yields a baseline which consists of a line with a specific slope, expressed in inches per year. The analysis also yields the standard deviation of the data set, which is a direct indication of the data scatter. The standard deviation can vary substantially from one tank to another, depending on the shape of the neutron response. ILL features that show very sharp, large-scale changes over a short distance can be determined very precisely, and tend to have smaller standard deviations than flatter, more rounded profiles. In addition, some tanks have a very large response to barometric pressure changes, which increases the calculated standard deviation value. An upper and lower limit of 3 standard deviations or 1.2 inches from baseline, whichever is larger, is established for each tank. The 1.2 inches in a 75-ft-diameter tank equates to roughly 16,000 L (4,000 gal) in tank volume. Any confirmed data point that falls outside this limit is investigated as a possible intrusion or leak, depending on the direction of the data deviation.

The two probe types currently in use are neutron and gamma. Whichever probe provides the sharpest and most repeatable ILL measurement is designated primary for that tank. The other probe is designated as the secondary probe.

The magnitudes of allowable decrease tolerances (leak detection) and increase tolerances (intrusion detection) are identical, but in opposite directions. The approved baseline typically has a symmetrical band above and below it for the allowable limits, and if either the lower or the upper limit is reached, a leak or intrusion is implied, respectively. The technical basis for establishing upper intrusion limits is identical to establishing lower leak detection limits. No leak detection capability is provided for tanks with dry surface conditions without LOWs; however, large-scale intrusions can be detected via surface-level devices, and the intrusion limit is set at 3 inches above the surface-level baseline.

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APPENDIX A

WASTE ESTIMATION METHODOLOGY OF SINGLE-SHELL TANK SYSTEM COMPONENTS

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A1.0 BACKGROUND

This appendix describes the methodology used to estimate waste volumes and characteristics in the single-shell tank (SST) system. To achieve an overall estimate, components have been binned into like groups. Engineering estimates have been made for each group to extrapolate waste constituent data for components where data are available (i.e., SSTs) to those components in the system where no data are available. The waste has been characterized in terms of location, quantity, as well as radioisotopic and chemical constituency. It is important to recognize that no individual component of a group may have exactly the same characteristic waste because of generalizations used in the modeling efforts. The results of this analysis are intended to provide an upper bound for use in the regulatory compliance assessment of the SST system.
Results from the characterization estimates indicate that most of the waste resides in the single-shell tanks with significantly less waste in the other storage components. The remaining SST components have a relatively small waste volume based on the modeling results. A summary of the data is shown in Table A-1 for the system components following interim stabilization.

Table A-1. Current SST Component Estimated Waste Inventory (Post Interim Stabilization)

System	Total Number of Components	Estimated Liquid Volume (gal)	Estimated Solid Volume (gal)	Estimated Total Volume (gal)
Single Shell Tanks	149	2,510,000	31,483,000	31,700,000
IMUSTs	24	11,000	63,000	120,000
Vaults	26	18,000	65,000	83,000
Evaporators	33	9,000	0	9,000
Pits	322	0	450	450
Transfer Lines	1,414	0	1,200	1,200
Miscellaneous Facilities	6	0	<20	<20
Totals	1974	2,548,000	31,600,000	32,000,000

Note: All volumes for ancillary equipment are rounded to two significant figures.

A2.0 METHODOLOGY

In order to assess the chemistry of the SST system, and specifically the radiological and chemical makeup of the wastes in the various components, a methodology was implemented to allow for bridging across data gaps. The concept underlying this methodology is based on recognizing that the constituency of the waste in the SSTs is similar to the constituencies of the wastes that the ancillary equipment was exposed to during operations. The foundation of this analysis is the Best Basis Inventory (BBI). The BBI provides estimated constituent concentrations and volumes for each of the 149 SSTs. The BBI is the Hanford Site's best understanding of the SSTs and represents the culmination of the waste processing over the past 40-plus years.
The first step was to create a representative waste characteristic that could be applied to the components with no known inventory characterization. After a review of the BBI, and assessing the historical perspectives (PNL-9814) of waste transfers and supporting processing facilities, seven tank farm groupings were created as listed below:

- Group 1 -- A and AX tank farms
- Group 2 -- B tank farm
- Group 3 -- BX and BY tank farms
- Group 4 -- C tank farm
- Group 5 -- S, SX, TX, and U tank farms
- Group 6 -- T tank farm
- Group 7 -- TY tank farm.

The aggregation of tank concentrations within each of these groups provided a representative characterization that was subsequently applied to the components supporting each group (i.e., the radiological and chemical constituents in the A and AX tanks were deemed to represent the type of wastes likely present in the pits and transfer lines associated with the A and AX Tank Farms.) This aggregation was accomplished by (1) totaling each radionuclide and chemical for each of the tanks in a group and (2) dividing by the total volume to derive a normalized concentration as depicted in Example 1.

Example 1: Procedure to Determine Group Concentration of Individual Isotope or Chemical

(1) Tabulate the total quantity of waste and volume in a group as listed in the BBI

SST	^{14}C (Ci)	NO_3 (g)	Volume of Waste (L)
Tank-101	6.20E+01	3.55E+08	3.10E+06
Tank-102	2.48E-01	2.05E+07	1.40E+05
Tank-103	1.65E-02	2.25E+08	1.40E+06
Tank-104	0.00E+00	4.10E+05	1.10E+05
Total	**6.23E+01**	**6.01E+08**	4.75E+06

(2) Calculate the concentration for each isotope and chemical by dividing the quantity by the volume:

^{14}C: 6.23E+01 Ci / 4.75E+06 L = 1.31E-05 Ci/L
NO_3: 6.01E+08 g / 4.75E+06 L = 1.27E+02 g/L.

These procedures are performed for each radiological and chemical constituent. The results are listed in Tables A-2 and A-3 for the radionuclide and chemical inventories respectively.

With representative concentrations established for each group, the second step is to identify the waste locations. The waste locations are a function of the design and operation of the various components. Three types of waste locations were recognized: engineered low-points, non-engineered low-points, and surfaces. The SST system components can be assigned to one or more of these waste locations. By assigning waste locations, a graded approach was identified that allowed for reasonable estimation of the waste volumes based on waste accumulation models.

The final step involved estimating waste volumes accumulated at the various waste locations. The waste accumulation estimates take one of four forms: stored, residual, fixed, and adsorbed. In estimating the volume of stored waste, it was recognized that the waste volumes contained within vessels should be based on waste level measurements. These measurements provide volumes that are orders of magnitude larger than other waste accumulation mechanisms.

Waste volume estimates for non-storage components rely on estimates for residual, fixed and adsorbed waste. The residual waste accumulation model uses loose adhesion as the basis for calculations. Loose adhesion is the result of loose molecular bonding between the waste and the component. The fixed waste accumulation model accounts for the wastes that are trapped due to blockages. Fixed wastes are derived from the overall capacity of the individual components. The adsorbed waste accumulation model incorporates the stronger, more steadfast bonding that can occur between the molecular structure of the surface and the waste. The degree of adsorption varies depending on the surface to which the waste was exposed.

Table A-2. Calculated Radionuclide Concentrations per Group Ci/L (2 sheets)

Constituent	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
106Ru	7.49E-12	1.35E-11	5.73E-13	1.60E-11	7.00E-13	3.94E-14	1.33E-13
113mCd	2.90E-06	1.19E-06	5.79E-07	1.77E-06	8.66E-07	4.89E-08	1.67E-07
125Sb	2.82E-06	2.20E-08	2.53E-07	4.09E-07	4.24E-07	5.05E-08	7.34E-08
126Sn	1.50E-07	5.22E-08	1.93E-08	1.79E-07	3.17E-08	1.68E-09	5.73E-09
129I	6.21E-09	2.90E-10	3.79E-09	2.07E-09	4.76E-09	2.67E-10	8.48E-10
134Cs	1.49E-08	1.30E-09	1.63E-09	2.13E-09	2.88E-09	1.40E-10	5.34E-10
137Cs	4.57E-03	6.60E-04	1.66E-03	2.13E-03	2.23E-03	4.20E-04	3.08E-04
14C	4.01E-07	1.53E-08	3.77E-07	2.98E-08	3.87E-07	3.35E-08	5.33E-08
151Sm	8.39E-04	2.87E-04	1.06E-04	9.90E-04	1.75E-04	9.34E-06	3.18E-05
152Eu	1.97E-07	1.97E-07	3.80E-08	2.05E-07	5.03E-08	3.26E-09	1.05E-08
154Eu	1.94E-05	2.22E-06	2.87E-06	1.85E-05	5.86E-06	4.14E-07	8.91E-07
155Eu	7.63E-06	1.57E-06	1.24E-06	1.18E-05	3.73E-06	1.90E-07	3.61E-07
226Ra	1.99E-11	6.40E-12	1.65E-12	4.33E-11	3.98E-12	2.86E-13	5.68E-13
227Ac	1.08E-10	2.37E-10	1.46E-10	1.70E-07	2.51E-11	1.05E-10	5.15E-12
228Ra	3.63E-09	2.51E-10	1.97E-08	3.26E-08	6.77E-10	4.26E-11	1.06E-10
229Th	8.45E-11	3.20E-11	4.80E-10	1.45E-09	2.26E-11	1.51E-11	4.77E-12
231Pa	2.17E-10	3.30E-10	2.86E-10	3.38E-07	6.78E-11	1.43E-10	1.32E-11
232Th	4.25E-10	1.11E-11	5.76E-10	1.21E-08	8.43E-11	5.74E-12	1.70E-11
232U	1.29E-08	3.22E-10	1.28E-09	4.42E-08	3.20E-09	2.48E-10	1.51E-09
233U	4.99E-08	1.24E-09	5.19E-09	9.14E-07	1.28E-08	1.02E-09	5.79E-09
234U	8.54E-09	4.45E-08	3.75E-08	1.40E-07	2.42E-08	2.88E-08	1.61E-07
235U	3.37E-10	1.99E-09	1.64E-09	5.40E-09	1.03E-09	1.26E-09	7.12E-09
236U	2.75E-10	3.59E-10	3.84E-10	3.19E-09	5.38E-10	2.86E-10	1.67E-09
237Np	1.25E-08	6.59E-10	6.05E-09	1.22E-08	1.36E-08	6.35E-10	1.50E-09
238Pu	1.54E-07	9.28E-08	4.16E-08	6.64E-07	4.82E-07	3.69E-08	6.65E-09
238U	7.57E-09	4.51E-08	3.73E-08	1.20E-07	2.30E-08	2.87E-08	1.64E-07
239Pu	3.87E-06	2.35E-06	1.93E-06	2.55E-05	6.33E-06	2.87E-06	7.22E-07
240Pu	7.48E-07	4.24E-07	2.85E-07	4.31E-06	1.01E-06	3.43E-07	7.21E-08
241Am	1.34E-05	2.13E-06	1.29E-06	3.47E-05	4.62E-06	8.49E-07	2.64E-07
241Pu	9.49E-06	4.57E-06	1.86E-06	6.03E-05	7.09E-06	1.17E-06	6.64E-07
242Cm	7.05E-09	5.52E-09	1.20E-08	2.84E-08	3.05E-09	9.32E-09	7.44E-10
242Pu	6.96E-11	4.78E-11	1.05E-11	2.24E-10	5.27E-11	9.76E-12	1.55E-12

Table A-2. Calculated Radionuclide Concentrations per Group Ci/L (2 sheets)

Constituent	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
243Am	2.76E-10	1.91E-10	2.54E-11	5.87E-10	1.43E-10	8.28E-12	3.03E-12
243Cm	5.26E-10	2.96E-10	3.14E-10	1.30E-09	1.92E-10	1.92E-10	1.53E-11
244Cm	1.41E-08	7.75E-09	6.69E-10	2.30E-08	2.16E-09	1.48E-10	1.43E-10
3H	1.89E-06	3.47E-08	9.05E-07	2.32E-07	1.53E-06	7.88E-08	2.34E-07
59Ni	3.06E-07	1.12E-07	4.85E-08	5.46E-07	6.50E-08	4.77E-09	1.53E-08
60Co	1.71E-06	1.25E-08	1.47E-07	3.09E-06	2.75E-07	1.44E-08	1.30E-08
63Ni	2.88E-05	1.06E-05	4.52E-06	5.08E-05	5.94E-06	4.35E-07	1.37E-06
79Se	2.25E-08	1.95E-09	3.23E-09	4.24E-08	5.23E-09	2.78E-10	9.48E-10
90Sr	1.57E-02	3.02E-03	2.03E-03	1.91E-02	2.09E-03	8.49E-04	1.93E-03
93mNb	9.05E-07	3.12E-07	1.13E-07	1.08E-06	1.98E-07	1.09E-08	3.75E-08
93Zr	1.09E-06	3.81E-07	1.55E-07	1.20E-06	2.56E-07	1.36E-08	4.65E-08
99Tc	3.82E-06	4.03E-07	1.88E-06	7.17E-07	2.45E-06	3.61E-07	5.99E-07

Table A-3. Calculated Chemical Constituent Concentrations g/L per Group

Constituent	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Al	6.26E-01	4.14E-01	6.72E-01	1.46E+00	7.50E-01	4.19E-01	1.92E-01
Bi	1.54E-03	1.89E-01	5.19E-02	9.19E-02	1.61E-02	3.29E-01	2.93E-01
Ca	1.95E-02	1.98E-02	5.29E-02	9.72E-02	7.21E-03	2.60E-02	8.37E-02
Cl	1.14E-01	2.89E-02	3.54E-02	1.51E-02	7.91E-02	1.69E-02	2.95E-02
Cr	3.85E-02	1.74E-02	6.18E-02	1.16E-02	7.34E-02	2.32E-02	4.67E-02
F	1.18E-02	2.02E-01	1.83E-01	1.28E-01	5.87E-02	9.91E-02	4.18E-02
Fe	1.42E-01	2.13E-01	1.15E-01	3.46E-01	4.50E-02	2.98E-01	5.42E-01
Hg	3.34E-04	2.60E-04	2.49E-04	5.03E-04	5.79E-05	4.30E-05	1.37E-03
K	7.76E-02	1.39E-02	4.59E-02	1.41E-02	2.43E-02	1.31E-02	6.63E-03
La	1.62E-03	3.59E-04	2.91E-04	2.42E-03	5.86E-04	2.15E-02	1.78E-04
Mn	1.17E-02	3.31E-03	3.95E-03	2.99E-02	1.36E-02	4.75E-02	7.66E-03
Na	4.10E+00	2.95E+00	4.52E+00	1.50E+00	4.34E+00	1.41E+00	2.85E+00
Ni	1.14E-02	1.33E-02	1.72E-02	7.70E-02	3.59E-03	1.95E-03	3.75E-02
NO2	1.99E+00	2.92E-01	5.23E-01	3.89E-01	8.47E-01	1.94E-01	5.74E-01
NO3	2.96E+00	3.33E+00	4.73E+00	8.10E-01	6.46E+00	1.46E+00	4.09E+00
OH	2.10E-01	0.00E+00	6.92E-02	3.63E-05	1.80E-01	6.68E-06	8.87E-04
Pb	9.01E-03	1.21E-02	5.77E-03	2.10E-02	4.55E-03	1.07E-02	8.11E-03
PO4	1.49E-01	1.27E+00	7.29E-01	5.42E-01	4.52E-01	8.61E-01	1.93E+00
Si	7.69E-02	1.13E-01	1.38E-01	2.75E-01	5.14E-02	1.15E-01	2.70E-01
SO4	3.06E-01	9.11E-01	4.03E-01	1.11E-01	3.37E-01	1.42E-01	2.83E-01
Sr	4.13E-04	2.98E-03	1.64E-02	2.90E-03	1.24E-03	5.22E-03	6.17E-03
TIC-CO3	1.16E+00	2.22E-01	1.21E+00	5.11E-01	7.37E-01	1.95E-01	3.57E-01
TOC	1.15E-01	1.99E-02	1.03E-01	7.39E-02	8.21E-02	3.39E-02	3.24E-02
UTOTAL	2.17E-02	5.69E-02	8.99E-02	2.24E-01	3.82E-02	8.30E-02	1.87E-01
Zr	4.35E-03	1.19E-03	1.80E-03	1.73E-01	7.73E-03	1.00E-03	3.61E-03

A3.0 WASTE LOCATIONS

There are three general classifications for waste locations according to the physical layout of the component: engineered low points, nonengineered low points, and surfaces. These three locations dictate the type of waste accumulation modeling used to derive waste volumes.

A3.1 ENGINEERED LOW POINTS

Engineered low points are designed to retain and store waste materials. The SSTs, IMUSTs, evaporator vessels, and vault tanks represent the waste storage components located at engineered low points. These tanks have been used for long storage durations (i.e., many years). Although pits function as low points for the transfer system, they were not designed for storage. As such, they were designed and constructed with drain lines that channel the waste to engineered low points (e.g. SSTs or IMUSTs).

A3.2 NONENGINEERED LOW POINTS

Wherever present, nonengineered low points are located in flow paths that are caused by localized conditions (e.g., plugged pipes, imperfections in piping gradients, or imperfections in floor structures). The latter two may be prime locations for residuals to accumulate following operations activities. Residual waste from nonengineered low points is more likely to occur in transfer piping than on the floors of components because of the extensive surface area associated with the transfer piping.

A3.3 SURFACES

Numerous component surfaces were routinely in direct contact with tank wastes. The molecular structures of these surfaces are capable of retaining some of the waste materials through an adsorption process. Although storage components like SSTs and IMUSTs have surface contamination, the quantity of the contamination attributed to the surface of the container is significantly less than that which is stored in the vessel. Because surface contamination is significantly less than the stored volumes in storage vessels, surface contamination is disregarded for SSTs, IMUSTs, vault tank, and evaporator vessels.

In order to quantify the volume of waste associated with surface contamination, it is necessary to assess the types of bonds holding contaminants to the surface of a component.
Bonding strengths vary widely depending on the bonding mechanism. Two types of bonds are considered in this task:

- **Strong bonds.** Waste fills the pores of a surface and also covers the surface. This mechanism accounts for waste that strongly resists decontamination cleaning methods and is typified by adsorption.

- **Weak bonds**. Loose adhesion occurs when residual waste accumulates on the surface. Initially, the adhesive bond is strong enough to resist gravity and to allow the waste to accumulate but because it is weak, it may fail in time. This mechanism accounts for the loose coatings of waste that may be observed in components.

A3.4 WASTE LOCATION SUMMARY

Each of the components contains differing levels and types of wastes and each potentially has a slightly different mechanism for accumulating waste. Table A-4 delineates the waste location as well as the applicable waste collection mechanisms for each of the SST system bins.

Table A-4. Binned Component Waste Characterization Methodology.

Component Bin	Waste Location		
	Engineered Low-Points	Non-Engineered Low-Points	Surfaces
SSTs	Stored	NA	Not Significant
IMUSTs	Stored	NA	Not Significant
Vault			
Tanks	Stored	NA	Not Significant
Cells	NA	Stored	Adsorbed
Pits	NA	NA	Adsorbed
Transfer Lines	NA	Fixed	Residual & Adsorbed
Evaporator Vessels	Stored	NA	Not Significant
Miscellaneous Facilities			
Ventilation Structures			
•Ventilation Building	NA	NA	Adsorbed
•Condenser Shielding Building	NA	NA	Adsorbed
•Cesium Removal Structures	NA	NA	Adsorbed
•Ion Exchange Column	NA	Fixed	Adsorbed
•In-Tank Solidification System	NA	NA	Adsorbed

Note: NA: Not Applicable

A4.0 WASTE ACCUMULATION ESTIMATES

Four waste accumulation mechanisms have been identified: Stored, Residual, Fixed and Adsorbed. The following section describes each of these mechanisms, their basis and applicability to the components identified in Table A-4.

A4.1 STORED WASTE ACCUMULATION

The Stored Waste Accumulation model was applied to the storage components of the SST system: SSTs, IMUST, evaporator vessels, and vault tanks. The storage quantities were derived from published sources including the Hanlon Report (HNF-IP-0812) for the SSTs, and the Authorization Basis (HNF-2503) for the IMUSTs, the evaporator vessels, and vault tanks. It is recognized that seasonal fluctuations and uncertainties in these reports may sway the waste volumes. The waste volume variations of these containers are not deemed significant for the purposes of this analysis.

A4.2 RESIDUAL WASTE ACCUMULATION

Residual waste accumulation is likely to have occurred on the floors of the pits, within the transfer lines, and within the vault cells. Without sampling each of these facilities, the exact quantity of waste attributable to residual waste build-up can only be estimated. The estimates for these facilities are based on loose adhesion.

Loose adhesion accounts for all residual waste accumulated that is not adsorbed waste. Residuals remain when waste is not removed after operations activities. Residual waste levels have been maintained at a low level due to flushing operations. This assertion is supported by the long operations performance lifetimes of the components. Most components are still able to perform to original specifications. For example, piping, which is particularly vulnerable to residual buildups, has performed excellently with only 5 known failures of lines due to waste plugging. This is from a total of approximately 1,400 pipes in the systems. This operational performance of small diameter piping is a clear measure of the effectiveness of flushing operations.

Quantities of residuals are based on known field information and data which are limited probably because of the excellent performance of the components. Historically, it has been of low priority to inspect operating systems performing to original engineering specifications. Based on visual inspections, 4% of the total pipe length is estimated to have a residual coating. Waste on the bottom of components is considered as loose adhesion waste that has simply been displaced from other surfaces.

A4.3 FIXED WASTE ACCUMULATION

Fixed waste accumulation is present in the transfer piping in the form of waste that was held-up due to blockages. Transfer piping contains fixed wastes in the form of plugged lines. These lines although designed to drain, have retained wastes at some fraction of their total capacity.

A4.4 ADSORPTION WASTE ACCUMULATION

Adsorption accounts for waste that is strongly held at the micro-surface level (Derjaguin and Kusakov 1939). It is possible that, due to adsorption, waste can build up to significant quantities over time if allowed to do so. The bonding occurs on a molecular and ionic level and accounts for the first layering of waste on the surface (Eubanks et al. 1962). Adsorption is a chemical process that may contaminate equipment surfaces with waste every time a piece of equipment is used. Waste accumulated by adsorption is so strongly held that it can be difficult to remove. It may be easier to remove it by removing a surface layer rather than by using washing techniques. Adsorption may account for the detection of residual radioactivity even when a piece of equipment has been treated with an effective decontamination procedure.

One issue for this task is whether or not the waste in the SST system components due to adsorption adds up to a significant quantity. To obtain the quantities of waste from adsorption, it is necessary to estimate the surface area of the system component and multiply this by the thickness of the adsorbed layer.

At the microscopic level where adsorption occurs, surfaces are rougher than as seen by the naked eye. The surfaces usually have many microscopic cracks, which are breaks in the crystal structure of the surface material. Consequently, the micro-level surface area of a component is much greater than the normal or geometrically measured surface area. Also, metal and concrete have very dissimilar surfaces with concrete surfaces being far more porous than metal ones.

In this study, to account for these differences, adsorption on metals has been treated as a layering process; i.e., layers build up on the metal surface in operations cycles in which the component was allowed to dry out before being used for another operations process. Concrete surfaces have been treated as forming a poor quality grout with the waste. This is because the porous surface allows for deeper penetration of the waste. The very strong chemical bonding between concrete and waste allows waste to be grouted even though the concrete was previously poured and set.

A4.4.1 Adsorbed Quantities of Waste on Metals

To obtain estimates of waste quantities on metals the engineering model for adsorption is one in which the pore sizes are small and the waste is held very close to the surface. In obtaining waste quantities, the first step is to determine the waste surface area and the second is to determine the waste thickness.

The actual surface area at the micro-level has been estimated by multiplying the geometric surface area by a corrective factor that is the product of multiplying two other factors related to surface roughness. One of these is a factor for roughness due to erosion/corrosion effect occurring over the operational history of the component. For this study, a value of 1.10 is used. That is, the surface areas are estimated to be 10 percent larger due to erosion/corrosion compared to when the components were first installed. The other factor is a roughness factor for micro-level imperfections in the surface. This is estimated as 1.30 in this study (Bickerman 1970). To obtain the estimated surface area the geometric surface area is multiplied by the 1.10 factor followed by the 1.3 factor. This gives a total factor of 1.43. Hence, the geometric surface areas are estimated to be 43 percent larger in this analysis.

The value for the surface area so calculated is an initial one that is an upper bound for the surface available on the metal for adsorption. As the adsorption process progresses, edges, corners, and other high-energy features are filled in and eliminated due to waste crystal growth. In time, as the layer thickens, the total surface area available for adsorption approximates the geometric surface area.

Determination of the waste thickness has been estimated by obtaining a value for a single layer and then multiplying it by a representative number of operations cycles in which the component was used. Waste of the concentration used in the tank farms is less concentrated than solutions that had surface thickness of 500 Angstroms (Eubanks et al. 1962). This value is considered an upper limit. For purposes of this study, the single absorbed waste layer has been used as 1,000 Angstroms, twice the found thickness. Hence, the value is twice the experimentally determined value for the upper limit for adsorption at the concentrations of the waste in the tank farms system. The number of operations cycles in which the component was used is estimated on average for the binned components at 500 cycles. This corresponds to the component being used twice a month for a period of twenty years. Hence, the adsorbed layer over time is estimated to have built up to a thickness of 1,000 Angstroms times 500 operations cycles. This gives a value of 500,000 Angstroms or 0.005 cm (0.002 in.). This value does not take into consideration removal of adsorbed waste by scouring from the next waste being transferred or from flushing operations. These activities could reduce the thickness significantly.

A4.4.2 Adsorbed Quantities of Waste in Concrete Surfaces

Concrete is a very porous material compared to metals. It is so porous that the waste penetrates the surface much more by filling pores in the surface. The waste can be viewed as forming a mixture with the concrete that is similar to a low-quality grout. In this engineering study, the waste is estimated to have adsorbed to a depth of 0.04 cm (0.0156 in.). This value has been used because of operations experience in decontamination activities in which most waste can be effectively removed by flushing or by sandblasting a thin layer of concrete. In the latter, removal of a surface layer equivalent to approximately 3.8 L (1 gal) per 9.3 m^2 (100 ft^2) corresponds to a waste penetration into the concrete of 0.04 cm (0.0156 in.).

Sealed concrete surfaces may have only adsorbed contamination. In this study, sealed concrete surfaces have not been considered separately from unsealed ones. In the event the concrete surfaces of a component were sealed prior to operations, the values calculated for waste may be high.

Field observations at the tank farms indicate that most concrete surfaces have good structural integrity, which supports the estimate of a penetration of 0.04 cm (0.0156 in.). The surfaces are not failing and spalling. This would not be the case if the grout formed with the waste were high in waste concentration. The upper limit for forming grout with sufficient integral strength is well below 30 percent for the waste in the tank farms. A concentration factor has been set at 0.30, which corresponds to the upper bound of 30 percent for grout formation. Hence, for concrete surfaces, the amount of equivalent waste adsorbed is obtained by multiplying the geometric area by a thickness of 0.04 cm (0.0156 in.) and by a factor of 0.30 for grout formation.

A5.0 WASTE ESTIMATE BY EQUIPMENT TYPE

The following sections describe the results of the waste estimation analysis for the each of the SST components. Specific waste accumulation models are detailed for particular components.

A5.1 SINGLE-SHELL TANKS

Waste characterization for the SSTs is summarized monthly in HNF-EP-0812, which is based on the extensive library available for the tanks. Also, the best-basis inventory has an extensive listing of the radionuclide and chemical constituencies as best know for each of the SSTs. It is based on sample data and operations history. Both of these reports are updated as new data become available.

A5.2 INACTIVE MISCELLANEOUS UNDERGROUND STORAGE TANKS

The following list provides an engineering description of the IMUSTs:

- There are 24 IMUST tanks included in this analysis.
- The tanks are either steel- or concrete-lined.
- Some field data and information is available for certain tanks.
- Waste is in the tanks as stored waste or as a residual from flushing operations.
- Adsorption is not significant compared to the stored or residual waste.
- Inflow of water from unspecified sources does not contribute to the amount of equivalent waste but does dilute the waste to a greater overall volume.
- Emptied tanks were flushed after waste removal.

Waste characterization specifics of the IMUSTs follow:

- **Locations** – Documented for all of the IMUSTs the waste in those tanks is primarily on the bottom of the vessels as stored waste or as residuals from operations pumping and flushing activities.
- **Quantity** – Documented in many cases and a heel is present for tanks with very low volumes of waste. Waste quantities are not estimated for tanks with very limited or no field information. Waste quantities and group assignments are shown in Appendix B, Table B-10.

- **Constituents** – They are based on historical data and information for those IMUSTs with no direct contact with tank farms waste. For those tanks that have been used in the handling and transfer of tank farm waste, the constituents are estimated to be those for the group to which the IMUST is assigned. A notable exception to this is the 241-Z-8 tank that received waste from the Plutonium Finishing Plant. The waste in this tank was not mixed with waste from the tank farms. Hence, the waste in this tank is unique to it. It has not been assigned to a group.

A5.3 VAULTS

The following list provides an engineering description of the SST system vaults:

- Six vaults and their associated tanks are considered in this task, 231-W-151, 244-AR, 244-CR, 244-BXR, 244-TXR, and 244-UR.
- The storage volume of each of these vaults and their cells are known and documented in SD-EN-ES-040.
- The 244-AR and 244-CR vaults are slated for stabilization by 2004.
- Waste penetration for the 231-W-151 vault is to a depth of 0.04 cm (0.0156 in.), which corresponds to approximately 3.8 L (1 gal) of grouted waste per 9.3 m^2 (100 ft^2) of wall surface.

Waste characterization specifics of the vaults follow:

- **Locations** – The tanks and sumps are known to store waste. Adsorbed waste is expected in the vault cells unless documented to have functioned as storage.
- **Quantity** – Waste quantities are not estimated for tanks with known volumes. Table 2-10 and 2-11 contain the published volumes of waste expected in each of the vaults and cells. The 231-W-151 vault cell contains an unknown waste volume. It is assumed that an adsorbed waste affixes to the surfaces of the vault cell to a height of two feet. The waste volume for the 231-W-151 vault cell is given by multiplying the wetted surface area times the waste thickness times the grout formation factor times the unit conversion factor to change the result to gallons.

  *Quantity = Surface area (ft^2) * 0.0156 in. * 0.30 * 0.623 conversion factor to gallons*
  The resulting estimate for the 231-W-151 vault cell is 1.01 gallons of adsorbed waste affixed to the sides of the vault.

- **Constituents** – For those vaults that have been used in the handling and transfer of tank farm waste, the constituents are estimated to be those for the group to which the vault is assigned.

A5.4 PITS

The following list provides an engineering description of the pits:

- Waste is held in the concrete surfaces as an adsorbed layer.
- Waste is flushed and drained in normal operations activities.
- Waste is returned to the SSTs or catch tanks via drainage lines.
- Waste penetration is to a depth of 0.04 cm (0.0156 in.), which corresponds to approximately 3.8 L (1 gal) of grouted waste per 9.3 m^2 (100 ft^2) of wall surface.

Waste characterization specifics of the pits follow:

- **Locations** – On the surfaces as adsorption.
- **Quantity** – Calculated by multiplying the wetted surface area times the waste thickness times the grout formation factor times the unit conversion factor to change the result to gallons.

  *Quantity = Surface area (ft^2) * 0.0156 in. * 0.30 * 0.623 conversion factor to gallons*

- **Constituents** – Those for the group to which the pit is assigned.

A5.5 TRANSFER PIPING

The following list provides an engineering description of the transfer piping:

- Waste is in the piping from adsorption as residuals and as fixed waste.
- Adsorption adds a layer of 1,000 Angstroms (Eubanks et al. 1962) in thickness each time the component goes through an operations cycle. This thickness corresponds to a wetting surface layer.
- An operations cycle is one in which a transfer is performed followed by a flushing and then an unspecified length of time before the piping is again put through the procedure.
- The average number of operations cycles for a pipe is estimated to be 500. This corresponds to 2 transfers per month for 20 years.
- The pipe surface area is increased by 10 percent due to corrosion/erosion the corrective factor for the surface area of the pipe is then 1.10.
- The pipe surface area is large on the micro level scale by 30 percent (Bickerman 1970); the corrective factor for the surface area of the pipe is 1.30.

- Based on field information, residual waste is expected to reside in only 4 percent of the total piping.
- Residual waste has an estimated cross-sectional area of 1.9 cm^2 (0.291 $in.^2$) based on field information and an estimation of 0.08 cm (0.0325 in.) for the residual waste thickness that may be molded to the pipe shape (WHC-SD-WM-ES-259).
- Fixed waste is trapped in the pipes due to pipe clogging.
- The number of known plugged transfer pipes is five.
- The plug point it estimated to be at the midway of the pipe, on average. This gives a factor of 0.5.
- Half of the waste upstream of the plug is estimated to drain back toward the source for that pipe. This also gives a factor of 0.5.
- Inflow of water from unspecified sources does not contribute to the equivalent waste but only dilutes the waste in the piping.

Waste characterization specifics of the transfer piping follow:

- **Locations** – Waste is tightly held on the piping surfaces by adsorption, loosely held by adhesion, or trapped in pipes that have clogged.
- **Quantity** – Calculated differently for each waste location.
  - Waste Held by Adsorption (695 gal) – The geometric surface area is multiplied by the factor for corrosion/erosion then multiplied by the factor for micro level surface area. This yields the actual surface area. This is then multiplied by the thickness of the waste from a single cycle then multiplied by the estimated number of cycles and finally it is multiplied by a unit conversion factor to give the result in gallons:

    *Adsorbed quantity = geometric surface area (ft^2) * 1.10 * 1.30 * 1000 Angstroms * 500 cycles * 2.45 $\times 10^{-9}$ conversion factor to gallons.*

  - Waste Held as Residuals (305 gal) – The total number of miles of pipe is multiplied by a factor for the fraction of pipe retaining residuals then it is multiplied by the estimated cross-sectional area of the residuals and then by a unit conversion factor to give the result in gallons:

    *Residual Quantity = 95.67 (mi) * 0.04 * 0.291 ($in.^2$) * 274.3 conversion factor to gallons.*

  - Waste Held in Fixed Locations (164 gal) – The total number of miles of pipe is divided by the number of pipes to give an average pipe length. This is then multiplied by the number of plugged pipes to obtain an overall average pipe length for all the plugged piping. This is then multiplied by the area of the pipe and then by a factor for the amount of waste retained and finally by a unit conversion factor to give the result in gallons:

*Fixed Quantity = 95.67 (mi) / 1414 * 5 * (3.14 * 1.5 * 1.5) *0.5 * 0.5 * 274.3.*

- **Constituents** – Those for the group to which the transfer piping is assigned.

A5.6 EVAPORATORS

The following list provides an engineering description of the SST system evaporators:

- Two evaporators are considered in this task, 242-S Evaporator and 242-T Evaporator.
- The 242-T Evaporator is believed to be partially decontaminated with some waste and process chemicals being removed.
- The actions taken at 242-T Evaporator are not well documented and field information is limited.
- 242-S Evaporator was decontaminated and process chemicals were removed.
- The actions taken with 242-S Evaporator are documented and field information is readily available.

Waste characterization specifics of the 242-S Evaporator follow:

- **Locations** – Within the facility on wall surfaces and in process vessels.
- **Quantity** – From either field information or data or from engineering estimates. For engineering estimates, the following equations are applied.

  For metal surfaces, waste volume is calculated by multiplying the geometric surface area by the micro level surface correction factor then by the wetted film thickness and finally by a unit conversion factor to give the result in gallons:

  Adsorbed quantity = geometric surface area (ft^2) ** 1.30 * 5000 (Angstrom) ** 2.45×10^{-9} *conversion factor to gallons.*

  For concrete surfaces, they are calculated by multiplying the wetted surface area times the waste thickness times the grout formation factor times the unit conversion factor to change the result to gallons.

  Adsorbed quantity = Surface area (ft^2) ** 0.0156 in. * 0.30 * 0.623 conversion factor to gallons.*

  For residuals, they are identified as heel quantities in vessels and are based on the known final operation activity with the vessels as well as the physical layout of the vessel (i.e., the vessel shape is such that a heel can be retained in it.)

- **Constituents** – The constituent concentrations for S tank farm were used for the 242-S Evaporator because the evaporator was used primarily to concentrate waste from this tank farm.

The waste volume in 242-T Evaporator is based on information provided in RPP-4780. This information is based on facility radiation measurements and MicroShield calculations. An estimated waste volume of approximately 150 L (40 gal) is present in the 242-T Evaporator.

A5.7 MISCELLANEOUS STRUCTURES

A5.7.1 Ventilation Structures

A5.7.1.1 Ventilation Building (241-A-431)

The following list provides an engineering description of the Ventilation Building (241-A-431).

- Facility was used to vent off-gases from the A and AX farms. Structure was not used in direct contact with liquid tank waste materials.
- RPP-6637 states that "The building is contaminated, but the 100m person would not be affected by release of the building contamination." This assertion coupled with the fact that this building was not designed to store waste, indicates that remaining wastes are likely adsorbed onto the walls of the process vessels and the building.

Waste characterization specific to the ventilation building follow:

- **Locations** – Locations are assumed to be internal to the deentrainer and on the walls of the facility. For the purposes of this analysis, a two feet high contamination depth on the walls is assumed similar to the pits.
- **Quantity** – The estimated waste volume is approximately one gallon after modeling the deentrainer in the same manner as a transfer line. This does not refute the readings discussed in RPP-6637.
- **Constituents** – Concentrations are modeled as Group 1 because the Ventilation Building serviced the 241-A tank farm.

A5.7.1.2 Condenser Shielding Buildings (241-SX-401 & 241-SX-402)

The following list provides an engineering description of the Condenser Shielding Buildings (241-SX-401 and 241-SX-402):

- These facilities were used to cool off-gases from some of the 241-SX tanks. Structure was not used in direct contact with liquid tank waste materials.
- All vessels either drained to a crib or to the one of two SX tanks (241-SX-106 or 241-SX-112).

- Neither 241-SX-401 or 241-SX-402 stored waste (RPP-6637).

Waste characterization specific to the ventilation building follow:

- **Locations** – Locations are assumed to be internal to the condensers and each tank.
- **Quantity** – The estimated waste volume is approximately one gallon after modeling the condensers, the catch tank, and the return tank in the same manner as a transfer line. This does not refute the findings discussed in RPP-6637.
- **Constituents** – Concentrations are modeled as Group 5 because the Ventilation Building serviced the 241-SX tank farm.

A5.7.2 Ion Exchange Column (241-AX-IX)

The following provides an engineering description of the Ion Exchanger (241-AX-IX):

- Except for piping and valves, this facility consists of a cuno filter and an ion exchange column. The cuno filter does not have any radiation postings and hence the waste estimate for the cuno filter is approximated to zero.
- Radiation readings in 2000 indicated essentially background readings for the ion exchange column (RPP-6637).

Waste characterization specific to the ventilation building follow:

- **Locations** – Locations are assumed to be internal and external to the ion exchanger contained within the ion exchange column. The ion exchanger is modeled as concrete for conservative purposes.
- **Quantity** – The estimated waste volume is less than one gallon for the ion exchanger. This corroborates the findings discussed in RPP-6637.
- **Constituents** – Concentrations are modeled as Group 1 because the Ion Exchanger serviced the 241-A-401 facility in the 241-A tank farm.

A5.7.3 In-Tank Solidification System (241-BY-ITS1)

The following list provides an engineering description of the In-Tank Solidification System:

- The 241-BY-ITS1 was not designed to retain wastes, but used to treat heated vapor from the 241-BY-102 tank.
- Five process vessels comprised the ITS1 structure. These vessels were to be drained during shutdown; however, high dose readings have been measured around the deentrainer. All other vessels allow unrestricted access.

Waste characterization specific to the miscellaneous structures follow:

- **Locations** – Each of the vessels is likely to contain an adsorbed layer of waste.
- **Quantity** – The total waste estimate for the 241-BY-ITS1 system is less than 10 gallons. Calculations for these vessels may be inaccurate given the lack of field data substantiating the status of the vessels. Due to the limited radiological readings encountered with this facility, minimal waste volume is expected.
- **Constituents** – Concentrations are modeled as Group 3 because the feed tank for this system was 241-BY-102.

A6.0 MICROSHIELD COMPARISON OF EXTRAPOLATED DATA

A comparison of the waste volume and constituency in the ancillary equipment to that found in the field is possible by either direct physical comparison, observation, or by a more indirect means, correlation of estimated waste inventories with radiation measurements. The former has been done during the course of this work where observation data have been available but these data have been limited. Calculating radiation field values using the estimated waste volumes and constituencies using Microshield™ calculations allows for a more universal comparison across all types of ancillary equipment in all locations. The radiation field is calculated based on the estimated waste content and then it is compared to actual field survey data.

The MicroShield software allows for calculating exposure based on gamma radiation. This is ideal because for the constituents in the groups, the gamma emitted by the barium-137m, the daughter of cesium-137, contributes approximately 99 percent of the total exposure. Hence, the seven groups can be compared by simply using the ratios of cesium-137 concentrations in the group once the exposure value has been calculated for any one of them. Two cases were considered. One was a 7.6-cm (3-in.)-diameter Schedule 40 pipe and the other was a concrete wall. The values obtained for exposure are shown in Table A-5 as Cases 1 and 2 for the seven different waste inventory groups. Group 1 was taken as the base case and the other groups were normalized to it by taking the cesium-137 values in each.

The data in the table are based on data from SSTs in the B, BY, SY (excluding the DSTs in the SY farm), T, TX, TY, and U farms. Data from other farms were reviewed and were comparable but not included in the calculations presented in Table A-5. The radiological survey data were obtained from "Project Hanford Radiological Survey Reports." The reports were reviewed for the years 2002 and 2001 so as to have values most close to those for the waste as it is currently contained in the ancillary equipment.

The field values for exposure in Table A-5 are shown for two different radiological survey listings. Far more data are available for concrete surfaces than for piping surfaces. This is a reflection of the kind of work that is most often performed in the tank farms. It is much more the case that a pit with concrete surfaces is surveyed than a pipe with metal surfaces. In the normal tank farm work, pits are entered for equipment replacement and repair, which requires radiation surveys that directly support any work being performed. Piping on the other hand is not equipment requiring nearly as much attention because it rarely needs repair and equipment is not placed in it on a routine basis.

Field data for exposure values were randomly reviewed from approximately seventy-five locations that had concrete surfaces, mostly pits. The average values shown in the table are for those locations that had exposure values greater than 5 mrem/hour. Generally, the values were about the same magnitude but there were outlying values that were much higher. Four of the values were greater than 40 mrem/hr and eight were greater than 20 mrem/hr. The remainder were of similar magnitude and about one half of the values were below 5 mrem/hr.

Hence, the field data favorably agree with the engineering estimations. The field values are lower overall compared to the estimated engineering values, which indicates that the waste values calculated in this work are, on average, likely greater than those actually in the field. Hence, for concrete surfaces the waste quantities are conservative values that may be considered as bounding values for the waste in the ancillary equipment.

Field data for metal piping were all found to be less than 0.5 mrem/hr. The engineering estimates are higher than this for four of the seven groups and lower for three of them. Overall, the engineering estimates are comparable to the field values. However, this comparison must be made with some reservation because the field values do not necessarily directly relate to the amount of waste that may be present in the piping. This is because circumstances may exist in the field that affect the readings, e.g., other pipes or objects close by that either contribute to the radiation or shield the detector from it. In this respect, the field data for concrete surfaces are a more accurate reflection of the amount of waste present because readings are taken directly of the waste, which is layered on the surface with no interfering objects present.

The results from Microshield calculations are the same order of magnitude as previously performed radiological surveys, which indicates that the waste estimations made in this document are generally comparable to existing conditions.

Table A-5. Microshield Calculation Comparison with Observed Radiologic Surveys.

Exposure Scenarios	Waste Inventory Group						
	1	2	3	4	5	6	7
Case 1							
Pipe at contact (mR/hr)	2.77	0.40	1.00	1.29	1.35	0.25	0.19
Pipe at 30 cm (mR/hr)	0.80	0.12	0.29	0.37	0.39	0.07	0.05
Case 2							
Concrete Pit at Contact (mR/hr)	35.30	5.10	12.82	16.45	17.23	3.24	2.38
Concrete Pit at 30 cm (mR/hr)	31.63	4.57	11.49	14.74	15.43	2.91	2.13
Radiological Survey							
Piping at Contact (mR/hr)	<0.5				<0.5	<0.5	
Radiological Survey							
Concrete Pit at Contact (mR/hr)		10.3*	14.4*		16.8*		13.75*

Note: * Average reading for measurements ≥ 5 mR/hr.

A7.0 CONCLUSIONS

The waste in the ancillary components, while similar in composition to the waste in the tanks, is present in quantities that are very low compared to those stored in the SSTs. Generally, the waste is spread in very low quantities throughout the components so that they are not amenable to ready recovery and storage in a single vessel.

A8.0 REFERENCES

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APPENDIX B

DATABASE OUTPUT

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B1.0 INTRODUCTION

This appendix describes a few of the reports available from the database. Not all reports are discussed here; however, the reports used for analysis of the single-shell tank (SST) system are included for the benefit of the reader. Additional reports are available through the graphical user interface (e.g., user-defined queries, other reports). As stated in Appendix A, not all of the data in the database has been validated. Additionally, sources encountered during the compilation efforts presented conflicting information. Extensive efforts to resolve these differences were not within the scope of this report. The available source documents for each set of components are summarized in Appendix E. Engineering judgment was used to select data/information for use in this assessment when inconsistencies were encountered.

B2.0 REPORTS

This section describes reports available from the database and contains output from the database. In some cases, the outputs for specific reports are in excess of 100 pages. Extracts are presented to familiarize the reader with the structure and information available from the reports.

B2.1 RANKING REPORTS

The ranking reports are used to compare the relative impacts of the radionuclide and chemical constituents of concern (CoCs). The following summarize the various ranking reports generated to compare the total and liquid volumes of the SSTs and the inactive miscellaneous underground storage tanks (IMUSTs).

B2.1.1 Risk-Based Ranking for Total Waste Volume

The SSTs, the IMUSTs, and the vault tanks are ranked according to a calculated long-term risk metric. The radiological and chemical hazard risk metrics do not provide meaningful risk values for comparison against regulatory standards because they do not include contaminant fate and transport and the calculation of contaminant concentrations in receptor pathways. The risk metric does, however, provide a means to make relative comparisons among the components. The components are evaluated based on specified CoCs, either radionuclide or chemical. The quantity of each constituent is modified by a unit risk factor (URF) to account for the relative risk associated with that constituent as depicted in Formulas B.1 and B.2. The ranking of the component is determined by comparing the sum of the relative risk factors for each of the CoCs categories (e.g., radionuclide or chemicals). The radionuclide CoCs and their associated URFs are listed in Table B-1.

Formula B.1. Relative Risk Calculation for Radionuclides

Concentration of CoC [Ci/mL] * Volume of Waste in Specific Component (mL)

* Unit Risk Factor [Incremental Lifetime Cancer Risk per Ci/mL]

Formula B.2. Relative Risk Calculation for Chemicals

Concentration of CoC [g/mL] * Volume of Waste in Specific Component [mL]

* Unit Risk Factor [Hazard Index per g/mL].

Table B-1. Tank Ranking Criteria.

Constituent of Concern Radionuclide	Unit Risk Factor ILCR per Ci/mL
C-14	5.23E+06
I-129	9.33E+08
Se-79	3.22E+07
Tc-99	7.11E+06
U-238	2.84E+08
Chemical	**HI per g/mL**
NO2	9.92E+03
NO3	6.20E+03
Cr	3.31E+06
U(Total)	3.52E+06

Notes:
ILCR = Incremental Lifetime Cancer Risk
HI = Hazard Index
Source: TWRS EIS (DOE/EIS-0189)

The results of this ranking are provided in Table B-2 for radiological risk and in Table B-3 for chemical hazards; these tables illustrate that the SSTs have the highest ranking.

B2.1.1 Risk-Based Ranking for Liquid Waste

The second reports, presented in Tables B-4 and B-5, provide a risk-based ranking for liquid waste and consider the same radionuclides and chemicals as described in Section B.2.1.1. This report ranks the SSTs, IMUSTs, and vaults based on the known liquid volumes and contaminant concentrations.

Table B-2. Ranking Report Potential Radiological Risk (6 Sheets).

Rank	Farm	Component	Risk Measure
1	A	241-A-101	8.89E+09
2	AX	241-AX-101	6.35E+09
3	U	241-U-108	5.72E+09
4	U	241-U-107	5.43E+09
5	TX	241-TX-113	4.88E+09
6	C	241-C-104	4.66E+09
7	U	241-U-105	4.64E+09
8	TX	241-TX-105	4.60E+09
9	TX	241-TX-112	4.51E+09
10	BY	241-BY-106	4.34E+09
11	TX	241-TX-115	4.09E+09
12	BX	241-BX-104	3.74E+09
13	SX	241-SX-102	3.63E+09
14	BY	241-BY-101	3.60E+09
15	SX	241-SX-106	3.60E+09
16	BY	241-BY-104	3.55E+09
17	S	241-S-112	3.50E+09
18	TX	241-TX-114	3.49E+09
19	S	241-S-108	3.48E+09
20	SX	241-SX-103	3.33E+09
21	TX	241-TX-110	3.23E+09
22	S	241-S-109	3.22E+09
23	U	241-U-111	3.22E+09
24	BY	241-BY-110	3.09E+09
25	BY	241-BY-103	3.06E+09
26	S	241-S-111	3.05E+09
27	S	241-S-110	2.99E+09
28	S	241-S-106	2.96E+09
29	S	241-S-102	2.91E+09
30	SX	241-SX-102	3.63E+09
31	C	241-C-112	2.76E+09
32	S	241-S-105	2.75E+09
33	U	241-U-103	2.69E+09

Table B-2. Ranking Report Potential Radiological Risk (6 Sheets).

Rank	Farm	Component	Risk Measure
34	BY	241-BY-105	2.64E+09
35	TX	241-TX-106	2.63E+09
36	TX	241-TX-111	2.46E+09
37	SX	241-SX-104	2.39E+09
38	BY	241-BY-108	2.38E+09
39	T	241-T-107	2.37E+09
40	TX	241-TX-116	2.28E+09
41	BY	241-BY-112	2.26E+09
42	U	241-U-109	2.26E+09
43	SX	241-SX-101	2.26E+09
44	S	241-S-103	2.25E+09
45	BY	241-BY-107	2.14E+09
46	TX	241-TX-117	2.11E+09
47	BY	241-BY-111	2.05E+09
48	SX	241-SX-105	2.00E+09
49	U	241-U-102	2.00E+09
50	BY	241-BY-102	1.97E+09
51	S	241-S-107	1.95E+09
52	TY	241-TY-103	1.89E+09
53	TX	241-TX-102	1.72E+09
54	TX	241-TX-118	1.69E+09
55	BY	241-BY-109	1.61E+09
56	C	241-C-105	1.60E+09
57	U	241-U-110	1.57E+09
58	BX	241-BX-109	1.57E+09
59	A	241-A-103	1.43E+09
60	AX	241-AX-103	1.40E+09
61	BX	241-BX-110	1.25E+09
62	BX	241-BX-111	1.20E+09
63	U	241-U-106	1.18E+09
64	S	241-S-104	1.12E+09
65	TX	241-TX-103	1.06E+09
66	TY	241-TY-105	1.04E+09

Table B-2. Ranking Report Potential Radiological Risk (6 Sheets).

Rank	Farm	Component	Risk Measure
67	C	241-C-107	1.03E+09
68	SX	241-SX-109	1.01E+09
69	TX	241-TX-108	1.01E+09
70	B	241-B-111	9.38E+08
71	C	241-C-101	9.18E+08
72	A	241-A-102	9.03E+08
73	BX	241-BX-107	8.77E+08
74	T	241-T-111	8.28E+08
75	B	241-B-109	8.22E+08
76	A	241-A-105	8.01E+08
77	C	241-C-103	7.92E+08
78	C	241-C-102	7.86E+08
79	A	241-A-106	7.57E+08
80	BX	241-BX-105	7.35E+08
81	AX	241-AX-104	7.22E+08
82	TX	241-TX-109	7.06E+08
83	B	241-B-106	6.61E+08
84	SX	241-SX-114	6.45E+08
85	C	241-C-109	6.17E+08
86	T	241-T-101	5.81E+08
87	TY	241-TY-104	5.75E+08
88	TX	241-TX-101	5.07E+08
89	B	241-B-104	4.86E+08
90	SX	241-SX-111	4.30E+08
91	C	241-C-111	4.25E+08
92	C	241-C-110	4.17E+08
93	T	241-T-105	3.62E+08
94	B	241-B-105	3.50E+08
95	SX	241-SX-107	3.36E+08
96	B	241-B-107	3.03E+08
97	B	241-B-101	2.95E+08
98	SX	241-SX-108	2.93E+08
99	SX	241-SX-112	2.73E+08

Table B-2. Ranking Report Potential Radiological Risk (6 Sheets).

Rank	Farm	Component	Risk Measure
100	TX	241-TX-104	2.59E+08
101	BX	241-BX-108	2.30E+08
102	TX	241-TX-107	2.28E+08
103	T	241-T-102	2.24E+08
104	SX	241-SX-110	2.19E+08
105	BX	241-BX-106	2.19E+08
106	TY	241-TY-101	2.03E+08
107	BX	241-BX-112	2.03E+08
108	U	241-U-104	1.96E+08
109	B	241-B-110	1.85E+08
110	T	241-T-110	1.47E+08
111	TY	241-TY-106	1.41E+08
112	T	241-T-104	1.40E+08
113	BX	241-BX-103	1.35E+08
114	A	241-A-104	1.22E+08
115	B	241-B-112	1.09E+08
116	B	241-B-103	1.07E+08
117	TY	241-TY-102	1.03E+08
118	SX	241-SX-113	1.02E+08
119	AX	241-AX-102	1.01E+08
120	B	241-B-108	9.76E+07
121	T	241-T-103	9.61E+07
122	U	241-U-112	8.87E+07
123	BX	241-BX-101	8.84E+07
124	U	241-U-101	7.45E+07
125	T	241-T-106	7.39E+07
126	C	241-C-108	6.05E+07
127	C	241-C-106	6.03E+07
128	B	241-B-102	2.98E+07
129	T	241-T-112	1.95E+07
130	T	241-T-109	1.90E+07
131	BX	241-BX-102	1.82E+07
132	T	241-T-108	1.65E+07

Table B-2. Ranking Report Potential Radiological Risk (6 Sheets).

Rank	Farm	Component	Risk Measure
133	SX	241-SX-115	1.50E+07
134	U	241-U-201	1.07E+07
135	B	241-B-202	9.15E+06
136	C	244-CR-011	5.74E+06
137	B	241-B-203	3.94E+06
138	B	241-B-204	3.52E+06
139	T	241-T-204	2.28E+06
140	B	241-B-201	2.16E+06
141	U	241-U-204	1.84E+06
142	T	241-T-201	1.83E+06
143	AZ	244-AR-002	1.79E+06
144	C	241-C-301	1.69E+06
145	T	241-T-203	1.64E+06
146	B	241-B-301B	1.35E+06
147	T	241-T-202	9.72E+05
148	T	241-T-301B	9.40E+05
149	BX	244-BXR-001	8.08E+05
150	BX	244-BXR-011	7.97E+05
151	TX	244-TXR-003	7.49E+05
152	C	244-CR-003	6.44E+05
153	C	241-C-203	5.43E+05
154	C	241-C-204	3.50E+05
155	TX	244-TXR-002	3.41E+05
156	U	244-UR-002	3.33E+05
157	C	244-CR-001	3.22E+05
158	U	241-U-202	3.18E+05
159	B	241-B-302B	3.00E+05
160	TX	241-TX-302A	2.87E+05
161	AZ	244-AR-003	2.87E+05
162	C	241-C-202	2.84E+05
163	C	241-C-201	2.73E+05
164	U	241-U-203	2.72E+05
165	TX	244-TXR-001	2.71E+05

Table B-2. Ranking Report Potential Radiological Risk (6 Sheets).

Rank	Farm	Component	Risk Measure
166	S	240-S-302	2.64E+05
167	U	244-UR-001	2.62E+05
168	BX	244-BXR-002	2.45E+05
169	C	244-CR-002	2.41E+05
170	BX	244-BXR-003	2.02E+05
171	AZ	244-AR-001	1.87E+05
172	TX	241-TX-302B	1.85E+05
173	U	244-UR-003	1.82E+05
174	SX	241-SX-302	1.57E+05
175	TX	241-TX-302BR	1.32E+05
176	BX	241-BX-302B	1.17E+05
177	BX	241-BX-302C	9.66E+04
178	BX	241-BX-302A	9.35E+04
179	TY	241-TY-302A	8.83E+04
180	TX	241-TX-302XB	4.09E+04
181	AZ	244-AR-004	3.59E+04
182	C	244-CR Vault	1.15E+03
183	BX	244-BXR Vault	8.02E+02
184	AZ	244-AR Vault	7.44E+02
185	U	244-UR Vault	7.28E+02
186	TX	244-TXR Vault	5.72E+02
187	TY	241-TY-302B	0.00E+00
188	S	241-S-302B	0.00E+00
189	U	244-UR-004	0.00E+00
190	AX	241-AX-151-CT	UNK

Table B-3. Ranking Report Potential Chemical Hazard Risk (6 Sheets).

Rank	Farm	Component	Chemical Hazard Measure
1	BX	241-BX-104	1.41E+14
2	C	241-C-104	1.30E+14
3	BY	241-BY-112	1.19E+14
4	SX	241-SX-101	1.03E+14
5	S	241-S-101	8.96E+13
6	S	241-S-107	8.79E+13
7	C	241-C-112	8.59E+13
8	U	241-U-108	8.27E+13
9	T	241-T-107	7.70E+13
10	S	241-S-108	7.26E+13
11	S	241-S-110	7.11E+13
12	S	241-S-112	7.02E+13
13	TY	241-TY-103	6.56E+13
14	SX	241-SX-102	6.50E+13
15	U	241-U-105	6.48E+13
16	SX	241-SX-104	6.42E+13
17	BY	241-BY-104	6.37E+13
18	BY	241-BY-110	6.29E+13
19	S	241-S-106	6.27E+13
20	BX	241-BX-109	6.02E+13
21	SX	241-SX-103	5.77E+13
22	U	241-U-110	5.70E+13
23	TX	241-TX-105	5.58E+13
24	S	241-S-105	5.04E+13
25	BY	241-BY-101	4.88E+13
26	A	241-A-101	4.87E+13
27	BY	241-BY-105	4.85E+13
28	S	241-S-111	4.61E+13
29	TX	241-TX-112	4.43E+13
30	BY	241-BY-108	4.36E+13
31	S	241-S-104	4.12E+13
32	TX	241-TX-115	4.11E+13
33	SX	241-SX-109	4.00E+13

Table B-3. Ranking Report Potential Chemical Hazard Risk (6 Sheets).

Rank	Farm	Component	Chemical Hazard Measure
34	SX	241-SX-106	4.00E+13
35	T	241-T-111	3.85E+13
36	BX	241-BX-105	3.83E+13
37	BY	241-BY-106	3.79E+13
38	S	241-S-102	3.71E+13
39	C	241-C-105	3.62E+13
40	TX	241-TX-114	3.54E+13
41	B	241-B-109	3.53E+13
42	C	241-C-101	3.53E+13
43	TX	241-TX-110	3.32E+13
44	U	241-U-111	3.30E+13
45	S	241-S-109	3.19E+13
46	C	241-C-102	3.17E+13
47	U	241-U-103	3.12E+13
48	TX	241-TX-118	3.07E+13
49	U	241-U-107	3.01E+13
50	AX	241-AX-101	3.00E+13
51	SX	241-SX-105	2.96E+13
52	BY	241-BY-103	2.84E+13
53	BX	241-BX-110	2.84E+13
54	TY	241-TY-105	2.77E+13
55	A	241-A-102	2.74E+13
56	TY	241-TY-101	2.71E+13
57	TX	241-TX-106	2.69E+13
58	TX	241-TX-111	2.58E+13
59	U	241-U-102	2.58E+13
60	S	241-S-103	2.46E+13
61	B	241-B-106	2.45E+13
62	SX	241-SX-108	2.45E+13
63	U	241-U-109	2.43E+13
64	SX	241-SX-114	2.41E+13
65	TX	241-TX-117	2.38E+13
66	TX	241-TX-116	2.30E+13

Table B-3. Ranking Report Potential Chemical Hazard Risk (6 Sheets).

Rank	Farm	Component	Chemical Hazard Measure
67	TX	241-TX-113	2.19E+13
68	BX	241-BX-107	2.17E+13
69	TX	241-TX-109	2.05E+13
70	TY	241-TY-104	2.03E+13
71	BY	241-BY-107	2.03E+13
72	SX	241-SX-111	1.96E+13
73	B	241-B-105	1.96E+13
74	TX	241-TX-101	1.94E+13
75	B	241-B-104	1.93E+13
76	TX	241-TX-102	1.89E+13
77	C	241-C-103	1.88E+13
78	BY	241-BY-111	1.84E+13
79	C	241-C-107	1.76E+13
80	A	241-A-103	1.75E+13
81	SX	241-SX-107	1.67E+13
82	C	241-C-111	1.54E+13
83	C	241-C-109	1.49E+13
84	BX	241-BX-106	1.47E+13
85	BY	241-BY-102	1.36E+13
86	A	241-A-106	1.33E+13
87	SX	241-SX-112	1.30E+13
88	TX	241-TX-108	1.23E+13
89	U	241-U-104	1.21E+13
90	BX	241-BX-111	1.20E+13
91	BY	241-BY-109	1.17E+13
92	T	241-T-110	1.12E+13
93	U	241-U-106	1.08E+13
94	T	241-T-104	1.01E+13
95	TX	241-TX-103	1.00E+13
96	SX	241-SX-110	9.67E+12
97	B	241-B-101	9.46E+12
98	AX	241-AX-103	9.13E+12
99	C	241-C-110	9.00E+12

Table B-3. Ranking Report Potential Chemical Hazard Risk (6 Sheets).

Rank	Farm	Component	Chemical Hazard Measure
100	T	241-T-101	8.83E+12
101	B	241-B-107	8.56E+12
102	BX	241-BX-108	8.47E+12
103	BX	241-BX-112	7.35E+12
104	T	241-T-105	7.28E+12
105	B	241-B-110	5.90E+12
106	B	241-B-111	5.77E+12
107	TX	241-TX-104	5.55E+12
108	BX	241-BX-103	5.46E+12
109	B	241-B-103	5.12E+12
110	T	241-T-102	4.83E+12
111	B	241-B-108	4.12E+12
112	U	241-U-101	4.04E+12
113	BX	241-BX-101	3.70E+12
114	T	241-T-103	3.09E+12
115	U	241-U-112	2.98E+12
116	T	241-T-112	2.92E+12
117	TX	241-TX-107	2.91E+12
118	T	241-T-106	2.67E+12
119	T	241-T-204	2.66E+12
120	B	241-B-204	2.64E+12
121	TY	241-TY-106	2.60E+12
122	B	241-B-203	2.59E+12
123	T	241-T-203	2.13E+12
124	T	241-T-201	2.12E+12
125	TY	241-TY-102	2.09E+12
126	A	241-A-105	1.82E+12
127	B	241-B-201	1.80E+12
128	B	241-B-102	1.68E+12
129	B	241-B-112	1.62E+12
130	C	241-C-108	1.49E+12
131	B	241-B-202	1.42E+12
132	AX	241-AX-102	1.12E+12

Table B-3. Ranking Report Potential Chemical Hazard Risk (6 Sheets).

Rank	Farm	Component	Chemical Hazard Measure
133	T	241-T-202	1.09E+12
134	BX	241-BX-102	1.07E+12
135	SX	241-SX-115	8.05E+11
136	T	241-T-109	7.12E+11
137	AX	241-AX-104	6.93E+11
138	C	241-C-106	6.84E+11
139	T	241-T-108	6.31E+11
140	A	241-A-104	5.40E+11
141	U	241-U-201	4.72E+11
142	SX	241-SX-113	2.54E+11
143	C	244-CR-011	1.13E+11
144	U	241-U-204	8.71E+10
145	U	241-U-202	7.85E+10
146	U	241-U-203	6.71E+10
147	C	241-C-301	3.32E+10
148	T	241-T-301B	3.20E+10
149	C	241-C-203	3.07E+10
150	B	241-B-301B	2.37E+10
151	C	241-C-204	1.98E+10
152	C	241-C-202	1.82E+10
153	BX	244-BXR-001	1.52E+10
154	BX	244-BXR-011	1.50E+10
155	C	241-C-201	1.34E+10
156	C	244-CR-003	1.27E+10
157	AZ	244-AR-002	1.14E+10
158	TX	244-TXR-003	1.04E+10
159	C	244-CR-001	6.33E+09
160	B	241-B-302B	5.25E+09
161	C	244-CR-002	4.75E+09
162	TX	244-TXR-002	4.75E+09
163	U	244-UR-002	4.63E+09
164	BX	244-BXR-002	4.60E+09
165	TX	241-TX-302A	4.00E+09

Table B-3. Ranking Report Potential Chemical Hazard Risk (6 Sheets).

Rank	Farm	Component	Chemical Hazard Measure
166	BX	244-BXR-003	3.80E+09
167	TX	244-TXR-001	3.77E+09
168	S	240-S-302	3.67E+09
169	U	244-UR-001	3.65E+09
170	TX	241-TX-302B	2.58E+09
171	U	244-UR-003	2.53E+09
172	BX	241-BX-302B	2.20E+09
173	SX	241-SX-302	2.18E+09
174	TX	241-TX-302BR	1.84E+09
175	AZ	244-AR-003	1.83E+09
176	BX	241-BX-302C	1.82E+09
177	BX	241-BX-302A	1.76E+09
178	TY	241-TY-302A	1.44E+09
179	AZ	244-AR-001	1.19E+09
180	TX	241-TX-302XB	5.69E+08
181	AZ	244-AR-004	2.29E+08
182	C	244-CR Vault	2.27E+07
183	BX	244-BXR Vault	1.51E+07
184	U	244-UR Vault	1.01E+07
185	TX	244-TXR Vault	7.95E+06
186	AZ	244-AR Vault	4.75E+06
187	S	241-S-302B	0.00E+00
188	U	244-UR-004	0.00E+00
189	TY	241-TY-302B	0.00E+00

Table B-4. Ranking Report Potential Chemical Hazard Risk Measure from Liquid Waste (3 Sheets).

Rank	Farm	Component	Risk Measure
1	A	241-A-101	8.85E+12
2	AX	241-AX-101	4.68E+12
3	S	241-S-111	2.40E+12
4	U	241-U-108	6.19E+11
5	U	241-U-107	5.91E+11
6	S	241-S-107	4.26E+11
7	C	241-C-106	3.49E+11
8	T	241-T-102	3.37E+11
9	C	241-C-103	1.63E+11
10	T	241-T-112	1.59E+11
11	TX	241-TX-104	1.36E+11
12	BX	241-BX-104	1.24E+11
13	T	241-T-103	1.21E+11
14	BX	241-BX-110	6.74E+10
15	C	244-CR-011	6.65E+10
16	BX	241-BX-103	5.99E+10
17	A	241-A-103	5.25E+10
18	B	241-B-102	4.55E+10
19	BX	241-BX-105	4.22E+10
20	TY	241-TY-104	2.55E+10
21	U	241-U-106	2.50E+10
22	BX	241-BX-112	2.03E+10
23	B	241-B-112	1.60E+10
24	S	241-S-103	1.48E+10
25	C	244-CR-003	1.27E+10
26	B	241-B-106	1.21E+10
27	AZ	244-AR-002	1.11E+10
28	U	241-U-203	9.14E+09
29	U	241-U-201	9.02E+09
30	U	241-U-202	8.23E+09
31	U	241-U-204	7.96E+09
32	C	241-C-110	7.79E+09
33	A	241-A-102	5.84E+09

Table B-4. Ranking Report Potential Chemical Hazard Risk Measure from Liquid Waste (3 Sheets).

Rank	Farm	Component	Risk Measure
34	B	241-B-111	5.81E+09
35	B	241-B-110	5.81E+09
36	U	241-U-103	5.65E+09
37	C	241-C-301	4.65E+09
38	B	241-B-302B	4.52E+09
39	T	241-T-201	3.63E+09
40	B	241-B-203	3.00E+09
41	AX	241-AX-151-CT	2.70E+09
42	B	241-B-204	2.60E+09
43	S	231-W-151-001	2.30E+09
44	AZ	244-AR-003	1.79E+09
45	S	231-W-151-002	1.53E+09
46	T	241-T-110	1.21E+09
47	AZ	244-AR-001	1.10E+09
48	U	244-UR-002	9.19E+08
49	T	241-T-301B	8.46E+08
50	BX	244-BXR-002	7.99E+08
51	BX	244-BXR-003	7.49E+08
52	U	244-UR-001	6.29E+08
53	B	241-B-301B	6.28E+08
54	SX	241-SX-302	4.92E+08
55	BX	241-BX-302C	4.80E+08
56	TX	241-TX-302XB	3.95E+08
57	BX	244-BXR-011	2.06E+08
58	BX	241-BX-302B	1.98E+08
59	AZ	244-AR-004	1.83E+08
60	TX	241-TX-302BR	8.06E+07
61	TX	244-TXR-001	7.90E+07
62	TX	241-TX-302A	4.84E+07
63	C	244-CR Vault	2.27E+07
64	BX	244-BXR Vault	1.51E+07
65	U	244-UR Vault	1.01E+07
66	TX	244-TXR Vault	7.95E+06

Table B-4. Ranking Report Potential Chemical Hazard Risk Measure from Liquid Waste (3 Sheets).

Rank	Farm	Component	Risk Measure
67	AZ	244-AR Vault	4.75E+06
68	S	240-S-302	0.00E+00
69	S	241-S-302B	0.00E+00
70	BX	241-BX-302A	0.00E+00
71	BX	244-BXR-001	0.00E+00
72	U	244-UR-004	0.00E+00
73	U	244-UR-003	0.00E+00
74	TY	241-TY-302A	0.00E+00
75	TY	241-TY-302B	0.00E+00
76	TX	244-TXR-003	0.00E+00
77	TX	244-TXR-002	0.00E+00
78	C	244-CR-002	UNK

Table B-5. Ranking Report Potential Radiological Risk Measure from Liquid Waste (3 Sheets).

Rank	Farm	Component	Chemical Hazard Measure
1	A	241-A-101	6.92E+09
2	AX	241-AX-101	4.73E+09
3	U	241-U-107	7.39E+08
4	S	241-S-111	5.26E+08
5	U	241-U-108	4.96E+08
6	S	241-S-107	8.73E+07
7	C	241-C-103	7.50E+07
8	T	241-T-102	7.18E+07
9	C	241-C-106	3.24E+07
10	A	241-A-103	2.90E+07
11	A	241-A-102	2.74E+07
12	T	241-T-103	2.40E+07
13	TX	241-TX-104	1.97E+07
14	U	241-U-106	1.71E+07
15	BX	241-BX-105	1.55E+07
16	S	241-S-103	1.19E+07
17	BX	241-BX-110	1.14E+07
18	BX	241-BX-104	1.06E+07
19	U	241-U-103	5.95E+06
20	C	244-CR-011	3.38E+06
21	T	241-T-112	2.35E+06
22	AZ	244-AR-002	1.74E+06
23	TY	241-TY-104	1.48E+06
24	B	241-B-102	9.54E+05
25	BX	241-BX-103	6.86E+05
26	C	241-C-110	6.45E+05
27	C	244-CR-003	6.44E+05
28	AX	241-AX-151-CT	4.23E+05
29	BX	241-BX-112	3.82E+05
30	AZ	244-AR-003	2.80E+05
31	B	241-B-302B	2.58E+05
32	B	241-B-106	2.54E+05
33	C	241-C-301	2.37E+05

Table B-5. Ranking Report Potential Radiological Risk Measure from Liquid Waste (3 Sheets).

Rank	Farm	Component	Chemical Hazard Measure
34	AZ	244-AR-001	1.72E+05
35	S	231-W-151-001	1.66E+05
36	S	231-W-151-002	1.10E+05
37	U	241-U-203	9.03E+04
38	U	241-U-201	8.91E+04
39	U	241-U-202	8.12E+04
40	U	244-UR-002	6.61E+04
41	U	244-UR-001	4.52E+04
42	BX	244-BXR-002	4.26E+04
43	U	241-U-204	3.99E+04
44	BX	244-BXR-003	3.99E+04
45	B	241-B-301B	3.59E+04
46	SX	241-SX-302	3.53E+04
47	B	241-B-203	3.26E+04
48	T	241-T-201	3.13E+04
49	AZ	244-AR-004	2.87E+04
50	TX	241-TX-302XB	2.84E+04
51	BX	241-BX-302C	2.55E+04
52	T	241-T-301B	2.48E+04
53	T	241-T-110	1.70E+04
54	B	241-B-204	1.10E+04
55	BX	244-BXR-011	1.10E+04
56	BX	241-BX-302B	1.05E+04
57	TX	241-TX-302BR	5.79E+03
58	TX	244-TXR-001	5.68E+03
59	TX	241-TX-302A	3.48E+03
60	C	244-CR Vault	1.15E+03
61	BX	244-BXR Vault	8.02E+02
62	AZ	244-AR Vault	7.44E+02
63	U	244-UR Vault	7.28E+02
64	TX	244-TXR Vault	5.72E+02
65	S	240-S-302	0.00E+00
66	BX	241-BX-302A	0.00E+00

Table B-5. Ranking Report Potential Radiological Risk Measure from Liquid Waste (3 Sheets).

Rank	Farm	Component	Chemical Hazard Measure
67	S	241-S-302B	0.00E+00
68	TX	244-TXR-003	0.00E+00
69	TY	241-TY-302A	0.00E+00
70	B	241-B-112	0.00E+00
71	B	241-B-111	0.00E+00
72	TY	241-TY-302B	0.00E+00
73	BX	244-BXR-001	0.00E+00
74	B	241-B-110	0.00E+00
75	U	244-UR-004	0.00E+00
76	U	244-UR-003	0.00E+00
77	TX	244-TXR-002	0.00E+00

B2.2 WASTE INVENTORY ESTIMATES BY SINGLE-SHELL TANK COMPONENT

Table B-6 summarizes the estimated volumes of waste for each type of component in the SST system. These estimates attempt to delineate the various states of the waste for each component. In some cases, especially in the IMUSTs, only a total volume is known. No data are currently available to differentiate between the various waste states for some tanks. The result is that the summation of the liquid and solid volumes does not equal the volume depicted in the total volume column. Further sampling efforts could differentiate the waste form in order to assess the potential for liquid migration.

B2.3 SINGLE-SHELL TANK SYSTEM AND PREVENTATIVE MEASURES FOR LIQUID MIGRATION

Table B-7 provides a component listing for the SST system. This report was used during the evaluation of alternatives to determine which components require additional measures to prevent the migration of liquids.

B2.4 EXTRAPOLATED WASTE SUMMARY REPORT

Table B-6 details the individual components with the estimated surface areas and volumes of waste. The methodology for estimating the waste volume for each of these components is detailed in Section 5.0 as well as Appendices A and D.

Table B-6. SST Component Total Estimated Waste Inventory.

Total Number of Components	Estimated Liquid Volume (Gallons)	Estimated Solid Volume (Gallons)	Estimated Total Volume (Gallons)
Single Shell Tanks			
149	2,510,000	31,483,000	31,700,000
IMUSTs			
24	58,000	63,000	121,000
Vaults			
26	18,000	65,000	83,000
Evaporators			
33	9,000	13	9,000
Pits			
322	--	450	450
Transfer Lines			
1,414	--	1,200	1,200
Totals			
2,120	2,595,000	31,600,000	32,000,000

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
B	241-B-04
B	241-B-05
B	241-B-07
B	241-B-108-P
B	241-B-110-P
B	241-B-111-P
B	241-B-201-P
BX	241-BX-07
BX	241-BX-08
BX	241-BX-09
BX	241-BX-10
BX	241-BX-11
BX	241-BX-12
C	241-C-04D
C	241-C-07
C	241-C-08
C	241-C-09
C	241-C-110-P
C	241-C-111-P
C	241-C-112-P
T	241-T-04
T	241-T-05
T	241-T-06
T	241-T-07
T	241-T-08
T	241-T-09
T	241-T-111-P
T	241-T-112
T	241-T-201-P
T	241-T-202-P

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
T	241-T-203-P
T	241-T-204-P
TY	241-T-05
TY	241-TY-06
U	241-U-12
Distribution Pits	
A	241-A-01H
A	241-A-02D
A	241-A-03D
A	241-A-06D
AX	241-AX-02A
AX	241-AX-03A
AX	241-AX-04A
S	241-S-02B
U	241-U-02B
U	241-U-07B
U	241-U-08B
U	241-U-09B
U	241-U-10B
U	241-U-11B
Evaporators	
S	242-S-C-A-1
S	242-S-DU-C-1
S	242-S-E-A-1
S	242-S-E-C-1
S	242-S-E-C-2
S	242-S-E-C-3
S	242-S-Evaporator
S	242-S-IX-D-1
S	242-S-SMP
S	242-S-TK-302-C

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
S	242-S-TK-C-100
S	242-S-TK-C-103
S	242-S-TK-E-101
S	242-S-TK-E-102
S	242-S-TK-E-104
T	242-T-101
T	242-T-102
T	242-T-103
T	242-T-104
T	242-T-105
T	242-T-106
T	242-T-107
T	242-T-108
T	242-T-109
T	242-T-110
T	242-T-112
T	242-T-123
T	242-T-601-TK-1
T	242-T-601-TK-2
T	242-T-601-TK-3
T	242-T-601-TK-4
T	242-T-601-TK-5
T	242-T-601-TK-6
T	242-T-601-TK-7
T	242-T-Evaporator
Facilities	
A	241-A-431
AX	241-AX-IX
BY	241-BY-ITS1
C	241-C-801
SX	241-SX-401

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
SX	241-SX-402
Flush Pits	
WR	241-WR
Heel Pits	
B	241-B-01B
B	241-B-02B
B	241-B-03B
BX	241-BX-01B
BX	241-BX-02B
BX	241-BX-03B
BX	241-BX-04B
BX	241-BX-05B
BX	241-BX-06B
BY	241-BY-02B
BY	241-BY-111B
C	241-C-01B
C	241-C-02B
C	241-C-03B
C	241-C-04B
C	241-C-05B
C	241-C-06B
SX	241-SX-05B
T	241-T-01B
T	241-T-02B
T	241-T-03B
U	241-U-01B
U	241-U-03B
U	241-U-04B
U	241-U-05B
U	241-U-06B
Miscellaneous Underground Storage Tanks	

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
A	241-A-302A
A	241-A-302B
AX	241-AX-151-CT
B	241-B-301B
B	241-B-302B
BX	241-BX-302A
BX	241-BX-302B
BX	241-BX-302C
BY	216-BY-201
BY	241-BY-ITS2-Tank-2
C	241-C-301
ER	241-ER-311A
S	200-W-7
S	240-S-302
S	241-S-302B
SX	241-SX-302
T	241-T-301B
T	242-T-135
T	242-TA-R1
TX	241-TX-302A
TX	241-TX-302B
TX	241-TX-302BR
TX	241-TX-302XB
TY	241-TY-302A
TY	241-TY-302B
U	241-UX-702A
Z	241-Z-8
Pump Pits	
A	241-A-01A
A	241-A-01B
A	241-A-02A

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
A	241-A-02B
A	241-A-03A
A	241-A-03B
A	241-A-03C
A	241-A-04A
A	241-A-05A
A	241-A-05C
A	241-A-06A
A	241-A-06C
AX	241-AX-01A
AX	241-AX-01B
AX	241-AX-02B
AX	241-AX-02D
AX	241-AX-03B
AX	241-AX-03D
AX	241-AX-04B
B	241-B-01A
B	241-B-02A
B	241-B-03A
B	241-B-06A
B	241-B-08A
B	241-B-09A
B	241-B-104
B	241-B-105
B	241-B-107
B	241-B-109-P
B	241-B-112A
BX	241-BX-007
BX	241-BX-009
BX	241-BX-011A
BX	241-BX-012A

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
BX	241-BX-01A
BX	241-BX-02A
BX	241-BX-03A
BX	241-BX-04A
BX	241-BX-05A
BX	241-BX-06A
BX	241-BX-08A
BY	241-BY-010A
BY	241-BY-011A
BY	241-BY-012A
BY	241-BY-01A
BY	241-BY-02A
BY	241-BY-03A
BY	241-BY-04A
BY	241-BY-05A
BY	241-BY-06A
BY	241-BY-07A
BY	241-BY-08A
BY	241-BY-09A
C	241-C-01A
C	241-C-02A
C	241-C-03A
C	241-C-04A
C	241-C-05A
C	241-C-06A
S	241-S-01A
S	241-S-02A
S	241-S-03A
S	241-S-04A
S	241-S-05A
S	241-S-06A

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
S	241-S-07A
S	241-S-08A
S	241-S-09A
S	241-S-11A
S	241-S-12A
SX	241-SX-01A
SX	241-SX-02B
SX	241-SX-03A
SX	241-SX-03B
SX	241-SX-04A
SX	241-SX-05A
SX	241-SX-06A
SX	241-SX-07A
SX	241-SX-08A
SX	241-SX-09A
SX	241-SX-10A
SX	241-SX-11A
SX	241-SX-12A
SX	241-SX-13A
SX	241-SX-14A
SX	241-SX-15A
T	241-T-01A
T	241-T-02A
T	241-T-03A
TX	241-TX-01A
TX	241-TX-02A
TX	241-TX-03A
TX	241-TX-04A
TX	241-TX-05A
TX	241-TX-06A
TX	241-TX-07A

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
TX	241-TX-08A
TX	241-TX-09A
TX	241-TX-10A
TX	241-TX-11A
TX	241-TX-12A
TX	241-TX-13A
TX	241-TX-14A
TX	241-TX-15B
TX	241-TX-16A
TX	241-TX-17A
TX	241-TX-18A
TY	241-TY-01A
TY	241-TY-02A
TY	241-TY-03A
TY	241-TY-04A
U	241-U-01A
U	241-U-02A
U	241-U-03A
U	241-U-04A
U	241-U-05A
U	241-U-06A
U	241-U-07A
U	241-U-08A
U	241-U-09A
U	241-U-10A
U	241-U-11A
System Diversion Boxes	
A	241-A-151
A	241-A-152
A	241-A-153
A	241-AR-151

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
AX	241-AX-151
AX	241-AX-152
AX	241-AX-153
AX	241-AX-155
B	241-B-151
B	241-B-152
B	241-B-153
B	241-B-154
B	241-B-252
B	241-BR-152
B	242-B-151
BX	241-BX-153
BX	241-BX-154
BX	241-BX-155
BX	241-BXR-151
BX	241-BXR-152
BX	241-BXR-153
BY	241-BYR-152
BY	241-BYR-153
BY	241-BYR-154
C	241-C-151
C	241-C-152
C	241-C-153
C	241-C-154
C	241-C-252
C	241-CR-151
C	241-CR-152
C	241-CR-153
ER	241-ER-152
S	240-S-151
S	240-S-152

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
S	241-S-152
SX	241-SX-151
SX	241-SX-152
T	241-T-151
T	241-T-152
T	241-T-153
T	241-T-252
T	241-TR-152
T	241-TR-153
T	242-T-151
TX	241-TX-153
TX	241-TX-155
TX	241-TXR-151
TX	241-TXR-152
TX	241-TXR-153
TX	241-TXR-244
TY	241-TY-153
U	241-U-153
U	241-U-252
U	241-UR-151
U	241-UR-152
U	241-UR-153
U	241-UR-244
U	241-UX-154
Sluice Pits	
A	241-A-01C
A	241-A-02C
A	241-A-04B
A	241-A-04C
A	241-A-05B
A	241-A-05D

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
A	241-A-06B
AX	241-AX-01C
AX	241-AX-01D
AX	241-AX-02C
AX	241-AX-03C
AX	241-AX-04C
AX	241-AX-04D
B	241-B-01C
B	241-B-02C
B	241-B-03C
BX	241-BX-01C
BX	241-BX-02C
BX	241-BX-03C
BX	241-BX-04C
BX	241-BX-05C
BX	241-BX-06C
BY	241-BY-011C
BY	241-BY-011D
BY	241-BY-012C
BY	241-BY-012D
BY	241-BY-01C
BY	241-BY-01D
BY	241-BY-02C
BY	241-BY-02D
BY	241-BY-03C
BY	241-BY-03D
BY	241-BY-04C
BY	241-BY-04D
BY	241-BY-05C
BY	241-BY-05D
BY	241-BY-06C

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
BY	241-BY-06D
C	241-C-01C
C	241-C-02C
C	241-C-03C
C	241-C-05C
T	241-T-01C
T	241-T-02C
TX	241-TX-01C
TX	241-TX-01D
TX	241-TX-02C
TX	241-TX-02D
TX	241-TX-03C
TX	241-TX-03D
TX	241-TX-04C
TX	241-TX-04D
TX	241-TX-05C
TX	241-TX-05D
TX	241-TX-06C
TX	241-TX-06D
TX	241-TX-07C
TX	241-TX-07D
TX	241-TX-08C
TX	241-TX-08D
TX	241-TX-15A
U	241-U-01C
U	241-U-03C
U	241-U-04C
U	241-U-05C
U	241-U-06C
U	241-U-07C
U	241-U-08C

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
U	241-U-09C
Single Shell Tanks	
A	241-A-101
A	241-A-102
A	241-A-103
A	241-A-104
A	241-A-105
A	241-A-106
AX	241-AX-101
AX	241-AX-102
AX	241-AX-103
AX	241-AX-104
B	241-B-101
B	241-B-102
B	241-B-103
B	241-B-104
B	241-B-105
B	241-B-106
B	241-B-107
B	241-B-108
B	241-B-109
B	241-B-110
B	241-B-111
B	241-B-112
B	241-B-201
B	241-B-202
B	241-B-203
B	241-B-204
BX	241-BX-101
BX	241-BX-102
BX	241-BX-103

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
BX	241-BX-104
BX	241-BX-105
BX	241-BX-106
BX	241-BX-107
BX	241-BX-108
BX	241-BX-109
BX	241-BX-110
BX	241-BX-111
BX	241-BX-112
BY	241-BY-101
BY	241-BY-102
BY	241-BY-103
BY	241-BY-104
BY	241-BY-105
BY	241-BY-106
BY	241-BY-107
BY	241-BY-108
BY	241-BY-109
BY	241-BY-110
BY	241-BY-111
BY	241-BY-112
C	241-C-101
C	241-C-102
C	241-C-103
C	241-C-104
C	241-C-105
C	241-C-106
C	241-C-107
C	241-C-108
C	241-C-109
C	241-C-110

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
C	241-C-111
C	241-C-112
C	241-C-201
C	241-C-202
C	241-C-203
C	241-C-204
S	241-S-101
S	241-S-102
S	241-S-103
S	241-S-104
S	241-S-105
S	241-S-106
S	241-S-107
S	241-S-108
S	241-S-109
S	241-S-110
S	241-S-111
S	241-S-112
SX	241-SX-101
SX	241-SX-102
SX	241-SX-103
SX	241-SX-104
SX	241-SX-105
SX	241-SX-106
SX	241-SX-107
SX	241-SX-108
SX	241-SX-109
SX	241-SX-110
SX	241-SX-111
SX	241-SX-112
SX	241-SX-113

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
SX	241-SX-114
SX	241-SX-115
T	241-T-101
T	241-T-102
T	241-T-103
T	241-T-104
T	241-T-105
T	241-T-106
T	241-T-107
T	241-T-108
T	241-T-109
T	241-T-110
T	241-T-111
T	241-T-112
T	241-T-201
T	241-T-202
T	241-T-203
T	241-T-204
TX	241-TX-101
TX	241-TX-102
TX	241-TX-103
TX	241-TX-104
TX	241-TX-105
TX	241-TX-106
TX	241-TX-107
TX	241-TX-108
TX	241-TX-109
TX	241-TX-110
TX	241-TX-111
TX	241-TX-112
TX	241-TX-113

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
TX	241-TX-114
TX	241-TX-115
TX	241-TX-116
TX	241-TX-117
TX	241-TX-118
TY	241-TY-101
TY	241-TY-102
TY	241-TY-103
TY	241-TY-104
TY	241-TY-105
TY	241-TY-106
U	241-U-101
U	241-U-102
U	241-U-103
U	241-U-104
U	241-U-105
U	241-U-106
U	241-U-107
U	241-U-108
U	241-U-109
U	241-U-110
U	241-U-111
U	241-U-112
U	241-U-201
U	241-U-202
U	241-U-203
U	241-U-204
Transfer Lines	
A	01A
A	01B
A	01C

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
A	03A
A	03B
A	03C
A	04B
A	04C
A	05B
A	05C
A	05D
A	06A
A	06B
A	06C
A	153A
A	241-A-152 DRAIN LINE
A	241-A-153 UNMARKED
A	241-A-153 UNMARKED
A	241-A-A L17 FLUSH LINE
A	241-A-A L8/6 FLUSH LINE
A	241-A-B R17 FLUSH LINE
A	241-A-B R6/8 FLUSH LINE
A	4001
A	4004
A	4530
A	8025-A
A	A-101 UNMARKED PURPLE
A	A-102 02A-U1 UNMARKED
A	A-102 02A-U7 UNMARKED
A	A-102 02B-U1 UNMARKED
A	A-102 02C-U1 UNMARKED
A	A-102 FLUSH LINE
A	A-102 SIDE 1 UNMARKED
A	A-102 SIDE 2 UNMARKED

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
A	A-102 SIDE 3 UNMARKED
A	A-103 UNMARKED PURPLE
A	A-104 UNMARKED PURPLE
A	A-350 OVERFLOW LINE
A	D-020
A	D-040
A	D-070
A	D-088
A	D-149
A	D-186
A	DR-300
A	DR-301
A	DR-304
A	DR-307
A	DR-315
A	DR-316
A	DR-317
A	E-006
A	E-167
A	F-241
A	F-274
A	F-377
A	F-429
A	F-719
A	F-791
A	G-057
A	G-180
A	G-212
A	LIQW-702
A	M-044
A	M-045

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
A	PW-481
A	R-165
A	R-345
A	SL-102
A	SL-104-A
A	SL-105-A
A	SL-106
A	SL-106-A
A	SL-107-A
A	SL-114
A	SN-202-A
A	SN-204-A
A	SN-205-A
A	SN-206-A
A	SN-207-A
A	SN-215-A
A	SN-216-A
A	SN-219-A
A	SN-220-A
A	SN-235
A	SN-650
A	U-039
A	U-136
A	V004
A	V005
A	V006
A	V007
A	V008
A	V021
A	V-021
A	V027

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
A	V028
A	V032
A	V038
A	V039
A	V040
A	V041
A	V042
A	V043
A	V044
A	V045
A	V046
A	V047
A	V048
A	V049
A	V052
A	V061
A	V714-A
A	V718-A
A	V720
AX	241-AX-A FLUSH LINE
AX	241-AX-B FLUSH LINE
AX	326
AX	4001-XX
AX	4002
AX	4003
AX	4004-XX
AX	4005
AX	4006
AX	4007
AX	4009
AX	4010

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
AX	4011
AX	4012
AX	4013
AX	4014
AX	4016
AX	4017
AX	4017-XX
AX	4018
AX	4018-XX
AX	4019
AX	4020
AX	4021
AX	4021-AX-151
AX	4021-BYPASS
AX	4022
AX	4026
AX	4027
AX	4030
AX	4101
AX	4102
AX	4103
AX	4104
AX	4105
AX	4106
AX	4107
AX	4507
AX	4508
AX	4510
AX	4511
AX	8021
AX	8022

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
AX	8023
AX	8024
AX	8025
AX	8026
AX	8027
AX	8028
AX	8032-AX
AX	8033
AX	8034
AX	8036
AX	8039
AX	8040
AX	8041-AX
AX	8042
AX	8043
AX	8044-AX
AX	8061
AX	8062
AX	8063
AX	8064
AX	806-AX
AX	814-AX
AX	8656
AX	A101
AX	A102
AX	A103
AX	A104
AX	A106
AX	A108
AX	AX-101 UNMARKED
AX	AX-101 UNMARKED RED

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
AX	AX-103 UNMARKED
AX	B101
AX	B102
AX	B103
AX	B104
AX	B106
AX	B108
AX	C101
AX	C102
AX	C103
AX	C104
AX	DR-325
AX	F102
AX	SL-100-AX
AX	SL-101-AX
AX	SL-108-AX
AX	SL-109-AX
AX	SL-110-AX
AX	SL-111-AX
AX	SL-112-AX
AX	SL-502
AX	SN-200-AX
AX	SN-201-AX
AX	SN-208-AX
AX	SN-209-AX
AX	SN-210-AX
AX	SN-211-AX
AX	SN-212-AX
AX	SN-247-AX
AX	SN-400
AX	V113

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
AX	V713-AX
AX	V714-AX
AZ	837
B	108-B
B	223
B	223-offshoot
B	224
B	225
B	226
B	227
B	228
B	231
B	232
B	233
B	234-B
B	241-B-154 DRAIN LINE
B	241-B-252 DRAIN LINE
B	244
B	4 MISC
B	822-B
B	823
B	824
B	826
B	827
B	829
B	833
B	834
B	9002
B	9006
B	9010
B	9012

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
B	9014
B	9017
B	9020
B	9025
B	9031
B	9032
B	9035
B	9037
B	9038
B	9041
B	9044
B	9047
B	9053
B	9624
B	9630
B	9636
B	B-105 UNLABELED GREEN
B	B-106 UNLABELED BLUE
B	B-106 UNLABELED RED
B	B-108 UNMARKED
B	B-109 UNMARKED
B	B-111 UNMARKED
B	B-112 UNMARKED
B	B-201 UNLABELED GREEN
B	BWCTL
B	BWCTL-M2
B	PL2021
B	V130
B	V200
B	V2001
B	V201

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
B	V203
B	V204
B	V208
B	V209
B	V210
B	V211
B	V213
B	V214
B	V215
B	V225
B	V230
B	V231
B	V233
B	V234
B	V235
B	V236
B	V237
B	V238
B	V240
B	V242
B	V243
B	V245
B	V246
B	V247
B	V250
B	V252
B	V253
B	V260
B	V261
B	V262
B	V263

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
B	V266
B	V267
B	V268
B	V271
B	V272
B	V273
B	V285
B	V290
B	V291
B	V292
B	V293
B	V294
B	V295
B	V296
B	V297
B	V304
B	V305
B	V307
B	V308
B	V309
B	V310
B	V311
B	V312
B	V313
B	V314
B	V315
B	V319
B	V329
B	V330
B	V331
B	V332

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
B	V333
B	V334
B	V335
B	V336
B	V337
B	V339
B	V340
B	V341
B	V342-B
B	V743
BX	241-BX-153 UNMARKED
BX	241-BXR-152 UNMARKED
BX	241-BXR-154 UNMARKED
BX	6443
BX	815
BX	816
BX	817
BX	819
BX	820-BX
BX	9202
BX	9206
BX	9210
BX	9214
BX	9217
BX	9225
BX	9231
BX	9232
BX	9235
BX	9236
BX	9237
BX	9237-NC

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
BX	9238
BX	9241
BX	9244
BX	9247
BX	9256
BX	9263
BX	9280
BX	92800
BX	9402
BX	9406
BX	9414
BX	9417
BX	9420
BX	9431
BX	9432
BX	9435
BX	9437
BX	9438
BX	9441
BX	9444
BX	9447
BX	9453
BX	9463
BX	9465
BX	9470
BX	9477
BX	9601
BX	9604
BX	9613
BX	9616
BX	9622

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
BX	9644
BX	9647
BX	9648
BX	9719
BX	9765
BX	BX-101 UNMARKED GREEN
BX	BX-102 UNMARKED GREEN
BX	BX-104 UNMARKED GREEN
BX	BX-105 UNMARKED GREEN
BX	BX-107 UNMARKED GREEN
BX	BX-108 UNMARKED RED
BX	BX-110 UNMARKED RED
BX	BX-111 UNMARKED
BX	SN-213-BX
BX	SN-214-BX
BX	SN-215-BX
BX	SN-216-BX
BX	SN-217-BX
BX	SN-230-BX
BX	V2000
BX	V282
BX	V283
BX	V284
BX	V289
BX	V316
BX	V317
BX	V318
BX	V323
BX	V338
BX	V342-BX
BX	V343

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
BX	V344
BX	V345
BX	V346
BX	V347
BX	V348
BX	V349
BX	V350
BX	V351
BX	V352
BX	V353
BX	V355
BY	6202
BY	6206
BY	6210
BY	6214
BY	6217
BY	6220
BY	6232
BY	6235
BY	6238
BY	6241
BY	6244
BY	6247
BY	6249
BY	6307
BY	6402
BY	6406
BY	6410
BY	6414
BY	6417
BY	6420

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
BY	6432
BY	6435
BY	6438
BY	6441
BY	6444
BY	6447
BY	6449
BY	7406
BY	7410
BY	7412
BY	7417
BY	7420
BY	7425
BY	7431
BY	7435
BY	7437
BY	7438
BY	7441
BY	7444
BY	7447
BY	7507
BY	800
BY	801
BY	804
BY	805
BY	806-BY
BY	807
BY	808
BY	809
BY	810
BY	813

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
BY	814-BY
BY	821
BY	822-BY
BY	9212
BY	9249
BY	9412
BY	9425
BY	9449
BY	9623
BY	9625
BY	9626
BY	9631
BY	9632
BY	9633
BY	BY-101 UNMARKED RED
BY	BY-102 UNMARKED
BY	BY-103 OVERGROUND
BY	BY-104 UNMARKED GREEN
BY	BY-105 OVERGROUND
BY	BY-105 UNMARKED
BY	BY-105 UNMARKED RED
BY	BY-106 UNMARKED GREEN
BY	BY-108 UNMARKED RED
BY	BY-109 UNMARKED GREEN
BY	BY-109 UNMARKED
BY	BY-111 UNMARKED
BY	BY-111 UNMARKED RED
BY	BY-112 UNMARKED
BY	PL-P11
BY	PL-P22
BY	SN-112

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
BY	SN-200-BY
BY	SN-201-BY
BY	SN-202-BY
BY	SN-203-BY
BY	SN-204-BY
BY	SN-205-BY
BY	SN-206-BY
BY	SN-207-BY
BY	SN-208-BY
BY	SN-209-BY
BY	SN-211-BY
C	241-C-151 UNMARKED
C	241-C-152 UNMARKED
C	241-C-153 UNMARKED
C	241-C-154 UNMARKED RED
C	241-C-252 UNMARKED
C	241-CR-151 UNMARKED
C	8002
C	8006
C	8010
C	8012
C	8014
C	8017
C	8020
C	8025-C
C	8031
C	8032-C
C	8035
C	8037
C	8038
C	8041-C

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
C	8044-C
C	8047
C	8107
C	8202
C	8206
C	8210
C	8212
C	8214
C	8217
C	8220
C	8225
C	8231
C	8232
C	8235
C	8237
C	8238
C	8241
C	8244
C	8247
C	8552
C	8555
C	8601
C	8616
C	8618
C	8622
C	8624
C	8625
C	8630
C	8631
C	8636
C	8648

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
C	8900
C	C-101 UNMARKED BLACK
C	C-101 UNMARKED GREEN
C	C-101 UNMARKED RED
C	C-102 UNMARKED BLACK
C	C-102 UNMARKED RED
C	C-103 SIDE 1 UNMARKED
C	C-103 SIDE 1 UNMARKED
C	C-103 SIDE 1 UNMARKED
C	C-103 SIDE 1 UNMARKED
C	C-103 SIDE 2 UNMARKED
C	C-103 SIDE 2 UNMARKED
C	C-103 SIDE 2 UNMARKED
C	C-103 SIDE 3 UNMARKED
C	C-103 UNMARKED PURPLE
C	C-103 UNMARKED RED
C	C-104 SIDE UNMARKED
C	C-104 UNMARKED BLACK
C	C-104 UNMARKED GREEN
C	C-104 UNMARKED RED
C	C-105 UNMARKED GREEN
C	C-105 UNMARKED RED
C	C-106 UNMARKED RED
C	C-107 UNMARKED BLACK
C	C-107 UNMARKED RED
C	C-108 UNMARKED GREEN
C	C-109 SIDE UNMARKED
C	C-109 UNMARKED GREEN
C	C-110 UNMARKED PURPLE
C	C-110 UNMARKED RED
C	C-111 UNMARKED PURPLE

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
C	C-111 UNMARKED RED
C	C-112 UNMARKED GREEN
C	C-112 UNMARKED PURPLE
C	C-201 UNMARKED BLACK
C	C-201 UNMARKED RED
C	C-202 UNMARKED BLACK
C	C-202 UNMARKED RED
C	C-203 UNMARKED BLACK
C	C-203 UNMARKED RED
C	C-204 UNMARKED BLACK
C	C-204 UNMARKED RED
C	DR-302
C	SL-100-C
C	SN-200-C
C	SN-275-C
C	V050
C	V051
C	V100
C	V1000
C	V1001
C	V1002
C	V101
C	V-101
C	V102
C	V103
C	V104
C	V107
C	V108
C	V109
C	V110
C	V115

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
C	V118
C	V119
C	V120
C	V121
C	V122
C	V136
C	V137
C	V138
C	V139
C	V140
C	V141
C	V142
C	V143
C	V144
C	V145
C	V147
C	V148
C	V149
C	V150
C	V156
C	V157
C	V158
C	V159
C	V160
C	V161
C	V162
C	V163
C	V172
C	V175
C	V228
C	V839

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
C	V843
ER	9653-ER
ER	V219
ER	V365
S	1006
S	1045
S	1115
S	1140
S	1145
S	1238
S	1540
S	1541
S	234-S
S	235
S	240-S-152 DRAIN LINE
S	241-S-151 DRAIN LINE
S	241-S-A DRAIN LINE
S	241-S-A L17 FLUSH LINE
S	241-S-A L6/8 FLUSH LINE
S	241-S-A OVERGROUND
S	241-S-A UNMARKED
S	241-S-B DRAIN LINE
S	241-S-B OVERGROUND
S	241-S-B R17 FLUSH LINE
S	241-S-B R6/8 FLUSH LINE
S	241-S-B UNMARKED
S	3130
S	3591
S	3592
S	3603
S	3610

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
S	3635
S	3658
S	3666
S	4242
S	JET PUMP REC LINE
S	S-101 UNMARKED RED
S	S-102 02A-B UNMARKED
S	S-102 02A-B-B UNMARKED
S	S-102 DRAIN LINE
S	S-102 SIDE DRAIN LINE
S	S-102 UNMARKED BLACK
S	S-103 DRAIN LINE
S	S-103 SIDE 1 UNMARKED
S	S-103 SIDE 2 UNMARKED
S	S-103 SIDE 3 UNMARKED
S	S-103 SIDE 4 UNMARKED
S	S-107 SIDE 1 DRAIN LINE
S	S-107 SIDE 2 DRAIN LINE
S	S-107 UNMARKED BLACK
S	S-109 OVERGROUND
S	S-109 SIDE 1 UNMARKED
S	S-109 SIDE 2 UNMARKED
S	S-302A DRAIN LINE
S	S-302B DRAIN LINE
S	S-302B UNMARKED BLACK
S	SL-113-S
S	SL-115
S	SL-116
S	SL-119
S	SL-120
S	SL-121

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
S	SL-122
S	SL-123
S	SL-124
S	SL-125
S	SL-127
S	SL-128
S	SL-134
S	SL-138
S	SL-139
S	SL-139-XX
S	SL-140
S	SL-175
S	SL-176
S	SN200
S	SN-200-S
S	SN-201-S
S	SN-213-S
S	SN-214-S
S	SN-215-S
S	SN-216-S
S	SN-216-XX
S	SN-219-S
S	SN-220-S
S	SN-221
S	SN-222
S	SN-223
S	SN-224
S	SN-225
S	SN-226
S	SN-227
S	SN-228

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
S	SN-239
S	SN-242
S	SN-245
S	SN-246
S	SN-246-YY
S	SN-247-S
S	SN-248
S	SN249
S	SN-249
S	SN-275-S
S	SN-276
S	SN-281
S	SN-282
S	V5006
S	V508
S	V509
S	V510
S	V512
S	V513
S	V514
S	V515
S	V516
S	V517
S	V517-XX
S	V519
S	V521
S	V522
S	V533
S	V534
S	V535
S	V536

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
S	V537
S	V538
S	V539
S	V540
S	V541
S	V542
S	V543
S	V544
S	V547
S	V548
S	V550
S	V552
S	V553
S	V554
S	V555
S	V560
S	V561
S	V562
S	WT-SNL-5350
S	WT-SNL-5351
SX	103
SX	105
SX	107
SX	108-SX
SX	109
SX	110
SX	111
SX	112
SX	113
SX	114
SX	115

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
SX	241-SX-151 UNMARKED
SX	241-SX-A FLUSH
SX	241-SX-A OVERGROUND
SX	241-SX-A UNMARKED
SX	241-SX-A UNMARKED
SX	241-SX-B FLUSH
SX	312
SX	318
SX	SL-117
SX	SL118
SX	SL-118
SX	SL-129
SX	SL-130
SX	SL-131
SX	SL-132
SX	SL-133
SX	SL-137
SX	SN-217-SX
SX	SN-218
SX	SN-229
SX	SN-230-SX
SX	SN-231
SX	SN-232
SX	SN-233
SX	SN-241
SX	SX-101 OVERGROUND
SX	SX-103 OVERGROUND
SX	SX-105 OVERGROUND
SX	SX-105 UNMARKED BLACK
SX	SX-106 UNMARKED BLACK
SX	V456-XX

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
SX	V526
SX	V527
SX	V528
SX	V529
SX	V530
SX	V563
SX	V564
SX	V566
SX	V569
SX	V570
SX	V571
SX	V572
SX	V574
SX	V575
SX	V576
SX	V577
SX	V578
SX	V579
SX	V580
SX	V581
SX	V582
SX	V583
SX	V584
SX	V591
SX	V595
SX	V762
T	5185-T
T	6002
T	6006
T	6010
T	6012

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
T	6012-TR
T	6014
T	6017
T	6020
T	6025
T	6031
T	6032
T	6035
T	6037
T	6038
T	6041
T	6044
T	6047
T	6053
T	6160
T	6165
T	6170
T	6172
T	703
T	7624-PURPLE
T	7624-RED
T	7624-TR
T	7630
T	7644
T	T-101 SIDE 1 UNMARKED
T	T-101 SIDE 1 UNMARKED
T	T-101 SIDE 2 UNMARKED
T	T-101 SIDE 2 UNMARKED
T	T-101 SIDE 3 UNMARKED
T	T-101 SIDE UNMARKED
T	T-101 UNMARKED GREEN

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
T	T-102 UNMARKED GREEN
T	T-104 UNMARKED PURPLE
T	T-105 UNMARKED GREEN
T	T-107 SIDE UNMARKED
T	T-107 UNMARKED RED
T	T-108 UNMARKED PURPLE
T	T-109 UNMARKED PURPLE
T	T-110 UNMARKED GREEN
T	T-110 UNMARKED RED
T	T-111 UNMARKED RED
T	V399
T	V405
T	V411
T	V445
T	V601
T	V653
T	V654
T	V657
T	V658
T	V660
T	V661
T	V663
T	V664
T	V667
T	V668
T	V669
T	V671
T	V675
T	V676
T	V677
T	V689

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
T	V690
T	V691
T	V692
T	V695
T	V696
T	V697
T	V698
T	V699
T	V700
T	V701
T	V702
T	V707
T	V711
T	V712
T	V713-T
T	V714-T
T	V715
T	V716-T
T	V717
T	V718-T
T	V727
T	V730
T	V732
T	V734
T	V735
T	V737
T	V738
T	V827
T	V831-T
TX	202
TX	203

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
TX	241-TX-153 1 DRAIN LINE
TX	241-TX-153 2 DRAIN LINE
TX	241-TX-154 DRAIN LINE
TX	241-TX-155 DRAIN LINE
TX	241-TXR-151 DRAIN LINE
TX	4851
TX	4859
TX	5185-TX
TX	5191
TX	5193
TX	6012-TXR
TX	625
TX	7002
TX	7006
TX	7010
TX	7012
TX	7014
TX	7017
TX	7020
TX	7025
TX	7031
TX	7032
TX	7035
TX	7037
TX	7038
TX	7041
TX	7044
TX	7047
TX	706
TX	707
TX	708

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
TX	709
TX	710
TX	711
TX	714
TX	715
TX	7159
TX	7162
TX	7164
TX	7166
TX	717
TX	718
TX	720
TX	7202
TX	7206
TX	721
TX	7210
TX	7212
TX	7214
TX	7217
TX	7220
TX	7225
TX	723
TX	7231
TX	7232
TX	7235
TX	7237
TX	7238
TX	724
TX	7241
TX	7244
TX	7247

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
TX	724-TX
TX	730
TX	731
TX	7359
TX	7362
TX	7364
TX	7366
TX	750
TX	7601
TX	7609
TX	7613
TX	7616
TX	7622
TX	7624-TXR
TX	7625
TX	7626
TX	7631
TX	7632
TX	7636
TX	7647
TX	7648
TX	7653
TX	7759
TX	820-TX
TX	SN-200-TX
TX	SN-201-TX
TX	SN-203-TX
TX	SN-204-TX
TX	SN-205-TX
TX	SN-206-TX
TX	SN-207-TX

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
TX	SN-208-TX
TX	SN-209-TX
TX	SN-210-TX
TX	SN-211-TX
TX	SN-212-TX
TX	SN-213-TX
TX	SN-214-TX
TX	SN-215-TX
TX	TX-101 DRAIN LINE
TX	TX-105 DRAIN LINE
TX	TX-105 UNMARKED
TX	TX-106 UNMARKED GREEN
TX	TX-106 UNMARKED RED
TX	TX-107 UNMARKED
TX	TX-108 UNMARKED RED
TX	TX-109 UNMARKED
TX	TX-110 UNMARKED
TX	TX-111 UNMARKED
TX	TX-112 UNMARKED GREEN
TX	TX-113 UNMARKED GREEN
TX	TX-113 UNMARKED RED
TX	TX-114 UNMARKED GREEN
TX	TX-115 UNMARKED
TX	TX-115 UNMARKED GREEN
TX	TX-116 UNMARKED GREEN
TX	TX-302A UNMARKED
TX	V375
TX	V376
TX	V382
TX	V383
TX	V384

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
TX	V385
TX	V386
TX	V387
TX	V387-XX
TX	V388
TX	V388-XX
TX	V391
TX	V392
TX	V393
TX	V394
TX	V396
TX	V397
TX	V398
TX	V398-XX
TX	V401
TX	V402
TX	V402-XX
TX	V403
TX	V404
TX	V404-XX
TX	V406
TX	V406-XX
TX	V407
TX	V408
TX	V408-XX
TX	V409
TX	V410-TX
TX	V412
TX	V413
TX	V416
TX	V596

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
TX	V600
TX	V603
TX	V604
TX	V606
TX	V608
TX	V609
TX	V610
TX	V612
TX	V613
TX	V615
TX	V616
TX	V617
TX	V618
TX	V619
TX	V621
TX	V622
TX	V625
TX	V736
TX	V739
TX	V831-TX
TY	241-TY-153 DRAIN LINE
TY	704
TY	724-TY
TY	726
TY	727
TY	728
TY	TY-101 UNMARKED
TY	TY-102 UNMARKED RED
TY	TY-103 A UNMARKED RED
TY	TY-103 C UNMARKED RED
TY	TY-103 UNMARKED

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
TY	TY-105 UNMARKED GREEN
TY	TY-105 UNMARKED RED
TY	V402-SEG
TY	V406-SEG
TY	V408-SEG
TY	V597
TY	V629
TY	V644
TY	V645
TY	V648
TY	V649
U	241-U-151 UNMARKED
U	241-U-152 UNMARKED
U	241-U-153 UNMARKED
U	241-U-252 UNMARKED
U	241-U-A L17 FLUSH LINE
U	241-U-A L6/8 FLUSH LINE
U	241-U-A UNMARKED
U	241-U-A UNMARKED RED
U	241-U-B R17 FLUSH LINE
U	241-U-B R6/8 FLUSH LINE
U	241-U-C L17 FLUSH LINE
U	241-U-C R6/8 FLUSH LINE
U	241-U-C UNMARKED
U	241-U-C UNMARKED
U	241-U-D R17 FLUSH LINE
U	241-U-D R6/8 FLUSH LINE
U	241-UX-154 UNMARKED
U	244-UR L UNMARKED
U	244-UR M UNMARKED
U	244-UR TK-002 UNMARKED

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
U	244-UR UNMARKED
U	244-UR UNMARKED RED
U	4700
U	4701
U	4702
U	4878
U	4977
U	5002
U	5006
U	5012
U	5014
U	5025
U	5032
U	5035
U	5037
U	5038
U	5041
U	5053
U	5076
U	5202
U	5206
U	5212
U	5214
U	5225
U	5232
U	5235
U	5237
U	5238
U	5241
U	5307
U	5402

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
U	5406
U	5410
U	5412
U	5414
U	5417
U	5420
U	5425
U	5431
U	5432
U	5435
U	5437
U	5438
U	5441
U	5444
U	5447
U	5507
U	5601
U	5609
U	5613
U	5622
U	5624
U	5625
U	5626
U	5630
U	5631
U	5632
U	5644
U	5647
U	5648
U	5653
U	7765

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
U	K1 UNMARKED BLACK
U	SL-100-U
U	SL-101-U
U	SL-103
U	SL-104-U
U	SL-105-U
U	SL-106-U
U	SL-107-U
U	SL-108-U
U	SL-109-U
U	SL-110-U
U	SL-111-U
U	SL-112-U
U	SN-102
U	SN-202-U
U	SN-203-U
U	SN-204-U
U	SN-205-U
U	SN-206-U
U	SN-207-U
U	SN-209-U
U	SN-210-U
U	SN-211-U
U	SN-212-U
U	SN-213-U
U	SN-215-U
U	SN-216-U
U	SN-264
U	SN-265
U	SN-266
U	U-102 02A UNMARKED

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
U	U-102 02A-C UNMARKED
U	U-102 UNMARKED PURPLE
U	U-103 03B-A UNMARKED
U	U-103 03B-U2 UNMARKED
U	U-103 UNMARKED BLACK
U	U-105 05C-B 1 UNMARKED
U	U-105 05C-B 2 UNMARKED
U	U-105 05C-C 1 UNMARKED
U	U-105 05C-C 2 UNMARKED
U	U-105 UNMARKED BLACK
U	U-105 UNMARKED PURPLE
U	U-106 OVERGROUND
U	U-106 UNMARKED PURPLE
U	U-107 07A-B UNMARKED
U	U-107 07C UNMARKED
U	U-107 UNMARKED PURPLE
U	U-108 08A-B UNMARKED
U	U-108 08A-C UNMARKED
U	U-108 UNMARKED PURPLE
U	U-109 OVERGROUND
U	U-109 UNMARKED PURPLE
U	U-111 11A-D 1 DRAIN LINE
U	U-111 11A-D 2 DRAIN LINE
U	U-111 11A-D 3 DRAIN LINE
U	U-111 11A-E DRAIN LINE
U	U-112 UNMARKED RED
U	UX-302A UNMARKED
U	V362
U	V363
U	V364
U	V366

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
U	V374
U	V379
U	V410-U
U	V426
U	V427
U	V428
U	V450
U	V452
U	V453
U	V455
U	V456
U	V458
U	V459
U	V460
U	V465
U	V466
U	V467
U	V470
U	V471
U	V472
U	V487
U	V488
U	V489
U	V490
U	V491
U	V492
U	V493
U	V494
U	V716-U
Ventilation Systems	
B	241-B-201-Vent

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
B	241-B-202-Vent
B	241-B-203-Vent
B	241-B-204-Vent
Valve Pits	
A	241-A-A
A	241-A-B
AX	241-AX-501
AX	241-AX-A
AX	241-AX-B
BY	241-BY-109-P
C	241-C
C	Hot Semi Works VP
S	241-S-110A
S	241-S-111A
S	241-S-112A
S	241-S-151-P
S	241-S-A
S	241-S-B
S	241-S-C
S	241-S-D
SX	241-SX-110A
SX	241-SX-111A
SX	241-SX-112A
SX	241-SX-113A
SX	241-SX-114A
SX	241-SX-115A
SX	241-SX-A
SX	241-SX-B
T	241-T-06
T	241-T-08
T	241-T-110-P

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
T	241-T-112-P
TX	241-TX-110A
TX	241-TX-111A
TX	241-TX-112A
TX	241-TX-113A
TX	241-TX-114A
TX	241-TX-115A
TX	241-TX-116A
TX	241-TX-117A
TX	241-TX-118A
TX	241-TX-14B
TX	241-TX-15B
TX	241-TX-15X
TY	241-TY-06
U	241-U-02B-P
U	241-U-07B-P
U	241-U-110A
U	241-U-110B
U	241-U-111A
U	241-U-111B
U	241-U-112-P
U	241-U-201-P
U	241-U-202-P
U	241-U-203-P
U	241-U-204-P
U	241-U-A
U	241-U-B
U	241-U-C
U	241-U-D
U	241-UR-09A
U	241-UR-09B

Table B-7. Single Shell Tank System (64 Pages).

Farm	Designation
U	241-UX-154-P
WS	241-WS-3
Waste Transfer Vaults	
AZ	244-AR Vault
AZ	244-AR-001
AZ	244-AR-002
AZ	244-AR-003
AZ	244-AR-004
BX	244-BXR Vault
BX	244-BXR-001
BX	244-BXR-002
BX	244-BXR-003
BX	244-BXR-011
C	244-CR Vault
C	244-CR-001
C	244-CR-002
C	244-CR-003
C	244-CR-011
S	231-W-151 Vault
S	231-W-151-001
S	231-W-151-002
TX	244-TXR Vault
TX	244-TXR-001
TX	244-TXR-002
TX	244-TXR-003
U	244-UR Vault
U	244-UR-001
U	244-UR-002
U	244-UR-003
U	244-UR-004

Table B-8. Estimated Surface Area and Waste Volume Summary.

Total Surface Area (ft^2)	Total Volume (Gallons)	Number of Components
Caissons And Covered Saltwell Caissons		
695	6.75	18
Distribution Pits		
1,256	12.20	14
Flush Pit		
		1
Heel Pits		
2,143	20.82	25
Pump Pits		
21,171	205.75	114
Diversion Boxes		
17,128	49.93	59
Sluice Pits		
14,462	140.55	74
Valve Pits		
1,899	18.45	17
Vaults		
100	0.97	1
Piping		
Total Absorption Gallons:	**Total Fixed Waste:**	
695.95	157.96	
Total Residual Gallons:	**Total Piping Gallons:**	**Number of Lines:**
305.47	1159.39	1414

B2.5 INACTIVE MISCELLANEOUS UNDERGROUND STORAGE TANK/VAULT INVENTORY ESTIMATES

Table B-9 lists for each IMUST and vault tank the currently accepted liquid, solid, and total volumes. Some tanks contain an unknown quantity of waste; these tanks are identified and do not contribute to the overall volume estimate. Similar to the Waste Inventory Estimate by SST Component Report, the waste form is not known for all tanks. In these cases, no attempt is made to arbitrarily distinguish between solid and liquids; the total value is presented with no breakout for composition. This data base report will be used for the alternatives analysis to determine the priority of action required for the various tanks.

Table B-9. Miscellaneous Underground Storage Tank and Vault Tank Waste. (3 Sheets)

Designation	Farm	Group	Capacity	Waste Volume (Gallons)	Solid Volume (Gallons)	Liquid Volume (Gallons)
200-W-7	S	5	550	Unknown	Unknown	Unknown
216-BY-201	BY	3	11,220	Unknown	Unknown	Unknown
231-W-151 Vault			*	1	1	0
231-W-151-001	S	5	4,000	1,4300	0	1,430
231-W-151-002	S	5	950	960	10	950
240-S-302	S	5	1,7684	2,276	2276	0
241-AX-151-CT	AX	1	11,000	Unknown	Unknown	2,946
241-B-301B	B	2	36,000	22,250	21,660	590
241-B-302B	B	2	17,684	4,930	690	4,240
241-BX-302A	BX	3	17,684	835	835	0
241-BX-302B	BX	3	11,389	1,044	950	94
241-BX-302C	BX	3	11,378	863	635	228
241-BY-ITS2-Tank-2	BY	3	2,742	Unknown	Unknown	Unknown
241-C-301	C	4	36,000	10,486	9,016	1,470
241-ER-311A	ER	2	27,700	Unknown	Unknown	Unknown
241-S-302B	S	5	14,314	0	0	0
241-SX-302	SX	5	17,684	1,355	1,050	305
241-T-301B	T	6	36,000	22,246	21,658	588
241-TX-302A	TX	5	17,684	2,480	2,450	30
241-TX-302B	TX	5	17,684	1,600		
241-TX-302BR	TX	5	12,000	1,140	1,090	50
241-TX-302XB	TX	5	14314	353	108	245
241-TY-302A	TY	7	17,684	450	450	0

Table B-9. Miscellaneous Underground Storage Tank and Vault Tank Waste. (3 Sheets)

Designation	Farm	Group	Capacity	Waste Volume (Gallons)	Solid Volume (Gallons)	Liquid Volume (Gallons)
241-TY-302B	TY	7	14,314	0	0	0
241-Z-8	Z	0	15,435	500	500	0
242-T-135	T	6	830	Unknown	Unknown	Unknown
242-TA-R1	T	6	4,200	Unknown	Unknown	Unknown
244-AR Vault	AZ	1	*	3,000	0	3,000
244-AR-001	AZ	1	43,000	1,300	100	1,200
244-AR-002	AZ	1	43,000	12,500	400	12,100
244-AR-003	AZ	1	4,700	2,000	50	1,950
244-AR-004	AZ	1	4,700	250	50	200
244-BXR Vault	BX	3	*	12,801	11,923	878
244-BXR-001	BX	3	50,000	7,215	7,215	0
244-BXR-002	BX	3	15,000	2,185	1,805	380
244-BXR-003	BX	3	15,000	1,805	1,449	356
244-BXR-011	BX	3	50,000	7,118	7,020	98
244-CR Vault	C	4	*	3,400	0	3,400
244-CR-001	C	4	40,000	2,000		
244-CR-002	C	4	15,000	1,500		
244-CR-003	C	4	15,000	4,000	4,000	
244-CR-011	C	4	40,000	35,683	14,683	21,000
244-TXR Vault	TX	5	*	47	24	23
244-TXR-001	TX	5	50,000	2,340	2,291	49
244-TXR-002	TX	5	15,000	2,945	2,945	0
244-TXR-003	TX	5	15,000	6,460	6,460	0
244-UR Vault	U	5	*	11,002	2,595	8,407
244-UR-001	U	5	50,000	2,262	1,872	390
244-UR-002	U	5	15,000	2,874	2,304	570
244-UR-003	U	5	15,000	1,568	1,568	0
244-UR-004	U	5	8,230	0	0	0

Notes:

* Vault cells were not designed for storage and hence do not have a capacity.

** Total Waste volume for the tanks in 231-W-151 are listed as "unknown" in HNF-EP-0182, Rev. 167, however, HNF-1566 identifies the volumes listed in Table B-9.

*** Tanks 241-A-302A, 241-A-302B and 241-UX-702A have been identified in RPP-10466, however, are not included in this analysis because they are RCRA past practice units.

B2.6 SINGLE-SHELL TANK SYSTEM DESCRIPTION

The database described in Appendix C includes a SST System Description report that provides the data and information collected for each component. The database report is approximately 2,400 pages long and to conserve space is not included in this document.

APPENDIX C

SYSTEM DESCRIPTION DATABASE

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C1.0 INTRODUCTION

A database was developed to store the voluminous data associated with the single-shell tank (SST) system and allow for summary analysis of various facets. This appendix describes the structure of the database. The first portion of this appendix describes the assumptions and limitations of the database. The second portion details the various tables, their associated fields, and the relationships between the tables.

C2.0 FUNDAMENTAL ASSUMPTIONS

This section describes some of the fundamental assumptions associated with the data in the database. These assumptions permeate the entire database and manifest themselves in the output as detailed in Appendix B. A thorough understanding of the assumptions presented here will allow a user to more accurately glean information from the efforts expended during the compilation of this SST 5-Step Process.

C2.1 VALIDITY OF THE SOURCES OF INFORMATION

Not all of the data in the database has been validated. During the compilation phase, various sources were reviewed that contained conflicting information. Although no effort has been made to resolve these differences, the sources reviewed have been included in the reference section for each individual component (Appendix F, System Assessment document). The historical notes and operational history encapsulate the information in the sources encountered.

C2.2 INHERENT FLEXIBILITY

The database is designed to allow for maximum flexibility for future use. The primary example of this flexibility is the ability of the user to define queries based on required data needs as provided by the Graphical User Interface. In addition to the ability to create specific queries, the data has been partitioned to allow for easy update (e.g., if a component is moved from the SST system to the double-shell tank system, the user can quickly input this change and it will permeate all subsequent reports).

User names and passwords have been implemented to safeguard the underlying dataset.

C3.0 DATABASE TABLES AND FIELDS

The purpose of this section is to describe the various tables and the data structure implemented as the foundation of the database. Each of the following subsections details the various fields contained within a table. Included in the subsections are the specific database field names. Adjacent to the field name is the field type that identifies the type of data contained in the specific field. Typically, the field type contains a series of words, identified as either a text or memo field type. The other common field type contains a series of numbers identified as integers. The field size indicates the number of characters capable of being contained within the data field. The field description expands on the field name and provides a more intuitive description of the database data element.

C3.1 CONSTRUCTION DATA

Table C-1 holds construction information for the various system designation identifiers. This table has a one-to-one relationship with the System table.

Table C-1. Construction.

Field Name	Field Type	Field Size	Field Description
Designation	Text	50	Tank farm ID
YearConst	Text	25	Year of construction
YearRemoved	Text	25	Year removed from service
Capacity	Long Integer	8	Capacity (gallons)
Diameter	Long Integer	8	Diameter (feet)
ConstMat	Text	50	Construction materials
Depth	Long Integer	8	Depth below surface (feet)
Height	Long Integer	8	Height of facility (feet)
Length	Long Integer	8	Length of facility (feet)
Width	Long Integer	8	Width of facility (feet)
LiquidDepth	Long Integer	8	Liquid depth (feet)
FloodDepth	Long Integer	8	Liquid flood depth (feet)
Surface Area	Long Integer	4	Wetted surface area (square feet)
Orientation	Text	5	Orientation (H/V) H- Horizontal; V-Vertical
PhysicalLocation	Text	150	Location of the facility

C3.2 HISTORICAL DATA

Table C-2 holds historical information for the various system designation identifiers. This table has a one-to-one relationship with the System table.

Table C-2. Hist

Field Name	Field Type	Field Size	Field Description
Designation	Text	50	Tank farm ID
HistNotes	Memo	64K	Historical notes

C3.3 MISCELLANEOUS DATA

Table C-3 holds information pertaining to waste producers, status of isolation efforts, integrity information, and expected future use. This table has a one-to-one relationship with the System table.

Table C-3. Info1.

Field Name	Field Type	Field Size	Field Description
Designation	Text	50	Tank farm ID
WasteProd	Text	50	Waste producer
SecCon	Yes/No	1	Secondary containment present (Y/N)
Failed	Yes/No	1	Failed system (Y/N)
Stable	Yes/No	1	Stabilized system (Y/N)
Isolated	Yes/No	1	Isolated from the system (Y/N)
Ventilation	Text	10	Ventilation system (Forced/Passive)
IsolatedH2O	Text	3	Isolated from H2O ingress (Y/N/UNK)
Monitor	Text	150	Monitoring systems present (none, leak, level, thermocouple, etc.)
Intrusion	Text	3	Intrusion prevention (Y/N/UNK)
Drain	Text	10	Drain present (Y/N/Sealed)
Future	Text	3	Future use planned (Y/N/UNK)

C3.4 PIPELINE SPECIFICATIONS

Table C-4 holds information pertaining to specific transfer piping. Piping designation is forced to be unique and contained within the Designation field. This table has a one-to-one relationship with the System table.

Table C-4. Pspec.

Field Name	Field Type	Field Size	Field Description
Designation	Text	50	Tank farm ID
Composition	Text	50	Pipe composition (carbon steel, stainless steel, clay, other)
Length	Long Integer	8	Length of piping (feet)
Status	Text	50	Status of pipeline (active/inactive/blanked/failed)
Burial	Text	50	Type of burial (direct/encased)
Type	Text	25	Type of piping (transfer/overflow/drain)

C3.5 TANK INVENTORY

Table C-5 contains the best-basis inventory (BBI) data from the TWINS database. For each tank, a listing of the estimated inventory is provided. This table has a one-to-many relationship with the System table.

Table C-5. Inventory.

Field Name	Field Type	Field Size	Field Description
Tank Name	Text	255	Tank identification number
Baseline Status	Text	255	BBI baseline date
Analyte	Text	255	Constituent
Waste Phase/Type	Text	255	Phase (saltcake, sludge, supernate)
Inventory	Long Integer	8	Quantity of inventory
Inventory Units	Text	255	Units for quantity of inventory
Basis	Text	255	Engineer judgment
Inventory Formula	Text	255	Formula used to derive inventory
Inventory Calculation	Text	255	Values input into the formula
Density	Long Integer	8	Density of the analyte
Density Units	Text	255	Units for density
Volume	Long Integer	8	Waste volume of tank
Volume Units	Text	255	Units for volume
Concentration	Long Integer	8	Concentration of the analyte
Concentration Units	Text	255	Units for concentration
Decay Date	Text	255	Date when radioactivity of radionuclide elements was calculated
Best Basis Derivation	Text	255	Database containing original BBI

Note: BBI = best-basis inventory.

C3.6 TANK INVENTORY

Table C-6 contains the estimated waste constituents by SST component. This table has a one-to-one relationship with the System table.

Table C-6. Waste 1.

Field Name	Field Type	Field Size	Field Description
Designation	Text	50	Designation identification number
WasteVol	Long Integer	8	Estimated waste volume (gal)
SolidVol	Long Integer	4	Estimated solid volume (gal)
LiquidVol	Long Integer	4	Estimated liquid volume (gal)

C3.7 MASTER SYSTEM DATA

Table C-7 contains the complete system list of components. This table has a one-to-many relationship with the System table.

Table C-7. System.

Field Name	Field Type	Field Size	Field Description
Farm	Text	5	Tank farm ID
Designation	Text	50	System designation ID
Type	Text	10	System component type (SST, VP, FP, WTV, SDB, FAC, etc.)
Active/Inactive	Text	2	Is this an active or inactive component/system
Phase	Long Integer	4	Phase number (1, 2, 3, ...)
Grouping	Long Integer	4	Waste calculation group number (1-7)
SST	Yes/No	1	Part of the SST system (Y/N)
DST	Yes/No	1	Part of the DST system (Y/N)
Other	Yes/No	1	Not in the SST or DST system (Y/N)

Notes:

DST = double-shell tank.
SST = single-shell tank.

C3.8 WASTE MANAGEMENT AREA DATA

Table C-8 contains the operational units. This table has a one-to-many relationship with the System table.

Table C-8. WMA.

Field Name	Field Type	Field Size	Field Description
Designation	Text	50	System designation ID
OpUnit	Text	50	Operable unit
SiteCode	Text	50	Site code
Description	Text	255	Description of the site

C3.9 PIPELINE CONNECTING FACILITIES

Table C-9 contains the connecting facilities for each transfer line. This table has a one-to-many relationship with the System table.

Table C-9. Cfac.

Field Name	Field Type	Field Size	Field Description
Designation	Text	50	System designation ID
CFac	Text	50	Connecting facility
Direction	Text	5	Direction (from/to)
Port	Text	30	Port ID (U1, L1, Side, etc.)

C3.10 REFERENCE LISTING

Table C-10 contains the references used by component. Data in this table constitutes the bibliography for the SST System Description. This table has a one-to-many relationship with the System table.

Table C-10. Ref.

Field Name	Field Type	Field Size	Field Description
Designation	Text	50	System designation ID
Reference	Text	150	Reference

C3.11 OPERATIONAL INFORMATION

Table C-11 contains the operation procedure information by system component. This table has a one-to-many relationship with the System table.

Table C-11. Ops

Field Name	Field Type	Field Size	Field Description
Designation	Text	50	System designation ID
OperProc	Text	150	Operation procedure or specification

C3.12 ALTERNATE SYSTEM DESIGNATIONS

Table C-12 contains the alternate naming conventions for individual system components. This table has a one-to-many relationship with the System table.

Table C-12. Sec.

Field Name	Field Type	Field Size	Field Description
Designation	Text	50	System designation ID
SecDesign	Text	50	Secondary system designation ID

C3.13 CONSTRUCTION SPECIFICATION INFORMATION

Table C-13 contains the general construction specification information. This table has a one-to-many relationship with the System table.

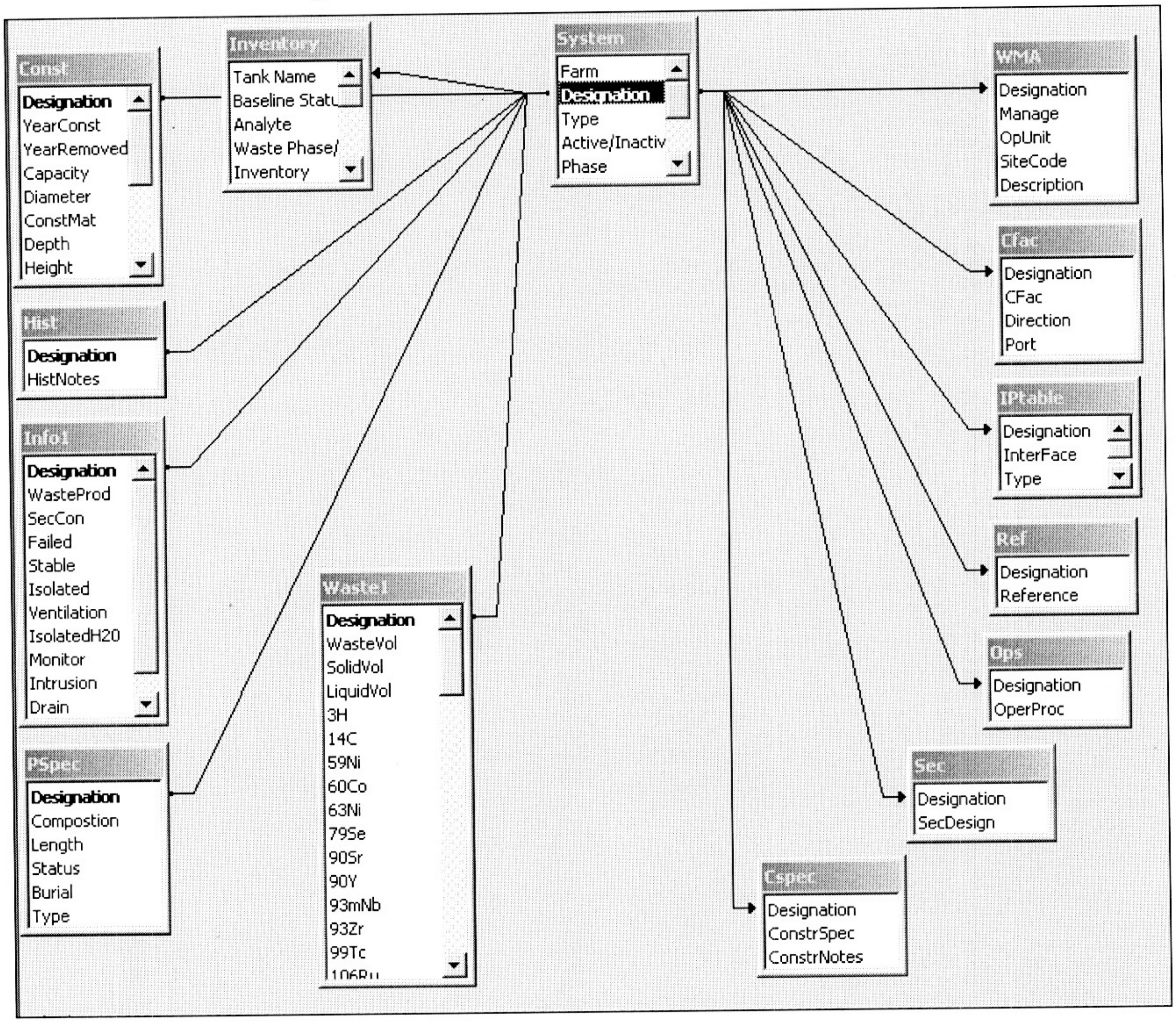
Table C-13. Cspec.

Field Name	Field Type	Field Size	Field Description
Designation	Text	50	System designation ID
ConstSpec	Memo	64 K	Construction specification
ConstrNotes	Memo	64 K	Construction notes

C3.14 RELATIONSHIPS BETWEEN TABLES

Figure C-1 details the relationships between the database tables. The Designation field is the primary key for the database and is contained in each of the tables.

Figure C-1. Database Relationship Schematic.



APPENDIX D

PIPING EXTRAPOLATION METHODOLOGY

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D1.0 INTRODUCTION

The single-shell tank (SST) piping systems were constructed from the early 1940s to the 1960s to support waste transfers. This appendix describes the methodology used to estimate the length and volume of pipelines associated with the SST system based on four readily available sources.

The following sections describe (1) the pipeline parameters that were tabulated, (2) the method of extrapolation for pipeline length and volume, and (3) the basis for the statistical calculations.

D2.0 PIPELINE PARAMETERS TABULATED

Efforts have focused on tabulating data elements into a database that will allow further refinement and continued use of the information for decision-making purposes. The data tabulated in the database for this project relating to the piping network are listed in Table D-1.

Table D-1. Data Elements Tabulated.

Pipeline Identification Number
Length of Pipe (feet)
Line Diameter (inches)
Line Failed (Y/N)
Line Capped (Y/N)
Direct Burial or Encased
Connection Facility 1
Connection Facility 2
Alias (or Alternate ID #)

Data collection efforts used the routing boards (H-14-104175 and H-14-104176) as the primary source of pipeline data and other documents to fill in data fields. Although discrepancies between sources were encountered, extensive efforts to resolve all conflicts were beyond the scope of this effort. The following describe collection of the data elements.

- **Record the Pipeline Identification Number** – For each component within a tank farm, the pipeline identification number from the routing boards (H-14-104175 and H-14-104176) was recorded. In some cases, lines did not have an identification number. In these cases, unmarked lines were typically given a unique description (e.g., "Unmarked Black- 241-AX-151" or "Unmarked Purple- 241-SX-252"). The color designation was derived from colors present on the routing boards. In a few instances, the pipeline identification number was not unique on the routing board (i.e., a line started out with one number and at a different point on the line, a new identification number was annotated.) When this transition between identification numbers occurred, the other ID number was tabulated in the "Alias" field in the database.

- **Record Whether the Line has been Capped or Failed** – Document whether the line had been capped or failed. This designation was not intended to substantiate where the failure or cap occurred.

- **Record the Connecting Facilities** – Document not only the connecting facilities, but also the ports on those facilities to allow more utility to future users (e.g., line SN-207 runs between tank 241-A-101 port 01B-A to valve pit 241-A-A port L14.)

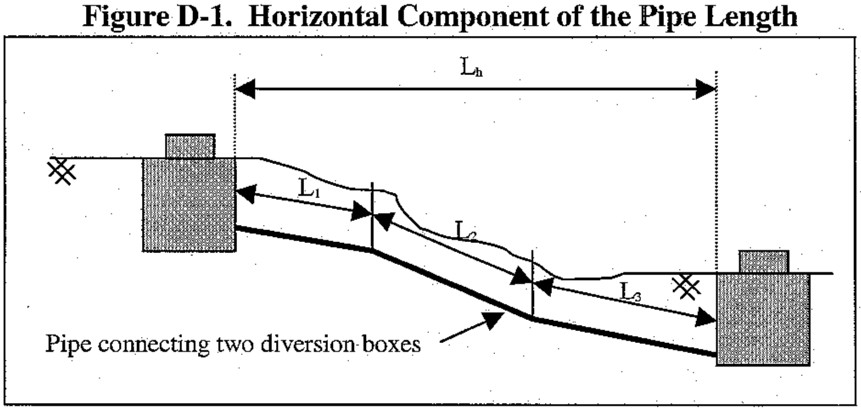
- **Record the Type of Burial** – The routing board depicts whether a line is directly buried or encased. In some cases lines may start as encased and transition to direct burial as depicted on the routing board. This transition is not important except to identify that the line is neither exclusively directly buried nor encased. The type of burial, either direct burial or encased is tabulated to assist in any assessment of remediation actions in the future.

- **Determine the Pipeline Diameter** – Because pipeline diameters are not shown on the routing board, two other sources were used to determine the diameter of a given pipe. The first source of data came from the pipeline specification drawings (H-13-000275, H-13-000199, and H-13-000280). These drawings list the pipes servicing a tank farm with their diameter. Although this listing proved very useful, discrepancies were noticed between pipeline identification numbers that were listed on the routing board and the H-13-000275 series drawings.

  Although the H-13-000275 series drawings provided a wealth of information on the pipeline diameters, it provided less than 20 percent of the diameters of the tabulated lines. The secondary source for dimensional information was the H-2-2338 drawings. These drawings detail the designs of the diversion boxes and specify nozzle sizes for each port on the diversion box. These nozzle sizes were assumed equivalent to the incoming pipeline diameter unless other information proved contrary.

- **Take Scaled Measurements to Determine Length** – The final step in the data collection process was to determine the length of the pipeline. The site diagrams (H-2-44501 and H-2-44511), provided the spatial relation of the various facilities/components and routing of the piping network. Although these plan measurements do not capture the slope of the pipes, Figure D-1 illustrates why this error was deemed insignificant.

Figure D-1. Horizontal Component of the Pipe Length



Although the horizontal component of the length is not equal to the sum of the individual angled runs, the slope on the lines has not been found to be greater than 3%. At this small angle, the horizontal length is approximately equal to the sum of the angled runs as given by Equation 1.

Equation 1: Approximation of the Length of Individual Pipes

$$L_h \approx L_1 + L_2 + L_3$$

D3.0 METHOD OF EXTRAPOLATION

The tabulation efforts identified in the previous section yielded approximately 1,400 pipelines. Not all of these lines had the requisite information to be able to determine lengths and volumes. The following section details the method by which the SST system lengths and volumes were computed.

D3.1 GENERAL APPROACH

In order to determine the length of piping in the SST system, one could record the individual lengths of pipes for all "n" pipes in the system and sum the length as is given in Equation 2:

Equation 2: Summation of Each Pipeline Properties

$$\textit{Total Length of Pipeline in the SST System} = \sum_{n} L_i$$

Or one could determine the average length (L) of piping and multiply the average length times the number of lines in the system as given in Equation 3.

Equation 3: Use of the Average to Determine Pipeline Properties

$$\textit{Total Length of Pipeline in the SST System} = n * L$$

The approach outlined in Equation 3 was used to overcome data gaps resulting from the procedures outlined in section D.2.0. The next two sections discuss the computation of (1) the number of pipes by tank farm and (2) the average length of piping by tank farm.

D3.2 COMPUTING THE NUMBER OF LINES ASSOCIATED WITH A TANK FARM

Queries have been established in the database that sort lines into two separate categories: those connected to tanks and those not connected to tanks. The query is constructed by first looking at the lines that are connected to a tank on the "from" side. A count is conducted by tank farm from this query. The next step is to conduct a similar count for the remaining lines that are connected to a tank on the "to" side. The third step is to sort the remaining lines (those not associated with tanks) by looking again at the "from" side. From the connection facility on the "from" side, another count is conducted by tank farm. The final step is to look at the remaining lines and count for the "to" side, which farm the line services. The outcome of these queries is shown in Table D-2.

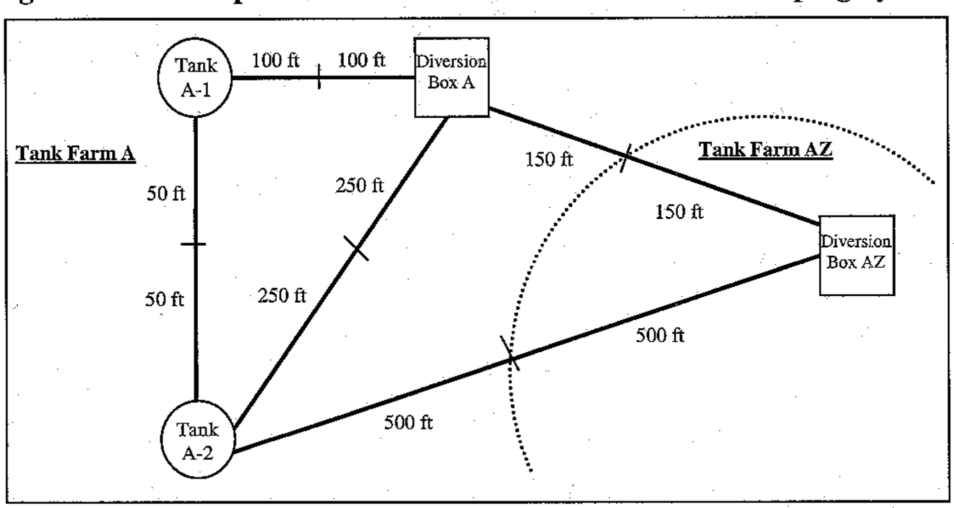
Table D-2. Number of Lines by Tank Farm

Tank Farm	# Lines Connected to Tanks	# Lines Not Connected to Tanks	Total # of Lines
A	50	71	121
AX	60	59	119
B	69	74	143
BX	70	25	95
BY	77	25	102
C	101	45	146
S	60	86	146
SX	43	26	69
T	59	43	102
TX	103	79	182
TY	16	10	26
U	91	72	163
Total	799	615	1,414

D3.3 ATTRIBUTING LENGTHS TO A CONNECTING FACILITY

Figure D-2 displays a hypothetical scenario of two tanks connected to two diversion boxes. This scenario illustrates the arbitrariness associated with assigning lengths to a particular farm. In this example, the two tanks and only one of the diversion boxes are in the tank farm and the other diversion box lies outside the farm (notably in the double-shell tank system).

Figure D-2. Example of A Tank Farm and AZ Tank Farm Piping System.



The pipeline assessment attributes half of the length of the piping to each connecting facility. No effort is made to locate a valve or other apparatus by which a partition could be fixed. For the level of this analysis, half the length was deemed sufficient to account for the fact that in most cases the piping system was not constructed solely for a particular tank farm. This method models the fact that lines in the system are arrayed internal to and between farms. The database sums the pipe lengths internal to the tank farm and includes ½ of the pipe lengths between tank farms.

For each farm, statistical parameters (sample population, sample average length, and sample standard deviation) were calculated (Table D-3). These parameters were then used to calculate a 95% confidence interval (presented in Figure D-3 as range values) providing a measure of the repeatability of the results.

Table D-3. Statistical Parameters Computed for Piping.

Tank Farm	Sample Average Length	Sample Standard Deviation	Number in Sample
A	397	500	56
AX	350	291	32
B	249	277	39
BX	431	443	43
BY	528	451	56.5
C	337	382	61
S	313	321	42
SX	289	257	34
T	551	678	53
TX	394	328	75
TY	179	189	13
U	232	185	74

This methodology was applied across all of the SST farms to calculate the total piping length. Figure D-3 displays the summary results from this analysis. These results correlate well to the estimates presented in HW-35009 of 500,000 ft (90 mi) of line in 1955.

Figure D-3. Summary Pipeline Length and Volume Information.

1.1.1.11 A Tank Farm

Lines: 121
Length of Piping: 9.1 mi +/- 3.0 mi
Volume of Piping: 17.6 kgal +/- 5.8 kgal

1.1.1.12 AX Tank Farm

Lines: 119
Length of Piping: 7.9 mi +/- 2.3 mi
Volume of Piping: 15.3 kgal +/- 4.4 kgal

1.1.1.7 B Tank Farm

Lines: 143
Length of Piping: 6.7 mi +/- 2.4 mi
Volume of Piping: 13.1 kgal +/- 4.6 kgal

1.1.1.9 BX Tank Farm

Lines: 95
Length of Piping: 7.7 mi +/- 2.4 mi
Volume of Piping: 15.0 kgal +/- 4.6 kgal

1.1.1.10 BY Tank Farm

Lines: 102
Length of Piping: 10.2 mi +/- 2.3 mi
Volume of Piping: 19.8 kgal +/- 4.4 kgal

1.1.1.13 C Tank Farm

Lines: 146
Length of Piping: 9.3 mi +/- 2.7 mi
Volume of Piping: 18.1 kgal +/- 5.1 kgal

1.1.1.1 S Tank Farm

Lines: 146
Length of Piping: 8.7 mi +/- 2.7 mi
Volume of Piping: 16.8 kgal +/- 5.2 kgal

1.1.1.2 SX Tank Farm

Lines: 69
Length of Piping: 3.8 mi +/- 1.1 mi
Volume of Piping: 7.3 kgal +/- 2.2 kgal

1.1.1.3 T Tank Farm

Lines: 102
Length of Piping: 10.6 mi +/- 3.5 mi
Volume of Piping: 20.6 kgal +/- 6.8 kgal

1.1.1.4 TX Tank Farm

Lines: 182
Length of Piping: 13.6 mi +/- 2.6 mi
Volume of Piping: 26.3 kgal +/- 5.0 kgal

1.1.1.5 TY Tank Farm

Lines: 26
Length of Piping: 0.9 mi +/- 0.5 mi
Volume of Piping: 1.7 kgal +/- 1.0 kgal

1.1.1.6 U Tank Farm

Lines: 163
Length of Piping: 7.1 mi +/- 1.3 mi
Volume of Piping: 13.9 kgal +/- 2.5 kgal

1.1.1.8 SST System Totals

 # Lines: 1414
Length of Piping: 95.7 mi +/- 26.8 mi
Volume of Piping: 185.5 kgal +/- 51.6 kgal

D4.0 REFERENCES

Drawing H-2-2338, 1979, *Diversion Box Information*, Rev. 2, Atlantic Richfield Hanford Company, Richland, Washington.

Drawing H-2-44501, 1982, *Area Map – 200 East*, Rev. 11, General Electric, Richland, Washington.

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APPENDIX E

REFERENCES BY SST SYSTEM COMPONENT

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E1.0 PITS

Including at-tank and between tank pits:

H-2-2294, Pump Pit Details; Structural Concrete; Plan & Sections

H-2-3403, Structural Concrete; Plans & Details; Pump Pit

H-2-33452, Structural; Pump Pit Plans and Details

H-2-34801, Structural; Pump Pit; Plan & Details; TKs 107 & 110 BY

H-2-34961, Salt Well Pump Pit; 241-TY-105; Plot Plan & Details

H-2-34975, Salt Well Pump Pit; 241-BX-109; Plot Plan & Details

H-2-35221, Structural Concrete; Pump Pits; 241-TX-10A, 11A, 12A; Plan, Sections & Details

H-2-36270, Structural; Pump Pits, Flush Pits & Central Switching Stations

H-2-36473, Salt Well; Plot Plan & Details

H-2-37351, Piping Arrangement; 241-U Tank Farm; Distributor Pit U-10B & U-11B

H-2-38597, Salt Well Pump Pit Assembly; For Std. 12" Riser

H-2-40191, Structural Concrete; Plan And Sections; Pump Pit

H-2-40192, Structural Concrete; Plan & Sections; Heel Pit

H-2-40193, Structural Concrete; Plan & Sections; Sluicing Pit

H-2-41342, Structural Concrete; Plan, Sections & Details; Pump Pit

H-2-41343, STRUCTURAL CONCRETE; PLAN AND SECTIONS; PUMP PIT

H-2-41344, Structural Concrete; Plan & Sections; Sluicing Pit

H-2-41345, Structural Concrete; Plan & Sections; Heel Pit

H-2-41346, Structural Concrete; Plan And Sections; Pump Pit

H-2-41347, Structural Concrete; Plan & Sections; Sluicing Pit

H-2-41348, Structural Concrete; Plan & Sections; Heel Pit

H-2-41352, Structural Concrete; Plan & Sections; Heel Pit

H-2-41353, Structural Concrete; Plan & Sections; Pump Pit

H-2-41354, Struct Conc; Plan & Sections; Sluicing Pit

H-2-41843, Structural Concrete; Plan, Sections & Details; Jet Pump Pit, C-200

H-2-42065, Structural Concrete; Plan & Sections; Pump Pit A; 241-TXR

H-2-42066, Structural Concrete; Plan & Sections; Sluicing Pits C & D; 241-TXR

H-2-42067, Structural Concrete; Plan & Sections; Pump Pit A; 241-BYR

H-2-42068, Structural Concrete; Plan & Sections; Sluicing Pits C & D; 241-BYR

H-2-42262, Structural Concrete; Plan, Sections & Dets.; Valve Pit, Instr. Pit & Pipe Trench

H-2-42617, Structural Concrete; Plan & Sections; Pump Pit

H-2-42618, Structural Concrete; Plan & Sections; Heel Pit

H-2-42619, Structural Concrete; Plan & Sections; Sluicing Pit

H-2-46148, Strl Conc Pump Pits 241-S-01A, -3A, -05A, -06A, -07A, -08A, -09A, -10A, -11A, -12A

H-2-46150, Strl Conc Distr Pit 241-SX-05B; Pump Pits 241-SX-02B, -3B, -04A, & -06A

H-2-46521, Dwg Index/Structural Distributor Pit 02b; Plans & Sections

H-2-55919, Waste Storage Tanks; Pump Pit Details

H-2-57943, Structural; Pump Pit Conversion to Sluice Pit 241-A-03B

H-2-61985, Structural; Sluice Pits; 241-A Tank Farm; Plans & Dets

H-2-63826, Structural; Pump Pit Modifications; Plans, Section & Details

H-2-63827, Structural; Sluice Pit; Plans, Section & Details

H-2-69770, Salt Well Pit Assembly; 241-BX-107 TK

H-2-70895, Piping Arrangement Pump Pit; Pit Heater & Insulation Details

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